

FLORA VITIENSIS NOVA

VOLUME 2

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FLORA VITIENSIS NOVA
A NEW FLORA OF FIJI
(SPERMATOPHYTES ONLY)

ALBERT C. SMITH

VOLUME 2
Angiospermae: Dicotyledones, Families 44-116



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INTRODUCTION

In the Introduction to Volume 1 of this *Flora* (p. 3) I stated that publication was expected to be in three volumes. The first volume included the anticipated material, except that the family Orchidaceae was perforce omitted. As work continued on dicotyledons, however, it was realized that two additional volumes would not adequately cover them and the orchids, assuming a degree of coverage similar to that of the gymnosperms and monocotyledons in Volume 1. It is now planned to extend *Flora Vitiensis Nova* to four volumes. Volume 2, herewith, includes the dicotyledonous families assigned to the subclasses Magnoliidae, Ranunculidae, Hamamelididae, Caryophyllidae, and Dilleniidae, in the approximate sequence of Takhtajan (1969)¹. As now planned, Volume 3 will include the families of the subclass Rosidae, and Volume 4 will include those of the subclass Asteridae. Volume 4 will presumably also contain indices to the entire work as well as pertinent concluding material; the Orchidaceae will be incorporated into either Volume 3 or Volume 4, unfortunately out of sequence.

It had been hoped and expected that no new names would require publication in *Flora Vitiensis Nova*. However, it has proved impracticable to avoid the use of a few new names, as various precursor papers have not covered all families and genera in such detail that all novelties or required combinations were adequately treated. Because it is inconvenient for the compilers of indices to search floristic works for new names, I here list those presented in this volume:

Peperomiaceae (fam. nov.; apparently not previously validly published)

Euphorbiaceae: *Glochidion atrovirens*, *G. brunnescens*, *G. multilobum*, *G. inusitatum*, *G. collinum* (spp. nov.)

Flacourtiaceae: *Casearia fissistipula*, *C. crassipes* (spp. nov.)

Ebenaceae: *Diospyros gillespiei* var. *nandarivatensis* (comb. nov.), *D. phlebodes* (comb. et stat. nov.)

Sapotaceae: *Planchonella brevipes* (sp. nov.), *P. umbonata* (comb. et stat. nov.), *P. smithii* (comb. et stat. nov.)

In this connection it has been noted with interest that L. K. Weresub and J. McNeill (in *Taxon* 29: 474. 1980) "...question the desirability of publishing taxonomic novelties in Floras..." Pertinent as such questioning may be, it can affect only future publication, since thousands of botanical names have been first used in regional Floras by botanists of the last two centuries. It would indeed be more convenient to compilers of plant indices if Floras presented merely compendia of already published knowledge, but so many exceptions are justifiable that it seems unwise to consider any legislated restrictions in this respect.

Since the publication of Volume 1 of the present *Flora* (or more or less coincident with it), many books and journal articles pertinent to the subject matter, or to related taxonomic or nomenclatural topics, have been produced. A few are here discussed and listed.

The appearance of a new edition of the *International Code of Botanical Nomencla-*

¹References indicated by parenthetical dates, if not otherwise modified, are listed in Volume 1, pp. 84-88, and in the present volume, p. 3.

ture (ICBN) is always noteworthy. The "Leningrad edition" (Stafleu et al., 1978) differs primarily in a few matters of detail from the preceding "Seattle edition," but it introduces the use of a decimal system for indicating each paragraph of Articles and Recommendations; this decimal system when pertinent will be used in future references to the ICBN in the present *Flora*.

The second volume of the second edition of *Taxonomic Literature* (Stafleu & Cowan, 1979), covering authors whose family names begin with H-Le, is now available; together with the first volume (cf. Volume 1 of this *Flora*, p. 11) it includes invaluable information about botanical publications. Botanists await the completion of this major compilation with keen anticipation.

For 25 years the card index so valuable to botanists, *Index Nominum Genericorum* (ING), has been supplemented by the efforts of many collaborators working on behalf of the International Association for Plant Taxonomy. Publication of the *Index* in book form (Farr, Leussink, & Stafleu, 1979) was an event of major significance (cf. *Taxon* 29: 266. 1980). The compilers of the book edition are well aware that errors or omissions will require future correction. Indications of type species for genera (when not obvious) are primarily documented suggestions, and specialists are free to propose and to document alternative choices.

Students of flowering plants continue attempts to improve a system of classification that will more naturally group families, orders, and higher taxa in accord with advances in knowledge in pertinent fields. A recent classification with many merits is that of Dahlgren (1980), who recognizes only two subclasses of angiosperms (Magnoliidae and Liliidae, i. e. dicotyledons and monocotyledons), utilizing superorders for the next step in his division. In many respects his classification resembles those of Cronquist (1968), Takhtajan (1969), and Thorne (1976), but several interesting new concepts are introduced.

A. L. Takhtajan (1980) has recently summarized his concepts of the classification of flowering plants in a comprehensive review in English. This valuable contribution was not perused in time to be considered in the preparation of the present volume of this *Flora*, and at any rate it does not significantly alter Takhtajan's earlier (1967, 1969) family sequences, but it incorporates data from recent pertinent literature and will provide useful documentation to phylogenists.

A useful analysis of plant communities on two islands of the Lau Group of Fiji has been published by P. J. Garnock-Jones (1978), mentioned as a collector in Volume 1, p. 83, of this *Flora*.

Comments of considerable interest have recently been made by P. S. Green (1979) in respect to the occurrence of presumed Fijian endemics in the New Hebrides. As a result of the 1971 Royal Society Expedition to the New Hebrides, several species previously thought to be endemic to Fiji are now known from the more westerly archipelago. Among these species is *Collospermum montanum* (Seem.) Skottsbl. (Liliaceae), which is no longer to be considered a Fijian endemic as stated in Volume 1 of the present *Flora*, p. 143. Other cases, occurring among dicotyledons, will be mentioned in this and remaining volumes. The extension of some Fijian taxa to the New Hebrides is of course to be anticipated, and those mentioned by Green illustrate again that no *Flora* may be considered complete in detail at the moment of its publication.

A noteworthy publication is that by Briggs and Johnson (1979) on evolution in the

Myrtaceae; the main thrust of this treatment bears on the orders Myrtales and Lythrales (subclass Rosidae, to be discussed in Volume 3 of this *Flora*), but important discussions are included on the families Lecythidaceae and Rhizophoraceae, which have often been included in the subclass Rosidae as relatives of the Myrtales but which, in the light of recent evidence, appear better placed in the subclass Dilleniidae and hence are included in the present volume of this *Flora*.

In recent years W. R. Sykes and G. P. Buelow have made extensive collections of plants in Tonga, and both have kindly called my attention to occurrences that affect the known distribution of Fijian plants. As has been the case in the New Hebrides, these recent Tongan collections have disclosed range extensions of several taxa that had previously been considered endemic to Fiji, or of taxa previously believed to terminate the eastward extent of generic distributions in Fiji. Similarly, W. A. Whistler, who has recently published an interesting discussion of the vegetation of Eastern Samoa (1980), has made large collections throughout Samoa, and in a few cases his findings have extended the known distribution of species or genera occurring in Fiji.

I take this opportunity to acknowledge the valuable assistance of G. L. Webster in my preparation of manuscript for the family Euphorbiaceae; the key to genera of that family recorded from Fiji was kindly contributed by him.

SUPPLEMENTARY REFERENCES

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- , et al. 1978. *International Code of Botanical Nomenclature* (Twelfth International Botanical Congress, Leningrad, 1975). Utrecht.
- TAKHTAJAN, A. L. 1980. Outline of the classification of flowering plants (Magnoliophyta). *Bot. Rev.* **46**: 225-359.
- WHISTLER, W. A. 1980. The vegetation of Eastern Samoa. *Allertonia* **2**: 45-190.

DIVISION ANGIOSPERMAE (MAGNOLIOPHYTA) (continued)
CLASS DICOTYLEDONES (MAGNOLIATAE)

Users of this *Flora* may recall my comments in Volume I (p. 6) as to the inherently unsatisfactory nature of keys to families (and larger taxa) that presume to indicate evolutionary relationships. It will be obvious that keys to taxa, in any systematic work, become less and less useful as the rank of the taxon becomes more inclusive. In dividing a species into subspecies or varieties one seldom has difficulty in producing a satisfactory key with mutually exclusive alternatives. In keying the species of a genus the difficulties are somewhat greater, but even here most keys are quite satisfactory. To separate the genera of a family by keying in a reasonable manner is still quite feasible, and even to prepare a key to the families of an order is possible, particularly if the order is restricted in inclusiveness. Above the level of order the difficulties are compounded, as is evident to the user of any work in which keys of this nature are attempted. At this stage the preparer is assailed by doubts of the naturalness of the higher grouping, whether subclass or superorder. Indeed, modern studies of plants from increasingly multitudinous angles make it obvious that no consensus has been reached as to the components of any given superorder or subclass. Perhaps for this reason most angiosperm phylogenists present their conclusions in the form of summaries and discussions, carefully avoiding keys to their major taxa. Such students as Cronquist (1968) are to be complimented on their willingness to attempt the impossible by preparing keys to subclasses and orders; such keys, however guarded and however surrounded by warnings, cannot yet be very satisfactory.

Nevertheless, in the present volume a key to the subclasses of dicotyledons is presented, in large part adapted from Cronquist's (1968) work, but the reader should not expect it to be very informative. In such a subclass as the Dilleniidae, the key to its component orders (occurring in Fiji) here presented is definitely unsatisfactory, and the writer is aware of his rashness in even attempting it. Perhaps the difficulties are compounded by the necessarily vague circumscriptions of the subclasses Dilleniidae and Rosidae, which for their cohesiveness depend upon esoteric characters that are still not entirely analyzed and certainly not very useful to field and herbarium botanists. The sequence of component orders of the Dilleniidae as outlined by Takhtajan (1969) is in general here followed, but certain transfers of taxa to and from the Rosidae have seemed desirable. Quite possibly it is unrealistic to divide dicotyledonous plant families into seven cohesive groupings (subclasses), and future phylogenists may well agree with Thorne (1976) that a greater number of basic large taxa (superorders in his terminology) is required in order to provide anything like realistic groupings.

With these comments the writer warns nonbotanical users of this *Flora* that the following key to subclasses will be of very little use to them, and that the keys to component orders, especially those referred to the subclass Dilleniidae, should be given limited credence.

USEFUL TREATMENTS OF CLASS (in addition to many works cited in Volume I of this *Flora*, pp. 84-88): Bailey, I. W., & B. G. L. Swamy. The conduplicate carpel of dicotyledons and its initial trends of specialization. *Amer. J. Bot.* **38**: 373-379. 1951 (a highly significant paper, for its date, indicating probable evolutionary trends in the dicotyledonous carpel). Brewbaker, J. L. The distribution and phylogenetic significance of binucleate and trinucleate pollen grains in the angiosperms. *Amer. J. Bot.* **54**: 1069-1083. 1967 (an important contribution to our understanding of phylogenetic trends in the angiosperms as a whole, referring to monocotyledons as well as dicotyledons; the characters described will not be of use to the field or herbarium botanist, but nevertheless, because of their evolutionary implications, they are mentioned in my key to subclasses of dicotyledons). Smith, A. C. An appraisal of the orders and families of primitive extant angiosperms. *J. Indian Bot. Soc.* **50A**: 215-226. 1972 (an attempted justification of the use of comparatively small orders and families of putatively "primitive" dicotyledons). Walker, J. W. Comparative pollen morphology and phylogeny of the ranalean complex. *In* Beck, C. B. *Origin and Early Evolution of Angiosperms*, 241-299. 1976 (although primarily directed toward the evolution of pollen in the subclass Magnoliidae, this paper suggests evolutionary trends pertinent to dicotyledons as a whole and defines terminology here utilized).

KEY TO SUBCLASSES

Plants putatively suggestive of the ancestral dicotyledonous condition; flowers usually apocarpous and with a well-developed perianth (except in Piperales and Chloranthales in our area), this always polypetalous or apetalous; stamens usually numerous and developing in centripetal sequence (but reduced in number in Aristolochiales, Piperales, Chloranthales, and some Laurales); pollen always binucleate when shed; carpels primitively conduplicate (this sometimes apparent only at tip of style), with modified laminar placentation, unsealed (at least in distal portion) in early stages, the pollen tube sometimes not penetrating solid carpillary tissues; ovules always bitegmic and crassinucellate.

Spherical idioblasts (etheral oil cells) present in parenchymatous tissues (except in Nymphaeales); xylem comparatively unspecialized; pollen grains anasulcate or uniaperturate or derived from such types.

MAGNOLIIDAE

Spherical idioblasts lacking; plants herbaceous or secondarily woody; pollen grains never anasulcate or uniaperturate-derived. RANUNCULIDAE

Plants putatively more "advanced" in one or more respects than those of the Magnoliidae or Ranunculidae; pollen grains never anasulcate or uniaperturate-derived; spherical idioblasts lacking in parenchymatous tissues.

Flowers more or less strongly reduced, often unisexual and with the perianth poorly developed or lacking, often borne in catkins but never grouped into bisexual pseudanthia, never with numerous ovules on parietal placentas; woody plants (except some Urticales); pollen usually binucleate when shed, rarely trinucleate. HAMAMELIDIDAE

Flowers usually comparatively well developed and with an evident perianth, or otherwise usually either grouped into bisexual pseudanthia or with numerous ovules on parietal placentas.

Flowers usually polypetalous, less frequently apetalous or sympetalous (if sympetalous usually with stamens more numerous than corolla lobes, or with stamens opposite corolla lobes, or with bitegmic or crassinucellate ovules); carpels 1-many, free or united.

Placentation of various types, often parietal or free-central or basal, sometimes axile; stamens, if numerous, developing in a centrifugal sequence; species with the combination of few stamens and axile placentation usually with several or many ovules per locule or with sympetalous corollas or both.

Pollen always trinucleate when shed; ovules bitegmic, crassinucellate, usually campylotropous or amphitropous; seeds often with perisperm; plants either with betalains instead of anthocyanins or with free-central to basal placentation or both; none of the species occurring in Fiji tree-like (except some Nyctaginaceae). CARYOPHYLLIDAE

Pollen usually binucleate when shed, infrequently trinucleate; ovules various but seldom campylotropous or amphitropous; seeds seldom with perisperm; plants never with betalains; placentation rarely free-central or basal (except in Primulales); species occurring in Fiji often trees or shrubs but sometimes herbs or vines. DILLENIIDAE

Placentation seldom parietal; flowers seldom with free-central or basal placentation in a unilocular, compound ovary, but often with 2-several locules with only 1 or 2 ovules each, usually polypetalous, less often apetalous, rarely sympetalous; stamens, if numerous, developing in a centripetal sequence; pollen predominantly binucleate when shed, but often trinucleate.

ROSIDAE

Flowers sympetalous (with few exceptions), the stamens usually the same number as corolla lobes or fewer, never opposite corolla lobes; carpels frequently 2, sometimes 3-5 or more; ovules unitegmic and tenuinucellate; pollen most frequently trinucleate when shed, but often binucleate.

ASTERIDAE

SUBCLASS MAGNOLIIDAE

There has been great diversity in the grouping of the orders and families generally construed as composing the "ranalean complex" (e. g. Cronquist (1968), Takhtajan (1969), and Thorne (1976) as listed in my Vol. 1, pp. 84-88, and Smith (1972) and Walker (1976) as listed above under the class Dicotyledones). In the present work I accept Takhtajan's suggestion (1969: 207) of separating the subclass Ranunculidae from the Magnoliidae, with minor modifications (Smith, 1972: 218). The problems involved bear only marginally on the flora of Fiji, but conclusions implied in the arrangement of orders and families in the present work may impel some readers to examine the larger questions. Although there is no single set of characters that rigidly defines the subclass Magnoliidae, there exist in its included orders some of the features that probably characterized the earliest dicotyledons. Recognition of these features as "primitive" in no sense suggests the direct origins of other subclasses in the extant Magnoliidae; the implication is merely that in this subclass certain features suggesting dicotyledonous forbears seem to have persisted, while in other subclasses these features have been obscured by accelerated evolutionary change. Furthermore, many botanists are now inclined to question the origin of monocotyledons from any putative magnoliidean ancestry; it seems more reasonable to assume that the two classes of angiosperms had independent origins in a common ancestral taxon (cf. Moore, H. E., Jr., & N. W. Uhl. The monocotyledons: their evolution and comparative biology. VI. Palms and the origin and evolution of monocotyledons. *Quart. Rev. Biol.* **48**: 414-436. 1973). This hypothesis does not carry implications of a biphyletic origin of angiosperms; the parallel pointed out by Moore and Uhl is to be found in the birds and mammals, which presumably evolved from related reptilian lines but may, in a reasonable sense, be considered monophyletic.

USEFUL TREATMENTS OF SUBCLASS (in addition to works cited in Vol. 1 of this *Flora* or above under the class Dicotyledones): Ehrendorfer, F., F. Krendl, E. Habeler, & W. Sauer. Chromosome numbers and evolution in primitive angiosperms. *Taxon* **17**: 337-353. 1968. Walker, J. W. Evolution of exine structure in the pollen of primitive angiosperms. *Amer. J. Bot.* **61**: 891-902. 1974. Walker, J. W. Aperture evolution in the pollen of primitive angiosperms. *Amer. J. Bot.* **61**: 1112-1137. 1974. Walker, J. W., & J. J. Skvarla. Primitive columellaless pollen: a new concept in the evolutionary morphology of angiosperms. *Science* **187**: 445-447. 1975. Okada, H. Karyomorphological studies of woody Polycarpicaceae. *J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot.* **15**: 115-200. 1975. Walker, J. W. Evolutionary significance of the exine in the pollen of primitive angiosperms. *In* Ferguson, I. K., & J. Muller. The evolutionary significance of the exine. *Linn. Soc. Symposium Ser. 1*: 251-308. 1976. The listed papers provide valuable supplementary data supporting the hypothesis that the "ranalean complex" retains palynological and caryological features suggesting a "primitive" position among dicotyledons.

KEY TO ORDERS OCCURRING IN FIJI

Plants mostly woody and terrestrial, with comparatively unspecialized xylem (but with true vessels in all our representatives) and with cambium; spherical idioblasts (etheral oil cells) present in parenchymatous tissues.

Flowers hypogynous (except epigynous in most Aristolochiales); ovules often several or many per carpel but sometimes solitary; nodes trilacunar or multilacunar.

Perianth evident, sometimes divided into sepals and petals; seeds with well-developed endosperm; stipules (in our representatives) lacking.

Flowers actinomorphic; carpels superior and usually free, less often united.

Perianth parts basically spiralled (but in Degeneriaceae, the only family of the order in Fiji, the calyx 3-lobed); stamens laminar, usually with 3 or more traces; pollen grains (in Degeneriaceae) anisulcate, boat-shaped, atectate and primitively columellaless, psilate; carpels (in Degeneriaceae) solitary or rarely 2, with many ovules. MAGNOLIALES (FAMILY 44)

Perianth parts basically in threes; stamens not laminar, constantly 1-traced; pollen grains diverse, rarely (but in no genera in our area) columellaless; carpels 1-many, each with 1-many ovules.

ANNONALES (FAMILIES 45, 46)

- Flowers (in the only genus in our area) zygomorphic and without petals, the calyx enlarged and petaloid, the anthers united with the style into a gynostemium, the pollen grains anasulcate, inaperturate, globose or globose-oblate, tectate or semitectate, the ovary inferior, with numerous ovules in each locule, the fruit a septicial capsule. . . . ARISTOLOCHIALES (FAMILY 47)
- Perianth none, the flowers crowded into a spadix; pollen grains anasulcate, inaperturate, subglobose, tectate; ovary 1-locular, the ovule solitary, erect (in families in our area); seeds with copious perisperm and scanty endosperm; stipules present or absent. . . . PIPERALES (FAMILIES 48, 49)
- Flowers perigynous to epigynous (in our area hypogynous only in Trimeniaceae of Laurales); pollen grains (in genera in our area) inaperturate or forate, subglobose, tectate or semitectate; ovules (in our families) solitary, pendulous; seeds sometimes lacking endosperm; nodes unilacunar.
- Perianth lacking; plants (in *Ascarina*, the only genus in our area) usually appearing dioecious but probably basically monoecious, the ♂ flowers (in *Ascarina* in our area) with a single stamen; ovary inferior, unilocular, the ovule orthotropous; stipules present. . . . CHLORANTHALES (FAMILY 50)
- Perianth evident but often small and lacking petals, rarely lacking; plants with bisexual, polygamous, or unisexual flowers; stamens few to numerous; carpels 1-many, each carpel or ovary locule with an anatropous ovule; stipules (in our representatives) absent. . . . LAURALES (FAMILIES 51-56)
- Aquatic herbs, lacking vessels and without cambium; spherical idioblasts lacking; leaves floating, emersed, or submersed; pollen grains (in our representatives) zonosulcate or inaperturate, tectate.
- NYMPHAEALES (FAMILIES 57, 58)

ORDER MAGNOLIALES

The order Magnoliales is sometimes interpreted in an extraordinarily extended sense (e. g. Cronquist, 1968: 135-144), but more logically it is construed as comprising two suborders (Magnoliineae and Annonineae) and seven families (cf. Smith (1972) and Walker (1976) cited above under the class). Since 1972, however, continuing study has convinced me that differences between the two suborders are of such a nature that the recognition of two orders is advisable. As thus defined, the Magnoliales form a very coherent order composed of four families: the widespread and predominantly Northern Hemisphere Magnoliaceae, the Eupomatiaceae and Himantandraceae of New Guinea and eastern Australia, and the Degeneriaceae, endemic to Fiji. With the possible exception of the order Winterales (composed of the sole family Winteraceae), the Magnoliales probably possess a greater accumulation of plesiomorphic ("primitive") characters than any other extant dicotyledons. Their secondary xylem, although not vesselless, retains features indicating early stages of advancement. The stamens are broad, dorsiventral, 3-veined microsporophylls with elongated, immersed sporangia. The pollen grains of the Magnoliaceae and Degeneriaceae are anasulcate and boat-shaped, and those of *Degeneria* and *Eupomatia* have atectate and primitively columellaless exine. The carpel of *Degeneria* is best described as an adaxially folded, 3-veined megasporophyll with laminar placentation and flaring stigmatic surfaces that are not coherent at the time of pollination. Such carpels are very similar to those of *Tasmannia* and *Bubbia* in the Winteraceae.

FAMILY 44. DEGENERIACEAE

DEGENERIACEAE I. W. Bailey & A. C. Sm. in J. Arnold Arb. 23: 357. 1942.

Trees; stipules none, the leaves alternate, petiolate, simple, pinnatinerved; flowers solitary (but bearing 2 or 3 bracts near middle of pedicel), supra-axillary, ♀, hypogynous, the receptacle subglobose or convex, depressed in center; perianth clearly differentiated into calyx and corolla; calyx deeply lobed, the sepals 3 (rarely 4), much smaller than petals; petals numerous, 2-4-seriate, imbricate, carnose; stamens numerous, spiralled in 2 or 3 series, carnose, laminar, rounded or subtruncate at apex. 3-veined, with 4 slender, parallel, elongated, extrorse, immersed sporangia dehiscing

by 2 longitudinal clefts; pollen grains anasulcate, bilateral, boat-shaped, psilate, atectate and primitively columellaless; staminodes within the stamens and fewer, similar in texture but conspicuously introrsely cucullate; carpel solitary (or carpels rarely 2 and attached at slightly different levels on the receptacle), inaequilaterally ellipsoid, conduplicate, open in early stages, the ventral margins externally flaring, with numerous, loosely interlocking, short, glandular hairs, the stigmatic areas extending inward along adaxial surfaces of carpel; ovules numerous, anatropous, biseriate but sometimes vascularized by branches of both ventral and median traces; fruit an asymmetrical, oblong-ellipsoid, tardily dehiscent follicle with a long-persistent vascular skeleton composed of branches of median, ventral, and supernumerary traces, the pericarp coriaceous and smooth, the endocarp intrusively lobed with spongy ingrowths; seeds large, with copious, irregularly grooved and cleft, subruminate endosperm, the outer integument of mature seeds with a thick cuticle, a succulent outer coat bearing oil cells, and an inner stony coat; cotyledons 3 or 4, very rarely 2.

DISTRIBUTION: Endemic to Fiji, with a single species.

USEFUL TREATMENTS OF FAMILY (in addition to many papers already listed in this *Flora*): Bailey, I. W., & A. C. Smith. Degeneriaceae, a new family of flowering plants from Fiji. *J. Arnold Arb.* 23: 356-365. 1942. Smith, A. C. Additional notes on *Degeneria vitiensis*. *Op. cit.* 30: 1-9. 1949. Swamy, B. G. L. Further contributions to the morphology of the Degeneriaceae. *Op. cit.* 30: 10-38. 1949. Lemesle, R., & A. Duchaigne. Contribution à l'étude histologique et phylogénétique du *Degeneria vitiensis* I. W. Bailey et A. C. Sm. *Rev. Gén. Bot.* 62: 699-719. 1955. Dahl, A. O., & J. R. Rowley. Pollen of *Degeneria vitiensis*. *J. Arnold Arb.* 46: 308-323. 1965.

Although I. W. Bailey had long been concerned with the morphology and anatomy of members of the "ranalean complex," the discovery of a new species, genus, and family of this complex and their description in 1942 gave a pronounced impetus to research in this area by him and his associates and students. It is no overstatement to



FIGURE 1. *Degeneria vitiensis*, from DA 15292; flower, showing petals and extrorse surfaces of stamens and staminodes, $\times 2$.

suggest that the first paper on the Degeneriaceae led to a recrudescence of interest in the "Ranales," as the putatively most primitive dicotyledons were then known. Since 1942 several hundred studies of diverse aspects of "ranalean" plant taxa by botanists of many countries and disciplines have contributed to our present understanding of the evolutionary history of dicotyledons. This understanding is still inadequate, but the new knowledge so promulgated has led, in less than 40 years, to a vastly keener appreciation of some of the principles suggested by such perceptive pioneers as Jussieu, de Candolle, and Bessey.

1. *DEGENERIA* I. W. Bailey & A. C. Sm. in J. Arnold Arb. 23: 357. 1942; A. C. Sm. in op. cit. 36: 277. 1955.

Characters and distribution of the family.

TYPE SPECIES: *Degeneria vitiensis* I. W. Bailey & A. C. Sm., the only known species.

The original formal description of *Degeneria vitiensis* having been based on only two collections, substantial amplification is now possible. It has always surprised me that a plant so abundant in Fiji escaped the notice of such discerning collectors as Seemann, Horne, Gibbs, Greenwood, and Gillespie, among others. However, exhaustive search of herbaria where Fijian collections might be deposited has convinced me that the species remained uncollected until May 7, 1934, when specimens were obtained by me (no. 1754) in the lower Wainunu River Valley, Mbua Province, Vanua Levu; these specimens, in young fruit and with ample wood material, remained unidentified to family. The second collection now known to me is *DA 287*, a sterile specimen collected in Naitasiri Province, Viti Levu, in 1936 but without further locality or collector's name. A third collection was made by B. E. V. Parham (as *DA 1488*) on May 11, 1939, in the vicinity of Nanduna, near Waindrandra Creek, Lomaivuna Tikina, Naitasiri Province, Viti Levu; this was also accompanied by immature fruits, but neither of the Department of Agriculture collections was available to Bailey and me in 1942. The fourth known collection, and the first in flower, was *Degener 14537*, collected February 24, 1941, near Nauwangga, south of Nandarivatu, Mba Province, Viti Levu; this collection we indicated as the type.

It is perhaps understandable that earlier collectors failed to obtain the species, which is a tree of the upper storey of the rain forest, mingling its branches and foliage with those of many other species. Even when the tree is in full flower or fruit those organs are not discernible from the ground; the flowers shatter soon after opening. Once the plant is detected from a fallen fruit or the decaying vascular skeleton of one, it can be located in the forest canopy. As a result I have now observed at least 100 individuals and have collected material from many of them in such quantity that specimens are available in most major world herbaria and many wood samples are at hand.

1. *Degeneria vitiensis* I. W. Bailey & A. C. Sm. in J. Arnold Arb. 23: 357. *pl. 1-5*. 1942; A. C. Sm. in Bull. Torrey Bot. Club 70: 537. 1943, in J. Arnold Arb. 30: 1. *fig. 1; pl. 1*. 1949; Swamy in op. cit. 30: 10. *fig. 1-106*. 1949; Lemesle & Duchaigne in Rev. Gén. Bot. 62: 699. *fig. 1-8*. 1955; J. W. Parham, Pl. Fiji Isl. 46. *fig. 23*. 1964, ed. 2. 76. *fig. 23*. 1972.

FIGURES 1-3, 77.

A tall forest tree attaining a height of 30 m. at maturity, with a comparatively compact crown and a straight, slender trunk to 70 cm. in diameter, and with 3-7 obvious rounded buttresses in the lowest 1-2 m. The dark gray bark has regular fissures and presents no outstanding characteristics, although with experience it seems readily recognized by Fijians and other foresters. Juvenile plants have larger leaves

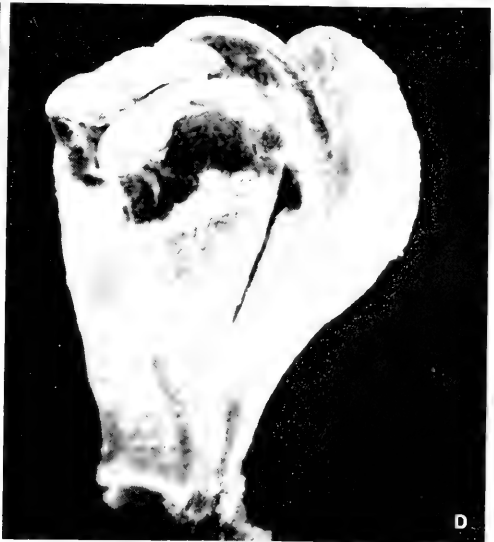
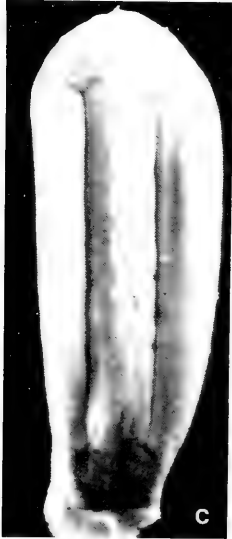
than mature trees, the blades being as much as 45×14 cm., long-decurrent on the petiole, and deltoid-cuspidate at apex, with as many as 30 pairs of secondary nerves. Mature leaf blades may measure only $5-27 \times 2.5-14$ cm. and are rounded or slightly emarginate at apex, with 8-18 pairs of secondary nerves. Specimens may be spectacularly loaded with flowers, even though these are seldom discernible from the ground. When fully open the flowers may attain a diameter of 6.2 cm., then emitting a delicious fragrance suggestive of the flowers of *Cananga odorata* and some other Annonaceae. The 3 (rarely 4) green sepals may be somewhat more than 5 mm. in length and breadth, obscurely yellow-glandular, entire and inconspicuously ciliate. The petals are 12-14, white or cream-white or the outer ones greenish without, spiralled in 2-4 series, carnosely and broadly imbricate, the exterior ones elliptic, 18-25 mm. long and 10-13 mm. broad, obscurely yellow-glandular, the inner ones narrower and somewhat oblong. The stamens are 20-31, spiralled in 2 or 3 series, dull pink in bud, becoming yellowish to white or cream-colored at anthesis and obscurely yellow-glandular, rounded or truncate at apex and there inconspicuously ciliate. The outer stamens may measure as much as 7×3 mm., the inner ones being slightly smaller. The staminodes are 9-11 in number, 1- or 2-seriate, at first rich pink dorsally, nearly white ventrally but yellow distally, becoming cream-white at anthesis, with 3 parallel veins and conspicuously hooded, rarely bearing rudimentary sporangia; they are obovate, conspicuously narrowed at base and larger than stamens, sometimes attaining a size of 12×5 mm. The pure white carpel bears 22-30 ovules on 2 parallel placentas borne between the median trace and the 2 ventral traces, some sessile and some funicled but not (as originally described) limited in this respect to one or the other placenta. At anthesis the carpel may be as large as 7×3 mm. and with its wall copiously immersed-yellow-glandular. The fruits at first are green, then pink to purple, and at maturity black, up to 11×5 cm. The seeds (most ovules maturing) are embedded in pale green pulp; their succulent outer coat is salmon-pink to bright orange. Swamy has pointed out the extraordinary fact that he did not discern dicotyledony in *Degeneria* (actually, however, it does very rarely occur). Of the more than 300 seeds he examined, about 87% had 3 cotyledons and about 13% 4 cotyledons. In the related Magnoliaceae tricotyledonous embryos are only occasionally encountered. The distantly related Queensland family Idiospermaceae (Laurales) has 3 or 4 massive, peltately attached cotyledons of a very different type than those of *Degeneria*.

TYPIFICATION: The holotype, as mentioned above, is *Degener 14537* (A), collected February 24, 1941, near Nauwangga, valley of Nandala Creek south of Nandarivatu, Mba Province, Viti Levu. There are many isotypes.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, Vanua Levu, and Taveuni, occurring at elevations between 30 and 1,150 m. in dense or open forest or in second-growth forest. Because of the interest of the species I cite below all the collections I have examined. Certainly many other collections exist, since most botanists who visit Fiji wish to see the species and have prepared herbarium material. A few "show trees" in southern Naitasiri Province, readily accessible from Suva, are well known to members of the Departments of Agriculture and Forestry and are protected for the convenience of interested visitors.

LOCAL NAMES AND USES: *Masiratu* is the name best known in southern Viti Levu, while in the more northern uplands the name *vavaloa* (black shoe) is widely used. In first collecting the species on Vanua Levu I recorded the name *yaranggele*, but this name has not otherwise been noted. The timber of *Degeneria vitiensis* is occasionally milled (although the species is too scattered in occurrence to be deliberately sought);

FIGURE 2. *Degeneria vitiensis*, from DA 15292; A, flower with many petals removed, showing calyx, a few inner petals, and extrorse surfaces of stamens and staminodes, $\times 4$; B, extrorse surface of an outer stamen, $\times 16$; C, extrorse surface of an inner stamen, $\times 16$; D, four staminodes, showing introrse and lateral surfaces, $\times 8$.



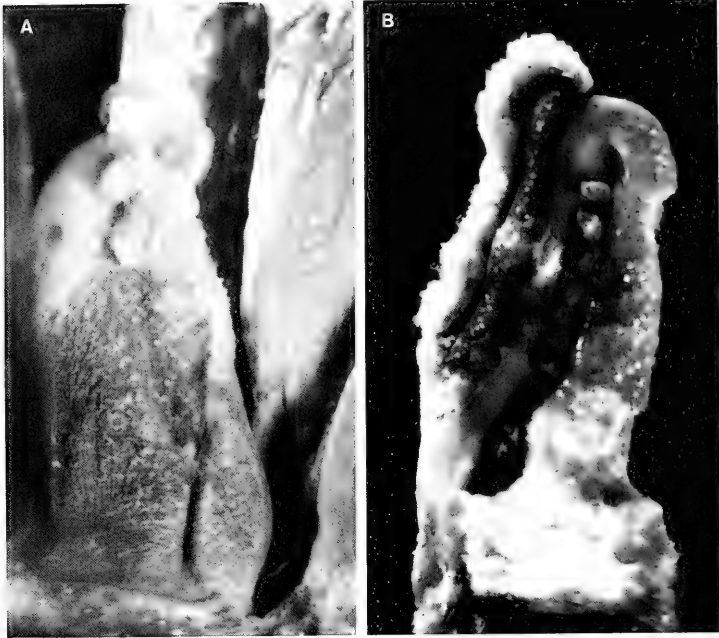


FIGURE 3. *Degeneria vitiensis*, from DA 15292; A, carpel and bases of staminodes, $\times 16$; B, longitudinal section of carpel, showing the copiously glandular wall, one stigmatic crest, and one row of ovules, $\times 16$.

the wood is considered potentially useful as a building timber, a case wood, for furniture, and for peeled and sliced veneer. Many attempts have been made to germinate seeds and to establish the plant outside of Fiji for its potential ornamental and scientific value; most such attempts have failed, but a few young plants may exist in U. S. or European greenhouses.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith* 6170, 6190; western slopes of Mt. Nanggaranambuluta, east of Nandarivatu, *Smith* 6301, 6318; hills east of Nandala Creek, south of Nandarivatu, *Smith* 5923; Nauwanga, valley of Nandala Creek, DA 3642; hills between Nggaliwana and Tumbendreketi Creeks, east of the sawmill at Navai, *Smith* 5875, 5880, 6018; western and southern slopes of Mt. Tomanivi, *Smith* 5744, DA 12726 (*Melville et al.* 7115), 13041. MBA or NAITASIRI: Waimongge Creek, south of Mt. Tomanivi, DF 1079. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith* 5555; Nausori Highlands, *Bola* NH-12, DA 13892, DF 1144 (S1561/6), 1145 (S1561/5); Nandronga & Navosa without further locality, DA 14297. SERUA: Nambukelevu East, *Berry* 95; inland from Namboutini, *Damanu* 105, 106, DF 456, 457, 1105, 1126 (S1561/2), 1129 (S1561/1); hills north of Ngaloa, in drainage of Wainngere Creek, *Smith* 9189; Tumarua, inland from Ngaloa, DF 878, 1135 (S1561/4), 1136 (S1561/3). NAMOSI: Hills bordering Wainavindrau Creek, in vicinity of Wainimakutu, *Smith* 8600; northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith* 8701; hills east of Wainikoroiuva River, near Namuamua, *Smith* 8939; Lombau River, *Bola* 79; Nambukavesi Creek, DF 230, *Bola* NI-17. NAITASIRI: Vicinity of Nanduna, near Waindrandra Creek, DA 1488 (coll. B. E. V. Parham, May 11, 1939).

3008, 3641, 3772, 5841, 10132, 10146, 15223, 15292; opposite Nawanggambena District School, *Stauffer & Kuruvoli* 5852; Nawanggambena, *DA 11854*; Naivuthini, *DA 1533*; Waimanu River, *DA L 13244* (*Berry* 54); Adi Cakobau School water supply road, Sawani, *Webster & Hildreth 14101*; Naitasiri without further locality, *DA 287* (coll. in 1936), *DA*, June 22 or 27, 1947. REWA: Mt. Korombamba, *DA 16538*. VANUA LEVU: MBUA: Lower Wainunu River Valley, *Smith 1754* (May 7, 1934); north of Thongea, Wainunu River, *DA 15773*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8200*; Nggathavulo Estate, *DA 16937*.

ORDER ANNONALES

Many phylogenists have taken the order Annonales in a very broad sense, submerging it in their concept of Magnoliales or taking it as the appropriate ordinal name for an extended complex of magnoliidean families. At another extreme, Hutchinson (1973) limits the Annonales to the two families Annonaceae and Eupomatiaceae. It is more generally considered, however, that the latter family is more strictly related to the Magnoliaceae than to the Annonaceae. Most recent students of "ranalean" taxa agree that three families, Annonaceae, Myristicaceae, and Canellaceae (not in Fiji), are closely related and group them into a suborder (of either Magnoliales or Annonales). In the present treatment this coherent cluster of families is taken to compose the order Annonales.

KEY TO FAMILIES OCCURRING IN FIJI

- Plants with hermaphrodite flowers (our species) or rarely monoecious; perianth basically 3-whorled, 1 whorl calycine and the other 2 petaloid; stamens free, hypogynous; carpels numerous or few, free or rarely united; fruit composed of free carpels or these connate into a syncarp, the seeds 1-many, sometimes (but not conspicuously) arillate. 45. ANNONACEAE
- Plants dioecious; flowers apetalous, the perianth composed of a 3 (rarely 2-5)-lobed calyx; stamens usually with filaments (and sometimes anthers) united, the ♂ flowers without carpellary vestiges; ♀ flowers without staminodes, the ovary unilocular, the ovule solitary, essentially basal; fruit usually dehiscent and 2-valved, the seed conspicuously arillate. 46. MYRISTICACEAE

FAMILY 45. ANNONACEAE

ANNONACEAE Juss. Gen. Pl. 283, as *Anonae*. 1789.

Trees or shrubs, rarely climbers (none of our species), with hermaphrodite flowers (our species) or rarely monoecious, often with aromatic wood and leaves; leaves exstipulate, alternate, distichous, simple, the blades entire, pinnately nerved; inflorescences 1-many-flowered, the flowers often fragrant, the receptacle broad, convex to flattened, sometimes with a cupuliform, stamiferous extension, the perianth basically 3-whorled and with each whorl 3-merous; sepals usually 3, free or partially connate, usually valvate, rarely imbricate; petals hypogynous, usually 6 (rarely 3 or 4 or 8) and in 2 whorls of 3 each, valvate or imbricate in each whorl, free or sometimes laterally coherent or connate; stamens hypogynous, with a single trace, usually numerous and spiralled on receptacle, rarely as few as 3 (but not in any of our species), the filament short or lacking, the anthers with 2 linear, extrorse or lateral, longitudinally dehiscent locules, these rarely transversely septate, the connective often produced beyond locules, often truncate and enlarged; pollen grains diverse, sometimes in tetrads or polyads, sometimes catasulcate or cataulcerate; gynoecium apocarpous or rarely syncarpous, the carpels usually free or subconnate and sessile or stipitate, less often united into a pluricarpellate or unilocular ovary, the ovules laminar or appearing parietal or basal, 1-many, anatropous, the styles usually short or none, the stigmas often capitate or clavate, sometimes coherent or agglutinated; fruits composed of free, sessile or stipitate, rarely dehiscent carpels, or these connate into a carnosely syncarp; seeds 1-many, in 1 or 2 series, sometimes arillate, the embryo minute, the endosperm copious and ruminant.

DISTRIBUTION: A large, tropical (infrequently temperate), tricentric family of

about 130 genera and 2,300 species. Most genera are limited to one of the three tropical areas (Africa-Madagascar, Asia-Australia-Pacific, or America). Only one genus (*Xylopia*) occurs in all three areas. *Polyalthia*, also indigenous in Fiji, occurs in both the African and Asian sectors but not in America. *Annona*, introduced into Fiji, is indigenous in America and Africa.

USEFUL TREATMENTS OF FAMILY: Sinclair, J. A revision of the Malayan Annonaceae. Gard. Bull. Singapore 14: 149-516. 1955. Fries, R. E. Annonaceae. In Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 17aII: 1-171. 1959. Hutchinson, J. Annonaceae. Gen. Fl. Pl. I: 71-108. 1964. Walker, J. W. Pollen morphology, phyto-geography, and phylogeny of the Annonaceae. Contr. Gray Herb. 202: 3-131. 1971.

The Annonaceae are represented in Fiji by six genera, four of them with indigenous species and two with cultivated and sometimes naturalized species.

KEY TO GENERA

Carpels free or essentially so, always free in fruit.

Anthers with the connective truncate or expanded and covering the locules distally.

Petals of the two series essentially similar; stamens not septate; pollen grains solitary, inaperturate, tectate, with distinct columellae.

Carpels numerous (rarely as few as 4), the ovules 1-5 (-8); petals free or slightly coherent, flat, at length spreading, not connivent over stamens and carpels. 1. *Polyalthia*

Carpels 1-10, the ovules 2-numerous; petals proximally broadened and connivent over stamens and carpels, distally projecting in spreading laminae. 2. *Cyathocalyx*

Petals of the two series dissimilar, those of the inner series connivent over stamens and carpels; stamens septate; pollen grains in tetrads or polyads, catasulcate or cataulcerate, with indistinct or indiscernible columellae.

Outer 3 petals thick, often lanceolate, narrowly concave, connivent nearly to apex; inner 3 petals included, smaller, triquetrous distally; carpels few, the ovules 2-12 per carpel; mature carpels sometimes dehiscent, the seeds not winged. 3. *Xylopia*

Outer 3 petals deltoid-ovate, free; inner 3 petals shorter, connivent into a pyramid; carpels numerous, the ovules 1 or 2 per carpel; mature carpels indehiscent, the seeds (in our species) conspicuously winged. 4. *Richella*

Anthers with the connective produced into a broad, lanceolate, acute appendage; pollen grains in loose tetrads, cataulcerate, microtectate, psilate; petals usually subequal, the inner ones not proximally connivent over stamens and carpels. 5. *Cananga*

Carpels united into a pluricarpellate ovary, the fruit a carnosose syncarp; sepals and petals valvate; pollen grains in tetrads (rarely solitary), tectate-perforate to tectate, with distinct columellae. 6. *Annona*

1. *POLYALTHIA* Bl. Fl. Javae, Anon. 68. 1830; Seem. Fl. Vit. 4. 1865; A. C. Sm. in Bishop Mus. Bull. 141: 59. 1936, in J. Arnold Arb. 36: 278. 1955.

Trees or shrubs; flowers solitary or fasciculate, axillary, extra-axillary, or leaf-opposed, sometimes on older branches; sepals 3 (rarely 4), valvate or slightly imbricate; petals 6 (rarely 8), valvate in 2 series, free, flat, subequal or those of the 2 series slightly unequal, at length spreading or some coherent; stamens numerous, the connective broad, truncate; carpels numerous (rarely as few as 4), the ovules 1-5 (-8), basal if solitary, otherwise superposed, the stigma usually sessile, capitate or irregular; mature carpels stipitate or subsessile, subglobose to oblong or obovoid, indehiscent, the seeds 1-5 (rarely -8), longitudinally grooved.

LECTOTYPE SPECIES: *Polyalthia subcordata* (Bl.) Bl. (*Annona subcordata* Bl.) (vide Hutchinson in Kew Bull. 1923: 259. 1923).

DISTRIBUTION: About 150 species, occurring from Africa through Indo-Malesia and eastward in the Pacific to Tonga and Samoa. In 1955 (cited above) I mentioned the genus as having a range terminating in Fiji, but since then the endemic Tongan *Polyalthia amicorum* A. C. Sm. has been described. A recent collection from Savaii, Samoa (*Whistler 576*, BISH), indicates that *Polyalthia* also occurs there, although the species is apparently undescribed; it is of the general relationship of *P. amoena* A. C.

Sm. but differs in several obvious characters. Nine species, all believed to be endemic, occur in Fiji.

The Fijian species of *Polyalthia* appear to be reticulately related to one another, but they are readily separable by combinations of characters related to indument, petiole and leaf blade characters, number of ovules, and features of mature fruits such as receptacle shape, carpel shape, and length of carpel stipe. Since fruiting specimens seem to be more often collected than flowering ones, characters of the mature carpels may be the most useful.

KEY TO SPECIES

Branchlets and leaves glabrous.

Carpels about 7, ovoid-globose to oblong-ellipsoid and strigose to sericeous at anthesis, sometimes with several ovules; fruiting carpels subglobose-ovoid or ellipsoid, about 15 mm. in diameter or up to 20 mm. long, essentially sessile and estipitate or abruptly short-stipitate, glabrous or sparsely strigose at maturity, the receptacle subglobose; leaf blades oblong-lanceolate, up to 20 × 7 cm., rounded to subcordate at base, with inconspicuous petioles usually 2-3 mm. long. 1. *P. amygdalina*

Carpels 6-20, the ovules usually 1 or 2; fruiting carpels oblong to obovoid-ellipsoid, obviously longer than broad, obviously stipitate, the stipe at least 2 mm. long.

Leaf blades rounded to a cordate base, often appearing amplexicaul, ovate to ovate-lanceolate, 8-16 × 3.5-7 cm., the petioles 1-5 mm. long; fruiting receptacle short-yellow-setose; fruiting carpels 6-8, copiously but closely tomentellous. 2. *P. laddiana*

Leaf blades obtuse to attenuate or infrequently rounded at base, 6.5-21 × 1.7-7 cm., usually decurrent on petiole, the petioles 2-10 mm. long; fruiting receptacle glabrous; fruiting carpels usually 8-20, glabrous.

Fruiting carpels oblong, about 3 times longer than broad, 25-45 × 8-15 mm., the stipe 2-8 mm. long, the receptacle transversely ellipsoid and irregular; leaf blades ovate- or oblong-elliptic, (8-) 12-21 × (2.5-) 5-7 cm., 2-3 times longer than broad, acute to sometimes rounded at base, the petioles 2-6 mm. long; pedicels at anthesis (20-) 35-40 mm. long, in fruit up to 50 mm. long. 3. *P. vitiensis*

Fruiting carpels obovoid or oblong-ellipsoid, less than twice as long as broad, 15-27 × 7-16 mm., the receptacle subglobose; leaf blades lanceolate or oblong-lanceolate, usually 4-5 times longer than broad, acute at base; fruiting pedicels 20-35 mm. long.

Leaf blades usually 12-18 × 2.5-4 cm., the petioles 6-10 mm. long; fruiting carpels 15-27 × 12-16 mm., the stipe about 2 mm. long. 4. *P. angustifolia*

Leaf blades 6.5-13 × 1.7-3.5 cm., the petioles 2-5 mm. long; fruiting carpels 15-17 × 7-10 mm., the stipe 10-20 mm. long. 5. *P. amoena*

Branchlets and principal nerves on lower surfaces of leaf blades with subsistent indument.

Carpels in fruit not tuberculate; ovules and seeds apparently solitary.

Fruiting carpels oblong or conical-ellipsoid, 3-4 times longer than broad, glabrous; leaf blades 10-24 × 4-10.5 cm., acuminate at apex.

Indument associated with branchlets and leaves setulose, spreading; petioles 2-3 mm. long; leaf blades 10-23 × 4-7.5 (-10) cm., rounded to subcordate at base; fruiting carpels 25-45 × 9-12 mm., the stipe 3-5 mm. long. 6. *P. loriformis*

Indument associated with branchlets and leaves crispate or sericeous; petioles 8-12 mm. long; leaf blades 15-24 × 6-10.5 cm., broadly obtuse at base; fruiting carpels 25-35 × 6-10 mm., the stipe 5-10 mm. long. 7. *P. capillata*

Fruiting carpels subglobose or ellipsoid, 13-18 × 11-17 mm., copiously velutinous-puberulent, the stipe 1-2 mm. long; leaf blades elliptic- or ovate-oblong, 4-12.5 × 2-5 cm., rounded to subcordate at base, obtuse to obtusely acuminate at apex; petioles 2-3 mm. long; indument associated with branchlets and leaves setulose, spreading. 8. *P. habrotricha*

Carpels in fruit conspicuously tuberculate, copiously pilose with spreading hairs 0.1-0.4 mm. long, ellipsoid-oblong, up to 4 × 1 cm.; ovules and seeds usually 6-8; petioles inconspicuous, 1-2 mm. long, the leaf blades narrowly elliptic-oblong, up to 10 × 4 cm., truncate-subcordate at base, obtuse at apex. 9. *P. insularis*

1. *Polyalthia amygdalina* (A. Gray) Gillespie in Bishop Mus. Bull. 83: 4, excl. syn. *P. vitiensis*. 1931; A. C. Sm. in op. cit. 141: 60. 1936; J. W. Parham, Pl. Fiji Isl. 49, p. p. 1964, ed. 2. 79. 1972; A. C. Sm. in Allertonia 1: 350. 1978. FIGURE 4A.

Uvaria amygdalina A. Gray, Bot. U. S. Expl. Exped. 1: 31. 1854; Seem. Viti, 432. 1862, Fl. Vit. 4. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 103. 1889.

Desmos leucanthus A. C. Sm. in J. Arnold Arb. 31: 156. 1950, in op. cit. 36: 278. 1955; J. W. Parham, Pl. Fiji Isl. 49. 1964, ed. 2. 79. 1972.

A small tree or slender shrub 2–8 m. high, occurring in dense forest, sometimes on creek banks, or in dense crest thickets, at elevations of 400–1,130 m. Its petals are dull white, the inner ones being pinkish at base, its stamens are also dull white, and its carpels at anthesis are brownish. Flowers and fruits have been obtained in scattered months.

TYPIIFICATION AND NOMENCLATURE: The holotype of *Uvaria amygdalina* is *U. S. Expl. Exped.* (US 2503), collected in 1840 on Ovalau without further data; an isotype is at GH. *Desmos leucanthus* is based on a unicate specimen, *Smith 5613* (A HOLOTYPE), collected Aug. 11, 1947, on the northern part of the Rairaimatuku Plateau between Nandrau and Rewasau, Nandronga & Navosa Province, Viti Levu. In suggesting this synonymy in 1978 (cited above), I indicated that the genus *Desmos* does not extend as far eastward as Fiji. The species is readily separated from *Polyalthia vitiensis*, with which it has sometimes been confused.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Ovalau.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Summit of Mt. Nanggaranambuluta, *Gillespie 3928*. NAMOSI: Vicinity of Namosi, *DA 14583*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7687*; above Levuka reservoir, *Gillespie 4532*; Ovalau without further locality, *Horne 318*, *Graeffe 1550*. F11 without further locality, *Gillespie s. n.* (possibly part of no. 4532).

2. *Polyalthia laddiana* A. C. Sm. in Bishop Mus. Bull. 141: 60. fig. 28. 1936; J. W. Parham, Pl. Fiji Isl. 49. 1964, ed. 2. 80. 1972. **FIGURE 4C & D.**

This distinct but inadequately known species, collected only in fruiting condition, is a tree 4–5 m. high, with a slender trunk 3–8 cm. in diameter, found in forest on limestone from near sea level to about 80 m. Its fruiting carpels are greenish brown, the seeds being darker brown and surrounded by orange pulp. Fruits are known to occur in February and August.

TYPIIFICATION: The holotype is *Smith 1147* (BISH), collected Feb. 22, 1934, on the island of Fulanga; there are several isotypes.

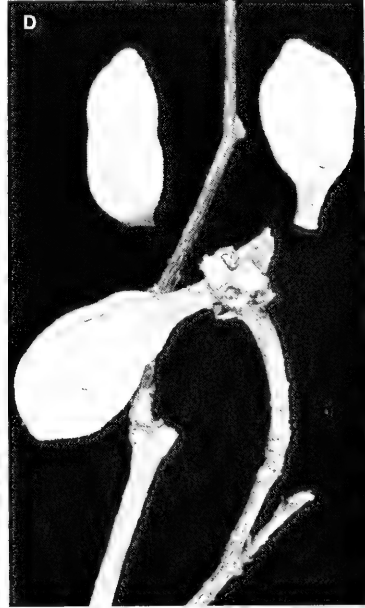
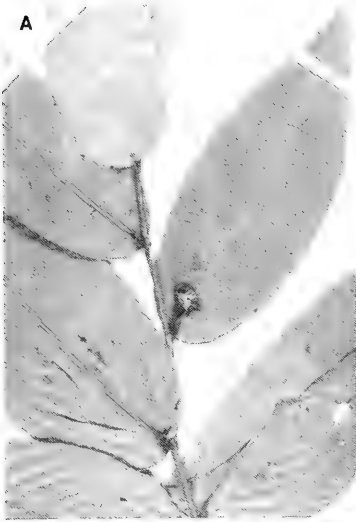
DISTRIBUTION: Endemic to Fiji and known from only three islands in southern Lau.

LOCAL NAME: *Vuvundi*, recorded only for the type collection.

AVAILABLE COLLECTIONS: ONEATA: Interior forest, *Bryan 489*. KAMBARA: Central wooded basin, *Bryan 509*.

3. *Polyalthia vitiensis* Seem. in Bonplandia 9: 254, nom. nud. 1861; A. Gray in op. cit. 10: 34, nom. nud. 1862, in Proc. Amer. Acad. Arts 5: 315, nom. nud. 1862; Seem. Viti, 432, nom. nud. 1862, Fl. Vit. 4. pl. 3. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 104. 1889; A. C. Sm. in Bishop Mus. Bull. 141: 60. 1936, in Allertonia 1: 351. 1978. **FIGURE 4B.**

FIGURE 4. A, *Polyalthia amygdalina*, branchlet and foliage, with an axillary flower from which one sepal, the petals, and most stamens have been removed, $\times 1/2$, from *Smith 5613*. B, *Polyalthia vitiensis*, fruiting pedicel and receptacle, with detached mature carpels, $\times 2$, from *Smith 5629*. C & D, *Polyalthia laddiana*, from *Smith 1147*; C, branchlet and foliage, with an immature fruit from which several carpels have been removed, $\times 1/2$; D, mature fruit, with one carpel attached and two detached, $\times 2$.



Polyalthia pedicellata A. C. Sm. in Bishop Mus. Bull. **141**: 61, fig. 29. 1936, in Sargentia **1**: 32. 1942, in J. Arnold Arb. **31**: 158. 1950; J. W. Parham, Pl. Fiji Isl. **49**. 1964, ed. 2. 80. 1972.

Polyalthia amygdalina sensu J. W. Parham, Pl. Fiji Isl. **49**, p. p. fig. 24. 1964; non Gillespie.

An often slender tree 5–20 m. high, occurring at elevations between 50 and 1,150 m. in dense or dry forest or in forest on crests and ridges. The petals, stamens, and carpels at anthesis are yellowish green; the fruits are borne with the leaves or on the branches and trunks of the tree, their carpels turning from green to orange at maturity. Flowers have been noted only between July and September, but fruits are found in months scattered throughout the year.

TYPIFICATION AND NOMENCLATURE: The holotype of *Polyalthia vitiensis* is *Seemann* 4 (K), collected in July, 1860, in southern Ovalau near Port Kinnaird. *Polyalthia pedicellata* is typified by *Smith* 647 (BISH HOLOTYPE; many ISOTYPES), obtained Nov. 28, 1933, on the crest of the Mt. Mbatini Range, Thakaundrove Province, Vanua Levu. As mentioned by me in 1978 (cited above), I originally gave undue weight to the shape of the leaf base in separating *P. pedicellata* (then known only in fruit) from *P. vitiensis* (the type having both flowers and fruits, the latter with unusually short pedicels). It is now seen that the irregular fruiting receptacle and the elongate, comparatively long-pedicellate fruiting carpels best characterize this species.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Ovalau, Vanua Levu, and Taveuni.

LOCAL NAMES AND USE: Recorded local names, all from Viti Levu, are *singasa*, *kai sou*, and *makosai*; the tough bark is said to be used locally for rope (*Degener* 14737).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie* 3909.1; hills east of Nandala Creek, south of Nandarivatu, *Smith* 6220; Nauwanga, south of Nandarivatu, *Degener* 14737; hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith* 6009; western and southern slopes of Mt. Tomanivi, *Smith* 5116. NADRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith* 5629. SERUA: Inland from Namboutini, *DA* 13993; hills between Wainingere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith* 9561. TAVEUNI: Nggeleni road, *DA* 15872; slopes of Mt. Manuka, east of Wairiki, *Smith* 8203.

4. *Polyalthia angustifolia* A. C. Sm. in Bull. Torrey Bot. Club **70**: 538. 1943; J. W. Parham, Pl. Fiji Isl. **49**. 1964, ed. 2. 79. 1972. FIGURE 5A & B.

A tree 3 m. or more high, occurring in open and dense forest at elevations of about 100–150 m. It is known only in fruiting condition; the fruits, obtained in May and August, have green carpels that become red at maturity.

TYPIFICATION: The type is *Gillespie* 2198 (A HOLOTYPE; ISOTYPES at BISH, GH), collected Aug. 9, 1927, near Tamavua, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from southeastern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: REWA or NAITASIRE: "Suva," *Tothill* 4. REWA: Mt. Korombamba, *Parks* 20103.

This insufficiently known species is readily distinguished from the preceding by its oblong-lanceolate, proportionately narrower leaf blades, subglobose fruiting receptacle, and shorter, comparatively short-stipitate fruiting carpels.

5. *Polyalthia amoena* A. C. Sm. in J. Arnold Arb. **31**: 159. 1950; J. W. Parham, Pl. Fiji Isl. **49**. 1964, ed. 2. 79. 1972.

FIGURE 5. A & B, *Polyalthia angustifolia*; A, distal portion of branchlet and leaves, $\times 1/2$, from *Parks* 20103; B, fruiting pedicel and receptacle, with one carpel attached and two detached, $\times 2$, from *Gillespie* 2198. C, *Polyalthia capillata*, fruiting pedicel and receptacle, with attached mature carpels, $\times 1$, from *Smith* 4581. D, *Polyalthia loriformis*, portion of branchlet with petiole, base of leaf blade, and lower portions of two axillary pedicels, showing setulose indument, $\times 4$, from *Gillespie* 2445.



An often slender tree 4-7 m. high, found in dense or open forest at elevations of 60-590 m.; the mature carpels are orange. Both flowering and fruiting material has been obtained in April and October.

TYPIFICATION: The type is *Smith 6423* (A HOLOTYPE; many ISOTYPES), collected Oct. 29, 1947, on the summit ridge of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Vanua Levu, probably from the general vicinity of the type locality.

LOCAL NAME: *Sitiloa* (recorded only for *Smith 6380*).

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Vicinity of Lambasa, *Greenwood 539*, p. p.; mountains along Mathuata coast, *Greenwood 539*, p. p.; southern slopes of Mt. Numbuiloa, *Smith 6380*.

From its only close relative, *Polyalthia angustifolia*, the present species is to be distinguished by its short petioles, its smaller, thinner leaf blades with more obvious venation, and its narrower fruiting carpels with conspicuously longer stipes.

6. *Polyalthia loriformis* Gillespie in Bishop Mus. Bull. **83**: 4. fig. 1. 1931; A. C. Sm. in op. cit. **141**: 60. 1936; J. W. Parham, Pl. Fiji Isl. **49**. 1964, ed. 2. 80. 1972.

FIGURE 5D.

This distinctive species is a shrub or small tree 1-5 m. high, often slender and with dependent branches, occurring at elevations of 100-700 m. in light or dense forest, sometimes on creek banks. The copious, yellow indument of its vegetative parts is striking. Its petals are dull yellow or cream-yellow, and its fruiting carpels are at first yellow-green, becoming orange or bright red at maturity. Flowers and fruits have been obtained in months scattered throughout the year.

TYPIFICATION: The holotype is *Gillespie 3639* (BISH), obtained Oct. 29, 1927, in the vicinity of Nasinu, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from Viti Levu, Ovalau, and Vanua Levu. It is the best represented species of the genus in Fiji, perhaps because of its abundance in southeastern Viti Levu.

LOCAL NAME: Only the name *vutinaboro* (referring to the conspicuous indument) has been recorded (*DA 3396*).

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Waiyauyau, *DA 14245*. NAITASIRI: Waindrandra Creek, *DA 3396*, *DA*, Apr. 28, 1936; Waimbau Creek, Waindina River Valley, *DA 11216*; Central road, *Tothill F484*, *F536*; vicinity of Tamavua, *Gillespie 2055*, *2445*; vicinity of Nasinu, *Greenwood 1125*, *Gillespie 3437*, *3448*. NAITASIRI OF REWA: "Suva," *Tothill 3*. TAILEVU: Forest Reserve, King's Road, *DA 7182*, *7184*, *7185*. OVALAU: Without further locality, *Storck VII* (Aug. 1881). VANUA LEVU: THAKAUNDOVE: Vunimoli, Vaturamulo, *DA 15392*; southwestern slope of Mt. Mbatini, *Smith 601*; Navonu Creek, Natewa Peninsula, *DA 13819*, *14331*. FIJI without further locality, *DA L.14179* (*Berry*).

7. *Polyalthia capillata* A. C. Sm. in J. Arnold Arb. **31**: 158. 1950; J. W. Parham, Pl. Fiji Isl. **49**. 1964, ed. 2. 79. 1972.

FIGURES 5C, 6.

A slender tree 4.5-6 m. high, found in dense forest at 300-600 m. elevation. Thus far it is known only in fruiting condition, its fruits (obtained in May and June) being borne on the trunk and with the carpels yellow at maturity.

TYPIFICATION: The type is *Smith 4581* (A HOLOTYPE; many ISOTYPES), collected May 29, 1947, on the southern slopes of the Nausori Highlands, in the drainage of Namosi Creek, above Tumbenasolo, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the Nausori Highlands.

USE: It is indicated that the wood has been used in making farming tools (*Vetawa 13*, *15*).

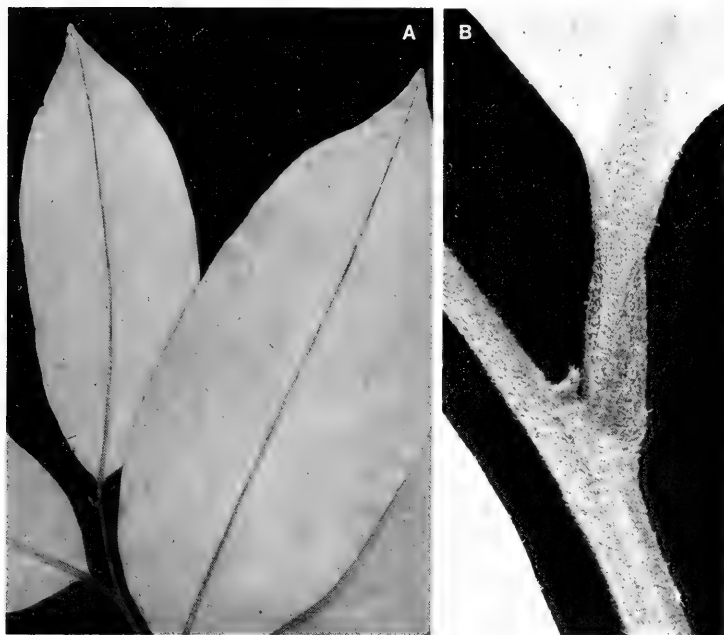


FIGURE 6. *Polyalthia capillata*, from Smith 4581; A, distal portion of branchlet and lower leaf surfaces, $\times 1/2$; B, portion of branchlet, with petiole and base of leaf blade, showing close indument, $\times 4$.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, DA 13315, *Vetawa* 13, 15.

Polyalthia capillata suggests *P. vitiensis* in its foliage and fruits, but it has longer petioles and proportionately broader leaf blades, and it differs sharply in the obvious and persistent indument of its branchlets and petioles. From *P. loriformis* the present species is readily separated by its much closer indument, its leaves with longer petioles and obtuse rather than rounded or subcordate bases, and its smaller, long-stipitate fruiting carpels.

8. *Polyalthia habrotricha* A. C. Sm. in *J. Arnold Arb.* 31: 157. 1950; J. W. Parham, *Pl. Fiji Isl.* 49. 1964, ed. 2. 79. 1972.

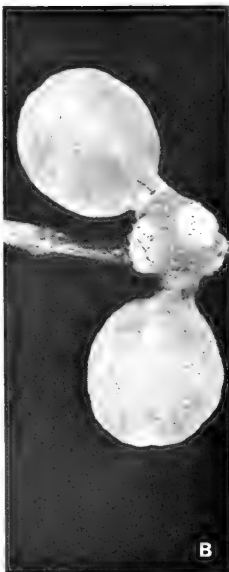
FIGURE 7A & B.

A slender shrub or tree 2–8 m. high, with a compact crown, occurring in dense or dry forest at elevations of 50–1,000 m. The petals are greenish white and the fruiting carpels (probably not fully mature) are green. Flowers have been obtained in November and December and fruits between May and December.

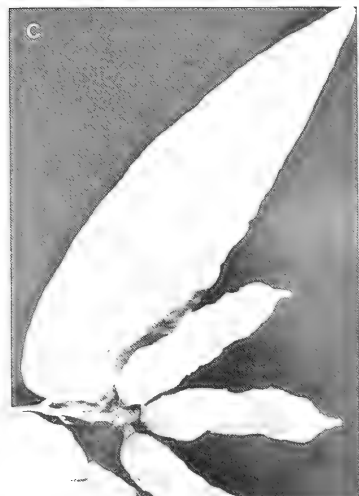
TIPIFICATION: The holotype is a unicate specimen, *Smith 5614* (A), collected Aug. 11, 1947, on the northern portion of the Rairaimatuku Plateau, between Nandrau and Rewasau, Nandronga & Navosa Province, Viti Levu.



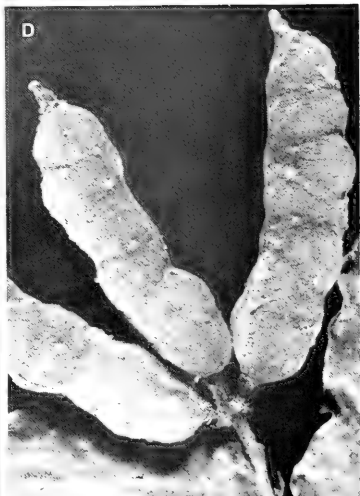
A



B



C



D

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Navai Range, *DA 2310*; Mt. Tomanivi, *DA 12699* (*Melville et al. 7087*). SERUA: Inland from Namboutini, *DA L. 13419* (*DF 964*); hills between Wainingere and Waisees Creeks, between Ngaloa and Wainiyambia, *Smith 9562*.

Polyalthia habrotricha is not as closely related to *P. amygdalina* as I originally suggested, being closer to *P. loriformis*, from which it is distinguished by its smaller leaves and very readily by its subglobose or ellipsoid fruiting carpels with shorter stipes.

9. *Polyalthia insularis* (A. C. Sm.) A. C. Sm. in *Allertonia* 1: 351. 1978.

FIGURE 7C & D.

Desmos insularis A. C. Sm. in *Sargentina* 1: 31. 1942, in *J. Arnold Arb.* 36: 278. 1955; J. W. Parham, *Pl. Fiji Isl.* 49. 1964, ed. 2. 79. 1972.

This inadequately represented species is a compact tree about 5 m. high, occurring (as far as known) in an isolated, dry, forested ravine at an elevation of 60–120 m. Its flowers and its brownish gray fruits are known to occur only in April.

TIPIFICATION: The type is *Degener 14968* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected April 1, 1941, near Korovou, east of Tavua, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type material and a second collection without detailed data.

AVAILABLE COLLECTION: FIJI without further locality, *Gillespie 3716*.

As indicated by me in 1978 (cited above), this taxon cannot remain in *Desmos* because of its psilate pollen grains, but it is placed in *Polyalthia* with certain reservations. Its conspicuously tuberculate fruiting carpels are not characteristic of the genus, at least in the Fijian Region, and in having 6–8 ovules and seeds per carpel it does not suggest the other known Fijian species with obvious indument. In foliage, however, it is somewhat similar to *P. habrotricha*.

2. *CYATHOCALYX* Champion ex Hook. f. & Thoms. *Fl. Ind.* 126. 1855; A. C. Sm. in *J. Arnold Arb.* 31: 160. 1950, in *op. cit.* 36: 278. 1955.

Trees (our species); flowers solitary or fasciculate, extra-axillary or leaf-opposed; sepals 3, valvate, nearly free or connate into a 3-lobed calyx; petals 6, valvate in 2 series, subequal, proximally broadened and connivent over stamens and carpels, distally projecting in flat, spreading laminae; stamens numerous, elongate, the connective broad, often copiously glandular, truncate or that of the innermost whorl of anthers prolonged adaxially; carpels 1–20, the ovules 2–numerous, the stigmas (in our species) connate or agglutinated into a subglobose or peltate capitulum, the outer rim of this sometimes clasping the connective tips of the inner stamens; mature carpels usually stipitate, ellipsoid to subglobose, indehiscent, the seeds 1–several.

TYPE SPECIES: *Cyathocalyx zeylanicus* Champion ex Hook. f. & Thoms.

DISTRIBUTION: About 20–40 species from southeastern Asia through Malasia and eastward in the Pacific to Fiji, where four endemic species terminate the range.

USEFUL TREATMENT OF GENUS: Smith, A. C. *Cyathocalyx*. *J. Arnold Arb.* 31: 160–164. 1950.

FIGURE 7. A & B, *Polyalthia habrotricha*, from *Smith 9562*; A, branchlet with young inflorescence and foliage, × 2; B, fruit, with two attached carpels, × 2. C & D, *Polyalthia insularis*, from *Degener 14968*; C, distal portion of branchlet, with upper leaf surface and fruit, × 1; D, fruit, with three attached carpels, × 2.

KEY TO SPECIES

Petals proportionately broad, the spreading portions oblong-elliptic or elliptic-lanceolate from a contracted base, at anthesis 4–10 (–15) mm. broad; flowers (pedicels, calyx, and petals) minutely puberulent, often glabrescent; ovules 2–6 per carpel but usually only 1–3 developing into seeds; stipes of mature carpels 4–7 mm. long, the carpel slightly contracted between seeds (if more than 1), the seeds usually oblique (if more than 1).

Leaf blades obovate or elliptic, 10–20 × 5–8.5 cm., obtuse or rounded or emarginate at apex, the secondary nerves usually 10–14 per side, straight or slightly curved, spreading; stamens sometimes as many as 150; carpels about 20, but usually only 3–5 persisting to maturity; mature carpels obovoid, 10–15 × 7–10 mm. 1. *C. vitiensis*

Leaf blades usually proportionately narrower, 9–23 (–26) × 4–8 (–11.5) cm., obtusely cuspidate at apex with an acumen 3–10 mm. long, the secondary nerves 9–12 per side, curved-ascending; stamens 55–85; carpels 6–10, but usually only 3–7 persisting to maturity; mature carpels ellipsoid, 10–20 × 8–14 mm. 2. *C. insularis*

Petals proportionately narrow, the spreading portions ligulate and hardly contracted at base, at anthesis 2–6 (–7) mm. broad.

Leaf blades 9–20 × 4.5–8.5 cm., obtuse or subacute at base, the secondary nerves 7–10 per side; flowers (pedicels, calyx, and petals) puberulent, glabrescent; carpels 9 or 10, but usually only 3–7 persisting to maturity, the ovules 2 per carpel; mature carpels oblong-ellipsoid, to 15 × 10 mm., often contracted between seeds, these usually 2, rarely solitary, the stipes 7–8 mm. long. 3. *C. stenopetalus*

Leaf blades usually 15–32 × 8–12 cm., rounded or broadly obtuse at base, the secondary nerves 11–16 per side; flowers (pedicels, calyx, and petals) closely and persistently tomentellous; carpels 5–7, but usually only 3–6 persisting to maturity, the ovules 6 or 7 per carpel; mature carpels subglobose, often rugulose, to 25 mm. in diameter, the seeds often 3, horizontal, the stipes 3–7 mm. long.

4. *C. suaveolens*

1. *Cyathocalyx vitiensis* A. C. Sm. in Bishop Mus. Bull. 141: 64. fig. 31. 1936, in J. Arnold Arb. 31: 161. 1950; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 79. 1972.

FIGURE 8A & B.

A sometimes slender tree 3–10 m. high, occurring in dense, light, or secondary forest at elevations of 10–430 m.; the petals are pale green or pale or dull yellow, and the fruits are noted as bluish green. Flowers and fruits have been obtained only in April and May.

TIPIFICATION: The type is *Smith 1720* (BISH HOLOTYPE; several ISOTYPES), collected May 7, 1934, in the lower Wainunu River Valley, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Vanua Levu.

LOCAL NAMES: *Mako* and *salusalu* have been recorded, but both names are more often referred to other, quite different species.

AVAILABLE COLLECTIONS: VANUA LEVU: THAKAUNDROVE: Mt. Kasi, Yanawai River region, *Smith 1791*; Vunimoli, Vaturamulo, *DA 15398*; "track to Natewa Bay," *DA 15072*.

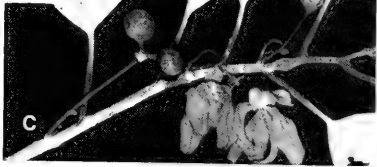
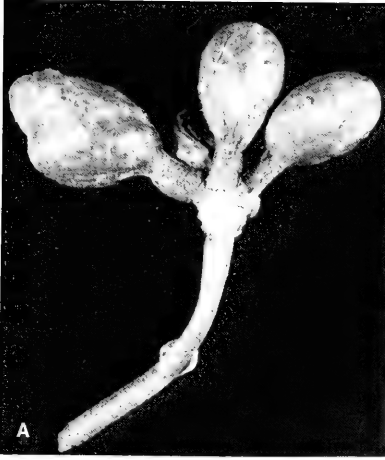
2. *Cyathocalyx insularis* A. C. Sm. in J. Arnold Arb. 31: 161. 1950; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 78. 1972.

FIGURES 8C & D, 9A–C.

Cyathocalyx vitiensis sensu A. C. Sm. in *Sargentia* 1: 33. 1942; non sensu typi.

This comparatively abundant species is an often slender tree 2–20 m. high, found in various types of forest (dense, open, dry, secondary) at elevations of 30–1,100 m.; the fragrant flowers have petals noted as green or cream-white to dull or pale yellow, and at maturity the carpels become deep purple to black. Flowers and fruits have been obtained in months scattered throughout the year.

FIGURE 8. A & B, *Cyathocalyx vitiensis*, from *Smith 1791*; A, fruiting pedicel and receptacle, with four attached carpels, × 2; B, distal portion of branchlet, with leaves and inflorescences, × 1/2. C & D, *Cyathocalyx insularis*: C, distal portion of branchlet, with leaves, inflorescences, and fruit, × 1/2, from *Smith 9424*; D, basal portion of flower, with two sepals, two outer petals, and one inner petal removed, × 6, from *Smith 9483*.





TYPIFICATION: The type is *Smith 5868* (A HOLOTYPE; many ISOTYPES), collected Sept. 2, 1947, in hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Kandavu. It appears to be the most frequent species of the genus in Fiji, 40 collections having been studied.

LOCAL NAMES AND USES: *Makosoi* (the usual name for the genus), *makasoi*, *mako-soi ni veikau* (indicating a distinction from *Cananga*); it is considered a usable timber tree, and the bark is sometimes used locally for rope.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 3854*; Mt. Matomba, Nandala, *Degener 14638*; Navai, *DA 14977*. NANDRONGA & NAVOSA OF NAITASIRI: Between Nandrau and Namboubutho Creek, *Horne 987*. SERUA: Nathengathenga Creek, *DA 14271*; inland from Namboutini, *DA L.13420 (DF 963)*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9483*; hills north of Ngaloa, in drainage of Waininggere Creek, *Smith 9424*; hills east of Navua River, near Nukusere, *Smith 9130*. NAMOSI: Mt. Naitarandamu, *Gillespie 3145*; hills near Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8518*; vicinity of Namuamua, *Gillespie 3252*. NAITASIRI: Waindrandra Creek, *DA 175*; Central road, *Tothill F517*; Tholo-i-suva, *DA 12479 (DF 128)*; Suva Pumping Station, *Degener & Ordenez 13744*; vicinity of Nasinu, *Gillespie 3612*. REWA: Namboro, *DA 16975*. KANDAVU: Kiombo, *DA 12434 (DF 79)*; Naikorokoro, *DA 13866*.

3. *Cyathocalyx stenopetalus* A. C. Sm. in J. Arnold Arb. 31: 162. 1950; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 78. 1972. FIGURES 9D, 10A.

A tree 4–15 m. high, occurring in dense forest at elevations of 100–600 m.; the sometimes very fragrant flowers have green sepals and petals, the latter becoming yellow, and the fruiting carpels turn from green to cream-colored, doubtless darkening at full maturity. Flowers and fruits have been obtained between December and June.

TYPIFICATION: The type is *Smith 6778* (A HOLOTYPE; many ISOTYPES), obtained Dec. 1, 1947, at the southern base of the Mathuata Range, north of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from Vanua Levu and Rambi.

LOCAL NAMES: *mako*, *tumbu ni makasoi*, *makosoi ni veikau*.

AVAILABLE COLLECTIONS: VANUA LEVU: MBUA: Southern slope of Mt. Seatura, *Smith 1681*. MATHUATA: Lingangaungau, Natua, *DA 15344*. THAKAUNDRIVE: Namoliwawa, *DA 13162*; Navonu Creek and nearby ridge, Natewa Peninsula, *Howard 205, DA 16889*. RAMBI: *Horne 430*.

This species and the next differ sharply from *Cyathocalyx vitiensis* and *C. insularis* in having the spreading portions of their petals, above the expanded and connivent basal parts, narrow and ligulate rather than conspicuously broadened and elliptic.

4. *Cyathocalyx suaveolens* A. C. Sm. in J. Arnold Arb. 31: 163. 1950; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 79. 1972. FIGURES 10B–D, 11.

A tree 9–20 m. high, found in dense or open forest between 100 and 900 m.; the very fragrant flowers have green or yellowish green petals, and the fruiting carpels are at first green and eventually black. Flowers and fruits have been noted between December and July.

FIGURE 9. A–C, *Cyathocalyx insularis*, from *Smith 9483*; A, flower, $\times 2$; B, gynoecium, the stigmas crescent into a capitulum, the connectives of the innermost whorl of anthers wedged under the edges of the capitulum, $\times 20$; C, two stamens, the left one from a middle whorl, the right one, with a prolonged connective, from the innermost whorl, $\times 40$. D, *Cyathocalyx stenopetalus*, terminal portion of branchlet, with an inflorescence and foliage, $\times 1/3$, from *DA 16889*.

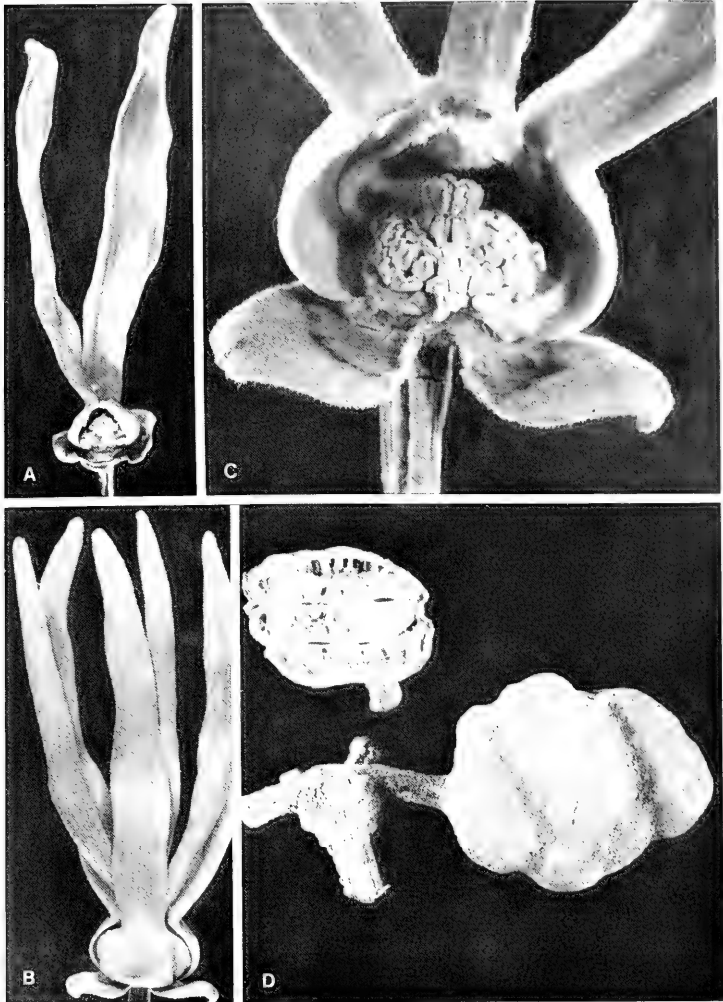


FIGURE 10. A, *Cyathocalyx stenopetalus*, flower, with one sepal, two outer petals, two inner petals (except for basal portion of one of them), and many stamens removed, $\times 2$, from DA 16889. B-D, *Cyathocalyx suaveolens*; B, flower, $\times 2$; C, basal portion of flower, with one outer petal and two inner petals removed, $\times 6$; D, mature fruit, with one attached carpel and a detached carpel longitudinally sectioned, showing three flattened, horizontal seeds, $\times 2$; B & C from Smith 392, D from Gillespie 4741.

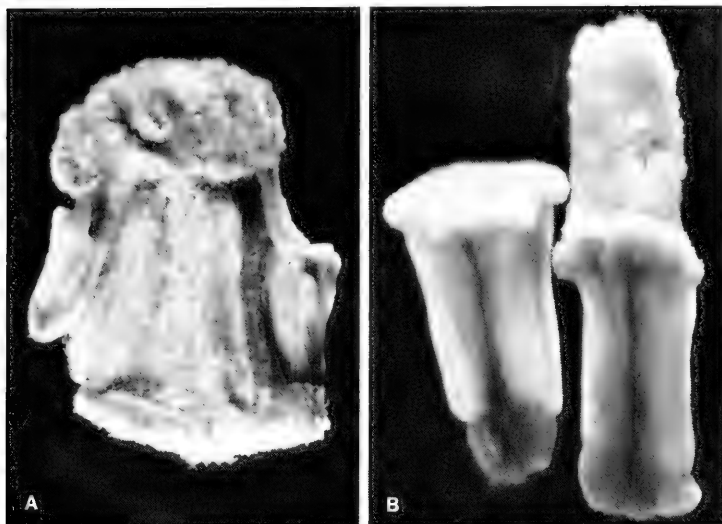


FIGURE 11. *Cyathocalyx suaveolens*, from *Smith 392*; A, gynoecium, the stigmas conerescent into a capitulum, the connectives of the innermost whorl of anthers wedged under the edges of the capitulum, $\times 20$; B, two stamens, the left one from a middle whorl, the right one, with a prolonged connective, from the innermost whorl, $\times 40$.

TYPIFICATION: The type is *Smith 5342* (A HOLOTYPE; many ISOTYPES), collected July 21, 1947, in the valley of Nggaliwana Creek, north of the sawmill at Navai, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Vanua Levu, and Taveuni.

LOCAL NAME AND USE: *Makosoi*; the fragrant flowers have been noted as used in garlands.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 4267*. NAITASIRI: Wailala Creek, valley of Waimanu River, *DA L. 14180* (coll. *Howard*). VANUA LEVU: MBUA: Above Thongea, Wainunu River, *DA 15800* (coll. *Berry*). THAKAUNDROVE: Namoliwawa, *DA 13143*; southern slope of Valanga Range, *Smith 392*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4741*.

Most closely related to *Cyathocalyx stenopetalus*, the present species is readily distinguished by foliage details, by its closely and persistently tomentellous flowers, and by its more numerous ovules and subglobose, comparatively short-stipitate, often rugulose fruiting carpels.

3. XYLOPIA L. Syst. Nat. ed. 10. 1241, 1250, 1378. 1759; A. C. Sm. in J. Arnold Arb. 36: 278. 1955. Nom. cons.

Trees or shrubs; flowers solitary or fasciculate, axillary or borne on defoliate branches; sepals 3, connate proximally; petals 6, valvate in 2 series, the outer 3 thick, often lanceolate, narrowly concave, connivent or nearly so, forming an inconspicu-

ously hexagonal pseudocorolla, the inner 3 included, smaller, subulate or triquetrous distally, forming a chamber over the stamens and carpels; receptacle sometimes distally extended into a stamiferous cupule, the stamens numerous, closely imbricate, the anthers oblong, septate, the connective dilated, truncate; carpels few, the ovules 2-12 per locule, superposed, laminar-ventral, the styles short or elongated, the stigmas sometimes elongated and agglutinated; mature carpels ellipsoid to oblong or obovoid, stipitate, often shortly so, dehiscent or indehiscent, the seeds up to 12 in number.

LECTOTYPE SPECIES: *Xylopia muricata* L., one of Linnaeus's two original species. Typ. cons.

DISTRIBUTION: Tricentric-tropical, with many species in Africa, comprising about 170 species, extending through Indo-Malesia and eastward in the Pacific to Fiji, where three endemic species terminate the range.

The Fijian taxa are somewhat similar in vegetative characters, all having a sericeous or minutely tomentellous indument on some vegetative and floral parts; in general their leaf blades are ovate to oblong-elliptic, up to 13 × 6 cm., abruptly decurrent on the petiole, cuspidate to obtusely short-acuminate at apex, and with 7-18 secondary nerves and intricate, prominulous venation. Their flowers are usually 1 or 2 (or sometimes few) per inflorescence, and their fruiting carpels are inaequilaterally obovoid to narrowly ellipsoid-oblong, usually with at least 4 obliquely superposed, flattened seeds, and with a thick pericarp that sometimes develops air cavities. Nevertheless, the three Fijian species seem reasonably discrete and recognizable by character combinations indicated in the following key.

KEY TO SPECIES

Leaves with obvious, glabrous petioles 15-20 mm. long, the blades 7-13 × 3-6 cm.; calyx lobes obvious in mature flowers, 2-5 mm. long; stamens about 100; ovules about 8 per carpel; mature carpels 4-8, the pericarp concolorous, the seeds 6-8 or fewer, up to 10 × 5 mm.

Calyx 5-6 mm. in apical diameter, the lobes about 2 mm. long; outer 3 petals 15-18 mm. long at anthesis, the stamens 0.5-0.6 mm. long; mature carpels obovoid, 2.5-3.5 × 1.5-2 cm., rounded at apex, dorsally and ventrally rounded, the stipe 4-8 mm. long, the seeds about 8. 1. *X. vitiensis*

Calyx 8-9 mm. in apical diameter, the lobes 3-5 mm. long; outer 3 petals 28-30 mm. long at anthesis, the stamens 2-2.2 mm. long; mature carpels narrowly ellipsoid-oblong, 2-3.7 × 0.5-1 cm., obtusely cuspidate at apex, inconspicuously circumcarinate, the stipe 5-10 mm. long, the seeds 6 or fewer. 2. *X. degeneri*

Leaves with comparatively short petioles 2-7 mm. long, these cinereous-puberulent, the blades 4.5-12 × 2.5-5 cm.; calyx lobes sometimes scarcely apparent in mature flowers, 2 mm. long or less; stamens very numerous, about 200, 1.2-1.5 mm. long; ovules as many as 12 per carpel; mature carpels usually 2-4, ellipsoid or obovoid-ellipsoid, (1.3-) 2.5-3.2 × (1-) 1.6-2.2 cm., rounded or obtusely cuspidate at apex, inconspicuously circumcarinate or not, the stipe to 4 mm. long or essentially none, the pericarp at length cinereous-variegated, the seeds (3-) 4-12, often 16 × 10 mm. 3. *X. pacifica*

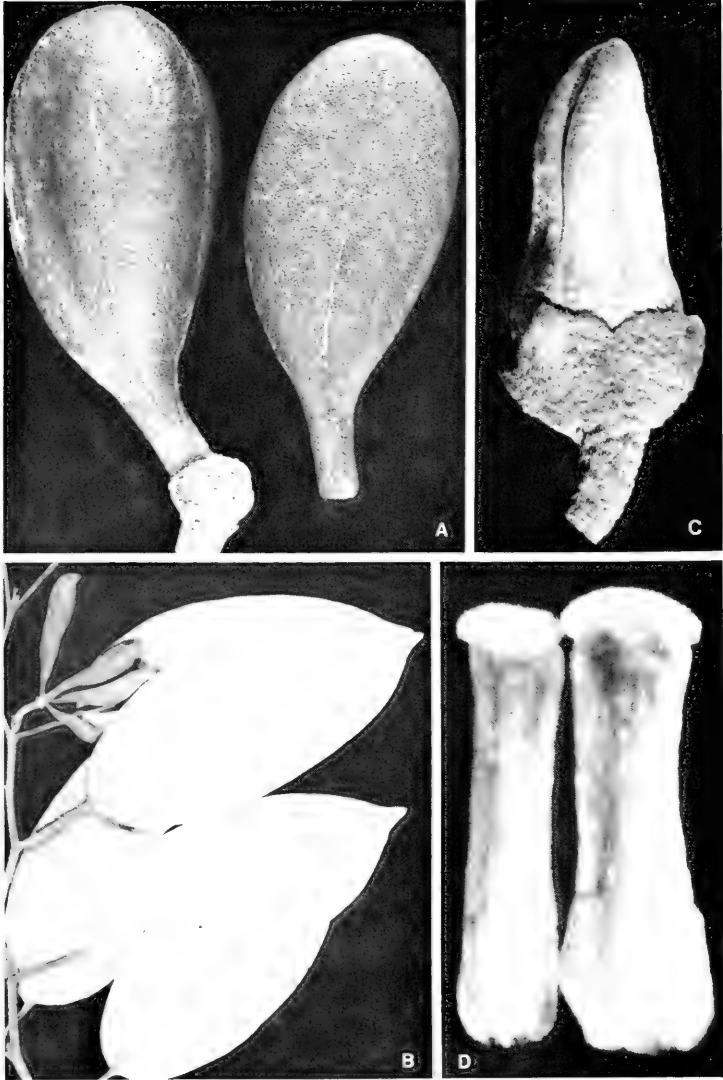
1. *Xylopia vitiensis* A. C. Sm. in *Sargentia* 1: 32. 1942; J. W. Parham, *Pl. Fiji Isl.* 51. 1964, ed. 2. 80. 1972. FIGURE 12A.

Fissistigma sericeum A. C. Sm. in *Bishop Mus. Bull.* 141: 62. fig. 30. 1936; non *Xylopia sericea* St. Hil.

An often slender tree to about 10 m. high, occurring in dense or dry forest at elevations from near sea level to 700 m.; the calyx is green and the petals dull yellow. Flowers have been obtained between August and November and fruits in November.

TIPIFICATION AND NOMENCLATURE: The type is *Smith 669* (BISH HOLOTYPE; several ISOTYPES), collected Nov. 28, 1933, on the southwestern slope of Mt. Mbatini, Tha-

FIGURE 12. A, *Xylopia vitiensis*, receptacle and fruiting carpels, × 2, from *Smith 669*. B, *Xylopia degeneri*, branchlet with foliage and a mature fruit, × 1/2, from *Smith 9533*. C & D, *Xylopia pacifica*, from *DA 13808*; C, flower, × 6; D, stamens, extrorse (left) and introrse (right) surfaces, × 60.



kaundrove Province, Vanua Levu. *Xylopia vitiensis* was a new name for *Fissistigma sericeum*, the epithet of the latter not being available in *Xylopia*.

DISTRIBUTION: Endemic to Fiji and known to occur sparingly on Viti Levu and Vanua Levu.

LOCAL NAME: *Tondo* (perhaps a meaningless name), recorded only for the type collection.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Tholo-i-suva, DA 102. REWA: Low hills in the vicinity of Lami, Gillespie 2376; vicinity of Suva, Tothill F516.

2. *Xylopia degeneri* A. C. Sm. in *Sargentia* 1: 32. 1942; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 80. 1972. FIGURE 12B.

On the basis of the limited available material, this species is a slender tree 4-6 m. high occurring in dry forest at 50-150 m. elevation, with yellowish or green outer petals and dull yellow inner ones. Flowers and fruits are known to occur in May and December.

TYPIFICATION: The holotype is *Degener 15204* (A), collected May 5, 1941, near Vatutavathe, vicinity of Ngaloa, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from only two collections from Serua Province, Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: SERUA: Hills between Wainiggere and Waisee Creeks, between Ngaloa and Wainiyambia, Smith 9533.

From the preceding species, which it closely resembles in foliage, *Xylopia degeneri* is readily separable by its substantially larger petals and stamens and by its very differently shaped fruiting carpels.

3. *Xylopia pacifica* A. C. Sm. in *Bull. Torrey Bot. Club* 70: 538. 1943; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 80. 1972. FIGURES 12C & D, 13.

An often slender tree (sometimes noted as a shrub) 3-24 m. high, the trunk to 32 cm. in diameter and probably more, found in various types of forest or in the dense thickets of crests and ridges at elevations from near sea level to 900 m.; the petals are pale or dull yellow and the mature carpels, often borne on branchlets below the leaves, are dark green or brownish. Flowers and fruits have been obtained in months scattered throughout the year.

TYPIFICATION: The type is DA 2654 (coll. B. E. V. Parham) (A HOLOTYPE; ISOTYPES at BISH, SUVA), collected Jan. 16, 1939, near Tholo-i-suva, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several of the larger islands. This is the most frequently seen species of the genus in Fiji, some 34 collections being at hand for study.

LOCAL NAMES AND USES: *Ndulewa, wako ni sathau, kavukavu*. There seems to be some disagreement as to the value of the wood, as several collectors indicate the species to be a timber tree, while at least one suggests that the wood is soft and of no value.

FIGURE 13. *Xylopia pacifica*; A, branchlet with foliage and inflorescences, $\times 1/2$; B, inner surface of an outer petal and inner whorl of petals, with some stamens detached from receptacle and adhering to petals, $\times 6$; C, section through gynoecium, showing cupuliform distal extension of receptacle bearing numerous stamen scars, strigose ovaries with many ovules, free styles, and elongate, agglutinated, glandular stigmas, $\times 20$; D, fruiting receptacle with one attached and two detached carpels, $\times 2$; A-C from DA 13808, D from DA 14690.



REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 4153*. SERUA: Nathengathenga Creek, *DA L.13337 (Berry 76)*; inland from Namboutini or Korovisilou, *DF 560*; Ngaloa logging site, *DA 14690*; hills east of Navua River, near Nukusere, *Smith 9118*. NAMOSI: Nambukavesi Creek, *DA 13808*. NAITASIRI: Waimanu River, *DA 15842*; Tholo-i-suva, *DA 12478 (DF 127)*; vicinity of Nasinu, *Gillespie 3663*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7213*. NAITASIRI or REWA: "Suva," *Tothill 43*. REWA: Vicinity of Lami, *Parks 20942*. KANDAVU: Kiombo, *DA 11923 (Watkins 672)*; Kandavu without further locality, *DA 11944 (DF 24)*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7692*. VANUA LEVU: MBA: Wainunu River, *DA 15755 (Berry)*. THAKAUNDROVE: Upper Yanawai River, *DA 15745 (Berry)*; Nathula, Sanggani Tikina, *Howard 130*; Navonu Creek, Natewa Peninsula, *DA 15065*. TAVEUNI: Valley between Mt. Manuka and main ridge of island, *Smith 8283*.

Xylopia pacifica, the only adequately known Fijian species of the genus, is readily distinguished from its local congeners by its short petioles, its very numerous stamens, its often comparatively numerous ovules and seeds, and the eventually cinereous-variegated pericarp of its mature carpels.

4. RICHELLA A. Gray in Proc. Amer. Acad. Arts 2: 325. 1852, Bot. U. S. Expl. Exped. 1: 28. 1854; Benth. & Hook. f. Gen. Pl. 1: 26. 1862; Seem. Fl. Vit. 5. 1865; A. C. Sm. in J. Arnold Arb. 36: 278, p. p. 1955; Fries in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 17aII: 138, p. p. 1959; van Steenis in Blumea 12: 356. 1964.

Trees; flowers solitary or paired, leaf-opposed or extra-axillary, the pedicels bracteate; receptacle flattened or convex; sepals 3, valvate, united proximally; petals 6, valvate in 2 series, the outer 3 deltoid-ovate, free, carnosose or coriaceous, the inner 3 similar in shape but shorter, forming a pyramid connivent over stamens and carpels; stamens numerous, the anthers septate, the connective broadened; carpels numerous, the ovules 1 or 2, basal or superposed, the style short, the stigma elongate (at least in our species), sometimes entire and sometimes deeply divided; mature carpels obovoid, slightly flattened, short-cuspidate to rounded at apex, gradually narrowed proximally to a short, inconspicuous stipe or this sometimes to 9 mm. long, indehiscent, the seeds 1 or 2, triquetrous but somewhat flattened, irregularly and narrowly circumalate except at base (in our species), the testa thick, coriaceous.

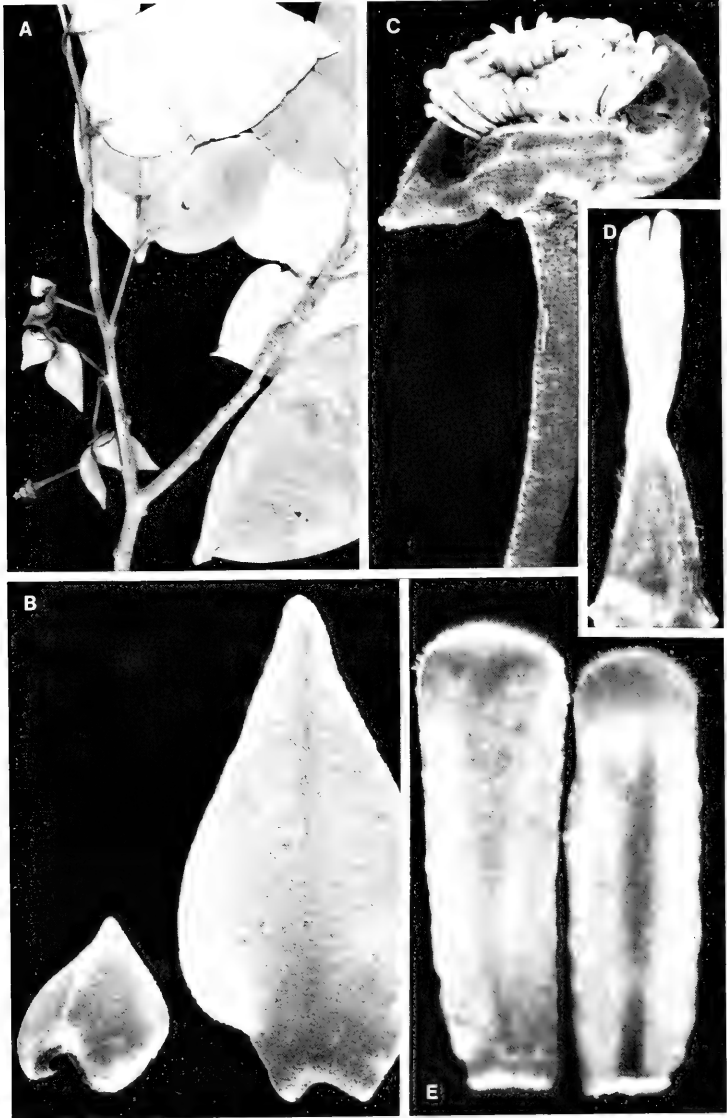
TYPE SPECIES: *Richella monosperma* A. Gray, validly published as part of his 1852 descriptio generico-specifica.

DISTRIBUTION: Three species, one each endemic to Fiji, New Caledonia, and Borneo. The generic name has sometimes been taken to include the larger genus *Oxymitra* Hook. f. & Thoms. (1855), a later homonym of *Oxymitra* Bischoff ex Lindenb. (1829). For *Oxymitra* Hook. f. & Thoms. van Steenis has proposed the name *Friesodielsia* (in Bull. Jard. Bot. Buitenzorg III. 17: 458. 1948, and in the 1964 publication listed below).

USEFUL TREATMENT OF GENUS: Steenis, C. G. G. J. van. An account of the genera *Richella* A. Gray and *Oxymitra* (Bl.) Hook. f. & Th. (Annonaceae). *Blumea* 12: 353-361. 1964.

1. ***Richella monosperma*** A. Gray in Proc. Amer. Acad. Arts 2: 325. 1852, Bot. U. S. Expl. Exped. 1: 28. 1854, Atlas, pl. 2. 1856; Seem. Viti, 432. 1862, Fl. Vit. 5. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 104. 1889; A. C. Sm. in J. Arnold Arb. 36: 278. 1955; van Steenis in *Blumea* 12: 357. fig. 1, d-g. 1964; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 80. fig. 24. 1972. FIGURES 14, 15.

FIGURE 14. *Richella monosperma*, from *Smith 7292*; A, branchlet with foliage and inflorescences, $\times 1/2$; B, inner three petals connivent into a pyramid, and introrse surface of an outer petal, $\times 3$; C, receptacle, with one sepal, petals, and some stamens removed, showing stamens and stigmas, $\times 6$; D, carpel, with divided stigma, $\times 30$; E, two stamens, extrorse (left) and introrse (right) surfaces, $\times 40$.



Oxymitra grayana Baill. Hist. Pl. 1: 237. fig. 285, 286, nom. illeg. 1868.

Oxymitra monosperma A. C. Sm. in Bishop Mus. Bull. 141: 62. 1936, in Sargentia 1: 33. 1942, in J. Arnold Arb. 31: 164. 1950.

An often slender tree 2–15 m. high, found in dense, open, or secondary forest at elevations of 100–1,150 m.; the calyx is greenish; the petals are dull green or dull yellow to yellowish green, often tinged at margins with orange-brown, and the mature fruits, usually borne on branchlets below the leaves, have dull yellow to yellowish brown carpels which may measure up to 5×3 cm. Flowers and fruits have now been observed in most months.

TYPIFICATION: The holotype is *U. S. Expl. Exped.* (us 2551), collected in 1840 on Ovalau, without further data.

DISTRIBUTION: Endemic to Fiji and somewhat more frequent than previously believed, now known from Viti Levu, Ovalau, and Taveuni. I have examined 25 collections, all of which are here listed.

LOCAL NAMES AND USES: *Makosoi* (used for several genera of the family), *iviivi*, *vavaloa*, *mbaumuri*, *losilosii*; I am inclined to question these last four names, since they generally refer to quite different families and may have been obtained from overwilling local informants. The species is sometimes mentioned as a timber tree, and the bark may be locally used for rope.

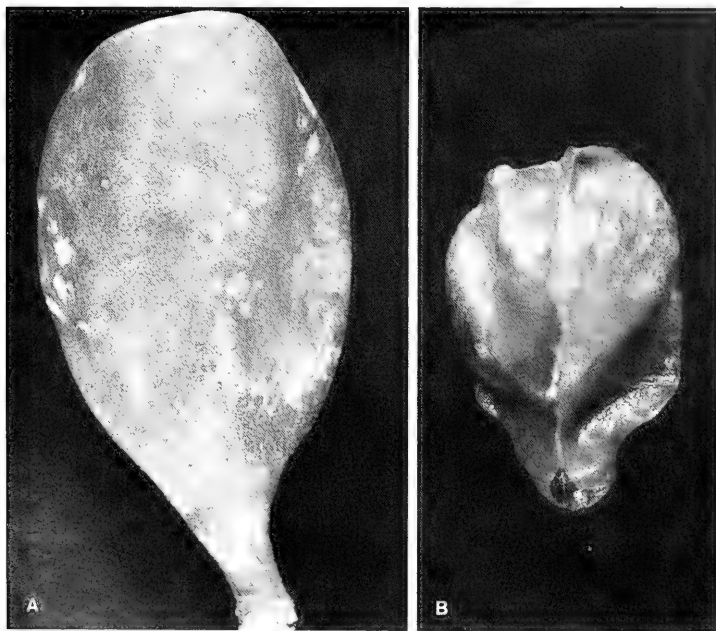


FIGURE 15. *Richella monosperma*; A, mature fruiting carpel, $\times 2$, from DA 15027; B, seed, $\times 2$, from DA 15885.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 4006, 4047*; Nandala Creek and bordering hills, *Degener 14385a, 14639, Smith 5932*; western and southern slopes of Mt. Tomanivi, *Smith 5111*; Nandendeleva, *DA 14849*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 397*. SERUA: Mt. Tuvutau, *DA 15528*; hills east of Navua River, near Nukusere, *Smith 9098, 9125*. NAITASIRI: Track to Mendrausuthu Range, *DA 15027*; Tholo-i-suva, *DA 14602, Vukicea*, July 18, 1950; vicinity of Nasinu, *Gillespie 3652*. NAITASIRI-REWA boundary: Mt. Kombalevu, *Parks 20325, 20329*. OVALAU: Summit and adjacent slopes of Mt. Korotolutolu, west of Thawathi, *Smith 8047*; Lovoni Valley, *DA 17082*; hills east of Lovoni Valley, *Smith 7292, 7731*; near summit of range west of Levuka, *Gillespie 4440*. TAVEUNI: Natambua, Nggeleni, *DA 15885*; track from Somosomo to crater lake, *DA 17110*.

Although *Richella monosperma* has sometimes been misidentified as various species of the three preceding genera, it should be readily recognized by virtue of its dissimilar petal series, the outer petals not being connivent as in *Xylopia* nor proximally much-broadened as in *Cyathocalyx*. The mature carpels suggest those of some species of *Polyalthia*, but the circumalate seeds are unique among Fijian Annonaceae.

5. CANANGA Hook. f. & Thoms. Fl. Ind. 129. 1855; Seem. Fl. Vit. 4. 1865. Nom. cons.

Trees or rarely shrubs; flowers fasciculate, pendulous in short-pedunculate axillary inflorescences, or these borne at defoliate nodes; sepals 3, valvate; petals 6 (occasionally more), valvate in 2 series, finely pubescent, subequal or the inner ones slightly smaller, soon marginally free, short-clawed, flat, lanceolate or linear-lanceolate, flaccid; stamens numerous, the connective with a broad, lanceolate, acute appendage; carpels numerous, with many biseriate ovules, the style slender, the stigmas subcapitate, agglutinated; mature carpels usually 7-15, stipitate, ellipsoid-obovoid, indehiscent, the seeds usually 3-13, immersed in pulp, the testa punctate, with spinelike processes intruded into the endosperm.

TYPE SPECIES: *Cananga odorata* (Lam.) Hook. f. & Thoms. (*Uvaria odorata* Lam.).

DISTRIBUTION: Two species in tropical Asia to Australia. *Cananga odorata* is widely cultivated and naturalized elsewhere.

1. *Cananga odorata* (Lam.) Hook. f. & Thoms. Fl. Ind. 130. 1855; Seem. Fl. Vit. 4. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 104. 1889; Turrill in J. Linn. Soc. Bot. **43**: 16. 1915; Yuncker in Bishop Mus. Bull. **178**: 53. 1943; Greenwood in J. Arnold Arb. **25**: 398. 1944; Yuncker in Bishop Mus. Bull. **184**: 39. 1945, in op. cit. **220**: 113. 1959; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 78. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 44. 1970.

Uvaria odorata Lam. Encycl. Méth. Bot. **1**: 595. 1785; Seem. in Bonplandia **9**: 254. 1861, Viti, 432. 1862.

Canangium odoratum Baill. ex King in J. Asiat. Soc. Bengal **61** (2): 41. 1892; Merr. Interpret. Rumph. Herb. Amb. 226. 1917; Christophersen in Bishop Mus. Bull. **128**: 86. 1935.

A tree 6-20 m. high, cultivated and also extensively naturalized in gullies and on slopes, in forest and on its edges, at elevations from near sea level to about 800 m.; its very fragrant flowers have the conspicuous petals pale green to yellowish green or dull or pale yellow, and the maturing carpels, at first green, eventually become black, with pale brown seeds embedded in yellowish, oily pulp. Flowers and fruits may be expected throughout the year.

TIPIFICATION: According to Merrill (1917, cited above), the primary basis of *Uvaria odorata* was a specimen (presumably at P) collected by Sonnerat. The name *Cananga* Rumph. was listed as a synonym.

DISTRIBUTION: Presumably indigenous in southeastern Asia, Malasia, and northern Australia, and perhaps even as far east as the Solomon and Caroline Islands. Elsewhere in the southern Pacific it is cultivated and abundantly naturalized eastward

to the Societies and Marquesas. The precise limits of its indigenoussness are somewhat speculative.

LOCAL NAMES AND USES: *Makosoi* (and many variants such as *makusui*, *makasoi*, *makosui*, *mokosoi*, and *mokohoi*). *Ylang-ylang* is the most commonly used local name in Malesia and has been extensively adopted elsewhere. The fragrant flowers are used for scenting coconut oil and in necklaces; the stem of young plants is reputed to be part of an external remedy for back pains, and the timber is sometimes indicated as useful. The last usage may be questioned, as *Cananga* is often locally confused with species of *Cyathocalyx*, also known as *makosoi*. Even when found in the forest, *Cananga* is most likely to be seen near villages and along creeks, in situations further indicating that it is adventive rather than indigenous; presumably it was an aboriginal introduction. *Cananga* oil is extensively used in perfumery; an interesting account of the plant is given by Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 426-429. 1966.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4449*; vicinity of Nandarivatu, *im Thurn 288*. NANDRONGA & NAVOSA: Kumbuna, *DA 13860 (DF 295)*; near Ndranumi and Nakalavo, Singatoka Tikina, *H. B. R. Parham 222, 247a, 247b*; near Tonuve, Mbemana, and Nggalimare, Ruwailevu Tikina, *H. B. R. Parham 181, 214, 331*. SERUA: Vicinity of Ngaloa, *Smith 9487*. RA: Vicinity of Soa, *DA 18099*. NAITASIRI: Prince's Road, *DA 7570*. REWA: Department of Agriculture grounds, *DA 16783*. OVALAU: Nathula Point, *Weiner 7-32*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 652*. LAKEMBA: Tumbou River forks, *Garnock-Jones 845*. KAMBARA: On limestone formation, *Smith 1291*. FIJI without further locality, *Seemann 5, Graeffe 22* ("Noca," possibly a reference to Notho Tikina, Rewa Province).

6. ANNONA L. Sp. Pl. 536. 1753.

Trees or shrubs, the indument of simple or stellate hairs; flowers solitary or few together, leaf-opposed or internodal, sometimes borne on older branches; sepals 3, small, valvate, connate at base; petals 6, valvate in 2 series, free or proximally connate, the outer 3 carnosse, concave at least at base, connivent or subspreading, the inner 3 sometimes rudimentary or lacking; stamens numerous, the connective distally dilated, rarely apiculate; carpels numerous, connate, the ovules solitary, basal, erect, the style obvious or absent; fruit a carnosse syncarp, often large, formed of united monocarps and the receptacle, the seeds numerous.

LECTOTYPE SPECIES: *Annona muricata* L. (vide Safford in J. Wash. Acad. Sci. 1: 119. 1911), one of Linnaeus's original seven species.

DISTRIBUTION: About 125 species in tropical America and Africa; a few species are widely cultivated and often naturalized elsewhere. Four species are known to occur in Fiji.

USEFUL TREATMENT OF GENUS: Backer, C. A., & R. C. Bakhuizen van den Brink, Jr. *Annona*. Fl. Java 1: 115-116. 1963.

KEY TO SPECIES

Outer petals ovate-deltoid, less than twice as long as broad; inner petals obvious, more than half as long as the outer, connivent; mature fruits ovoid; leaf blades coriaceous, nitid, narrowly oblong to ovate, seldom exceeding 18×8 cm.; flowers solitary or paired.

Mature fruits $15-38 \times 10-15$ cm., with many recurved spines; leaf blades acute to cuneate at base, sparsely pilose beneath; petals lacking a colored spot within, the outer ones to 5 cm. long, acuminate, finely pilose without, the inner ones to 3.5 cm. long. 1. *A. muricata*

Mature fruits $8-10 \times 6-7.5$ cm., without spines; leaf blades rounded to cordate at base, glabrous; petals with a red or yellow spot toward base within, the outer ones to 3.5 cm. long, obtuse to acute, glabrous.

2. *A. glabra*

Outer petals narrower, more than twice as long as broad, $22-30 \times 6-9$ mm., finely pilose on both surfaces; inner petals inconspicuous or lacking; mature fruits globose or broadly ovoid, 5-13 cm. in diameter, not spiny; leaf blades oblong-lanceolate, acute to rounded at base.

Mature fruits glaucous and bullate or tuberculate; peduncles with 1 or 2 flowers; inner petals less than 1 mm. long or lacking; leaf blades glaucous beneath, glabrate, often rounded at apex, up to 18 × 8 cm.

3. *A. squamosa*

Mature fruits brown to reddish, smooth; peduncles with 2-10 flowers; inner petals 1-2.5 mm. long; leaf blades greenish beneath, sparsely pilose on nerves, usually acuminate at apex, up to 30 × 7 cm.

4. *A. reticulata*

1. *Annona muricata* L. Sp. Pl. 536. 1753; Christophersen in Bishop Mus. Bull. **128**: 86. 1935; Yuncker in op. cit. **178**: 54. 1943, in op. cit. **220**: 116. 1959; J. W. Parham, Pl. Fiji Isl. **47**. 1964, ed. 2. **77**. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 43. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 322. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 108. 1972.

A small tree, to about 7 m. high, found near sea level; the flowers are greenish and the fruits dark green, readily characterized by numerous recurved spines.

TYPIFICATION: Linnaeus probably saw several specimens, citing prior references, but I have not noted a suitable lectotypification.

DISTRIBUTION: Indigenous from Central America to Peru, and widely cultivated in tropical countries. It was introduced into Fiji in the 1880's and is probably commonly cultivated, although only one herbarium voucher supports this statement. It does not appear to have become naturalized in Fiji.

LOCAL NAMES AND USES: *Soursop*, *seremaia*, *sarifa*. The pulp of the fruit is pleasantly acid and is used in jellies, sweets, ice cream, and drinks.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Ndreketi Plantation, DA 16960.

2. *Annona glabra* L. Sp. Pl. 537. 1753; A. C. Sm. in Sargentia **1**: 34. 1942; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 33. fig. 10. 1959, Pl. Fiji Isl. **46**. 1964, ed. 2. **76**. 1972.

A straggling shrub or small tree 2-8 (-12) m. high, cultivated or naturalized near sea level; the flowers are fragrant, with cream-colored petals marked with red or yellow within, and the fruit, when mature, is yellow to yellow-red, with black seeds. Probably flowers and fruits may be seen throughout the year.

TYPIFICATION: Linnaeus indicates "*Habitat in Carolina*" and cites only Catesby's Nat. Hist. Carol. **2**: 64. t. 64 (1738). The plate may be taken as the type, although a specimen may also exist in the Sloane Herbarium (BM).

DISTRIBUTION: Tropical and subtropical America, and introduced elsewhere, although not widely so in the Old World tropics. In Fiji it was probably fairly recently introduced in mistake for one of the more obviously edible species, and it has now become widely naturalized, especially along the south coast of Viti Levu from Rewa to Serua Provinces. It naturalizes most readily in swampy places or in the drier parts of mangrove swamps.

LOCAL NAMES AND USE: *Bullock's heart*, *pond apple*, *uto ni mbulumakau*, *kaitambo*, *kaitambu*. The ripe fruit is edible, even though not considered so by most samplers.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Flat coastal strip in vicinity of Ngaloa, Degener 15069, Smith 9343; Waimate Beach, Navua, DA 10117. REWA: Suva and Suva Point, DA 7566, 10931.

3. *Annona squamosa* L. Sp. Pl. 537. 1753; Seem. in Bonplandia **9**: 253, as *Anona s.* 1861, Viti, 432, as *Anona s.* 1862, Fl. Vit. **5**, as *Anona s.* 1865; A. C. Sm. in Sargentia **1**: 34. 1942; Yuncker in Bishop Mus. Bull. **178**: 55. 1943, in op. cit. **220**:

116. 1959; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 78. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 43. 1970.

A tree 5–10 m. high, occurring near sea level; the mature fruit is greenish yellow, with a waxy bloom. Although perhaps it is not seasonal, the only specimen at hand was fruiting in February.

TYPIFICATION: Linnaeus gives two prior references; perhaps the most suitable type would be Sloane's *t.* 227 in Voy. Isl. vol. 2 (1725), although a specimen may exist in the Sloane Herbarium (BM).

DISTRIBUTION: West Indies and South America, now widely cultivated elsewhere in the tropics.

LOCAL NAMES AND USE: *Sweetsop, sugar apple, apeli*; the plant produces an excellent dessert fruit.

AVAILABLE COLLECTION: FULANGA: On limestone formation, *Smith 1193*.

Annona squamosa is more frequent in Fiji than here indicated, although presumably it does not become naturalized. It was probably an early (but not aboriginal) introduction, observed on Ovalau and Taveuni by Seemann in 1860 but not collected by him.

4. *Annona reticulata* L. Sp. Pl. 537. 1753; Yuncker in Bishop Mus. Bull. **178**: 54. 1943, in op. cit. **220**: 116. 1959; J. W. Parham, Pl. Fiji Isl. 48. 1964, ed. 2. 78. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 43. 1970.

A tree usually 5–8 m. high, found near sea level; the petals are fleshy and yellowish green, and the ripe fruit is reddish brown.

TYPIFICATION: Of the references cited by Linnaeus, a plate of Sloane or Catesby might be taken as the type, but I have not noted a lectotypification.

DISTRIBUTION: West Indies and other parts of tropical America, now widely cultivated elsewhere.

LOCAL NAMES AND USE: *Custard apple, bullock's heart, uto nimbulumakau, chotka sarifa*. The fruit is edible but is considered inferior to that of *Annona squamosa*.

No herbarium specimens from Fiji have been seen, but presumably *Annona reticulata* is moderately common in cultivation, according to Parham; probably it was a fairly recent introduction.

FAMILY 46. MYRISTICACEAE

MYRISTICACEAE R. Br. Prodr. Fl. Nov. Holl. 399, as *Myristicaeae*. 1810.

Dioecious (or rarely monoecious) trees (or rarely shrubs), often large and with aromatic wood and foliage; leaves exstipulate, alternate, simple, the blades entire, pinnately nerved, often with pellucid dots; flowers small, apetalous, axillary or supra-axillary, usually in several-many-flowered inflorescences, rarely solitary; calyx cupuliform to hypocrateriform, with 3 (rarely 2–5) valvate lobes; ♂ flowers with 2–30 (–40) stamens and without carpellary vestiges, the filaments united into a solid column (or rarely connate only proximally), the anthers bilocular, free or variously united, extrorsely and longitudinally dehiscent; pollen grains diverse, anasulcate or inaperturate, tectate, semitectate, or atectate; ♀ flowers without staminodes, with a superior, sessile, unilocular ovary, the ovule solitary, seemingly basal (but fundamentally laminar), anatropous, the stigma sessile or terminating a short style, often bilobed; fruits carnosely or coriaceous, usually dehiscent by 2 valves; seed solitary, erect, arillate, the aril variously lacinate or subentire, often conspicuous and brightly colored, the embryo small, the endosperm copious and usually ruminant.

DISTRIBUTION: A tricentric-tropical family of 17 genera and 300 or more species. Each of the genera is restricted to one or another of the three basic tropical areas: eight to Africa-Madagascar, five to America, and four to the Indo-Malesian-Pacific area. In the Old World only the genus *Myristica* extends eastward into the Fijian Region, its range terminating in Samoa and Tonga.

USEFUL TREATMENTS OF FAMILY: Sinclair, J. A revision of the Malayan Myristicaceae. Gard. Bull. Singapore 16: 205-466. 1958. Uphof, J. C. T. Myristicaceae. In Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 17: 177-220. 1959. Hutchinson, J. Myristicaceae. Gen. Fl. Pl. 1: 146-153. 1964.

1. *MYRISTICA* Gronov. Fl. Orient. 141. 1755; Seem. Fl. Vit. 204. 1867; Warb. in Nova Acta Acad. Leop.-Carol. 68: 374. 1897; A. C. Sm. in Bull. Torrey Bot. Club 68: 397. 1941; Sinclair in Gard. Bull. Singapore 23: 1. 1968. Nom. cons.

Trees, the bark with watery, reddish sap, the leaves with obvious petioles, the blades usually glabrous, sometimes tomentellous beneath (but not in any Fijian species), often pale and ceriferous beneath, the waxy deposit uniformly thin or in minute, crowded globules, the secondary nerves anastomosing near margins, the tertiary nerves often obscure; inflorescence axillary or supra-axillary or borne on defoliate branchlets, coarsely vermiform (and simple or forked) or with a more slender, bifurcate or trichotomous peduncle or rachis, the indument associated with inflorescence composed of simple or branched hairs, the bracts small, the pedicels bracteolate at apex with a single bracteole closely subtending the flower; calyx campanulate to urceolate or cylindric, 3 (rarely 4)-lobed; filaments connate into a column, the anthers 6-20 (-30), elongate, connate dorsally and usually longer than filaments, often exceeded by an apiculate extension of the column; ovary pilose, the stigma subsessile or terminating a short style, scarcely or obviously bilobed; fruit ellipsoid to ovoid, with a carnosé or crustaceous pericarp, the aril deeply lacinate, the testa hard, the endosperm ruminant, the cotyledons connate basally or marginally.

TYPE SPECIES: *Myristica fragrans* Houtt.

DISTRIBUTION: About 120 species in Indo-Malesia and eastward in the Pacific to Tonga and Samoa.

USEFUL TREATMENTS OF GENUS: Smith, A. C. Studies of Pacific Island plants—I. The Pacific species of *Myristica*. Bull. Torrey Bot. Club 68: 397-406. 1941. Sinclair, J. Florae Malesianae precursores—XLII. The genus *Myristica* in Malesia and outside Malesia. Gard. Bull. Singapore 23: 1-540. 1968.

Myristica, best known for the important economic species *M. fragrans*, the nutmeg, includes other species similarly used as spices or as adulterants of the genuine nutmeg and mace. Many species are considered to have useful timber and seeds with large quantities of fats and oils often used medicinally. All the species indigenous in Fiji fall into Sinclair's section *Fatua* and have the following characters in common: leaf blades glabrous, ceriferous beneath; inflorescences pilose; anthers 6-12, not or slightly exceeded by the staminal column, the filament column nearly as stout as the antheriferous portion but shorter; fruits tomentellous, essentially sessile or borne on pedicels not more than 1 cm. long, rarely exceeding 6 cm. in length and rounded to obtusely apiculate at apex.

KEY TO SPECIES

- Inflorescence axis not persistent, producing flowers only once; ♂ inflorescence (in our species) a slender main axis dividing dichotomously, once- or twice-forked, the peduncle (in our species) the slender 10-15 mm. long; calyx and flower-subtending bracteole glabrous; fruits glabrous, comparatively large, 6-9 cm. long and nearly as broad; leaf blades elliptic to oblong-lanceolate, 5-15 × 2-7 cm., with 8-11 secondary nerves per side; cultivated species of sect. *Myristica*. 1. *M. fragrans*
- Inflorescence axis persistent, producing flowers from season to season; ♂ inflorescence a comparatively short or vermiform woody tubercle or a dichotomous cyme, sometimes with a basal portion (peduncle) free of scars, the pedicels short, 2-6 mm. long; ♀ inflorescence similar or shorter; calyx and flower-

subtending bracteole and pedicel obviously sericeous or tomentellous; fruits tomentellous, comparatively small, 2.7-6 (rarely -8) cm. long; leaf blades variously shaped but larger than 10×4 cm. (as small as 6×2.5 cm. only in species no. 6), with 17-35 secondary nerves per side; indigenous species of sect.

Fatua.

Indument of pedicels, flower-subtending bracteoles, and calyces usually sericeous, the hairs usually straight and appressed, less frequently subspreading, (0.2-) 0.4-1.5 mm. long, simple or obscurely plumulose near base; inflorescences coarsely vermiform, unbranched or once-branched, the σ 10-80 mm. long (the φ somewhat shorter), the peduncle short, 1-7 mm. long and nearly as stout as the floriferous rachises, these 4-12 mm. in diameter; σ pedicel at anthesis 1.2-3 mm. in diameter, the calyx 5-12 mm. long, the filament column lacking obvious glands; leaves often comparatively large and with robust petioles; fruits ellipsoid to ovoid, truncate to obtuse at base, not or scarcely stipitate. Leaves robust, with petioles 2-6.5 cm. long and 4-12 mm. in diameter, the blades 23-65 (-75) \times 7-27 (-30) cm., with 18-35 secondary nerves per side; σ inflorescences 25-60 mm. long at anthesis, the pedicel 2-3 mm. in diameter, the calyx 10-12 mm. long, the androecium 6-9 mm. long.

Leaf blades obovate to obovate-lanceolate or oblong-elliptic, gradually narrowed to an acute or obtuse base or sometimes rounded at base; androecium to 9 mm. long at anthesis and then with the filament column 3-4 mm. long and pilose in its central portion; fruiting pedicels 5-10 mm. long and 8-12 mm. in diameter, the mature fruits 5-6 (-8) \times 3-3.5 (-5.5) cm. 2. *M. grandifolia*

Leaf blades oblong to oblong-elliptic, rounded to a narrowly cordate base; androecium 6-8 mm. long at anthesis and then with the filament column not more than 2 mm. long and glabrous; fruiting pedicels to 4 mm. long and 9 mm. in diameter, the mature fruits seldom exceeding 4×3 cm.

3. *M. macrantha*

Leaves less robust, with petioles 1.2-3.5 cm. long and 1.5-5 mm. in diameter, the blades (10-) 11-32 \times 4-14 cm., oblong-elliptic, obtuse to rounded or subcordate at base, with 17-27 secondary nerves per side; σ inflorescences 10-30 mm. long at anthesis, the pedicel usually 1.2-1.5 mm. in diameter, the calyx usually 5-8 mm. long, the androecium usually 4-5 mm. long; fruiting pedicels to 5 mm. long and 8 mm. in diameter, the mature fruits 2.8-4.5 \times 1.8-3 cm. 4. *M. castaneifolia*

Indument of pedicels, flower-subtending bracteoles, and calyces tomentellous, the hairs 0.1-0.5 mm. long, branched from or near base, often tangled; inflorescences simple or 2- or 3-times branched, the σ 5-30 mm. long (the φ somewhat shorter), the primary peduncle 2-15 mm. long, more slender than the floriferous rachises, these 3-4 (-5) mm. in diameter or the flowers fasciculate and congested at apex of primary or secondary peduncle; σ pedicel at anthesis 0.5-1 mm. in diameter, the calyx 3-6 mm. long, the androecium 2-5 mm. long, the filament column with immersed glands; leaves with blades not exceeding 32×11 cm. and often with slender petioles, the blades elliptic to oblong- or obovate-elliptic, rounded or obtuse to truncate-subcordate at base, with 17-26 secondary nerves per side.

Leaves comparatively robust, the petioles 1-5 cm. long and 2.5-4 mm. in diameter, the blades 15-32 \times 4-11 cm.; σ inflorescences at anthesis sometimes simply short-vermiform but more often 2- or 3-times branched, (6-) 10-30 mm. long, the flower-subtending bracteole 3-5 \times 4-6 mm.; fruiting pedicels robust, usually 7-8 mm. long and 8-15 mm. in diameter, the mature fruits oblong- or obovoid-ellipsoid, 3.5-5.5 (-7) \times 2.3-5 cm., obtuse to acute or gradually attenuate at base, often with an obvious stipe to 1 cm. long. 5. *M. gillespieana*

Leaves less robust, the petioles 0.7-2.6 cm. long and 1-2 (-3) mm. in diameter, the blades 6-15 \times 2.5-7 cm.; σ inflorescences simple, at anthesis 5-10 mm. long, the flower-subtending bracteole 2-4 mm. long and broad; fruiting pedicels less robust, to 4 mm. long and 6 mm. in diameter, the mature fruits often subsessile, ovoid-ellipsoid, 2.7-5 \times 1.7-3 cm., truncate or rounded at base, not stipitate.

6. *M. chartacea*

1. *Myristica fragrans* Houtt. Nat. Hist. 3: 333. 1774; Warb. in Nova Acta Acad. Leop.-Carol. 68: 458. 1897; Sinclair in Gard. Bull. Singapore 23: 225. 1968.

A spreading tree sometimes as high as 20 m., infrequently cultivated in Fiji, and readily distinguished from indigenous species as indicated in the above key.

TYPEIFICATION: The type locality is either Banda or Amboina, but Houttuyn did not indicate an actual specimen as the type. Authentic material is that sent to Houttuyn by Vahl and Burman but not collected by them. Warburg in 1897 (cited above, p. 471) suggested that a specimen in the Breyne Herbarium at w, dated 1682, was the oldest example known to him.

DISTRIBUTION: Presumably indigenous in the eastern islands of the Moluccas, but seldom if ever found truly wild, now widely cultivated throughout tropical areas.

LOCAL NAME AND USES: The *nutmeg* of commerce has various Malesian names. It is important commercially as the source of the spices nutmeg (from the dried seed) and mace (from the dried aril); both of these spices have medicinal uses, and the pericarp of the fruit is sometimes made into sweetmeats and jellies in Malasia.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nasinu Experiment Station, *DA 1560, 3770*.

Detailed accounts of the commercial history, uses, and husbandry of *Myristica fragrans* are given by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 1550-1556. 1966) and Purseglove (Trop. Crops, Dicot. 391-397. 1968).

2. *Myristica grandifolia* A. DC. in DC. Prodr. **14**: 194. 1856; Seem. Fl. Vit. 205. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 277. 1892; A. C. Sm. in Bishop Mus. Bull. **141**: 69. 1936, in Bull. Torrey Bot. Club. **68**: 406. 1941; J. W. Parham, Pl. Fiji Isl. 60. 1964, ed. 2. 92. 1972. FIGURE 16.

Myristica macrophylla A. Gray, Bot. U. S. Expl. Exped. **1**: 33. 1854; non Roxb. (1832) nec Benth. (1853). *Myristica castaneifolia* sensu Sinclair in Gard. Bull. Singapore **23**: 473, p. 1968.

A tree 3-15 m. high, occurring in dense or secondary forest at elevations of 100-800 m.; the inflorescences are borne on branchlets below the leaves and the ♂ ones may be as much as 8 cm. long. The calyx is copiously brown-sericeous without, glabrous and greenish white within, and the anthers are yellow. The fruits, which may sometimes attain a size of 8 × 5.5 cm., have a brown indument and a bright red aril. Thus far flowers and fruits have been collected only in April and May.

TIPIFICATION AND NOMENCLATURE: The holotype of *Myristica macrophylla* A. Gray (for which *M. grandifolia* is a substitute name) is *U. S. Expl. Exped.* (US 58427), collected in 1840 on Ovalau. The specimen is sterile, but subsequent collections permit an understanding of the taxon.

DISTRIBUTION: Endemic to Fiji and now known from Viti Levu, Ovalau, Vanua Levu, and Taveuni.

LOCAL NAME: The only local name noted for this species is *kau ndamu* (Smith 7141), although it is doubtless also encompassed by the generic name *male*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Waingganaki Creek, *DA 9*; Sawani, *DA 7604*. TAILVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7141*. OVALAU: Slopes of hills in Lovoni Valley, *Horne 243*. VANUA LEVU: THAKAUNDOVE: Namoliwawa, *DA 13159*; Navonu Creek, Natewa Peninsula, *DA 15068*. TAVEUNI: Slopes inland from Somosomo, *Gillespie 4832*; valley between Mt. Manuka and main ridge, east of Wairiki, *Smith 8285*; above Nggathavulo Estate, *DA 16909, 16921*.

It appears to me that Sinclair in 1968 treated *Myristica castaneifolia* very broadly, reducing to its synonymy *M. grandifolia* and *M. macrantha*, assuming that specimens referred to the two latter taxa had their leaves and inflorescences taken from older branches, while material usually referred to *M. castaneifolia* was taken from apical portions of branchlets. He cited 29 collections as *M. castaneifolia*, among which I consider three to represent *M. grandifolia*, two *M. macrantha*, and three *M. gillespieana*. When an extensive series of collections from this complex is examined (I have now studied 83 collections of the *M. castaneifolia-grandifolia-macrantha* group), it is seen that differences in leaf shape and size are not due entirely to position on branches and are paralleled by differences in inflorescences, flowers, and fruits that seem, as suggested by my key and photographs, to justify specific recognition. Of course this conclusion is a subjective one, but I have no difficulty in placing the specimens seen and therefore I believe that the differences have a genetic implication.

3. *Myristica macrantha* A. C. Sm. in Bishop Mus. Bull. **141**: 67. fig. 33. 1936, in Bull.



Torrey Bot. Club **68**: 399. 1941, in op. cit. **70**: 540. 1943; J. W. Parham, Pl. Fiji Isl. **60**. 1964, ed. 2. 92. 1972. FIGURE 17.

Myristica castaneifolia sensu Sinclair in Gard. Bull. Singapore **23**: 473, p. p. 1968.

A tree 5–20 m. high, found in dense or secondary forest at elevations from near sea level to about 700 m. The calyx is brown-sericeous without and green within, and the fruits have a brown indument. Flowers and fruits have been collected between April and November.

TYPIFICATION: The type is *Smith 1719* (BISH HOLOTYPE; many ISOTYPES), collected May 7, 1934, in the lower Wainunu River Valley, Mbua Province, Vanua Levu. The leaves of this collection are associated with fruiting material, but ample ♂ inflorescences were added from an adjacent tree and assigned the same number.

DISTRIBUTION: Endemic to Fiji and known from Viti Levu, Ovalau, and Vanua Levu.

LOCAL NAMES AND USE: Although the generic name *male* has been applied to this taxon, it is more often known locally as *male wangga* or *kau ndamu*. It is considered to be a timber tree, often used in house-building.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Wainandoi River, *DA 3771*. NAITASIRI: Waindrandra Creek, *DA 180*; Adi Cakobau School catchment area, Sawani, *DA 15221*; Tholo-i-suva, *DF 550, 1045, 1125*; Prince's Road, *DA 1626*. TAILEVU: Namata, *DA 2668*. REWA: Mt. Korombamba, *Parks 20123*; vicinity of Lami, *Toihill 682*; Lomanikoro, *DA 423*. OVALAU: Hills east of Lovoni Valley, *Smith 7363*. VANUA LEVU: MBUA: East of Thongea, Wainunu River, *DA 15772*. MATHUATA: Vuniviva River, *Howard 402*. THAKAUNDROVE: Southwestern slope of Mt. Mbatini, *Smith 613*. Navonu Creek, Natewa Peninsula, *Howard 208*. FIJI without further locality, *Howard 243*.

4. *Myristica castaneifolia* A. Gray, Bot. U.S. Expl. Exped. **1**: 32, as *M. castaneaeifolia*. 1854; Warb. in Nova Acta Acad. Leop.-Carol. **68**: 492. *pl. 18*. 1897; Sinclair in Gard. Bull. Singapore **23**: 473, p. p. 1968; J. W. Parham, Pl. Fiji Isl. ed. 2. 92. 1972.

FIGURE 18.

Myristica castaneaeifolia A. Gray ex A. DC. in DC. Prodr. **14**: 193. 1856; Drake, Ill. Fl. Ins. Mar. Pac. **277**, p. p. 1892; A. C. Sm. in Bull. Torrey Bot. Club **68**: 399, p. p. 1941.

Myristica hypargyrea sensu A. C. Sm. in Bishop Mus. Bull. **141**: 66. 1936; non A. Gray.

Myristica castaniifolia A. Gray ex J. W. Parham, Pl. Fiji Isl. **58**. 1964.

A comparatively abundant tree 5–30 m. high, occurring in dense, light, or open forest at elevations of 30–1,150 m., the trunk often slender and to 40 cm. in diameter, the branches horizontal, the latex thin, yellowish or red. The calyx is brown-pilose without and dull greenish yellow within; the fruits, borne on branchlets below the leaves, are yellowish to brown, copiously pubescent, and with a bright red or scarlet aril. Flowers and fruits have been obtained throughout the year.

TYPIFICATION: The holotype is *U. S. Expl. Exped.* (US 61405 & 61406), collected in 1840 on Ovalau; isotypes have been seen at GH, K, and NY.

DISTRIBUTION: Endemic to Fiji and known from several high islands. I have examined 54 collections that I believe to represent this species.

LOCAL NAMES AND USE: The names *male*, *kali*, and *kau ndamu* commonly refer to this species, and also recorded are *mbaumbulu*, *tambandani*, and *songa ni kiva*. It is said to be a useful timber tree.

FIGURE 16. *Myristica grandifolia*; A, branchlet tip, leaf, and ♂ inflorescences from lower portion of a branchlet, × 1/4; B, tip of ♂ inflorescence, showing scars of fallen flowers and bracts subtending flower buds, × 8; C, ♂ flower with one calyx lobe and bracteole removed to show androecium, × 8; D, fruit, × 1; A & C from *Smith 7141*; B from *DA 16909*, D from *DA 16921*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Thorika Creek, Naloto Range, *DA 14783*; Mt. Ndelainathovu, west of Nandarivatu, *Smith 4946*; vicinity of Nandarivatu, *Gillespie 3964*; slopes of Mt. Tomavi, *Smith 5122*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 12656* (*Melville et al. 7029*); northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5550*. SERUA: Vatuvathe, vicinity of Ngaloa, *Degener 15184*. NAMOSI: Mt. Naitarandamu, *Gillespie 3357*; hills east of Wainikoriliva River, near Namuamua, *Smith 8962*. RA or NAITASIRI: Between Nukulau and Nasonggo, *Howard 309*. NAITASIRI: Waindrandra Creek, *DA 3398*; lower Waimanu River, *DA L.13247*; Tholo-i-suva, *DA 14603*; Tamavua, *Yeoward 57*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7161*. REWA: Mt. Korombamba, *Gillespie 2311*. KANDAVU: Naikorokoro, *DF 610* (*SI402/5*). OVALAU: Slopes of Mt. Korotolulotu, west of Thawathi, *Smith 8059*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1537*. MATHUATA: Mt. Numbuloa, east of Lambasa, *Smith 6336*. THAKAUNDOVE: Nakoroutari, *DA 15227*; Maravu, near Salt Lake, *Degener & Ordenez 14134*.

5. *Myristica gillespieana* A. C. Sm. in Bishop Mus. Bull. **141**: 67. fig. 32. 1936, in Bull. Torrey Bot. Club **68**: 404. 1941; J. W. Parham, Pl. Fiji Isl. 59. 1964, ed. 2. 92. 1972.

FIGURE 19.

Myristica castaneaeifolia sensu Seem. in Bonplandia **9**: 254. 1861, Viti, 432. 1862, Fl. Vit. 205. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 277, p. p. 1892; non A. Gray.

Myristica macrophylla sensu Seem. in Bonplandia **9**: 254. 1861, Viti, 432. 1862; A. Gray in Bonplandia **10**: 34. 1862; non A. Gray (1854).

Myristica sp. Seem. in Bonplandia **10**: 295. 1862, Viti, 432. 1862.

Myristica hypargyrea var. *gillespieana* Sinclair in Gard. Bull. Singapore **23**: 418. 1968.

A tree 5–30 m. high with horizontal branches and thin, reddish latex, the trunk to 70 cm. in diameter, found in often dense forest and in forest on ridges from near sea level to about 610 m. elevation. The calyx is brown- or grayish-pilose without and green or white within; the fruits, usually borne on branchlets below the leaves, are brown to yellow and occasionally as long as 7 cm., with a bright red aril. Flowers and fruits seem to occur at any season.

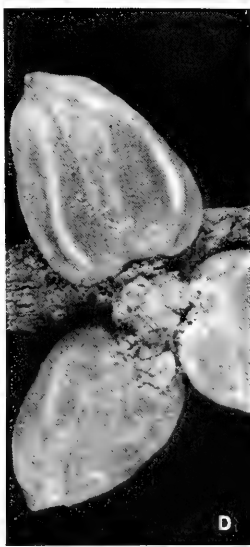
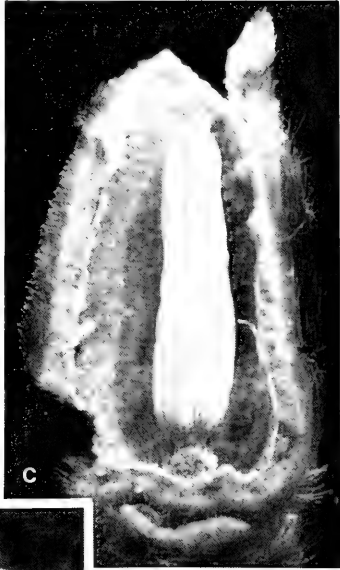
TIPIFICATION AND NOMENCLATURE: The type is *Smith 946* (BISH HOLOTYPE; many ISOTYPES), collected in fruit Jan. 29, 1934, on the eastern slope of the main ridge of Koro. The cited references to *Myristica castaneaeifolia* and *M. macrophylla* mention *Seemann 6* and *7* and *Storck 866*, all of which seem to me to represent *M. gillespieana*.

DISTRIBUTION: Endemic to Fiji and apparently the most widely distributed of the Fijian taxa; I have referred 62 collections to this species.

LOCAL NAMES AND USE: The commonly used names for *Myristica gillespieana*, as for its relatives, are *male*, *kali*, *kale*, and *kau ndamu*; also recorded are the names *kali male*, *male ndina*, and *kau ndamu vula*. It is said to be a useful timber tree, suitable for building and for furniture.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4445*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13344*. SERUA: Nambukelevu, *DA L.13657* (*Berry 112*); inland from Namboutini, *DF 570* (*SI402/7*); Yarawa, *DF 1056* (*SI402/13*); Koromba Beach, *DA 15276*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8601*; hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith 8999*. NAITASIRI: Waimanu River, *DA 15647*; vicinity of Nasinu, *Gillespie 3660*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7048*. REWA: Vicinity of Lami, *Tohill 682*. VITI LEVU without further locality, *Seemann 6*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 124*. OVALAU: Hills southeast of valley of Mbureta River, *Smith 7398*. MOTURIKI: *Storck 866*. KORO: Main ridge, *Smith 1048*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7768*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1597*. MATHUATA: Above Nasingasinga, *Berry 49*. THAKAUNDOVE: Maravu, near Salt Lake, *Degener & Ordenez 14155*; Koroivonu, Natewa Peninsula, *Seemann 7*. VANUA MBALAVU: Slopes of Koroilevu, near Lomaloma, *Garnock-Jones 1035*; Namalata islet, southern limestone section, *Smith 1457*.

FIGURE 17. *Myristica macrantha*; A, fruiting branchlet and foliage with detached fruit, and ♂ inflorescences from an adjacent plant, × 1/4; B, ♂ flower and subtending bracteole, × 8; C, ♂ flower with one calyx lobe and bracteole removed to show androecium, × 8; D, fruits, × 1; A–C from *Smith 1719*, D from *Howard 208*.



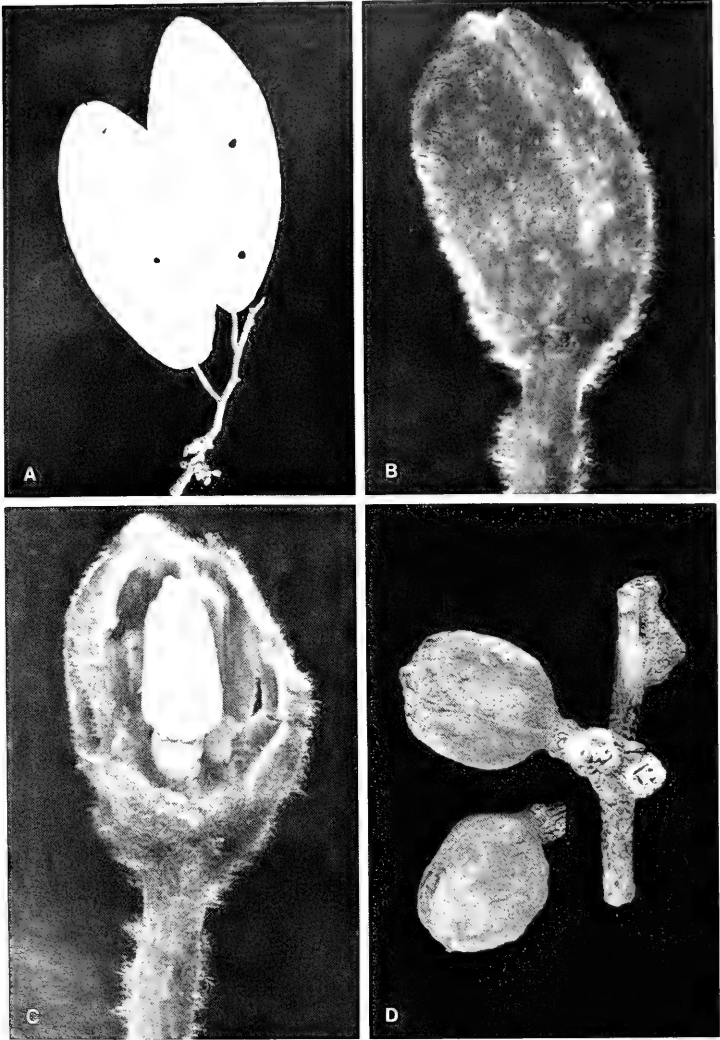


FIGURE 18. *Myristica castaneifolia*; A, branchlet with foliage and ♂ inflorescences, $\times 1/4$; B, ♂ flower and subtending bracteole, $\times 8$; C, ♂ flower with two calyx lobes removed to show androecium and subtending bracteole, $\times 8$; D, fruits, $\times 1$; A-C from Gillespie 3964, D from Smith 7161.

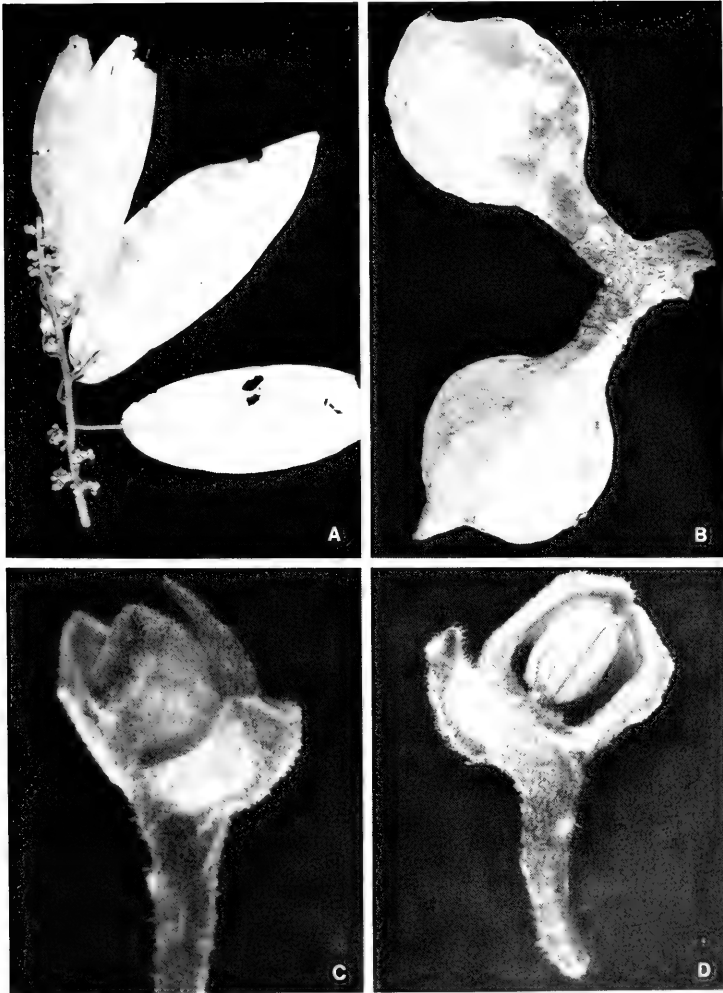
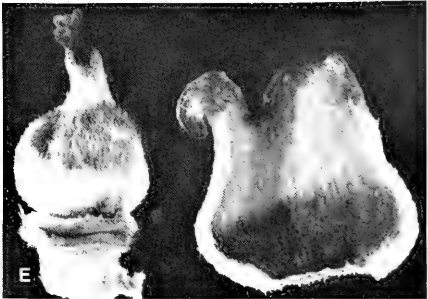
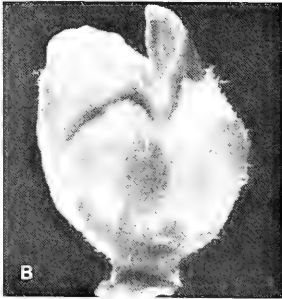
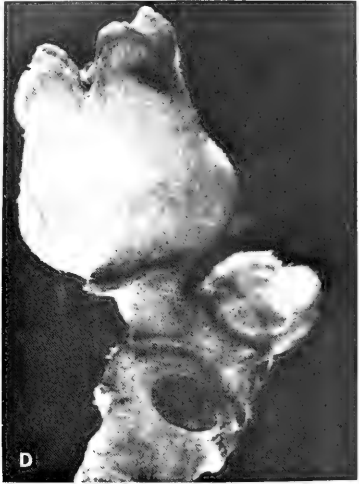


FIGURE 19. *Myristica gillespieana*; A, branchlet with foliage and ♂ inflorescences, $\times 1/4$; B, fruits, $\times 1$; C, ♂ flower and subtending bracteole, $\times 8$; D, ♂ flower with one calyx lobe removed to show androecium and subtending bracteole, $\times 8$; A from *Smith 1048*, B from *Smith 8999*, C & D from *Smith 1457*.



In herbaria *Myristica gillespieana* is more often confused with *M. castaneifolia* than with *M. chartacea*, but it is readily distinguished from *M. castaneifolia* by its inflorescence indument, more obviously pedunculate ♂ inflorescences, usually smaller calyx, often obviously stipitate fruits, and usually by its proportionately narrower leaf blades. Although Sinclair has reduced the present species to varietal status under the Samoan *M. hypargyrea* A. Gray, I believe that differences in the type of inflorescence indument (discussed in my 1941 treatment) are very dependable. In general, *M. hypargyrea* also has inflorescences considerably more robust than those of *M. gillespieana*. I believe that the Tongan collections cited by Sinclair as *M. hypargyrea* var. *gillespieana* are better referred to the Samoan taxon (i. e. *M. hypargyrea* in the more narrow specific sense). Sinclair placed *M. hypargyrea* var. *gillespieana* in his series *Heterophyllae* and *M. chartacea* in his series *Castaneifoliae*, but these two taxa are definitely closely related in characters of their inflorescence and indument and neither should be referred to series *Castaneifoliae*.

6. *Myristica chartacea* Gillespie in Bishop Mus. Bull. **83**: 5, fig. 2. 1931; A. C. Sm. in op. cit. **141**: 66. 1936, in Bull. Torrey Bot. Club **68**: 401. 1941; J. W. Parham, Pl. Fiji Isl. **59**. 1964, ed. 2. 92. 1972; Sinclair in Gard. Bull. Singapore **23**: 470, fig. 83. 1968. FIGURE 20.

Myristica hornei Warb. in Nova Acta Acad. Leop.-Carol. **68**: 107, nom. nud. 1897; A. C. Sm. in Bull. Torrey Bot. Club **68**: 406, nom. nud. 1941.

An often slender tree 4–24 m. high, with a trunk to 47 cm. or perhaps more in diameter, occurring in dense or secondary forest at elevations of 50–900 m. The calyx is brown- or yellowish-pilose without, and the fruits have a brown indument and a salmon-pink aril. Fruits and flowers may be found at any season.

TYPIFICATION AND NOMENCLATURE: The holotype is *Gillespie 4206* (BISH), collected in fruit Dec. 6, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu. The source of the name *Myristica hornei* is *Horne 966*, cited below.

DISTRIBUTION: Endemic to Fiji and known from several high islands. I have studied 58 collections of this well-marked species.

LOCAL NAMES AND USE: The usual generic names *male* and *kau ndamu* are used for this species, and also noted by collectors are the names *kau yalewa*, *kau ndamu male*, *wale*, and *kau ndamu loa*. It is considered a useful timber tree.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Hills between Nggaliwana and Nandala Creeks, south of Nauwanga, *Smith 5842*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15624*; vicinity of Mbelo, near Vatukarasa, *Degener 15289*; "between Matasa & Beila," *Horne 966*. SERUA: Nambukelevu, *DA 15657*; Yarawa, *DF 1053 (S1402/10)*; inland from Ngaloa, *DA 15677*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8777*; Waindina Valley near Namosi, *Gillespie 2871*. NAITASIRI: Viria, *Parks 20457*; Waimanu River, *DA L.13248 (Berry 41)*. TAILEVU: Raralevu road, *DA 5633*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7634*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7763*. VANUA LEVU: MBUA: Koromba Forest, *DA 15112*. MATHUATA: Above Nasingasinga, *Berry 47*; Motuyangaikaveta, vicinity of Lambasa, *DF 609 (S1402/4)*. THAKAUNDRUVE: Southern slope of Korotini Range, below Navitho Pass, *Smith 501*; Korotasere, *DA 15497*; Navonu Creek, Natewa Peninsula, *Howard 90*. MOALA: Near Naroi, *Smith 1316, 1319*.

FIGURE 20. *Myristica chartacea*; A, branchlet with foliage and ♂ inflorescences, × 1/4; B, ♂ flower and subtending bracteole, × 8; C, ♂ flower with one calyx lobe removed to show androecium and subtending bracteole, × 8. D, ♀ inflorescence, showing a flower (with scar of fallen bracteole) with four calyx lobes, × 8; E, gynoecium and inner surface of a 4-lobed calyx with two lobes removed, × 8; F, fruits, × 1; A–C from *Smith 1319*, D & E from *DA 15677*, F from *Smith 8777*.

ORDER ARISTOLOCHIALES

The order Aristolochiales, usually now taken to include the sole family Aristolochiaceae, appears well placed in the Magnoliidae by virtue of its ethereal oil cells, pollen characters, and the morphological aspects of its more primitive extant members. The order has sometimes been construed (e. g. Hutchinson, 1973) as also including the families Hydnoraceae, Rafflesiaceae, and Nepenthaceae, none of which occur in Fiji; these seem better placed in the orders Rafflesiales and Nepenthales or Sarraceniales, referable to the subclasses Rosidae and/or Dilleniidae.

FAMILY 47. ARISTOLOCHIACEAE

ARISTOLOCHIACEAE Juss. Gen. Pl. 72, as *Aristolochiae*. 1789.

Herbs or shrubs, often twining or scandent; leaves alternate, spirally arranged, exstipulate but sometimes with axillary buds producing pseudostipules, the blades entire or lobed; flowers axillary or on defoliate branches, solitary or in many-flowered racemes or cymes, hermaphrodite, actinomorphic or more commonly zygomorphic, usually epigynous, apetalous (petals present only in *Saruma*); calyx in some genera 3 (rarely 4)-parted, more often enlarged and petaloid, in our genus strongly zygomorphic; stamens (3-) 6-36, in 1 or more series, free or adnate to style or stigma, the anthers with 2 parallel, extrorse, longitudinally dehiscent locules; ovary inferior or semisuperior, 4-6-loculed or with carpels partially free (*Saruma* only), each locule with numerous, anatropous, axile ovules, these horizontal or pendulous, the styles 3-numerous, connate at least proximally, obvious or inconspicuous; fruit usually a 4-6-valved septical capsule, rarely follicular with 1-seeded mericarps, the seeds usually numerous, often immersed in pulpy endocarp, seldom winged, the embryo minute, the endosperm copious.

DISTRIBUTION: Pantropical and warm temperate, with 7-11 genera and about 400 species.

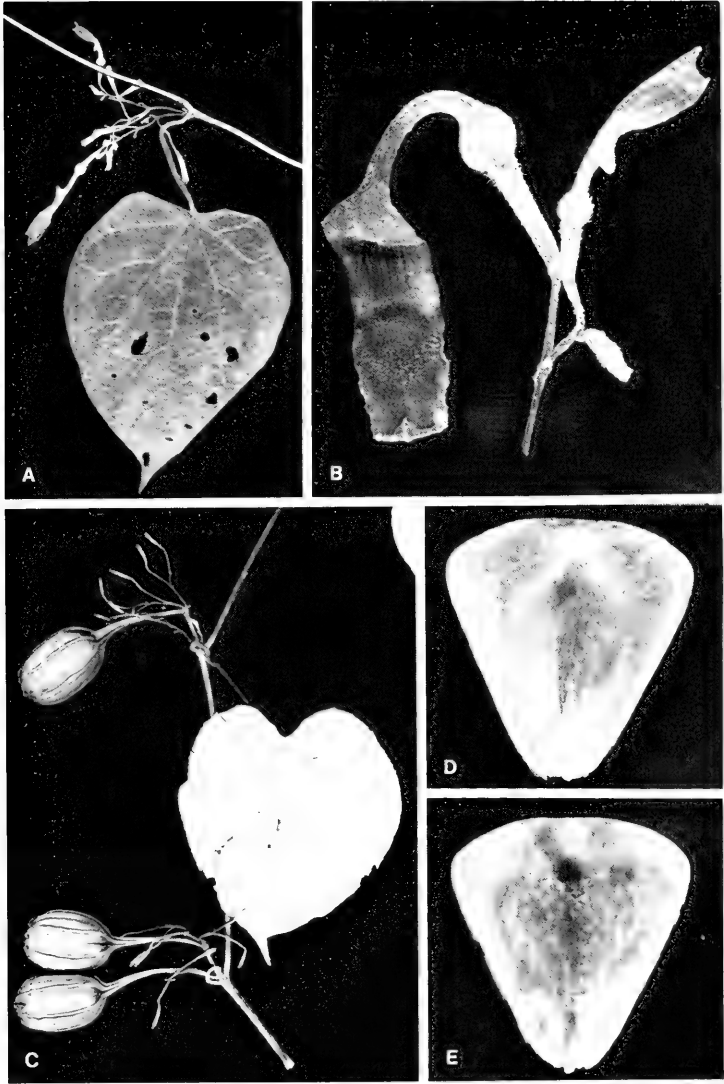
USEFUL TREATMENTS OF FAMILY: Schmidt, O. C. Aristolochiaceae. In Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16b: 204-242. 1935. Gregory, W. G. A phyletic rearrangement in the Aristolochiaceae. Amer. J. Bot. 43: 110-122. 1956.

The Asiatic genus *Saruma*, with actinomorphic flowers, three well developed petals, partially free carpels, and follicular fruits seems to provide a transition from such "ranalean" groups as Annonales. *Aristolochia* is highly modified within the family.

1. ARISTOLOCHIA L. Sp. Pl. 960. 1753.

Herbs or shrubs, usually twining or scandent with the aid of the petioles; leaf blades entire or 2-7-lobed, often cordate, pinnately or palmately veined; flowers axillary or on old wood, epigynous, zygomorphic, apetalous; calyx zygomorphic, gamosepalous, often highly colored and foetid, ventricose at or just above base and then contracted, distally expanding into a 1-3-lobed limb, this 3-6-toothed; stamens 3 (rarely 4), 5, 6, or in multiples of these, the anthers sessile and adnate to stylar column, forming a gynostemium; ovary inferior, usually 5- or 6-loculed, the styles 3, 5, or 6, marginally connate, carnos, with coroniform to subcapitate stigmatic lobes; fruit a capsule with septical or septifragal, acropetal or basipetal dehiscence; seeds deltid, more or less

FIGURE 21. *Aristolochia vitiensis*; A, stem, leaf, and axillary inflorescence, $\times 1/2$; B, portion of inflorescence showing a mature flower and a young flower, $\times 2$; C, two nodes, leaf, and axillary infructescence, $\times 1/2$; D, distal surface of seed, $\times 6$; E, proximal surface of seed, $\times 6$; A & B from DA 7249, C-E from Smith 7683.



vertically compressed in 5 or 6 vertical rows, provided with elaiosomes (oily appendages).

LECTOTYPE SPECIES: *Aristolochia rotunda* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 1: 645. 1913), one of Linnaeus's original 13 species.

DISTRIBUTION: Pantropical and warm temperate, with about 350 species, by far the largest genus of the family; it is abundant in Indo-Malesia and extends eastward in the Pacific to Samoa. Two species are reported from Fiji, one indigenous and one cultivated.

KEY TO SPECIES

- Indigenous species; leaf blades ovate, 8–15 × 7–10.5 cm., slightly cordate to truncate-rounded at base, obtusely acuminate at apex; inflorescence freely branched, several- or many-flowered, with copious indument of several- to many-celled hairs; calyx limb oblong, not exceeding 2.5 × 0.8 cm., inconspicuously 3-lobed at apex; fruit rounded at apex, the hypanthial projection obscure, not more than 2 mm. long. 1. *A. vitiensis*
- Cultivated species; leaf blades cordate-triangular or cordate-reniform, up to 10 cm. long and broad, rounded or obtuse at apex; flowers solitary in leaf axils; calyx glabrous, the limb broadly ovate-cordate or orbicular, 4–10 cm. long and broad, yellowish with dark purple markings; fruit with a conspicuous apical hypanthial projection 5–7 mm. long. 2. *A. littoralis*

1. *Aristolochia vitiensis* A. C. Sm. in J. Arnold Arb. 31: 155. 1950; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972. FIGURES 21 & 22.

Aristolochia sp. Horne, A Year in Fiji, 257. 1881.

A high-climbing vine or liana, occurring in dense forest or on edges of forest and scrambling over bushes and reeds, known between elevations of 180 and 825 m. Flowers are known from a single collection made by B. E. V. Parham (*DA 7249*) on Jan. 27, 1953, and fruits have been obtained between May and September. Since the species was originally described from only two collections, the following amplification is now possible.

Petioles 3–8 cm. long; leaf blades sometimes only 8 cm. long; inflorescences axillary, 2- or 3-branched from base, several- or many-flowered, the lateral branches usually opposite, the bracts ovate, 2–3 mm. long; inflorescence indument copious, the hairs several- or many-celled, 0.5–1 mm. long, those of the branches, pedicel, and ovary retrorse, those of the calyx spreading or ascending; flower-subtending bracteoles slightly smaller than bracts; pedicels of mature flowers 7–10 mm. long; ovary at anthesis about 10 mm. long and 1.5 mm. in diameter; calyx 43–47 mm. long, the utricle subglobose, about 5 mm. long and broad, the syrinx absent, the tube curved, 15–17 mm. long and about 1.5 mm. in diameter, the annulus absent, the limb 23–25 mm. long, abruptly infundibular proximally and flattened into an oblong blade 7–8 mm. broad, this 3-lobed at apex with the middle (largest) lobe deltoid-cuspidate and 2–3 mm. long and broad, membranaceous, finely reticulate-veined, glabrate within except for persistent indument near middle; gynostemium 6-lobed, about 3.5 mm. high and 2.5 mm. broad, the anthers 6, about 0.9 mm. long, the stigmatic lobes carnosae, lanceolate, about 2 mm. long; fruit to 3.5 cm. long and 2.5 cm. broad.

TIPIFICATION: The holotype is *Smith 5484* (A), collected Aug. 4, 1947, on the northern portion of the Rairaimatuku Plateau, between Nandrau and Nanga, Nandronga & Navosa Province, Viti Levu; there are several isotypes.

DISTRIBUTION: Endemic to Fiji and apparently not common, but now known from Viti Levu, Ovalau, and Ngau.

LOCAL NAME: The only recorded local name is *wa sou*, pertaining to the type collection.



FIGURE 22. *Aristolochia vitiensis*, from DA 7249; gynostemium in sectioned utricle, $\times 25$.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 580*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8712*. REWA: Mt. Korombamba, DA 7249; "near Suva," *Horne 735* (June, 1878). OVALAU: Hills east of Lovoni Valley, *Smith 7683*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7808*.

Aristolochia vitiensis is not closely related to the following cultivated species, but to the Samoan *A. cortinata* Reinecke, a species with often larger and more deeply cordate leaf blades, an essentially glabrous and comparatively elongate inflorescence, a calyx with an elliptic-lanceolate, acute (not tridentate) limb, and an obovoid fruit.

2. *Aristolochia littoralis* Parodi in *Anales Soc. Ci. Argent.* **5**: 155. 1878; H. Pfeifer in *Ann. Missouri Bot. Gard.* **53**: 160. *fig. 35*. 1966.

Aristolochia elegans Mast. in *Gard. Chron.* n. s. **24**: 301. *fig. 64*. 1885; Hoehne in *Mem. Inst. Oswaldo Cruz* **20**: 42. *pl. 36*. 1927; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 304. 1972.

This widely cultivated species may be anticipated near sea level in Fiji; it is a slender climbing vine, the conspicuous calyx limb being purple-mottled and the calyx tube pale green. The sole available voucher was in flower and fruit in March.

TYPIFICATION AND NOMENCLATURE: The type of *Aristolochia littoralis* is *Parodi s. n.*, collected in Argentina, that of *A. elegans* is *Glaziov 13163* (κ HOLOTYPE), obtained near Rio de Janeiro, Brazil. In referring this commonly cultivated species, usually known under the name *A. elegans*, to *A. littoralis*, I follow Pfeifer's treatment of 1966.

DISTRIBUTION: Presumably indigenous in Brazil and Argentina, but now cultivated throughout the tropics. It is probably more frequently grown in Fiji than implied by the single known collection, having been noted in several Polynesian archipelagoes.

LOCAL NAME AND USE: *Dutchman's pipe* (applicable to many species of the genus); the plant is a striking ornamental curiosity.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, in private garden, DA 16727.

ORDER PIPERALES

The order Piperales is sometimes taken to include the family Chloranthaceae and even the Lactoridaceae (not in Fiji), but stricter criteria suggest that it is better limited to the Saururaceae (not in Fiji) and Piperaceae, from the latter of which the family Peperomiaceae is often segregated, a course here followed. In the present work I place the Chloranthaceae in its own order, and elsewhere I have agreed with many other phylogenists in referring the Lactoridaceae to the order Laurales.

KEY TO FAMILIES OCCURRING IN FIJI

- Shrubs, vines, or trees, the outer vascular bundles united into a cylinder, the inner ones scattered in 1 or 2 series; stipules adnate to petiole or variously modified, rarely absent; flowers usually unisexual, the subtending bract various although often peltate; stamens 1-10, often 3, the anthers with discrete locules; gynoecium composed of 2-4 (-5) carpels, the stigmas 2-4 (-5), essentially terminal; embryo sac usually with 8 nuclei. 48. PIPERACEAE
- Herbs, usually with succulent stems, the vascular bundles separate; stipules lacking; flowers hermaphrodite, each subtended by a consistently peltate, orbicular or suborbicular, glabrous bract; stamens 2, the anthers with eventually confluent locules; gynoecium composed of a single carpel, the stigma simple, often subapical, often penicillate; embryo sac usually with 16 nuclei. 49. PEPEROMIACEAE

FAMILY 48. PIPERACEAE

PIPERACEAE C. Aghard, Aphor. Bot. 201. 1824.

Unarmed shrubs, vines, or trees, often with adhesive roots when juvenile, often aromatic, rarely with hermaphrodite flowers, more often dioecious or monoecious or polygamous, the stems often articulate and with swollen nodes, frequently zigzag, the outer vascular bundles united into a cylinder, the inner ones scattered in 1 or 2 series; leaves petiolate, usually alternate, often distichous or spiralled, sometimes opposite or verticillate; stipules adnate to petiole or variously modified, rarely absent; leaf blades pinnate- or palmate-nerved, often pellucid-punctate, entire; inflorescence terminal, leaf-opposed, axillary, or extra-axillary, simply or umbellately spicate or racemose, the spadix often carnos; flowers very small and reduced, lacking a perianth, each subtended by a minute, often peltate bract; stamens hypogynous, 1-10, the filaments often carnos and obvious, usually free, the anthers dorsifixed or basifixed, with 2 discrete, longitudinally dehiscent locules; pollen grains anasulcate or uniaperturate, subglobose, tectate; gynoecium superior, 1-loculed, composed of 2-4 (-5) carpels, the ovule solitary, basal, orthotropous, the styles none or short, the stigmas 2-4 (-5), capitate or linear, essentially terminal on the ovary; fruit drupaceous, berrylike, free to connate, adnate to subtending bract, sessile or stipitate, the seed 1, subglobose, the pericarp thin, dry or succulent, the embryo minute, the endosperm scanty, the perisperm copious, the embryo sac customarily with 8 nuclei.

DISTRIBUTION: Eight or nine genera with more than 2,000 species, pantropical. *Piper* is by far the largest genus. Two genera, with several indigenous and a few cultivated or adventive species, occur in Fiji.

USEFUL TREATMENT OF FAMILY: Yuncker, T. G. The Piperaceae—a family profile. *Brittonia* 10: 1-7. 1958.

KEY TO GENERA

- Developing axis of branchlet projecting between ultimate leaf and inflorescence, the inflorescence consequently leaf-opposed; inflorescence simply spicate, solitary; stipules free or adnate to petiole, usually soon caducous; our species shrubs, slender trees, or lianas. 1. *Piper*
- Developing axis of branchlet projecting opposite ultimate leaf, the inflorescence consequently axillary, composed of 1-many simple spikes; stipules adnate to petiole, persistent; shrubs or small trees. 2. *Macropiper*

1. *PIPER* L. Sp. Pl. 28. 1753; Seem. Fl. Vit. 259, p. p. 1868; A. C. Sm. in J. Arnold Arb. 24: 347, p. p. 1943.

Our species shrubs, slender trees, or lianas, if lianas often with dimorphic branching, the orthotropic (vertical) branches climbing, with adventitious roots, the plagiotropic (spreading) branches inflorescence-bearing; stipules free or adnate to petiole, the ultimate one forming a lanceoloid sheath enclosing the developing axis, this projecting between ultimate leaf and inflorescence, the stipules sometimes persisting at penultimate and lower nodes and then accrescent, leaving an annular scar on stem; inflorescence simply spicate, solitary, leaf-opposed; stamens in our species often 3, sometimes 2 or 4, with short locules; ovary and fruit glabrous, not muricate, usually free, rarely coalescent.

LECTOTYPE SPECIES: *Piper nigrum* L. (vide Hitchcock, Prop. Brit. Bot. 117. 1929), one of Linnaeus's original 17 species.

DISTRIBUTION: Pantropical and perhaps with more than 2,000 species; agreement on the number of species to be recognized in this huge genus is probably far in the future. Eight species are known to occur in Fiji, of which four are indigenous (and endemic) and four cultivated or adventive.

USEFUL TREATMENT OF GENUS: Smith, A. C. Studies of Pacific Island plants, II. Notes on the Pacific species of *Piper*. J. Arnold Arb. 24: 347-361. 1943. (This discussion includes *Macropiper*, recognized as a separate genus in the present treatment.)

KEY TO SPECIES

Flower-subsending bracts copiously pilose; leaf blades lanceolate to narrowly elliptic or narrowly ovate, usually 12-25 × 4-10 cm., inaequilaterally rounded-subcordate at base, scabrid above, puberulent beneath at least on nerves, pinnate-nerved, the lateral nerves 4-8 per side, ascending, the uppermost ones arising near or above middle of costa; spikes curved, ascending, to 16 cm. long (including peduncle to 2 cm. long); adventive species. 1. *P. aduncum*

Flower-subsending bracts glabrous; leaf blades smooth above, not scabrid, the principal nerves spreading from base or the uppermost ones concurrent with costa for less than half its length (or in no. 8 slightly higher).

Leaf blades large, 13-28 × 10-22 cm. at maturity, deeply cordate at base, minutely puberulent on nerves beneath, the principal nerves 9-13, spreading from base except the 3 uppermost, these loosely concurrent for 5-15 mm.; stipules large, accrescent and usually persisting at penultimate and sometimes at lower nodes, 45-55 mm. long, 8-20 mm. broad; mature spikes 3-9 cm. long (including peduncle to 1.7 cm. long); erect shrub; cultivated species or occasionally naturalized.

2. *P. methysticum*

Leaf blades rarely exceeding 20 × 12 cm., obtuse to shallowly cordate at base, the principal nerves 5-7; stipules not exceeding 40 mm. in length; lianas, often with dimorphic branching, or no. 8 possibly a shrub.

Spikes at anthesis at least 2 cm. long and usually much longer, the peduncles at least 6 mm. long.

Rachis of fruiting spike scarcely accrescent, remaining slender, 1-2 mm. in diameter, the fruits not congested, obviously free from rachis and from one another; ♀ or ♂ spikes sometimes up to 25 cm. long; leaf blades (of plagiotropic branches) ovate to elliptic, 8-20 × 4-15 cm., obtuse to rounded at base, the uppermost principal nerves concurrent for 10-25 mm.; cultivated species.

3. *P. nigrum*

Rachis of fruiting spike accrescent, at least 3 mm. in diameter at maturity, the fruits congested or coalescent.

Ovaries embedded in rachis, the fruits completely coalescent, the ♀ or ♂ spikes up to 18 cm. long (including peduncle 1.5-6 cm. long) and 5 mm. thick; filaments as broad as anthers; leaf blades (of plagiotropic branches) ovate, usually 12-20 × 6-12 cm., shallowly cordate to rounded or

obtuse at base, the uppermost principal nerves spreading from base or concurrent for 15-30 mm.; cultivated species. 4. *P. betle*
 Ovaries sessile but free from one another and from rachis, the fruits not coalescent; ♂ spikes sometimes as long as 25 cm., the filaments much narrower than anthers; leaf blades rounded to broadly obtuse at base, the uppermost principal nerves concurrent for 7-50 mm.; ultimate stipule forming a narrow, lanceoloid sheath 7-33 mm. long and 1.5-3 mm. broad; indigenous species.

Stipules fugacious, very infrequently persisting at penultimate node; leaf blades ovate, up to 15 × 10 (-16) cm., the uppermost principal nerves concurrent for 20-50 mm., the costa with obvious lateral distal nerves, the veinlets usually prominulous on both surfaces.

Plant glabrous throughout, or stipules and young parts obscurely puberulent and inflorescence rachis sparsely pilose. 5. *P. insectifugum*

Branchlets distally, stipules, petioles, peduncles, and leaf blades on both surfaces crispate-pilose with multicellular hairs to 1.5 mm. long, the upper leaf surfaces at length glabrescent; inflorescence rachis densely pilose. 6. *P. crispatum*

Stipules usually persisting at penultimate and sometimes at lower nodes, accrescent, oblong-lanceolate, 15-40 mm. long, 7-10 mm. broad; leaf blades broadly ovate, up to 18 × 12.5 cm., the uppermost principal nerves concurrent for 7-23 mm., the costa without obvious lateral distal nerves, the veinlets comparatively inconspicuous, plane or slightly impressed above; plant glabrous throughout, or inflorescence rachis sparsely pilose. 7. *P. stipulare*

Spikes (♀ only known) at anthesis and in fruit 1.2-2 cm. long (including peduncle to 4 mm. long); leaf blades elliptic, 6-13 × 2.5-6.5 cm., appearing pinnate-nerved, the uppermost principal nerves concurrent for 30-50 mm.; plant glabrous throughout, a shrub or liana; indigenous species.

8. *P. degeneri*

1. **Piper aduncum** L. Sp. Pl. 29. 1753; C. DC. in DC. Prodr. 16 (1): 285. 1869; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 9 (3): 12. 1938; A. C. Sm. in J. Arnold Arb. 24: 352. 1943; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 101. 1948, in Dept. Agr. Fiji Bull. 35: 36. fig. 11, 12. 1959, Pl. Fiji Isl. 220. 1964, ed. 2. 307. 1972.

A shrub or slender tree 1.5-8 m. high, occurring from near sea level to 400 m., as an aggressive weed along roadsides and in thickets near cultivation, but also sometimes in secondary forest or on forested ridges, rarely in rain forest. The flowering spikes are white or pale yellow, and the mature fruits are red. Flowers and fruits are found throughout the year.

TYPIIFICATION: Linnaeus gave several prior references and indicated: "*Habitat in Jamaica.*" Probably a Sloane specimen may be taken as the lectotype.

DISTRIBUTION: West Indies and throughout a large part of tropical America, but now widely distributed throughout the tropics as a weed. However, I have noted no Pacific material except in Fiji, although the plant occurs in Java and doubtless in other parts of Malesia. Apparently it was introduced into Fiji in the early 1920's and is now widespread in the wet and intermediate zones on Viti Levu, although no occurrences on other Fijian islands are noted. The earliest collection I have seen is *Tothill 835*, dated April 16, 1926. Thirty Fijian collections have been examined.

LOCAL NAME: *Yanggona ni Onolulu* is widely used on Viti Levu but is a misnomer, as the species has not been reported from Hawaii.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NAMOSI: Valley of Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8819*; hills above Navua River, *Greenwood 1028*; Nambukavesi Creek, *DF425*. NAITASIRI: Nanduna, *DA 9591*; Viria, *Meebold 16884*; Sawani-Serea road, *DA 11302*; Tholo-i-suva, *DA 3149*; Nanduruloulou, *DA 8387*. NAITASIRI-REWA boundary: Mt. Kombalevu, *Parks 20282*. TAILEVU: Wailotua Cave, *DA 9410*; hills east of Wainimbuka River, near Wailotua, *Smith 7248*. REWA: Base of Mt. Korombamba, *Webster & Hildreth 14082*; between Suva and Lami, *Gillespie 2079*; Vatuwangga River, *DA 9225* (*McKee 2790*); vicinity of Suva, *Tothill 835*.

2. **Piper methysticum** Forst. f. Pl. Esc. Ins. Oc. Austr. 76. 1786, Fl. Ins. Austr. Prodr. 5. 1786; Seem. Fl. Vit. 260. 1868; C. DC. in DC. Prodr. 16 (1): 354. 1869; Drake,

Ill. Fl. Ins. Mar. Pac. 274. 1892; C. DC. in *Candollea* **1**: 180. 1923; Guillaumin in *J. Arnold Arb.* **13**: 82. 1932; Christophersen in *Bishop Mus. Bull.* **154**: 6. 1938; A. C. Sm. in *J. Arnold Arb.* **24**: 353. 1943; Yuncker in *Bishop Mus. Bull.* **178**: 44. 1943, in op. cit. **184**: 34. 1945, in op. cit. **220**: 93. 1959; J. W. Parham, *Pl. Fiji Isl.* 221. *fig.* 78. 1964, ed. 2. 308. *fig.* 91. 1972; Fosberg in *Phytologia* **13**: 238. 1966; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 168. 1970; St. John & A. C. Sm. in *Pacific Sci.* **25**: 325. 1971; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 19. 1972; A. C. Sm. in *Bot. J. Linn. Soc.* **71**: 4. *pl. 1, A.* 1975; non L. f. *Suppl.* 91 (pro syn. *P. latifolii* L. f. in *Emendanda*). 1781.

Figure 78 (upper).

Macropiper methysticum Miq. *Comment. Phyt.* 36. *t. 4, D.* 1840, *Syst. Piper.* 217. 1843; Seem. in *Bonplandia* **9**: 259. 1861, *Viti*, 442. 1862; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* **8** (1): 2. 1935.

Piper methysticum is widely cultivated in native gardens in Fiji and is also occasionally naturalized along trails from near sea level to 700 m. or perhaps higher. It is usually seen to be a shrub 2–3 m. high, with white spikes. Inflorescences have been noted between February and June but probably occur throughout the year.

TYPIFICATION AND NOMENCLATURE: In his first publication Forster noted the species from the New Hebrides and New Caledonia, subsequently noting its occurrence in the Societies, Tonga, and Hawaii; I am not aware of a lectotypification. The nomenclatural situation has been discussed several times (for a brief summary see my comments in *Bot. J. Linn. Soc.* **71**: 23–24. 1975). *Piper methysticum* L. f. (1781) may be considered as not accepted by the author in the original publication (ICBN, Art. 34.1), where it was replaced by *P. latifolium* L. f. [= *Macropiper latifolium* (L. f.) Miq.], thus permitting the legitimacy of Forster's 1786 binomial.

DISTRIBUTION: The nativity of *Piper methysticum* is uncertain, but probably it was indigenous in eastern Malesia or possibly in the New Hebrides; it is now widely cultivated eastward throughout the Pacific and is occasionally naturalized. It is certainly one of the first plants that aboriginal voyagers would have taken with them.

LOCAL NAMES AND USES: *Yanggona* is the commonly used Fijian name, but sometimes the Polynesian *kava* has been adopted. The species provides an important beverage throughout Polynesia and in those parts of Melanesia, such as Fiji, where *Piper betle* is not used. The beverage, also known as *yanggona* or *kava*, is prepared from the fresh or dried roots or the lower parts of the stem, which are pounded into a pulp or powder and added to water. It is not an intoxicant but rather a mild narcotic, acting as a sedative or soporific. The beverage is, or at least was in the immediate past, closely connected with the entire social and political life of the people.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4008*. TAILEVU: Vicinity of Ndakuivuna, east of Wainimbuka River, *Smith 7231*. VANUA LEVU: THAKAUNDROVE: Savusavu, *Bierhorst F45*; along trail from Mbiangunu to Vemsi, over Mt. Mariko, *Bierhorst F122*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 1063*. LAKEMBA: Near Tumbou, *Garnock-Jones* (coll. *E. Delai*) 863, 864. FIJI without further locality, *Seemann 568*.

Piper methysticum is one of those species that collectors ignore because of its abundance in village gardens. There are many cultivars, indicated by Fijian names (J. W. Parham, 1964, 1972). Interesting, if somewhat prejudiced, remarks about the use of *yanggona* a century ago are provided by Seemann (1868).

3. *Piper nigrum* L. *Sp. Pl.* 28. 1753; V. E. Sills in *Agr. J. Dept. Agr. Fiji* **30**: 61. 1960; J. W. Parham, *Pl. Fiji Isl.* 222. 1964, ed. 2. 308. 1972; St. John & A. C. Sm. in *Pacific*

Sci. 25: 325. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 100. 1972.

The cultivated pepper is a climbing shrub, sparingly grown in Fiji near sea level. TYPIIFICATION: Giving several prior references, Linnaeus noted: "*Habitat in India.*"

DISTRIBUTION: A native of India, probably indigenous in the Western Ghats, but very early naturalized in adjacent parts of southeastern Asia. It is now cultivated on a commercial scale from Ceylon to Malesia and also in various other tropical countries in both hemispheres.

LOCAL NAME AND USES: *Pepper* is the most widespread name for the species, but many other names are recorded in different parts of the world. The plant is the source of both the black pepper and white pepper of commerce. Black pepper is the whole dried fruit. White pepper is the fruit that has been retted in water and the mesocarp removed. Commercial ground pepper is often a blend of black and white and can be easily adulterated. In addition to providing an important spice, *Piper nigrum* is considered to have various medicinal uses in Asia and Malesia.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Cocoa Station, Nanduruloulou, DA 12256.

Piper nigrum was first introduced into Fiji in the 1880's; further introductions have been made since 1950 and the species is cultivated on a small scale. Many cultivars have been developed. A discussion of pepper cultivation in Fiji is provided by Sills in the 1960 paper cited above, pp. 61-65. *pl. 1-4*. Valuable comments on the origin, spread, cultivation, and uses of *P. nigrum* are provided by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 1776-1781. 1966) and Purseglove (Trop. Crops, Dicot. 441-450. 1968).

4. **Piper betle** L. Sp. Pl. 28. 1753; C. DC. in DC. Prodr. 16(1): 359. 1869, in Candollea 1: 189. 1923; Jan in Agr. J. Dept. Agr. Fiji 8(4): 49. 1937; A. C. Sm. in J. Arnold Arb. 24: 353. 1943; J. W. Parham, Pl. Fiji Isl. 220. 1964, ed. 2. 307. 1972; Fosberg in Phytologia 13: 234. 1966.

The betel pepper, occasionally grown in Fiji near sea level, is a woody vine with dimorphic branching.

LECTOTYPIFICATION: Linnaeus gave three prior references and indicated: "*Habitat in India.*" Fosberg and Sachet (in Smithsonian Contr. Bot. 24: 17. 1975) indicate a Hermann specimen from Ceylon as the type, and this may be considered the suitable lectotype.

DISTRIBUTION: A native of central and eastern Malesia, but spreading in comparatively early times throughout tropical Asia and Malesia, and later to Madagascar and eastern Africa. It is now cultivated in many other tropical areas, apparently being a comparatively recent introduction into Fiji.

LOCAL NAMES AND USES: *Betel pepper* and *betel vine* are the commonly used names for *Piper betle*; in Fiji it is also known as *pan* (Hindi). The leaves are chewed together with betel nut (*Areca catechu*) as a masticatory, primarily from eastern Africa and India throughout Malesia and into the Pacific. Slices of betel nut are wrapped in a betel pepper leaf, smeared with lime, and chewed; often other spices, such as cloves, cinnamon, and cardamom, are added. Usually the betel pepper is not used by those Melanesians and Polynesians who utilize *P. methysticum*, although it is cultivated and used to a certain extent by the Indian population of Fiji, as indicated by Jan (1937, cited above). It is often used in ceremonial gatherings, as some Melanesians and most

Polynesians use *yanggona* or *kava*. In Malesia *P. betle* has various medicinal uses. Many cultivars, sometimes recognized as botanical varieties or forms, have been developed in Malesia and Micronesia.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nanduruloulou, *DA 9613*. TAILEVU: Ndravo, *DA 2527*.

Interesting discussions of the cultivation and uses of *Piper betle* are given by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 1767-1772. 1966) and Purseglove (Trop. Crops, Dicot. 437-440. 1968).

5. ***Piper insectifugum*** C. DC. ex Seem. Fl. Vit. 262. 1868; C. DC. in DC. Prodr. **16** (1): 354. 1869; Drake, Ill. Fl. Ins. Mar. Pac. 274. 1892; C. DC. in J. Linn. Soc. Bot. **39**: 164. 1909, in *Candollea* **1**: 178. 1923; A. C. Sm. in J. Arnold Arb. **24**: 353. 1943; J. W. Parham, Pl. Fiji Isl. 221. 1964, ed. 2. 307. 1972; A. C. Sm. in Bot. J. Linn. Soc. **71**: 6. *pl. 2*, A. 1975. FIGURE 23A-C.

Piper sp. Seem. in *Bonplandia* **9**: 259. 1861.

Piper siriboa sensu Seem. Viti, 442. 1862; non auct.

Piper insectifugum is a subscandent shrub or high-climbing liana with dimorphic branching, the orthotropic branches appressed to tree trunks, the plagiotropic branches freely spreading. It has been noted from near sea level to 850 m. in open or dry forest or on forest edges, in patches of forest in open country, and sometimes in coconut plantations or pastures. The flowering spikes are white and the fruiting spikes green, eventually becoming darker. Flowers and fruits may be expected throughout the year.

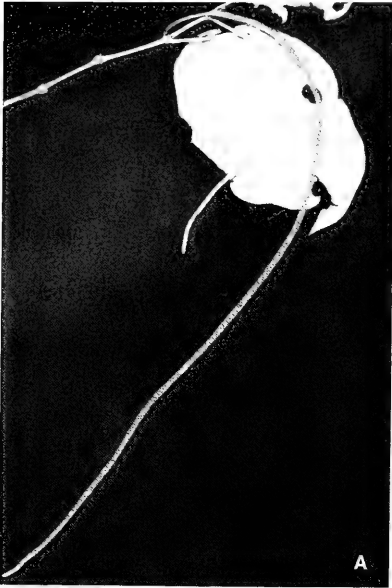
TIPIFICATION: Since the species was first published by Seemann on the basis of a communication from C. de Candolle, I believe that the κ specimen (rather than the G-DC specimen) should be considered the holotype: *Seemann 569* (κ HOLOTYPE; ISOTYPES at GH, BM), collected between Aug. 22 and Sept. 2, 1860, in Namosi Province and probably in the vicinity of Namosi Village, Viti Levu.

DISTRIBUTION: Endemic to Fiji and now known from several islands; I have studied 32 collections, this being the most abundant indigenous *Piper*. Bülow (in *Gartenflora* **45**: 575. 1896) mentioned *P. insectifugum* from Samoa, but this was probably a misidentification, as no other records support such an occurrence and I have seen no Samoan material of the species.

LOCAL NAMES AND USES: The species has been reported as *wakawa*, *wanggawa*, *wanggangga*, *wanggawangga*, *wangakau*, *wakambakamba*, *wandai*, and *kakawa*. One collector has noted that the bark is used to perfume oil and also that an extract from the stem is considered a cure for wounds inflicted on dogs by wild boars.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Hills between Nandala and Nukunuku Creeks, between Nandarivatu and Lewa, *Smith 6165*; Nandarivatu, *Gibbs 809*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5447*. SERUA: Upper Navua River, *DA 15502*; near Nasinu, *Greenwood 1111*. TAILEVU: Waisere Creek, *DA 2681*. REWA: Slopes of Mt. Korombamba, *Gillespie 2315*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 75*. OVALAU: Lovoni Valley, *DA 14503*. VANUA LEVU: MBUA: *Horne 1059*; southern portion of Seatovo Range, *Smith 1545*. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6684*; slopes of Mt. Ndelaikoro, *DA 13426*. THAKAUNDROVE: Mbalanga, Savusavu Bay, *Degener & Ordonez 13907*. TAVEUNI: Western slope between Somosomo and Wairiki, *Smith 841*. YATHATA: Navakathuru, *DA 16200*.

6. ***Piper crispatum*** A. C. Sm. in J. Arnold Arb. **24**: 354. 1943, in op. cit. **27**: 319. 1946, in



op. cit. **31**: 148. 1950; J. W. Parham, Pl. Fiji Isl. **220**. 1964, ed. 2. 307. 1972.

FIGURE 23D.

An often high-climbing liana, occurring at elevations of 100–1,195 m. in dense forest or in the dense thickets of crests and ridges. Although this unmistakable species is frequently seen in sterile condition, the white or ivory-colored spikes have been obtained in May, October, and November.

TYPIFICATION: The type is *Gillespie 3092* (BISH HOLOTYPE; ISOTYPE at A), a ♀ specimen obtained in Fiji in 1927 or 1928 without further locality.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu. Since the original collection, several others have become available, some with ♂ spikes, which do not materially differ from those of *Piper insectifugum* except in the copious indument of the rachis.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1145*; summit of Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4196*. SERUA: Hills east of Navua River, near Nukusere, *Smith 9134*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8500*; northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8717*; Mt. Nambui, Korombasambasanga Range, *DA 14539*.

7. *Piper stipulare* A. C. Sm. in J. Arnold Arb. **24**: 354. 1943, in op. cit. **31**: 148. 1950; J. W. Parham, Pl. Fiji Isl. **222**. 1964, ed. 2. 309. 1972. FIGURE 24.

A high-climbing liana found in dense or open forest at elevations of 30–1,150 m. The flowering spikes are white to pale or dull yellow or orange-yellow, and the fruiting spikes are green, attaining a diameter of 1.5 cm. Flowers have been noted in most months but fruits only between August and December.

TYPIFICATION: The type is *Gillespie 2423* (BISH HOLOTYPE; ISOTYPE at A), collected Aug. 27, 1927, near Tamavua, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several islands.

LOCAL NAMES: *Nggakawa, wa ndai*.

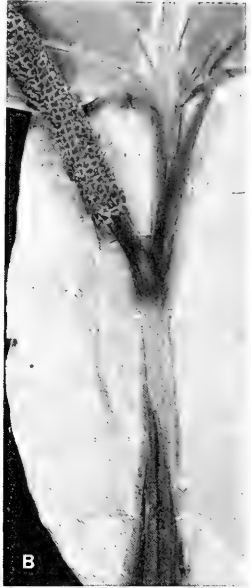
AVAILABLE COLLECTIONS: VITI LEVU: MBA: Western and southern slopes of Mt. Tomanivi, *Smith 5245*. SERUA: Inland from Namboutini, *DA 14263*; inland from Ngaloa, *Smith 9169, DA 14096, 16585, Webster & Hildreth 14346*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8825*; hills bordering Wainavindrau Creek, near Wainimakutu, *Smith 8597*; near Namuamua, *Gillespie 3074*; track to Mt. Vakarongasiu, *DA 16109*; Mburotu, *DA 11615*; hills near Navua River, *Greenwood 1039*. NAITASIRI: "Probably Central Road, Suva," *Tothill 812*. REWA: Lami quarry, *Parks 20879*. OVALAU: In mountains, *Horne 48* (Dec. 1877). MAKONGAI: *Tothill 855*. VANUA LEVU: MATHUATA: Mountains near Lambasa, *Greenwood 631*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8183*.

8. *Piper degeneri* A. C. Sm. in Sargentia **1**: 10. 1942, in J. Arnold Arb. **24**: 355. 1943; J. W. Parham, Pl. Fiji Isl. **220**. 1964, ed. 2. 307. 1972. FIGURE 25.

This little-known species, first designated as a shrub, probably becomes scandent and climbs as a liana. It is reported from dense forest at an elevation of 150 m., the ♀ spike being orange and eventually becoming bright red, with orange fruits. In this condition it has been obtained in January and March.

TYPIFICATION: The holotype is *Degener & Ordenez 14096* (A), collected Jan. 12,

FIGURE 23. A–C, *Piper insectifugum*; A, tip of branchlet with a leaf and ♂ spikes, × 1/2, from *Smith 6165*; B, terminal stipule, with base of ♀ spike, petiole, and portion of an older ♀ spike, × 2, from *St. John 18233*; C, portion of young fruiting spike, showing subtending bracts and free fruits with three stigmas, one fruit removed to show a foveola (f) in rachis and multicellular hairs associated with rachis, × 15, from *Smith 8906*. D, *Piper crispatum*, tip of branchlet showing terminal stipule, base of ♂ spike, and petiole, and penultimate node with attached leaf, the stipule fallen, × 2, from *Smith 9134*.



1941, east of Naunduna, eastern drainage of Yanawai River, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from only two collections, both from Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Seanggangga area, on a lee slope, DA 13925.

The second collection of this very distinct species, like the type, bears ♀ spikes and a few maturing fruits.

2. *MACROPIPER* Miq. in Bull. Sci. Phys. Nat. Néerl. **1839**: 447, 449. 1839, Comment. Phyt. 35. 1840, Syst. Piper. 216. 1843 or 1844, in Nova Acta Acad. Leop.-Carol. **21**: Suppl. 1: 29. 1847; A. C. Sm. in Bot. J. Linn. Soc. **71**: 8. 1975.

Piper sect. *Pothomorphe* C. DC. in DC. Prodr. **16** (1): 240, p. p., 331, p. p. 1869.

Piper sect. *Macropiper* C. DC. in J. Linn. Soc. Bot. **39**: 162. 1909, in Candollea **1**: 171. 1923.

Anderssonioper Trel. in Proc. Amer. Philos. Soc. **73**: 329. 1934.

Soft-wooded shrubs or rarely small trees; stipules adnate to petiole, the ultimate one forming a sheath bearing a bud enclosing one or more spikes and a new developing axis, this projecting opposite ultimate leaf, the stipules persistent; inflorescence composed of 1-many simple, axillary spikes (or adjacent inflorescences sometimes with a common peduncle); stamens usually 3, sometimes 2 or 4, with 2 locules dehiscent by extrorse clefts; ovary and fruit glabrous, not muricate, free (coalescent only in *Macropiper excelsum*, not in Fiji).

LECTOTYPE SPECIES: *Macropiper latifolium* (L. f.) Miq. (vide A. C. Sm. in Bot. J. Linn. Soc. **71**: 2-4. 1975); lectotypification is necessary because of Miquel's confusion of his concept with *Piper methysticum* Forst. f. and the species now known as *Macropiper guahamense* (C. DC.) A. C. Sm. The type species of *Anderssonioper* is *A. panamense* Trel., which in spite of its epithet is based on a Tahitian plant now referred to *Macropiper latifolium*.

DISTRIBUTION: Nine species restricted to a Pacific area delimited by the Bonin, Mariana, Caroline, Santa Cruz, and New Hebrides Islands on the west, Lord Howe Island and New Zealand on the southwest, and the Marquesas, Society, and Austral Islands on the east. Six species, of which three are endemic, occur indigenously in Fiji.

USEFUL TREATMENT OF GENUS: Smith, A. C. The genus *Macropiper* (Piperaceae). Bot. J. Linn. Soc. **71**: 1-38. 1975.

KEY TO SPECIES

Inflorescences solitary in leaf axils, occasionally 2, rarely 3 but not consistently more than 1.

Leaf blades glabrous at least on upper surfaces; inflorescence bracts not ciliate; ovaries rounded to obtuse at apex, the stigmas sessile or essentially so.

Inflorescences usually 7-26 cm. long, the spikes (not including peduncle) usually 6-21 cm. long, the bracts 0.5-1 mm. in diameter; petioles 1-5 (-6) cm. long, the wings obvious, 8-30 (-32) mm. long and 1-2 mm. broad; leaf blades oblong- to suborbicular-ovate, (5-) 9-23 × (2.5-) 4-17 cm., obtuse to cordate at base, with 5-9 (-13) principal nerves. 1. *M. puberulum*

Inflorescences 4-8 cm. long, the spikes (not including peduncle) not more than 7 cm. long, the bracts 0.3-0.5 mm. in diameter; petioles 0.7-1.9 cm. long, the wings inconspicuous, 5-13 mm. long and 0.3-0.7 mm. broad; leaf blades oblong-elliptic to ovate-lanceolate, 5-10 (-11) × 1.7-4 (-4.7) cm., acute to narrowly rounded at base, with 3 or 5 principal nerves. 2. *M. melanostachyum*

Leaf blades copiously soft-strigose on both surfaces with 15-30-celled hairs 0.7-1.8 mm. long, ovate or broadly ovate, 9-21 × 5-15 cm., rounded to cordate at base, with (5 or) 7 or 9 principal nerves; petioles

FIGURE 24. *Piper stipulare*; A, branchlet with foliage, stipules, and a ♂ spike, × 1/2; B, tip of branchlet showing terminal stipule, base of ♀ spike, and petiole, and lower leaf surface and tip of stipule from penultimate node, × 2; C, stipule at penultimate node, × 2; D, portion of fruiting spike, showing congested but free fruits, × 10; A from Parks 20879, B & C from Smith 8597, D from Smith 8825.

1.3-5.5 cm. long, vaginate with wings 10-30 mm. long and 1-2 mm. broad; ♀ spikes (not including peduncle) 5-12 cm. long, the peduncle and rachis copiously pilose, the bracts conspicuously ciliate; ovaries narrowed into a style often 0.5 mm. long. 3. *M. oxycarpum*

Inflorescences 3 or more per leaf axil, occasionally 2, very rarely 1 but not consistently fewer than 3.

Petioles 1-4.5 cm. long, highly vaginate, the wings 8-35 mm. long and 1-5 mm. broad; leaf blades (6-) 8-20 × (3.5-) 6-16 cm., obtuse to subcordate at base, the principal nerves 7 or 9; inflorescences usually 3-7 (rarely 2 and very rarely 1).

♀ spikes (not including peduncle) 5-8 cm. long; ♂ spikes not known; leaf blades broadly ovate, 10-18.5 × 8-16 cm.; stigmas submembranous, laminar, oblong or obovate, 0.3-0.6 mm. long, rounded or subtruncate at apex, when receptive spreading-pilose with 3-6-celled hairs 0.1-0.2 mm. long.

..... 4. *M. kandavuense*

♀ spikes (not including peduncle) 0.8-4 (-5) cm. long; ♂ spikes (not including peduncle) usually 3.5-8 cm. long; leaf blades ovate-elliptic or suborbicular-ovate, (6-) 8-20 × (3.5-) 6-14 cm.; stigmas oblong, 0.2-0.3 mm. long, rounded at apex, when receptive copiously papillose-hispidulous with 3-5-celled hairs less than 0.04 mm. long. 5. *M. timothianum*

Petioles (4-) 6-30 cm. long, vaginate less than half their length, the wings conspicuous, 20-90 mm. long and 3-8 mm. broad; leaf blades suborbicular, (10-) 15-60 cm. long and broad, usually deeply cordate at base (rarely subcordate to rounded), the principal nerves 11-15; inflorescences usually 10-30 (rarely as few as 5); ♀ spikes (not including peduncle) 2-5 cm. long; ♂ spikes (not including peduncle) 4-11 cm. long. 6. *M. vitiense*

1. *Macropiper puberulum* Benth. in London J. Bot. 2: 235. 1843; A. C. Sm. in Bot. J. Linn. Soc. 71: 11. 1975.

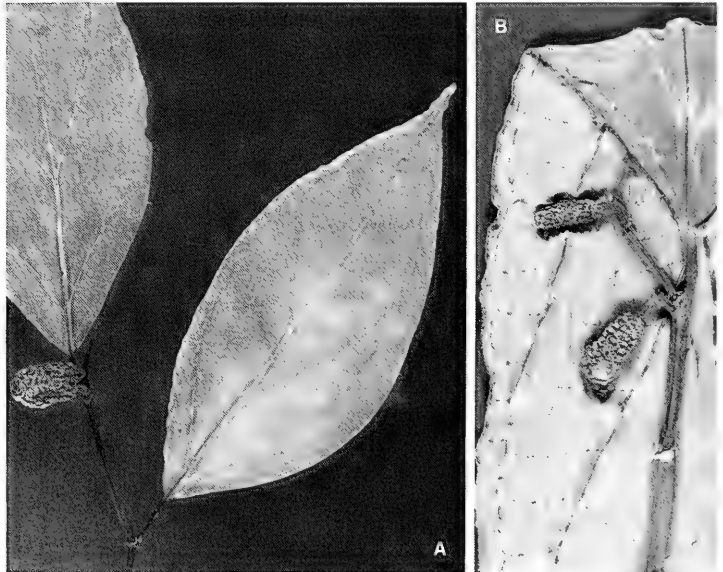


FIGURE 25. *Piper degeneri*; A, tip of branchlet with leaves, terminal stipule, and a ♀ spike, × 1, from Degener & Ordonez 14096; B, tip of branchlet with ♀ spikes, showing stipule and spike at ultimate node (leaf fallen) and spike and persistent leaf at penultimate node (stipule fallen), × 2, from DA 13925.

Piper macgillivrayi C. DC. ex Seem. Fl. Vit. 262, nom. superfl. 1868; C. DC. in DC. Prodr. 16 (1): 335. 1869.

Piper puberulum Benth. ex Seem. Fl. Vit. 262, pro syn. pl. 75. 1868; A. C. Sm. in J. Arnold Arb. 24: 355. 1943; non *P. puberulum* Maxim. (1887).

The taxon here discussed has been nomenclaturally variously subdivided, often on the basis of size and shape of leaf blade, characters now seen to be of minor consequence. It is one of the most frequent species of the Fijian Region, occupying many environmental niches. A taxonomic character of some use refers to the presence or absence of foliar indument, which seems independent of environmental conditions and therefore may be utilized to distinguish forms.

DISTRIBUTION: *Macropiper puberulum* is the most abundant species of the genus in Fiji and Samoa; it is the only representative of the genus known from Tonga, Niue, the Wallis Islands, and Rapa in the Austral Islands; it also occurs in the Horne Islands.

LOCAL NAMES AND USES: The two forms here recognized are not distinguished in local usage. In Fiji the most frequently used name is *yanggoyanggona*, but the following have also been noted: *yanggona meriseri*, *yanggona mereserari*, *nggonamerasari*, *nanggonananggona*, *nggonanggonarau*, and *ngakawa*. Many medicinal uses are ascribed to the species: the crushed leaves are applied to wounds to promote healing, or they may be used to dull toothache pains, and a liquid prepared from leaves and stems may be used internally or externally for a variety of ills.

KEY TO FORMS

Indument obvious on lower surfaces of leaf blades, or at least on principal nerves proximally, composed of hairs usually 0.1–0.5 mm. long; ovary often puberulent. la. f. *puberulum*
 Indument lacking throughout, or obscurely present only on inflorescence rachis. lb. f. *glabrum*

1a. ***Macropiper puberulum* Benth. f. *puberulum***; A. C. Sm. in Bot. J. Linn. Soc. 71: 13. pl. 1, B, 3, A, B. 1975. FIGURE 26A & B.

Macropiper puberulum Benth. in London J. Bot. 2: 235. 1843; Miq. Syst. Piper. 221. 1843 or 1844, in London J. Bot. 4: 431. 1845; Seem. in Bonplandia 9: 259, p. p. 1861, Viti, 442, p. p. 1862.

Piper macgillivrayi C. DC. ex Seem. Fl. Vit. 262, nom. superfl. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 274, p. p. 1892; Turrill in J. Linn. Soc. Bot. 43: 35. 1915; C. DC. in Candollea 1: 172. 1923.

Piper puberulum Benth. ex Seem. Fl. Vit. 262, pro syn. 1868.

Piper gibbsiae C. DC. in J. Linn. Soc. Bot. 39: 163. 1909, in Candollea 1: 173. 1923; A. C. Sm. in J. Arnold Arb. 24: 360. 1943; J. W. Parham, Pl. Fiji Isl. 221. 1964, ed. 2. 307. 1972.

Piper erectispicum C. DC. in J. Linn. Soc. Bot. 39: 163. 1909, in Candollea 1: 173. 1923; A. C. Sm. in J. Arnold Arb. 24: 360. 1943; J. W. Parham, Pl. Fiji Isl. 220. 1964, ed. 2. 307. 1972.

Piper puberulum var. *typicum* A. C. Sm. in J. Arnold Arb. 24: 356. 1943.

Piper puberulum var. *puberulum*; J. W. Parham, Pl. Fiji Isl. 222. 1964, ed. 2. 309. 1972.

As it occurs in Fiji, this form is abundant in beach thickets and forest, in dense or dry inland forest and on its edges, in hillside thickets, and sometimes as a weed in plantations and along roadsides, at elevations from sea level to about 900 m. It is a shrub, sometimes spreading, (0.5–) 1–3 m. high, with white or greenish white spikes and white anthers; the fruiting spikes are red to dull red. Flowers and fruits occur throughout the year.

TYPIIFICATION AND NOMENCLATURE: The holotype (κ) is best taken as the two sheets studied by Bentham, one collected by Hinds and the other by Barclay but presumably from the same plant, obtained between May 28 and June 16, 1840, on Nukulau Island, Rewa Province, Viti Levu. Isotypes include a third κ sheet collected by Barclay but apparently not seen by Bentham, and also *Barclay 3448* (BM); these latter two specimens appear to be parts of the same Nukulau plant. *Piper macgillivrayi* is a nomenclaturally superfluous name, since *Macropiper puberulum* was originally included in its synonymy. Seemann, in addition to listing material from Tonga and the Society

Islands (erroneously, since the species does not occur in the Societies), cited two Fijian collections in his original publication of de Candolle's manuscript name, *Seemann 567* (from Viti Levu, Taveuni, and Kandavu, a mixture of the two forms) and *Barclay*; the latter is presumably part of the type material of *M. puberulum*. Designation of a lectotype for *P. macgillivrayi* is at any rate moot, since the binomial is illegitimate. *Piper gibbsiae* is based on *Gibbs 722* (BM HOLOTYPE), collected in September, 1907, on dry, open slopes of the escarpment north of Nandarivatu, Mba Province, Viti Levu. The holotype of *P. erectispicum* is *Gibbs 599* (BM), obtained in August, 1907, in forest at Nandarivatu. Both *P. gibbsiae* and *P. erectispicum*, although somewhat small-leaved and presumably from exposed habitats, fall well within the reasonable variation of *M. puberulum* f. *puberulum*. In the above synonymy, only those references that relate to Fijian plants are given; extra-Fijian references are listed in my 1975 treatment.

DISTRIBUTION: The typical form of *Macropiper puberulum* is frequent in Fiji and Samoa and also occurs in Tonga (less frequently than f. *glabrum*), Niue, and the Horne and Wallis Islands. I have studied approximately 60 Fijian collections, and the form is to be expected on essentially all the islands.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 342A*; Mt. Namendre, east of Mt. Koromba, *Smith 4541*; slopes of escarpment north of Nandarivatu, *Smith 6261*; Nandarivatu, *im Thurn 176*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 11732*; Mbulu, near Sovi Bay, *Degener 15042*. SERUA: Hills between Wainngere and Waisee Creeks, *Smith 9670*. NAMOSI: Waisevu, track to Namosi, *DA 11635*. NAITASIRI: Tamavua, *Tothill 817*. TAILEVU: Matavatathou, *DA 15364*. REWA: Lami, *DA 13235*. VITI LEVU without further locality, *Milne 62*. KANDAVU: Mt. Mbuke Levu, *Smith 210*; hills above Namalata and Ngaloa Bays, *Smith 56*. OVALAU or VANUA LEVU: *U. S. Expl. Exped. "J"*. KORO: East coast, *Smith 1105*; Uthunivanua, *DA 15832*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7935*. VANUA LEVU: MATHUATA: Ngamea, *DA 3135*. THAKAUNDROVE: Ndromoninuku, *DA 16824*. TAVEUNI: Vatuwiri, *DA 8924*. NGAMEA: Naiiviivi Village, *Weiner 45a*. MOALA: *Tothill 815*. MATUKU: *Bryan 286*. VANUA MBALAVU: Near Lomaloma, *Smith 1408*. THIKOMBIA-ILAU: *Tothill 813*. THITHIA: Nasolo, *DA 13255*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 767*. FULANGA: On limestone formation, *Smith 1137*.

1b. *Macropiper puberulum* f. *glabrum* (C. DC.) A. C. Sm. in Bot. J. Linn. Soc. 71: 14. pl. 2, D, 3, C-E. 1975. FIGURE 26C.

Macropiper puberulum sensu Seem. in Bonplandia 9: 259, p. p. 1861, Viti, 442, p. p. 1862; non sensu typi.

Piper puberulum Benth. ex Seem. Fl. Vit. t. 75. 1868; non sensu typi.

Piper macgillivrayi var. *glabrum* C. DC. in DC. Prodr. 16 (1): 335, excl. syn. *Macropiper puberulum*. 1869, in J. Linn. Soc. Bot. 39: 162. 1909, in Candollea 1: 172. 1923.

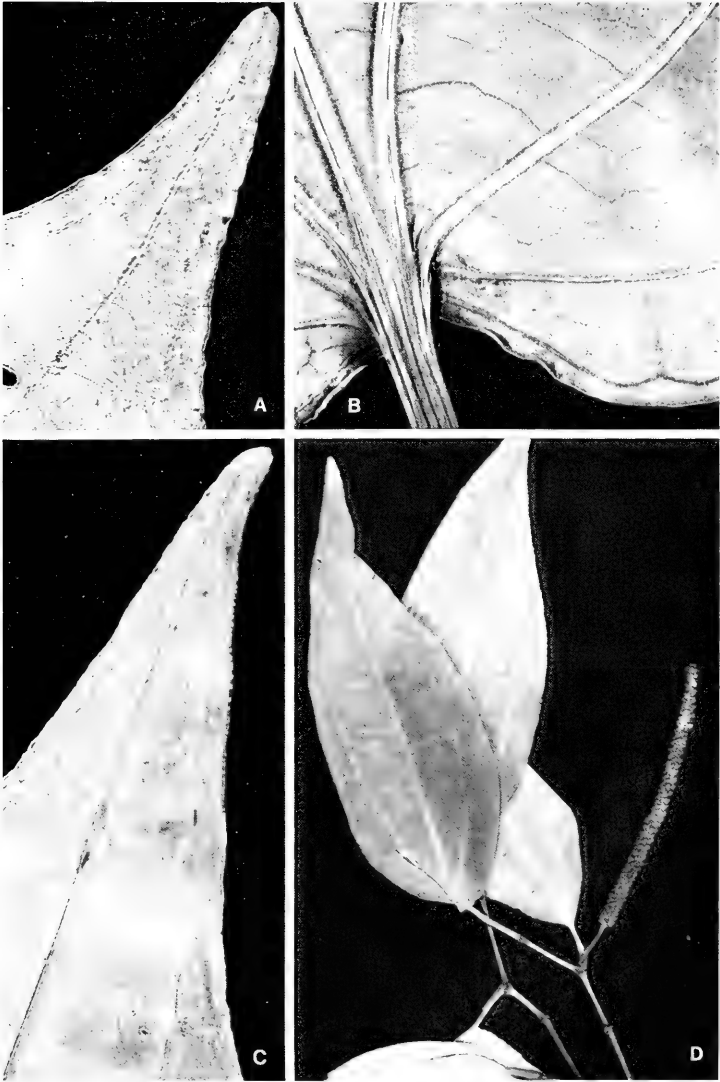
Piper puberulum var. *glabrum* A. C. Sm. in J. Arnold Arb. 24: 356. 1943; J. W. Parham, Pl. Fiji Isl. 222. 1964, ed. 2. 309. 1972.

Piper puberulum var. *puberulum*; J. W. Parham, Pl. Fiji Isl. fig. 79. 1964, ed. 2. fig. 92. 1972; non sensu typi.

In Fiji this form occurs abundantly from sea level to 1,195 m., in various types of forest, in dense thickets of ridges, in patches of forest in open country, and in pastures, often being common along streams. It has been noted as a shrub 1-4 m. high, the spikes being white at anthesis and red in fruit. Flowers and fruits are to be found throughout the year.

TYPIFICATION AND NOMENCLATURE: The holotype is *Seemann 567* (G-DC). As noted under f. *puberulum*, this number was indicated by Seemann as from Viti Levu, Taveuni, and Kandavu, and in it he mixed the two forms of the species. Apparently the

FIGURE 26. A & B, *Macropiper puberulum* f. *puberulum*; A, tip of leaf blade, lower surface, $\times 4$, from *Smith 4541*; B, base of leaf blade, lower surface, $\times 4$, from *Smith 7935*. C, *Macropiper puberulum* f. *glabrum*, tip of leaf blade, lower surface, $\times 4$, from *Smith 5668*. D, *Macropiper melanostachyum*, distal portions of branchlets, with foliage and a ♀ inflorescence, $\times 1$, from *Smith 6014*.



specimen sent to de Candolle was the glabrous form, as indicated by the author's phrase "foliis utrinque glabris." Specimens of *Seemann 567* at BM, GH, and K are mixtures of the two forms; since they may well come from different localities, it is probably unwise to consider any of them as isotypes of de Candolle's variety. Seemann's original description of *Piper macgillivrayi* states: "foliis...subtus...pubescentibus v. glabris." His figure (t. 75), reprinted by Parham, illustrates the glabrous form. A more complete discussion of the complicated synonymy, including references to extra-Fijian citations, is available in my 1975 treatment.

DISTRIBUTION: The glabrous form of *Macropiper puberulum* is frequent in Fiji, Samoa, and Tonga, apparently occurring on Niue less frequently than the typical form. Only f. *glabrum* is known from Rapa in the Austral Islands. Approximately 100 collections of the present form from Fiji have been studied.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Waroro Creek, *St. John 18062*. VITI LEVU: MBA: Summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4186*; Nandarivatu, *Gibbs 676*; Mt. Nanggaranambuluta, *Smith 5668*; slopes of Mt. Tomanivi, *Webster & Hildreth 14174*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5607*; Nausori Highlands, *DA 12645 (Melville et al. 7018)*. SERUA: Vatuvathe, near Ngaloa, *Degener 15179*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8593*; Mt. Voma, *DA 11683*. NAITASIRE: Wainimala Valley, south of Matawailevu, *St. John 18240*; Tholo-i-suva, *DA 10650*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7095*. REWA: Mt. Korombamba, *Gillespie 2235*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 167*. OVALAU: U. S. Expl. Exped. "2"; hills east of Lovoni Valley, *Smith 7297*. WAKAYA: *Milne 37*. VANUA LEVU: MBUA: Mt. Uluimbau, *DA 15177*. MATHUATA: Summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6416*; Mt. Ndelaikoro, *DA 12819*. THAKAUNDROVE: Mbalanga, Savusavu Bay, *Degener & Ordonez 13908*. RAMBI: Horne, March, 1878. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8133*. MOALA: *Milne 125*. MATUKU: *Moseley*, July, 1874. TOTOYA: *Milne 78*. YATHATA: Namberanavula, *DA 15544*.

2. *Macropiper melanostachyum* (C. DC.) A. C. Sm. in Bot. J. Linn. Soc. 71: 19. pl. 5, A, B. 1975. FIGURE 26D.

Piper melanostachyum C. DC. in J. Linn. Soc. Bot. 39: 162. 1909, in Candollea 1: 172. 1923; A. C. Sm. in J. Arnold Arb. 24: 357. 1943; J. W. Parham, Pl. Fiji Isl. 221. 1964, ed. 2. 308. 1972; St. John & A. C. Sm. in Pacific Sci. 25: 325. 1971.

An often slender shrub 0.6–3 m. high, occurring in dense forest or on its edges and also in the thickets and forest of ridges, at elevations from near sea level to 1,195 m. The spikes are white at anthesis and the fruits eventually become red. Flowers have been obtained between April and October and fruits between May and January.

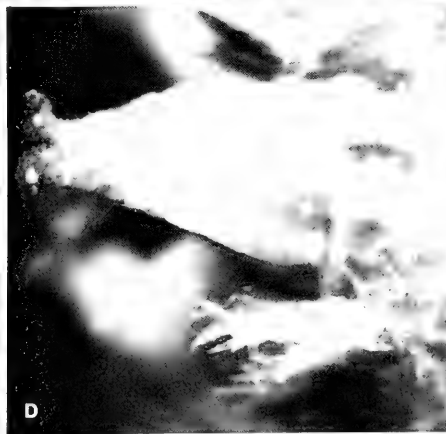
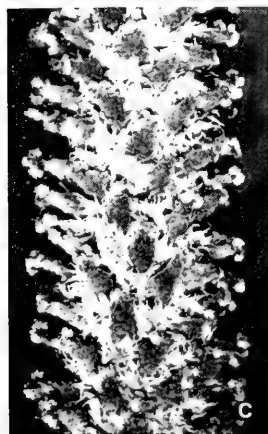
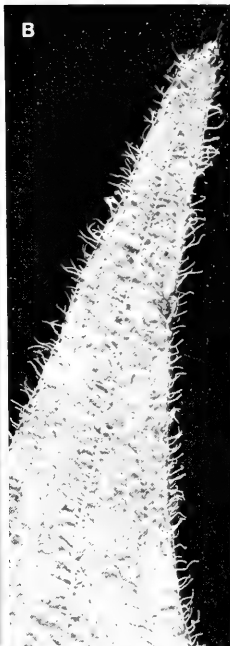
TYPIIFICATION: The type is *Gibbs 703* (BM HOLOTYPE; ISOTYPE at K), collected in August, 1907, at Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Known only from Viti Levu and from a single collection obtained on Alofi, Horne Islands.

LOCAL NAME: *Yanggoyanggon*a, essentially a generic name for indigenous species, has been recorded on Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Natualevu, Mt. Evans Range, *DA 14191*; summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4173*; Mt. Mbatilamu, Vunda, *DA 14125*; Nandarivatu, *Parks 20546*, *DA 10418*; Mt. Nanggaranambuluta, east of Nandarivatu, *Tothill 829*; hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 6014*. NANDRONGA & NAVOSA: Uluvatu, vicinity

FIGURE 27. *Macropiper oxycarpum*; A, distal portion of branchlet, with foliage and ♀ inflorescences, × 1/2; B, tip of leaf blade, lower surface, × 4; C, portion of mature ♀ spike, × 10; D, pistil and subtending bract, × 40; A & C from *Parks 20738*, B from *Smith 4552*, D from *DA 16595*.



of Mbelo, near Vatukarasa, *Tabualewa 15556*. REWA: Slopes and summit of Mt. Korombamba, *Gillespie 2217, 2350, DA 1304*. FIJI without further locality, *U. S. Expl. Exped. "3"*.

Although *Macropiper melanostachyum* is clearly related to *M. puberulum* f. *glabrum*, it is appreciably and consistently smaller in all respects and appears to merit specific status.

3. *Macropiper oxycarpum* (C. DC.) A. C. Sm. in Bot. J. Linn. Soc. 71: 20. pl. 5, C, D, 6. 1975. FIGURE 27.

Piper oxycarpum C. DC. in J. Linn. Soc. Bot. 39: 164. 1909, in *Candollea* 1: 171. 1923; A. C. Sm. in J. Arnold Arb. 24: 355. 1943, in op. cit. 31: 148. 1950; J. W. Parham, Pl. Fiji Isl. 222. 1964, ed. 2. 308. 1972.

A shrub to 2 m. high (sometimes flowering when only 0.2 m. high), found in dense forest at elevations of 150–900 m. The flowering spikes are white, becoming dull orange or red in fruit and often somewhat recurved. Flowers and fruits have been observed between April and September.

TYPIIFICATION: The holotype is *Gibbs 604* (BM), collected in September, 1907, along the road to Navai south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu.

LOCAL NAME: *Yanggona meriseri* has been noted for a single collection (*DA 1472*).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4552*; vicinity of Nandarivatu, *Tohill 830, 831* (coll. *W. Teulon*), *Parks 20572*. SERUA: Ngaloa Nature Reserve, *DA 16595*. NAITASIRI: Tholo-i-suva Forest Reserve, *DA 1472*. VITI LEVU without further locality, *Parks 20738*. FIJI without further locality, *Gillespie 3839*.

As one of the most sharply distinct species of *Macropiper*, *M. oxycarpum* is at once distinguished by its copious foliar indument of long, many-celled hairs and its distally attenuate ovaries.

4. *Macropiper kandavuense* (A. C. Sm.) A. C. Sm. in Bot. J. Linn. Soc. 71: 25. pl. 8, C, D. 1975. FIGURE 28A.

Piper kandavuense A. C. Sm. in J. Arnold Arb. 24: 359. 1943; J. W. Parham, Pl. Fiji Isl. 221. 1964, ed. 2. 307. 1972.

The apparently rare *Macropiper kandavuense* is a shrub to 3 m. high, occurring in dense forest between elevations of 200 and 500 m. Only ♀ specimens are known, collected in flower in October.

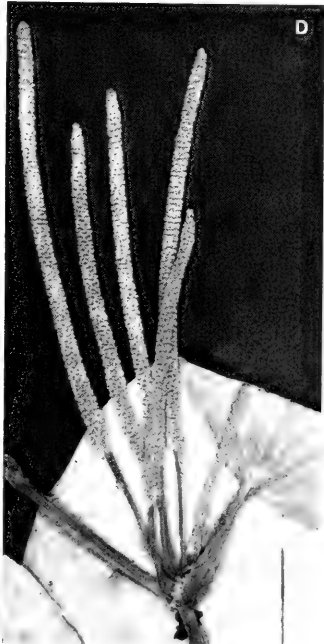
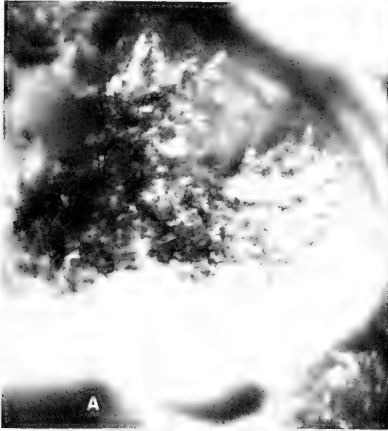
TYPIIFICATION: The type is *Smith 219* (GH HOLOTYPE; many ISOTYPES), collected Oct. 23, 1933, on Mt. Mbuke Levu, Kandavu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection.

Macropiper kandavuense is closely related only to *M. latifolium* (L. f.) Miq., a species with the curiously disjunct distribution of the Marquesas, Society, Austral, and Cook Islands and the Santa Cruz Islands and New Hebrides. Its absence from Fiji remains puzzling, but I do not believe that the rare and endemic *M. kandavuense* can be included in it. Differences relate to leaf blade base and venation and more strikingly to the shape, texture, and indument of stigmas, as discussed in my 1975 treatment.

5. *Macropiper timothianum* (A. C. Sm.) A. C. Sm. in Bot. J. Linn. Soc. 71: 26. pl. 2, C, 9. 1975. FIGURE 28B–D.

FIGURE 28. A, *Macropiper kandavuense*, a pistil, showing the laminar, copiously pilose stigmas, × 60, from *Smith 219*. B–D, *Macropiper timothianum*; B, a pistil, showing the papillose-hispidulous stigmas, × 70, from *Webster & Hildreth 14225*; C, fruiting inflorescences, petioles, and bases of leaf blades, × 1, from *Smith 4030*; D, ♂ inflorescences, petiole, and basal portion of a leaf blade, × 1, from *Smith 8718*.



Piper macgillivrayi var. *fasciculare* Warb. in Bot. Jahrb. 25: 609, as var. *fascicularis*. 1898; Turrill in J. Linn. Soc. Bot. 43: 35, as var. *fascicularis*. 1915; non *P. fasciculare* Rudge.

Piper fasciculatum Rechinger in Karsten & Schenck, Vegetationsbilder 6: pl. 5. 1908; non Ruiz & Pavon.

Piper macgillivrayi var. *fascicularis* (sic) forma *b* C. DC. in J. Linn. Soc. Bot. 39: 162. 1909.

Piper timothianum A. C. Sm. in Sargentina 1: 10. 1942, in J. Arnold Arb. 24: 358. 1943; J. W. Parham, Pl. Fiji Isl. 222. 1964, ed. 2. 309. 1972.

A sometimes spreading or freely branching shrub or a small, sometimes slender tree 1.5–5 m. high, occurring in dense forest and crest thickets at elevations of 250–1,175 m. (in Fiji) (up to 1,500 m. on Savaii, Samoa). Flowering spikes are greenish white or white; the filaments are pale green and the anthers white. Fruiting spikes are red and up to 12 mm. in diameter, the fruits becoming darker at maturity. Flowers have been observed between July and November, but fruits persist throughout the year.

TIPIFICATION AND NOMENCLATURE: *Piper macgillivrayi* var. *fasciculare* is typified by Reinecke 433 (B HOLOTYPE, probably destroyed; ISOTYPE at BISH), collected in September, 1894, in the interior of Savaii, Samoa. The binomial *P. fasciculatum* was probably inadvertently used by Karsten and Schenck. De Candolle described without naming a forma *b* of Warburg's trinomial, based on Gibbs 677 (BM), collected in September, 1907, at Nandarivatu, Mba Province, Viti Levu. The epithets based on Samoan plants are not available at the specific level. *Piper timothianum* is based on Degener & Ordenez 13570 (A HOLOTYPE; many ISOTYPES), collected Nov. 22, 1940, at Nandarivatu, Mba Province, Viti Levu. Additional Samoan references are given in my 1975 treatment.

DISTRIBUTION: Fiji (known with certainty only from Viti Levu, Kandavu, and Vanua Levu) and Samoa (known with certainty only from Savaii and Upolu). It is a fairly frequent species in both archipelagoes, and from Fiji I have studied 45 collections.

LOCAL NAMES AND USE: Recorded names in Fiji are *yanggoyanggona*, *yanggona sasari*, *yanggona merasasari*, *nggonanggonarau*, and *nggonanggonarau lailai*. The last of these (*lailai*=small) implies a distinction from the next species (*levu*=large) which is very real. The crushed leaves are sometimes used for dressing wounds.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 128*; Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4030*; upper slopes of Mt. Koromba, *Smith 4684*; Nandarivatu, *im Thurn 304* (Dec. 3, 1906, apparently the earliest Fijian collection); Mt. Nanggaranambuluta, east of Nandarivatu, *Webster & Hildreth 14225*; Mt. Tomanivi, *DA 12693*, p. p. (*Melville et al. 7081A*). NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14891*; northern portion of Rairaimatuku Plateau, *Smith 5500*. NAMOSE: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8499*; northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8718*; Mt. Voma, *DA 11662*. NAITASIRI: Wainimala Valley, *Rarandawai, Wainamo-Wainisavulevu divide, St. John 18258*. KANDAVU: Slopes of Mt. Mbuke Levu, *DA 14935*. VANUA LEVU: MATHUATA-THAKAUNDOVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelai-koro, *Smith 548*.

6. *Macropiper vitiense* (A. C. Sm.) A. C. Sm. in Bot. J. Linn. Soc. 71: 28. pl. 10. 1975. FIGURE 78 (lower).

Macropiper latifolium sensu Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862; non Miq.

Piper latifolium sensu Seem. Fl. Vit. 261. quoad spec. vit. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 274. quoad spec. vit. 1892; non L. f.

Piper polystachyum C. DC. in J. Linn. Soc. Bot. 39: 162. 1909, in Candollea 1: 172. 1923; A. C. Sm. in Bishop Mus. Bull. 141: 25. 1936; non *P. polystachyon* Ait.

Piper vitiense A. C. Sm. in J. Arnold Arb. 24: 357. 1943; J. W. Parham, Pl. Fiji Isl. 222. 1964, ed. 2. 310. 1972.

This spectacularly robust species is a shrub or slender tree 1–7 m. high, found between elevations of 250 and 1,195 m. in dense forest and in the forest and thickets of ridges. Its flowering spikes and stamens are white and its fruiting spikes red and

attaining a diameter of 10 mm. Flowers and fruits have been obtained between May and January.

TYPEFIICATION AND NOMENCLATURE: The holotype of *Piper polystachyum* is Gibbs 794 (BM), collected in September, 1907, at Nandarivatu, Mba Province, Viti Levu. This binomial is an orthographic variant (ICBN, Art. 75.2) and later homonym of *P. polystachyon* Ait. (Hort. Kew. 1: 49. 1789), even though the latter may be a superfluous name, *P. obtusifolium* Jacq. being cited as a synonym. *Piper vitiense* was proposed as a new name for de Candolle's species and of course has the same type.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Vanua Levu, and Taveuni; I have examined 31 collections.

LOCAL NAMES AND USE: *Yanggoyanggona; nggonanggonarau levu*. Liquid squeezed from the leaves, as noted for other species of the genus, is said to promote healing of wounds.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 358*; summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4181*; Nandarivatu, *Parks 20786*; western slopes of Mt. Nanggaranambuluta, east of Nandarivatu, *Smith 4812*; Mt. Tomanivi, *DA 12693*, p. p. (*Melville et al. 7081B*). NADRONGA & NAVOSA: Nausori Highlands, *O. & J. Degener 32347*; northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5649*. NAMOSI-NAITASIRI boundary: Mt. Naitrandamu, *Gillespie 3360*. NAMOSI: Northern base of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8693*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6108*; Wainimala Valley, Taunmaisali, Wainisavulevu-Numbulolo divide, *St. John 18345*. VANUA LEVU: THAKAANDROVE: Mt. Mariko, *Smith 458*. TAVEUNI: *Seemann 566* (June, 1860); Mt. Manuka, east of Wairiki, *Smith 8242*.

In discussing this taxon in 1936 (cited above), I referred to it a Moseley collection from the New Hebrides; this was incorrect, the Moseley material actually representing *Macropiper latifolium* (L. f.) Miq., as noted in my 1975 treatment (p. 24).

INADEQUATELY KNOWN TAXON OF MACROPIPER

Piper macgillivrayi var. **parvifolium** C. DC. in DC. Prodr. 16 (1): 335. 1869; A. C. Sm. in J. Arnold Arb. 24: 360. 1943, in Bot. J. Linn. Soc. 71: 35. 1975.

De Candolle's entire description is: "limbis 0,06 longis, 0,03 latis 5-7-nerviis." The holotype is said to be a Barclay specimen at K from Fiji, but no such specimen has been located. The trinomial does not appear in de Candolle's 1923 treatment in *Candollea*.

FAMILY 49. PEPEROMIACEAE

PEPEROMIACEAE A. C. Sm. fam. nov.¹

Peperomiaceae Novák in Preslia 26: 357, nom. nud. 1954; Nemejc in Acta Mus. Nat. Pragae, Ser. B. 12 (2-3): 91, 92, sine descr. lat. 1956.

A family often submerged in the Piperaceae but differing in reasonably obvious characters as here mentioned: herbs, often epiphytic, the stems usually succulent, often

¹As far as I have been able to ascertain, the family name Peperomiaceae has never been validly published (i. e. in accord with ICBN Arts. 18, 34, and 36), although it has been used in many works subsequent to the 1954 and 1956 treatments listed above. Günther Buchheim (in litt.) is also of this opinion, and therefore I here propose the family as new. If we have overlooked a publication of it that is in compliance with the ICBN, the present proposal would of course be superseded.

Herbae terrestres vel epiphyticae, caulibus plerumque succulentis, fascibus vascularibus discretis, stipulis nullis; floribus ♂ unoquoque bractea peltata suborbiculari glabra subtento; staminibus 2, antherarum loculis lateralibus demum confluentibus; gynoeceo unicapellato, stigmati simplici saepe subapicali, sacculo embryonali plerumque 16-nucleato.

Typus genericus familiae: *Peperomia* Ruiz & Pavon.

with swollen nodes, the vascular bundles separate; leaves opposite, alternate, or verticillate; stipules lacking; flowers sessile (very rarely short-pedicellate) or immersed in spadix pits, ♂, each subtended by a consistently petlate, orbicular or suborbicular, glabrous bract; stamens 2, the anthers with lateral, eventually confluent locules; gynoecium 1-loculed, composed of a single carpel, the stigma simple, often penicillate, often subapical; embryo sac normally with 16 nuclei.

DISTRIBUTION: Two to four genera with more than 1,000 species, pantropical. The only large genus is *Peperomia*, which has several species indigenous in Fiji.

1. PEPEROMIA Ruiz & Pavon, Fl. Per. Chil. Prodr. 8. 1794; Seem. Fl. Vit. 259. 1868; Yuncker in Bishop Mus. Bull. 141: 25. 1936, in Occas. Pap. Bishop Mus. 17: 215. 1943, in J. Arnold Arb. 30: 443. 1949, in Bull. Torrey Bot. Club 83: 300. 1956.

Usually fleshy, terrestrial or epiphytic herbs with prostrate or ascending to erect stems; leaves alternate, opposite, or whorled, petiolate (sometimes shortly so), glabrous or variously pilose, with palmate, plinerved, or pinnate venation; spadices unbranched or in branching clusters, terminal, axillary, or leaf-opposed; flowers numerous, subtended by petlate, sessile, essentially orbicular bracts; stamens 2; pistil 1, the stigma glabrous or pilose, apical or usually subapical on the oblique apex of ovary; fruit usually less than 1 mm. long, sometimes verrucose and viscid.

LECTOTYPE SPECIES: Probably the most appropriate lectotype species, among the three discussed by Ruiz and Pavon, is *Peperomia secunda* Ruiz & Pavon (vide Britton, Fl. Bermuda, 94. 1918; Howard in J. Arnold Arb. 54: 382. 1973).

DISTRIBUTION: Pantropical, with at least 1,000 species. In the present treatment I recognize 24 species as occurring in Fiji, one of them being an adventive and 23 indigenous, of which 21 are considered endemic. To many of the endemic species Yuncker assigned infraspecific taxa, which he uniformly treated as varieties; some of these are here retained and I have kept the category of variety for them, although I believe that most would be better treated as forms of minor consequence.

USEFUL TREATMENTS OF GENUS: Yuncker, T. G. Genus *Peperomia* Ruiz and Pavon. Bishop Mus. Bull. 141: 25-47. 1936. Yuncker, T. G. Additional notes on the Fijian species of *Peperomia*. J. Arnold Arb. 30: 443-449. 1949.

The only critical work on the genus *Peperomia* in Fiji has been published by T. G. Yuncker between 1936 and 1956, as noted above; this has been followed, with a few alterations as indicated, in the text below. It is interesting to note (Yuncker in Brittonia 10: 3. 1958) that in *Peperomia* the place of origin of the inflorescences and their degree of branching are not useful characters in dividing the genus, as the inflorescences originate variously, often in the same species. In the Piperaceae (sensu str.), however, the place of origin of the inflorescences and whether or not they are branching appear to be sufficiently constant characters to permit the recognition of discrete genera.

Following Yuncker's usage, the length of the spike when expressed in the following key is taken to imply the length of the fertile rachis only; the length of the peduncle is sometimes stated separately in the key. Whether the stigma is apical or subapical, a character utilized by both de Candolle and Yuncker, may have some significance but is here considered too difficult of observation to provide a useful key character. Similarly, the flower-subtending bracts and the flowers themselves (FIGURE 34B) are too uniform in our species to provide satisfactory key characters, although crowding or spacing of flowers on the rachis may be useful in some cases. The fruit surfaces are fairly uniform in the indigenous Fijian species, usually being verrucose (FIGURE 33D) or papillose (FIGURE 34D) and viscid; the adventive *Peperomia pellucida* has quite

different fruits, pointed and longitudinally costulate.

In addition to the 24 species discussed below, at least one and probably more species are cultivated in Fiji. However, the only available vouchers for such cultivated *Peperomia* are DA 16473 and DA 16474, both obtained in a private garden in Lami, Rewa Province, Viti Levu. Neither of these specimens is in good enough condition to permit a positive identification, but it seems likely that they represent two different cultivars of *P. obtusifolia* (L.) A. Dietr., a widely cultivated and variable species with large, thick-carnose, suborbicular or obovate leaf blades, which sometimes are yellowish toward margins.

KEY TO SPECIES AND INFRASPECIFIC TAXA

Leaves predominantly opposite to verticillate; usually terrestrial plants.

Stems, leaf blades, and peduncles often densely (at least moderately) hirtellous, the leaf blades variable in shape, predominantly oval to obovate, up to 5 × 3 cm. but often smaller, usually obtuse at apex; spikes numerous, axillary and terminal, up to 12 cm. long; widely distributed species often growing on rocky shores or on dry, rocky slopes, infrequently epiphytic in forest. 1. *P. leptostachya*

Stems, leaf blades, and peduncles glabrous or very sparsely hirtellous.
Nodal thickenings of stem (padlike enlargements immediately beneath leaf scars) present; petioles about 2 mm. long, grooved on upper surface; leaf blades obovate, up to 3 × 1.2 cm.; species of high elevation, known only from Viti Levu. 2. *P. nodosa*

Nodal thickenings of stem lacking; petioles 4–12 mm. long, not conspicuously grooved; leaf blades usually elliptic to subovate, usually 2.5–5 × 2–3.5 cm.; species of rocky shores or sea cliffs, known only from Lau. 3. *P. pilostigma*

Leaves predominantly alternate; epiphytic or terrestrial plants.

Spikes leaf-opposed, slender, 1.5–5 cm. long; plants epiphytic, lax, with slender stems not more than 2 mm. thick; petioles 5 mm. long or less; leaf blades elliptic or rhomboid-elliptic to lanceolate, 1.5–4.5 × 1–2 cm. at maturity; known only from Viti Levu and Kandavu.

Stems, petioles, and peduncles glabrous; leaf blades glabrous except for inconspicuous, distal, marginal cilia. 4. *P. subroseispica*

Stems, petioles, and peduncles densely (or at least obviously) hirtellous; leaf blades puberulent on both surfaces. 5. *P. vitilevuensis*

Spikes axillary and/or terminal.

Plants obviously and mostly more or less completely pilose (i. e. on stems, petioles, leaf blades at least beneath, and usually on peduncles).

Petioles of mature leaves as long as or longer than leaf blades, 1–2.5 (–6) cm. long (in early stages sometimes only 2 mm. long), the blades orbicular to elliptic-obovate, usually 1–3 cm. long and broad at maturity, rounded at apex; peduncles (0.3–) 1–2 cm. long, the spikes not more than 2.5 cm. long (sometimes as short as 0.4 cm.); small, short-stemmed, essentially erect plants not more than 5 cm. high.

Leaf blades orbicular, (0.2–) 1–1.4 cm. long and broad; known only from Viti Levu and Ovalau.

6a. *P. orbiculimba* var. *orbiculimba*

Leaf blades obovate or elliptic-obovate, (0.8–) 1–2.5 × (0.7–) 1–3 cm.; known only from Vanua Levu. 6b. *P. orbiculimba* var. *mathuataensis*

Petioles obviously shorter than leaf blades; comparatively large plants, more than 5 cm. high (or, if repeat, with stems exceeding 5 cm. in length).

Spikes mostly solitary (seldom in branching, axillary clusters).

Leaf blades palmately 3-nerved, oval or obovate; known only from Viti Levu and Ovalau.

Stems erect or ascending, not rooting at nodes, densely pilose with hairs to 1 mm. long; spikes 2–7 cm. long, the peduncles 5–12 mm. long, densely puberulent; petioles 5–8 mm. long, densely puberulent; leaf blades oval to obovate, up to 3.5 × 2 cm., puberulent beneath.

7. *P. nandarivatensis*

Stems more or less decumbent and rooting at nodes, minutely puberulent; spikes 0.4–2.7 cm. long, the peduncles 2–6 mm. long, essentially glabrous; petioles 2–3 mm. long, minutely puberulent; leaf blades usually not more than 1.7 × 1.1 cm. (but sometimes to 4 × 2.3 cm.), glabrous on both sides or minutely puberulent beneath. 8. *P. curtispica*

Leaf blades palmately 5(or more)-nerved.

Apex of leaf blades appreciably narrowed and attenuate, acute to acuminate (rarely obtuse).

Stems and petioles densely hirtellous with spreading hairs; known only from Viti Levu.

Nodes of the stem and branches not conspicuous, green in living specimens; leaf blades

- lance-elliptic to obovate, (1.8-) 2.5-4 × (0.7-) 1.2-2.5 cm., dark-glandular-punctate beneath. 9. *P. parhamii*
- Nodes of the stem and branches conspicuously swollen, deep purple in living specimens; leaf blades elliptic to elliptic-subobovate, (2.5-) 4-8 × (1-) 1.5-4 cm., strongly orange-red-glandular. 10. *P. purpurinodis*
- Stems and petioles densely appressed-hirtellous, the nodes of stems and branches not conspicuous, green in living specimens; leaf blades elliptic to ovate-lanceolate, 1.5-5 × (0.7-) 1-2 cm., inconspicuously glandular-punctate; known only from Koro, Vanua Levu, and Taveuni. 11. *P. vitiana*
- Apex of leaf blades rounded or obtuse, not narrowed or attenuate, the blades 3-5.5 (-7) × 1.5-3.3 (-4) cm.
- Stems, branches, petioles, and peduncles densely hirtellous with stiffly spreading hairs less than 0.25 mm. long; leaf blades elliptic; spikes 1.5-3.5 cm. long and slender, 1 mm. or less in diameter; known only from Viti Levu. 12. *P. namosiana*
- Stems, branches, petioles, and peduncles densely hirsute with curved-appressed hairs 0.5-1 mm. long; leaf blades elliptic to obovate; spikes 1.5-4 cm. long and comparatively stout, about 2 mm. in diameter; known only from Vanua Levu. ... 13. *P. ciliifolia*
- Spikes in branching, axillary clusters (very infrequently solitary).
- Stems, branches, and petioles densely white-villose with spreading hairs 1 mm. long or less; leaf blades elliptic or lanceolate-elliptic, 3-4.5 × 1-1.4 cm., acute to acuminate at apex, loosely villose on both surfaces; spikes mostly in umbellate clusters of 3, 5-10 mm. long (immature only known), the peduncles to 5 mm. long, glabrous or sparsely villose.
14. *P. naitasiriensis*
- Stems, branches, and petioles with hairs 0.25 mm. long or less; spikes mostly 3-5 in branching clusters, the peduncles 2-3 mm. long.
- Indument densely hirtellous, composed of stiff, spreading hairs; petioles 2-3 mm. long; leaf blades 2-5 × 0.7-2 cm., acute to obtusish at apex.
- Peduncles densely hirtellous; leaf blades elliptic or lanceolate, 2-5 × 0.7-2 cm., acute at apex, densely hirtellous on both surfaces; spikes 12-25 mm. long; known only from Viti Levu. 15a. *P. nandalana* var. *nandalana*
- Peduncles glabrous; leaf blades elliptic-obovate to rhomboidal, 2.5-4 × 1.2-1.7 cm., acute to obtusish at apex, moderately to sparingly crispate-puberulent on both surfaces; spikes 5-12 mm. long; known only from Vanua Levu.
- 15b. *P. nandalana* var. *nudipeduncula*
- Indument crisp-pubescent, composed of curved hairs; petioles up to 5 mm. long; leaf blades elliptic or elliptic-lanceolate, 4-6 × 1.5-2.5 cm., acuminate at apex; spikes 10-15 mm. long; known only from Viti Levu and Ovalau. 16. *P. disticha*
- Plants essentially glabrous or at most with only a few hairs (and these usually restricted to stems, rarely occurring on nerves or margins of leaf blades).
- Fruits rostellate, longitudinally costulate; leaf blades drying thin and membranous, broadly ovate, cordate or cordate-truncate at base; spikes leaf-opposed and terminal, slender, up to 5 cm. long, with well separated flowers; a weedy adventive. 17. *P. pellucida*
- Fruits not longitudinally costulate; leaf blades often carnosely, usually remaining thick when dried, obtuse to attenuate at base; spikes not leaf-opposed; indigenous species.
- Leaf blades palmately 3- or 5-nerved (or the uppermost principal nerves sometimes loosely concurrent with costa for 1-2 mm.), essentially glabrous.
- Spikes mostly solitary.
- Leaf blades not more than 4 cm. long.
- Plants suberect, terrestrial, glabrous, the stems often 3 mm. or more in diameter when dried, with conspicuous nodes; leaf blades elliptic to obovate, 2.5-4 × 1.5-2.3 cm., often obtusely attenuate at apex; spikes up to 8 cm. long; habitat in low elevation rocky places; known only from Lau. 18. *P. endlicheri* var. *fijiana*
- Plants more or less decumbent and rooting at nodes, epiphytic at high elevations, the stems slender, scarcely 1 mm. in diameter, with inconspicuous nodes; leaf blades oval or obovate, to 4 × 2.3 cm., usually not more than 1.7 × 1.1 cm.; spikes 1-2 cm. long; minute pubescence often present on stems and leaves, but entire plant sometimes glabrous; known only from Viti Levu and Ovalau. 8. *P. curtispica*
- Leaf blades about 6 × 1-1.5 cm., pubescent on nerves beneath, falcately long-acuminate; known only from Taveuni. 21. *P. falcata*
- Spikes mostly in branching, axillary clusters; leaf blades often more than 4 cm. long (but sometimes as small as 1 cm. long); widespread on high islands throughout Fiji.
- Base of leaf blades acute to attenuate, the apex acute to acuminate, the blades seldom smaller than 3 × 1 cm.; petioles 3-7 mm. long; spikes 2-7 cm. long at anthesis.

Leaf blades elliptic-lanceolate, (2-) 5-8 × (0.7-) 1.3-2.6 (-2.9) cm.; comparatively slender plants, the stems succulent but seldom more than 5 mm. in diameter when fresh or 3 mm. in diameter when dried; spikes comparatively slender, rarely exceeding 1 mm. in diameter. 19a. *P. lasiostigma* var. *lasiostigma*

Leaf blades predominantly elliptic to ovate, 4-10 × (1.8-) 2.2-4 cm.; comparatively robust plants, the stems succulent, up to 10 mm. in diameter when fresh or 6 mm. in diameter when dried; spikes comparatively robust, often 2 mm. in diameter.

19b. *P. lasiostigma* var. *cariosa*
Base of leaf blades rounded to acute, the apex obtuse, the blades 1-1.8 × 0.7-0.9 cm.; petioles 1-2 mm. long; spikes about 6 mm. long; known only from Vanua Levu.

19c. *P. lasiostigma* var. *microlimba*
Leaf blades mostly plinerved (the principal nerves concurrent for at least a few millimeters above base, very rarely free nearly to base), glabrous or sparsely pilose.

Two innermost lateral nerves of leaf blades concurrent for 2-5 mm., the blades ovate- or elliptic-lanceolate, acute to cuneate at base.

Leaf blades narrowly and conspicuously attenuately acuminate.

Stems and branches glabrous or when very young with minute appressed hairs distally; leaf blades 6-9 × 2-4.5 cm., essentially glabrous, not falcate; petioles 2-3 mm. long, glabrous or when young obscurely appressed-pilose; spikes to 4 cm. long and comparatively robust, often 1.5-2 mm. in diameter.

Leaf blades about 3 times as long as broad, elliptic-lanceolate; known only from Koro, Vanua Levu, and Taveuni.

Apex of leaf blades narrowly and attenuately acuminate, the base acute; leaves all alternate. 20a. *P. attenuata* var. *attenuata*

Apex of leaf blades less slenderly pointed, the base acute to cuneate, the lower leaves not uncommonly opposite. 20b. *P. attenuata* var. *taveuniana*

Leaf blades mostly 2-2.5 times as long as broad, ovate-lanceolate.

20c. *P. attenuata* var. *roseispica*
Stems and branches crisp-pubescent with hairs about 0.5 mm. long; leaf blades about 6 × 1-1.5 cm., pubescent on nerves beneath, falcately long-acuminate; petioles 3-5 (-10) mm. long, crisp-pubescent; spikes (known only in immature state and solitary in that condition) 1.5-1.7 cm. long and slender, about 1 mm. in diameter; known only from Taveuni. 21. *P. falcata*

Leaf blades acute to acuminate but not slenderly attenuate, elliptic-lanceolate, 3-6 × 0.9-2.3 cm., glabrous or pilose along nerves on upper surface; petioles 3-10 mm. long, glabrous; stems and branches glabrous; inflorescences mostly in upper leaf axils, the spikes to 3 cm. long, comparatively slender, 1-1.5 mm. in diameter.

Leaf blades mostly 3-5 × 0.9-1.8 cm., glabrous; known only from Viti Levu.

22a. *P. flavida* var. *flavida*
Leaf blades 4-6 × 1.5-2.3 cm., pilose above along nerves but often glabrescent; known only from Vanua Levu. 22b. *P. flavida* var. *pubinervis*

Two innermost lateral nerves of leaf blades concurrent for 5-10 mm., the blades attenuately acuminate at apex, acute at base.

Leaf blades ovate to oval-lanceolate, (3-) 4-6.3 × (1-) 1.8-3.5 cm.; petioles usually 5-15 mm. long; spikes 1.5-4 cm. long; epiphytic plants with pendent branches to 1 m. long, these succulent and up to 12 mm. in diameter when fresh and about 6 mm. in diameter when dried; known only from Vanua Levu. 23. *P. albertiana*

Leaf blades elliptic- to oblong-lanceolate, 3.5-6 × 0.7-1.7 cm.; petioles 2-3 mm. long; spikes 0.5-1.2 cm. long; terrestrial or epiphytic plants 15-75 cm. high, the stem and branches 2-4 mm. in diameter when dried; known only from Taveuni. 24. *P. laevilimba*

1. *Peperomia leptostachya* Hook. & Arn. Bot. Beechey Voy. 96. 1832; Yuncker in Bishop Mus. Bull. 112: 57. fig. 16. 1933, in op. cit. 141: 46. 1936, in Occas. Pap. Bishop Mus. 17: 219. 1943, in J. Arnold Arb. 30: 444. 1949, in Bishop Mus. Bull. 220: 94. 1959; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 306. 1972.

As it occurs in Fiji, *Peperomia leptostachya* is found at elevations from sea level to 900 m., usually as a terrestrial herb on rocky shores, on the rocks and boulders of open hillsides, on rocks in dry forest, or on boulders in crest thickets. Occasionally it is noted

as an epiphyte in forest. Its succulent stems are pink to red, and flowers and fruits may be anticipated throughout the year.

TYPIFICATION: The holotype (k) was collected during the voyage of H. M. S. *Blossom*, probably by Lay and Collie, on the island of Oahu, Hawaii, in 1826 or 1827.

DISTRIBUTION: From Micronesia and Queensland eastward through Melanesia and Polynesia. Various segregate taxa have been recognized of the relationship of this widespread species (cf. Yuncker in Bishop Mus. Bull. **143**: 58-62. 1937); if it is divided into varieties or other infraspecific taxa, the Fijian material seems to fall into the type-including group.

LOCAL NAME: The name *tangatanga* has been noted by St. John in the Yasawas.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nangua, *St. John 18108*. VITI LEVU: MBA: Mt. Mbatilamu, Vunda, *DA 14128, 14813*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4296*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4433*; Korovou, east of Tavua, *Degener 14946*; Waikumbukumbu, *DA 7057*; Nandarivatu, *Gillespie 4173*. NANDRONGA & NAVOSA: Ruwailevu, Singatoka River, *Webster & Hildreth 14372*; Thuvu, west of Singatoka, *Greenwood 1058*. NAMOSI: Mt. Voma, *DA 1845*. KANDAVU: *DA 2977*; Namalata Isthmus region, *Smith 31*. OVALAU: Vuma, *DA 17036*. NGAU: *Tothill 810*; shore of Herald Bay, in vicinity of Sawaieke, *Smith 7927*. VANUA LEVU: MATHUATA: Coast near Lambasa, *Greenwood 677*; Mt. Uluimbau, south of Lambasa, *Smith 6605*. THAKAUNDRIVE: Mt. Uluinambathi, Savusavu Bay region, *Degener & Ordenez 13942*; small island in Mbutha Bay, *Bierhorst F177*. MOALA: North coast, *Smith 1402*. FIJI without further locality, *Weber 49* (b, probably destroyed but cited by Yuncker), *DA 5540*.

2. *Peperomia nodosa* Yuncker in Occas. Pap. Bishop Mus. **17: 219. fig. 3. 1943; J. W. Parham, Pl. Fiji Isl. 220. 1964, ed. 2. 306. 1972.**

A rare species known only from the upper elevations of the Mt. Evans Range, Viti Levu, probably at about 1,100-1,190 m. It is a terrestrial, tufted herb with the stems ascending or suberect and up to 20 cm. high, and with thin, red spikes. Flowering specimens have been obtained in October.

TYPIFICATION: The holotype is *Greenwood 950* (GH), collected Oct. 25, 1942, on the main ridge of the Mt. Evans Range, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type locality.

AVAILABLE COLLECTION: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 126*.

This very distinctive endemic is well figured by Yuncker; its relationship to the lowland *Peperomia pilostigma*, with which I have keyed it, does not seem very close.

3. *Peperomia pilostigma* Yuncker in Bishop Mus. Bull. **141: 47. fig. 20. 1936; J. W. Parham, Pl. Fiji Isl. 220. 1964, ed. 2. 306. 1972.**

This rare endemic is a terrestrial herb 15-30 cm. tall, occurring near sea level on cliffs or shores and perhaps only on limestone. Flowering and fruiting specimens have been obtained in March and April.

TYPIFICATION: The type is *Smith 1492* (BISH HOLOTYPE; several ISOTYPES), collected April 2, 1934, in the northern limestone section of Vanua Mbalavu.

DISTRIBUTION: Endemic to Fiji and thus far known only from two islands of the northern Lau group.

AVAILABLE COLLECTIONS: YATHATA: On coast, *DA 15550*. VANUA MBALAVU: Nambavatu (near type locality), *Tothill 811, 811A*.

4. *Peperomia subroseispica* C. DC. in J. Linn. Soc. Bot. **39: 165. 1909. FIGURE 29A. *Peperomia flexuosa* Yuncker in Bishop Mus. Bull. **141**: 30. fig. 11. 1936; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972.**

An epiphytic herb in dense forest, or sometimes terrestrial on volcanic agglomerate on high ridges, at elevations of 500–1,323 m. (one specimen cited below is said to be from low elevation at Lami, but this may be questioned). The reddish stems are up to 40 cm. or more long, the lower leaf surfaces are sometimes reddish-streaked, and the spikes are greenish. Flowering and fruiting collections have been made between May and October.

TYPEIFICATION AND NOMENCLATURE: The holotype of *Peperomia subroseispica* is Gibbs 726 (BM), collected in September, 1907, at Nandarivatu, Mba Province, Viti Levu; the elevation stated, 1,010 m., indicates that the collection came from the summit of a ridge (as noted by Gibbs) substantially higher than Nandarivatu itself. It is strange that Yuncker (in Bishop Mus. Bull. **141**: 35. 1936) reduced de Candolle's species to *P. lasiostigma*, although he cited and doubtless saw the holotype, a specimen which (as described by de Candolle) clearly has leaf-opposed spikes. As a result of this oversight, Yuncker redescribed the species as *P. flexuosa*, typified by Smith 263 (BISH HOLOTYPE;



FIGURE 29. A, *Peperomia subroseispica*, distal portion of stem, with foliage and leaf-opposed spikes, $\times 1$, from Smith 263. B, *Peperomia vitilevuensis*, distal portion of stem, with foliage and leaf-opposed spikes, $\times 6$, from DA 13070.

many ISOTYPES), collected Oct. 25, 1933, on Mt. Mbuke Levu, Kandavu. There can be no doubt that the two types are conspecific.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Kandavu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes and summit of Mt. Tomanivi, *Parks 20825, Smith 5197, DA 12708 (Melville et al. 7096), 13082, Webster & Hildreth 14177*. NAMOSI: Mt. Voma, *DA 1927, 1939*. NAITASIRE: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5773, 6107*. REWA: Lami, *Tohill 818*. (The last locality, as noted above, seems dubious, as this species is not to be expected near sea level.)

5. *Peperomia vitilevuensis* Yuncker in J. Arnold Arb. **30**: 445. 1949; J. W. Parham, Pl. Fiji Isl. **220**. 1964, ed. 2. 307. 1972. FIGURE 29B.

An epiphytic herb occurring in dense forest and summit thickets at elevations between 850 and 1,323 m. The stems are up to 15 cm. high (or long) and, like the leaves, are sometimes reddish-mottled; the spikes are green. Flowering material has been obtained between June and October, but fruits have thus far been noted only in October.

TYPIIFICATION: The type is *Smith 4862* (A HOLOTYPE; ISOTYPE at US), collected June 23, 1947, on the summit of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Tomanivi, *DA 13070*; summit of Mt. Tomanivi, *Webster & Hildreth 14201*. SERUA: Mt. Tuvutau, *DA 14497*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5711*.

This species and the preceding (*Peperomia subroseispica*, including *P. flexuosa*) differ unmistakably from other Fijian *Peperomiae* in their invariably leaf-opposed spikes. The densely hirtellous indument of *P. vitilevuensis* readily distinguishes it from the definitely glabrous *P. subroseispica*. It seems curious that the two species are found sympatrically, both occurring on the summit of Mt. Tomanivi and perhaps elsewhere. However, no intermediates have been found and the cited material may be confidently referred to one or the other taxon.

6. *Peperomia orbiculimba* Yuncker in Bishop Mus. Bull. **141**: 27. 1936.

Some years after describing this species Yuncker proposed a variety of it, distinguishable in minor characters of leaf shape and size. On the basis of the available material, the two varieties of *Peperomia orbiculimba* seem reasonably distinct and have different ranges, as far as known; therefore they are here maintained. The species as a whole is one of the most distinct of the Fijian *Peperomiae*.

6a. *Peperomia orbiculimba* Yuncker var. *orbiculimba*; J. W. Parham, Pl. Fiji Isl. **220**. 1964, ed. 2. 306. 1972.

Peperomia orbiculimba Yuncker in Bishop Mus. Bull. **141**: 27. fig. 8. 1936, in Occas. Pap. Bishop Mus. **17**: 215. 1943.

The typical variety of *Peperomia orbiculimba* occurs sparsely from sea level to 800 m., terrestrial on dry rocks or epiphytic in forest. It is an essentially erect, short-stemmed plant not more than 5 cm. high, with yellowish green spikes. The few known collections, all in flower, were obtained between January and April.

TYPIIFICATION: The holotype is *Horne 370* (K), collected in January, 1878, on dry rocks near Levuka, Ovalau.

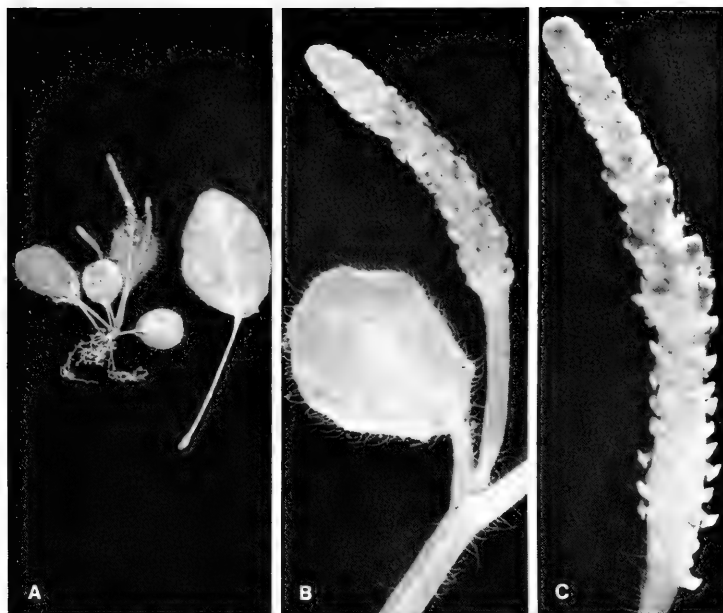


FIGURE 30. *Peperomia orbiculimba* var. *mathuataensis*, from *Smith 6859*; A, entire plant and a leaf blade from another plant, $\times 1$; B, distal portion of plant, with a developing leaf blade and a young spike, $\times 6$; C, mature spike, $\times 6$.

DISTRIBUTION: Endemic to Fiji and thus far known only from three collections from Viti Levu and Ovalau.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 212*; vicinity of Nandarivatu, *Degener 14534*.

The Greenwood specimen (seen only at κ) agrees perfectly with the type in facies, leaf shape, and indument, but it is much smaller (perhaps coming from a very exposed situation); petioles 2–3 mm. long; leaf blades 2–4 mm. in diameter; peduncles 3–4 mm. long; spikes 4–5 mm. long.

6b. *Peperomia orbiculimba* var. *mathuataensis* Yuncker in *J. Arnold Arb.* 30: 445. 1949; *J. W. Parham, Pl. Fiji Isl.* 220. 1964, ed. 2. 306. 1972. FIGURE 30.

A terrestrial plant occurring at elevations of 100–500 m. on rocky banks or cliffs along streams in dense forest or in steep, open forest. The leaf blades are sometimes reddish purple beneath. Flowering material has been obtained in November and December and fruits only in the latter month.

TYPIFICATION: The type is *Smith 6859* (A HOLOTYPE; many ISOTYPES), collected Dec. 4, 1947, at the southern base of the Mathuata Range, north of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from two collections from Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6569*.

7. *Peperomia nandarivatensis* Yuncker in *Occas. Pap. Bishop Mus.* **17**: 216. *fig. 1*. 1943, in *J. Arnold Arb.* **30**: 446. 1949; J. W. Parham, *Pl. Fiji Isl.* **219**. 1964, ed. 2. 306. 1972.

A terrestrial herb to 15 cm. high, occurring on rock ledges or boulders in dense forest at elevations of 750–1,075 m. Flowers have been noted in March, June, and December and fruits only in March.

TYPIFICATION: The type is *Degener 14838* (GH HOLOTYPE; ISOTYPE at K), collected Mar. 16, 1941, near Nandala, south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Upper slopes of Mt. Koromba, *Smith 4670*; near Navai, south of Nandarivatu, *O. & I. Degener 32352*.

8. *Peperomia curtispica* C. DC. in *J. Linn. Soc. Bot.* **39**: 166. 1909; Yuncker in *Bishop Mus. Bull.* **141**: 34. *fig. 13*. 1936, in *J. Arnold Arb.* **30**: 446. 1949; J. W. Parham, *Pl. Fiji Isl.* **218**. 1964, ed. 2. 304. 1972. FIGURE 31A.

Peperomia parhamii var. *glabra* Yuncker in *Bull. Torrey Bot. Club* **83**: 304. 1956; J. W. Parham, *Pl. Fiji Isl.* **220**. 1964, ed. 2. 306. 1972.

A epiphytic herb, sometimes with deep red nodes, often decumbent and rooting at nodes, occurring in dense forest, mossy ridge forest, or in the dense thickets of crests at elevations of 575–1,120 m. Flowering specimens have been obtained between May and September.

TYPIFICATION AND NOMENCLATURE: The holotype of *Peperomia curtispica* is *Gibbs 651* (BM), collected in September, 1907, in the vicinity of Nandarivatu, Mba Province, Viti Levu. *Peperomia parhamii* var. *glabra* is typified by *Smith 7377* (US 2190297 HOLOTYPE), obtained May 11, 1953, on the summit of Mt. Ndelaivalau and adjacent ridge, Ovalau. The indument of the stems and leaf blades of this distinctive species is sometimes apparent, although inconspicuous, and sometimes apparently quite lacking. The type of *P. parhamii* var. *glabra* appears to me to belong with the glabrous phase of *P. curtispica*.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu and Ovalau.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Summit of Mt. Nanggaranambuluta, east of Nandarivatu, *Smith 4861*; hills east of Nandala Creek, south of Nandarivatu, *Smith 5948*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandra and Nanga, *Smith 5515*. NAMOSI: Mt. Naitarandamu, *Gillespie 3097*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5710*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5772*. VITI LEVU without further locality, *Parks 20619, 20703*. FIJI without further locality, *Gillespie 3109, DA 3879*.

9. *Peperomia parhamii* Yuncker in *J. Arnold Arb.* **30**: 446. 1949.

Peperomia parhamii Yuncker var. *parhamii*; J. W. Parham, *Pl. Fiji Isl.* **220**. 1964, ed. 2. 306. 1972.

An epiphytic herb with stems to 30 cm. high or more, occurring in dense forest or on ridges and crests at elevations of 700–1,155 m. Flowering material has been obtained between March and August.

TYPIFICATION: The type is *DA 2187* (coll. *B. E. V. Parham*) (A HOLOTYPE; ISOTYPES

at κ, SUVA), collected March 24, 1940, in the Korombasambasanga Range, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known definitely only from Viti Levu.

LOCAL NAME: The name *mbeta ni koro* was recorded by Gillespie (no. 2747).

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Summit of Mt. Naitarandamu, Gillespie s. n.; slopes of Mt. Voma, DA 597, 605, 1778, 1920. FIJI without further locality, Gillespie 2747, 2747a, 3152.

Yuncker also described a var. *glabra* of *Peperomia parhamii*, but, as noted under the preceding species, I believe this better placed in *P. curtispica*. With its removal, there is no need for a var. *parhamii*.

10. *Peperomia purpurinodis* Yuncker in Bull. Torrey Bot. Club **83**: 303. fig. 4. 1956; J. W. Parham, Pl. Fiji Isl. 220. 1964, ed. 2. 307. 1972.

An epiphytic herb occurring in dense forest at elevations of 50–400 m. The plant attains a height of about 30 m., the nodes of its stem being conspicuously swollen and deep purple; the upper internodes and spikes are reddish. Flowers and fruits have been obtained in months scattered throughout the year.

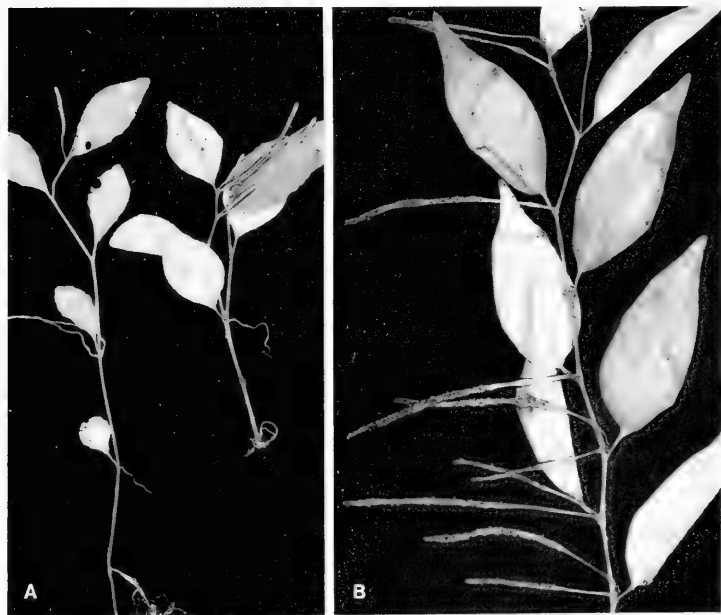


FIGURE 31. A. *Peperomia curtispica*, entire plants, $\times 1$, from Smith 4861. B. *Peperomia vitiana*, distal portion of stem, with foliage and axillary inflorescences, $\times 1$, from Smith 644.

TYPIIFICATION: The type is *Smith 9033* (US 2191634 HOLOTYPE; ISOTYPE at BISH), collected Oct. 26, 1953, in hills east of the Wainakoroiuva River, near Namuamua, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Vicinity of Namosi, *Parks 20193*. NAITASIRI: Viria, *Parks 20438*; Waimanu River region, *DA 15442*; Waimbau Creek, Sawani-Serea road, *DA 11213*; Prince's Road, *DA 532, 1589, 6060*; Tholo-i-suva, *Parks 20090*; vicinity of Tamavua, *Gillespie 2426, 2427*; vicinity of Nasinu, *Gillespie 3603*. VITI LEVU without further locality, *Parks 20446, 20873, 20937*.

This species, known to Yuncker only from the type collection, is now seen to be fairly frequent in southeastern Viti Levu; it is readily recognized by the swollen, purple nodes of its stems.

11. *Peperomia vitiana* C. DC. in DC. Prodr. **16** (1): 458. 1869; Seem. Fl. Vit. 433, pro syn. 1873; C. DC. in J. Linn. Soc. Bot. **39**: 167. 1909; Yuncker in Bishop Mus. Bull. **141**: 28. fig. 9. 1936; J. W. Parham, Pl. Fiji Isl. **220**. 1964, ed. 2. 307. 1972.

FIGURE 31B.

Peperomia sp. Seem. in Bonplandia **9**: 259, p. p. 1861, Viti, 442, p. p. 1862.

Peperomia pallida sensu Seem. Fl. Vit. 259, p. p. 1868; Drake, Ill. Fl. Ins. Mar. Pac. **276**, p. p. 1892; non A. Dietr.

An epiphytic herb, or growing on dead logs, in forest or in dense crest thickets at elevations of 300–1,030 m. The stems are 35 cm. or more high and the spikes are reddish. Flowering and fruiting material has been obtained in months scattered throughout the year.

TYPIIFICATION AND NOMENCLATURE: The type is *Seemann 565*, p. p. (K HOLOTYPE; ISOTYPE at GH), collected in June, 1860, on Taveuni, without further locality. Seemann combined two species in his no. 565, the second being *Peperomia laevilimba* Yuncker. The two parts of no. 565 at K are mounted on a single sheet. The specimen at GH represents *P. vitiana*, whereas that at BM represents *P. laevilimba*.

DISTRIBUTION: Endemic to Fiji and now known from Koro, Vanua Levu, and Taveuni.

AVAILABLE COLLECTIONS: KORO: Eastern slope of main ridge, *Smith 971*. VANUA LEVU: THAKAUNDROVE: Crest of Mt. Mbatini Range, *Smith 644*; Mt. Mariko, *Smith 479*; between Mbiangu and Vemsi, along trail over Mt. Mariko, *Bierhorst F131*; Mt. Ndikeva, *Smith 1899*. TAVEUNI: Wainggilo, Nggeleni, *DA 15884*; vicinity of Waiyevo, *Gillespie 4733*.

12. *Peperomia namosiana* Yuncker in Bull. Torrey Bot. Club **83**: 302. fig. 3. 1956; J. W. Parham, Pl. Fiji Isl. **219**. 1964, ed. 2. 306. 1972.

An apparently infrequent epiphytic herb occurring in dense forest at elevations of 250–350 m. The stems attain a length of 1 m. and are dull purplish proximally and up to 2 cm. in diameter, being greenish distally.

TYPIIFICATION: The type is *Smith 8829* (US 2191471 HOLOTYPE; ISOTYPES at BISH, K), collected in flower and fruit Oct. 5, 1953, in the valley of Wainambua Creek, south of Mt. Naitarandamu, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection.

13. *Peperomia ciliifolia* Yuncker in Bishop Mus. Bull. **141**: 30. fig. 10. 1936; J. W. Parham, Pl. Fiji Isl. **218**. 1964, ed. 2. 304. 1972. FIGURE 32A.

A terrestrial herb, occurring on moist banks in dense forest and on forested ridges at elevations of 600–900 m.; the stem attains a height (or length) of 60 cm. Flowering material of this infrequent species has been obtained in August and November.

TYPIFICATION: The type is *Smith 478* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, on Mt. Mariko, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 12794*.

This apparently rare species is readily distinguished from *Peperomia namosiana*, its closest relative, by its copious indument of curved-appressed hairs, these being much longer than the stiffly spreading hairs of *P. namosiana*.

14. *Peperomia naitasiriensis* Yuncker in J. Arnold Arb. 30: 447. 1949; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 306. 1972.

This apparently rare species is an epiphytic herb occurring in dense forest at elevations of 870 to perhaps 1,200 m. or more; the stems and lower leaf surfaces are reddish-tinged. Flowering material has been obtained in August and September.

TYPIFICATION: The holotype is a unicate specimen, *Smith 6144* (A), collected Sept. 18, 1947, on the northern portion of the Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from upland Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: MBA: Mt. Tomanivi, *Vaughan 3256* (BM).

The dense, white, villose indument of the stems and leaves sharply characterizes this species, which is also marked by having the spikes in umbellate clusters of three.

15. *Peperomia nandalana* Yuncker in Occas. Pap. Bishop Mus. 17: 217. 1943.

Both varieties of this species are rare, one known only from Viti Levu and the other only from Vanua Levu. As far as indicated by the available material, the differences utilized in my key seem reliable.

15a. *Peperomia nandalana* Yuncker var. *nandalana*; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 306. 1972. FIGURE 32B & C.

Peperomia nandalana Yuncker in Occas. Pap. Bishop Mus. 17: 217. fig. 2. 1943.

A terrestrial herb occurring on rock ledges and boulders in dark, wet, dense forest at elevations (as far as recorded) of 750–780 m.; the stems attain a length of 90 cm. Flowering and fruiting material has been obtained in February, March, and May.

TYPIFICATION: The type is *Degener 14837* (GH HOLOTYPE; ISOTYPES at BISH, K, US, and perhaps elsewhere), collected March 16, 1941, near Nandala, south of Nandari-vatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu.

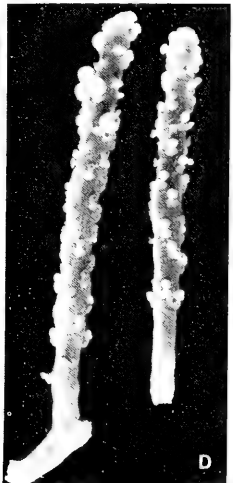
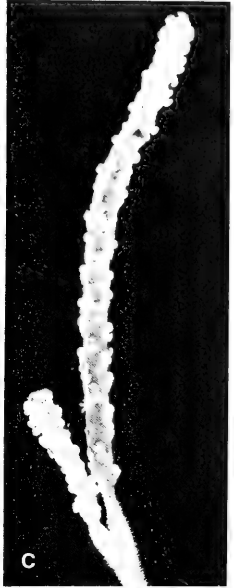
LOCAL NAME: The name *mbeta* was recorded by Degener (no. 14460), but this merely implies a plant in flower.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Matomba, near Nandala, *Degener 14460*. NAMOSI: Wainimbaivatu, *DA 14235*.

15b. *Peperomia nandalana* var. *nudipeduncula* Yuncker in J. Arnold Arb. 30: 447. 1949; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 306. 1972. FIGURE 32D.

A terrestrial herb on rocky banks along streams in dense forest, or epiphytic on forested ridges, occurring at elevations of 100–930 m. Flowering and fruiting material has been obtained in August and December.

TYPIFICATION: The type is *Smith 6862* (A HOLOTYPE; ISOTYPES at BISH, K, US),



collected Dec. 4, 1947, at the southern base of the Mathuata Range, north of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from Vanua Levu from two collections.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Summit ridge of Mt. Ndelaikoro, DA 12788.

16. *Peperomia disticha* Yuncker in Bull. Torrey Bot. Club **83**: 302. fig. 2. 1956; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972.

An epiphytic herb with stems 40 cm. or more long, occurring in dense forest or crest thickets at elevations of 100–626 m. Flowering and fruiting specimens have been obtained in April and May.

TYPIFICATION: The type is *Smith 7369* (US 2190291 HOLOTYPE; many ISOTYPES), collected May 11, 1953, on the summit of Mt. Ndelaiovalau and adjacent ridge, Ovalau.

DISTRIBUTION: Endemic to Fiji and known from only two collections obtained on Viti Levu and Ovalau.

AVAILABLE COLLECTION: VITI LEVU: TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakui-vuna, *Smith 7211*.

Although Yuncker implied a relationship of this rare species to *Peperomia lasiostigma*, it appears to me more closely allied to the Fijian *Peperomia* with obvious indument and paniculately branched, axillary clusters of spikes. Therefore I have keyed it with *P. nandalana*, although the two species are readily separated by the type of indument and leaf characters.

17. *Peperomia pellucida* (L.) H. B. K. Nova Gen. et Sp. **1**: 64. 1816; Yuncker in Occas.

Pap. Bishop Mus. **17**: 215. 1943; Greenwood in J. Arnold Arb. **30**: 81. 1949; J. W.

Parham in Dept. Agr. Fiji Bull. **35**: 35. 1959, Pl. Fiji Isl. 220. 1964, ed. 2. 306. 1972.

Piper pellucidum L. Sp. Pl. 30. 1753.

A terrestrial or occasionally epiphytic herb usually 20–45 cm. high, occurring at elevations of sea level to about 400 m. as a weed along roadsides, in plantations, on damp ground in shady places near houses, and occasionally along forest trails. Flowering and fruiting material may be found throughout the year.

TYPIFICATION: From the three references given by Linnaeus, it seems likely that a specimen in Clifford's Herbarium (BM) may be taken as the lectotype.

DISTRIBUTION: Tropical America, but now widely dispersed as a weed throughout tropical areas. It is a comparatively recent introduction into Fiji, the earliest available collection being *Greenwood 562*, obtained in November, 1922.

USE: One collector indicates that the plant may be used as a medicinal poultice.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Navua River region, *Greenwood 562A*. NAITASIRI-REWA boundary: Mt. Kombalevu, *Parks 20301*. REWA: Suva, *Meebold 16869*, *Degener & Ordonez 13670*; by-pass road, Suva, *DA 11054*, *11228*; Department of Agriculture compound, Suva, *DA 12222*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 562*. TAVEUNI: Nggathavulo Estate, *DA 8883*.

FIGURE 32. A, *Peperomia ciliifolia*, distal portion of stem, with foliage and inflorescences, $\times 1$, from *Smith 478*. B & C, *Peperomia nandalana* var. *nandalana*, from *Degener 14837*: B, distal portion of stem, with foliage and inflorescences, $\times 1$; C, two spikes of an inflorescence, showing hirtellous peduncles, $\times 6$. D, *Peperomia nandalana* var. *nudipeduncula*, two spikes of an inflorescence, showing glabrous peduncles, $\times 6$, from *Smith 6862*.

18. *Peperomia endlicheri* Miq. var. *fijiana* Yuncker in Bishop Mus. Bull. **141**: 32. fig. 12. 1936; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 305. 1972.

A terrestrial herb to 40 cm. high, found at elevations between sea level and 100 m. on cliffs and in crevices of rock faces. The flowering spike is olive-green to brown, the fruits at length dark brown. Flowering and fruiting material has been obtained between March and August.

TIPIFICATION: The type of the variety is *Smith 1282* (BISH HOLOTYPE; many ISO-TYPES), collected March 5, 1934, on a limestone cliff, Kambara.

DISTRIBUTION: The type locality of Miquel's species is Norfolk Island, and the typical variety is also known from at least New Zealand and Samoa (cf. Yuncker in Bishop Mus. Bull. **143**: 17. fig. 6. 1937). The Fijian variety is characterized by having its leaf blades usually obtusely attenuate at apex rather than rounded; it is known only from the Lau Group.

AVAILABLE COLLECTIONS: MATUKU: *Moseley*, July, 1874. NAVUTU-I-LOMA: *Bryan 466*.

19. *Peperomia lasiostigma* C. DC. in J. Linn. Soc. Bot. **39**: 165. 1909.

The specimens here referred to *Peperomia lasiostigma* form the largest complex in the genus of Fiji. Here may be placed those essentially glabrous plants, mostly epiphytic and mostly but not always from higher elevations, with the spikes in axillary, branching clusters (occasionally solitary) and with the leaf blades 3- or 5-nerved from the base (or with the uppermost principal nerves loosely concurrent with the costa for an insignificant distance). Both de Candolle and Yuncker appear to me to have subdivided this complex into either species or varieties too freely; in examining material in the field and in herbaria I can conscientiously recognize only two readily distinguishable groups, one (var. *carcosa*) substantially more robust as to its succulent stems, larger leaves, and more robust spikes than the other (var. *lasiostigma*); even between these two groups some specimens will appear intermediate, but I believe that they may be retained, although the category of *forma* might be more appropriate than that of *varietas*. A third entity (var. *microlimba*) appears correctly placed in this general complex; the only known specimen of it is unsatisfactory and scarcely worth consideration.

It should be noted that Gibbs assigned her field number 600 to various collections that she thought conspecific. In studying her material, de Candolle divided the specimens into three parts, retaining the number 600 for the part he described as *Peperomia carcosa*. The portion that he described as *P. lasiostigma* was renumbered by him as 890 and the portion described as *P. gibbsiae* as 883. As the first author to combine these three taxa into a single species, Yuncker in 1936 took *P. lasiostigma* as the basic epithet and must be followed.

- 19a. *Peperomia lasiostigma* C. DC. var. *lasiostigma*; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972. FIGURE 33A & B.

Peperomia lasiostigma C. DC. in J. Linn. Soc. Bot. **39**: 165. 1909; Yuncker in Bishop Mus. Bull. **141**: 35. fig. 14, a-f. 1936, in Occas. Pap. Bishop Mus. **17**: 218. 1943, in J. Arnold Arb. **30**: 448. 1949.

Peperomia gibbsiae C. DC. in J. Linn. Soc. Bot. **39**: 164. 1909.

Peperomia pallida sensu Turrill in J. Linn. Soc. Bot. **43**: 35. 1915; non A. Dietr.

Peperomia lasiostigma var. *gibbsiae* Yuncker in Bishop Mus. Bull. **141**: 37. fig. 14, g, h. 1936.

Peperomia lasiostigma var. *tomaniviensis* Yuncker in J. Arnold Arb. **30**: 449. 1949; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972.

A succulent herb occurring at elevations from near sea level to about 1,200 m. It is usually epiphytic in dense forest and in woods along streams, less frequently terrestrial in rocky places. The stems, lower leaf surfaces, and inflorescences are often reddish or red-streaked, and the inconspicuous nodes are sometimes purplish. Flowering and fruiting material has been obtained throughout the year.

TIPIFICATION AND NOMENCLATURE: The holotype of *Peperomia lasiostigma* is *Gibbs 890* (BM), collected in September, 1907, near Nandarivatu, Mba Province, Viti Levu. *Peperomia gibbsiae* is typified by *Gibbs 883* (BM HOLOTYPE), also collected in September, 1907, near Nandarivatu. Neither de Candolle nor Yuncker suggests any valid points to separate this taxon from typical material of *P. lasiostigma*; Yuncker has not identified any material as var. *gibbsiae* except the type. The type of *P. lasiostigma* var. *tomaniviensis* is *Smith 5114* (A HOLOTYPE; several ISOTYPES), collected July 7, 1947, on the western and southern slopes of Mt. Tomanivi, Mba Province, Viti Levu. Yuncker's reason for distinguishing the two specimens he referred to var. *tomaniviensis* from typical *P. lasiostigma* was "... because of the shape and smaller size of the leaves and more slender petioles. The stems are also more erect and more widely branched upward." The specimens cited appear to me not to differ materially from many others from the same localities that Yuncker referred to the typical variety.

DISTRIBUTION: Endemic to Fiji and probably occurring on most of the high islands. I have examined about 55 collections of this variety in addition to the types mentioned above. It may be noted that *Peperomia lasiostigma* is sympatric with *P. subroseispica* and *P. vitilevuensis* on Mt. Tomanivi. The three taxa are sufficiently similar to have been confused in herbaria, but the leaf-opposed spikes of the two latter immediately distinguish them.

LOCAL NAMES: Recorded names have been *na miningalava* and *resuale* (from inner Naitasiri Province), *kaliningata* (from Mba Province), and *mbeta*.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Nangua, *St. John 18112*. VITI LEVU: Mba: Mt. Evans Range, *Greenwood 1153*; upper slopes of Mt. Koromba, *Smith 4699*; slopes of escarpment north of Nandarivatu, *Smith 6266*; Nandarivatu, *im Thurn 285*; Mt. Nanggaranambuluta, *Vaughan 3239*; slopes of Mt. Tomanivi, *im Thurn 29, 30, Smith 5268*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5596*; Thuvu, west of Singatoka, *Greenwood 1058a*. NAMOSI: Northern base of Korombasambasanga Range, *Smith 8689*; Mt. Voma, *DA 11647*. NAITASIRI: Wainimala Valley, Rarandawai, Wainimala-Wainisavulevu divide, *St. John 18259*; vicinity of Tamavua, *Gillespie 2426a*. REWA: Summit of Mt. Korombamba, *Gillespie 2391*. OVALAU: *Horne 29*; summit and slopes of Mt. Korotolotolu, west of Thawathi, *Smith 8022*. VANUA LEVU: THAKAUNDRIVE: Mt. Vatunivuaomonde, Savusavu Bay region, *Degener & Ordenez 14012*; hills south of Natewa, Natewa Peninsula, *Smith 1972*. TAVEUNI: Track to lake east of Somosomo, *DA 12411*; western slope, between Somosomo and Wairiki, *Smith 738*.

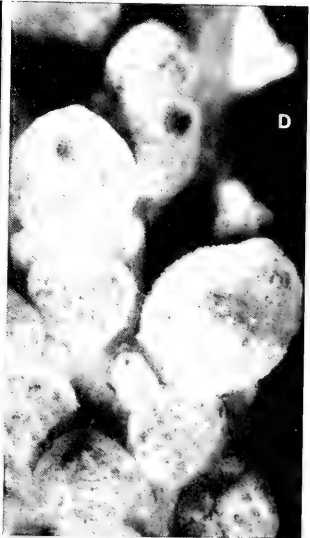
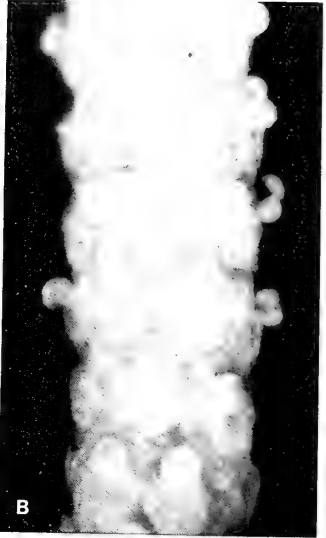
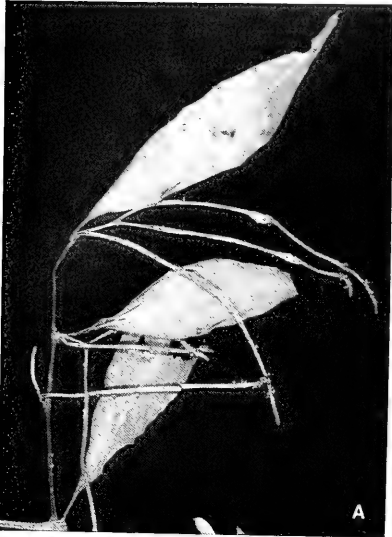
19b. *Peperomia lasiostigma* var. *carnosa* (C. DC.) Yuncker in Bishop Mus. Bull. 141: 36. fig. 14, i. 1936, in Occas. Pap. Bishop Mus. 17: 219. 1943, in J. Arnold Arb. 30: 448. 1949; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972. FIGURE 33C & D.

Peperomia carnosa C. DC. in J. Linn. Soc. Bot. 39: 166. 1909.

Peperomia kandavuana Yuncker in Bishop Mus. Bull. 141: 39. fig. 15. 1936, in J. Arnold Arb. 30: 449. 1949; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972.

A succulent herb occurring in dense forest and in crest thickets at elevations from 200 to 1,323 m. It is usually epiphytic but sometimes terrestrial on rocks and humus-covered boulders. The stems are usually 20–50 cm. long and about 1 cm. in diameter when fresh, the internodes green to deep red, the nodes often deep red to purplish, and the inflorescences pale to deep red. Flowers and fruits have been observed in most months.

TIPIFICATION AND NOMENCLATURE: The holotype of *Peperomia carnosa* is *Gibbs*



600 (BM), collected in September, 1907, near Nandarivatu, Mba Province, Viti Levu. *Peperomia kandavuana* is typified by *Smith 292* (BISH HOLOTYPE; many ISOTYPES), collected Oct. 25, 1933, on the summit of Mt. Mbuke Levu, Kandavu. In proposing the latter species, Yuncker provided no information to differentiate it from the robust specimens of *P. lasiostigma* here referred to var. *carnosa*; subsequently, in 1949, he referred to *P. kandavuana* specimens from upland Viti Levu from the precise localities where var. *carnosa* is abundant.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Kandavu, and Ovalau, but probably also occurring on other high islands. I have studied 32 collections in addition to the two type collections.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 905*; Mt. Evans Range, *Greenwood 125*; vicinity of Nandarivatu, *Parks 20763*; ridge between Mt. Nanggaranambuluta and Mt. Namama, east of Nandarivatu, *Smith 4985*; Mt. Tomanivi, *DA 12710* (*Melville et al. 7099*); summit of Mt. Tomanivi, *Smith 5148*. NANDRONGA & NAVOSA: Ridge near Korolevaleva, *DA 1454*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8481*; Korombasambasanga Range, *DA 2259*; Mt. Voma, *DA 11682*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5720*. NAITASIRE: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5782*. KANDAVU: Mt. Mbuke Levu, *Graeffe 39*, *Smith 246*. OVALAU: *U. S. Expl. Exped., Horne 30*; hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7648*.

19c. *Peperomia lasiostigma* var. *microlimba* Yuncker in Bishop Mus. Bull. **141**: 37. *fig. 14, j, k*. 1936; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972.

The single collection referred to this taxon was said by the collector to grow on rocks and trees in damp forest; the elevation of the locality is presumably less than 500 m.

TIPIFICATION: The holotype is *Horne 652* (κ), collected in April, 1878, between Waiwai and Lomaloma, Mathuata or Thakaundrove Province, Vanua Levu; the route followed by Horne was an old track leading from Savusavu Bay to Nanduri, on the north coast of Vanua Levu.

DISTRIBUTION: Known only from the type specimen.

The only available specimen of this variety does indeed seem correctly placed in the *Peperomia lasiostigma* complex, but whether it really represents a distinct taxon or whether it is merely an extremely depauperate individual of var. *lasiostigma* must remain uncertain. Yuncker's comment is: "Variety *microlimba* is based on a fragmentary and poorly prepared specimen which appears to be most closely allied to *P. lasiostigma*. However, the small size of the plant and the shape and small size of the leaves distinguish it from that species."

20. *Peperomia attenuata* Yuncker in Bishop Mus. Bull. **141**: 39. 1936.

Yuncker's concept of *Peperomia attenuata* is not readily separated from *P. lasiostigma* var. *carnosa*, the degree of concurrence of the principal nerves of the leaf blades not being an entirely constant character. However, the very slenderly acuminate leaf

FIGURE 33. A & B, *Peperomia lasiostigma* var. *lasiostigma*; A, distal portion of stem, with foliage and inflorescences, $\times 1$, from *Smith 738*; B, portion of flowering spike, $\times 30$, from *Smith 8689*. C & D, *Peperomia lasiostigma* var. *carnosa*, from *Smith 5148*; C, distal portion of stem, with foliage and inflorescences, $\times 1$; D, portion of spike with young fruits, $\times 30$.

blades of *P. attenuata* do indeed give the taxon a distinctive appearance and therefore I retain it as specifically distinct. There seems to be a certain degree of incipient geographic differentiation between the two populations. Yuncker's varieties are also retained, although the differences among them are slight.

20a. *Peperomia attenuata* Yuncker var. *attenuata*; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972.

Peperomia attenuata Yuncker in Bishop Mus. Bull. 141: 39. fig. 16, a-f. 1936.

A terrestrial or epiphytic herb, with stems to 50 cm. long or more, occurring at elevations of 300–1,030 m. in dense forest or dense crest thickets. Flowers have been noted between November and February and fruits only in November.

TYPIFICATION: The type is *Smith 712* (BISH HOLOTYPE; ISOTYPE at NY), collected Nov. 29, 1933, on the summit of Mt. Mbatini, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far sparingly known only from Koro and Vanua Levu.

AVAILABLE COLLECTIONS: KORO: Eastern slope of main ridge, *Smith 976*. VANUA LEVU: THAKAUNDROVE: Mt. Mariko, *Smith 480*.

20b. *Peperomia attenuata* var. *taveuniana* Yuncker in Bishop Mus. Bull. 141: 41. fig. 16, g, h. 1936; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972.

An epiphytic herb, or terrestrial on humus and decayed logs, occurring in dense forest at elevations of 600–900 m. The succulent stems are 25–60 cm. long and 8–15 mm. in diameter when fresh, green to dark reddish. Flowering and fruiting material has been obtained in months scattered throughout the year.

TYPIFICATION: The type is *Smith 889* (BISH HOLOTYPE; many ISOTYPES), collected Dec. 29, 1933, on the western slope of Taveuni between Somosomo and Wairiki.

DISTRIBUTION: Endemic to Fiji and, as far as now known, to the island of Taveuni.

AVAILABLE COLLECTIONS: TAVEUNI: Hills east of Somosomo, west of the old crater occupied by a small swamp and lake, *Gillespie 4818*, *Smith 8356*, *DA 12409*; immediate vicinity of the lake, *DA 15892*; valley between Mt. Manuka and main ridge of island, *Smith 8300*, *8307*; above Nggathavulo Estate, *DA 16915*.

20c. *Peperomia attenuata* var. *roseispica* Yuncker in Bishop Mus. Bull. 141: 41. fig. 16, i. 1936; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972.

A succulent epiphytic herb, occurring in dense forest or on forested ridges at elevations of 600–930 m. The stems are 45–60 cm. long and the flowering spikes are pinkish. Flowers have been obtained in April and August.

TYPIFICATION: The type is *Smith 1658* (BISH HOLOTYPE; many ISOTYPES), collected April 27, 1934, on Navotuvotu, the summit of Mt. Seatura, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and, as far as now known, to Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 12798*.

21. *Peperomia falcata* Yuncker in Bull. Torrey Bot. Club 83: 300. fig. 1. 1956; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 305. 1972.

An inadequately known succulent, epiphytic herb, with stems to 40 cm. long or more, occurring in dense forest at elevations of 660–900 m.

TYPIFICATION: The holotype is *Smith 8363a* (US 2191070), collected Aug. 18, 1953, in hills east of Somosomo, west of the old crater occupied by a small swamp and lake, Taveuni.

DISTRIBUTION: Known only from the type specimen, apparently a unicate.

Although the single available specimen was obtained in the same area as specimens of *Peperomia attenuata* var. *taveuniana*, *P. falcata* seems readily separable from *P. attenuata* in the different indument of its stems and leaves, its proportionately narrower and falcate leaf blades, and its longer petioles.

22. *Peperomia flavida* C. DC. in J. Linn. Soc. Bot. **39**: 165. 1909.

Although the characters by which *Peperomia flavida* is distinguished from *P. attenuata* (cf. Yuncker's key in Bishop Mus. Bull. **141**: 26-27. 1936, and the key in the present work) are not very strong, I find no difficulty in distinguishing between the two species (and also *P. falcata*), and therefore the species and varieties as recognized by Yuncker are here maintained.

22a. *Peperomia flavida* C. DC. var. *flavida*; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 305. 1972.

Peperomia flavida C. DC. in J. Linn. Soc. Bot. **39**: 165. 1909; Yuncker in Bishop Mus. Bull. **141**: 42. fig. 17. a-f. 1936.

An epiphytic herb, occurring in forest at elevations of approximately 900-1,100 m. Only two collections are known, obtained in August and December, both with flowers and fruits.

TYPIIFICATION: The holotype is *Gibbs 549* (BM), collected in August, 1907, between Nasonggo and Navai, Naitasiri or Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: MBA: Mt. Nanggaranambuluta, east of Nandarivatu, O. & I. *Degener 32001*.

22b. *Peperomia flavida* var. *pubinervis* Yuncker in Bishop Mus. Bull. **141**: 43. fig. 17, g-j. 1936; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 305. 1972.

An epiphytic herb, with stems to 40 cm. or more long, occurring in dense forest at elevations of 600-820 m. The only available collection bears both flowers and fruits.

TYPIIFICATION: The type is *Smith 2000* (BISH HOLOTYPE; many ISOTYPES), collected June 15, 1934, on Mt. Uluingala, Natewa Peninsula, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Known only from the type collection.

23. *Peperomia albertiana* Yuncker in Bishop Mus. Bull. **141**: 43. fig. 18. 1936; J. W. Parham, Pl. Fiji Isl. 218. 1964, ed. 2. 304. 1972. FIGURE 34A & B.

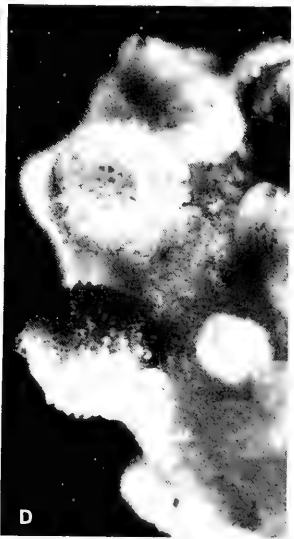
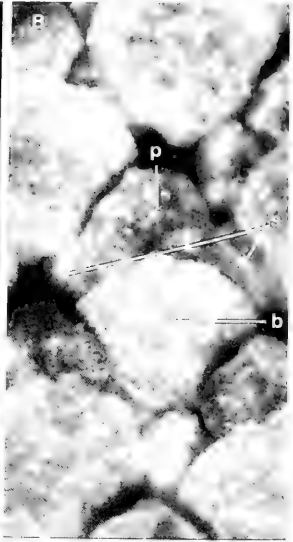
An epiphytic herb with pendent branches to 1 m. long, occurring in dense forest at elevations of 600-700 m. The only available collection was in flower and fruit in April.

TYPIIFICATION: The type is *Smith 1637* (BISH HOLOTYPE; many ISOTYPES), collected April 27, 1934, on the southern slope of Mt. Seatara, Mbua Province, Vanua Levu.

DISTRIBUTION: Known only from the type collection.

The two final species of *Peperomia* in this treatment, both apparently rare and local in distribution, appear to be readily distinguished from other Fijian species by the comparatively highly concurrent principal nerves of the leaf blades.

24. *Peperomia laevilimba* Yuncker in Bishop Mus. Bull. **141**: 44. fig. 19. 1936; J. W. Parham, Pl. Fiji Isl. 219. 1964, ed. 2. 305. 1972. FIGURE 34C & D.



Peperomia sp. Seem. in *Bonplandia* 9: 259, p. p. 1861, Viti, 442, p. p. 1862.

Peperomia pallida sensu Seem. Fl. Vit. 259, p. p. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 276, p. p. 1892; non A. Dietr.

A terrestrial herb on rocks in dense forest, or sometimes epiphytic, with a succulent stem 15–75 cm. long, known with certainty from elevations of 700–850 m. (although the type collection may have come from lower elevations). Flowering and fruiting material has been obtained in May and June.

TYPIFICATION: The type is *Seemann 565*, p. p. (K HOLOTYPE; ISOTYPE at BM; photo of BM specimen at BISH), collected in June, 1860, on Taveuni, without further locality. As noted above under *Peperomia vitiana*, that species was based on part of *Seemann 565*; Yuncker separated the other part as type of the present species.

DISTRIBUTION: Endemic to Fiji and thus far known only from Taveuni.

AVAILABLE COLLECTIONS: TAVEUNI: Above Nggathavulo Estate, DA 16919, 16925, 16926.

ORDER CHLORANTHALES

The family Chloranthaceae has often been considered a member of the order Piperales and is still so regarded by some students. Thorne, Takhtajan, and the present writer (in treatments cited earlier in this *Flora*) have considered the family a member of the order Laurales (or suborder Laurineae in the sense of Thorne). In view of the careful study of the Chloranthaceae by Swamy (1953, cited below under the family), there seems no justification for the inclusion of the family in the Piperales. Swamy's evidence, derived from many facets of the concerned taxa, appears incontrovertible. Highly reduced flowers or greatly compacted biparous sessile cymes of the type found in the Chloranthaceae are not simulated in members of the Piperales or Laurales. Furthermore, the level of structural specialization of the cambium and xylem (vesselless in *Sarcandra*) is more primitive than that of most members of the Piperales or Laurales. The nodal anatomy is basically of the unilacunar type (as in Laurales but not Piperales) or a modification therefrom. The pollen shows an extraordinarily wide range of development from inaperturate to polycolpate. These characters point to a long and independent evolutionary history; the family seems so isolated as to merit being placed in a separate order, a course that I suggested in a review of the genus *Ascarina* (1976, cited below under the genus).

FAMILY 50. CHLORANTHACEAE

CHLORANTHACEAE R. Br. ex Lindl. Collect. Bot. sub t. 17, as *Chlorantheae*. 1821.

Herbs, shrubs, or trees, monoecious or dioecious or with ♂ flowers, usually aromatic; stipules present, usually small; leaves opposite, simple, with petioles sometimes basally connate; inflorescences usually compound-spicate, sometimes congested-paniculate, axillary or terminal, the flowers sometimes closely approximated and partly fused, bisexual or unisexual, subtended by 1 or 3 bracts (and sometimes by bracteoles as well) and lacking a perianth (in *Hedyosmum* ♂ flowers lacking bracts and ♀ flowers enveloped by a perianthlike cupule); stamens 1–3 (rarely 4 or 5), adnate to pistil in genera with bisexual flowers, the anthers usually 2-locular, dehiscing by longitudinal clefts; pollen grains anasulcate, inaperturate to polycolpate,

FIGURE 34. A & B, *Peperomia albertiana*, from *Smith 1637*: A, distal portion of stem, with foliage and inflorescences, × 1; B, portion of flowering spike, showing flower-subtending bract (b), two stamens (s), and pistil (p), × 70. C & D, *Peperomia laevilimba*, from DA 16919; C, portion of stem, showing foliage and inflorescences, × 1; D, tip of fruiting spike, × 40.

boat-shaped to subglobose, tectate or semitectate; pistil 1, the ovary unicarpellate, usually considered inferior (i. e. perianth sometimes represented by an inconspicuous rim overlapped by the stigma lobes), the stigma sessile, unequally 2-lipped or capitate or short and papillose, the ovule solitary, orthotropous, pendulous; fruit a small, ovoid or subglobose drupe, the exocarp succulent, the endocarp hard; seed with copious endosperm and minute embryo.

DISTRIBUTION: Tropics and subtropics, with five genera and 65–75 species.

USEFUL TREATMENT OF FAMILY: Swamy, B. G. L. The morphology and relationships of the Chloranthaceae. *J. Arnold Arb.* **34**: 375–408. 1953.

One genus occurs in Fiji, represented by two species. The nature of the inflorescences and flowers of the genera of Chloranthaceae is still inadequately understood. It had been suggested by various early students (cf. Swamy, 1953, pp. 391–392) that the “flowers” of some genera are actually reduced inflorescences, a viewpoint rejected by Swamy but nevertheless one that requires careful reexamination. The genus *Ascarina* has long been considered dioecious, but monoecism is probably its basic condition, although this is often not apparent.

1. *ASCARINA* J. R. & G. Forst. *Char. Gen. Pl.* **59**. 1775, ed. 2. 117. 1776; *Seem. Fl. Vit.* **258**. 1868; Swamy in *Proc. Nat. Inst. Sci. India* **19**: 375. 1953; A. C. Sm. in *J. Arnold Arb.* **57**: 406. 1976.

Aromatic, glabrous shrubs or trees, dioecious or monoecious; leaves decussate, the petioles connate at base and forming a small sheath, the stipules minute, emerging from the petiolar sheath on each side; leaf blades often subcoriaceous, usually lanceolate to elliptic, cuneate to attenuate at base, obtuse to acuminate at apex, glandular-serrate or -crenulate at margin at least distally; inflorescence terminal and/or axillary, usually a compound spike or panicle with 3 main branches, the median one often again branched; flowers basically borne in greatly compacted biparous sessile cymes (glomerules) borne in the axil of an outer bract, each cyme having an abaxial ♂ flower and 1 or 2 adaxial ♀ flowers subtended by 2 inner bracts (♀ flowers if 2 each subtended by 2 bracteoles), the glomerules often reduced and composed of a single ♂ flower or 1 or 2 ♀ flowers (in plants seemingly dioecious or monoecious with unisexual glomerules); ♂ flowers subtended by 1 persistent bract and sometimes by 3 bracts (the inner 2 often lacking), composed of 1 or 2 stamens, the anthers essentially sessile, cylindrical, often slightly curved, acuminate or obtuse at apex, the locules dehiscing by lateral, longitudinal slits; pollen grains monocolpate; ♀ flowers composed of a single pistil (if solitary in a glomerule then each subtended by 1 persistent outer bract and 2 often caducous inner bracts; if paired in a glomerule then each subtended by 2 bracteoles in addition to the persistent bracts); ovary ovoid to globose, the stigma sessile, unequally 2-lipped, the locule 1, the ovule solitary, pendulous; fruit a drupe, the stigmatic crest persistent, the exocarp succulent but thin, the endocarp stony, smooth or verrucose.

TYPE SPECIES: *Ascarina polystachya* J. R. & G. Forst., the only original species.

DISTRIBUTION: Ten or eleven species extending from the Philippine Islands and Borneo eastward through New Guinea and Melanesia to the Marquesas on the east and New Zealand on the south.

USEFUL TREATMENTS OF GENUS: Swamy, B. G. L. A taxonomic revision of the genus *Ascarina* Forst. *Proc. Nat. Inst. Sci. India* **19**: 371–388. 1953. Smith, A. C. Studies of Pacific Island plants, XXXIII. The genus *Ascarina* (Chloranthaceae) in the southern Pacific. *J. Arnold Arb.* **57**: 405–425. 1976. Moore, L. B. The flowers of *Ascarina lucida* Hook. f. (Chloranthaceae). *New Zealand J. Bot.* **15**: 491–494. 1977.

Most discussions of *Ascarina*, such as that of Swamy (cited above), have treated the genus as dioecious. In 1976 (cited above) I indicated that rarely the ♂ and ♀ inflorescences occur on the same plant and therefore that monoecism is sometimes to be expected in the genus. The more detailed study of *A. lucida* by Moore (1977, cited

above), however, demonstrates that at least that species exhibits a different type of monoecism. The inflorescence bears biparous sessile cymes composed of unisexual flowers, one ♂ and two ♀, or sometimes one ♂ and one ♀; the first type demonstrates protandry and the second type often demonstrates protogyny. Reviewing some of the species of the southern Pacific with this interpretation in mind, I now perceive that the type of monoecism described by Moore occurs in other species, at least in *A. diffusa*. In many specimens of *A. diffusa* reduction of the inflorescence has been carried so far that all traces of this type of monoecism have been lost and each individual plant with rare exceptions bears only ♂ or only ♀ flowers—the situation believed by Swamy to hold throughout the genus. My generic description, above, incorporates Moore's observations, which I now believe to explain the basic pattern for the genus even though the pattern is lost in most of its component species.

KEY TO SPECIES

- Petioles (4-) 5-27 mm. long; leaf blades lanceolate or narrowly elliptic, usually 6-14.5 × 1.5-4.5 cm. and 3-4 times as long as broad, attenuate at base and long-decurrent on petiole, the margins with (2-) 3-8 crenations per centimeter; inflorescence glomerules basically with a single abaxial ♂ flower (composed of a single stamen) and a single adaxial ♀ flower (composed of a single pistil), or more frequently each glomerule unisexual, with either a ♂ flower (composed of a single stamen) or a single ♀ flower (composed of a single pistil). 1. *A. diffusa*
- Petioles (10-) 12-30 mm. long; leaf blades elliptic, usually 5-12 × 2.5-5 cm. and 2-2.5 times as long as broad, acute at base, the margins with 2 (or 3) crenations per centimeter; inflorescence glomerules not known to be bisexual (but possibly these to be expected), as far as known each glomerule unisexual, with either a ♂ flower (composed of a single stamen) or two paired ♀ flowers (each composed of a single pistil). 2. *A. swamyana*

1. *Ascarina diffusa* A. C. Sm. in J. Arnold Arb. 57: 415. fig. 5-10. 1976.

FIGURE 35A & B.

Ascarina lanceolata sensu Guillaumin in J. Arnold Arb. 13: 82, p. p. 1932; Christophersen in Bishop Mus. Bull. 128: 70. 1935; Swamy in Proc. Nat. Inst. Sci. India 19: 377, excl. spec. Ins. Soc. et Marq. fig. 5. 1953; J. W. Parham, Pl. Fiji Isl. ed. 2. 311, quoad var. *lanceolatam*. 1972; non Hook. f.

Ascarina lucida var. *lanceolata* sensu B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 12, 34, 130. 1972; non Allan.

As known in Fiji this rare species is a tree 5-12 m. high, occurring in dense forest at elevations (as far as known) of 350-500 m. (Elsewhere it is reported to attain a height of 25 m. and to occur up to 1,825 m. elevation.) The only available color notes indicate the anthers as rich purple, and the only dated Fijian collection (the type, now seen to bear both flowers and fruits) was obtained in June.

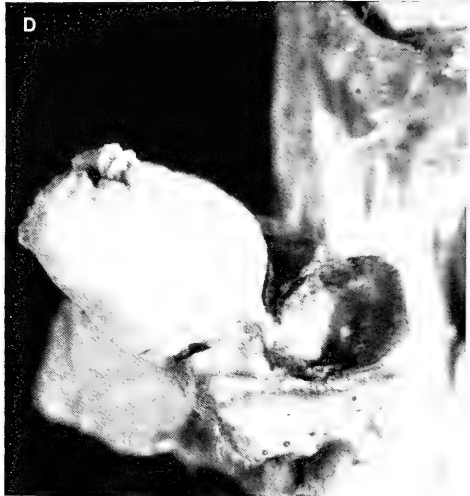
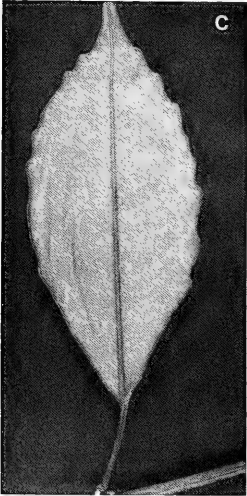
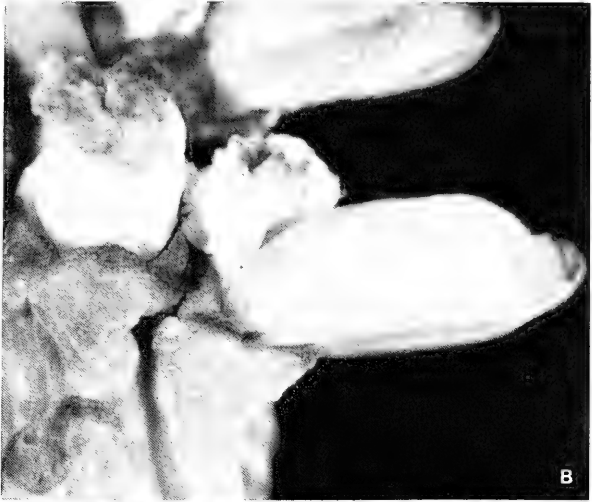
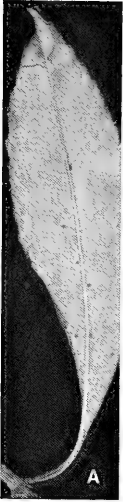
TIPIFICATION: The holotype is *Smith 7887* (US 2190693; many ISOTYPES), collected June 22, 1953, on the northern spur of Mt. Ndelaito, toward Navukailangi, Ngau.

DISTRIBUTION: A species of infrequent occurrence in the Solomon Islands, New Hebrides, Fiji, Samoa, and the Cook Islands. The circumstances surrounding the confusion of this species with *Ascarina lanceolata* Hook. f. (of the Kermadec Islands) and with species of the Societies and Marquesas were discussed in my 1976 treatment.

LOCAL NAME: The name *langolango* has been listed by J. W. Parham, but I have been unable to trace the source of this to any collector's notes. The name usually denotes *Cycas rumphii*.

AVAILABLE COLLECTIONS: VITI LEVU without further locality, *Graeffe s. n.* FIJI without further locality, *U. S. Expl. Exped.*

In 1953 (p. 378) Swamy indicated the occasional occurrence of "pseudo-bisexual flowers" with an undeveloped pistil on normally staminate inflorescences, an observa-



tion repeated by me in 1976 (p. 418, fig. 6). It is now apparent, however, that such "flowers" are actually protandrous glomerules (FIGURE 35B).

2. *Ascarina swamyana* A. C. Sm. in J. Arnold Arb. 57: 418. fig. 11-17. 1976.

FIGURE 35C & D.

Ascarina lanceolata sensu Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862, Fl. Vit. 258, p. p. t. 74, solum quoad fig. 4. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 277. quoad spec. vit. 1892; Guillaumin in J. Arnold Arb. 13: 82, p. p. 1932; J. W. Parham, Pl. Fiji Isl. 223. 1964; non Hook f.

Ascarina lanceolata var. *smithii* Swamy in Proc. Nat. Inst. Sci. India 19: 378. fig. 6. 1953; J. W. Parham, Pl. Fiji Isl. ed. 2. 311. 1972.

This rare species occurs in Fiji as a slender tree 5-10 m. high in dense forest or in dense crest thickets at elevations of 760-1,241 m. Flowers have been obtained in January and fruits in January and August.

TYPIFICATION: The holotype of *Ascarina swamyana* and also of *A. lanceolata* var. *smithii* is *Smith 908* (GH; many ISOTYPES), collected Jan. 3, 1934, on the summit of Mt. Uluinalau, Taveuni.

DISTRIBUTION: An infrequent species known only from the New Hebrides and Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Mt. Voma, *Seemann 564*, *DA 612*.

ORDER LAURALES

The order Laurales, if taken in a restricted sense as composed of about 15 families (cf. Smith, 1972, but excluding Chloranthaceae) is well characterized as including terrestrial magnoliidean families with unilacunar nodes. All the families represented in Fiji lack stipules and have comparatively specialized flowers, with solitary, pendulous, anatropous ovules.

KEY TO FAMILIES OCCURRING IN FIJI

Anthers longitudinally dehiscent; cotyledons never convolute (suborder MONIMIINEAE).

Ovary superior, the style short or essentially none; endosperm copious; anthers dehiscent by simple clefts; inflorescence bracts lacking or inconspicuous; leaves opposite or subopposite.

Flowers hypogynous, the carpel 1 (rarely 2); floral axis bearing bracteoles from near base, these not clearly separable from tepals; receptacle inconspicuous, not clearly separable from pedicel.

51. TRIMENIACEAE

Flowers perigynous, the carpels several to numerous; tepals usually small and few; receptacle concave, often expansive, in fruit enclosing the separate carpels or exposing them. . . . 52. MONIMIACEAE

Ovary inferior, the style grooved; endosperm lacking; anthers dehiscent by laterally opening valves; ultimate partial inflorescences (in our genus) 1-3-flowered and usually subtended by a whorl of 4 bracts; leaves alternate; fruit (in our genus) enclosed in a cupule. 53. HERNANDIACEAE

Anthers dehiscent by valves opening upwardly; endosperm lacking (in our families) (suborder LAURINEAE).

Ovary superior; fruit baccate or drupaceous, not winged; cotyledons thick, fleshy; leaves alternate, rarely opposite or subopposite (true leaves lacking in Family 55).

Trees or shrubs with well-developed green leaves; inflorescences definite (i. e. axis terminating in a flower); tepals usually similar; fruit baccate or drupaceous, the endocarp often thin and smooth; testa of seed thin. 54. LAURACEAE

FIGURE 35. A & B, *Ascarina diffusa*, from *Smith 7887*; A, leaf, $\times 1$; B, two inflorescence glomerules, the one on the right bearing a σ flower composed of a single stamen and an adaxial developing f flower composed of a single pistil, the one on the left bearing a f flower composed of a single maturing pistil, $\times 30$. C & D, *Ascarina swamyana*, from *Smith 908*; C, leaf, $\times 1$; D, an infructescence glomerule composed of two maturing f flowers in the axil of an outer bract, the one on the left bearing a single young fruit, the one on the right with the fruit fallen to disclose an inner bract and two bracteoles, $\times 30$.

- Filiform twining plants, without true leaves; inflorescences indefinite (i. e. axis not terminating in a flower); tepals dissimilar, the 3 outer ones the smaller and bractlike; fruit drupaceous, with a hard endocarp; testa of seed tough, membranous or coriaceous. 55. CASSYTHACEAE
- Ovary inferior; fruit drupaceous, in our genus with 2 conspicuous terminal wings; cotyledons broad, contortuplicate; leaves alternate. 56. GYROCARPACEAE

FAMILY 51. TRIMENIACEAE

TRIMENIACEAE Gibbs, Fl. Arfak Mts. 135. 1917.

Trees or shrubs, lacking stipules, the leaves decussate or subopposite, aromatic, the blades pinnate-nerved, entire or serrate; inflorescences axillary or terminal, racemiform or paniculiform, the flowers often in dichasial cymes, transitional from bisexual to unisexual, the floral axis not differentiated into pedicel and receptacle, bearing bracteoles from near base of pedicel, these closely imbricate and gradually increasing in size into tepals of similar texture, the bracteoles and tepals deciduous prior to anthesis; stamens many, the filaments short or long, the anthers of ♂ flowers large, linear-oblong, dehiscent by longitudinal clefts, the ♂ flowers with or without a rudimentary carpel; pollen grains subglobose, tectate, forate in *Trimenia*; ♀ and ♂ flowers with a single carpel (or rarely with 2 carpels) and with fertile or sterile stamens; fertile carpel composed of an oblong or ellipsoid ovary and a sessile, papillose or penicillate stigma, the ovule solitary, pendulous, anatropous; fruit baccate, of magnified carpellary form.

DISTRIBUTION: Eastern Malesia and eastern Australia into the Pacific to the Marquesas Islands, with two genera and probably about nine species. *Trimenia*, which is not known from Australia, has a more extended range than the second genus, *Piptocalyx*.

USEFUL TREATMENT OF FAMILY: Money, L. L., I. W. Bailey, & B. G. L. Swamy. The morphology and relationships of the Monimiaceae. *J. Arnold Arb.* 31: 372-404. 1950. (This important paper includes discussions of families related to the Monimiaceae, including the Trimeniaceae.)

1. TRIMENIA Seem. Fl. Vit. 425. 1873; Perkins & Gilg in *Pflanzenr.* 4(IV. 101): 21. 1901; Rodenburg in *Blumea* 19: 6. 1971; A. C. Sm. in *Allertonia* 1: 351. 1978.

Monococious or dioecious trees or shrubs, glabrous or with a tomentose indument, the leaf blades usually serrate or crenulate; inflorescence usually a pyramidal, compound raceme with 1-5 pairs of lateral branches, each terminating in a flower; bracteoles and tepals (graduating in size so that no line can be drawn between them) 8-38, the lower ones decussate, the upper ones spirally arranged; stamens 9-23, usually 2- or 3-seriate, less developed (often sterile) in ♀ flowers, the filaments short, linear, the anthers basifixed, laterally or extrorsely dehiscent, the connective projecting at apex; carpels rudimentary or absent in ♂ flowers, well developed in ♀ flowers, sessile, the stigma calyptriform, coarsely papillose; fruit with the seed ovoid or obliquely ovoid, the testa hard and thick, the endosperm abundant, gelatinous, the embryo erect.

TYPE SPECIES: *Trimenia weinmanniifolia* Seem., the only original species.

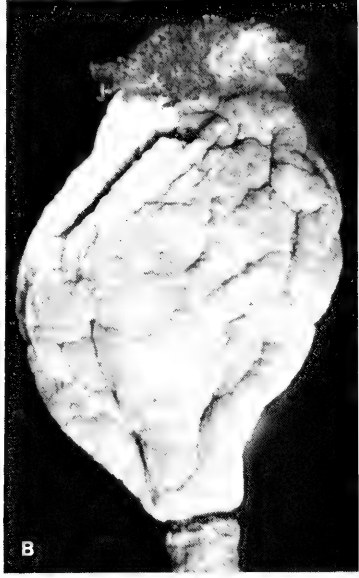
DISTRIBUTION: Celebes and the Moluccas eastward to Samoa and the Marquesas, probably with about seven species.

USEFUL TREATMENT OF GENUS: Rodenburg, W. F. A revision of the genus *Trimenia* (Trimeniaceae). *Blumea* 19: 3-15. 1971.

FIGURE 36. *Trimenia weinmanniifolia*; A, branchlet of a fruiting plant, × 1/3; B, maturing carpel, × 15; C, ♂ flower, × 15; D, floral axis with stamens, the bracteoles and tepals removed, × 20; A & B from *DA 15889*, C from *DA 3881*; D from *Smith 5639*.



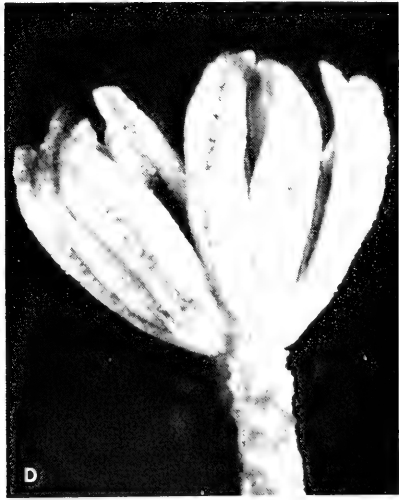
A



B



C



D

1. *Trimenia weinmanniifolia* Seem. Fl. Vit. 425, as *T. weinmanniaefolia*. t. 99. 1873; Perkins & Gilg in Pflanz. 4 (IV. 101): 22. 1901; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 83. 1972; A. C. Sm. in Allertonia 1: 352. fig. 6, A, B. 1978.

FIGURES 36, 79.

Weinmannia sp. Seem. in Bonplandia 9: 256. 1861, Viti, 437. 1862.

Trimenia weinmanniaefolia Seem. ex Drake, Ill. Fl. Ins. Mar. Pac. 117. 1890; Christophersen in Bishop Mus. Bull. 128: 88. 1935.

Trimenia vitiensis Ridley in Trans. Linn. Soc. Bot. 9: 144, sphalm. 1916.

Trimenia weinmanniifolia subsp. *weinmanniifolia*; Rodenburg in Blumea 19: 11. 1971.

A sometimes spreading tree 3–10 m. high, occurring at elevations of 640–1,030 m. in dense forest, crest thickets, or in the forest-grassland transition. The bracteoles and tepals are brown, often tinged with deep red, the stamens are white, and the fruit is at first pink, becoming red to rich purple. Flowering material has been obtained between March and August and fruiting material between June and January.

TIPIFICATION: The type is *Seemann 198* (K HOLOTYPE; ISOTYPE at BM), collected in 1860 on Kandavu. This is the only collection known from the island of Kandavu and possibly it is mislabelled, as the species is frequent on Taveuni, where Seemann made many collections.

DISTRIBUTION: Fiji (Viti Levu, Vanua Levu, Taveuni, and presumably Kandavu) and Samoa (Savaii only, at elevations of 900–1,700 m.).

LOCAL NAMES: On two of my collections names are recorded, *langolango* (Thakaundrove) and *vovo* (Nandronga & Navosa); both names seem questionable, the former usually referring to *Cycas*, as noted above under *Ascarina diffusa* (Chloranthaceae).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes of Mt. Tomanivi, *Gillespie 4382*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5639*. NAMOSI: Mt. Vakarongasiu, *DA 16134, 17601*. NAITASIRI: Nggoronggorotambuatani, Nasonggo, *DA 15319*. VANUA LEVU: THAKAUNDRÖVE: Crest of Mt. Mbatini Range, *Smith 664*; eastern buttress of Mt. Ndikeya, *Smith 1888*. TAVEUNI: Hills east of Somosomo, west of old crater occupied by small swamp and lake, *Gillespie 4843, Smith 8355*; Rairai Ndreketi, above Somosomo, *DA 12413, 15889*. FIJI without further locality, *DA 3881*.

Trimenia weinmanniifolia bears only unisexual flowers; according to Rodenburg it is monoecious, but in my observation the plants are usually if not always dioecious. It seems to merit specific separation from its closest ally, *T. bougainvilleensis* (Rodenburg) A. C. Sm., in being entirely glabrous even when young, in having more numerous tepals and bracteoles, and in having its seed obliquely ovoid, with an irregular pattern of ridges; the more western relative has a certain amount of indument and an ovoid seed with 5–7 radiating ridges, among other minor differences.

FAMILY 52. MONIMIACEAE

MONIMIACEAE Juss. in Ann. Mus. Hist. Nat. (Paris) 14: 133, as *Monimieae*. 1809.

Dioecious or monoecious trees or shrubs, usually aromatic, without stipules; leaves opposite, the blades entire or serrate; inflorescence axillary or rarely terminal, cymose or racemose or panicle or rarely with solitary flowers, bracteate or not; flowers unisexual, the receptacle concave, often expansive, cupuliform to urceolate; tepals variable in size and form but usually small and few, with varying degrees of basal concrescence and adnation, not separable into sepals and petals; stamens usually numerous, usually without associated staminodes, the filaments short, the anthers 2-locular, dehiscent by longitudinal clefts; pollen grains usually inaperturate and subglobose, tectate, in permanent tetrads only in *Hedyccarya*; carpels numerous to several, free, sessile, with a single, pendulous, anatropous ovule with the micropyle oriented upward, the style short or essentially none, the stigma terminal; fruit com-

posed of separate carpels enclosed by the accrescent receptacle or exposed by the flattened or recurved receptacle, the mature carpels indehiscent, often drupaceous, the exocarp often carnos, the endocarp often crustaceous, the seed pendulous, with copious endosperm and small embryo.

DISTRIBUTION: In the limited sense of the above description, the Monimiaceae are tropical-tricentric, with about 24 genera and 330 species. Their major center of diversity seems to be the Malesian-Australasian area, southward to New Zealand and eastward into Polynesia. The only genus occurring in Fiji is *Hedycarya*.

USEFUL TREATMENTS OF FAMILY: Perkins, J., & E. Gilg. Monimiaceae. Pflanz. 4 (IV. 101): 1-122. 1901. Money, L. L., I. W. Bailey, & B. G. L. Swamy. The morphology and relationships of the Monimiaceae. J. Arnold Arb. 31: 372-404. 1950.

The families of the monimiaceous alliance were informatively discussed in the 1950 study of Money et al., who proposed division of the Monimiaceae proper into four subfamilies. These are now often recognized as discrete families, the distribution of which was considered by me in 1973 (in Meggers, B. J., et al. Tropical Forest Ecosystems in Africa and South America: a Comparative Review, 55-57).

1. *HEDYCARYA* J. R. & G. Forst. Char. Gen. Pl. 64. 1775, ed. 2. 127. 1776; Seem. Fl. Vit. 206. 1867; Perkins & Gilg in Pflanz. 4 (IV. 101): 18. 1901; Perkins in Pflanz. 49: (IV. 101): 3. 1911.

Dioecious trees or shrubs; inflorescence axillary, cymose or paniculiform, with or without small bracts; ♂ flowers with few to many tepals, these small and inflexed, the receptacle becoming essentially flattened at anthesis and nearly covered by numerous stamens, the anthers subsessile, often cucullate distally, with separate locules dehiscing laterally; ♀ flowers with caducous tepals, the carpels numerous, the stigma often large and subcapitate, the receptacle flattened or recurved in fruit; mature carpels drupaceous.

TYPE SPECIES: *Hedycarya arborea* J. R. & G. Forst., the only original species.

DISTRIBUTION: About 25 species from eastern Australia, New Zealand, and eastern Malesia into Polynesia.

1. *Hedycarya dorstenioides* A. Gray in J. Bot. 4: 83, as *Hedycaria d.* 1866; Seem. Fl. Vit. 206. 1867; A. DC. in DC. Prodr. 16 (2): 673. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 278, as *Hedycaria d.* 1892; Perkins & Gilg in Pflanz. 4 (IV. 101): 19. fig. 3, J-N. 1901; Gibbs in J. Linn. Soc. Bot. 39: 167. 1909; Perkins in Pflanz. 49 (IV. 101): 6. 1911; Yuncker in Bishop Mus. Bull. 220: 117. 1959; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 82. fig. 25. 1972; A. C. Sm. in Allertonia 1: 354. 1978.

FIGURES 37, 38.

Hedycarya sinuato-dentata Perkins in Pflanz. 49 (IV. 101): 7. 1911; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 82. 1972.

Hedycarya crassifolia Gillespie in Bishop Mus. Bull. 91: 6. fig. 4. 1932; J. W. Parham, Pl. Fiji Isl. 51. 1964, ed. 2. 81. 1972.

As it occurs in Fiji, *Hedycarya dorstenioides* is found at all elevations from near sea level to 1,323 m. in various types of forest, in dense crest thickets, and in the forest-grassland transition. It is a tree or slender shrub 2-15 m. high, occasionally to 20 m. high, and frequently gnarled at higher elevations. Flowering receptacles and the anthers are yellow; the carpels in fruit are green to yellow-green, at length becoming dark red to purple or black. Flowers and fruits are found throughout the year.



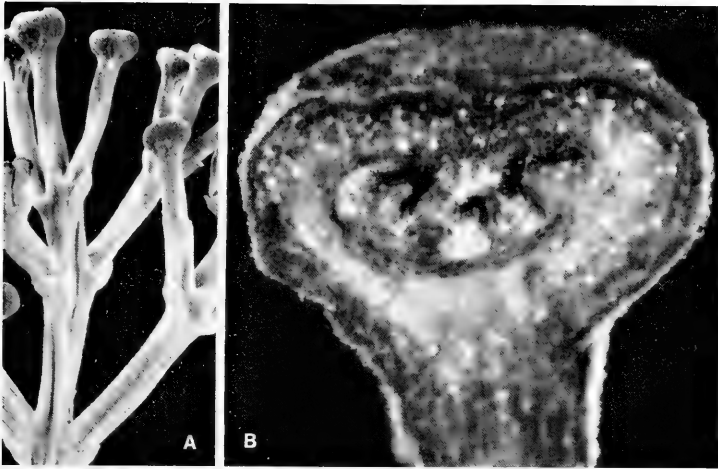


FIGURE 38. *Hedycarya dorstenioides*, from Smith 7028; A, portion of young ♀ inflorescence, $\times 6$; B, section through young ♀ flower, $\times 50$.

TIPIFICATION AND NOMENCLATURE: The lectotype is *U. S. Expl. Exped.* (US 40451), collected in 1840 at Mbua Bay (Sandalwood Bay), Mbua Province, Vanua Levu; this specimen bears the locality cited by Gray and some original drawings. Other *U. S. Expl. Exped.* specimens (GH, K, US 61653, and probably elsewhere) may not strictly be isoelectotypes. The holotype of *Hedycarya sinuato-dentata* is Milne 225 (κ), collected on Ngau and dated October, 1855. *Hedycarya crassifolia* is typified by Gillespie 4124 (BISH HOLOTYPE), collected Nov. 29, 1927, on the summit of Mt. Tomanivi, Mba Province, Viti Levu. The lectotypification of this species, its leaf variability, and the above-cited synonyms were discussed in my 1978 note.

DISTRIBUTION: Fiji and Tonga; in Fiji it is known from several high islands and is to be expected on most of them. I have examined 168 Fijian collections in addition to the type material cited above.

LOCAL NAMES AND USE: Collectors have indicated a host of local names in connection with this species; they are here listed by province or island. Mba: *makoro*, *mbarakoto*, *thengethenge*, *vuaisoso*. waininggilyango, *waruwaru*; Nandronga & Navosa: *kauloa*, *nwasa*, *vombo*, *warowaro*; Namosi: *tava*; Naitasiri: *mavinda*, *mbulei*;

FIGURE 37. *Hedycarya dorstenioides*; A, variations in leaf blade size and margin, $\times 1$, from left to right: "sinuato-dentata" type, typical, "crassifolia" type with denticulate margins, small-leaved type; B, mature ♂ flowers, $\times 6$; C, stamen, $\times 50$; D, mature carpels, $\times 4$; A left to right from Bryan 321, Smith 8595, Gillespie 3299, Smith 4128; B & C from Smith 4793; D from Smith 6054.

Tailevu: *nondra moto na yalewa*; Ovalau: *kau vusou*; Mbua: *ndasia*; Mathuata: *kavuru*; Thakaundrove: *vatambua*; Moala: *thula ni vasua*. Obviously there is no consensus of opinion and I would not vouch for any of these names, some of which also apply to different plants. The *Hedycarya*, in Fijian opinion, seems good for nothing except firewood.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 915*; Naloto Range, *DA 14769*; Mt. Evans Range, *Smith 4128*; vicinity of Nandarivatu, *Gibbs 583*, *Smith 6054*; Mt. Nanggaranambuluta, *Smith 4793*; Mt. Tomanivi, *DA 12742 (Melville et al. 7134)*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13319*; northern portion of Rairaimatuku Plateau, *Smith 5459*. NAMOSI: Summit of Mt. Naitarandamu, *Gillespie 3299*; hills bordering Wainavindrau Creek, *Smith 8595*; Mt. Voma, *Gillespie 2756*; Mt. Vakarongasiu, *DA 16124*. SERUA: Inland from Namboutini, *DA 13767 (DF 464)*; inland from Ngaloa, *DF 876*. RA: Vicinity of Rewasa, *Degener 15378*. NAITASIRI: Rarandawai, *St. John 18269*; Viria, *Meebold 16679*; vicinity of Nasinu, *Gillespie 3520*. TAILLEVU: Vicinity of Ndakuivuna, *Smith 7028*; Nukurua Creek, *DA 1012*. REWA: Mt. Korombamba, *Gillespie 2386*. KANDAVU: Mt. Mbuke Levu, *DA 14933*. OVALAU: Hills east of Lovoni Valley, *Smith 7266*. KORO: Ndelaikoro, *DA 15830*. NGAU: Hills east of Herald Bay, *Smith 7737*. VANUA LEVU: MBUA: Koromba Forest, *DA 15124*. MATHUATA: Near Mbasakalave, Ndreketi District, *Stauffer & Kuruvoli 5850*; Mt. Numbuloa, *Smith 6457*. THAKAUNDRIVE: Mt. Mbatini, *Smith 607*; Navonu Creek, Natewa Peninsula, *DA 15056*. TAVEUNI: Nggeleni, *DA 15869*; ridge inland from Somosomo, *Gillespie 4839*; Mt. Manuka, *Smith 8232*. MOALA: *Bryan 321*; near Naroi, *Smith 1321*.

Hedycarya dorstenioides is one of the most abundant small trees in Fiji, seeming ubiquitous in wooded areas from near sea level to the highest elevations. Its flowers and fruits appear quite uniform, but its leaves offer a puzzling series of variations in size, texture (chartaceous to coriaceous), and margin (entire to irregularly denticulate) that seem unrelated to altitude or environment. Apparently no isolating mechanisms have been established within the taxon, further subdivision of which seems inadvisable.

FAMILY 53. HERNANDIACEAE

HERNANDIACEAE Bl. Bijdr. Fl. Ned. Ind. 550, as *Hernandieae*. 1826.

Trees and shrubs, or lianas, monoecious (rarely dioecious) or with ♂ flowers; leaves alternate, without stipules, the blades entire or 3- or 5-lobed or digitately compound, glabrous or rarely sparsely pubescent on veins beneath; inflorescences axillary or terminal, panicle or cymose or corymbose, bracteate, the partial inflorescences many-flowered or 3 (rarely 2- or 1-) flowered; flowers ♂ or unisexual, epigynous, 3-6-merous; perianth segments (tepals) in 2 verticils; interstaminal glands sometimes present; stamens equal in number to outer tepals and opposite them, the filaments with glands basifixed in pairs or single or rarely fused, the anthers bilocular, dehiscing longitudinally by laterally opening valves; pollen grains inaperturate, subglobose, tectate, echinate; ovary inferior, unilocular, with a single, pendulous, anatropous ovule, the style grooved on placental side, the stigma subpeltate, decurrent into the stylar groove; fruit drupaceous, fusiform to globose, indehiscent, unwinged and then enclosed in a cupule formed by the accrescent upper part of the ♀ pedicel or by large bracteoles, or with 2-4 lateral wings in perpendicular plane, one pair larger than the other 1 or 2 wings, the endosperm none, the cotyledons fleshy, smooth or ruminate.

DISTRIBUTION: A family of two or four genera and about 42-50 species. One genus (*Hernandia*) is tricentric-tropical. A second genus (*Illigera*) occurs in the African-Asian-Malesian sector, and two smaller genera (referred to *Hernandia* by Kubitzki) are limited to Madagascar and eastern Australia respectively. Only *Hernandia* is found in Fiji.

USEFUL TREATMENTS OF FAMILY: Shutts, C. F. Wood anatomy of Hernandiaceae and Gyrocarpaceae. *Trop. Woods* 113: 85-123. 1960. Kubitzki, K. Monographie der Hernandiaceen. *Bot. Jahrb.* 89: 78-209. 1969.

Many recent students have considered the lauralean families Hernandiaceae and Gyrocarpaceae to be independent, the first related to suborder Monimiineae and the second to suborder Laurineae, a position supported by Shutts (1960, cited above) and here adopted but refuted by Kubitzki (1969, cited above). Kubitzki, recognizing the two groups as subfamilies of Hernandiaceae, points to overlapping characters, but these are mostly suggested by two somewhat aberrant genera that may be too hastily incorporated into *Hernandia*. Characters suggesting the antiquity and separate origin of the two families are found in xylem anatomy, the presence or absence of cystoliths, tepal arrangement, the mode of anther dehiscence, styler and stigmatic features, and cotyledon structure.

1. *HERNANDIA* L. Sp. Pl. 981. 1753; Seem. Fl. Vit. 204. 1867; Shutts in Trop. Woods 113: 91. 1960; Hutchinson, Gen. Fl. Pl. 1: 145. 1964; Kubitzki in Bot. Jahrb. 89: 122. 1969.

Biasoletia Presl, Rel. Haenk. 2: 141. 1835.

Monoecious or rarely polygamous trees (rarely shrubs); leaf blades simple or very rarely 3- or 5-lobed, essentially palmately veined or subtriplinerved (costa sometimes with obvious secondary nerves distally), sometimes peltate; inflorescences usually aggregated toward apices of branchlets, the peduncle mostly elongate, the ultimate partial inflorescences comprised of modified cincinni, these usually subtended by a whorl of 4 bracts and composed of 2 (rarely 1) ♂ flowers and 1 ♀ (rarely ♂) flower, the flowers pedicellate; outer tepals with quincuncial aestivation or imbricate, the inner ones subimbricate to valvate; ♂ flowers usually 3-5-merous, lacking an ovary or rarely with a styler vestige, the stamens usually 3-5, the filaments with 2 basal glands or these sometimes fused; ♀ flowers 4-6-merous, without staminodes, the ovary slightly compressed laterally, the style sigmoid or straight, often thickened proximally, surrounded by 4 or 5 (sometimes 10-12) free or connate glands, the stigma often lobed; drupe ovoid to ellipsoid, often inconspicuously longitudinally costate, at maturity enclosed by a usually carnosous cupule formed by the accrescent upper part of pedicel (cupule rarely replaced by essentially free bracteoles), the cotyledons free or fused, ruminate.

TYPE SPECIES: *Hernandia sonora* L., the only original species.

DISTRIBUTION: Pantropical, with 24 species (as recognized by Kubitzki), of which three occur in Fiji.

The organ (FIGURE 80, upper left) that surrounds the mature fruit of many species of *Hernandia* is buoyant in seawater for a time. It has been variously described as an involucre, envelope, receptacle, or cupule. Probably "cupule" is the most suitable appellation, the organ being formed by the inflated upper part of the ♀ pedicel. In a few species outside our range the "cupule" seems to be 2-valved and composed of true bracteoles, but I would suggest that these species be reexamined as to their generic placement.

KEY TO SPECIES

- Leaf blades peltate, attached to petiole 1-3 cm. within margin (perhaps rarely subcordate), broadly deltoid-ovate, (7-) 13-25 (-30) × (6-) 11-22 cm., with 7-9 nerves spreading from point of petiole attachment; petiole 5-17 cm. long; ♂ flowers 3-merous; ♀ flowers 4-merous; cupule of fruit up to 4 cm. in diameter, 15-20 mm. in apical diameter, not produced distally beyond apex of drupe; occurring on or near beaches, not much above sea level. 1. *H. nymphaeifolia*
- Leaf blades not peltate; ♂ flowers 4- or 5-merous; ♀ flowers 5-merous; cupule of fruit rarely exceeding 3 cm. in diameter; inland species, sometimes occurring near sea level but not associated with beach vegetation.
- Cupule of fruit somewhat urceolate, irregularly undulate at apex, 15-20 mm. in apical diameter, produced distally 5-20 mm. beyond apex of drupe; leaf blades usually elliptic, (6-) 8-22 × 4-14 cm.,

with 1 or 2 pairs of secondary nerves arising from or near base, the inner of these ascending and evident for at least half the length of blade; petiole 2.5-8 cm. long.

2. *H. moerenhoutiana* subsp. *campanulata*

Cupule of fruit ellipsoid-subglobose, truncate or slightly reflexed at apex, 8-15 mm. in apical diameter, not or very slightly produced beyond apex of drupe; leaf blades elliptic to oblong, 3.5-15 (-20) x 2-7.5 cm., the basal secondary nerves comparatively inconspicuous, only rarely evident for more than one-third the length of blade, the costa with obvious pinnately arranged secondary nerves; petiole 2-5 cm. long. 3. *H. olivacea*

1. *Hernandia nymphaeifolia* (Presl) Kubitzki in Bot. Jahrb. 90: 272. 1970.

FIGURES 39, 80 (upper left).

Hernandia sonora sensu Forst. f. Fl. Ins. Austr. Prodr. 65. 1786; Benth. in London J. Bot. 2: 1843; Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862; non L.

Hernandia ovigera sensu Gaertn. Fruct. Sem. Pl. I: 193. t. 40, fig. 3. 1788; Christophersen in Bishop Mus. Bull. 128: 93. 1935; Yuncker in op. cit. 178: 56. 1943, in op. cit. 184: 40. 1945; A. C. Sm. in Smithsonian Rep. 1954: opp. 310. pl. 3, fig. 1. 1955; Yuncker in Bishop Mus. Bull. 220: 121. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 102. 1970; non L.

Biasolettia nymphaeifolia Presl, Rel. Haenk. 2: 142. 1835.

Hernandia peltata Meissn. in DC. Prodr. 15 (1): 263. 1864; Seem. Fl. Vit. 204. t. 52. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 279. 1892; Guillaumin in J. Arnold Arb. 13: 86. 1932; J. W. Parham in Agr. J. Dept. Agr. Fiji 29: 32. 1959, Pl. Fiji Isl. 58, fig. 27. 1964, ed. 2. 90, fig. 28. 1972; Kubitzki in Bot. Jahrb. 89: 153. 1969; St. John & A. C. Sm. in Pacific Sci. 25: 323. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 103. 1972.

Hernandia vitiensis Seem. ex Pax in Engl. & Prantl, Nat. Pflanzenfam. III. 2: 129. fig. 79A. 1889.

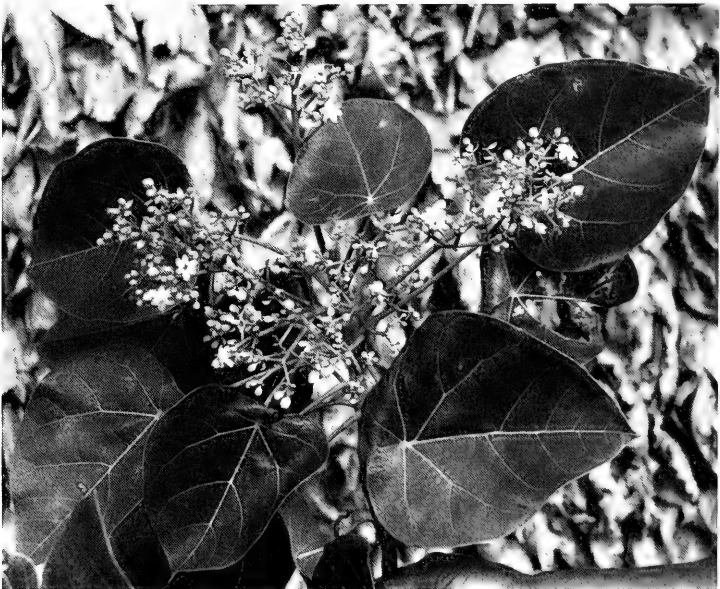


FIGURE 39. *Hernandia nymphaeifolia*, from Smith 9340; flowering branchlet, x 1/5.

As it occurs in Fiji, *Hernandia nymphaeifolia* is a spreading tree 5–20 m. high, with a massive trunk to 2 m. in diameter, occurring at or near sea level on beaches or in thickets and woods immediately behind beaches. The bracts subtending the modified cincinni of fragrant flowers are pale green; the tepals are white to greenish white; the filaments are white, bearing orange or bright yellow anthers; and the drupes are brown, surrounded by a succulent cupule that is white to reddish. Flowers and fruits seem not to be seasonal.

TYPIFICATION AND NOMENCLATURE: This taxon has often been erroneously referred to *Hernandia sonora*, a West Indian species, or *H. ovigera*, which according to Kubitzki does not occur east of the Solomon and Mariana Islands. The holotype of *Biasolettia nymphaeifolia* is a Haenke specimen (PR) collected on Guam. As lectotype of *H. peltata* Kubitzki has indicated *Thwaites CP 2914* (G-DC; several isolectotypes), collected in Ceylon. *Hernandia vitiensis* is a binomial perhaps used inadvertently by Pax; it is probably based on a duplicate specimen of *Seemann 372* (Seemann's only collection of this taxon, although the binomial used by Pax is not found on the k sheet).

DISTRIBUTION: Eastern Africa and Madagascar to southeastern Asia and Malesia, northward to the Ryukyu and Bonin Islands, and eastward through Micronesia, Melanesia, and Polynesia to Pitcairn Island. It is a frequent component of the beach vegetation of Fiji, from which about 40 collections are available.

LOCAL NAMES AND USE: The usual names are *evuevu* or *yevuyevu*; other reported names are *mbuembu* (Yasawas) and *uviuvi* (noted only by Seemann and perhaps inaccurate). Weiner reports that on Taveuni the scraped and pounded bark is taken internally after childbirth.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Yalombi, *St. John 18090*. VITI LEVU: MBA: Lautoka, *Greenwood 338*. NANDRONGA & NAVOSA: Mbaravi, east of Tumbukula Creek, *Webster & Hildreth 14392*. SERUA: Vicinity of Ngaloa, *Smith 9340*; Loloma Beach, Ndeumba, *DA 18849*. RA: Viti Levu Bay, *DA 12778* (*Melville et al. 7170*). TAILEVU: Matavatathou, *DA 7748*. REWA: Suva, *Meebold 16506*; Nukulau Island, *Barclay, Hinds*. MBENGGGA: Rukua Beach, *DA 6054*. OVALAU: Vicinity of Thawathi, *Smith 8100*. KORO: East coast, *Smith 1103*. NGAU: *Tothill 681*. VANUA LEVU: THAKAUNDOVE: Maravu, near Salt Lake, *Degener & Ordonez 14187*; vicinity of Ndakunimba, Natewa Peninsula, *Howard 113*. TAVEUNI: *Seemann 372*; Navakawau, *Weiner 7-71-24*. MOALA: *Bryan 348*. VANUA MBALAVU: Lomaloma, *DA 10229*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 770*. KAMBARA: On limestone, *Smith 1262*.

2. *Hernandia moerenhoutiana* Guillemain subsp. *campanulata* Kubitzki in Bot. Jahrb.

89: 128. fig. 24. 1969; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 100. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 90. 1972. FIGURE 40.

Hernandia moerenhoutiana sensu Seem. Fl. Vit. 204, p. p. 1867; Hook. in Bot. Mag. 96: t. 5839. 1870; Yuncker in Bishop Mus. Bull. 220: 120. 1959; J. W. Parham, Pl. Fiji Isl. 58. 1964; non Guillemain, sensu str.

As represented by subsp. *campanulata* in Fiji, *Hernandia moerenhoutiana* is a tree 4–10 m. high found infrequently at elevations from near sea level to 300 m. in light forest or on its edges. The bracts subtending the partial inflorescences are cream-white to yellowish, and the only available fruit is green. Flowering material has been collected between January and April and fruits only in April.

TYPIFICATION AND NOMENCLATURE: The type of *Hernandia moerenhoutiana* is *Bertero & Moerenhout* (P HOLOTYPE; ISOTYPE at G), from Tahiti; subsp. *campanulata* is typified by *Smith 1462* (NY HOLOTYPE; many ISOTYPES), collected March 29, 1933, in the southern limestone section of Vanua Mbalavu.

DISTRIBUTION: The species as a whole is found from the Solomon Islands to the Societies. Kubitzki has divided it into three subspecies, of which subsp. *campanulata*

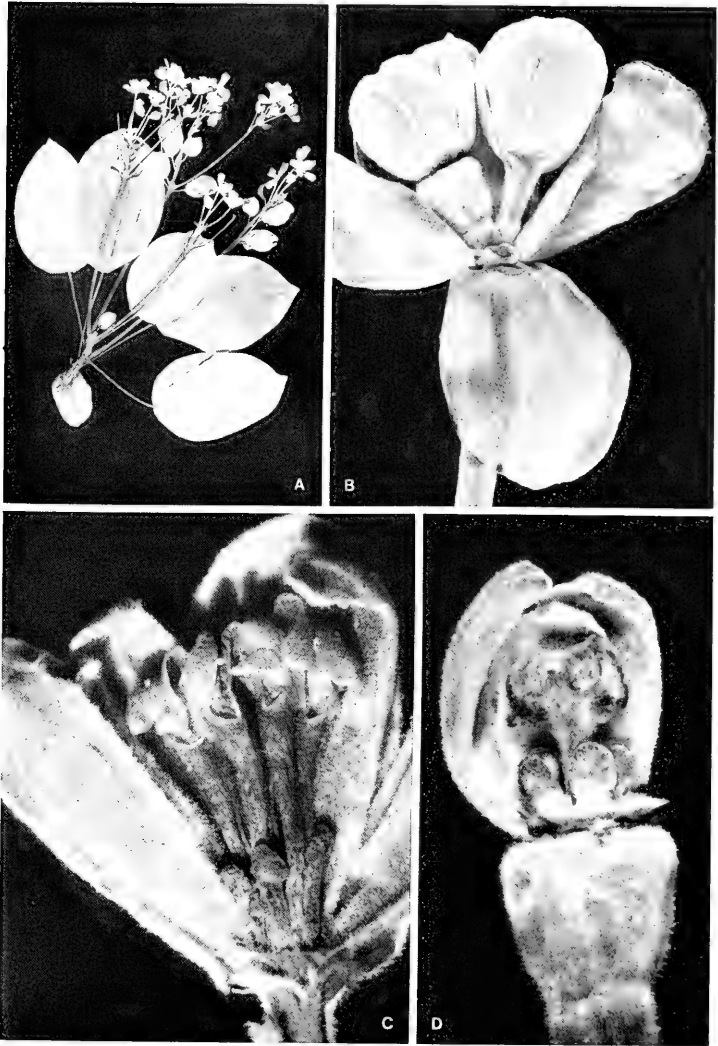


FIGURE 40. *Hernandia moerenhoutiana* subsp. *campanulata*, from Smith 1462; A, distal portion of branchlet, with foliage and inflorescences, \times about $1/4$; B, vertical of four bracts subtending two flowers (σ left, σ right) and the scar of a fallen σ flower, $\times 3$; C, σ flower with four tepals removed, $\times 8$; D, σ flower with all tepals except three removed, showing style, stigma, and free glands, $\times 8$.

occurs in Fiji, Samoa, Tonga, and Niue. The typical subspecies is found only in the Cook and Society Islands, and subsp. *samoensis* (Hochr.) Kubitzki from the Solomon Islands to Samoa (but absent from Fiji, Tonga, and Niue).

LOCAL NAME AND USE: The only such information comes from the type collection, known as *pipi*; the partial inflorescences were used in ceremonial necklaces on Vanua Mbalavu.

AVAILABLE COLLECTIONS: OVALAU: Steep mountain slopes near Levuka, *Gillespie 4440*. KORO: Eastern slope of main ridge, *Smith 1003*. VANUA LEVU: THAKAUNDRIVE: Vunimoli, Vaturamulo, *DA 15399*.

Kubitzki also referred to this taxon *Smith 1752*, from Vanua Levu, which to me appears to represent *Hernandia olivacea*. He implies that there may be a degree of hybridization between the two taxa, but the characters utilized in my key seem dependable, especially if fruits are available. In general, *H. moerenhoutiana* subsp. *campanulata* is found in a lighter type of forest and at lower elevations than *H. olivacea*.

3. *Hernandia olivacea* Gillespie in Bishop Mus. Bull. **91**: 9. fig. 9. 1932; J. W. Parham, Pl. Fiji Isl. **58**. 1964, ed. 2. 90. 1972; Kubitzki in Bot. Jahrb. **89**: 133. 1969.

FIGURE 80 (upper right).

A tree 4–35 m. high, with a trunk to 80 cm. in diameter, occurring from near sea level to 1,130 m. elevation, usually in dense forest or in forest on ridges. The bracts subtending the modified cincinni are dull cream-colored to yellowish brown; the tepals and stamens are white; and the drupe is black at maturity, enclosed by a red cupule. Flowers have been obtained in most months and fruits between May and November.

TIPIFICATION: The holotype is *Gillespie 3785* (BISH), collected Nov. 16, 1927, on the summit of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several high islands; I have examined 37 collections.

LOCAL NAMES AND USE: A species well known to Fijian and other foresters, *Hernandia olivacea* is most frequently known as *makaloo*, *makoloo*, *nduvula*, *nduvule*, and *vavaloo*. Other recorded names are *wairiki* (Mba), *siti ni veikau* (Ovalau), *vuvula* (Mbua), and *evu* (Mbua). It is considered a useful timber tree, especially as a case timber.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu and southward to Navai, *DA 339*, *Gillespie 4139*, *Vaughan 3411*; summit of Mt. Nanggaranambuluta, *Smith 5678*; Mt. Tomanivi, *DA 14667*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 318* (*Bola 122*); northern portion of Rairaimatuku Plateau, *Smith 5576*. SERUA: Nambukelevu, *DA 15655*; inland from Ngaloa, *DA 15678*. NAMOSI: Summit of Mt. Vakarongasiu, *Gillespie 3288*. NAITASIRE: Waimanu River, *DA 15643*; Tholo-i-suva, *DA 14604*. NAITASIRE or REWA: "Vicinity of Suva," *Horne 738a*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7056*. KANDAVU: Kiombo, *DA 11930* (*DF 10*). OVALAU: Hills east of Lovoni Valley, *Smith 7321*. VANUA LEVU: MBUA: Lower Wainunu River valley, *Smith 1752*. THAKAUNDRIVE: Upper Yanawai River, *DA 15746*; Nakoroutari, *DA 15233*. RAMBI: *Horne 517*.

FAMILY 54. LAURACEAE

LAURACEAE Juss. Gen. Pl. **80**, as *Lauri*. 1789.

Trees or shrubs, dioecious, polygamodioecious, or monoecious, or more often with ♂ flowers, stipulate, aromatic; leaves alternate, less frequently opposite, subopposite, or whorled, the blades usually entire, rarely lobed, pinnately or subpalmately nerved, often triplinerved; inflorescences definite (i. e. axis terminating in a flower), usually axillary, paniculate, racemose, or capitellate, the ultimate flowers subtended

by bracteoles or in pseudoumbels surrounded by bracts; flowers small, usually less than 5 mm. in diameter, actinomorphic, usually 3-merous; perianth hypogynous or perigynous, the tube rotate, infundibuliform, or urceolate, often accrescent (very rarely adnate to ovary), usually with 6 tepals in 2 whorls (tepals sometimes lacking, rarely 4-10), these usually equal or subequal, deciduous or persistent; stamens attached to throat of perianth tube, usually definite in number and basically in 4 whorls (or sometimes more in *Litsea*) of 3 each, the 2 outer whorls sometimes abortive or reduced to staminodes, the third whorl nearly always present, the innermost whorl usually reduced to staminodes, the filaments of fertile stamens often glanduliferous, the anthers of the 2 outer whorls (if present) introrsely (less often extrorsely) dehiscent by 2 or 4 valves opening from base to apex, the anthers of the third whorl usually extrorsely dehiscent; pollen grains inaperturate, subglobose, tectate; ovary unilocular (but presumably formed of 3 carpels), free or rarely adherent to perianth tube and appearing inferior, the ovule solitary, pendulous, anatropous, the style usually obvious, the stigma often discoid; fruit baccate or drupeaceous, often with a thin and smooth endocarp, sometimes borne on a naked pedicel, sometimes basally surrounded by or embedded in a cupule formed by the accrescent perianth tube, or sometimes entirely included in a cupule; seed with a thin testa, lacking endosperm, the embryo large, with fleshy cotyledons.

DISTRIBUTION: A large, pantropical family, extending north and south into temperate areas, with 30-45 genera and perhaps 2,000-3,000 species.

USEFUL TREATMENTS OF FAMILY: Smith, A. C. Studies of Pacific Island plants, VIII. The Fijian species of Lauraceae. *J. Arnold Arb.* 32: 27-58. 1951. Stern, W. L. Comparative anatomy of xylem and phylogeny of Lauraceae. *Trop. Woods* 100: 1-72. 1954. Kostermans, A. J. G. H. Lauraceae. *Pengumuman Bal. Bes. Penjel. Kehut. Indonesia* 57: 1-64. 1957 (reprinted with minor changes in *Reinwardtia* 4: 193-256. 1957). Kostermans, A. J. G. H. *Bibliographia Lauracearum*. i-xvi, 1-1450. 1964. Hutchinson, J. Lauraceae. *Gen. Fl. Pl.* 1: 125-143. 1964. Kostermans, A. J. G. H. Lauracées. *In* Aubréville & Leroy, *Fl. Nouv. Caléd.* et *Dépend.* 5: 1-123. 1974.

The Lauraceae include various species of economic value: spices, essential oils, and flavoring materials (*Cinnamomum*, *Laurus*, *Sassafras*), the edible avocado (*Persea*), and valuable timber (*Cocotea* and many other genera).

KEY TO GENERA

- Inflorescence paniculate, the flower clusters not enclosed by an involucre of bracts; flowers (in our species) ♂, the tepals 6.
- Fruit without a cupule (i. e. perianth tube in fruit deciduous or at least not obviously accrescent and not clasping the fruit); perianth tube in flower usually shallow, cupuliform to obconical, rarely subglobose; leaves alternate or spirally arranged.
- Anthers 4-celled; fertile stamens 6 or 9, those of the 2 outer whorls with introrsely dehiscent anthers and eglandular filaments; the 3 inner ones with extrorsely dehiscent anthers and biglandular filaments; stamens of the innermost whorl replaced by conspicuous staminodes. 1. *Persea*
- Anthers 2-celled; fertile stamens 3 (in our species), the anthers dehiscent extrorsely or rarely laterally, the filaments biglandular; staminodes 3, sessile, subglobose, minute, sometimes lacking; leaf blades with areolate reticulation. 2. *Endiandra*
- Fruit with a cupule (i. e. perianth tube accrescent) surrounding its basal part or the entire fruit; perianth tube in flower usually obvious; fertile stamens 9 (in our species), those of the 2 outer whorls with introrsely dehiscent anthers and eglandular filaments, the 3 inner ones with extrorsely dehiscent anthers and biglandular filaments; stamens of the innermost whorl replaced by conspicuous staminodes.
- Anthers 4-celled; staminodes stipitate; basal part of fruit surrounded by a cupule; leaves usually opposite and with triplinerved blades. 3. *Cinnamomum*
- Anthers 2-celled; staminodes (in our species) subsessile; fruit entirely included in the cupule (accrescent perianth tube) except for a small apical orifice; leaves alternate or subopposite, the blades often pinnate-nerved, sometimes triplinerved. 4. *Cryptocarya*
- Inflorescence umbellate-racemose, the umbels or pseudoumbels (sometimes solitary in leaf axils) enclosed by an involucre of decussate, large, subsistent bracts; plants dioecious (in our species), the flowers unisexual, the tepals 6 or lacking (rarely 3-10); fertile stamens in ♂ flowers 5-18, the filaments of the 2 outer whorls usually lacking glands, those of the inner whorl(s) glandular, the anthers 4-celled,

dehiscing introrsely; ovary in ♂ flowers stipitiform or lacking; ♀ flowers with staminodes as many as stamens in ♂ flowers; fruit partially embedded in a small cupule; leaf blades pinnate-nerved or triplinerved. 5. *Litsea*

1. *PERSEA* Mill. Gard. Dict. Abr. ed. 4. 1754. Nom. cons.

Usually trees; leaves alternate or spirally arranged, the blades chartaceous to coriaceous, pinnate-nerved; inflorescence paniculate, axillary or subterminal (essentially terminal in our species); flowers ♂, the perianth tube shallow, the tepals 6, deciduous or persistent, the outer ones slightly smaller than the inner; fertile stamens 6 or 9, the 3 or 6 outer ones with slender eglandular filaments and introrsely dehiscing 4-celled anthers, the 3 inner ones with glandular filaments and extrorsely dehiscing anthers, the staminodes conspicuous, stipitate; style filiform, the stigma broad; pedicel in fruit cylindric or enlarged and fleshy, naked or with a more or less persistent but not accrescent perianth, the fruit globose to obovoid or pyriform.

TYPE SPECIES: *Persea americana* Mill. (*Laurus persea* L.).

DISTRIBUTION: Pantropical but primarily American, extending north and south into temperate areas in America. There is still disagreement as to the inclusiveness or exclusiveness of the genus. As interpreted by Kostermans (1957), *Persea* has 200-300 or perhaps more species. Hutchinson (1964) accepts the genus in a much narrower sense as comprised of only ten species in tropical Asia and America and some Atlantic islands. In Fiji *P. americana* occurs in cultivation.

1. *Persea americana* Mill. Gard. Dict. ed. 8. 1768; Yuncker in Bishop Mus. Bull. **178**: 55. 1943, in op. cit. **220**: 118. 1959; J. W. Parham in Agr. J. Dept. Agr. Fiji **29**: 33. 1959, Pl. Fiji Isl. 57. 1964, ed. 2. 90. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 108. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 323. 1971.

Laurus persea L. Sp. Pl. 370. 1753.

Persea gratissima Gaertn. f. Suppl. Carpol. 222. t. 221. 1807.

The cultivated avocado in Fiji has been noted at elevations from near sea level to about 200 m. as a tree 7-10 m. high (although it will grow to 20 m. or more). The somewhat fragrant flowers have a perianth 10-15 mm. in diameter, the segments being yellow or yellowish white; the conspicuous staminodes are orange to brown. The fruit, green to purplish when edible, is globose to pyriform and attains a size of 20 × 10 cm., the large seed being up to 5 cm. in diameter. Flowers have been noted in September and October and fruits in February and March.

TYPIIFICATION: Linnaeus cited several prior references for *Laurus persea*, but I have not noted a lectotypification.

DISTRIBUTION: Native of Central America, spreading early in cultivation into South America and somewhat later into the West Indies; the species is now cultivated in most tropical and subtropical areas.

LOCAL NAMES AND USES: *Avocado* and *alligator pear* are the usual names for this well-known species. The mesocarp is edible and the species provides a valuable addition to the diet of carbohydrates in tropical countries; the oil is used to a minor extent in cosmetics.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, DA 12242; Vunikawai, DA 6062. FIJI without further locality, DA 610.

The avocado is more extensively grown and used in Fiji than suggested by the few available collections, although not on a commercial scale; it was probably introduced in the 1880's. An interesting account of the species as to its history, cultivation, etc., is provided by Purseglove, Trop. Crops, Dicot. 192-198. 1968. Three ecological races are

generally recognized, but there are now hundreds of cultivars and great variations in fruit size, shape, and color.

2. ENDIANDRA R. Br. Prodr. Fl. Nov. Holl. 402. 1810; A. C. Sm. in J. Arnold Arb. 32: 40. 1951.

Trees; leaves alternate or spirally arranged, the blades pinnate-nerved, with areolate reticulation; inflorescence paniculate, axillary or at base of young shoots, often many-flowered; flowers ♂, the perianth tube obconical to subglobose, not accrescent, the tepals 6, equal or subequal, fertile stamens 3 (those of the third whorl) (rarely 6 but not in our species), with biglandular filaments and 2-celled extrorsely (rarely latrorsely) dehiscent anthers, the staminodes small, sometimes lacking; style short, the stigma inconspicuous, subcapitate; pedicel in fruit sometimes coriaceous and thickened, naked, the perianth tube usually caducous, the fruit ellipsoid to obovoid, often somewhat curved, in our species up to 6.5×3 cm.

TYPE SPECIES: *Endiandra glauca* R. Br.

DISTRIBUTION: Southeastern Asia, Malesia, Australia, and into the Pacific, with 80-95 species. In the present treatment seven Fijian species are recognized, six of them endemic and one also occurring in Samoa and Tonga.

KEY TO SPECIES

- Perianth tube subglobose, the tepals comparatively small, 0.2-1 mm. long, glabrous within; stamens thick-carnose, angular, with essentially latrorsely dehiscent anthers, the connective swollen and truncate at apex; leaf blades usually oblong-lanceolate, (6-) 9-18 cm. long, (2-) 3.5-7.5 cm. broad. 1. *E. reticulata*
- Perianth tube shortly obconical, less conspicuous than the tepals at anthesis; stamens dorsiventrally flattened, with extrorsely dehiscent anthers.
- Tepals densely tomentellous within at least toward base, the perianth tube densely sericeous within; filaments sericeous or tomentellous at least dorsally.
- Lower surface of leaf blades glabrous or sparsely tomentellous only on nerves or inconspicuously strigillose with hairs about 0.1 mm. long.
- Leaf blades obovate or elliptic, (7-) 13-31 cm. long, (4-) 6-14 cm. broad, with (5-) 6-8 secondaries per side, cuspidate or acuminate at apex, drying brownish or dark-olivaceous, essentially concolored, glabrous beneath or with a tangled indument along the nerves; indument of inflorescence branches and pedicels spreading, the hairs weak, crispate; filaments sericeous dorsally, the anthers glabrous. 2. *E. elaeocarpa*
- Leaf blades broadly elliptic, 7-16.5 cm. long, 4-12.5 cm. broad, with 3-5 secondaries per side, rounded or retuse at apex, drying brownish, paler beneath, on lower surface inconspicuously but regularly strigillose with minute appressed golden hairs; indument of inflorescence branches and pedicels strigillose, the hairs appressed; filaments copiously tomentellous on all surfaces, the indument extending to dorsal surfaces of anthers. 3. *E. gillespiei*
- Lower surface of leaf blades densely and uniformly pilose with spreading hairs 0.5 mm. or more long, the blades elliptic-obovate, usually 9-28 \times 3.5-13 cm., obtuse or short-cuspidate at apex, the secondaries 4-7 per side. 4. *E. trichotoma*
- Tepals glabrous on both sides or very sparsely pilose toward base within, the perianth tube glabrous or faintly puberulent or very minutely sericeous within; filaments glabrous.
- Flowers comparatively small, the tepals less than 2 mm. long, the stamens less than 1.5 mm. long; leaf blades usually glaucous or paler beneath, the veinlet-reticulation comparatively coarse, the ultimate obvious areoles 1 mm. or more across.
- Leaf blades ovate-elliptic, 7-14 cm. long, 4-8 cm. broad, often coriaceous; tepals 1.5-2 mm. long; stamens 1.2-1.5 mm. long. 5. *E. monticola*
- Leaf blades ovate-lanceolate, 4.5-6 cm. long, 2-3.3 cm. broad, comparatively thin, chartaceous in texture; tepals 0.8-1 mm. long; stamens about 1 mm. long. 6. *E. tryphera*
- Flowers comparatively large, the tepals 2.5-5 mm. long, the stamens 2-3 mm. long; leaf blades lanceolate to elliptic-oblong, (3-) 5-12 cm. long, (1-) 2-6 cm. broad, drying olivaceous, nearly concolored, the veinlet-reticulation finely prominulous, the ultimate obvious areoles 0.2-0.4 mm. across. 7. *E. luteola*

1. *Endiandra reticulata* Gillespie in Bishop Mus. Bull. **83**: 8, fig. 7. 1931; A. C. Sm. in J. Arnold Arb. **32**: 41. 1951; J. W. Parham, Pl. Fiji Isl. **55**. 1964, ed. 2. 87. 1972.

A slender tree 5–21 m. high, occurring in dense or dry forest at elevations of 50–1,130 m. The flowers are dull purple when in bud and have been found at anthesis between November and February; fruits are known to mature between September and June.

TIPIFICATION: The type is *Gillespie 3905* (BISH HOLOTYPE; ISOTYPE at GH), collected Nov. 19, 1927, on a hill near Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu.

LOCAL NAME AND USE: Department of Forestry collections indicate the local name as *malamala* and state that the species is a timber tree. Both statements require verification, as this local name usually refers to *Dysoxylum* (Meliaceae).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6181*; summit of Mt. Nanggaranambuluta, *Gillespie 4341*; hills east of Nandala Creek, *Smith 5950*. SERUA: Inland from Namboutini, *DF 154*, *DA L. 22304*; inland from Ngaloa, *DF 879*; hills between Waininggere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9384*. NAMOSI: Vicinity of Nanggarawai, *Gillespie 3220*; Mt. Voma, *DA 11654*; vicinity of Namuamua, *Gillespie 3073*; Nambukavesi Creek, *DF 490*. FIJI without further locality, *U. S. Expl. Exped.*

Endiandra reticulata, with subglobose young flowers and very small tepals, seems more closely related to the New Hebridean *E. aneityensis* Guillaumin than to any other Fijian species of the genus.

2. *Endiandra elaeocarpa* Gillespie in Bishop Mus. Bull. **83**: 7, fig. 6. 1931; Christopheren in op. cit. **128**: 92. 1935; A. C. Sm. in J. Arnold Arb. **32**: 42. 1951; Yuncker in Bishop Mus. Bull. **220**: 119. 1959; J. W. Parham, Pl. Fiji Isl. **54**. 1964, ed. 2. 86. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 17. 1972.

FIGURE 41C.

Tetranthera elaeocarpa A. Gray ex Seem. Fl. Vit. 202, nom. nud. 1867; A. Gray ex Gillespie in Bishop Mus. Bull. **83**: 7, pro syn. 1931.

A tree 2–25 m. high, with a trunk up to 1 m. in diameter, found in dense or light forest at elevations of 100–900 m. The tepals are white to yellowish green and at length brown, the filaments are white, and the fruit is black at maturity. Flowers have been obtained between October and January and fruits between April and October.

TIPIFICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (GH HOLOTYPE; ISOTYPE at US 40519), collected on Ovalau without further locality in 1840. This same collection is the source of the name *Tetranthera elaeocarpa*. Gillespie indicated his binomial as a new combination, but since the basionym had not been validly published the taxon is to be considered a new species dating from 1931.

DISTRIBUTION: Fiji (known with certainty only from Viti Levu, Ovalau, and Taveuni), Tonga (Vava'u), and Samoa (Savaii and Upolu).

LOCAL NAME AND USE: Several collections report the name *ndamambi* and indicate that the species is considered useful as a timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Mountains near Lautoka, *Greenwood 941, 1091*; Mt. Evans Range, *Greenwood 1275*; vicinity of Nandarivatu, *DA 13006*. SERUA: Nathengathenga, *Berry 78*. NAMOSI: Wainikoroiuva River, *DA L. 13324* (*Berry 72*). NAITASIRI: Toninaiwau, Tholo-i-suva, *DA 14531*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7184*. REWA: Slopes of Mt. Korombamba, *Gillespie 2091*. OVALAU: Lovoni Valley, *Horne 199*. TAVEUNI: Western slope, between Somosomo and Wairiki, *Smith 888*; slopes of Mt. Manuka, *Smith 8138*. FIJI without further locality, *DA L. 12626, L. 13733*.

3. *Endiandra gillespiei* A. C. Sm. in J. Arnold Arb. **32**: 42. 1951; J. W. Parham, Pl. Fiji Isl. **54**. 1964, ed. 2. 86. 1972.

A tree 6–12 m. high, found in dense forest, sometimes along streams, from 100 to 550 m. elevation. The only dated flowering collection is the type.

TYPIFICATION: The type is *Gillespie 4525* (US 1967775 HOLOTYPE; ISOTYPES at A, BISH, GH, K), collected Jan. 30, 1928, along a stream above Levuka reservoir, Ovalau.

DISTRIBUTION: Endemic to Fiji, and known with certainty only from the two largest islands and Ovalau.

LOCAL NAMES AND USE: Reported names are *ndamambi*, *tambandamu*, *ndirininiu*, and *lindi*. The third of these seems inapplicable, and the fourth (*lindi*) is better applied to species of *Litsea*. One collection notes the species as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Waimanu River, *DA 688, L. 13345 (Berry 36)*; Tholo-i-suva Forest Reserve, *DA 1484*. VANUA LEVU: MBUA: Above Thongea (Wainunu River), *DA 15791*. THAKAUNDOVE: Upper Yanawai River, *DA 15749*. FIJI without further locality, *DA L.13378*.

4. *Endiandra trichotosa* A. C. Sm. in *J. Arnold Arb.* **32**: 43. 1951; J. W. Parham, *Pl. Fiji Isl.* 55. 1964, ed. 2. 87. 1972. FIGURE 41A & B.

This very distinctive species is a slender tree 4–15 m. high, found at elevations of 50–250 m. in dense forest or on its edges. The tepals are pale green or greenish white, the anthers pale yellow, the gynoecium pale green, and the mature fruit deep glaucous-blue. Flowers and fruits have been noted only in November and December.

TYPIFICATION: The type is *Smith 6825* (A HOLOTYPE; many ISOTYPES), collected Dec. 4, 1947, at the southern base of the Mathuata Range, north of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu, Vanua Levu, and Taveuni.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9302, 9457*. NAITASIRI: Vicinity of Viria, *DA 213*. VITI LEVU without further locality, *Graeffe s. n.* TAVEUNI: Vicinity of Waiyevo, *DA 5729*.

5. *Endiandra monticola* A. C. Sm. in *Bishop Mus. Bull.* **141**: 71, *fig. 36*. 1936; Allen in *Sargentia* **1**: 35. 1942; A. C. Sm. in *J. Arnold Arb.* **32**: 44. 1951; J. W. Parham, *Pl. Fiji Isl.* 55. 1964, ed. 2. 87. 1972.

A tree 3–12 m. high, found at elevations of 30–900 m. in different types of forest (dense, dry, or secondary); the tepals are usually noted as white, but one collection indicates them as purple, while the mature fruit is purple-black. Flowers have been obtained between June and December, but fruits only in October.

TYPIFICATION: The type is *Smith 563* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 21, 1933, on the crest of the Korotini Range, between Navitho Pass and Mt. Ndelaikoro, Mathuata–Thakaundrove boundary, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu, Vanua Levu, and Rambi.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Inland from Namboutini, *DF 505, Damanu 144*. NAITASIRI: Between Navutu and Nanduna, *DA 3012*; Toninaiwau, Tholo-i-suva, *DA 14525*; Suva Pumping Station, *Degener & Ordonez 13775*; near Nasinu, *Greenwood 1122*. VANUA LEVU: MATHUATA: Summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6491*. VANUA LEVU without further locality, *U. S. Expl. Exped. RAMBI: Horne 434*. FIJI without further locality, *DA L.13736 (Howard 24)*.

6. *Endiandra tryphera* A. C. Sm. in *J. Arnold Arb.* **32**: 44. 1951; J. W. Parham, *Pl. Fiji Isl.* 55. 1964, ed. 2. 87. 1972.

This apparently rare species is known only from the type, for which no habit or habitat data are available.

TYPIFICATION: The holotype is *U. S. Expl. Exped.* (US 653997 and 653998

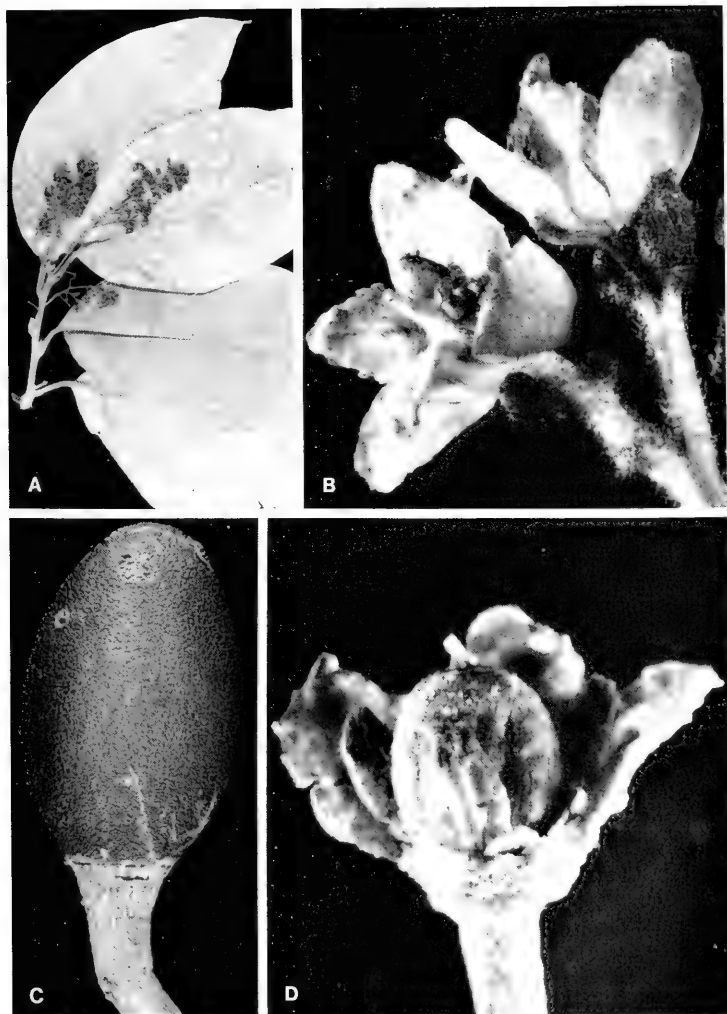


FIGURE 41. A & B, *Endiandra trichotosa*, from Smith 9457; A, distal portion of branchlet, with foliage and inflorescences, $\times 14$; B, flowers, $\times 10$. C, *Endiandra elaeocarpa*, fruit, $\times 2$, from Smith 8138. D, *Endiandra luteola*, flower, with three tepals removed, showing stamens and developing ovary, $\times 15$, from D-3 15679.

HOLOTYPE), collected in 1840 in Fiji but without definite locality.

DISTRIBUTION: Known only from the two sheets of the holotype.

Although this taxon remains very unsatisfactorily known, it is clearly separable from *E. monticola* in leaf and flower characters.

7. *Endiandra luteola* A. C. Sm. in *Bishop Mus. Bull.* **141**: 70. fig. 35. 1936, in J. Arnold *Arb.* **32**: 45. 1951; J. W. Parham, *Pl. Fiji Isl.* **55**. 1964, ed. 2. 86. 1972.

FIGURE 41D.

A clear-boled tree 8–30 m. high, with a trunk to 70 cm. or perhaps more in diameter, found in dense forest and ridge forest at elevations of 100–610 m. The tepals are white to yellowish green and the fruit becomes black at maturity. Flowers have been obtained between October and March and fruits between May and October.

TIPIFICATION: The type is *Smith 763* (BISH HOLOTYPE; many ISOTYPES), collected Dec. 18, 1933, on the western slope of Taveuni between Somosomo and Wairiki.

DISTRIBUTION: Endemic to Fiji and there the most frequently collected species of the genus, although presently known only from Viti Levu, Ovalau, and Taveuni.

LOCAL NAMES AND USE: Names probably correctly referred to this species are *ndamambi*, *tambandamu*, *ngelengai* or *nggelenggai*, and *namo*; also recorded are *malamala* and *moivi*, but these should be questioned, as usually they refer to other families. Many collectors report the species as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *DA 15639*, *DF 789*, *Damanu NH.33*. SERUA: Nambukelevu, *DA 15658*, *15662*; inland from Navutulevu, *Howard 45*; inland from Namboutini, *DA L.22306 (DF 98)*, *DF 525*, *Damanu 157*; inland from Ngaloa, *DA 15673*, *DF 884*, *910*, *930*, *1277*; Serua without further locality, *Bola 45*. NAMOSI: Hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith 8980*; Wainandoi River, *Vaisewa 19*. NAITISIRE: Upper Navatuvula Village, *DA 15679*. OVALAU: *Graeffe s. n.*; hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7539*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8324*.

Endiandra luteola, well marked by its essentially glabrous and comparatively large flowers and its leaf blades with fine reticulation and minute areoles, seems to be comparatively common, but this may be merely because of its occurrence in Serua Province, an area where the forest is accessible from the coast for timbering.

3. *CINNAMOMUM* Schaeffer, *Bot. Exped.* **74**. 1760; Seem. *Fl. Vit.* **201**. 1867; A. C. Sm. in *J. Arnold Arb.* **32**: 28. 1951. *Nom. cons.*

Trees or shrubs, often with aromatic bark and leaves, sometimes with conspicuous buds with imbricate scales; leaves opposite or occasionally alternate and distichous, the blades often coriaceous, usually triplinerved but sometimes pinnate-nerved; inflorescence paniculate, axillary or subterminal or lateral at base of young shoots; flowers usually ♂, the perianth tube short, accrescent, the tepals 6, equal; fertile stamens 9 (in our species but sometimes 6 elsewhere), the 6 outer ones with eglandular filaments and 4-celled introrsely dehiscent anthers, the 3 inner ones with biglandular filaments and extrorsely dehiscent anthers, the staminodes conspicuous, stipitate; stigma discoid or peltate; fruiting pedicel surmounted by a small cupule (formed by the accrescent perianth tube) surrounding basal part of fruit, the tepals often persistent on rim of cupule, the fruit subglobose.

TYPE SPECIES: *Cinnamomum zeylanicum* Bl. (*Laurus cinnamomum* L.); vide Kostermans in *J. Sci. Res. (Jakarta)* **1**: 86. 1952. This binomial is now referred to *C. verum* J. S. Presl.

DISTRIBUTION: China and Japan through Malesia to Australia and into the Pacific, probably with 150–300 species (the circumscription of many still remaining to be

ascertained). In addition to six endemic species, two species are sparsely cultivated in Fiji, one of them perhaps rarely naturalizing.

LOCAL NAME AND USE: All species of *Cinnamomum* in Fiji are probably known collectively as *mathou*. An oil from the bark is commonly used to perfume coconut oil. This name and usage are not repeated under the various species discussed below.

KEY TO SPECIES

- Leaves alternate, distichous, the blades pinnate-nerved or 3-nerved at base with the costa emitting obvious secondaries, ovate to oblong-lanceolate, acuminate, usually 5-11 × 2-7 cm.; vegetative buds conspicuous, perulate, with many imbricate scales increasing inwardly in size; tepals completely deciduous long before maturity of fruit; cultivated species. 1. *C. camphora*
- Leaves opposite or subopposite, the blades 3- or 5-nerved from base or 3- or 5-plinerved, the costa with comparatively inconspicuous secondaries; vegetative buds naked or with few scales not increasing inwardly in size; tepals subsistent or abscising above base and leaving truncate lobes on perianth tube.
- Leaf blades ovate to elliptic or lanceolate, comparatively large, usually more than 9 cm. long and 4.5 cm. broad (or if narrower then distinctly lanceolate), conspicuously 3(or 5)-nerved, the inner pair of basal lateral nerves nearly as prominent as the costa.
- Principal 3 nerves of leaf blade diverging from the broadened distal portion of petiole, the lateral ones usually following the blade margin for 5-10 mm. and then dividing and emitting obvious outwardly directed branches (fourth and fifth nerves); leaf blades rounded at base and abruptly decurrent on petiole, obtuse at apex; petiole 2-2.5 cm. long; indigenous species.
2. *C. pedatinervium*
- Principal lateral nerves of leaf blade concurrent with costa proximally, or the outermost ones (if diverging from apex of petiole) not following the blade margin nor emitting outwardly directed branches (i. e. fourth and fifth nerves, if present, diverging from apex of petiole and not concurrent with second and third nerves along blade margin); leaf blades attenuate to obtuse (rarely rounded) at base; petiole usually 2 cm. or less long.
- Cultivated species, perhaps infrequently naturalizing; bark and leaves when bruised emitting a strong odor of cinnamon; petioles slender, 1-2 cm. long, canalicate above; leaf blades pale-glaucous beneath; branches of inflorescence finely appressed-sericeous with grayish hairs; pedicels 4-7 mm. long at anthesis; tepals 3-5 mm. long at anthesis, appressed-sericeous without, in fruit finally abscising about 2 mm. below their apices. 3. *C. verum*
- Indigenous species; bark and leaves when bruised without or with only a faint odor of cinnamon; leaf blades concolorous; tepals 2-4 mm. long at anthesis, in fruit persistent and remaining intact or at length abscising below apices.
- Leaf blades oblong- or ovate-elliptic, averaging (1.5-) 2-2.5 times as long as broad, the lateral secondary nerves rarely concurrent with the costa for a short distance; petioles (1-) 2-2.5 cm. long, flattened above but not canalicate.
- Branches of inflorescence copiously tomentellous with pale hairs 0.5-0.7 mm. long; pedicels 2-3 mm. long at anthesis, stout; tepals 2-2.6 mm. long, the 3 inner ones obviously the narrower; stamens 1.8-2 mm. long, the filaments spreading-pilose, the anthers very densely yellow-glandular; staminodes about 1.5 mm. long; leaf blades usually acuminate or cuspidate at apex, sometimes obtuse. 4. *C. pallidum*
- Branches of inflorescence essentially glabrous at anthesis, the indument, if present, composed of sericeous hairs 0.1-0.2 mm. long; pedicels usually 5-7 mm. long at anthesis, comparatively slender; tepals subequal, 3-4 mm. long; stamens 2.2-3 mm. long, the filaments minutely sericeous-hispidulous, the anthers not conspicuously glandular; staminodes 1.8-2.3 mm. long; leaf blades obtuse or rounded at apex. 5. *C. leptopus*
- Leaf blades lanceolate, averaging 3 times as long as broad, attenuate at base, acuminate at apex, 3-nerved, the lateral secondary nerves usually concurrent with costa for 5-15 mm., the lower surface of blades, young branchlets, and young petioles sometimes with an evanescent indument of long, pale, tangled hairs. 6. *C. fitianum*
- Leaf blades oblong-ovate, comparatively small, (3-) 4-8.5 cm. long, 2-4.5 cm. broad, rounded or broadly obtuse at base.
- Principal lateral basal nerves of leaf blades inconspicuous, scarcely reaching middle of blade; petioles 3-10 mm. long; bracts and bracteoles of inflorescence persistent, 3-5 mm. long; inflorescence branches and perianth sericeous. 7. *C. rigidum*
- Principal lateral basal nerves of leaf blades obvious, nearly as prominent as costa; petioles 8-18 mm. long; bracts and bracteoles of inflorescence caducous; inflorescence branches and perianth fulvo-lanuginose at anthesis. 8. *C. degeneri*

1. ***Cinnamomum camphora*** (L.) J. S. Presl, Priroz. Rostlin 2: 36, 47-56. *t.* 8. 1825; Nees & Eberm. Handb. Med.-Pharm. Bot. 2: 430. 1831; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 98. 1948, in op. cit. 29: 32. 1959; Kostermans, Bibl. Laur. 261. 1964; J. W. Parham, Pl. Fiji Isl. ed. 2. 83. 1972.

Laurus camphora L. Sp. Pl. 369. 1753.

A tree to 12 m. high or much larger where native, in Fiji sparsely cultivated near sea level; the tepals are yellow.

TYPIFICATION: For *Laurus camphora* Linnaeus indicated five prior references, noting: "*Habitat in Japonia.*" I have not noted a lectotypification, but an appropriate lectotype would be the specimen in Clifford's Herbarium (BM), if one exists.

DISTRIBUTION: Indigenous in southern Japan, eastern China, Taiwan, and perhaps southward into northern Indo-China; now widely cultivated in tropical and subtropical areas.

LOCAL NAME AND USE: *Camphor* is the widely used name. Camphor oil is distilled from young parts of the plant and leaves, and the wood often contains lumps of pure camphor. The species was probably brought into Fiji in the 1880's as a tree of commercial potential, being listed by J. B. Thurston (cf. Vol. 1, p. 47, of this *Flora*), but it is now only sparingly cultivated, perhaps as an ornamental. Thurston also listed *C. cassia* as having been introduced into Fiji, but no voucher is available and it may no longer occur there. Elsewhere in the southern Pacific, *C. camphora* is known in cultivation in the Cook and Society Islands.

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Singatoka, DA 8302. J. W. Parham (1948, 1959, cited above) lists the species as growing in the Suva Botanical Gardens, but no voucher has been seen.

2. ***Cinnamomum pedatinervium*** Meisn. in DC. Prodr. 15 (1): 15. 1864; Seem. Fl. Vit. 201. *t.* 48, p. p. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 278, p. p. 1892; A. C. Sm. in J. Arnold Arb. 32: 29. 1951; J. W. Parham, Pl. Fiji Isl. 52. 1964, ed. 2. 84. 1972.

Cinnamomum sp. Seem. in Bonplandia 9: 258, p. p. 1861, Viti, 440, p. p. 1862.

A tree about 9 m. high (Seemann), occurring upward of 450 m. (Seemann), perhaps to 838 m. (summit of Mt. Mbuke Levu).

TYPIFICATION: As noted in my 1951 treatment, *Seemann 376*, the type collection, was a mixture of elements from Mt. Mbuke Levu, Kandavu, and Mt. Voma, Viti Levu, both parts being sterile. However, the sheet in the Meisner Herbarium (NY HOLOTYPE) is not a mixture, representing the plant illustrated at the left of Seemann's *t.* 48. This portion of the mixture is also found in other herbaria (GH ISOTYPE; K, p. p., ISOTYPE; photo of holotype at BISH, US); the BM specimen of no. 376 is from the smaller-leaved portion of the mixed collection. The type locality may now be definitely taken as Mt. Mbuke Levu, Kandavu, since the smaller-leaved portion of no. 376 (*Cinnamomum rigidum*) is matched by a more recent collection from Mt. Voma. That the type material of *C. pedatinervium* has not been matched may be explained by the fact that no other material of *Cinnamomum* from Kandavu has become available. The Berwick specimen cited by Seemann, from Ngau, is not found at K or BM, and there are no other available collections of the genus from Ngau.

DISTRIBUTION: Known only from the sterile type collection.

LOCAL NAME AND USE: The name reported in use on Kandavu by Seemann was *mou*; he indicated that an oil from the bark was used for scenting coconut oil, but this is perhaps true of any species of *Cinnamomum* in Fiji.

3. **Cinnamomum verum** J. S. Presl, Priroz. Rostlin 2: 36, 37-44. t. 7. 1825; Kostermans, Bibl. Laur. 360. 1964.

Laurus cinnamomum L. Sp. Pl. 369. 1753.

Cinnamomum zeylanicum Bl. Bijdr. Fl. Ned. Ind. 568. 1826; Christophersen in Bishop Mus. Bull. 128: 89. 1935; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 98. 1948, Pl. Fiji Isl. vi. 1964; Kostermans, Bibl. Laur. 364. 1964; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform Ser. 85: 127. 1972.

A tree to 20 m. high where native, cultivated or perhaps infrequently naturalizing near sea level or river level in Fiji. Fruiting and flowering have been noted in months scattered throughout the year.

TYPIFICATION: *Cinnamomum verum* and *C. zeylanicum* are both based on *Laurus cinnamomum*, for which Linnaeus cited several prior references, indicating the species as being from Ceylon. An appropriate lectotype is doubtless the Hermann specimen from Ceylon (if one exists at BM or L) mentioned in L. Fl. Zeyl. 145. 1747.

DISTRIBUTION: Indigenous in Ceylon and southwestern India, spreading early in cultivation into other parts of Asia and to Europe and Africa, and now widely cultivated in tropical areas.

LOCAL NAMES AND USES: *Cinnamon* is the commonly used name, but there is one Fijian report of the name *kaloni*. The true cinnamon of commerce is obtained from the bark of *Cinnamomum verum* and is used as a spice or condiment, for flavoring foods, in incense, dentifrices, and perfumes. Oil from the bark and leaves is used for much the same purposes. In Fiji the species appears to have been introduced for possible commercial use, but now it is utilized as an ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: RA: Ndombulevu Agricultural Farm Plantation, *Vetawa 31*. NAITASIRI: Vunindawa, *DA 7016*; Nanduruloulou, *DA 7178, 12259*. REWA: Suva, in private garden, *DA 16095*; (also grown in Suva Botanical Gardens and on Government House grounds, no vouchers available). VANUA LEVU: MBUA: Lekutu, *DA 13494*. MATHUATA: Ndreketi Plantation, *DA 13580, 16966*.

Although this well-known commercial species is said by J. W. Parham (cited above) to have been an early introduction into Fiji, it is more likely to have been introduced by J. B. Thurston (cf. Vol. I, p. 47, of this *Flora*), in whose introduction garden it had already flowered in 1886. (*DA 16095*, cited above, was collected in that garden.) This species and the two following, presumably Fijian endemics, are not easily separable from herbarium material, but it seems certain that *Cinnamomum verum* could not have been obtained in Fiji by the U. S. Exploring Expedition as early as 1840 (cf. *C. pallidum*, below), nor could it have spread to such remote areas as Mt. Tomanivi and Mt. Voma (localities for *C. leptopus*, as noted below). In Fiji, Samoa, and the Cook Islands *C. verum* may infrequently become naturalized, but then only near settlements where it had been introduced.

4. **Cinnamomum pallidum** Gillespie in Bishop Mus. Bull. 91: 6. fig. 5. 1932; A. C. Sm. in J. Arnold Arb. 32: 30. 1951; J. W. Parham, Pl. Fiji Isl. 52. 1964, ed. 2. 84. 1972.

A tree 7-15 m. high, found in dense forest from near sea level to 1,000 m. elevation. All the available collections are sterile except those of Horne, which are undated, and *Smith 9433* (flowering in December).

TYPIFICATION: The type is *Horne 99* (GH HOLOTYPE; K ISOTYPE; photos of holotype at BISH, US), collected in Fiji without other locality or date.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu; one specimen cited below was obtained either on Ovalau or Vanua Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 3904*. SERUA: Inland from Namboutini, *DF 507 (Damau 146)*; hills north of Ngaloa, in drainage of Wainngere Creek, *Smith 9433*; Mburelotu, Taunovo River, *DA 2857*. NAITASIRI: Nanduna, near Waindrandra Creek, *DA 1082*.

REWA: Slopes of Mt. Korombamba, *Gillespie 2273*, *Meebold 16441*. "OVALAU and VANUA LEVU:" *U. S. Expl. Exped. FIJI* without further locality, *Horne 85, 867a, DA 261A*.

Of the above collections, *Gillespie 2273* (BISH) has been annotated by Kostermans with an unpublished name, but I find no differences between it, the other known collection from Mt. Korombamba, and the type of *Cinnamomum pallidum*.

5. *Cinnamomum leptopus* A. C. Sm. in *J. Arnold Arb.* 32: 31. 1951; J. W. Parham, *Pl. Fiji Isl.* 52. 1964, ed. 2. 83. 1972. FIGURE 42A & B.

Cinnamomum pedatinervium sensu *Gillespie* in *Bishop Mus. Bull.* 91: 7. fig. 6. 1932; non *Meisn.*

A tree 2–12 m. high, occurring from near sea level to about 1,000 m. elevation in dense or secondary forest, sometimes along creek banks, or in patches of forest in open country; the tepals are white. Specimens with flowers or fruits have been obtained in scattered months.

TIPIFICATION: The type is *Gillespie 2718* (GH HOLOTYPE; ISOTYPES at BISH, K, NY), collected Sept. 6, 1927, on the summit of Mt. Voma, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Vanua Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes of Mt. Tomanivi, *Gillespie 4084*. NAITASIRI: Waindina River, *DA 3131*. TAILEVU: Namulomulo, *DF 567 (Watkins 881)*. VANUA LEVU: "Mountains, interior," *Greenwood 567*. MATHUATA: Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6867*.

6. *Cinnamomum fitianum* (Meisn.) A. C. Sm. in *J. Arnold Arb.* 32: 32. 1951; J. W. Parham, *Pl. Fiji Isl.* 52. 1964, ed. 2. 83. 1972. FIGURE 42C & D.

Cinnamomum camphoratum var. *fitiana* *Meisn.* in *DC. Prodr.* 15 (1): 11. 1864.

A tree 7–15 m. high occurring in open or dense forest from near sea level to about 900 m. elevation.

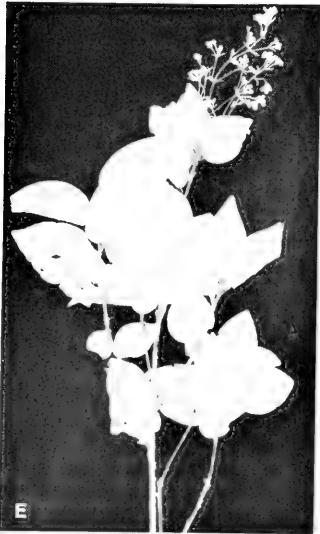
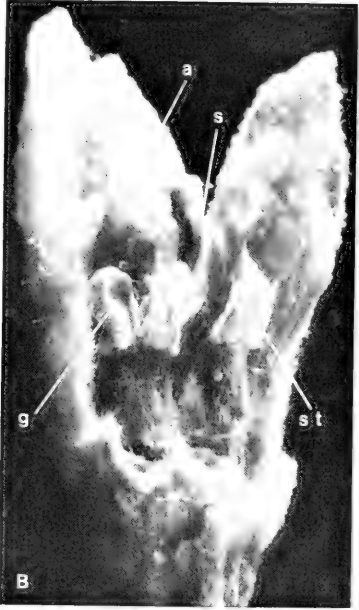
TIPIFICATION: The holotype is *Milne 260* (κ), collected in 1858 above Nandi Bay, Mbua Province, Vanua Levu. In Vol. 1 of this *Flora* (pp. 42, 43) I indicated the dates of *Milne's* collections in Fiji as 1854 and 1856, but his annotations sometimes indicate 1855 or 1858, and I assume that H. M. S. *Herald* must have touched in Fiji during those years as well.

DISTRIBUTION: Endemic to Fiji and known definitely only from Viti Levu, Vanua Levu, and Taveuni.

LOCAL NAMES AND USE: Reported names, in addition to *mathou*, are *mbatho* (*Smith 614*), *vorovoro* (*Milne*), and *mathovu* (*DA 261*); oil from the bark is said to be used medicinally on the skin (*Smith 614*).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vuniyasi, Nandi, *DA 2355*; vicinity of Nandarivatu, *Tothill 680*, *Mead 1981*, *Gillespie 4154, 4205*. VANUA LEVU: MBUA: Hills behind Mbua Bay, *U. S. Expl. Exped.* THAKAUNDOVE: Southwestern slope of Mt. Mbatini, *Smith 614*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4649*. FIJI without further locality, *Horne 832, DA 261, 514*.

FIGURE 42. A & B, *Cinnamomum leptopus*, from *Gillespie 2718*; A, distal portion of branchlet, with foliage and inflorescence, $\times 1/3$; B, flower, with three tepals and some outer stamens removed, showing the anther (a) and filament with paired glands (g) of a stamen of the third whorl, a staminode (st) of the fourth whorl, and the style (s), $\times 20$. C & D, *Cinnamomum fitianum*, from *Gillespie 4154*; C, older portion of branchlet, with petiole and proximal part of lower surface of mature leaf blade, $\times 2$; D, distal portion of young branchlet, terminal bud, and petioles and proximal parts of lower surfaces of young leaf blades, $\times 2$. E, *Cinnamomum rigidum*, distal portion of branchlet, with foliage and inflorescence, $\times 1/3$, from *DA 7127*.



Gillespie 4154 (BISH) was annotated in 1977 as the holotype of an undescribed species by Kostermans; the specimen seems to me quite typical of *Cinnamomum fitianum*, with abundant but evanescent indument on the younger branchlets and foliage.

7. *Cinnamomum rigidum* Gillespie in Bishop Mus. Bull. **91**: 7. fig. 7. 1932; A. C. Sm. in J. Arnold Arb. **32**: 32. 1951; J. W. Parham, Pl. Fiji Isl. **52**. 1964, ed. 2. 84. 1972.

FIGURE 42E.

Cinnamomum sp. Seem. in Bonplandia **9**: 258, p. p. 1861, Viti, 440, p. p. 1862.

Cinnamomum pedatinervium sensu Seem. Fl. Vit. 201, p. p. t. 48, fig. 1. 1867; Drake, Ill. Fl. Ins. Mar. Pac. **278**, p. p. 1892; non Meisn.

A tree or shrub 1.5–5 m. high, occurring at elevations of 500–1,323 m. in forest or crest thickets. The tepals are greenish white to white. Flowers have been obtained in January, February, March, September, and October, and fruits in September.

TIPIFICATION: The type is *Gillespie 5103* (BISH HOLOTYPE and ISOTYPES), collected Sept. 28, 1927, on the summit of Mt. Naitarandamu, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from the higher elevations of Viti Levu; the existence of a U. S. Exploring Expedition specimen, which is unlikely to have come from high elevations on Viti Levu, is puzzling.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Upper slopes and summit of Mt. Tomanivi, *Gillespie 4118*, DA 7127, 13067, 14652, Webster & Hildreth 14198. NAMOSI: Near Veinungga Creek, *Horne 872*; Mt. Nambui track, Korombasambasanga Range, DA 14550; upper slopes and summit of Mt. Voma, *Seemann 376* (BM, K p. p.), DA 593. NAITASIRI: Summit of Mt. Nambukelevu, Mendrausuthu Range, *Horne 974*, DA 15460, 15461. FIJI without further locality, U. S. Expl. Exped.

8. *Cinnamomum degeneri* Allen in Sargentia **1**: 34. 1942; A. C. Sm. in J. Arnold Arb. **32**: 33. 1951; J. W. Parham, Pl. Fiji Isl. **52**. 1964, ed. 2. 83. 1972.

A tree 10–18 m. high, occurring infrequently in dense forest or dense crest thickets at elevations of 500–750 m. Flowers are known only from the type collection (February) and fruits have been obtained in May and June.

TIPIFICATION: The type is *Degener 14531* (A HOLOTYPE; ISOTYPES at BISH, NY, K, US), collected Feb. 24, 1941, at Nauwanga, south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu and Ovalau.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, DA L.17144. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7696*.

Kostermans in 1977 annotated *Smith 7696* as the type of an undescribed species; it is a fruiting specimen that I cannot separate from *Cinnamomum degeneri*.

4. CRYPTOCARYA R. Br. Prodr. Fl. Nov. Holl. **402**. 1810; A. C. Sm. in J. Arnold Arb. **32**: 33. 1951.

Trees or shrubs; leaves alternate, less often subopposite, the blades often coriaceous, pinnate-nerved or triplinerved; inflorescence paniculate, axillary or terminal; flowers ♂, the perianth tube campanulate to turbinate, constricted at apex after anthesis, accrescent, the tepals 6, equal or subequal, caducous; fertile stamens 9 (in our species, but sometimes 3 or 6 elsewhere), the 6 outer ones with eglandular filaments and 2-celled introrsely dehiscent anthers, the 3 inner ones with biglandular filaments and extrorsely dehiscent anthers, the staminodes conspicuous and stipitate or (in our species) sessile; style short, the stigma small, inconspicuous, discoid or capitate; fruit globose to ellipsoid, entirely included in the cupule (formed by the accrescent perianth tube) except for a small apical orifice.

LECTOTYPE SPECIES: *Cryptocarya glaucescens* R. Br.; vide Kostermans in Notul. Syst. (Paris) 8: 112. 1939.

DISTRIBUTION: Pantropical and subtropical, extending into south temperate areas in America, with a center of diversity in Malesia and probably with 200–300 species. I believe eight species to occur in Fiji, six of them endemic, two also found in Tonga, and one of these extending to Niue.

LOCAL NAMES AND USE: Most species of *Cryptocarya* in Fiji are called *mathou* or *kalinimathou*, indicating a relationship to *Cinnamomum*. The species of *Cryptocarya* also provide a bark which is sometimes used to scent coconut oil. These names and the use, referable to the genus in general, are not repeated under the species discussed below.

KEY TO SPECIES

Lower surface of leaf blades glabrous or inconspicuously sericeous (usually evanescently so) with appressed hairs scarcely exceeding 0.2 mm. long, not barbellate in nerve axils.

Leaf blades lanceolate-oblong, 4.5–15 cm. long, 1–3 cm. broad, 3–5 times longer than broad, rounded or narrowly cordate at base, pinnate-nerved with 4–8 pairs of secondaries, the margins recurved especially toward base. 1. *C. lancifolia*

Leaf blades ovate to elliptic-oblong, usually 2–3 times longer than broad, acute to obtuse (rarely broadly rounded) at base, the margins not conspicuously recurved.

Leaf blades pinnate-nerved, the secondaries 4–8 per side, often curved-ascending but the lower ones scarcely longer or more conspicuous than the upper ones.

Tepals within and filaments obscurely sericeous or faintly pilose; fruit at apparent maturity up to 25 mm. long and 15–20 mm. broad and then stipitate at base; leaf blades ovate or oblong-elliptic, (6–) 8–28 cm. long, 3–11 cm. broad, usually obtuse to rounded (sometimes acute) at base, the secondaries usually 5–8 per side. 2. *C. fusca*

Tepals within comparatively densely sericeous; filaments sericeous-hispidulous; apparently mature fruit 10–16 × 8–13 mm. and then contracted but hardly stipitate at base; leaf blades ovate or ovate-lanceolate, 5–8 (–15) cm. long, 2–5 (–6) cm. broad, acute at base, the secondaries 4–6 (–7) per side. 3. *C. turbinata*

Leaf blades triplinerved or subtriplinerved, (4–) 5–13 (–17) cm. long, (1.5–) 2.5–6.5 (–8) cm. broad, the lowermost secondaries very conspicuous, ascending, oriented directly from petiole or concurrent with costa (but seldom for as much as 20 mm.), the lateral nerves arising distally from costa 1–4 pairs, comparatively inconspicuous. 4. *C. hornei*

Lower surface of leaf blades pilose with spreading hairs usually 0.5 mm. or more long, or similarly pilose at least on costa and secondaries, or conspicuously barbellate in nerve axils.

Axils of secondary nerves of lower leaf blade surfaces not barbellate, essentially no more copiously pilose than costa, the blades oblong-lanceolate; fruit comparatively smooth, inconspicuously costate or ecostate.

Leaf blades (7–) 9–23 cm. long, (3–) 4–8.5 cm. broad, pinnate-nerved, the secondaries 5–7 per side, ascending, the lowermost ones not pronounced. 5. *C. constricta*

Leaf blades (6–) 8–18 cm. long, (2.5–) 3–8.5 cm. broad, subtriplinerved, the lower secondaries sharply ascending, longer and more pronounced than the 2 or 3 pairs arising distally from costa.

6. *C. turrilliana*

Axils of secondary nerves of lower leaf blade surfaces with obvious tufts of crispate hairs, the blades elliptic or ovate-oblong, pinnate-nerved, the secondaries 5–9 per side, subspreading; fruit drying with irregular angles or obviously costate, the perianth tube much thickened in fruit.

Leaf blades (7–) 9–15 cm. long, 5.5–9.5 cm. broad, broadly obtuse at base, short-cuspidate at apex, essentially glabrous beneath except for the large (3–7 mm. in diameter) barbellate axillary areas, the costa and secondaries leprose-puberulent; fruit irregularly ovoid, drying with conspicuous projecting angles. 7. *C. barbellata*

Leaf blades (4–) 5–11 cm. long, (1.5–) 2.5–6 cm. broad, usually truncate-rounded at base, acuminate or short-cuspidate at apex, the indument of costa and secondaries beneath comparatively obvious and persistent, the barbellate axillary areas small, usually 1–2 mm. in diameter; fruit subglobose, drying with obvious parallel costas. 8. *C. parinarioides*

1. *Cryptocarya lancifolia* A. C. Sm. in Bishop Mus. Bull. **141**: 70. fig. 34. 1936, in J. Arnold Arb. **32**: 34. 1951; J. W. Parham, Pl. Fiji Isl. **54**. 1964, ed. 2. 86. 1972.

A slender tree about 5 m. high, found in dense forest at elevations of 150–430 m.; the mature fruit is black. Flowers and fruits are known only from the type collection.

TIPIFICATION: The type is *Smith 1762* (BISH HOLOTYPE; many ISOTYPES), collected May 10, 1934, on Mt. Kasi, Yanawai River region, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and apparently rare, known from only two collections on Viti Levu and Vanua Levu.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Vicinity of Nasinu, *Gillespie 3641*.

2. *Cryptocarya fusca* Gillespie in Bishop Mus. Bull. **91**: 8. fig. 8. 1932; A. C. Sm. in J. Arnold Arb. **32**: 35. 1951; J. W. Parham, Pl. Fiji Isl. **52**. fig. 25, A. 1964, ed. 2. 84. fig. 26, A. 1972.

A tree 4–20 m. high, with a trunk to 40 cm. or perhaps more in diameter, occurring at elevations of 50–1,000 m. in various types of forest (dense, dry, or secondary). The flower buds are dull green, with a silky, evanescent, brown indument; the tepals at first are cream-white, becoming greenish brown or brownish yellow; and the fruits are green but doubtless turning darker at maturity. Flowers and fruits have been obtained in months scattered throughout the year.

TIPIFICATION: The type is *Gillespie 2624* (BISH HOLOTYPE; ISOTYPES at GH, K), collected Sept. 6, 1927, in the vicinity of Namosi Village, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the two largest islands. I have examined 26 collections.

LOCAL NAMES: *Karaua*, *kaurau*, *kaurivau*, *karava*, and *vorovoro* have been recorded by collectors in addition to the usual generic names.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Nanggaranambuluta, *Smith 6323*; valley of Nggaliwana Creek, north of the sawmill at Navai, *Smith 5344*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13305*; Uluvatu, vicinity of Mbalo, near Vatukarasa, *Tabualewa 15557*. SERUA: Inland from Namboutini, *DF 157*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9287*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8793*; Saliandrau, Wayauyau Creek, *DA 15010*; Mt. Voma, *DA 1722*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6105*; Central Road, *Tohill 515*. VANUA LEVU: "Interior," *Horne 650*. MBUA: Southern slope of Mt. Seatura, *Smith 1610*. MATHUATA: Nasautha, *DA 12935*. MATHUATA–THAKAUNDROVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 536*.

3. *Cryptocarya turbinata* Gillespie in Bishop Mus. Bull. **83**: 7. fig. 5. 1931; A. C. Sm. in J. Arnold Arb. **32**: 35. 1951; J. W. Parham, Pl. Fiji Isl. **54**. 1964, ed. 2. 86. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 106. fig. 10. 1970.

Cryptocarya glaucescens var. *pacifica* Burkill in J. Linn. Soc. Bot. **35**: 52. 1901; Yuncker in Bishop Mus. Bull. **220**: 118. 1959.

Cryptocarya sp. Yuncker in Bishop Mus. Bull. **178**: 55. 1943.

A tree 6–25 m. high, with a trunk to 80 cm. in diameter, found in dense or open forest at elevations of 100–1,127 m. (or nearer sea level in Tonga and Niue). The tepals are noted as brown and yellow-tinged, and the fruit at maturity is jet-black. Flowers and fruits have been obtained in scattered months.

TIPIFICATION AND NOMENCLATURE: The type of *Cryptocarya turbinata* is *Gillespie 3915* (BISH HOLOTYPE; ISOTYPE at GH), collected Nov. 21, 1927, on slopes at the base of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu. The holotype of *C. glaucescens* var. *pacifica* is *Crosby 241* (K), obtained on Vava'u, Tonga. The few available specimens of this relationship from Tonga and Niue seem correctly

referred to *C. turbinata*, although this species and *C. fusca* are distinguishable, when sterile, only by minor leaf characters.

DISTRIBUTION: Known from several high islands in Fiji and also from Tonga (Vava'u) and Niue.

LOCAL NAMES: In addition to the usual generic names, this species has been noted as *mbatho* and *lilingi*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Summit of Mt. Nanggaranambuluta, *Smith 5676*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5582*. SERUA: Nambukelevu East, *Berry 97*. KORO: Eastern slope of main ridge, *Smith 954*. NGAU: Slopes of Mt. Ndelaitho, on northern spur, toward Navukailangi, *Smith 7872*; hills east of Herald Bay, inland from Sawaieke, *Smith 7765, 7794*. VANUA LEVU: MBUA: "Woods of Mbua," *Horne 1068*; "woods near Mbua," *Horne 1117*; southern portion of Seatovo Range, *Smith 1528*. MATHUATA: Southern slopes of Mt. Numbulua, east of Lambasa, *Smith 6395*.

4. *Cryptocarya hornei* Gillespie in Bishop Mus. Bull. **83**: 6. fig. 4. 1931; A. C. Sm. in J. Arnold Arb. **32**: 36. 1951; Yuncker in Bishop Mus. Bull. **220**: 119. 1959; J. W. Parham, Pl. Fiji Isl. **54**. fig. 25, B. 1964, ed. 2. 84. fig. 26, B. 1972; A. C. Sm. in *Allertonia* **1**: 356. 1978.

FIGURE 43A-C.

Laurinea Seem. in Bonplandia **9**: 258. 1861, Viti, 440. 1862, Fl. Vit. 202. 1867.

Cryptocarya degeneri Allen in Sargentia **1**: 34. 1942.

A tree 3-15 m. high, with a trunk up to 20 cm. or perhaps more in diameter, occurring from near sea level to 900 m. elevation in usually dense forest, often on limestone. The tepals are cream-colored to pinkish or brownish white, and the fruit turns from green to brown or purplish, becoming black at maturity. Flowers and fruits may be found at all seasons.

TIPIFICATION AND NOMENCLATURE: The type of *Cryptocarya hornei* is *Horne 171* (GH HOLOTYPE; ISOTYPE at K), collected in December, 1877, in the mountains of Ovalau (these data were not available to Gillespie but are found on the K sheet). Seemann's "*Laurinea*," provided with a brief diagnosis in 1867, is based on his no. 377. *Cryptocarya degeneri* is typified by *Degener 15412* (A HOLOTYPE; ISOTYPES at BISH, K, NY, US), obtained June 3, 1941, at Mataimeravula, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu. The two type collections disclose no differences of consequence.

DISTRIBUTION: Known from several islands in Fiji, from which I have studied about 40 collections, and also from 'Eua, Tonga.

LOCAL NAMES: *Iviivi*, *wawanunu*, *nduvundu*, and *ndrausasa* have been recorded for this species but should be treated with skepticism, since some of them are used for quite different families.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1090*; below Mt. Koromba, *DA 14727*; Mangondro (Tikina), *DA 14903*; vicinity of Nandarivatvu, *Degener 14311*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 829*; vicinity of Mbelo, near Vatukarasa, *Degener 15228*. SERUA: Hills north of Ngaloa, in drainage of Waininggere Creek, *Smith 9161*. NAMOSI: Mt. Voma, *Gillespie 2893*. NAITASIRI: Vicinity of Kalambo, *Tohill 548*. OVALAU: "Mountains," *Horne 128, 170*; hills southeast of valley of Mbureta River, *Smith 7408*. VANUA LEVU: MBUA: Rukuruku Bay, *H. B. R. Parham 378*. THAKAUNDROVE: Hills west of Mbutha Bay, Natewa Peninsula, *Smith 808*. MOALA: Near Naroi, *Smith 1317*. YATHATA: Navakathuru, *DA 16309*. VANUA VATU: On limestone slopes, *Bryan 552*. LAKEMBA: Near airport, *Garnock-Jones 867*. AIWA: Central wooded plateau, *Bryan 523*. FULANGA: On limestone formation, *Smith 1130*. ONGEA LEVU: Central forest, *Bryan 439*. FIJI without further locality, *U. S. Expl. Exped., Seemann 377*.

This distinctive species is the most abundant and widespread member of the genus within Fiji. Its relationship seems to be with the Samoan *Cryptocarya elegans* (Reincke) A. C. Sm. (cf. J. Arnold Arb. **32**: 37. 1951).

5. *Cryptocarya constricta* Allen in Sargentia 1: 35. 1942; A. C. Sm. in J. Arnold Arb. 32: 37. 1951; J. W. Parham, Pl. Fiji Isl. 52. 1964, ed. 2. 84. 1972; A. C. Sm. in Allertonia 1: 356. 1978.

A tree 2–11 m. high, growing in forest or secondary forest at elevations of 30–600 m.; the fruit becomes black at maturity. Flowers have been obtained only in October, fruits between September and April.

TYPIFICATION: The type is *Degener & Ordonez 13761* (A HOLOTYPE; ISOTYPES at BISH, K, NY, US), collected Dec. 15, 1940, near the Suva Pumping Station, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and infrequent, known only from the two largest islands.

LOCAL NAME AND USES: *Lindi* has been reported for the species, but this name usually refers to *Litsea*. Collectors indicate that the bark is used for perfume and is also burned to provide a mosquito repellent; the wood has been used in house-building.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mbukuya Forest (Mangondro Tikina), Nausori Highlands, DF 1252. SERUA: Inland from Namboutini, DF 460, Damanu 109. NAMOSI: Veivatuloa, Lombau River, DF 466, Damanu 115. VANUA LEVU: MBUA: Mt. Seatura, DA 14892.

6. *Cryptocarya turrilliana* A. C. Sm. in J. Arnold Arb. 32: 37. 1951; J. W. Parham, Pl. Fiji Isl. 54. 1964, ed. 2. 86. 1972. FIGURE 43D.

A tree 5–20 m. high, occurring in dense or open forest or in patches of forest in open country at elevations of 100–825 m. The flower buds are pale brown and the fruit is purplish, becoming jet-black when mature. Flowers have been obtained in November and December and fruits between July and November.

TYPIFICATION: The type is *Smith 6731* (A HOLOTYPE; many ISOTYPES), collected Nov. 28, 1947, on the Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the two largest islands.

LOCAL NAMES: *Lindi thevuthevu*, *tumbu ni vorovoro*.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5520*. VANUA LEVU: MATHUATA: Nasolo, Ndreketi River, DA 12956; Seanggangga Plateau, DA 12276, 13469; mountains near Lambasa, *Greenwood 536, 536A*; southern slopes of Mt. Numbulua, east of Lambasa, *Smith 6381*. THAKAUNDROVE: Wailevu and vicinity, Savusavu Bay, DA 14281.

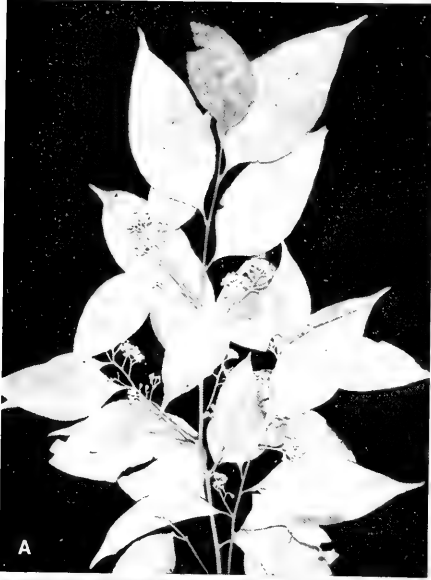
7. *Cryptocarya barbellata* A. C. Sm. in J. Arnold Arb. 32: 38. 1951; J. W. Parham, Pl. Fiji Isl. 52. 1964, ed. 2. 84. 1972. FIGURE 44A & B.

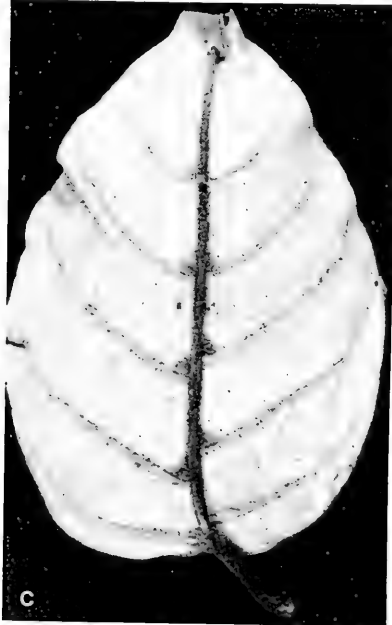
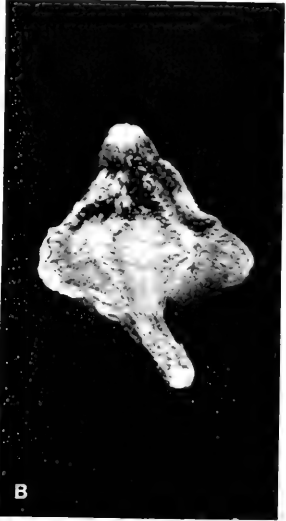
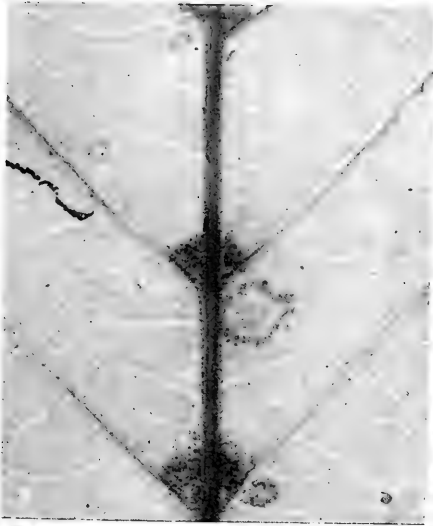
A tree about 15 m. high, found in dense forest at elevations of 850–1,000 m. The pale yellowish flowers and mature fruits have been obtained only in October.

TYPIFICATION: The type is *Smith 6319* (A HOLOTYPE; many ISOTYPES), collected Oct. 2, 1947, on the western slopes of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and apparently rare, known only from the type collection.

FIGURE 43. A–C, *Cryptocarya hornei*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$; B, flower, with three tepals removed, showing dorsal and lateral (at left) surfaces of stamens of the first and second whorls and staminodes of the fourth whorl, $\times 20$; C, fruits and leaf blade surfaces, $\times 2$. D, *Cryptocarya turrilliana*, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$. A & B from *Smith 1317*, C from *Smith 7408*, D from *Smith 6731*.





This species and the following, with pinnate-nerved leaf blades and conspicuous axillary hair tufts on the lower surfaces, are sharply distinguished from other Fijian *Cryptocaryae*, and from one another by leaf size and fruit shape.

8. *Cryptocarya parinarioides* A. C. Sm. in J. Arnold Arb. 32: 39. 1951; J. W. Parham, Pl. Fiji Isl. 54. 1964, ed. 2. 86. 1972. FIGURE 44C & D.

A tree 10–15 m. high, found in dense, often sloping forest, sometimes along streams, at elevations of 365–700 m. The flowers are green and the mature fruit black. Flowers have been seen in April and May, buds in November, and mature fruits only in May.

TYPIFICATION: The type is *Smith 4451* (A HOLOTYPE; many ISOTYPES), collected May 15, 1947, in the vicinity of Nalotawa, eastern base of Mt. Evans Range, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and infrequent, known only from northern and western Viti Levu.

LOCAL NAME: *Malawaso* (recorded for the type collection).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Ambatha, west of Mt. Evans Range, *DA 14206*; Waimongge Creek, south of Navai, *Berry 84*. NANDRONGA & NAVOSA: Nausori Highlands, *Berry et al. s. n. (K. 400)*.

5. *LITSEA* Lam. Encycl. Méth. Bot. 3: 574. 1792; A. C. Sm. in J. Arnold Arb. 32: 45. 1951. Nom. cons.

Tetranthera Jacq. Pl. Rar. Hort. Schoenbr. 1: 59. 1797; Seem. Fl. Vit. 202. 1867.

Usually dioecious trees or shrubs; leaves alternate or spirally arranged or rarely subopposite, the blades pinnate-nerved or triplinerved; inflorescence umbellate-racemose or sometimes composed of a solitary axillary pseudoumbel; flowers unisexual (in our species but rarely ♂ elsewhere), in pseudoumbels, these pedunculate, subglobose in bud, 2–7-flowered, each surrounded by an involucre of 4–6 decussate, large, subsistent bracts, the perianth tube ovoid, campanulate, or short, the tepals 6 (rarely 3–10) and subequal or lacking, deciduous after anthesis; fertile stamens in ♂ flowers 5–18 (in our species), the filaments well developed, those of the 2 outer whorls usually glandular, those of the inner whorl(s) glandular, the anthers 4-celled, all dehiscing introrsely; ovary in ♂ flowers stipitiform or lacking; ♀ flowers with as many staminodes as stamens in ♂ flowers, the ovary attenuate into the style, the stigma conspicuous, peltate or irregularly lobed; fruit subglobose, partially embedded in a small (in our species) cupule formed by the accrescent perianth tube.

TYPE SPECIES: *Litsea chinensis* Lam. The type species of *Tetranthera* is *T. laurifolia* Jacq.

DISTRIBUTION: A large, pantropical genus, extending north and south into temperate areas but lacking in Africa and Europe, with about 400 species. Thirteen species are here recognized from Fiji, twelve of them endemic and one also found in Tonga.

LOCAL NAME: A Fijian generic name for *Litsea* is *lindi*, referable to any species of the genus and therefore not repeated in the following discussions.

FIGURE 44. A & B, *Cryptocarya barbellata*, from *Smith 6319*; A, lower surface of leaf blade along costa, × 2; B, mature (dry) fruit, × 2. C & D, *Cryptocarya parinarioides*, from *Smith 4451*; C, lower surface of leaf blade, × 2; D, mature (dry) fruits, × 2.

KEY TO SPECIES

Flowers without tepals.

Leaf blades comparatively small, rarely exceeding 12×7 cm., the secondary nerves (including basal ones, these frequently pronounced) not more than 5 per side; inflorescence comparatively small, the peduncle 3-12 mm. long, the flower-subtending bracts 3-5 mm. in diameter; mature fruits not much exceeding 1 cm. in length.

Lower surface of leaf blades glabrous except for axillary hair tufts or inconspicuously scattered-pilose; rachis of inflorescence up to 4 mm. long, the pseudoumbels 3-6 per inflorescence; pedicels at anthesis 2-4 mm. long; stamens 12-17. 1. *L. pickeringii*

Lower surface of leaf blades pilose with minute scattered hairs, these subappressed or spreading, 0.1-0.2 mm. long; rachis of inflorescence minute, 1-2 mm. long, the pseudoumbels 1 or 2 per inflorescence; pedicels at anthesis less than 1 mm. long; stamens 6-9 (-12?). 2. *L. palmatinervia*

Leaf blades comparatively large, usually $12-20 \times 7-13$ cm., the secondary nerves (basal ones not pronounced) usually 6-8 per side; inflorescence large, the peduncle 11-20 mm. long at anthesis, the flower-subtending bracts 7-8 mm. in diameter; stamens (12-) 14-18; mature fruits 4 cm. or more long.

3. *L. magnifolia*

Flowers with tepals.

Flower-subtending bracts usually glabrous, rarely sparsely strigose dorsally; tepals 1-2.2 mm. long at anthesis, glabrous or sparsely sericeous dorsally; leaf blades comparatively small, only rarely exceeding 10×5 cm., the secondary nerves not more than 5 per side (or 6 in species no. 7).

Leaf blades elliptic, usually 3-7 cm. long and 2-3.5 cm. broad, rounded or broadly obtuse at apex, the secondaries curved-ascending; stamens or staminodes 6-9.

Inflorescence, including pedicels and floral parts, strictly glabrous except for a few scattered hairs on perianth and filaments; leaf blades subcoriaceous, glaucous beneath. 4. *L. seemanii*

Inflorescence noticeably pubescent, the pedicels copiously sericeous, the tepals and filaments sericeous dorsally at least toward base.

Leaf blades subcoriaceous, concolorous; peduncle minutely appressed-puberulent; flowers 6 or 7 per pseudoumbel; pedicels 0.7-1.5 mm. long, with hairs about 0.1 mm. long; tepals ciliate; stamens (7-) 9, the longest filaments 1-1.3 mm. long. 5. *L. hornei*

Leaf blades chartaceous, with comparatively conspicuous venation, glaucous beneath; peduncle glabrous; flowers 4 or 5 per pseudoumbel; pedicels about 0.5 mm. long, with hairs 0.2-0.3 mm. long; tepals eciliate; stamens (5-) 7-9, the longest filaments about 0.7 mm. long. 6. *L. grayana*

Leaf blades usually more than 7 cm. long and 3 cm. broad or, if smaller, gradually narrowed distally to an obtusely cuspidate apex; stamens or staminodes 12 or more.

Petioles 2.5-3.5 cm. long; leaf blades elliptic-oblong, usually $8-10 \times 4-4.5$ cm., with very fine veinlet-reticulation prominulous on both surfaces; peduncles 12-14 mm. long at anthesis, the flower-subtending bracts 4.5-5 mm. in diameter; flowers about 5 per pseudoumbel, the pedicel about 1 mm. long; tepals 1.5-2.2 mm. long, glabrous, eciliate. 7. *L. richii*

Petioles usually less than 1.5 cm. long; leaf blades lanceolate to elliptic, (4-) $5-10 \times 2.5-5.5$ cm., with the veinlet-reticulation comparatively coarse, often immersed; peduncles not more than 8 mm. long at anthesis, the flower-subtending bracts not more than 4 mm. in diameter; flowers 2-4 per pseudoumbel, essentially sessile; tepals not more than 1.5 mm. long, usually sericeous dorsally and ciliate. 8. *L. vitiana*

Flower-subtending bracts tomentellous or sericeous dorsally; tepals 1.5-4 mm. long at anthesis, densely sericeous dorsally; leaf blades comparatively large, exceeding 10 cm. in length (except in species no. 12), the secondary nerves 6 or more per side (fewer in species no. 12).

Leaf blades oblong-elliptic, rounded or faintly retuse at apex, rounded to broadly obtuse at base, glabrous beneath at maturity; tepals apparently always 6.

Rachis of inflorescence 2-6 mm. long, ferruginous-tomentose; stamens 12; petioles 1.5-2.5 cm. long; leaf blades usually $10-13 \times 4-5$ cm., the petioles and nerves of lower surface often puberulent when young, the secondary nerves 9-11 per side. 9. *L. imthurnii*

Rachis of inflorescence 7-10 mm. long, glabrous; stamens 12-15; petioles 3-5.5 cm. long; leaf blades usually $12-19 \times 6-9.5$ cm., strictly glabrous, the secondary nerves 6-8 per side.

10. *L. burckelloides*

Leaf blades ovate, gradually narrowed distally into an obtuse or obtusely cuspidate apex, broadly obtuse (rarely rounded when juvenile) to acute at base; tepals sometimes more than 6.

Lower surface of leaf blades [these (8-) $10-18$ (-40) \times (3.5-) $5-14$ (-19) cm.] persistently pubescent at least on costa and secondaries, the secondary nerves at least 6 per side; peduncles 7-14 mm. long at anthesis; tepals 6-10, 2.5-4 mm. long; stamens 12-16, the outer filaments up to 4 mm. long.

11. *L. mellifera*

Lower surface of leaf blades [these 6-8.5 \times (3-) $4-5$ cm.] glabrous at maturity, the secondary nerves 4 or 5 per side; peduncles about 5 mm. long at anthesis; tepals 6, not more than 2 mm. long; stamens usually 9 (sometimes 10-12), the outer filaments about 2 mm. long. 12. *L. alleniana*

Flowers not known; leaf blades elliptic-oblong, usually 7-10 × 3-4.5 cm., copiously short-pilose beneath, pinnate-nerved, with 4 or 5 secondaries per side. 13. *L. mathuataensis*

1. *Litsea pickeringii* (A. Gray ex Seem.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 278. 1892; A. C. Sm. in J. Arnold Arb. 32:47. 1951; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972. FIGURE 45A.

Laurinea Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862.

Tetranthera pickeringii A. Gray ex Seem. Fl. Vit. 203. 1867.

A tree 4-20 m. high, sometimes spreading or slender and often locally common, occurring at elevations from near sea level to 1,150 m. in dense or open forest or thickets. The stamens are white and the fruit green, presumably darkening at full maturity.

TYPIFICATION: Gray had mentioned the name *Tetranthera pickeringii* to Seemann in correspondence, indicating the identity of *Seemann 378* with the below-cited U. S. Exploring Expedition collection from Mbua Bay. However, Seemann directly cited only his own collection, which therefore must be taken as the type: *Seemann 378* (K HOLOTYPE; ISOTYPES AT BM, GH), collected in the vicinity of Somosomo, Taveuni, in 1860.

DISTRIBUTION: Endemic to Fiji and known from several islands; I have examined 34 collections of this well-marked species.

LOCAL NAMES AND USE: In various parts of Fiji this species is known as *singa* or *singga*, *lilindi*, *nduvundu vuvula*, *kasinga*, *malomalo*, *matandavo*, and *thivomei-randinivou*. The pounded stem, strained in water, has been reported as an internal cure for headache (*Weiner 71-74*). Seemann's indication of this species as a useful timber tree seems questionable.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MbuA: North of Natalau, near Lautoka, *Degener 14993*; Naloto Range, *DA 14760*; Nauwanga, south of Nandarivatu, *Degener 14559*; slopes of Mt. Tomanivi, *Smith 5306*. NADRONGA & NAVOSA: Nausori Highlands, *DA 13748 (Bola 123)*; Singatoka River, *Greenwood 833*. NAITASIRE: Namboumbutho Creek, *Horne 969*; between Nuku and Langonimbokala, Wainimala Valley, *DA 14013*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7063*. OVALAU: *Graeffe 1583*; slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8079*. KORO: East coast, *Smith 1040*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7778*. VANUA LEVU: MbuA: Mbua Bay, U. S. Expl. Exped. (GH, US 40458, 40459). MATHUATA: Seanggangga Plateau, *DA 13471*. THAKAUNDOVE: Savusavu Bay area, *Horne 544*, *Weiner 71-74*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4653*; Mt. Manuka, east of Wairiki, *Smith 8176*. MOALA: Near Maloku, *Smith 1336*. KAMBARA: On limestone formation, *Smith 1248*.

The first three species of *Litsea* in this treatment are readily characterized by having flowers without tepals. Additionally each of the three has vegetative and fruit characters that readily distinguish them from each other and from the more numerous species with tepals.

2. *Litsea palmatinervia* (Meisn.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 278. 1892; A. C. Sm. in J. Arnold Arb. 32:48. 1951; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972.

Laurinea Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862.

Tetranthera palmatinervia Meisn. in DC. Prodr. 15 (1): 191. 1864; Seem. Fl. Vit. 202. pl. 51. 1867.

A small tree 5-10 m. high (sometimes indicated as a shrub), occurring in dense forest at elevations of 350-920 m. The stamens are white or cream-colored and the fruit is reported as green, although it doubtless darkens at maturity. Flowers have been obtained in February and August and fruits between September and November.

TYPIFICATION: The type is *Seemann 375* (NY HOLOTYPE in Meisner Herbarium;

ISOTYPES at BM, GH, K), collected Aug. 24, 1860, near the summit of Mt. Voma, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and apparently fairly local, known definitely only from the south-central part of Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Inland from Ngaloa, *DA 14699*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8791*; track to Mt. Nambui, Korombasambasanga Range, *DA 14537*; between Nanggarawai and Saliandrau, *Gillespie 3216*; vicinity of Namosi Village, *Gillespie 2828, 3044*; near summit of Mt. Voma, *Gillespie 2724*; vicinity of Namuamua, *Gillespie 3069*. FIJI without further locality, *Howard 204*.

3. *Litsea magnifolia* Gillespie in Bishop Mus. Bull. **83**: 6. fig. 3. 1931; A. C. Sm. in J. Arnold Arb. **32**: 49. 1951; J. W. Parham, Pl. Fiji Isl. **55**. fig. 26, A. 1964, ed. 2. 87. fig. 27, A. 1972. FIGURE 45B.

A sometimes slender tree 8–20 m. high, found in dense forest at elevations from near sea level to 1,150 m. The flower-subtending bracts are greenish white; the stamens have filaments reddish proximally and yellowish anthers; and the fruits, recorded only as green, sometimes attain a size of 45 × 22 mm. Flowers and fruits have been noted in months scattered throughout the year.

TYPIFICATION: The type is *Gillespie 2823* (BISH HOLOTYPE; ISOTYPE at GH), collected Sept. 8, 1927, on mountain ridges in the vicinity of Namosi Village, Namosi Province, Viti Levu.

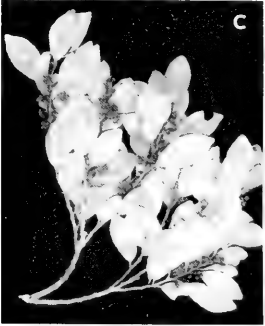
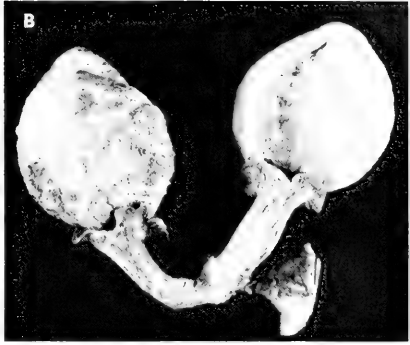
DISTRIBUTION: Endemic to Fiji and known from several high islands.

LOCAL NAMES AND USES: *Vavaloa vula*, *mundari*, and *wa korovundi* have been recorded, the last two by Gillespie, but I am skeptical of all of them. One collector reports that the bark has been used for ceremonial skirts and the wood used for partitions.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 86*; slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4051*; Mbukuya Forest (Mangondro Tikina), Nausori Highlands, *DA L.13422 (DF 1253)*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 1214*. SERUA: Hills east of Navua River, near Nukusere, *Smith 9136*. NAMOSI–NAITASIRI boundary: Mt. Naitarandamu, *Gillespie 3313, 3361*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8436*; northern base of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8687*; vicinity of Saliandrau, Wayauyau Creek, *DA 14590*; slopes of Mt. Voma, *Gillespie 2921*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7739*. VANUA LEVU: THAKAUNDROVE: Savuthuru Mt., near Valetli, Savusavu Bay region, *Degener & Ordonez 13851*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4783*; slopes of Mt. Manuka, east of Wairiki, *Smith 8177*.

The specimens referred to *Litsea magnifolia* (Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 106. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 13. 1972) and to *L. magnifolia* var. *samoensis* (Christophersen in Bishop Mus. Bull. **128**: 89. fig. 10. 1935; Yuncker in op. cit. **184**: 39. 1945) from Samoa and Niue in my opinion are best maintained as a separate species, *L. samoensis* (Christophersen) A. C. Sm. (in J. Arnold Arb. **32**: 50. 1951). These two related species differ markedly from the two preceding Fijian species in their larger leaves, flower-subtending bracts, and fruits.

FIGURE 45. A, *Litsea pickeringii*, a pseudoumbel of ♂ flowers (without tepals), subtended by bracts, × 7, from *Degener 14993*. B, *Litsea magnifolia*, fruits (not fully mature), × 1 1/2, from *Smith 8177*. C, *Litsea seemannii*, distal portion of branchlet, with foliage and inflorescences, × 1/4, from *DA 1989*. D, *Litsea vitiana*, mature fruits, × 1 1/2, from *Smith 7890*. E & F, *Litsea mellifera*, from *Smith 7510*; E, distal portion of branchlet, with foliage and inflorescences, × 1/5; F, ♂ flowers of a pseudoumbel (showing membranaceous tepals; some flowers removed), subtended by bracts (some removed), × 7.



4. *Litsea seemannii* (Meisn.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 278. 1892. FIGURE 45C.

Laurinea Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862.

Tetranthera seemanni Meisn. in DC. Prodr. 15 (1): 192. 1864; Seem. Fl. Vit. 203. t. 49. 1867.

Litsea seemanni Drake ex A. C. Sm. in J. Arnold Arb. 32: 50. 1951; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972.

An often compact tree 3–7 m. high (sometimes recorded as a shrub), occurring very locally in forest or in dense crest thickets at elevations of 500–923 m. The flower-subtending bracts, tepals, and filaments are greenish white. Flowers have been obtained between June and September, but fruits are still uncollected.

TIPIFICATION: The type is *Seemann 374*; as there is no specimen of this in the Meisner Herbarium it is probable that no duplicate was sent to him; therefore I here indicate the κ specimen as the lectotype. Isolectotypes are deposited at BM and GH. Seemann's material was collected Aug. 24, 1860, on the summit of Mt. Voma, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and very limited in occurrence, known only from Mt. Voma and from a single collection from Ovalau.

LOCAL NAME: Only the name *kau moya* has been recorded (*Gillespie 2754*).

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Summit and upper slopes of Mt. Voma, *Gillespie 2745*, DA 557, 598, 1989, 3769, 13960. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7701*.

This species and the two following form a well-marked cluster of rare Fijian endemics, readily separated from *L. richii* and *L. vitiana* by their small leaf blades, which are rounded or broadly obtuse at apex, and by their comparatively few stamens; they are easily distinguished from one another as noted in the above key.

5. *Litsea hornei* A. C. Sm. in J. Arnold Arb. 32: 50. 1951; J. W. Parham, Pl. Fiji Isl. 55. 1964, ed. 2. 87. 1972.

Probably a small tree, but lacking field notes.

TIPIFICATION: The type is *Horne 972* (GH HOLOTYPE; ISOTYPE at κ ; photos of holotype at BISH, US), collected in Fiji without further locality in 1877 or 1878.

DISTRIBUTION: Known only from two collections by Horne; although the type collection is without locality data, it seems identical with the unnumbered collection cited below and may indeed be part of the same gathering. Therefore there is a good possibility that the species is endemic to the isolated Mendrausuthu Range in Naitasiri Province, Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Mt. Nambukelevu (alt. 751 m.), Mendrausuthu Range, *Horne s. n.* (κ).

6. *Litsea grayana* A. C. Sm. in J. Arnold Arb. 32: 51. 1951; J. W. Parham, Pl. Fiji Isl. 55. 1964, ed. 2. 87. 1972; A. C. Sm. in Allertonia 1: 356. 1978.

Tetranthera seemanni var. *chartacea* A. Gray ex Seem. Fl. Vit. 202, nom. nud. 1867.

Probably a small tree, but lacking field notes.

TIPIFICATION: The type is *U. S. Expl. Exped.* (US 40461 HOLOTYPE; ISOTYPES at GH, κ), collected in Fiji without further locality in 1840. This collection is annotated with the manuscript trinomial noted above by Gray.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

7. *Litsea richii* A. C. Sm. in J. Arnold Arb. 32: 51. 1951; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972.

Tetranthera richii A. Gray ex Seem. Fl. Vit. 202, nom. nud. 1867.

Probably a small tree, but without collector's field notes.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 40460 HOLOTYPE; ISOTYPE at GH), collected in Fiji in 1840 without further locality.

DISTRIBUTION: Endemic to Fiji; a well-marked but apparently rare species known only from the type collection.

8. *Litsea vitiana* (Meisn.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 278. 1892; A. C. Sm. in J. Arnold Arb. 32: 52. 1951; J. W. Parham, Pl. Fiji Isl. 57. fig. 26, B. 1964, ed. 2. 89. fig. 27, B. 1972. FIGURE 45D.

Laurinea Seem. in Bonplandia 10: 297. 1862, Viti, 440. 1862.

Tetranthera vitiana Meisn. in DC. Prodr. 15 (1): 514. 1864; Seem. Fl. Vit. 203. t. 50. 1867.

Litsea montana Turrill in J. Linn. Soc. Bot. 43: 36. 1915; A. C. Sm. in J. Arnold Arb. 32: 52. 1951; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972.

A tree 3–20 m. high, often slender, with a trunk up to 50 cm. in diameter, occurring in dense or open forest or in crest forest at elevations from near sea level to 1,323 m. The flower-subtending bracts are white and the fruit is noted as green, although it doubtless darkens at full maturity. Flowers have been obtained between December and July and fruits between May and January.

TYPIFICATION AND NOMENCLATURE: The type of *Tetranthera vitiana* is *Storck 903* (G-DC HOLOTYPE; ISOTYPES at BM, GH, K), collected in December, 1860, on Ovalau adjacent to Port Kinnaird (cf. Vol. 1, p. 45, of this *Flora*). The type of *Litsea montana* is *im Thurn 217* (K HOLOTYPE; photos of holotype at BISH, US), collected March 29, 1906, in the vicinity of Nandarivatu, Mba Province, Viti Levu. In my 1951 treatment I expressed doubt of the value of the characters separating *L. montana* from *L. vitiana*; the increasing number of available specimens has expanded this doubt and I now find no dependable characters to separate the two concepts, which are herewith combined.

DISTRIBUTION: Endemic to Fiji and known from several high islands; I have now studied 30 collections.

LOCAL NAMES AND USE: In addition to the Fijian generic name this species has been recorded as *seti*, *thavuwaru*, and *tarutaru ni lolo*. In the Yasawas it is noted as a medicinal plant, used to relieve swollen breasts.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, near Mbatinaremba, *St. John 18054*. VITI LEVU: MBA: Northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4516*; slopes of escarpment north of Nandarivatu, *Gillespie 3194*; summit and slopes of Mt. Tomanivi, *DA 14659*, *Webster & Hildreth 14188*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5503*; southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 1186*; valley of Singatoka River, *O. & I. Degener 32192*. RA: Mountains near Penang, *Greenwood 750*; Vatundamusewa, vicinity of Rewasa, near Vaileka, *Degener 15457*. NGAU: Slopes of Mt. Ndelaiitho, on northern spur, toward Navukailangi, *Smith 7890*. VANUA LEVU: THAKAUDROVE: Between Savusavu Bay and Mt. Soro Levu, *DA 17176*. TAVEUNI: Western slope, between Somosomo and Wairiki, *Smith 745*; Mt. Manuka, *Smith 777*. FIJI without further locality, *U. S. Expl. Exped.*

9. *Litsea imthurnii* Turrill in J. Linn. Soc. Bot. 43: 35. 1915; A. C. Sm. in J. Arnold Arb. 32: 53. 1951; J. W. Parham, Pl. Fiji Isl. 55. 1964, ed. 2. 87. 1972.

A tree, indicated by the collector to have "yellow fluffy flowers."

TYPIFICATION: The type is *im Thurn 224* (K HOLOTYPE; ISOTYPE at BM; photo of holotype at US), collected March 30, 1906, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Known only from the type collection, obtained at an elevation of about 850 m. It is strange that this species has not been recollected, since the locality is often visited by botanists.

This species and the following three form a well-marked group, characterized by having the flower-subtending bracts and tepals obviously pilose and usually by comparatively large leaves and an increased number of stamens.

10. *Litsea burckelloides* A. C. Sm. in J. Arnold Arb. 32: 53. 1951; J. W. Parham, Pl. Fiji Isl. 55. 1964, ed. 2. 87. 1972.

Indicated by the collector as a large tree occurring in woods, but without other significant data.

TYPIFICATION: The type is *Horne 733* (GH HOLOTYPE; ISOTYPE at K; photo of holotype at BISH), collected in June, 1878, in the vicinity of Na Vasi, west of Suva, on Namuka Harbour, Rewa Province, Viti Levu. The locality, taken from the K sheet, was not stated in my original protologue.

DISTRIBUTION: Known only from the type collection; lack of additional material indicates that even the immediate vicinity of Suva requires more intensive botanical study.

11. *Litsea mellifera* A. C. Sm. in J. Arnold Arb. 32: 54. 1951; Yuncker in Bishop Mus. Bull. 220: 118. 1959; J. W. Parham, Pl. Fiji Isl. 57. 1964, ed. 2. 89. 1972.

FIGURE 45E & F.

Tetranthera enneadenia A. Gray ex Seem. Fl. Vit. 202, nom. nud. 1867.

A tree 10–35 m. high, with a trunk up to 1 m. or more in diameter, found in dense forest from near sea level to 850 m. elevation. The flower-subtending bracts are pale green, and the flowers are notably fragrant, the plant being visited by bees when at full anthesis. The tepals and stamens are white, becoming cream-white or yellowish, and the fruit is noted as red, although it doubtless darkens at full maturity. Flowers have been obtained between April and August and fruits in August and September.

TYPIFICATION: The type is *Smith 4393* (A HOLOTYPE; many ISOTYPES), collected May 14, 1947, on the slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, Mba Province, Viti Levu.

DISTRIBUTION: Fiji (known from Viti Levu, Ovalau, Vanua Levu, and Taveuni) and Tonga ('Eua).

LOCAL NAMES AND USE: Apparently well-known to Fijian and other foresters, this species has been recorded as *vurutomoko*, *linchi lailai*, *kasinga*, *yavuwei*, and *ndoindamu*. It is noted as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1301*; Mt. Evans Range, *Greenwood 1269*; slopes of escarpment north of Nandarivatu, *Smith 6290*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 830*; southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4576*. NAMOSI: Wainambua Creek, *DA 14214*; vicinity of Namosi, *Horne 777*. RA: Near Wainimbuka, vicinity of Nasukamai, *Gillespie 4692.4*; Tuvavatu, vicinity of Rewasa, near Vaileka, *Degener 15369*. NAITASIRE: Rarandawai, Wainamo-Wainisavulevu divide, Wainimala Valley, *St. John 18261, 18274A*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7177*. OVALAU: U. S. Expl. Exped. (source of the name *Tetranthera enneadenia*, GH, US 40457); hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7510*. VANUA LEVU: MBUA: Mbua Bay, U. S. Expl. Exped.; lower Wainunu River Valley, *Smith 1737*. MATHUATA: Nasavu River Valley (Ndongotuki Tikina), *Howard 135*. TAVEUNI: Slope above Waiyevo, *Gillespie 4735*. FIJI without further locality, *DA 3913*.

This striking and reasonably abundant tree, recognized as distinct but undescribed by Gray, is one of the most easily distinguished of the Fijian *Litseeae* and the only one not strictly endemic.

12. *Litsea alleniana* A. C. Sm. in *J. Arnold Arb.* **32**: 56. 1951; J. W. Parham, *Pl. Fiji Isl.* 55. 1964, ed. 2. 87. 1972.

A tree 12 m. high, occurring in dense ridge forest and thickets at elevations of 1,165–1,195 m. The only known collection, flowering in May, was noted as having white filaments.

TYPIFICATION: The type is *Smith 4232* (A HOLOTYPE; many ISOTYPES), collected May 2, 1947, on the summit of Mt. Koroyanitu, high point of Mt. Evans Range, Mba Province, Viti Levu.

DISTRIBUTION: Known only from the type collection.

13. *Litsea mathuataensis* A. C. Sm. in *J. Arnold Arb.* **32**: 56. 1951; J. W. Parham, *Pl. Fiji Isl.* 55. 1964, ed. 2. 87. 1972.

A small tree about 6 m. high, known definitely only from open forest at elevations of 100–350 m. The available collections are all in fruit but the only dated one is the type, obtained in October.

TYPIFICATION: The type is *Smith 6364* (A HOLOTYPE; many ISOTYPES), collected Oct. 27, 1947, on the southern slopes of Mt. Numbuloa, east of Lambasa, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji; the known collections other than the type are without locality data.

AVAILABLE COLLECTIONS: FIJI without further locality, *Horne s. n.*, *Yeoward 8*.

I ventured to describe this taxon in the absence of flowers because it clearly differs from the other known Fijian *Litseae*; its closest allies are probably *L. richii* and *L. vitiana*, but it differs from both in the indument of its leaves and branchlets and additionally from each in details of leaf and infructescence dimensions.

INADEQUATELY KNOWN TAXON

- Litsea ovalauensis* Kostermans in *Reinwardtia* **7**: 507. 1969; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 89. 1972; A. C. Sm. in *Allertonia* **1**: 357. 1978.

TYPIFICATION: The holotype is *U. S. Expl. Exped.* (us 653980), collected in 1840 on Ovalau without other data.

The holotype consists of a sterile branchlet bearing four leaves and apparently was taken from a sucker shoot; its foliage may therefore not be typical of that of a mature plant. Conceivably the specimen represents the juvenile stage of either *Litsea mellifera* or *Endiandra trichotosa*, but of course it may indeed represent an otherwise unknown species of either genus.

FAMILY 55. CASSYTHACEAE

CASSYTHACEAE Bartling ex Lindl. *Nixus Pl.* 15, as *Cassytheae*. 1833.

Parasitic or partly autotrophic twiners, without true leaves, with small haustoria, the stems filiform, chlorophylligerous, the leaves reduced to minute scales; inflorescence indefinite (i. e. axis not terminating in a flower), usually spicate or racemose, flowers ♂, basically as in Lauraceae, borne singly in axils of minute bracts, 2-bracteolate under the perianth, the perianth tube shallow but enlarging to envelop the fruit, the tepals 6, dissimilar, the 3 outer ones the smaller and bractlike; fertile stamens 9, those of the 2 outer whorls eglandular and with introrsely dehiscent 2-celled anthers, those of the third whorl flanked by glands and with extrorsely dehiscent anthers, the staminodes (of the innermost whorl) distinct, sessile or stipitate; gynoecium as in

Lauraceae but the stigma small, obtuse or capitellate; fruit drupaceous, with a hard endocarp, completely included in a succulent cupule formed by the accrescent perianth tube, this with a small apical orifice, the perianth lobes persistent; seed with a membranous or coriaceous testa.

DISTRIBUTION: Composed of a single paleotropical genus (but *Cassytha filiformis* is pantropical) with perhaps 15–20 species, and with a principal center of diversity in Australia. Only *C. filiformis* is widespread in the Pacific.

USEFUL TREATMENTS OF FAMILY: In all the treatments listed above under Lauraceae, *Cassytha* is included. The genus is usually treated as a subfamily of Lauraceae, but its habit and various minor characters seem of familial consequence.

1. *CASSYTHA* L. Sp. Pl. 35. 1753; Seem. Fl. Vit. 203. 1867.

Characters and distribution of the family.

TYPE SPECIES: *Cassytha filiformis* L., Linnaeus's only original species.

USEFUL TREATMENT OF GENUS: Okada, H., & R. Tanaka. Karyological studies in some species of Lauraceae. *Taxon* 24: 271–280. 1975. (Much of this paper is devoted to a chromosomal study of *Cassytha*, indicating substantial differences between that genus and those of the Lauraceae proper.)

1. *Cassytha filiformis* L. Sp. Pl. 35. 1753; Seem. in *Bonplandia* 9: 258. 1861, Viti, 440. 1862; Meisn. in DC. Prodr. 15 (1): 255. 1864; Seem. Fl. Vit. 203. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 279. 1892; Christophersen in Bishop Mus. Bull. 128: 92. 1935; Yuncker in op. cit. 178: 55. 1943; Greenwood in Proc. Linn. Soc. 154: 103. 1943; A. C. Sm. in J. Arnold Arb. 32: 57. 1951; Yuncker in Bishop Mus. Bull. 220: 119. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 35. 1959, Pl. Fiji Isl. 51. 1964, ed. 2. 83. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 105. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 323. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 42. 1972.

In Fiji *Cassytha filiformis* is a vine scrambling over trees and shrubs or sprawling on the upper parts of beaches and in other open places. It is found at elevations from sea level to 350 m., most often in beach thickets, on dry river banks and hillsides, along roadsides, and on the edges of forest. The tepals are white and the fruit is at first green, becoming yellow and at length white. Flowers and fruits occur throughout the year.

TYPIFICATION: Linnaeus cited several prior references and indicated: "*Habitat in India.*" I have not noted a lectotypification.

DISTRIBUTION: Cosmopolitan in tropical areas; it occurs abundantly in most Pacific archipelagoes. I have studied 34 Fijian collections.

LOCAL NAMES AND USE: This well-known species in Fiji is known as *wa urulangi* or *wa uruilangi*, *walukumailangi*, *wailutumailangi*, *waverelangi*, *walawala*, *walutumailangi*, *mbuwawalawala*, *ndrendruma*, and *fatai*. Medicinal value is ascribed to the plant, often unspecified; in the Yasawas a solution made from the plant is taken after childbirth to expel the afterbirth.

REPRESENTATIVE COLLECTIONS: YASAWAS: NATHULA: Naisililisi Village, *Weiner* 235. WAYA: Wailevu Creek, *St. John* 18097. MAMANUTHAS: NGGALITO Island, Malolo Group, *O. & I. Degener* 32212. VITI LEVU: Mba: Lautoka, *Greenwood* 353; shores of Mba River near its mouth, *Smith* 4743. NANDRONGA & NAVOSA: Singtoka, *DA* 3725. SERUA: Vicinity of Ngaloa, *Degener* 15090; Ndeumba Beach, *DA* 16578. RA: Rakiraki, *DA* 3726. TAILEVU: Matavatathou, *DA* 10020. REWA: Suva Point, *Tohill* 661. KORO: East coast, *Smith* 1036. VANUA LEVU: MBUA: Mbua Bay, *U. S. Expl. Exped.* MATHUATA: Road to Malau, east of Lambasa, *DA* 10504; southern slopes of Mt. Numbuiloa, *Smith* 6433. THAKAUNDROVE: Nasinu, Natewa Bay, *DA* 16843. WAILANGILALA: *Tohill* 678. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones* 1005. NAYAU: *Tohill* 679. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones* 776. KAMBARA: *Moore* 26. FULANGA: On limestone formation, *Smith* 1211. ONGEA NDIRIKI: *Bryan* 407. FIJI without further locality, *Seemann* 373.

FAMILY 56. GYROCARPACEAE

GYROCARPACEAE Dumort. Anal. Fam. Pl. 13, 14, as *Gyrocarpeae*. 1829.

Trees, shrubs, or lianas, monoecious or polygamous, with cystoliths in leaves and axis; leaves alternate, without stipules, the blades entire to palmately 5-lobed, often tomentose or otherwise pubescent; inflorescences axillary or terminal, paniculate, corymbose, or cymose, usually ebracteate; flowers ♂ or unisexual, epigynous; perianth segments (tepals) 4-8 in a single verticil, sometimes unequal, sometimes variously fused; staminodes fewer than stamens or absent; stamens fewer than tepals, the anthers bilocular, dehiscent by lateral valves opening upwardly; pollen grains inaperturate, subglobose, tectate; ovary inferior, unilocular, with a single, pendulous, anatropous ovule, the style terete, the stigma capitate; fruit drupaceous, ovoid to fusiform, indehiscent, unwinged or with 2 elongate, spatulate, terminal wings, the endosperm none, the cotyledons leafy, contortuplicate, broad, emarginate at base.

DISTRIBUTION: A family of two genera and about 16-22 species. One genus (*Gyrocarpus*) is tricentric-tropical, while the second (*Sparattanthelium*) occurs only in tropical America.

USEFUL TREATMENTS OF FAMILY: Shutts, C. F. Wood anatomy of Hernandiaceae and Gyrocarpaceae. Trop. Woods 113: 85-123. 1960. Kubitzki, K. Monographie der Hernandiaceen. Bot. Jahrb. 89: 78-209. 1969.

1. *GYROCARPUS* Jacq. Select. Stirp. Amer. 282. 1763; Seem. Fl. Vit. 94. 1866; Shutts in Trop. Woods 113: 92. 1960; Hutchinson, Gen. Fl. Pl. 1: 145. 1964; Kubitzki in Bot. Jahrb. 89: 181. 1969.

Monoecious or polygamous trees (rarely shrubs); leaves often crowded toward apices of branchlets, long-petiolate, the blades simple or palmately 3- or 5-lobed, usually with pedate venation; inflorescences sometimes precocious, paniculiform with the flowers in corymbs or cymes, usually bearing abundant ♂ flowers toward ends of inflorescence branches and comparatively few ♀ or ♂ flowers in lower portions of inflorescence; tepals often 7 but sometimes 4-8, small, the 2 lateral ones of ♀ or ♂ flowers with basal meristem that enlarges after anthesis into the wings of the fruit; ♂ flowers short-pedicellate, with or without clavate staminodes, with 3-5 long-exserted stamens, the filaments sometimes bearing dorsal glands, the anthers short, rounded at apex, the style rudimentary or none; ♀ or ♂ flowers with longer pedicels than ♂, usually with staminodes, with or without 3-5 functional stamens, the ovary narrowed toward base; infructescences slender, at length pendulous, the drupes ovoid or ellipsoid, with 2 apical, elongate, spatulate, thick-membranaceous wings usually 3-5 times longer than drupe.

TYPE SPECIES: *Gyrocarpus americanus* Jacq., the only original species.

DISTRIBUTION: Pantropical and sometimes considered to have about seven species, but these are combined into three species by Kubitzki. Only one species occurs in Fiji.

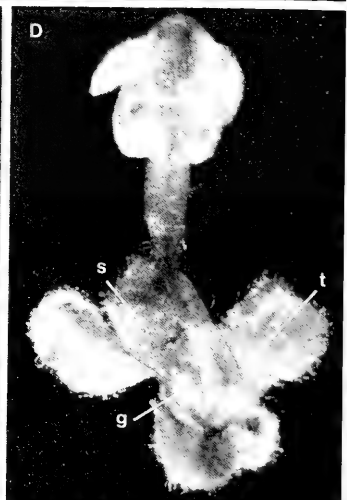
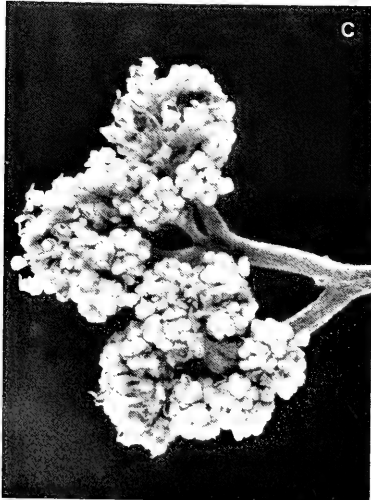
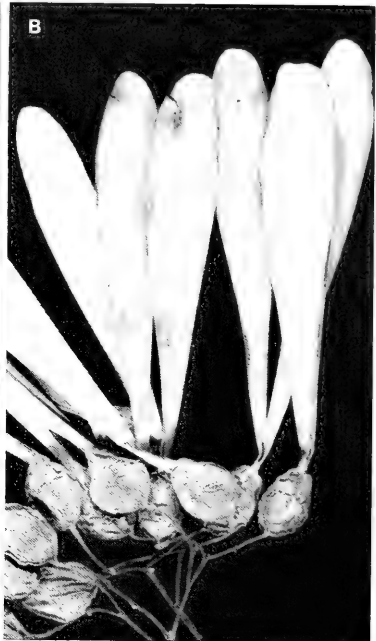
1. *Gyrocarpus americanus* Jacq. subsp. *americanus*; Kubitzki in Bot. Jahrb. 89: 183. fig. 45. 1969. FIGURE 46.

Gyrocarpus americanus Jacq. Select. Stirp. Amer. 282. t. 178, fig. 80. 1763; Drake, Ill. Fl. Ins. Mar. Pac. 167. 1890; Guillaumin in J. Arnold Arb. 14: 57. 1933; Christophersen in Bishop Mus. Bull. 128: 92. 1935; Yuncker in op. cit. 184: 39. 1945, in op. cit. 220: 120. 1959; J. W. Parham, Pl. Fiji Isl. ed. 2. 90. 1972.

Gyrocarpus jacquini Gaertn. Fruct. Sem. Pl. 2: 92. t. 97, fig. 3, nom. illeg. 1790; Seem. Fl. Vit. 95. 1866; J. W. Parham, Pl. Fiji Isl. 58. 1964.

Gyrocarpus asiaticus Willd. Sp. Pl. 4: 982. 1806; Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862.

As it occurs in Fiji, *Gyrocarpus americanus* subsp. *americanus* is a tree 8-18 m. high, with a trunk to 80 cm. in diameter, occurring at elevations from near sea level to about 300 m., along arid coasts, often near beaches, and in lowland woods. From the



limited number of available collections, it seems to bear flowers mostly between April and July and fruits between July and January, often being leafless when in fruit.

TIPIFICATION AND NOMENCLATURE: The holotype of *Gyrocarpus americanus* is a Jacquin specimen (BM) from Cartagena, Colombia. *Gyrocarpus jacquini* is a renaming of this and hence is illegitimate. *Gyrocarpus asiaticus* is typified by *G. jacquini* sensu Roxb. Pl. Coromandel 1: 1. t. 1. 1795 (non Gaertn.).

DISTRIBUTION: Kubitzki divides *Gyrocarpus americanus* into eight subspecies, all of which are comparatively limited in distribution except subsp. *americanus*, which occurs from eastern Africa through southeastern Asia, Malesia, and northeastern Australia into the southern Pacific to the Society Islands, as well as in tropical America. In parts of Australia and Africa, as well as in Madagascar, subsp. *americanus* is replaced by other subspecies. In Fiji the taxon is often common near beaches, its abundance not being reflected by the comparatively few known collections.

LOCAL NAMES AND USE: *Wiriwiri* is the commonly used local name; other recorded names are *toto* or *toutou* (Yasawas) and *mandora* (Mba). An extract of the bark is said to be widely used as a medicine in Fiji, but its more specific value is not indicated. The wood is reported to be soft and useless.

AVAILABLE COLLECTIONS: YASAWAS: YANGGETA: *Weiner* 247. WAYA: Nangua, *St. John* 18110; Nakawa Gulch, west side of Mbatinaremba, *St. John* 18151. VITI LEVU: MBA: Lautoka, *Greenwood* 263; Korovou, near Nandi, *Degener* 15329; Thelau, west of Mba, *O. & I. Degener* 32149; Walu Creek, Naloto Range, *DA* 14779. VITI LEVU without further locality, *Parks* 20855. KORO: *Tothill* 186. VANUA LEVU: "Lee shores," *Seemann s. n.* MBUA: Above Mbanikea Village on track to Kavula, *Berry* 58. THAKAUNDOVE: Maravu, near Salt Lake, *Degener & Ordonez* 14186. TAVEUNI: Vicinity of Somosomo, *Seemann* 561. TOTOYA: *Mulne* 90. FIJI without further locality, *U. S. Expl. Exped., Horne* 1054.

ORDER NYMPHAEALES

The Nymphaeales have long been considered correctly placed in the "ranalean complex," although they seem to be an ancient group differing from the terrestrial Magnoliidae in their strictly aquatic, freshwater habit and their lack of ethereal oil cells and cambium. However, in the basic structure of their stamens, their uniaperturate-derived pollen (except in Nelumbonaceae, which seem better referred to the subclass Ranunculidae), their laminar placentation, and their lack of vessels, they would be out of place in any subclass except Magnoliidae. Perhaps the eventual solution will be to elevate the order to a separate subclass, the Nymphaeidae, as suggested by Walker (1976, cited above under the class Dicotyledones, p. 251). The Nymphaeales, as presently construed, may be considered as composed of five families.

USEFUL TREATMENTS OF ORDER: LI, H.-L. Classification and phylogeny of Nymphaeaceae and allied families. *Amer. Midl. Nat.* 54: 33-41. 1955. MOSELEY, M. F., JR. Morphological studies of the Nymphaeaceae—I. The nature of the stamens. *Phytomorphology* 8: 1-29. 1958.

FIGURE 46. *Gyrocarpus americanus* subsp. *americanus*; A, tip of branchlet and foliage, $\times 12$; B, distal portion of infructescence and mature fruits, $\times 1$; C, distal portion of inflorescence with σ flowers, $\times 4$; D, stamen, showing a filament gland (g), a clavate staminode (s), and associated tepals (t), $\times 30$; A from *O. & I. Degener* 32149; B from *DA* 14779; C & D from *Degener* 15321.

KEY TO FAMILIES OCCURRING IN FIJI

- Plants with roots; leaves long-petiolate, arising from rhizome, the blades simple, with a basal sinus; flowers hermaphrodite, borne on long peduncles arising from rhizome; perianth present, often showy; pollen grains zonosulcate; carpels 3-many, the ovules numerous, laminar, anatropous. 57. NYMPHAEACEAE
- Plants without roots, with leafy floating branches; leaves verticillate at nodes of branches, the blades dichotomously dissected; flowers unisexual, each in the axil of 1 leaf in a whorl; perianth lacking, replaced by a thin-herbaceous involucre; pollen grains inaperturate; ovary unicarpellate, the ovule solitary, orthotropous. 58. CERATOPHYLLACEAE

FAMILY 57. NYMPHAEACEAE

NYMPHAEACEAE Salisb. in *Ann. Bot. (König & Sims)* 2: 70, as *Nymphaeaeae*. 1805.

Perennial, aquatic, freshwater, acaulescent herbs, the rhizome cylindrical or oblong, thick, horizontal or erect; leaves long-petiolate, alternate, arising from rhizome, the blades with a basal sinus, not peltate; flowers ♂, actinomorphic, solitary, axillary, borne on long peduncles arising from rhizome; sepals 4-6 or more, free or nearly so; petals numerous (small in *Nuphar*, lacking in *Ondinea*), in many series, hypogynous or perigynous, variously adnate to ovary; stamens numerous, sometimes transitional toward petals, the anthers introrse or latrorse, opening longitudinally; pollen grains zonosulcate, tectate; ovary compound, composed of 3-35 united or partially united carpels, the ovules numerous, laminar, anatropous, pendulous from sides of ovary locules, the stigmas united into a disk with radiating rays; fruit a many-seeded, spongy berry, dehiscing by swelling of mucilage surrounding seeds, the seeds with endosperm and abundant perisperm.

DISTRIBUTION: In the limited sense (excluding Euryalaceae, Barclayaceae, and Cabombaceae), the cosmopolitan Nymphaeaceae are composed of three genera and about 55-70 species. The family is sometimes taken in a very comprehensive sense, even to include such a distinct genus as *Nelumbo*, which would seem better placed in its own order and removed from the subclass Magnoliidae. The Nymphaeaceae are represented in Fiji only by a cultivated and sometimes naturalized species of *Nymphaea*.

1. NYMPHAEA L. *Sp. Pl.* 510. 1753, emend. Sm. in *Sibthorp & Sm. Fl. Graecae Prodr.* 1: 360. 1809. *Nom. cons.*

Characters of the family; leaves and flowers floating on surface of water or flowers raised above water level, the perianth wide-spreading; sepals 4, hypogynous, nearly free; petals showy, variously colored, with the stamens inserted on outer surface of receptacle, the anthers introrse; gynoecium apocarpous or syncarpous, the carpels adnate to a central prolongation of the floral axis, sunk in the cupuliform receptacle, their upper surfaces stigmatic, prolonged into slender, incurved projections (carpellary styles); seeds hard, operculate, arillate.

TYPE SPECIES: *Nymphaea alba* L., one of Linnaeus's four original species. *Typ. cons.*

DISTRIBUTION: A genus of wide tropical and temperate occurrence, with 35-50 species, many of which have numerous forms and are extensively cultivated. It is very probable that different species are in cultivation in private gardens in Fiji, but only one is documented by reports and herbarium vouchers.

USEFUL TREATMENT OF GENUS: Conard, H. S. *The waterlilies; a monograph of the genus Nymphaea*. Carnegie Inst. Wash. Publ. 4: i-xiv. 1-279. 1905 (a freely illustrated classical treatment).

1. *Nymphaea capensis* Thunb. Prodr. Pl. Cap. 92. 1800.

Conard, in his 1905 revision of *Nymphaea*, recognizes three varieties of *N. capensis* (including the typical variety, which is not named as such); the species is said to sport freely and to hybridize with other species in cultivation.

DISTRIBUTION: The species as a whole occurs in southern and eastern Africa and Madagascar; it is likely that specimens from Madagascar are referable to one of the nontypical varieties.

USE: Like many others of the genus, this beautiful species is widely cultivated and often becomes naturalized. In the Pacific it has been noted in Tahiti and Hawaii as well as in Fiji, but it probably also occurs in other archipelagoes.

KEY TO FORMS RECORDED IN FIJI

Petals caeruleus above, proximally paler to nearly white, yellowish at base. 1a. f. *capensis*
 Petals pink or reddish. 1b. f. *rosea*

1a. *Nymphaea capensis* Thunb. f. *capensis*.

Nymphaea capensis Thunb. Prodr. Pl. Cap. 92. 1800; Conard in Carnegie Inst. Wash. Publ. 4: 153. pl. X; fig. 60. 1905; Greenwood in J. Arnold Arb. 36: 397. 1955.

Nymphaea capensis Thunb. var. *capensis*; J. W. Parham, Pl. Fiji Isl. 217. 1964, ed. 2. 303. 1972.

Cultivated in Fijian gardens and locally abundantly naturalized in roadside ditches, etc. This aquatic herb is found in water 0.5–1 m. deep; it has floating leaves and flowers borne on stalks above the water level. The leaf blades are coarsely but inconspicuously sinuate-dentate. The petals are rich blue, somewhat paler proximally; the stamens are blue distally and dull yellow toward base.

TIPIFICATION: Conard in 1905 implied the type to be *Burman 491*, from South Africa, deposited in the Delessert herbarium at G. However, it would seem just as likely that the actual holotype is in the Thunberg herbarium at UPS.

LOCAL NAMES: *Blue water lily*, *Cape blue water lily*, or simply *water lily*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Malika Creek, near lower Sambeto River, *Greenwood 1306*. NAMOSI: In ditches along Queen's Road west of Melimeli, *DA 16813*.

1b. *Nymphaea capensis* f. *rosea* Hort. ex Conard in Carnegie Inst. Wash. Publ. 4: 161. 1905.

Nymphaea capensis var. *rosea* Hort.; Greenwood in J. Arnold Arb. 36: 398. 1955; J. W. Parham, Pl. Fiji Isl. 217. 1964, ed. 2. 303. 1972.

A form with pink or reddish petals, which Conard indicated as a sport of *Nymphaea capensis* var. *zanzibariensis* (Caspary) Conard (in op. cit. 4: 157. pl. XI; fig. 61. 1905). Conard states that the form was first published as "*Nymphaea zanzibariensis* fl. rubro" by Siber in Wittmack's *Gartenzeitung* 36: 83. pl. 1240. 1887.

DISTRIBUTION: The pink-flowered form appears to occur here and there in cultivation and has been naturalized near Nandi for at least 25 years.

LOCAL NAMES: *Pink water lily*, *pink-flowered water lily*, or simply *water lily*.

AVAILABLE COLLECTION: VITI LEVU: MBA: Swamps near Nandi, *Greenwood 1307*.

FAMILY 58. CERATOPHYLLACEAE

CERATOPHYLLACEAE S. F. Gray, Nat. Arr. Brit. Pl. 2: 395, 554, as *Ceratophyllae*. 1821.

Aquatic, freshwater, submerged, monoecious herbs, with leafy floating branches, lacking roots, stipulate; leaves verticillate, 6–10 at a node, the blades dichotomously dissected, the segments threadlike or linear; flowers usually solitary, each in the axil of

1 leaf in a whorl, actinomorphic, minute, the ♂ and ♀ flowers occurring at separate nodes, lacking a perianth, this replaced by a thin-herbaceous involucre (sometimes interpreted as a calyx) of 8–15 subvalvate segments, these dentate or lacerate at apex; ♂ flowers with 10–20 stamens spirally arranged on a flat receptacle, the anthers subsessile, erect, linear-oblong, with 2 parallel, lengthwise dehiscent locules, the connective produced beyond locules; pollen grains inaperturate, tectate, psilate; pollination subaquatic, the anthers detaching and floating upward, discharging pollen at surface; ♀ flowers without staminodes, the ovary superior, sessile, ovoid, unicarpellate, the ovule solitary, pendulous, orthotropous, the style filiform, oblique; fruit an achene tipped by the indurated, persistent style, ovoid or ellipsoid, the seed pendulous, the endosperm lacking or scanty, the embryo large.

DISTRIBUTION: Cosmopolitan, with a single genus variously interpreted as composed of 3–10 species.

1. *Ceratophyllum* L. Sp. Pl. 992. 1753; Seem. Fl. Vit. 258. 1868.

Characters and distribution of the family.

TYPE SPECIES: *Ceratophyllum demersum* L., the only original species.

The species of *Ceratophyllum* are readily dispersed by water birds carrying broken bits of stem on their feathers.

1. *Ceratophyllum demersum* L. Sp. Pl. 992. 1753; Seem. in Bonplandia 9: 258. 1861, Viti, 441. 1862, Fl. Vit. 258. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 304. 1892; Greenwood in Proc. Linn. Soc. 154: 104. 1943; J. W. Parham, Pl. Fiji Isl. 217. 1964, ed. 2. 303. 1972.

As it occurs in Fiji, *Ceratophyllum demersum* is found near sea level in swamps and ponds, and also at the edges of fast-flowing streams and rivers, sometimes associated with *Potamogeton crispus*. The branches elongate to about 2 m., dying off behind as they grow forward.

TYPIFICATION: Linnaeus gives several prior references, but I have not noted a lectotypification. Since *Hortus Cliffortianus* is cited, a specimen in Clifford's Herbarium (BM) might be a suitable lectotype.

DISTRIBUTION: Essentially cosmopolitan, found indigenously in North and South America, Europe, Asia, Africa, and perhaps Australia. Malesian specimens are presumably indigenous. In the Pacific, distribution of the species is spotty; its occurrence in Hawaii is thought to be due to the escape of cultivated plants. I believe that it may well be indigenous in Fiji, where it was already established as early as 1860.

LOCAL NAMES AND USE: The only recorded Fijian name is *lumilumi* (used for mosses and algae); the common English name *hornwort* has not been noted. The species is often used as an aquarium plant, but this has not been noted in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Vunindilo Beach, Ndeumba, DA 3471. NAITASIRI: Koronivia, by the packing shed landing, DA 16611. TAILEVU: Wainivesi River, DA 16621; Waimbula River, DA 16624. REWA (?): In swamps along Rewa River, Aug. 1860, Seemann 386.

SUBCLASS RANUNCULIDAE

The Ranunculidae, composed of four orders and 23 families (cf. Smith, 1972, cited above under the Class Dicotyledones) seem well separated from the Magnoliidae. As a rule their representatives are predominantly herbaceous or secondarily woody, lack ethereal oil cells, and never have anasulcate or uniaperturate-derived pollen grains; their carpels and stamens demonstrate comparatively advanced states. A transitional

order of woody, terrestrial plants, Illiciales (not in the Pacific area east of western Malasia), possesses magnolioid spherical idioblasts but has tricolpate or hexacolpate pollen grains. The Ranunculidae are represented in Fiji by only three species in three families, two of the species being indigenous.

KEY TO ORDERS OCCURRING IN FIJI

Gynoecium mostly with separate carpels or unicarpellate; sepals usually more than 2.

RANUNCULALES (FAMILIES 59, 60)

Gynoecium syncarpous; placentation parietal; sepals usually 2, occasionally 3. PAPAVERALES (FAMILY 61)

ORDER RANUNCULALES

KEY TO FAMILIES OCCURRING IN FIJI

Flowers unisexual; plants usually woody vines; leaves (in our representative) simple; stamens few (6 in our representative) and opposite petals, the anthers in our species transversely dehiscent; endosperm sometimes scanty or lacking, the embryo large, often curved. 59. MENISPERMACEAE

Flowers usually ♂ (but in our species unisexual); plants often herbaceous or shrubby (but ours a woody vine); leaves (in our representative) usually trifoliolate; stamens numerous, the anthers dehiscent by longitudinal slits; endosperm well developed, the embryo small, straight. . . . 60. RANUNCULACEAE

FAMILY 59. MENISPERMACEAE

MENISPERMACEAE Juss. Gen. Pl. 284, as *Menisperma*. 1789.

Usually dioecious twining vines or lianas, less often shrubs or small trees, rarely herbs, lacking stipules; leaves alternate, usually simple, sometimes trifoliolate, often palmately nerved; inflorescence axillary or borne on older wood, racemose, cymose, paniculate, or fasciculate, or rarely with solitary flowers; flowers small, actinomorphic, rarely slightly zygomorphic, usually with imbricate sepals in 1-4 series, the outer ones the smaller; petals usually smaller than sepals, often 3 or 6, often minute, sometimes absent, usually free; ♂ flowers usually with 3 or 6 stamens opposite petals, the stamens sometimes numerous, free or variously united, the anthers short, longitudinally or sometimes transversely dehiscent; pistillodes present or absent; ♀ flowers with or without staminodes, the carpels usually 3 or 6, rarely 1 or many, free, sessile or stipitate, the ovules 2, soon reduced to 1 by abortion, attached to ventral suture, pendulous, semianatropous, the stigma terminal, entire or lobed; fruits composed of free drupelets, these sessile or stipitate, the styler scar subterminal or near base due to excentric growth, the endocarp often bony and sculptured, the seed often curved, with uniform or ruminant endosperm or without endosperm, the embryo often curved.

DISTRIBUTION: Pantropical and warm temperate, with about 65 genera and 350 species. A single genus is known to occur in Fiji. A second genus, *Stephania*, is curiously absent, as far as known, but should be anticipated. *Stephania forsteri* (DC.) A. Gray occurs in the Solomons, New Caledonia, the New Hebrides, Tonga, Samoa, the Societies, and the Marquesas; the species is sometimes referred to *S. japonica* var. *timoriensis* (DC.) Forman.

USEFUL TREATMENT OF FAMILY: Diels, L. *Menispermaceae*. *Pflanzenr.* 46 (IV. 94): 1-345. 1910.

1. PACHYGONE Miers in *Ann. Mag. Nat. Hist.* II. 7: 37, 43. 1851; Miers ex Hook. f. & Thoms. *Fl. Ind.* 202. 1855; Diels in *Pflanzenr.* 46 (IV. 94): 241. 1910; A. C. Sm. in *J. Arnold Arb.* 36: 277. 1955; Forman in *Kew Bull.* 12: 457. 1958.

Woody climbers with petiolate leaves, the leaf blade ovate to ovate-oblong, 3- or 5-nerved from base, sometimes with an indument of unicellular hairs; inflorescences axillary or borne on stems, racemose or paniculate; flowers with 6-12 sepals, the inner ones the larger, imbricate; petals 6, auriculate toward base; ♂ flowers with 6 stamens,

the filaments free, the anthers transversely dehiscent, the pistillodes 3, minute; ♀ flowers with 6 minute staminodes and 3 glabrous carpels, the style reflexed, the stigma entire; drupelets subcompressed-obovoid, with the styler scar near base, the endocarp with lateral, elongate depressions, the seed curved, lacking endosperm, the cotyledons broad, thick.

TYPE SPECIES: There seems to be disagreement as to the first publication of *Pachygone*. Diels (1910, cited above) takes Miers's 1851 publication as valid, with *P. plukenetii* (DC.) Miers as the type species; this seems acceptable, since a few differentiating characters are mentioned in Miers's key (p. 37) and he designates *Cocculus plukenetii* DC. as the type species (p. 43). Forman (1958, cited above) considers the genus to date from 1855, with *P. ovata* (Poir.) Hook f. & Thoms. as the type species. Both authors consider *P. plukenetii* a synonym of *P. ovata*.

DISTRIBUTION: Eleven or twelve species in China, southeastern Asia, Malasia, northern Australia, New Caledonia, Fiji, and Tonga. As the Fijian species is now known to occur in Tonga, my 1955 indication of the termination of the generic range in Fiji is seen to be inaccurate.

1. *Pachygone vitiensis* Diels in Pflanzenz. 46 (IV. 94): 244. 1910; A. C. Sm. in Bishop Mus. Bull. 141: 73. 1936, in J. Arnold Arb. 36: 277. 1955; J. W. Parham, Pl. Fiji Isl. 217. 1964, ed. 2. 303. 1972.

FIGURE 47A-C.

This infrequent species occurs from near sea level to about 300 m. elevation as a liana climbing over rocks (and doubtless on vegetation) in forest. The sepals and petals are pale green. The original collections were in fruit, and the only dated collection in flower, described in my 1936 note cited above, was obtained in March.

TIPIFICATION: The type is *Graeffe 1382* (κ HOLOTYPE), collected on the island of Oneata, presumably in 1864. I indicate the κ specimen as the holotype because it bears Diels's annotation and he did not designate a depository.

DISTRIBUTION: Fiji and Tonga. In the first archipelago the species is known from only five collections, all from different islands. The Tongan collections are recent, having been obtained on 'Eua and Vava'u by W. R. Sykes and G. P. Buelow.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Tholo-i-suva, DA 83. VANUA LEVU: MATHUATA: Southern slopes of Mt. Numbuiloa, east of Lambasa, Smith 6379. KANATHEA: *Graeffe 1545*. KAMBARA: On limestone formation, Smith 1294.

As to the number of floral parts, my discussion of 1936 was inaccurate. The flowers have (at least usually) three narrow outer sepals, six inner sepals, and six small petals each clasping a stamen (FIGURE 47B & C).

FAMILY 60. RANUNCULACEAE

RANUNCULACEAE Juss. Gen. Pl. 231. 1789.

Perennial or annual herbs or shrubs or climbers, without stipules; leaves radical, alternate, or opposite, often compound; inflorescence paniculate or cymose or the flowers solitary; flowers ♂ or unisexual, actinomorphic, the receptacle often globular or elongated, the perianth often colored; sepals 3-8, imbricate to valvate, sometimes petaloid; petals few to many, hypogynous, free, often with a nectariferous claw, often showy but sometimes reduced or absent; stamens numerous and spirally arranged on receptacle, the filaments free, the anthers short, basifixed, extrorse, dehiscent by lengthwise slits; carpels usually many and spirally arranged, rarely only 1 or few, free, the ovule solitary, erect or pendulous, anatropous, the style often bifid or the stigma sometimes sessile; fruit a cluster of dry achenes, rarely berrylike, the seeds with copious endosperm and a small, straight embryo.

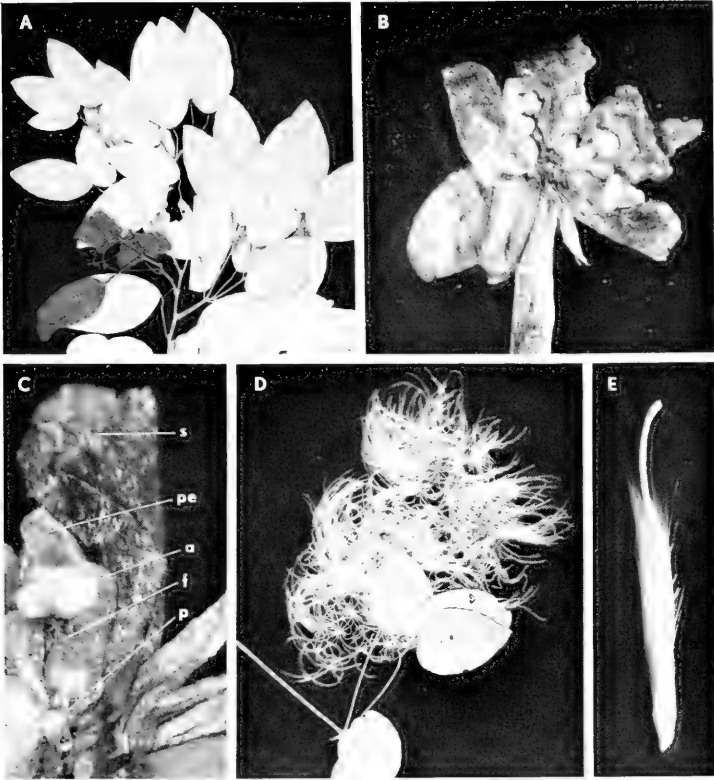


FIGURE 47. A-C, *Pachygone vitiensis*; A, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$; B, ♂ flower shedding pollen, with 1 stamen removed, showing 6 inner sepals and distal portions of 2 outer sepals, $\times 14$; C, stamen and opposed perianth parts, showing inner sepal (s), petal (pe) clasping stamen, anther (a) with transverse dehiscence, filament (f), and pistillode (p), $\times 36$. D & E, *Clematis pickeringii*; D, distal portion of stem, with a trifoliate leaf subtending an infructescence, $\times 1/4$; E, carpel, $\times 7$. A-C from Smith 1294, D from Smith 4965, E from DA 13953.

DISTRIBUTION: A cosmopolitan but predominantly Northern Hemisphere family, in the limited sense (as above described and excluding Helleboraceae and several very small families that sometimes are incorporated in Ranunculaceae) composed of about 24 genera and 500–1,000 species. Only the genus *Clematis* has been noted in Fiji.

1. CLEMATIS L. Sp. Pl. 543. 1753; Seem. Fl. Vit. 3. 1865; Kuntze in Verh. Bot. Vereins Prov. Brandenburg 26: 83. 1885; A. C. Sm. in J. Arnold Arb. 36: 277. 1955.

Perennial, usually woody climbers (rarely shrubs or herbs); leaves opposite, usually compound, sometimes simple, the petiole (and petiolules) often twining; flowers unisexual or ♂, usually in few-many-flowered cymose panicles; sepals 4-6 or rarely more, valvate, free, somewhat petaloid; petals absent; ♂ flowers with many stamens; ♀ flowers with staminodes, the carpels usually numerous, the ovule pendulous, the style filiform, persistent, usually pilose; fruit a cluster of sessile, laterally compressed achenes, each with a conspicuous, elongated, usually plumose and persistent style.

LECTOTYPE SPECIES: *Clematis vitalba* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2: 2: 121. 1913), one of Linnaeus's original nine species.

DISTRIBUTION: A cosmopolitan but mostly temperate genus of 200-250 species, occurring in Malesia and Australasia eastward to Fiji, where a single species terminates the generic range.

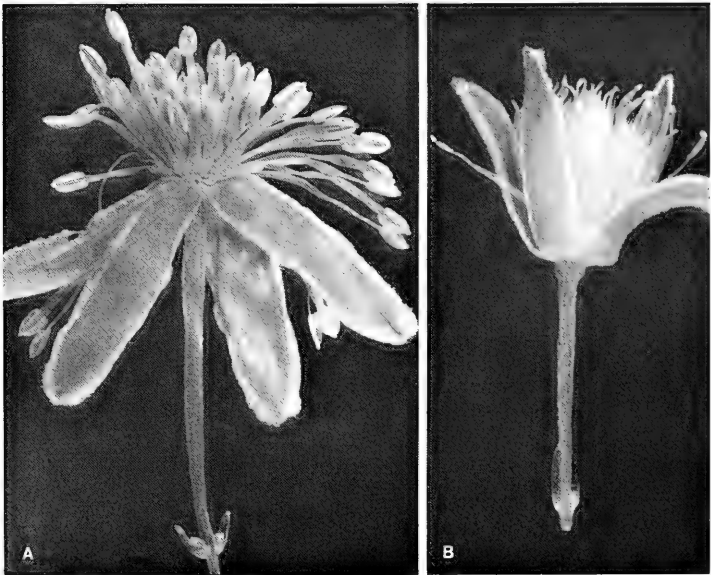


FIGURE 48. *Clematis pickeringii*; A, ♂ flower, $\times 3\frac{1}{2}$, from DA 15149; B, ♀ flower, $\times 3\frac{1}{2}$, from DA 13953.

1. *Clematis pickeringii* A. Gray, Bot. U. S. Expl. Exped. 1: 1. 1854; Seem. in Bonplandia 9: 253. 1861, Viti, 432. 1862, Fl. Vit. 3. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 103. 1889; Turrill in J. Linn. Soc. Bot. 43: 16. 1915; A. C. Sm. in J. Arnold Arb. 36: 277. 1955; J. W. Parham, Pl. Fiji Isl. 217. 1964, ed. 2. 303. 1972.

FIGURES 47D & E, 48.

Clematis aristata var. *pickeringii* Kuntze in Verh. Bot. Vereins Prov. Brandenburg 26: 156. 1885.

A woody vine and often a high-climbing liana, occurring at elevations from near sea level to 1,150 m. in dense or open forest, in crest thickets, or in patches of forest in open country. The inflorescence branches are often pale purplish and the sepals are white or cream-colored to yellowish. The filaments are white or creamy and the anthers pale yellow; the mature carpels have white or pale green, feathery styles. Flowers and fruits have been recorded as occurring in most months.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 247 HOLOTYPE), collected in 1840 on the island of Ovalau.

DISTRIBUTION: Fiji westward to the Solomon Islands and Queensland, and probably also in Malesia; Backer and Bakhuizen van den Brink (Fl. Java 1: 144. 1963) consider that it occurs as far west as Java. I have examined approximately 40 Fijian collections.

LOCAL NAMES: *Wa kamba* and *wa mila* are the usual names; *mbavola* has also been recorded in Mathuata Province.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 445*; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4518*; summit of Mt. Nanggaranambuluta, east of Nandari-vatu, *DA 13953*; ridge between Mt. Nanggaranambuluta and Mt. Namama, *Smith 4965*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *DF 1192*; Yawe, vicinity of Mbalo, near Vatukarasa, *Degener 15267*. SERUA: Vatutavathe, vicinity of Ngaloa, *Degener 15175*. NAITASIRI: Between Suva and Tholo-i-suva, *im Thurn 351*. OVALAU: Summit of Mt. Ndelaiovalau and adjacent ridge, *Smith 7566*. VANUA LEVU: MBUA: Koromba Forest, Wairiki, *DA 15149*. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6653*; Mt. Numbuloa, east of Lambasa, *DA 14647*. THAKAUNDRIVE: Mt. Kasi, Yanawai River region, *Smith 1800*; Maravu, near Salt Lake, *Degener & Ordonez 14243*. TAVEUNI: *Seemann 1* ("Vuna" on K sheet; "Vanua Levu" in Fl. Vit.).

Clematis pickeringii normally has trifoliate leaves, but simple leaves are occasionally found on the same plant as compound ones. Juvenile plants sometimes have the leaflets deeply trisected, each segment being pinnatifid. The four sepals are caducous after anthesis. The ♀ flowers bear 12–20 staminodes in a single whorl outside the numerous carpels (FIGURE 48B); the staminodes bear diminutive, sterile anthers and do not persist in mature ♀ flowers. The species as a rule is dioecious, but B. E. V. Parham (in Trans. Fijian Soc. 1922: 6. 1922) reports a *Clematis* with ♂ flowers from Mbua Province, Vanua Levu. This suggests that occasional individuals of *C. pickeringii* have ♀ flowers with developed stamens in place of staminodes, but such individuals seem rare and presumably are not worth nomenclatural recognition.

ORDER PAPAVERALES

The Papaverales are circumscribed to include one, two, or more families. Generally the Fumariaceae are separated from the Papaveraceae, but the order can as logically be divided into seven satisfactory families (cf. Smith, 1972, cited above under the class Dicotyledones). As described below, the Papaveraceae are equivalent to the subfamily Papaveroideae Ernst.

USEFUL TREATMENTS OF ORDER: Fedde, F. Papaveraceae. In Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 17b: 5–146. 1936. Ernst, W. R. The genera of Papaveraceae and Fumariaceae in the southeastern United States. J. Arnold Arb. 43: 315–343. 1962.

FAMILY 61. PAPAVERACEAE

PAPAVERACEAE Juss. Gen. Pl. 235. 1789.

Annual or perennial herbs (rarely woody), with latex, often pubescent with multicellular, multiserial hairs, without stipules; leaves rosulate and/or cauline, usually alternate; inflorescence terminal and determinate, 1-many-flowered, cymose or paniculiform; flowers ♂, usually hypogynous; perianth cyclic, usually 3-seriate; sepals 2 or 3, caducous at anthesis; petals usually twice as many as sepals, the outer series the larger and alternate with sepals; stamens usually numerous, the anthers basifixed, dehiscing by longitudinal, usually extrorse slits; gynoecium syncarpous, composed of 3-many carpels, the ovary unilocular, the placentation parietal, the ovules usually numerous, amphitropous; fruit a septicial capsule, basipetally and usually incompletely dehiscent, the valves as many as the persistent placentas; seeds usually many, with oily endosperm, the embryo small, straight or somewhat curved.

DISTRIBUTION: Eight genera with 130-160 species, predominantly of the Northern Hemisphere but also (*Papaver*) in Australia and southern Africa. The family is represented in Fiji by a single adventive species.

1. ARGEMONE L. Sp. Pl. 508. 1753; Fedde in Pflanzenr. **40** (IV. 104): 271. 1909; Ernst in J. Arnold Arb. **43**: 328. 1962.

Stout, prickly, usually annual herbs with yellow sap; leaves rosulate and cauline, the blades sessile and clasping or narrowed into a petiolelike base, pinnately veined and lobed, harshly prickly; inflorescence cymose, few-several-flowered; sepals usually cucullate and terminated by a sharp prickle; stamens numerous, the filaments narrow, the anthers narrowly oblong, apically revolute after anthesis; style short or obscure, the stigmas undulate with 3-7 lobes, the placentas as many as the stigmatic lobes; fruit usually with more than 3 valves, the seeds globose, reticulate.

LECTOTYPE SPECIES: *Argemone mexicana* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. **2**: 138. 1913), one of Linnaeus's three original species.

DISTRIBUTION: About 28 species in North America and the West Indies, often occupying disturbed habitats, and one presumably endemic species in Hawaii.

1. **Argemone mexicana** L. Sp. Pl. 508. 1753; Fedde in Pflanzenr. **40** (IV. 104): 273. fig. 36, B. 1909; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 37. 1959, Pl. Fiji Isl. 224. 1964, ed. 2. 311. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 144. 1970.

A prickly herb with a long taproot, 0.1-1 m. high, occasionally naturalized as a weed in sandy soil and in cane fields near sea level. The sepals are green and the petals bright yellow.

TYPIFICATION: Linnaeus lists several prior references, but I have not noted a lectotypification.

DISTRIBUTION: Probably native in Central America, the West Indies, and Florida, *Argemone mexicana* has become an essentially pantropical weed. Fedde in 1909 did not note its occurrence east of the Philippines and Australia, but it is now known from the Marianas, Fiji, Samoa, Niue, Hawaii, and doubtless other Pacific archipelagoes.

LOCAL NAME AND USE: *Mexican poppy*; it is probably a comparatively recent arrival in Fiji, where it is not yet a serious weed. It is reputed to be poisonous, but its prickly habit makes it unpalatable to stock.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Ndreketi Inlet, south of Lautoka, DA 9625, 10318, 11158. TAILEVU: Without further locality, DA 11177.

SUBCLASS HAMAMELIDIDAE

The comparatively small subclass Hamamelididae is considered by Takhtajan (1969) to be composed of 15 orders and 22 families, by Cronquist (1968) of nine orders and 23 families. Both of these authors and most other students of evolutionary trends in dicotyledons agree that some of the more primitive extant angiosperms are best placed toward the base of the Hamamelididae, providing links with magnolioid groups although not directly derived from them. These groups are the eastern Asiatic families Trochodendraceae, Tetracentraceae, Cercidiphyllaceae, and Eupteleaceae (placed in three orders by Takhtajan; cf. also Smith, 1972).

The Hamamelididae are characterized by strongly reduced, usually anemophilous flowers, often unisexual and with the perianth greatly reduced or lacking, and by triaperturate or triaperturate-derived pollen. In the most primitive members the xylem is vesselless. In the more advanced members the xylem is increasingly specialized and the flowers are often borne in catkins and have unilocular, indehiscent, and 1-seeded fruits. Three orders and six families of the subclass occur in Fiji; four of the families fall into the order Urticales, while two represent small and very isolated orders that are comparatively advanced (i. e. reduced) within the subclass.

KEY TO ORDERS OCCURRING IN FIJI

- Flowers not in spikes or simple racemes but usually otherwise clustered, often with a perianth (this reduced or sometimes lacking); ovary unilocular or rarely bilocular, the ovule solitary; plants woody or herbaceous; stipules usually present. URTICALES (FAMILIES 62-65)
- Flowers without a perianth or perianth reduced and composed of 1 or more minute teeth, these sometimes simulating bracteoles; ♂ flowers in simple or compound spikes or racemes, the ♀ flowers in heads or solitary; ovary 2- or 3-locular (sometimes becoming unilocular by abortion), the ovules 2 per locule (but only 1 maturing); plants woody, without stipules or these minute and inconspicuous.
- Leaves whorled, reduced to scale leaves; ♂ inflorescences simple or compound spikes, bearing at each node a cup formed of combined floriferous bracts, each flower subtended by 2 bracteoles and composed of 2 tepals and a solitary stamen; ♀ flowers and fruits borne in heads; gynoecium soon unilocular by abortion, with 1 fertile ovule often with multiple embryo sacs; fruit a terminally winged nut, the seed without endosperm. CASUARINALES (FAMILY 66)
- Leaves alternate or pseudovercillate, well developed; ♂ inflorescences spicate or racemose, each flower subtended by a single bract and with (1-) 3-6 or more stamens; ♀ flowers and fruits solitary; gynoecium imperfectly 2- or 3-locular, with 2 basal ovules in each locule, each ovule with a single embryo sac; fruit an acornlike drupe, the seeds with endosperm. BALANOPALES (FAMILY 67)

ORDER URTICALES

An order composed of five families, of which four occur in Fiji, three of them with indigenous genera and species. The relationships of the families have been greatly clarified through the several studies of E. J. H. Corner and Chew Wee-Lek.

USEFUL TREATMENTS OF ORDER: Chew Wee-Lek. *Florae Malesianae Precursores*—XXXIV. A revision of the genus *Poikilospermum* (Urticaceae). *Gard. Bull. Singapore* 20: 1-103. 1963 (especially: Systematic position of the Urticales, pp. 22-29). Berg, C. C. *Cecropiaceae* a new family of the Urticales. *Taxon* 27: 39-44. 1978.

KEY TO FAMILIES OCCURRING IN FIJI

- Ovule pendulous and anatropous or amphitropous or campylotropous; style usually bifid into stigmatic arms; seeds usually without or with scanty endosperm, the embryo straight or curved or involute.
- Plants without milky latex; stamens erect in bud.
- Trees or shrubs with hard wood; leaf blades simple; seeds usually lacking endosperm, the embryo straight or curved. 62. ULMACEAE
- Erect or scandent herbs with often fibrous stems; leaf blades often palmately lobed or compound; seeds with scanty endosperm, the embryo curved or spirally involute. 63. CANNABACEAE
- Plants with latex (this usually milky, less often watery); stamens erect or inflexed in bud. 64. MORACEAE

Ovule basal or subbasal, orthotropous; style unbranched; seeds with endosperm, the embryo straight; stamens inflexed in bud; herbs, shrubs, or soft-wooded trees, without milky latex; leaf epidermis often with prominent cystoliths. 65. URTICACEAE

FAMILY 62. ULMACEAE

ULMACEAE Mirbel, *Elém. Phys. Vég. Bot.* 2: 905. 1815.

Usually monoecious, rarely dioecious trees or shrubs, or sometimes with hermaphrodite flowers, without latex but with watery sap; leaves alternate, rarely opposite, simple, the blades often asymmetrical and oblique, pinnately or palmately nerved, usually serrate; stipules paired, extrapetiolar or intrapetiolar, free or connate, caducous; inflorescences fasciculate, cymose, paniculate, or racemose, axillary or subterminal or borne on defoliate branchlets, the flowers sometimes solitary; flowers actinomorphic to slightly zygomorphic, unisexual or ♂, often with remains of either androecium or gynoecium; perianth subcampanulate, herbaceous, the segments (2-) 4-8 (-10), more or less connate or free, imbricate or induplicate-valvate in bud, sepaloid; disk lacking; ♂ flowers with 3-8 (-10) stamens opposite perianth segments (or sometimes more numerous), the stamens arising from base of perianth, erect in bud, the filaments distinct, the anthers 2-locular, longitudinally dehiscent, extrorse or introrse, the gynoecium often rudimentary or absent; ♀ flowers with or without staminodes, with a superior ovary composed of 2 connate carpels, 1- or 2-locular (second locule usually abortive), the ovule solitary, anatropous or amphitropous, pendulous from apex of locule, the style 1, short or essentially lacking, with 2 slender stigmatic arms, these often bifid or lobed at tip, adaxially papillose-stigmatic for their entire length; fruit compressed or not, indehiscent, a winged samara or a drupe, the endosperm usually lacking, the embryo straight or curved.

DISTRIBUTION: Pantropical and temperate, mostly in the Northern Hemisphere, with about 15 genera and 200 species. Four genera occur in Fiji, all represented by indigenous species.

USEFUL TREATMENT OF FAMILY: Soepadmo, *E. Ulmaceae. Fl. Males. I.* 8: 31-76. 1977.

KEY TO GENERA

- Leaf blades triplinerved, the lateral nerves arising from the costa fewer than 5 pairs; stipules not leaving a circular scar around the node.
- Stipules intrapetiolar, connate. 1. *Parasponia*
- Stipules extrapetiolar, free.
- Perianth lobes of ♂ flowers induplicate-valvate; ♀ flowers borne in condensed, many-flowered racemes; fruit compressed, elliptic-lens-shaped in cross section. 2. *Trema*
- Perianth lobes of ♂ flowers imbricate; ♀ flowers 2-10 in racemose clusters or in branched racemes; fruit faintly 3-5-angular in cross section. 3. *Celtis*
- Leaf blades pinnately nerved, not triplinerved, the lateral nerves more than 5 pairs; stipules free but overlapping and at length leaving a circular scar around the node. 4. *Gironniera*

1. PARÁSPOНИЯ Miq. *Pl. Junghuhn.* 68. 1851; Soepadmo in *Fl. Males. I.* 8: 43. 1977.

Sponia sensu Seem. *Fl. Vit.* 235, p. 1867; non Commerson ex Lam.

Monoecious or dioecious (rarely polygamous) shrubs or trees, the young parts sericeous; stipules intrapetiolar, connate into a 2-parted unit enclosing the terminal bud, caducous; leaf blades concolorous, triplinerved at base, usually subglabrous above and pubescent beneath; inflorescences axillary, paniculate or thyrsoid, freely branched, many-flowered, the branches and bracts appressed-pilose; flowers 5-merous; ♂ flowers subglobose, the perianth lobes imbricate in bud, the stamens glabrous, the filaments subulate, the anthers reniform to subglobose, introrse, subbasifixed, the pistillode compressed, obovoid-conical; ♀ flowers ovoid-conical, without staminodes, the ovary ovoid, slightly compressed, the stigmatic arms short, simple; drupe ovoid, slightly compressed, the endocarp stony, the embryo curved, the cotyledons equal.

TYPE SPECIES: *Parasponia parviflora* Miq.

DISTRIBUTION: Western Malesia eastward to the Society Islands, probably with five species. Only one species extends eastward as far as Fiji.

1. ***Parasponia andersonii*** (Planch.) Planch. in DC. Prodr. 17: 195. 1873; Gibbs in J. Linn. Soc. Bot. 39: 170. 1909; J. W. Parham, Pl. Fiji Isl. 88. 1964, ed. 2. 133. 1972; Soepadmo in Fl. Males. I. 8: 46. 1977. FIGURE 49A & B.

Sponia andersonii Planch. in Ann. Sci. Nat. Bot. III. 10: 336. 1848; Seem. Fl. Vit. 235. 1867.

Sponia orientalis sensu Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862; non auct.

As it occurs in Fiji, *Parasponia andersonii* is an often compact tree or shrub 1.5–15 m. high, found at elevations from near sea level to 1,130 m. on open hillsides, in hillside thickets and crest thickets, and also in plantations and among reeds, infrequently encroaching into dense forest. It is often seen as a pioneer plant invading newly available habitats. The perianth segments are greenish white, the stamens pale green to yellow, the styles and stigmas greenish white to white, and the fruits orange-yellow to dull orange at maturity. Flowers and fruits occur throughout the year.

LECTOTYPIFICATION: In describing *Sponia andersonii*, Planchon listed two specimens collected on Tanna, New Hebrides: "*Anderson* in herb. Banks; *Barclay* in herb. Benth. et Hook." In view of the epithet I consider the excellent Anderson collection (BM) the lectotype; it was collected in 1774 during the second Cook voyage. The Barclay specimen (K) is also excellent; it was collected at Port Resolution, Tanna.

DISTRIBUTION: Eastern New Guinea and New Britain eastward to the Solomons, New Hebrides, and Fiji, and also in the Society Islands (but I have noted no collections from archipelagoes between Fiji and the Societies). It is abundant in Fiji, more than 60 collections being at hand.

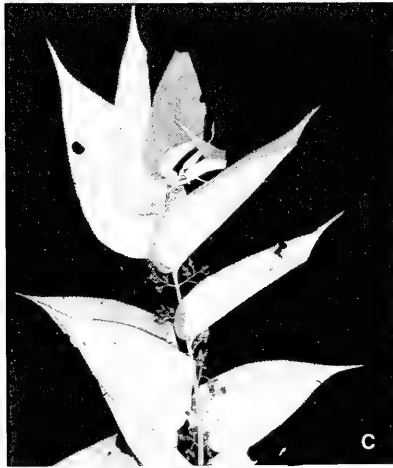
LOCAL NAMES AND USES: The usual Fijian name is *ndrou*; also recorded are *ndrou vula*, *ndoi*, and *kaka*; the two last names should be questioned, as they usually refer to other families. The wood is sometimes used in making utensils and otherwise for firewood, and the bark has been noted as medicinal (its purpose unspecified).

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Below Yalombi and Natawa, *DA 13673*. VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1291*; Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4299*; Nandarivatu, *Gibbs 863*; summit of Mt. Nanggaranambuluth, *Gillespie 3938*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 400*; Singatoka Valley, *Webster & Hildreth 14380*; Mbelo, near Vatukarasa, *O. & I. Degener 32190*. SERUA: Waimbale, near Namboutini, *Degener 15471*; hills between Wainingere and Waisee Creeks, *Smith 9672*; vicinity of Navua, *McKee 2849*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8824*; near Namosi Village, *Gillespie 2934*. NAITASIRI: Matawailevu, Wainimala River, *St. John 18195*; Sawani-Serea road, *DA 11303*; Waindina River basin, *MacDaniels 1043 (Tothill 803)*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Wailotua, *Smith 7250*; Naingani Island, *DA 3815*. REWA: Near Suva, *MacDaniels 1005 (Tothill 800)*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 61*. OVALAU: Vicinity of Levuka, *Gillespie 4477*. KORO: Western slope, *Smith 1068*. NGAU: Slopes of Mt. Vonda toward Waikama, *Smith 7955*. VANUA LEVU: THAKAUNDROVE: Wainigata Station, *DA 12043*; along Hibiscus Highway east of Savusavu, *Bierhorst F180*. TAVEUNI: *Seemann 562*; vicinity of Waiyevo, *Gillespie 4631*.

2. ***Trema*** Lour. Fl. Cochinch. 562. 1790; Soepadmo in Fl. Males. I. 8: 47. 1977.

Sponia Commerson ex Lam. Encycl. Méth. Bot. 4: 138. 1797; Seem. Fl. Vit. 235, p. p. 1867.

Usually monoecious (rarely polygamous) trees or shrubs; stipules free, extrapetiolar, enclosing terminal buds but soon caducous; leaf blades triplinerved at base, penninerved above, serrate, subglabrous to variously pilose; inflorescences axillary, paniculate, racemose, or thyrsoid, many-flowered, usually densely pilose, the bracts minute; ♂ flowers globular, the perianth 4- or 5-lobed, the lobes induplicate-valvate in bud, the stamens glabrous, the filaments subulate, incurved in bud, the anthers



subglobular to reniform, introrse, dorsifixed near base, the pistillode hirsute at base; ♀ flowers ovoid, the perianth as in the ♂, without staminodes or these rarely present, the ovary ovoid, slightly compressed, the style short; drupe ovoid or subglobose, slightly compressed, the endocarp stony, the embryo curved or nearly involute, the cotyledons equal.

TYPE SPECIES: *Trema cannabina* Lour.

DISTRIBUTION: Throughout the tropics, extending into warm temperate areas northward and southward, with 10–15 species. I consider that only one species of *Trema* occurs in Fiji.

1. *Trema cannabina* Lour. Fl. Cochinch. 563. 1790; Merr. in Trans. Amer. Philos. Soc.

24 (2): 131. 1935; Soepadmo in Fl. Males. I. 8: 50. 1977. FIGURE 49C & D.

Sponia velutina sensu Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862, Fl. Vit. 235. 1867, op. cit. 432. 1873; non Planch.

Trema amboinensis sensu Engl. in Bot. Jahrb. 7: 451. 1886; Drake, Ill. Fl. Ins. Mar. Pac. 294. 1892; Yuncker in Bishop Mus. Bull. 220: 96. 1959; J. W. Parham, Pl. Fiji Isl. 88. 1964, ed. 2. 134. 1972; non Bl.

Trema orientalis var. *viridis* Lauterb. in Bot. Jahrb. 50: 321. fig. 2, D. 1913; Christophersen in Bishop Mus. Bull. 128: 71. 1935; Yuncker in op. cit. 178: 46. 1943, in op. cit. 184: 35. 1945, in op. cit. 220: 96. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 207. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 319. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 31, 70, 73. 1972.

Trema orientalis sensu J. W. Parham, Pl. Fiji Isl. ed. 2. 134. 1972; non Bl.

The species of *Trema* occurring in Fiji is a sometimes slender tree or shrub 2–10 m. high, found from near sea level to about 250 m. in open country, thickets, and dry forest. Its perianth is greenish white, its anthers white to yellow, and its fruits red-brown, at length becoming purple to black. Flowers and fruits have been obtained in months scattered throughout the year.

TYPIIFICATION AND NOMENCLATURE: The holotype is a Loureiro specimen (BM) from Cochinchina, according to Merrill (1935, cited above); this is doubtless correct, although I was unable to find the specimen. In describing *Trema orientalis* var. *viridis*, Lauterbach cited a wide range of specimens from the Moluccas, Bismarck Islands, Australia, New Caledonia, the New Hebrides, Fiji (*Weber 100, 121, Gehrman*), Samoa, and Hawaii, indicating *T. cannabina* to be a synonym of his new variety.

DISTRIBUTION: India to southern China, thence southward and eastward throughout Malesia to Micronesia, northeastern Australia, and into the Pacific at least to Samoa and Niue. In Fiji it is found in habitats similar to those occupied by *Parasponia andersonii*, although it is perhaps less aggressive and limited to lower elevations.

LOCAL NAMES: *Ndrou* is the usual name (indicating that Fijians group it with *Parasponia andersonii*); also recorded are *ndroundrou*, *ndrikanaithembe* (Mathuata), and *matandra* (Vanua Mbalavu); the last is probably a misapplication, as it usually refers to Sapindaceae.

FIGURE 49. A & B, *Parasponia andersonii*, from *Smith 4299*; A, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/3; B, intrapetiolar stipules connate into apically bifid units, × 6. C & D, *Trema cannabina*, from *Smith 1405*; C, distal portion of branchlet, with foliage, ♀ inflorescences, and young fruits, × 1/3; D, distal portion of branchlet, showing a free, extrapetiolar stipule at penultimate node, × 6.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills between Wainingere and Waisea Creeks, between Ngaloa and Wainiyambia, *Smith 9355*. NAITASIRI: Tholo-i-suva and vicinity, *Meebold 16760*, *DF443*, *Bola 138*. KANDAVU: Kiombo, *DA 11927 (DF 7)*. NAIRAI: *Milne 168*. VANUA LEVU: MBUA: Nandi Bay, *Harvey*, Nov., 1855. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, *Smith 6713*, *DA 12941*; near Naravuka Village, Ndreketi River, *DA 12864*; Lambasa, *Greenwood 472*. MOALA: Near Naroï, *Smith 1315*. NAITAMBA: *Tothill 761*. VANUA MBALAVU: Central volcanic section, near Lomalomaa, *Smith 1405*, *Garnock-Jones 1079*. LAKEMBA: *Seemann 563*; ridge east of Levuka Valley, *Garnock-Jones 826*. KAMBARA: Central wooded valley, *Bryan 506*. FIJI without further locality, *U. S. Expl. Exped., Horne s. n.*, *DF 1220 (Bola 106)*, *Gillespie 3585*.

In his 1977 treatment, Soepadmo recognizes four species of *Trema* in Malesia, indicating an eastward extension of range for three of them as follows: *T. cannabina* to Fiji and Samoa; *T. orientalis* (L.) Bl. to Fiji, Tonga, and Tahiti; and *T. tomentosa* (Roxb.) Hara to Fiji, Tonga, and Hawaii. The distinguishing characters utilized by Soepadmo refer to leaf size and proportions, texture, number of secondary nerves, type of indument (as seen at high magnifications), and color, size, and shape of mature fruits. Such differences certainly exist, and probably the recognition of the three species in Malesia is justifiable. Nevertheless, Soepadmo's 1971 identifications of Pacific material at K indicate his then opinion that *T. orientalis* does not extend eastward of the Solomon and Mariana Islands, and that *T. tomentosa* does not extend eastward of Micronesia and New Caledonia except for its occurrence in Hawaii. *Trema cannabina*, according to material at K so identified by Soepadmo, extends eastward to Samoa, Niue, and Hawaii; whether the Society Island material of *Trema* is here referable is not clear to me. Whatever the ultimate disposition of the several names in *Trema* that have been ascribed a wide Melanesian and Polynesian distribution, it is my present opinion that the weedy and aggressive species established in the Fijian Region (New Hebrides, Fiji, Tonga, Niue, Samoa, and the Horne Islands) is best referred to a single species, *T. cannabina*. Of the specimens established in the Society Islands and Hawaii I cannot express an opinion.

Trema cannabina and *Parasponia andersonii* are often confused in herbaria and in the field, since both are pioneer "weed trees" and occupy similar habitats. Nevertheless, even when sterile they may be instantly distinguished by their stipules, which usually persist at two or three distal nodes, as follows:

Stipules 1.5–4 mm. long, 0.5–1.2 mm. broad, free, simply acuminate at apex, unicarinatè, the hairs along the keel not much more obvious than on other dorsal surfaces; indument of lower leaf blade surfaces nearly uniform, not especially pronounced on principal nerves. *Trema cannabina*
 Stipules 3.5–7.5 mm. long, connate into an apically bifid unit 2–5 mm. broad, this bicarinatè, the hairs along the keels obvious, the other dorsal surfaces often more or less glabrous; indument of lower leaf blade surfaces usually more pronounced on principal nerves than on other surfaces. *Parasponia andersonii*

3. *CELTIS* L. Sp. Pl. 1043. 1753; Soepadmo in *Fl. Males. I.* 8: 55. 1977; A. C. Sm. in *Allertonia* 1: 357. 1978.

Monoecious or polygamo-monoecious trees or shrubs; stipules peltately attached or free and scarious, caducous; leaf blades triplinerved at base, serrate to entire; inflorescences branched racemes or panicles, few- to many-flowered, axillary or subterminal; ♂ flowers globular, pedicellate or sessile, the perianth lobes 4 or 5 (or 6), imbricate in bud, membranous, recurved at anthesis, then caducous, the receptacle densely pilose, the stamens glabrous, the filaments subulate, incurved in bud, exerted at anthesis, the anthers ovoid to subreniform, extrorse, dorsifixed near base, the pistillode present or absent; ♀ flowers ovoid, pedicellate, the perianth as in the ♂, the stamens functional or rudimentary, the ovary ovoid-ellipsoid, the style short or absent, the stigmatic arms elongate, divergent, entire to deeply bifid; drupe fleshy, not com-

pressed, the endocarp hard, smooth or ridged and pitted, the embryo curved, the cotyledons flat or conduplicate.

TYPE SPECIES: *Celtis australis* L. (ING), one of the three original species.

DISTRIBUTION: Pantropical and extending northward and southward into temperate areas, with 50-60 species.

Soepadmo (1977, cited above) recognizes nine Malesian species of *Celtis*, including *C. paniculata* (Endl.) Planch., to which he assigns all the material from Fiji eastward. I have already (1978, cited above) expressed my disagreement with this uncritical disposition. *Celtis* is by no means as vagile a genus as *Parasponia* and *Trema*, which are well known as invaders of newly available habitats and whose disseminules are easily transported over extents of open sea. The same is not true of *Celtis*, the members of which are in no sense "weed trees" but are often large and infrequent components of the true Pacific forests. I cannot state the true extent of *C. paniculata*, typified by a Bauer collection from Norfolk Island; it may indeed occur in some parts of Malesia and even in western Melanesia, but from Fiji eastward and northward it is replaced by *C. harperi*, *C. vitiensis*, *C. pacifica* Planch., and perhaps by another species in Micronesia. The two Fijian species bear only the most superficial similarity to *C. paniculata*.

KEY TO SPECIES

- Petioles 10-20 mm. long, comparatively robust, 1.5-3 mm. in diameter; leaf blades ovate-elliptic, (6-) 7-14 cm. long, (3-) 4-7 cm. broad, smooth or obscurely papillose-rugulose on both surfaces, cuspidate to short-acuminate at apex and usually callose-mucronulate, with 2-4 pairs of obvious secondaries arising from costa; inflorescences 1-2 cm. long and comparatively few-branched at anthesis; infructescences 2-8 cm. long; mature drupes 10-14 × 7-10 mm. 1. *C. harperi*
- Petioles 4-10 mm. long, comparatively slender, 0.5-1.3 mm. in diameter; leaf blades elliptic or ovate-elliptic, (3-) 4-9 cm. long, (1.5-) 2-4 (-4.5) cm. broad, obviously papillose-rugulose on both surfaces, broadly obtuse or rounded or inconspicuously emarginate at apex, with 2 or 3 pairs of inconspicuous secondaries arising from costa; inflorescences cymose-paniculate, 1-2 cm. long and broad and freely branched at anthesis; infructescences 1-2 cm. long; mature drupes 6-10 × 5-7 mm. 2. *C. vitiensis*

1. *Celtis harperi* Horne, A Year in Fiji, 259, nom. nud. 1881; Horne ex Baker in J. Linn. Soc. Bot. 20: 371. 1883; A. C. Sm. in Bull. Torrey Bot. Club 70: 535. 1943, in J. Arnold Arb. 31: 150. 1950; Yuncker in Bishop Mus. Bull. 220: 96. 1959; J. W. Parham, Pl. Fiji Isl. 88. 1964, ed. 2. 131. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 207. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 319. 1971; A. C. Sm. in Allertonia 1: 357. 1978. FIGURE 50A & B.

Celtis pacifica sensu Hemsl. in J. Linn. Soc. Bot. 30: 192. 1894; non Planch.

Celtis paniculata sensu Yuncker in Bishop Mus. Bull. 178: 45. 1943; non Planch.

A sometimes slender tree 4-8 m. high, occurring at elevations of 100-1,075 m. (or lower in other parts of the Fijian Region) in dense forest, forest on ridges and spurs, and sometimes in secondary forest. The fruit is green, becoming darker to black at maturity. Flowers have been collected only in March and December, fruits between March and September.

TYPIFICATION: The holotype is *Horne 623* (κ), collected in March, 1878, between Waiwai (on Savusavu Bay, Thakaundrove Province) and Lomaloma (on track toward Nanduri, Mathuata Province), Vanua Levu.

DISTRIBUTION: An infrequent species known from the two largest islands of Fiji and from Tonga, Niue, and the Horne Islands.

LOCAL NAME: *Mala ni via* (southern Viti Levu).

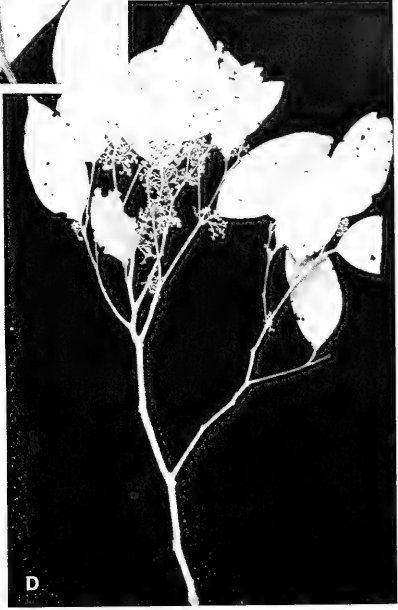
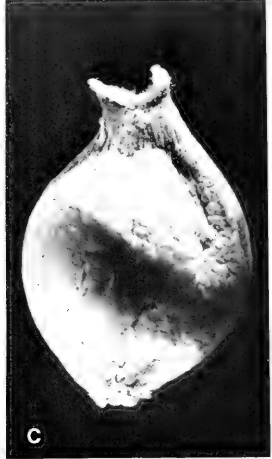




FIGURE 51. *Celtis vitiensis*, from DA 13010; ♂ inflorescence, $\times 7$.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, DA 324; upper slopes of Mt. Koromba, Smith 4637; western slopes of Mt. Mangondro, Webster & Hildreth 14282. NANDRONGA & NAVOSA: Nausori Highlands, DA 15357, DF 320, Bola 124. SERUA: Inland from Namboutini, DF 944. NAITASIRE: Tholo-i-suva, DA 460. VANUA LEVU: MBUA: Southern portion of Seatovo Range, Smith 1568. THAKAUNDROVE: Mt. Uluingala, Natewa Peninsula, Smith 1976.

2. *Celtis vitiensis* A. C. Sm. in Bull. Torrey Bot. Club 70: 536. 1943, in J. Arnold Arb. 31: 150. 1950; J. W. Parham, Pl. Fiji Isl. 88. 1964, ed. 2. 132. 1972.

FIGURES 50C & D, 51.

A tree 4–25 m. high, occurring in dense forest at elevations of 600–1,150 m. The perianth segments are white or greenish white, and the fruit is blue-black and glaucous, becoming black at maturity. Flowers have been obtained between July and January, and fruits between December and February.

TYPIFICATION: The type is Degener 14322 (A HOLOTYPE; several ISOTYPES), collected Feb. 9, 1941, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

FIGURE 50. A & B, *Celtis harperi*; A, distal portion of branchlet, with foliage and an infructescence, $\times 1/3$; B, mature drupe, $\times 6$. C & D, *Celtis vitiensis*; C, mature drupe, $\times 6$; D, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$. A from Smith 1568, B from Smith 1976, C from Degener 14322, D from DA 13010.

DISTRIBUTION: Endemic to Fiji, and thus far known only from northern and western Viti Levu.

LOCAL NAMES: *Tandili*, *marasa*, *matho*; the two latter are questionable, usually referring to Sapindaceae and Lauraceae respectively.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 971*; Mt. Mbatilamu, *Vunda, DA 14167*; vicinity of Nandarivatu, *Gillespie 4039, 4185, DA 13010*; western and southern slopes of Mt. Tomanivi, *Smith 5281*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14897*.

4. *GIRONNIERA* Gaud. Voy. Bonite, Vaillant, Bot. Atlas, *pl. 85*. 1844; Seem. Fl. Vit. 236. 1867; Soepadmo in Fl. Males. I. 8: 70. 1977.

Usually dioecious trees or shrubs, less often monoecious; stipules extrapetiolar, free but overlapping one another and enclosing the bud, when caducous leaving a circular scar around the node; leaf blades pinnately nerved, entire to slightly dentate, the nerves parallel, regularly spaced; inflorescences axillary or borne on defoliate branchlets, 1-many-flowered, paniculate, racemose, thyrsoid, or capitate, bracteate; ♂ flowers globular, sessile or short-pedicellate, the perianth lobes (4 or) 5, imbricate in bud, the stamens glabrous, the filaments subulate, inflexed, the anthers ovoid-reniform, introrse, subbasifixed, the pistillode present, well developed or rudimentary; ♀ flowers ovoid-ellipsoid, compressed, the perianth lobes 4 or 5, usually unequal in size, long persistent, the staminodes lacking, the ovary ovoid-ellipsoid, compressed, sessile, the stigmatic arms elongate, long persistent; drupe ovoid-globose, elliptic-lens-shaped, the endocarp hard, the embryo curved.

TYPE SPECIES: *Gironniera celtidifolia* Gaud.

DISTRIBUTION: Southeastern Asia and Ceylon eastward through Malesia to Micronesia, Fiji, and Samoa, with about six species.

1. *Gironniera celtidifolia* Gaud. Voy. Bonite, Vaillant, Bot. Atlas, *pl. 85*. 1844; Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862, Fl. Vit. 236. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 295. 1892; Gibbs in J. Linn. Soc. Bot. 39: 170. 1909; Christophersen in Bishop Mus. Bull. 128: 71. 1935; J. W. Parham, Pl. Fiji Isl. 88. 1964, ed. 2. 133. *fig. 40*. 1972; Soepadmo in Fl. Males. I. 8: 73. *fig. 26, a-g*. 1977. **FIGURE 52.**

An often slender tree 3-15 m. high as it occurs in Fiji, found from near sea level to 970 m. in dense or secondary forest, or in patches of forest in open country. It is often a very abundant, even dominant component of the lowland forest. Its perianth segments are pale yellowish green, its stamens with white filaments and yellowish green anthers, its styles yellow to greenish white, and its fruit at length black. Flowers and fruits are seen throughout the year.

TIPIFICATION: Gaudichaud's plate may be taken as the type; the text for this was never published.

DISTRIBUTION: From the Philippines and Moluccas through New Guinea and Melanesia to Samoa. As noted above, *Gironniera celtidifolia* is one of the most common small trees of the Fijian lowland forest; more than 75 specimens are at hand.

LOCAL NAMES AND USES: The usual Fijian names are *masivau* and *sisisi*, variants of the latter being *sisiti*, *sisichi*, *shishichi*, *sirisiri*, and *thithithi*. Seemann noted the name

FIGURE 52. *Gironniera celtidifolia*; A, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/4; B, ♂ flower, showing imbricate perianth lobes and stamens opposite them, × 25; C, pair of stipules enclosing a terminal bud, × 6; D, portion of ♀ inflorescence with developing fruits, × 6. A-C from *St. John 18950*, D from *Smith 6899*.



nunu and indicated that the fruit could be eaten in times of famine, but both of these comments are probably erroneous and refer to species of *Ficus*. The hard wood of *masivau* is utilized to make digging sticks for planting root crops, and it is also fashioned into tools used to remove the "meat" (endosperm) from coconuts.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Yoö, west of Nandarivatu, *Webster & Hildreth 14143*; Nandarivatu, *Gibbs 616*; Navai, *DA 15098*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 12629* (*Melville et al. 7000*); northern portion of Rairaimatuku Plateau, *Smith 5421*; north of Komave, *St. John 18950*. SERUA: North of Korovou, *St. John 18921*; hills east of Navua River, near Nukusere, *Smith 9135*. NAMOSI: Vicinity of Namuamua, *Gillespie 3017*; Wainandoi River, *DA 8358*. NAITASIRI: Wainimala Valley, *St. John 18292*; Waindina River, *MacDaniels 1028*; Nasinu, *DA 11809*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7033*; Naivithula, Wainivesi River, *Valentine 12*. REWA: Mt. Korombamba, *Gillespie 2284*; near Suva, *Yeoward 72*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 140*; Kiombo, *DA 11924 (DF 4)*. OVALAU: Vicinity of Levuka, *Gillespie 4454*; Port Kinnaird, *Seemann 423*. KORO: Ndelaikoro, *DA 15829*. NGAU: Slopes of Mt. Ndelaitho, on northern spur toward Navukailangi, *Smith 7877*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1531*. MATHUATA: Seangganga Plateau, vicinity of Natua, *Smith 6899*; Nakawanga, Mathuata Island, *Gressitt 2492*. THAKAUNDROVE: Southern slope of Korotini Range, below Navitho Pass, *Smith 486*; vicinity of Savusavu, *Bierhorst F204*. TAVEUNI: Vicinity of Somosomo, *Gillespie 4775*. VANUA MBALAVU: Site of Lomaloma Botanical Gardens, *DA 10218*.

FAMILY 63. CANNABACEAE

CANNABACEAE Endl. Gen. Pl. 286, as *Cannabineae*. 1837.

Diocious or rarely monoecious, annual or perennial, anemophilous, erect or scandent herbs, with usually free, persistent stipules, without milky latex; leaves alternate or opposite, simple, palmately lobed, or palmately compound, the blades serrate; ♂ inflorescences axillary, paniculate-cymose; ♂ flowers pedicellate, the perianth with 5 imbricate segments, the stamens 5, opposite perianth lobes, the filaments short, filiform, the anthers basifixed, erect in bud, 2-locular, longitudinally dehiscent, the pistillode lacking; ♀ inflorescences axillary, spicate-cymose, with large, conspicuous, persistent bracts; ♀ flowers sessile, often paired, the perianth cupular, minute, membranous, undivided, closely enveloping ovary, the stamindens lacking, the ovary superior, bicarpellate but unilocular, the ovule solitary, pendulous, anatropous, the style short, the stigmas 2, filiform; fruit an achene covered by the persistent perianth, the seed with scanty endosperm, the embryo curved or spirally involute.

DISTRIBUTION: Indigenous to temperate Asia, now much cultivated elsewhere, with two genera and three or four species.

USEFUL TREATMENT OF FAMILY: Miller, N. G. The genera of the Cannabaceae in the southeastern United States. *J. Arnold Arb.* 51: 185-203. 1970.

I. CANNABIS L. Sp. Pl. 1027. 1753.

Coarse, erect, weedy annual, the leaves decussate proximally, alternate distally, the blades palmately compound, with (3-) 5-9 (-15) coarsely serrate, lanceolate leaflets; ♂ flowers pedicellate, caducous soon after anthesis, the perianth lobes quincuncial in bud, widespread at anthesis; fruit ovoid, slightly compressed, the embryo curved.

TYPE SPECIES: *Cannabis sativa* L., Linnaeus's only species.

DISTRIBUTION: One (or perhaps two) species indigenous in temperate western Asia, early spreading into India and China, and now widespread as an adventive or naturalized weed.

USEFUL TREATMENT OF GENUS: Small, E., & A. Cronquist. A practical and natural taxonomy for *Cannabis*. *Taxon* 25: 405-435. 1976.

There has been considerable disagreement as to the taxonomic division of *Cannabis*, one of the oldest cultivated plants. Small and Cronquist (1976, cited above)

conclude that only one species should be recognized, this being divisible into two subspecies, each with two varieties.

1. *Cannabis sativa* L. Sp. Pl. 1027. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 134, as *C. sativus*. 1972.

Characters of the genus; a robust herb 1-5 m. high.

LECTOTYPIFICATION: W. T. Stearn (in Bot. Mus. Leaflet. 23: 325-336. 1974) has indicated as the lectotype the specimen in Hortus Siccus Cliffortianus, p. 457, indicated as *Cannabis* no. 1, B (BM); a photograph of this is reproduced by Small and Cronquist (1976, cited above), fig. 7.

DISTRIBUTION: As of the genus. It is doubtless more frequent in Fiji than indicated below.

LOCAL NAMES AND USES: *Hemp*, *Indian hemp*, *marihuana*, *marijuana*, *hashish* (Arabic), *bhang* (Hindi), *ganju* or *ganja* (Hindi). It is a fiber-yielding plant, the soft bast fibers being used for rope, twine, bags, etc., and it also has oil-producing seeds. It is doubtless now best known for the narcotic drug produced in resinous material that accumulates most abundantly on the tissues of ♀ inflorescences.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, DA 2533. RA: DA 17316. REWA: Suva, DA 2417.

Discussions of the origin, distribution, cultivation, and uses of *Cannabis sativa* are provided by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 442-446. 1966) and Pursglove (Trop. Crops, Dicot. 40-44. 1968).

FAMILY 64. MORACEAE

MORACEAE Link, Handb. 2: 444, as *Moriformes*. 1831.

Monoecious or dioecious trees, shrubs, or lianas, infrequently herbs, with usually milky latex, stipulate, the stipules often caducous and leaving scars; leaves alternate, rarely opposite, the blades simple to incised, palmate or pinnate, with or without cystoliths, palminerved or penninerved; inflorescences axillary, often paired, unisexual or bisexual, paniculate, racemose, spicate, capitata, or urceolate; flowers small, unisexual, apetalous, actinomorphic, the perianth with 0-8 (usually 4) lobes (tepals), these free or united, imbricate or valvate, persistent; ♂ flowers with stamens usually the same number as tepals and opposite them or rarely reduced to 1-3, the filaments straight or inflexed in bud, free or connate, the anthers large to small, 2-locular, longitudinally dehiscent, mucronate or bilobate and nonmucronate, or crescentic to turbinate (with transverse, equatorial dehiscence), the pistillode present or lacking; ♀ flowers with the ovary usually unilocular by abortion, rarely bilocular, superior to inferior or immersed in sockets in the inflorescence axis, the ovule solitary, pendulous, anatropous or campylotropous, the styles 1 or 2, with 1 or 2 stigmatic arms, the stigma not capitate or peltate; fruits drupaceous, discrete or more or less connate into large, fleshy syncarps or enclosed in fruitlike receptacles, the seeds large or small, invested in endocarp, the testa membranous or disintegrated, the endosperm lacking or scanty, the embryo straight or curved, the cotyledons plicate, conduplicate, or plane.

DISTRIBUTION: Pantropical and subtropical, occasionally extending into temperate areas, with about 53-65 genera and 1,400-1,600 species.

USEFUL TREATMENTS OF FAMILY: Corner, E. J. H. The classification of Moraceae. Gard. Bull. Singapore 19: 187-252. 1962. Hutchinson, J. Moraceae. Gen. Fl. Pl. 2: 151-178. 1967.

The following sequence of genera is that proposed by Corner, and the key to tribes and genera is adapted from his 1962 paper cited above. However, I have utilized characters referring primarily to genera in Fiji and not to other members of the

respective tribes. Eight genera are known to occur in Fiji, belonging to four of the six tribes recognized by Corner.

KEY TO GENERA

Flowers enclosed within urceolate receptacles (syconia), numerous, the styles not extruded from receptacles, the syconia with sterile, insect-inhabited ♀ flowers; stamens, when 2 or more, with introrse anthers, the filaments straight in bud; ♀ flowers stalked or sessile (Ficeae). 1. *Ficus*

Flowers not enclosed within syconia, or if so then the style exerted from receptacles, the inflorescences lacking sterile, insect-inhabited flowers; stamens usually extrorse; ♀ flowers mostly sessile; inflorescences unisexual or, if bisexual, not discoid.

♀ inflorescences racemose or spicate with a slender axis or 1-flowered or bisexual (cymose or spicate) and neither capitate nor discoid, the ovaries usually free, or if inferior then not in sockets; ♂ inflorescences paniculate, racemose, spicate, or capitate, often with a sterile groove; stamens 1-5, the filaments usually inflexed in bud; pistillode present (Moreae).

Fruiting perianth fleshy; seeds small, 1-2 mm. broad, somewhat compressed, the endocarp crustaceous, the embryo with a long, incumbent, transverse radicle, the cotyledons flat; inflorescences racemose or spicate, unbranched, unisexual. 2. *Morus*

Fruiting perianth not fleshy, but drupe thinly fleshy or with thickly fleshy base; seeds larger, 4-12 mm. broad, rounded, the embryo with the radicle not transversely elongate, the cotyledons often folded or much thickened, often unequal; ovary superior. 3. *Streblus*

♀ inflorescences capitate or thickly spicate, mostly syncarpous, the ovaries often immersed in sockets of receptacle or connate with it; ♂ flowers often lacking a pistillode.

♂ and ♀ inflorescences capitate, flattened, or urceolate, with an involucre of many bracts; ♀ inflorescences 1-flowered, the ovary adnate to the receptacle; stamens 4, the filaments straight in bud (Olmedieae). 4. *Antiaris*

♂ and ♀ inflorescences involucrate or not; ♀ inflorescences thickly spicate to capitate-globose, never 1-flowered, syncarpous; ♂ inflorescences paniculate, racemose, spicate, or capitate; stamens 1-4, the filaments straight or inflexed in bud (Artocarpeae).

Tepals of ♀ flowers 4, free at least in distal half, well developed, decussate, imbricate, fleshy in fruit; bracts and/or tepals with 2-7 immersed yellow glands; seed compressed, with ligneous endocarp; dioecious plants, often spiny (but not our species). 5. *Maclura*

Tepals of ♀ flowers not as above, without immersed yellow glands; unarmed plants.

♂ inflorescences racemose-spicate, unbranched, with a sterile groove, the filaments inflexed in bud, the pistillode present; ♀ perianth utricular, the ovaries not in receptacular loculi, the styles long; embryo curved; dioecious plants.

Syncarp globose, thickly set with slender, stalked bracts of various shapes and more or less covering drupes; seeds 1.7-2.5 mm. long, the endocarp crustaceous to ligneous, the cotyledons equal, flat, the radicle long, accumbent; stipules membranous; trees or shrubs.

6. *Broussonetia*

Syncarp with a few strongly projecting drupes, each invested by the utricular perianth, the bracts short; seeds 6-7 mm. long, the endocarp membranous, the cotyledons very unequal, the larger one thickly fleshy and folded; lianas. 7. *Malaisia*

♂ inflorescences clavate or capitate, or if spicate then without a sterile groove, the flowers superficial, the perianth tubular, the stamen 1, the filament straight in bud, the pistillode lacking; ♀ inflorescences globose-capitate or thick-spicate, the flowers with the perianth tubular, the ovaries sunk in receptacular sockets or concealed beneath the layer of connate perianths; drupes embedded in the more or less fleshy syncarp, the embryo straight or slightly curved, the cotyledons thick, equal or unequal, the radicle short; monoecious trees.

8. *Artocarpus*

1. *FICUS* L. Sp. Pl. 1059. 1753; Seem. Fl. Vit. 247. 1868; Corner in Gard. Bull. Singapore 21: 1. 1965.

Monoecious or dioecious woody plants, with latex, the stipules free, paired or connate, enveloping the bud, when caducous leaving an annular scar; leaves distichous, spiralled, or opposite, the blades simple or palmately lobed (sometimes pinnately lobed on juvenile plants), symmetric or asymmetric, dentate or entire, often with glands in axils of lateral or basal nerves on lower surfaces or abaxial at apex of petiole, often with cystoliths, these punctiform, occurring on both surfaces of the lamina (amphigenous), on the upper surface only (hypergenous), or on the lower surface only (hypogenous); inflorescences (syconia or "figs") often paired, sometimes solitary or

clustered, axillary to cauliflorous, urceolate and containing the flowers, with few to many external bracts, the orifice closed by small bracts; flowers with bracteoles between them or not, unisexual, small to minute, of three kinds (σ , ♀ , and gall-), the σ sometimes sterile, the perianth with 2-8 tepals, these red to white, free or joined, sometimes saccate to cupular, sometimes lacking; σ flowers ostiolar (located at orifice of syconium) in one or several rows or disperse within syconium, sometimes with a functional gall-ovary, with or without a vestigial pistillode, with 1-7 stamens, these free, or if 2 often with the filaments shortly joined, the anthers usually exserted, often mucronate, 4-celled with longitudinal, introrse dehiscence or 2-celled with apical-crescentic or equatorial-transverse dehiscence; ♀ flowers with the ovary unilocular, the style single, subapical to gynobasic, the stigma bifid or simple, often short-infundibular in gall-flowers; gall-flowers disperse, similar to ♀ flowers but the ovary empty or with a developing insect; mature syconia (inflorescence fruits) more or less fleshy, rarely dehiscent, the individual fruit (from each ♀ flower) a drupelet, thinly pulpy, with a woody endocarp forming a pyrene 0.5-5 mm. long, the seed with membranous integuments, the endosperm present or essentially lacking, the embryo curved, with conduplicate cotyledons (in larger seeds), to straight, with flat cotyledons (in smaller seeds).

LECTOTYPE SPECIES: *Ficus carica* L. (ING), one of Linnaeus's seven original species.

DISTRIBUTION: Pantropical and subtropical, with about 1,000 species. Corner (in treatments listed below) recognizes four subgenera in Asia and Australasia, three of which are represented in Fiji. In the present treatment 20 species are recorded from Fiji, of which 14 are indigenous (seven of them endemic) and six are cultivated.

USEFUL TREATMENTS OF GENUS: Corner, E. J. H. Taxonomic notes on *Ficus* Linn., Asia and Australasia. Gard. Bull. Singapore 17: 368-485. 1960; op. cit. 18: 1-69. 1960. Corner, E. J. H. Check-list of *Ficus* in Asia and Australasia with keys to identification. Gard. Bull. Singapore 21: 1-186. 1965. Corner, E. J. H. *Ficus* in the New Hebrides. Philos. Trans. Ser. B. 272: 343-367. 1975.

LOCAL NAMES AND USES: The names *nunu*, *masimasi*, and *losilosi* or variants of them are often equated with the genus *Ficus* in general, although more often these names are utilized only for the indigenous species of sect. *Ficus*, subsect. *Sycidium*. *Mbaka* may also be used as a general term for the genus, but usually this name is applied to the three indigenous banyans. The young leaves of several species are said to be edible when cooked, and the figs of many species are reported to be edible; minor medicinal uses are imputed to various indigenous species. Since usage is far from standardized, I list below under each taxon the local names and uses attributed to it by collectors.

Species of *Ficus* are symbiotic with small fig-wasps, on which their propagation depends. If removed from their natural area, species are seedless unless the specific fig-wasp has also been introduced. The females escape when the figs begin to ripen and carry pollen when they emerge. Our knowledge of the genus has been inestimably advanced by the work of Corner. In the present treatment I have abstracted the first key from his 1965 study, cited above, although of course the details refer only to species represented in Fiji and not to the entire circumscription of the infrageneric taxa indicated parenthetically. Comparatively few subsections and series are represented in Fiji; for the authorities, full circumscriptions, and names of included species of these and other infrageneric taxa the above-cited papers of Corner may be consulted. Classification of the species is intricate and depends upon microscopic details difficult to observe; therefore I have added a second, artificial key. None of the species cultivated in Fiji seem to have become naturalized, probably due to the absence of the specific gall-wasp in each case. But Corner's remarks (in Philos. Trans. Ser. B. 272:

350. 1975) on three banyans (*F. obliqua*, *F. prolixa*, and *F. tinctoria*) are significant in this connection. Eastward of the New Hebrides and New Caledonia these are the only banyans, and they are widespread into Polynesia. Corner's suggestion is that they may have acquired their present distributions through the agency of man, since the fruits and young leaves are edible as emergency foods. Their original distributions may be impossible to discover; quite possibly these three banyans are indeed aboriginal introductions into Fiji and Polynesia, but for distributional purposes they are usually treated as indigenous.

KEY TO SPECIES

Monoecious plants, rarely cauliflorous; figs often with interfloral bracts, without lateral bracts; tepals red or with white edges; stamen 1; gall- and ♀ flowers often similar; seeds smooth.

Banyans or strangling figs; leaf blades with a gland at back of petiole apex or none; style simple (subgen. *Urostigma*).

Fig orifice more or less closed by interlocking apical and internal bracts; anthers bilocular, with 4 pollen sacs, with longitudinal, introrse dehiscence.

Ovary red-brown at least in distal half; tepals generally narrow, acute; ♂ flowers ostiolar or disperse; leaf blades mostly with intercostal venation; cystoliths hypogenous or none; basal bracts persistent (sect. *Urostigma*).

Figs without internal bristles, sessile, subglobose, 8–15 mm. broad; ♂ flowers ostiolar, sessile in one ring; petioles 3.5–13 cm. long, usually articulate to lamina, separating in fallen leaves; leaf blades ovate, up to 26 × 16 cm., cordate or truncate at base, caudate-acuminate with the tip 25–90 mm. long, the lateral nerves 6–9 pairs; a large banyan but without aerial roots from branches (ser. *Religiosae*). 1. *F. religiosa*

Figs with abundant internal chaffy-vesicular bristles, sessile or on a peduncle to 3 mm. long, subglobose, 6–12 mm. broad; ♂ flowers ostiolar and disperse; petioles 0.8–3 cm. long; leaf blades elliptic to lanceolate-elliptic, up to 16 × 6.5 cm., rounded to cuneate at base, short-acuminate at apex, the lateral nerves 6–12 pairs, the intercostals few, zigzag, vague, or none; a large strangler with many descending roots, sometimes with aerial roots from branches (ser. *Caulobotryeae*). 2. *F. prolixa*

Ovary with a red mark at base; ♂ flowers disperse; petiole not articulate to lamina.

Leaf blades with intercostal venation or with the secondary lateral nerves almost as prominent as the primary; cystoliths mostly amphigenous or only hypergenous; figs with apical bracts in a disk, the internal bristles none (sect. *Conosycea*).

Petioles 1.5–7 cm. long; leaf blades elliptic to ovate, to 30 × 20 cm., usually cordate at base and obtuse at apex, with intercostal venation, the lateral nerves 5–7 pairs, the basal nerves 2–4 pairs, elongate, the cystoliths mostly hypergenous; figs sessile or the body pedicellate, depressed-globose, 14–25 mm. broad, the basal bracts mostly well developed, 3–7 × 10–14 mm.; a large banyan, with massive pillar-roots descending from the spreading branches (subsect. *Conosycea*, ser. *Drupaceae*, subser. *Indicae*). 3. *F. benghalensis*

Petioles 0.4–1.6 cm. long; leaf blades elliptic to ovate-elliptic, to 12 × 6 cm., usually cuneate at base, acute or acuminate at apex, without (or with a few vague) intercostals, the lateral nerves usually 6–11 pairs, the secondary nerves nearly as prominent, the basal nerves not elongate, the cystoliths amphigenous; figs sessile or with a slight, thick pedicel, ellipsoid to subglobose, 7–12 mm. broad, the basal bracts small, mostly concealed, 0.5–1.5 mm. long; a large banyan with drooping branches, with few or no aerial roots from branches (subsect. *Benjamina*, ser. *Benjamineae*). 4. *F. benjamina*

Leaf blades with the secondary lateral nerves as prominent as the primary, elliptic to subobovate, 10–40 × 4–22 cm., short-acuminate; cystoliths hypergenous; stipules large, pink to red; figs short-ellipsoid, to 12 × 9 mm., with a short thick peduncle usually 3–5 mm. long and 4–6 mm. thick, the basal bracts 3, early caducous; a large banyan with copious aerial roots but often cultivated as a small pot plant (sect. *Stilpnophyllum*). 5. *F. elastica*

Fig 6–13 mm. broad, the orifice bilabiate or triradiate, closed by inflexed (not interlocking) apical and internal bracts, the apical bracts often umbonate, the basal bracts 2 or 3, relatively large, early caducous, the peduncle variable, often short, dilated to 2–4 mm. broad at apex; ♂ flowers disperse, the anthers unilocular, reniform, with 2 pollen sacs, dehiscing longitudinally and crescentically; stipules 1–5 cm. long; leaf blades thin-coriaceous, up to 16 × 7 cm., the primary lateral nerves usually 8–13 pairs, the secondary laterals close, numerous, without distinct intercostals (sect. *Malvanthera*, ser. *Malvantheraeae*, subser. *Platypodeae*). 6. *F. obliqua*

Trees (not banyans); leaf blades usually elliptic to lanceolate and up to 22×9.5 cm., with 2 conspicuous basal glands, without auricles, not scabrid beneath, the lateral nerves scarcely raised beneath; figs 5–13 mm. broad, usually paired, with a peduncle 7–15 mm. long, the pedicel none or to 5 mm. long, the internal bristles few and minute or none; tepals mostly 3 or 4, often joined; ♂ flowers disperse, sometimes sparse; stigma bifid (subgen. *Pharmacosycea*, sect. *Oreosycea*, ser. *Nervosa*).

7. *F. smithii*

Diocious plants (rarely monoecious, only in species no. 20 in our area), sometimes cauliflorous; figs without interfloral bracts (subgen. *Ficus*).

Root-climber, with small, appressed bathyphylls, these ovate, to 3.5×2 cm., asymmetrically cordate, with petioles 2–4 mm. long; mature leaf blades ovate to oblong, $4-10 \times 2.5-6$ cm., somewhat cordate at base, obtuse to subacute at apex, the lateral nerves 3–6 pairs, oblique, the cystoliths hypogenous; petioles 8–25 mm. long; seed-figs obovoid or turbinate, to 8×5 cm., with abundant internal bristles, without lateral bracts, the basal bracts persistent; ♂ flowers ostiolar or distal, with 2 or 3 stamens, the filaments free or slightly joined, the anthers mucronate; indument of generally closely septate hairs; microscopic gland-hairs peltate (sect. *Rhizocladus*, ser. *Plagiostigmaticae*). 9. *F. pumila*

Trees or shrubs, sometimes epiphytic, strangling, or scrambling; indument of nonseptate hairs; microscopic gland-hairs various, mostly nonpeltate.

Perianth composed of separate tepals or lobate if these are joined; gall-stigma narrowly infundibuliform to subclavate; leaf blades often with glands in axils of principal basal nerves, or sometimes the glands subnodal.

Stamens 2–4, the filaments mostly free; tepals free, thin, white to reddish; ♂ flowers ostiolar, mostly pedicellate; style slender, the ♀ stigma often bifid; figs large, pyriform, usually solitary and axillary, with a collar of 3 basal bracts, without lateral bracts, the seeds lenticular, 1–2 mm. long; large shrub or small tree, the leaf blades symmetric, 10–20 cm. long, deeply 3- or 5-lobed, conspicuously palmately nerved, with hypogenous cystoliths (sect. *Ficus*, subsect. *Ficus*, ser. *Cariceae*). 8. *F. carica*

Stamen 1, or if stamens 2 then the fig with lateral bracts or without a collar of basal bracts; flowers often pedicellate; ♂ flowers ostiolar; ovary white, the style subterminal, the stigma simple, subclavate; seeds smooth or minutely reticulate, lenticular to short-oblong, generally with a single keel; leaf blades often toothed or asymmetric; trees or shrubs (sect. *Sycidium*).

Seeds lenticular, slightly keeled all around or in the upper half, rarely not at all, the hilum not prominent; receptacles axillary or cauliflorous, pedunculate or pedicellate; tepals white to pinkish; ♂ flowers without a normal gall-ovary, sometimes with a rudiment; figs often pedunculate, with a collar of 3 basal bracts; leaves distichous, the blades often asymmetric and scabrid, the cystoliths amphigenous or hypogenous, often papillate; trees or shrubs, not epiphytic (subsect. *Sycidium*, ser. *Scabrae*).

Leaf blades lanceolate, 6–13 cm. long, 0.5–1.5 cm. broad, cuneate at base, often narrowly so, not or slightly asymmetric, the basal nerves not elongate, the lateral nerves 7–11 pairs, the cystoliths amphigenous; petioles 1–5 mm. long; tepals pilose; figs axillary, solitary, subglobose, 7–12 mm. broad, mostly pedicellate, with scattered lateral bracts on stalk, the internal bristles few, minute, or none; small tree or slender shrub, 0.5–3 m. high, occurring along streams. 16. *F. bambusifolia*

Leaf blades broadly cuneate to cordate at base, asymmetric.

Base of leaf blades strongly asymmetric, narrowly cordate, the broader side often concealing the petiole (this 0.2–1 cm. long), the blades comparatively small, seldom more than 12×6 cm., the basal nerves not markedly elongate, scarcely reaching 1/3 length of blade, the cystoliths hypogenous; tepals pilose; figs solitary, axillary, 8–18 mm. broad, generally without a collar of basal bracts; shrub or small tree to 10 m. high, the vegetative parts glabrous or nearly so, the twigs 1–3 mm. thick. 15. *F. barclayana*

Base of leaf blade less strongly asymmetric, the petiole not concealed.

Leaf blades subacute to obtusely subacuminate, the intercostals lax; figs with basal bracts to 1.5 mm. long, the apical bracts not projecting.

Indument brown-hispidulous or fulvous-hispid; leaf blades scabrid above, the cystoliths amphigenous. 14. *F. fulvo-pilosa*

Indument white-villose or lacking.

Tepals pilose, reddish or pinkish; leaf blades ovate- to lanceolate-elliptic, up to 25×13 cm. on mature plants, slightly scabrid to nearly smooth above, the lateral nerves 4–9 pairs; cystoliths hypogenous; petioles 1–4 cm. long; mature figs 7–16 mm. broad, subglobose, with abundant internal bristles. 10. *F. scabra*

Tepals glabrous or slightly pilose, white; cystoliths amphigenous.

Leaf blades ovate to elliptic, usually not exceeding 17.5×15 cm. on mature plants, scabrid above, the lateral nerves 2–7 pairs; petioles to 9 cm. long; mature figs 5–15 mm. broad, subglobose, with abundant internal bristles. 11. *F. storckii*

Leaf blades oblong, large, up to 45×18 cm., narrowly cordate or auricled at base, smooth above, the lateral nerves 7-15 pairs; petioles 0.5-3.5 cm. long; mature figs 6-15 mm. broad, subglobose, with abundant internal bristles.

12. *F. masonii*

Leaf blades acute, acutely acuminate, cuspidate, or caudate, the intercostals generally numerous and regular; figs becoming ramiflorous in clusters or cauliflorous; pedunculate with a collar of basal bracts or, if without such bracts, then the apical bracts not projecting.

Figs 10-30 mm. broad, the apical bracts projecting, the basal bracts 1.5-4 mm. long; leaf blades comparatively large but seldom exceeding 30×15 cm., with hypogenous cystoliths, the lateral nerves 8-15 pairs; petioles 1-3 cm. long. 13. *F. greenwoodii*

Figs 9-25 mm. broad, without lateral bracts on body, on a peduncle up to 15 mm. long, the basal bracts 0.5-1.5 mm. long; leaf blades usually smaller than 25×14 cm., elliptic to ovate-elliptic, the lateral nerves 5-11 pairs, the intercostals usually lax, the cystoliths amphigenous; petioles 0.3-2.5 cm. long; indument brown-hispidulous to fulvous-hispid. 14. *F. fulvo-pilosa*

Seeds short-oblong, generally keeled or gibbous at apex; tepals white, puberulent; σ flowers usually with a normal gall-ovary; figs 10-17 mm. broad, smooth, without lateral bracts on body, not pedunculate; leaves spirally arranged, not distichous, the blades subcoriaceous, elliptic to oblong, slightly asymmetric, 4-13 cm. broad, smooth or subscabrid, brown-areolate beneath, subcordate to broadly cuneate at base, acute to subacuminate at apex, the lateral nerves 3-9 pairs, the cystoliths amphigenous, not papillate; a banyan (epiphytic strangler) to 25 m. high (subsect. *Palaecomorphe*, ser. *Pallidae*). 17. *F. vinctoria*

Perianth gamophyllous (saccate, cupular, annular), entire (or split by enlarging ovary), membranous, or none; receptacle without internal bristles; σ flowers ostiolar, the stamen 1 (in our species); gall-stigma widely infundibuliform, the \varnothing stigma simple; figs with or without lateral bracts, mostly with a collar of 3 basal bracts; leaves spirally arranged, the blades coriaceous, mostly without basal glands, but a subnodal gland often present on twig; often cauliflorous trees, our species essentially glabrous (sect. *Sycocarpus*).

Seeds 1.4-2 mm. long, subcompressed, often auriculiform, obtusely carinate, the hilum not prominent; perianth and ovary red or white; dioecious plants (subsect. *Auriculisperma*).

Leaf blades large, 30-90 cm. long, smooth, cordate-auricled, with 15-25 pairs of lateral nerves, the cystoliths amphigenous or hypogenous; figs axillary, 25-50 mm. broad, borne on a peduncle 3-9 mm. long, concealed, becoming cauliflorous, not verrucose, without lateral bracts, the basal bracts 1.5-9 mm. long; slender, simple tree, with leaves aggregated distally, the petioles 0.5-4 cm. long, the twigs 5-10 mm. thick (ser. *Theophrastoides*). . 18. *F. theophrastoides*

Leaf blades smaller, up to 32×24 cm., scabrid on both surfaces, subcordate at base but not auricled, with 4-10 pairs of lateral nerves and slightly elongate basal nerves, the cystoliths amphigenous; figs axillary and borne in clusters on defoliate branches, 15-50 mm. broad, slightly ridged toward apex, with several small lateral bracts; freely branched shrub or tree, with leaves scattered, the petioles 1-15 cm. long, the twigs comparatively slender (ser. *Vitienses*).

19. *F. vitiensis*

Seeds 1.2-1.5 mm. long, lenticular, scarcely carinate, the hilum not prominent; perianth red, saccate; ovary white; dioecious or monoecious plants; receptacle pedunculate, without lateral bracts; our species a monoecious tree with rami- or cauliflorous figs, these 10-30 mm. broad, borne on usually slender, woody, specialized branches 0.5-2 m. long but sometimes aggregated into dense, compact masses up to 1.5 m. in diameter; leaf blades elliptic to ovate-oblong, up to 18×10 cm., with intercostals, the nerves not raised beneath, the cystoliths amphigenous; petioles (0.2-) 1-2.5 cm. long; stigmas agglutinate at time of pollination into a synstigma, losing their identity, but in immature gall- and \varnothing flowers simple, discoid, and fimbriate, becoming subinfundibuliform before the synstigmatic stage (subsect. *Papuasyce*). 20. *F. pritchardii*

ARTIFICIAL KEY TO SPECIES

Cultivated species.

Root-climber with dimorphic leaves, the bathyphylls small, to 3.5×2 cm., usually appressed to stone surfaces and forming an ornamental cover, the mature leaf blades ovate to oblong, to 10×6 cm.

9. *F. pumila*

Trees, shrubs, or strangling figs.

Large shrub or small tree, the leaf blades deeply 3- or 5-lobed, palmately nerved; figs large, edible; the commercial fig. 8. *F. carica*

Banyans (epiphytic stranglers becoming large, spreading trees, sometimes with aerial roots from branches), the leaf blades not lobed.

Leaf blades with numerous, very close lateral nerves, the basal nerves not elongate.

Aerial roots copious; stipules large and conspicuous, pink to red; leaf blades up to 40×22 cm., the primary lateral nerves usually 15–20 pairs, the secondary lateral nerves as prominent as the primaries; often cultivated as a comparatively small pot plant. 5. *F. elastica*

Aerial roots few or none; stipules small, inconspicuous; leaf blades up to 12×6 cm., the primary lateral nerves usually 6–11 pairs, the secondary lateral nerves nearly as prominent as the primaries; a shade tree with long, drooping branches and dense foliage. 4. *F. benjamina*

Leaf blades with lateral nerves distinctly spaced, 5–9 pairs, the basal nerves elongate or not.

Apex of leaf blades caudate-acuminate with the tip 25–90 mm. long; petioles 3.5–13 cm. long, articulate to lamina; a large banyan but without aerial roots from branches. 1. *F. religiosa*

Apex of leaf blades obtuse; petioles 1.5–7 cm. long, not articulate to lamina; a large banyan with massive pillar-roots descending from branches. 3. *F. benghalensis*

Indigenous species.

Banyans (epiphytic stranglers becoming large trees, with prop roots or with aerial roots descending from branches).

Leaf blades with primary lateral nerves usually 8–13 pairs and the secondary lateral nerves fine, close, numerous, and without distinct intercostals. 6. *F. oblucua*

Leaf blades with the primary lateral nerves 3–12 pairs, spaced, usually with distinct intercostals.

Petioles disarticulating from lamina of dried, fallen leaves; leaf blades up to 6.5 cm. broad, short-acuminate at apex; figs 6–12 mm. broad, ripening white to pink and purple-black, sessile or on a peduncle to 3 mm. long. 2. *F. prolixa*

Petioles not disarticulating from lamina; leaf blades 4–13 cm. broad, brown-areolate beneath, acute to subacuminate at apex; figs 10–17 mm. broad, ripening yellow to orange to red or purple, tapering into a short pedicel but essentially without a peduncle. 17. *F. tinctoria*

Trees or shrubs, not epiphytic nor strangling, without aerial roots.

Base of leaf blades not or slightly asymmetric.

Leaves small, the petioles 1–5 mm. long, the blades lanceolate, 6–13 cm. long, 0.5–1.5 cm. broad; figs axillary, solitary, 7–12 mm. broad; small tree or slender shrub 0.5–3 m. high, occurring along streams. 16. *F. bambusifolia*

Leaves larger, the blades at least 2 cm. broad and usually much broader; trees or shrubs usually more than 3 m. high, not associated with watercourses.

Figs rami- or cauliflorous, 10–30 mm. broad, borne on usually slender, woody, specialized branches 0.5–2 m. long but sometimes aggregated into dense, compact masses up to 1.5 m. in diameter; leaf blades up to 18×10 cm. 20. *F. pritchardii*

Figs axillary or rami- or sometimes cauliflorous, but not borne on elongate, specialized branches nor in large masses, the clusters not exceeding 15 cm. in diameter.

Slender, simple tree, with leaves aggregated distally, the petioles stout, 0.5–4 cm. long, the blades large, 30–90 cm. long, cordate-auricled, with 15–25 pairs of lateral nerves; figs 25–50 mm. broad, not verrucose. 18. *F. theophrastoides*

Freely branched shrubs or trees, with leaves scattered, the blades smaller, rarely as long as 30 cm.

Figs 15–50 mm. broad, slightly ridged toward apex; petioles variable in length, 1–15 cm. (but usually at least 5 cm.) long; leaf blades usually ovate-oblong, up to 32×24 cm., scabrid on both surfaces, usually subcordate at base. 19. *F. vitiensis*

Figs 5–13 mm. broad, smooth; petioles 0.4–3.5 cm. long; leaf blades lanceolate to elliptic or elliptic-obovate, not more than 22×9.5 cm., smooth beneath, usually obtuse at base.

7. *F. smithii*

Base of leaf blades asymmetric, the blades often scabrid.

Indument of branchlets, leaves, and figs copious and persistent, brown-hispidulous or fulvous-hispid; petioles 0.3–2.5 cm. long; leaf blades elliptic to ovate-elliptic, usually smaller than 25×14 cm. 14. *F. fulvo-pilosa*

Indument sparse and white-villose or lacking.

Base of leaf blade strongly asymmetric, narrowly cordate, the broader side often concealing the petiole (this 0.2–1 cm. long), the blades seldom larger than 12×6 cm.; figs solitary, axillary, 8–18 mm. broad. 15. *F. barclayana*

Base of leaf blade less strongly asymmetric, the petiole not concealed.

Leaf blades acute, acutely acuminate, cuspidate, or caudate, comparatively large but seldom exceeding 30×15 cm.; petioles 1–3 cm. long; figs 10–30 mm. broad, with projecting apical bracts, the basal bracts 1.5–4 mm. long. 13. *F. greenwoodii*

Leaf blades subacute to obtusely acuminate; figs 5–16 mm. broad, with apical bracts not projecting, the basal bracts not more than 1.5 mm. long.

Lateral nerves of leaf blades 7–15 pairs, the blades oblong, large, up to 45×18 cm., narrowly cordate or auricled at base, smooth above; petioles 0.5–3.5 cm. long. 12. *F. masonii*

Lateral nerves of leaf blades 2-9 pairs, the blades ovate to elliptic, not larger than 25×15 cm., cordate to obtuse or acute at base, not auricled, scabrid to nearly smooth above.

Leaf blades up to 25×13 cm., slightly scabrid to nearly smooth above, the lateral nerves 4-9 pairs; cystoliths hypogenous; mature figs 7-16 mm. broad. 10. *F. scabra*

Leaf blades usually not exceeding 17.5×15 cm. and often much smaller, scabrid above, the lateral nerves 2-7 pairs; cystoliths amphigenous; mature figs 5-15 mm. broad.

11. *F. storckii*

1. ***Ficus religiosa*** L. Sp. Pl. 1059. 1753; Corner in Gard. Bull. Singapore 17: 371. 1960; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 138. 1972; Corner in Gard. Bull. Singapore 21: 6. 1965.

An epiphytic strangler, becoming a large banyan, or a large tree with few or no aerial roots, infrequently cultivated in Fiji.

TYPIFICATION: Five prior references are cited by Linnaeus.

DISTRIBUTION: Indigenous in the sub-Himalayan area, Bengal, and central India, now widely cultivated in many parts of the tropics as an ornamental or roadside tree.

LOCAL NAMES AND USES: *Pipal* (*peepul*) tree; *bodh* (*bo*) tree; a sacred tree among Buddhists and Hindus. It is sparingly grown in Fiji as an ornamental.

AVAILABLE COLLECTION: VITI LEVU: TAILEVU: Vunimono Girls' School, Nausori, DA 13271.

2. ***Ficus prolixa*** Forst. f. Fl. Ins. Austr. Prodr. 77. 1786; Seem. Fl. Vit. 248. 1868; Summerhayes in J. Arnold Arb. 13: 101. 1932; Yuncker in Bishop Mus. Bull. 178: 48. 1943, in op. cit. 184: 36. 1945, in op. cit. 220: 100. 1959; Corner in Gard. Bull. Singapore 21: 10. 1965; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 125. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 319. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 138 (as var. *prolixa*). 1972; Corner in Philos. Trans. Ser. B. 272: 354, fig. 3. 1975.

Ficus sp. Seem. in Bonplandia 9: 259, p. p. 1861.

Ficus obliqua sensu Seem. Viti, 441, p. p. 1862, Fl. Vit. 251, p. p., t. 68, fig. 8. 1868.

As it occurs in Fiji, *Ficus prolixa* is a much-branched tree 6-12 m. high, occurring on rocky shores and slopes from sea level to not much more than 60 m. elevation. It is a large strangler with many descending roots but is sometimes seen as a tree with a trunk to 50 cm. in diameter, usually but not always found on limestone. Its mature purple-black figs have been obtained only in August and September.

TYPIFICATION AND NOMENCLATURE: As lectotype I propose to take the specimen at BM from Tahiti marked "Otaheitee, Messrs. Forster," collected on the second Cook voyage. Also at BM is a second sheet bearing a single leaf, indicated as "G. Forster's Herbarium." The species is also represented by a Forster collection from Tanna, New Hebrides, at κ , originally identified as *F. obliqua*. In his comments and illustration of 1868 Seemann has mixed *F. prolixa* with *F. obliqua*, the former depicted from a sterile branch (fig. 8 only). Seemann 436 is a mixed collection, both species being mounted on the κ specimen, while the BM specimen represents *F. prolixa* only. The two species belong to different sections of subgen. *Urostigma*, *F. obliqua* being by far the more common in Fiji.

DISTRIBUTION: Micronesia, the New Hebrides, and New Caledonia eastward to the Tuamotus, Marquesas, and Line Islands. Our material falls into var. *prolixa*; a second variety from Micronesia has been described by Corner (in Gard. Bull. Singapore 17: 378. 1960).

LOCAL NAMES: *Nunu* and *mbaka ni Viti* have been recorded; the first refers to many species of *Ficus* in Fiji and the second usually to *F. obliqua*, which continues to be confused with *F. prolixa* in herbaria.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Mathuata coast, *Greenwood 650*. TAVEUNI: *Seemam 436*, p. p. (BM, K). KIMBOMBO ISLETS: *Bryan 591*. LAKEMBA: Vicinity of Tumbou, *DA 1384*; between Yandrana and Vakano, *Garnock-Jones 947*.

3. *Ficus benghalensis* L. Sp. Pl. 1059. 1753; Corner in Gard. Bull. Singapore **17**: 381. 1960, in op. cit. **21**: 14. 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 135. 1972.

Ficus indica L. Sp. Pl. 1060. 1753.

Ficus benghalensis is sparingly cultivated near sea level in Fiji. It becomes a huge banyan with massive pillar-roots descending from the spreading branches. The only available collections were in fruit in February and March.

LECTOTYPIFICATION AND NOMENCLATURE: Linnaeus cited several prior references for each of his species. In his informative discussion of 1960 (cited above, pp. 381-384) Corner takes *Ficus benghalensis* to be typified by Rheede, Hort. Ind. Malabar. **1**: t. 28, explaining his reduction of *F. indica* to it.

DISTRIBUTION: India; now widely cultivated.

LOCAL NAMES AND USE: No names have been indicated for Fijian collections, but elsewhere the species is known as *banyan*, *Indian banyan*, and *vada tree*. It is an ornamental that becomes spectacular for its enormous spread, but it is not common in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, in garden of Chinese School, *DA 6068*. FIJI without further locality, *DA 13269* (*L.9545*).

4. *Ficus benjamina* L. Mant. Pl. 129. 1767; Merr. Interpret. Rumph. Herb. Amb. 195. 1917; Corner in Gard. Bull. Singapore **17**: 374. 1960; J. W. Parham, Pl. Fiji Isl. 94. 1964, ed. 2. 136. 1972; Corner in Gard. Bull. Singapore **21**: 21. 1965, in Philos. Trans. Ser. B. **253**: 67. fig. 9 (left). 1967.

A large, spreading banyan, with drooping branches and usually without aerial roots, often cultivated near sea level in Fiji, where specimens up to 15 m. in height are seen. The small, essentially sessile figs, at first pink or red, become purple at maturity and are probably to be found in most months, although on available specimens they have been obtained only in May, June, and October.

TYPIIFICATION: The species is typified by Rheede, Hort. Ind. Malabar. **1**: t. 26 (Merrill, 1917, cited above, who indicates as a synonym *Varinga parviflora* Rumph. Herb. Amb. **3**: 139. t. 90. 1743).

DISTRIBUTION: India and southern China throughout Malesia to the Solomon Islands and northern Australia; widely cultivated throughout the tropics. It is much more frequent in Fiji than suggested by the few available collections.

LOCAL NAME AND USE: *Weeping fig*; the long, drooping branches and dense foliage of this species make it a desirable ornamental and shade tree, used as a street tree in Suva and other Fijian towns.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Namuamua, *Smith 9072*. REWA: Suva, *Setchell & Parks 15150*. VANUA LEVU: MATHUATA: Ndreketi Plantations, *DA 16962*.

5. *Ficus elastica* Roxb. Hort. Beng. 65, nom. nud. 1814, Fl. Ind. ed. 2. **3**: 541. 1832; Corner in Gard. Bull. Singapore **17**: 374. 1960; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 137. 1972; Corner in Gard. Bull. Singapore **21**: 24. 1965.

An epiphytic strangler, becoming a large banyan with copious aerial roots, sparingly grown in Fiji as a comparatively small pot plant or garden plant.

TYPIFICATION: Roxburgh mentions that the species inhabits the mountains of northern Silhet Province (presumably Sylhet in the present Bangladesh).

DISTRIBUTION: India to Malaya, and perhaps indigenous southward to Java; widely cultivated elsewhere.

LOCAL NAMES AND USES: The names commonly used are *rubber plant*, *India rubber tree*, and *India rubber fig*. At one time this *Ficus* was widely used as a source of commercial rubber, but its product is inferior to that of *Hevea*. Although it will become a large tree in gardens, its principal ornamental use is as a pot plant grown for its attractive foliage and large, pink or red stipules.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nasinu, Approved School, DA 11805. PROVINCE?: Ngerenggere, DA 5625.

6. *Ficus obliqua* Forst. f. Fl. Ins. Austr. Prodr. 77. 1786; Seem. Viti, 441, p. p. 1862, Fl. Vit. 251, p. p. t. 68 (excl. fig. 8). 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Gibbs in J. Linn. Soc. Bot. 39: 170. 1909; Summerhayes in J. Arnold Arb. 13: 101. 1932, in Bishop Mus. Bull. 141: 55. 1936; Yuncker in op. cit. 178: 47. 1943, in op. cit. 184: 35. 1945, in op. cit. 220: 99. 1959; J. W. Parham, Pl. Fiji Isl. 94. 1964, ed. 2. 138. 1972; Corner in Gard. Bull. Singapore 21: 26. 1965, in Philos. Trans. Ser. B. 253: 70. fig. 11. 1967; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 125. 1970; Corner in Philos. Trans. Ser. B. 272: 355. 1975.

Ficus sp. Seem. in Bonplandia 9: 259, p. p. 1861.

An often spreading tree 4–30 m. high, with copious white latex, at first an epiphytic strangler and becoming a banyan with numerous prop roots descending from the branches, occurring from near sea level to an elevation of about 900 m. It is found along rocky beaches and shores, in dry forest and secondary forest, on dry cliffs, and sometimes also cultivated in villages. The figs, turning from green to yellow, orange, and red, are seen throughout the year.

TYPIFICATION: Forster originally cited *Ficus obliqua* as from "Namoka, Tanna," references to specimens from the second Cook voyage from Nomuka Island, Tonga, and Tanna, New Hebrides. The Tongan specimen at BM is indicated as from Amsterdam Island (i. e. Tongatapu); Corner has indicated this as the type, as it agrees with Forster's drawing no. 294 (although the fig in that drawing represents *F. prolixa*). This BM specimen appears to be acceptable as the lectotype, since no Forster collection from Nomuka seems available. At BM there is also a fragmentary specimen pencilled: "Tana. 249. 409: *Ficus obliqua*." This actually represents *F. prolixa*.

DISTRIBUTION: *Ficus obliqua* seems indigenous from Celebes eastward to Australia, Fiji, Tonga, Niue, and Samoa. Our material falls into var. *obliqua*; other varieties from Australia are recognized by Corner. It is an abundant species in Fiji, from which about 40 collections have been examined.

LOCAL NAMES AND USES: *Mbaka* is the usual name, but *mbaka ni Viti* and *mbaka ni veikau* are also used. It was once regarded as a sacred tree by Fijians. The inner bark has been used for making cloth when *Broussonetia papyrifera* was not available in sufficient quantity. The latex has been used as birdlime and also as a medicine for sore joints.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, west of Mbatinaremba, St. John 18037. VITI LEVU: MBA: North of Lomolomo, Degener & Ordenez 13719; mountains near Lautoka,

Greenwood 296; Nalotawa, eastern base of Mt. Evans Range, *Smith 4429*; vicinity of Nandarivatu, *Gibbs 818*. NADRONGA & NAVOSA: Nausori Highlands, *DA 13350*. SERUA: Coastal hills near Taunovo River, east of Wainiyambia, *Smith 9581*. NAMOSI: Vicinity of Nanggarawai Village, *Gillespie 3202*. RA: Vatudamu, vicinity of Rewasa, near Vaileka, *Degener 15403*. NAITASIRI: Rarandawai, Wainamo-Wainisavulevu divide, Wainimala Valley, *St. John 18271*; Kalambo, *Bryan 209*. TAILEVU: Matavatathou, *DA 9237 (McKee 2802)*; near Londoni, *DA 14420*. REWA: Lami, *DA 17090*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 58*. NGAU: *Tothill 776*. VANUA LEVU: MATHUATA: Mountains near Lambasa, *Greenwood 544*; Lambasa market (cult.), *DA 12198 (DF 48)*. TAVEUNI: *Seemann 436*, p. p. FULANGA: On limestone formation, *Smith 1199*. ONGEA NDRIKI: Along rocky beach, *Bryan 419*.

Ficus obliqua and *F. prolixa* (q. v.) were confused by both Forster and Seemann, and many modern herbarium annotations also indicate uncertainty. The two species have very different stamens and fall into different sections of subgen. *Urostigma*. They can be distinguished, even when sterile, by the leaf blades of *F. obliqua* having fine, close, numerous lateral nerves without distinct intercostals, while those of *F. prolixa* have the lateral nerves spaced and often with distinct intercostals.

7. *Ficus smithii* Horne ex Baker in J. Linn. Soc. Bot. **20**: 372. 1883.

A species limited to Fiji, the New Hebrides, and the Solomon Islands, which Corner divides into two varieties. In his 1960 treatment (cited below) Corner placed the species in subgen. *Pharmacosycea*, sect. *Oreosycea*, ser. *Austrocaledonicae*, but in 1970 (cited below) he changed its position to ser. *Nervosae* (1970, pp. 387-392). This series occurs from Ceylon and southern China to Fiji and is composed of 20 species; *F. smithii* belongs to a cluster of five species ranging from New Guinea to Fiji, all five being indigenous in the Solomons. The closest ally of *F. smithii* is now believed to be *F. illiberalis* Corner (in *Philos. Trans. Ser. B.* **253**: 80. *fig. 17*. 1967).

Ficus smithii is the only species of subgen. *Pharmacosycea* found in Fiji. It has sometimes (more especially its var. *robusta*) been confused in herbaria with *F. tinctoria* (subgen. *Ficus*), to which it bears a superficial similarity in the size, shape, texture, color, and venation of leaf blades. However, *F. smithii* is a simple tree usually occurring in inland forest, with stipules at first copiously sericeous or strigose, the leaf blades equilateral at base, and the figs rounded at base to a short pedicel and an elongate peduncle; *F. tinctoria* is a banyan primarily of coastal thickets (but sometimes found inland), with glabrous stipules, the leaf blades slightly inequilateral at base, and the figs tapering at base into a short pedicel but essentially without a peduncle.

KEY TO VARIETIES

- Petioles 4-14 mm. long; leaf blades narrowly elliptic or lanceolate, up to 13 cm. long and 4.5 cm. broad, obtusely acuminate, the lateral nerves 7-9 per side; receptacle 5-8 mm. broad, the peduncle 6-12 mm. long, slender, about 0.5 mm. in diameter. 7a. var. *smithii*
 Petioles 15-35 mm. long; leaf blades elliptic to elliptic-obovate, 7-22 cm. long, 3.6-9.5 cm. broad, obtuse or subacute at apex, the lateral nerves 8-13 per side; receptacle 10-13 mm. broad, the peduncle 7-15 mm. long, comparatively robust, 1-1.5 mm. in diameter. 7b. var. *robusta*

7a. *Ficus smithii* var. *smithii*; Corner in *Gard. Bull. Singapore* **17**: 414. 1960, in op. cit. **21**: 34. 1965; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 138. 1972. FIGURE 53A.

Ficus smithii Horne, *A Year in Fiji*, 262, nom. nud. 1881.

Ficus smithii Horne ex Baker in J. Linn. Soc. Bot. **20**: 372. 1883; J. W. Parham, *Pl. Fiji Isl.* 94. 1964; Corner in *Philos. Trans. Ser. B.* **253**: 84. *fig. 20*. 1967, in op. cit. **259**: 387. 1970.

As it occurs in Fiji, the typical variety of *Ficus smithii* is a tree 3-10 m. high occurring in forest and secondary forest at elevations of about 100-900 m. Its pink or light crimson figs have been obtained in March, June, July, and December.

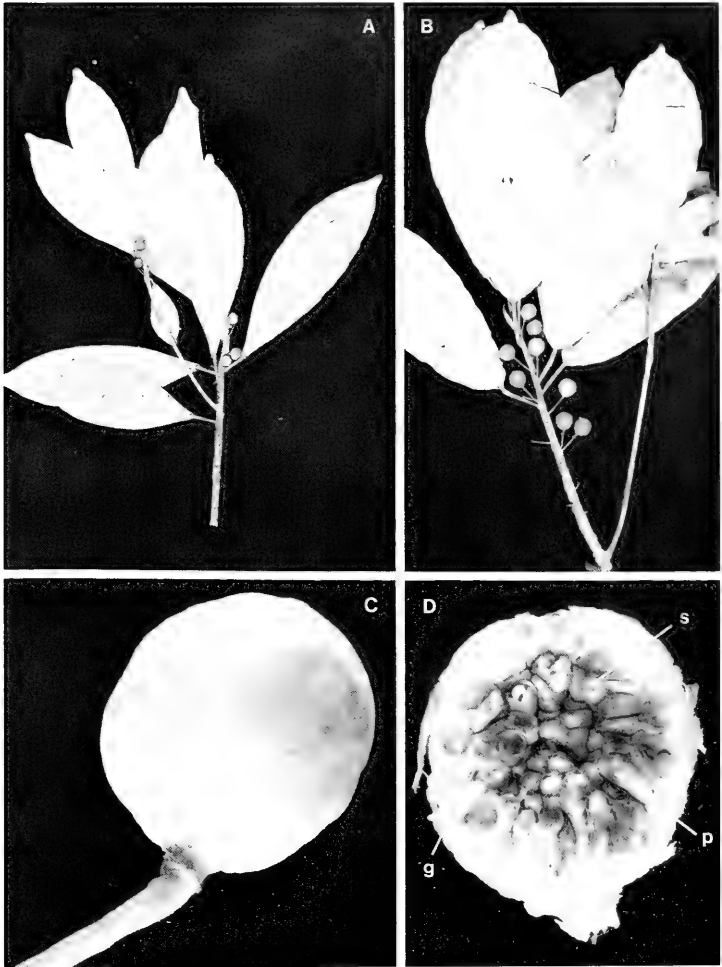


FIGURE 53. A, *Ficus smithii* var. *smithii*, from DA 13410; distal portion of branchlet, with foliage and mature figs, $\times 1/3$. B-D, *Ficus smithii* var. *robusta*, from DA 14256; B, distal portion of branchlet, with foliage and mature figs, $\times 1/3$; C, essentially mature fig, $\times 4$; D, longitudinal section of receptacle, showing σ^7 (s) flowers each with 1 stamen. f (p) flowers, and gall-flowers (g), $\times 4$.

TYPIFICATION: The holotype is *Horne 516* (κ), collected in March, 1878, in mountain forest on the island of Rambi. As requested in Horne's field notes, Baker named the species after J. C. Smith, Esq., then a member of the Council of the Fiji Government.

DISTRIBUTION: Solomon Islands and Fiji; in the former archipelago this is the only variety of the species to occur, but in Fiji this variety is comparatively rare.

LOCAL NAME: *Mbakani Viti* ("Fijian fig"), a not very informative name, is indicated for *DA 13410*, cited below.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: South of Nandarivatu, *Gillespie 4242*. VANUA LEVU: THAKAUNDOVE: Nakoroutari, *DA 15231*; Navonu Creek, Natewa Peninsula, *DA 13410*.

7b. *Ficus smithii* var. *robusta* Corner in Gard. Bull. Singapore **17**: 414, 1960, in op. cit. **21**: 34, 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 138, 1972; Corner in Philos. Trans. Ser. B. **272**: 355, fig. 4 (left), 1975. FIGURE 53B-D.

Ficus austro-caledonica sensu Summerhayes in J. Arnold Arb. **13**: 99, 1932; non Bureau.

Ficus smithii sensu Summerhayes in Bishop Mus. Bull. **141**: 55, 1936.

The more robust variety of *Ficus smithii*, as it occurs in Fiji, is a tree 4–30 m. high, with a trunk to 45 cm. in diameter or more (rarely noted as a shrub 2 m. high), found at elevations from near sea level to 970 m. It is usually seen in inland dense, thin, or rocky forest, less often in coastal forest. The figs, yellow to red in color, have been noted throughout the year.

TYPIFICATION: The type is *Smith 8339* (CGE HOLOTYPE; many ISOTYPES), collected Aug. 14, 1953, on the slopes of Mt. Manuka, east of Wairiki, Taveuni.

DISTRIBUTION: New Hebrides and Fiji; in the former archipelago it is the only variety of *Ficus smithii* known to occur; in Fiji it is fairly abundant, more than 40 collections being at hand.

LOCAL NAMES AND USE: Several local names have been recorded, here arranged by provinces: *kavika ni songge*, *nggaunggau*, and *lauito* (Mba); *mbulunato* (Nandronga & Navosa); *masimasi* and *yayawa* (Serua); *kaumindra* (Rewa); *mbauvundi* (Mbua). In reference to the Mbua collection I was informed that the tree trunks are used for masts, but the name (like some of the others listed) is more suggestive of Sapotaceae.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *DA 13031*; hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 5879*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 12671* (*Melville et al. 7047*); vicinity of Mbelo, near Vatukarasa, *Tabualewa 15637*. SERUA: Nathengathenga Creek, *DA 14272*; inland from Namboutini, *DA 14256*; hills north of Ngaloa, in drainage of Wainngere Creek, *Smith 9162*. NAMOSI: Mt. Naitarandamu, *Gillespie 3368*; northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8709*. NAITASIRE: Suva Pumping Station, *Degener & Ordenez 13747*. REWA: Suva Range, Nggoya, *DA L.9558*. KANDAVU: Kiombo, *DA 12436* (*DF 81*). VANUA LEVU: MBUA: Lower Wainunu River Valley, *Smith 1728*. THAKAUNDOVE: Southwestern slope of Mt. Mbatini, *Smith 605*; Maravu, near Salt Lake, *Degener & Ordenez 14229*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4753*.

8. *Ficus carica* L. Sp. Pl. 1059. 1753; Seem. Fl. Vit. 248. 1868; Yuncker in Bishop Mus. Bull. 178: 47. 1943, in op. cit. 220: 99. 1959; Corner in Gard. Bull. Singapore 17: 417. 1960; J. W. Parham, Pl. Fiji Isl. 98. 1964; Corner in Gard. Bull. Singapore 21: 36. 1965; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 124. 1970.

The commercial fig, very sparingly cultivated in Fiji, is a large shrub or small tree to 10 m. high, with characteristically 3- or 5-lobed leaf blades.

TYPIFICATION: Nine earlier references are mentioned by Linnaeus, but I am not aware of a formal lectotypification.

DISTRIBUTION: A native of Asia Minor, early spreading throughout the Mediterranean area. The species is of very ancient cultivation and is now grown in many parts of the world. It does not thrive in tropical lowlands but can be grown at higher elevations. Seemann's 1868 note refers to its cultivation in Hawaii, not in Fiji, and so its introduction was presumably later than 1860.

No Fijian vouchers support this record, but such material is available from Tonga and Niue, as noted by Yuncker and Sykes.

9. *Ficus pumila* L. Sp. Pl. 1060. 1753; Yuncker in Bishop Mus. Bull. **178**: 48. 1943, in op. cit. **220**: 100. 1959; Corner in Gard. Bull. Singapore **21**: 52. 1965; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 126. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 138. 1972.

Ficus repens Rottler in Ges. Naturf. Freunde Berlin Neue Schriften **4**: 208. 1803; J. W. Parham, Pl. Fiji Isl. 94. 1964.

A frequently cultivated root-climber, the plant appressed to stone surfaces when juvenile, if allowed to mature developing fertile branches of very different appearance, with obviously petiolate, ovate to oblong leaf blades and large figs. In Fiji it is used in gardens near sea level, found more frequently than suggested by the few available vouchers.

TYPEIFICATION AND NOMENCLATURE: Two references are given by Linnaeus; unless there is a specimen in one of the Linnaean herbaria the cited Kämpfer illustration could be taken as the lectotype. *Ficus repens* is noted as a direct synonym by Corner in 1965.

DISTRIBUTION: Indigenous in China and Japan and now widely cultivated in warm countries.

LOCAL NAMES AND USE: *Creeping fig*; *climbing fig*. It is an ornamental, widely used as a wall covering.

AVAILABLE COLLECTIONS: VITI LEVU: RA: Tovu Island, DA 11837. NAITASIRI: Nanduruloulou, DA 12059. REWA: Suva, DA 18060.

10. *Ficus scabra* Forst. f. Fl. Ins. Austr. Prodr. 76. 1786; Yuncker in Bishop Mus. Bull. **178**: 48. 1943, in op. cit. **184**: 36. 1945, in op. cit. **220**: 100. 1959; Corner in Gard. Bull. Singapore **21**: 71. 1965; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 126. fig. 34. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 138. 1972; Corner in Philos. Trans. Ser. B. **272**: 361. fig. 6, c-g, 7, a. 1975.

Ficus aspera sensu Yuncker in Bishop Mus. Bull. **220**: 99. 1959; non Forst. f.

Ficus storckii sensu Yuncker in Bishop Mus. Bull. **220**: 101. 1959; non Seem.

A tree to 18 m. high, or sometimes noted as a shrub, with scanty latex, occurring in coastal and lowland forest, infrequently found inland to elevations up to 300 m. The figs are axillary, often solitary, but becoming rami- or cauliflorous; at first they are yellow to red, becoming purple-black at maturity and to be expected in months scattered throughout the year.

TYPEIFICATION: Forster cited this species as from "Tanna, Namoka" (Tanna, New Hebrides, and Nomuka, Tonga). Of the three Forster specimens at BM, the one indicated as "Tanna, J. R. & G. Forster" may be taken as the lectotype, collected during Cook's second voyage. The other two sheets are indicated as "G. Forster's Herbarium" and "Pallas Herb."; they are not necessarily isolectotypes.

DISTRIBUTION: New Caledonia and the New Hebrides to Fiji, Tonga, Niue, and Samoa. In Fiji it seems less frequent than *Ficus storckii*, with which it is easily confused.

LOCAL NAMES AND USE: The names *laweto*, *losilosi*, and *numu* have been recorded; two collectors indicate that the cooked young leaves are edible.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 350*. NANDRONGA & NAVOSA: Thuvu, near beach, *Greenwood 244*; vicinity of Singatoka, *Greenwood 244A, 779* (coll. *H. Phillips*); Mbulu, near Sovi Bay, *Degener 14984*; Naruku, vicinity of Mbelo, near Vatukarasa, *Degener 15185*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8765*; vicinity of Namua-mua, *Gillespie 3015*. RA: Tuvavatu, vicinity of Rewasa, near Vaileka, *Degener 15366*. NAITASIRE: Prince's Road, *DA 11875*. NGAU: Hills east of Herald Bay, on slopes of Mt. Vonda toward Waikama, *Smith 7984*. VANUA MBALAVU: Nambavatu, *Tothill 773*. NAYAU: *Tothill 771*. LAKEMBA: *Tothill 772*. MARA-MBO: On rough limestone slope, *Bryan 515*. NAVUTU-I-LOMA: *Bryan 462*. FULANGA: *Tothill 774*; on limestone formation, *Smith 1177*. FIJI without further locality, *Gillespie 4414*.

Corner (1975, cited above) points out the similarity of *Ficus scabra* to *F. aspera* (endemic to the New Hebrides) and *F. storckii* (New Hebrides and Fiji). *Ficus scabra* has cystoliths only on the lower leaf surface, *F. storckii* on both surfaces; this distinction is useful in dividing the Melanesian and Polynesian species of ser. *Scabrae* into two groups.

11. *Ficus storckii* Seem. Fl. Vit. 251. 1868.

One of the most abundant indigenous species of *Ficus*, *F. storckii* shows considerable variability, and I believe that Corner correctly combines *F. kajewskii* with it at the varietal level. Although the two concerned types seem quite distinct, many specimens provide an essentially uninterrupted gradient of characters between them. The type of *F. storckii*, well illustrated by Seemann, has long petioles and large leaf blades cordate at base, but some available specimens are even more pronounced in these respects. The type of *F. kajewskii* is among the short-petiolate, small-leaved individuals referable to the complex. As stated by Corner, the surest distinction between *F. storckii* and glabrous forms of *F. scabra* is the presence of abundant cystoliths on both sides of the leaf blades of the former.

KEY TO VARIETIES

Petioles (15-) 18-40 (-90) mm. long; leaf blades (10-) 12-17.5 (-30) cm. long, (5-) 7-15 (-19) cm. broad, obliquely cordate to rounded or broadly obtuse at base, the lateral nerves usually 5-7 pairs; figs usually on trunk or old wood, but sometimes also on branchlets not far below leaves, sometimes axillary.

11a. var. *storckii*

Petioles (4-) 8-15 (-22) mm. long; leaf blades 4-11 (-15) cm. long, 1.8-5.5 (-8.5) cm. broad, inequilaterally rounded or truncate to obtuse or acute at base, the lateral nerves usually 2-5 pairs; figs usually on branchlets, often just below leaves, often axillary. 11b. var. *kajewskii*

11a. *Ficus storckii* var. *storckii*; Corner in Gard. Bull. Singapore **21**: 72. 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 138. 1972. FIGURE 54A.

Ficus sp. Seem. in Bonplandia **9**: 259. 1861, Viti, 442. 1862.

Ficus storckii Seem. Fl. Vit. 251. t. 69. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Summerhayes in Bishop Mus. Bull. **141**: 55. 1936; J. W. Parham, Pl. Fiji Isl. 95. fig. 43. 1964; Corner in Philos. Trans. Ser. B. **272**: 364. fig. 9 (left, as var. *storckii*). 1975.

Ficus cavei Horne, A Year in Fiji, 262, nom. nud. 1881; Horne ex Baker in J. Linn. Soc. Bot. **20**: 371, pro syn. 1883.

An often slender tree 3-15 m. high, with white or yellowish latex, occurring at elevations from near sea level to 600 m. in dense or dry forest or on its edges or in thickets. The figs, at first yellow-green to orange, become red to purple and attain a diameter of 15 mm.; they are sometimes associated with the leaves but more frequently occur in bunches on the trunk and branchlets. Mature figs seem to occur throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: In his protologue Seemann cited his own no. 442 and a Barclay specimen from Tonga, which is referable to *Ficus scabra*. The lectotype, therefore, is *Seemann 442* (κ), collected Sept. 6, 1860, on Mt. Mbuke Levu, Kandavu (this is the locality given in *Flora Vitiensis*, but the κ sheet is indicated as from Tavuni); there is a presumed isolectotype at BM. The source of the name *F. cavei* is *Horne 480* (κ), collected in March, 1878, on the island of Rambi; nothing is indicated about Mr. Cave in Horne's notes except that he was a merchant in Fiji. Baker correctly assigned the name to the synonymy of *F. storckii*.

DISTRIBUTION: The typical variety of *Ficus storckii* is fairly abundant in Fiji, represented by approximately 60 collections. It also occurs in the New Hebrides but is apparently rare there, only one collection, from Aneityum, being cited by Corner (1975, cited above).

LOCAL NAMES AND USE: *Nunu, masimasi, losilosi, leweto, ai masi ni ulutoa*; the leaves are sometimes used as sandpaper.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 57*; slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4052*; hills between Nandala and Nukunuku Creeks, west of Nandarivatu, *Smith 6178*. NANDRONGA & NAVOSA: Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15558*; north of Komave, *St. John 18954*. SERUA: Waimbale Creek, near Namboutini, *Degener 15468*; north of Korovou, *St. John 18924*; vicinity of Ngaloa, *Degener & Ordenez 13625*. NAMOSI: Northern base of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8652*; Wayayau Creek, *DA 14248*; vicinity of Namuamua, *Gillespie 3077*. RA: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15414*. NAITASIRI: Vicinity of Matawailevu, Wainimala Valley, *St. John 18213*; Nambukaluka, Waindina River, *DA 271*; Tamavua, *Yeoward 91*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7097*. OVALAU: Vuninduva, Lovoni Valley, *DA 13293*. KORO: Main ridge, *Smith 1057*. VANUA LEVU: MBUA: Liuka Creek, Rukuruku Estate, *H. B. R. Parham 393*. MATHUATA: Summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6475*. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 372*; Navonu Ridge, Natewa Peninsula, *DA 16882*. TAVEUNI: Nggeleni road, *DA 15875*; slopes of Mt. Manuka, east of Wairiki, *Smith 8187*. MOALA: Near Naroi, *Smith 1314*.

11b. *Ficus storckii* var. *kajewskii* (Summerhayes) Corner in Gard. Bull. Singapore 17: 472. 1960, in op. cit. 21: 72. 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 139. 1972; Corner in Philos. Trans. Ser. B. 272: 365. fig. 9 (right). 1975. FIGURE 54B-D.

Ficus kajewskii Summerhayes in J. Arnold Arb. 13: 103. 1932, in Bishop Mus. Bull. 141: 53. 1936; J. W. Parham, Pl. Fiji Isl. 94. 1964.

A tree (rarely indicated as a shrub) 3-18 m. high, with milky latex and sometimes with a compact crown, occurring between sea level and 1,130 m. in beach thickets, dense or open forest or on its edges, or forest on ridges. The figs are similar to those of var. *storckii* but are usually associated with the leaves, less frequently rami- or cauliflorous, and similarly found throughout the year.

TYPIFICATION: The type is *Kajewski 737* (A HOLOTYPE; ISOTYPES AT BISH, K, P, US), collected Feb. 12, 1929, near Anelgauhat Bay, Aneityum, New Hebrides.

DISTRIBUTION: New Hebrides and Fiji; in the former archipelago it is considerably more abundant than var. *storckii*, while in Fiji it is equally common, more than 50 collections being available.

LOCAL NAMES AND USE: *Masi, masimasi, numu, losilosi, loselose, ai masi, ai masi ni ulutoa, nduvunduvu, mbuluwai*, and *lolo* have been noted by collectors; some of these, of course, are merely general words for many species of *Ficus*, while the last three may be regarded as suspect in connection with the present species. There is one record of the young leaves being used as a green vegetable.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Nandendeleva, Mt. Evans Range, *DA 14845*; vicinity of Nandarivatu, *Greenwood 866*; near summit of Mt. Nanggaranambuluta, *Gillespie 3934*; slopes of Mt. Tomani, *Smith 5272*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13886*. SERUA: Hills west of

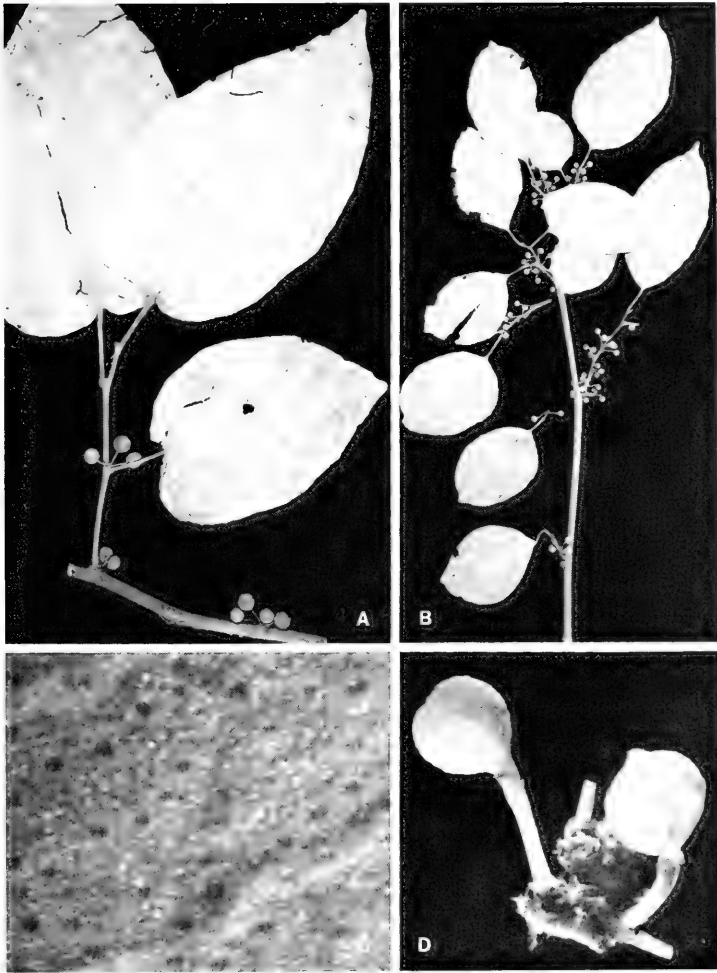


FIGURE 54. A, *Ficus storckii* var. *storckii*; distal portion of branchlet, with foliage and mature figs, $\times 1.3$. B-D, *Ficus storckii* var. *kajewskii*; B, distal portion of branchlet, with foliage and young figs, $\times 1.3$; C, portion of upper surface of leaf blade, with cystoliths, $\times 70$; D, young figs, $\times 4$. A from *Smith 372*, B & D from *MacDaniels 1046*, C from *Smith 532*.

Waivunu Creek, between Ngaloa and Korovou, *Smith 9477*. NAMOSI: Wainambua Creek, *DA 14215*; vicinity of Namuamua, *Gillespie 2973*. RA: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15343*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6141*; upper Waindina River, *MacDaniels 1046*; Tholo-i-suva, *DF 529*. TAILEVU: Vicinity of Wailotua, Wainimbuka River, *Howard 327*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 199*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7738*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1558*. MATHUATA: Mt. Uluimbau, south of Lambasa, *Smith 6606*. MATHUATA-THAKAUNDOVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 532*. THAKAUNDOVE: Mt. Mariko, *Smith 460*; Nasinu, Natewa Bay, *DA 16838*. RAMBI: *Horne 440*. TAVEUNI: Rairairandeketi, hills above Somosomo, *DA 17116*. MOALA: Near Naro'i, *Smith 1323*.

The two varieties of *Ficus storckii* often occur more or less sympatrically, but in general var. *kajewskii* attains higher elevations than var. *storckii*.

12. *Ficus masonii* Horne ex Baker in J. Linn. Soc. Bot. **20**: 371, as *F. masoni*. 1883; Corner in Gard. Bull. Singapore **21**: 72. 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 138. 1972. FIGURE 55A & B.

Ficus masoni Horne, A Year in Fiji, 262, nom. nud. 1881; Summerhayes in Bishop Mus. Bull. **141**: 54. 1936; J. W. Parham, Pl. Fiji Isl. 94. 1964; Corner in Philos. Trans. Ser. B. **272**: 363. fig. 10. 1975. *Ficus begoniifolia* Summerhayes in Bishop Mus. Bull. **141**: 49. fig. 22. 1936; J. W. Parham, Pl. Fiji Isl. 94. 1964.

An often slender tree (sometimes indicated as a shrub) 2-15 m. high, with white latex, occurring at elevations from near sea level to 1,150 m. in usually dense forest or on its edges or in secondary forest. The figs turn from green or yellow to deep red and are usually borne in clusters on the trunk and branchlets, less frequently being associated with leaves; they may be found mature throughout the year.

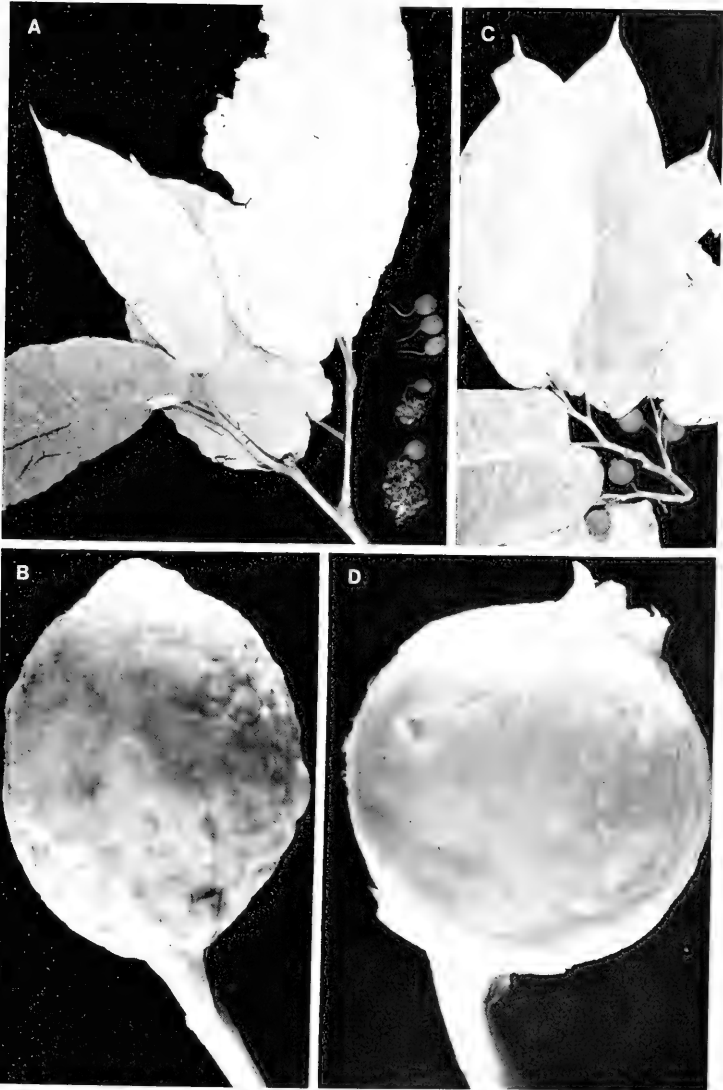
TIPIFICATION AND NOMENCLATURE: The holotype of *Ficus masonii* is *Horne 55* (K), collected in December, 1877, in mountain forests on Ovalau; at Horne's request Baker named the species for a Mr. Mason, at that time President of the Fiji Chamber of Agriculture. The type of *F. begoniifolia* is *Smith 1413* (BISH HOLOTYPE; many ISOTYPES), collected March 28, 1934, in the central volcanic section of Vanua Mbalavu, near Lomaloma. The type of *F. begoniifolia* and similar specimens have somewhat smaller leaves than typical *F. masonii*, but I believe that Corner is justified in combining them.

DISTRIBUTION: Endemic to Fiji and frequent on several islands; I refer 57 collections to the species.

LOCAL NAMES AND USES: Reported names are *nunu*, *masimasi*, *ai masi ni ulutoa*, *vuaitamona*, *losi*, *mbele*, and *mblendua*; I consider the last two questionable. It is reported that the figs may be cooked and eaten, and the mashed leaves are used medicinally for hives and for sores and boils.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, west of Mbatinaremba, *St. John 18040*. VITI LEVU: MVA: Mt. Evans Range, *Greenwood 371*; vicinity of Nandarivatu, *Gillespie 3719*; ridge between Mt. Nanggaranambuluta and Mt. Namama, *Smith 5001*; Mt. Tomanivi, *DA 12695* (*Melville et al. 7083*). NANDRONGA & NAVOSA: Nausori Highlands, *O. & I. Degener 32158*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5542*. SERUA: North of Korovou, *St. John 18925*; hills north of Ngaloa, in drainage of Wainingere Creek, *Smith 9200*. NAMOSI: Mt. Naitarandamu, *Gillespie 3558*; Mt. Voma, *Gillespie 2930*; track to Mt. Vakarongasiu, *DA 16104*; vicinity of Nakavu, on Navua River,

FIGURE 55. A & B, *Ficus masonii*, from *Smith 1915*; A, distal portion of branchlet, with foliage, and figs from cauliflorous clusters, $\times 1/3$; B, mature fig, with apical bracts not projecting and with small basal bracts, $\times 4$. C & D, *Ficus greenwoodii*, from *Smith 721*; C, distal portion of branchlet, with foliage and mature figs, $\times 1/3$; D, mature fig, with projecting apical bracts and with large basal bracts, $\times 4$.



Parks 20363. NAITASIRI: Viria, *Meebold 16895*; Waimanu River region, *DA 15435*; Tholo-i-suva, *DA 149*; Kalambo, *Tohill 767*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7107*; King's Road, Forest Reserve, *DA 846*. KANDAVU: Summit of Mt. Mbuke Levu, *Smith 285*. OVALAU: Valley of Mbureta and Lovoni Rivers, *Smith 7676*. VANUA LEVU: THAKAUNDRÖVE: Southern slope of Korotini Range, below Navitho Pass, *Smith 489*; Mt. Vatunivumonde, near Savusavu, *Degener & Ordenez 14020*; eastern slope of Mt. Ndikeya, *Smith 1915*. TAVEUNI: Nggeleli road, *DA 15871*. VANUA MBALAVU: Slopes of Korolevu, near Lomaloma, *Garnock-Jones 1029*. LAKEMBA: Tumbou River, *Garnock-Jones 838*.

The large-leaved *Ficus masonii* (including *F. begoniifolia*) is often confused in herbaria with *F. greenwoodii*, as their foliage can be quite similar. However, the cystoliths of *F. masonii* are amphigenous and the figs are quite different, usually borne on the main stems and branchlets, with inconspicuous bracts at the base of a usually obvious pedicel, and with the apical bracts not projecting. The leaf blades of *F. greenwoodii* have only hypogenous cystoliths and its figs are usually larger and associated with foliage (but sometimes on branchlets and trunk), with conspicuous basal bracts directly below the fig body (the pedicel being short to none, although the peduncle is obvious) and with projecting apical bracts.

13. *Ficus greenwoodii* Summerhayes in Bishop Mus. Bull. **141**: 52. fig. 24. 1936; J. W. Parham, Pl. Fiji Isl. **94**. 1964, ed. 2. 138. 1972; Corner in Gard. Bull. Singapore **21**: 72. 1965, in Philos. Trans. Ser. B. **272**: 363. fig. 8. 1975. FIGURE 55C & D.

Ficus sp. Seem. in Bonplandia **9**: 259. 1861.

Ficus aspera sensu Seem. Viti, 442. 1862, Fl. Vit. 249. t. 65. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 296. 1892; J. W. Parham, Pl. Fiji Isl. **92**. fig. 40. 1964, ed. 2. 135. 1972; non Forst. f.

A slender or sometimes spreading tree 3–20 m. high (rarely noted as a shrub 2–3 m. high), with yellow or white latex, found at elevations from near sea level to 850 m. in dense, open, or dry forest or on its edges. The bracts below the figs are tinged with deep red, and the figs themselves turn from yellow, orange, or red to purplish, becoming 10–30 mm. in diameter at maturity and usually axillary, but sometimes found as well on the trunk and branches; they may be expected throughout the year.

TYPIIFICATION: The holotype is *Greenwood 76* (κ), collected Sept. 18, 1920, in the Lototi Mountains, near Lautoka, Mba Province, Viti Levu. (I have not been able to find this locality, but it is probably in the foothills of the Mt. Evans Range inland from Lautoka.) Summerhayes noted as a "subsidiary type" *Smith 721*, from Taveuni, but this has no nomenclatural status.

DISTRIBUTION: Endemic to Fiji, where it is a fairly frequent species on several of the high islands; about 60 collections are at hand.

LOCAL NAMES: Noted names are *masi*, *masimasi*, *masimasi levu*, *ai masindraundrau*, *nunu*, *vuaitamona*, *losilosi*, and *mangeretaulolo*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Saione Creek, Ambatha, *DA 14136*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4446*; vicinity of Nandarivatu, *Parks 20746*; hills between Ngaliwana and Nandala Creeks, south of Nauwanga, *Smith 5818*. NANDRONGA & NAVOSA: Uluvatu, vicinity of Mbolo, near Vatukarasa, *Degener 15235*. SERUA: Natukatambua, upper Navua River, *DA 15535*; Waimbale Creek, near Namboutini, *Degener 15474*. NAMOSI: Between Saliandrua and Nanggarawai, *Gillespie 3228*; Mt. Voma, *Gillespie 2925*. RA: Tuvavatu, vicinity of Rewasa, near Vaileka, *Degener 15367*. NAITASIRI: Matawailevu, Wainimala River, *St. John 18248*; Viria, *DA 92*; vicinity of Nasinu, *Gillespie 3527*. REWA: Vicinity of Suva, *Yeoward 83*. KANDAVU: Mt. Mbuke Levu, *Seemann 446*, *Smith 221*; Lutumatavoro, *DA 14924*. OVALAU: Slopes of Mt. Korotolotolu, west of Thawathi, *Smith 8008*; hills above Levuka, *Gillespie 4460*. KORO: Ndelaikoro, *DA 15827*. NGAU: Hills east of Herald Bay, inland from Sawaieka, *Smith 7769*. VANUA LEVU: MBUA: Koromba Creek, *DA 15158*. MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6785*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6361*. THAKAUNDRÖVE: Mt. Uluinambathi, near Savusavu, *Degener & Ordenez 13946*; Wainingata Station, *DA 12049*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4786*; western slope, between Sogomo and Wairiki, *Smith 721*. MOALA: Near Naro, *Smith 1325*. MATUKU: Southern slope of Mt. Ngiingilia, *Bryan 273*.

14. *Ficus fulvo-pilosa* Summerhayes in Bishop Mus. Bull. **141**: 51. fig. 23. 1936; J. W. Parham, Pl. Fiji Isl. **94**. fig. 42. 1964, ed. 2. 137. fig. 42. 1972. FIGURE 56.

Ficus sp. Seem. in Bonplandia **9**: 259. 1861, Viti, 442. 1862.

Ficus scabra sensu Seem. Viti, 442. 1862, Fl. Vit. 249, p. p. t. 64. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297, p. p. 1892; Gibbs in J. Linn. Soc. Bot. **39**: 170. 1909; non Forst. f.

Ficus fulvopilosa Summerhayes ex Corner in Gard. Bull. Singapore **21**: 72. 1965, in Philos. Trans. Ser. B. **272**: 363. fig. 11. 1975.

An often slender tree 3–12 m. high (sometimes indicated as a shrub about 2 m. high), with white latex, found from near sea level to 1,150 m. in dense or dry forest, sometimes near streams, or on its edges or in patches of forest in open country. The figs are yellowish green or yellow, turning red to purple, up to 25 mm. in diameter, borne in compact clusters on the trunk and branches but also associated with leaves; they may be found throughout the year.

TIPIFICATION: The type of *Ficus fulvo-pilosa* is *Smith 512* (BISH HOLOTYPE; several ISOTYPES), collected Nov. 21, 1933, on the southern slope of the Korotini Range, below Navitho Pass, Thakaundrove Province, Vanua Levu. Summerhayes indicated as a "subsidiary type" *Smith 938*, from Koro, a specimen without nomenclatural consequence.

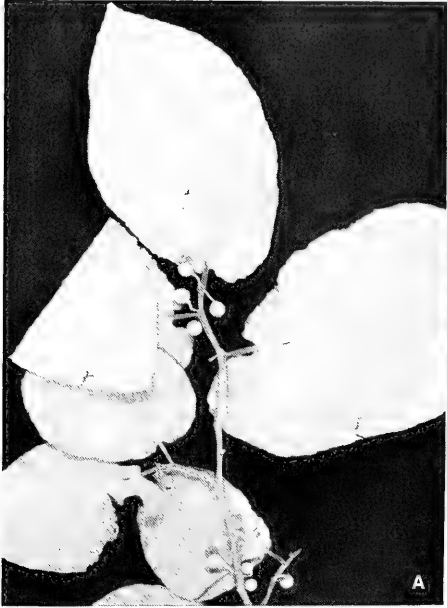
DISTRIBUTION: Endemic to Fiji and known from several high islands; it is the most abundant species of *Ficus* in Fiji, represented by at least 140 collections.

LOCAL NAMES AND USES: This frequently collected species has been referred to by many names: *nunu*, *nunu levu*, *masi*, *masimasi*, *masi ni ulutoa*, *ai masi*, *ai masei*, *losilosi*, *lulu*, *lutunggaunggau*, *teisusu*, and *mbelekiranduna*. The leaves have been used for sandpaper, and a decoction of the scraped bark is reported to have been used medicinally for dysentery.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MUA: Mountains near Lautoka, *Greenwood 233*; eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4137*; northern slopes of Mt. Namendro, east of Mt. Koromba, *Smith 4532*; vicinity of Nandarivatu, *Gibbs 841*; Mt. Tomanivi, *DA 12746* (*Melville et al. 7138*). NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5441*; between Naloka and Koronayalewa, *DA 1421*; Mbulu, near Sovi Bay, *Degener 14983*. SERUA: Inland from Namboutini, *DA 14253*; inland from Korovisilou, *DF 346*; hills east of Navua River, near Nukusere, *Smith 9151*. NAMOSE: Mt. Naitarandamu, *Gillespie 3307.9*; Mt. Voma, *DA 13971*; Wainandoi River, *DA 10803*. NAITASIRE: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5757*; Waisiwi Creek, Wainamo, Wainimala Valley, *St. John 18251*; track to Mendrausuthu Range, *DA 15020*; Tholo-i-suva, *DA 13828* (*DF 343*); vicinity of Tamavua, *Gillespie 2461*. TAILEVU: Near copper mine, Waimaro River, *DA 13643*; Uthunivanua, *DA 9247* (*McKee 2813*). REWA: Naikorokoro Creek, *Meebold 21944*; Mt. Korombamba, *Gillespie 2233*. KANDAVU: Summit of Mt. Mbuke Levu, *Smith 291*. OVALAU: Hills east of Lovoni Valley, *Smith 7262*. "OVALAU and TAVEUNI:" Port Kinnaird on Ovalau, *Seemann 445*. KORO: Eastern slope of main ridge, *Smith 938*. NGAU: Hills east of Herald Bay, inland from Sawaeke, *Smith 7812*. VANUA LEVU: MUA: Koromba Forest, *DA 15122*; southern slope of Mt. Seatura, *Smith 1612*. MATHUATA: Mt. Ndelaikoro, *DA 12796*; Wainikoro River, *Greenwood 233A*. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 397*; vicinity of Korotasere, *DA 15299*. TAVEUNI: *Seemann 448*; Wailailai, Nggeleni, *DA 14410*. MOALA: Near Naroi, *Smith 1326*.

As might be expected, this frequent species shows great variation in its leaf blades, which sometimes are as long as 30 cm. and have caudate tips to 4 cm. long, but more often the apices are merely cuspidate. The figs, also, vary in shape and size, being subglobose to ellipsoid and up to 25 mm. in diameter. Nevertheless, the abundant brown or yellowish indument makes *Ficus fulvo-pilosa* an easy species to recognize.

15. *Ficus barclayana* (Miq.) Summerhayes in J. Arnold Arb. **13**: 104. 1932, in Bishop Mus. Bull. **141**: 49. 1936; J. W. Parham, Pl. Fiji Isl. **93**. 1964, ed. 2. 135. 1972; Corner in Gard. Bull. Singapore **21**: 72. 1965, in Philos. Trans. Ser. B. **272**: 363. fig. 12. 1975. FIGURE 57A.



Covellia barclayana Miq. in London J. Bot. 7: 461. t. 7. B. 1848.

Ficus sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Ficus barclayi Seem. Fl. Vit. 250, nom. illeg. t. 66. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892.

A shrub or small tree 1–10 m. high, often freely branched or slender, occurring from near sea level to an elevation of 1,050 m. in dense, dry, or open forest or on its edges, and in coastal and hillside thickets. The figs, at first green to yellow, become reddish to purple or brown at maturity and may attain a diameter of 18 mm.; they are usually axillary, remaining associated with foliage, and may be found throughout the year.

TYPEIFICATION: The holotype is *Barclay* (κ), collected between May 28 and June 15, 1840, on Nukulau Island, Rewa Province, Viti Levu. A presumed isotype is *Barclay* 3465 (BM). Seemann intended to propose a new combination in 1868, but he used an incorrect epithet.

DISTRIBUTION: Endemic to Fiji and common on several high islands; I have studied 85 collections of the species.

LOCAL NAMES AND USES: Recorded names are *losilosi*, *loselese*, *lose*, *masi*, *masi-masi*, *ndrau ni wa masi*, and *vuaitamona*. The leaves, mixed with those of other plants, are made into a decoction used internally for stomach ailments; the figs are said to be edible and are also used to put into cavities in teeth.

REPRESENTATIVE COLLECTIONS: YASAWAS: YASAWA: Mbukama, *DA 13652*. NAVITI: Kese Village, *Weiner 253*. WAYA: Yalombi, *St. John 18096*. VITI LEVU: MBA: Vicinity of Lautoka, *Greenwood 411*; north of Lomolomo, *Degener & Ordonez 13652*; Korovou, east of Tavua, *Degener 14954*; vicinity of Nandarivatu, *DA 13059*; Mt. Nanggaranambuluta, *Tohill 805*. NANDRONGA & NAVOSA: Above Thotho Levu, *H. B. R. Parham 240*; Uluvatu, vicinity of Mbelo, near Vatukarasa, *Degener 15236*. NANDRONGA & NAVOSA-SERUA boundary: Mt. Tuvutau, *DA 14496*. SERUA: Hills north of Ngaloa, in drainage of Waininggere Creek, *Smith 9428*. NAMOSI: Korombasambasanga Range, *DA 2215*. RA: Penang, *Greenwood 397A*. NAITASIRE: Nanduruloulou, *DA 12132*; Wainimbuku Creek, near Nasinu, *DA 11255*. TAILEVU: Namulomulo, *DF 566 (Watkins 800)*; Londoni, *Tohill 797*. REWA: Mt. Korombamba, *Gillespie 2232*. KANDAVU: *Tohill 775*. OVALAU: Valley of Mbureta and Lovoni Rivers, *Smith 7675*. KORO: Namathu, *DA 1038*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7920*. VANUA LEVU: MBUA: Nasau, *H. B. R. Parham 96*. MATHUATA: Vicinity of Lambasa, *Greenwood 534*. THAKAUNDRUVE: Southern slope of Valanga Range, *Smith 381*. TAVEUNI: Somosomo, *Seemann 438*; slopes of Mt. Manuka, east of Wairiki, *Smith 8142*.

This readily recognized endemic is often found in drier habitats than other Fijian species of *Ficus*; it is characterized by its comparatively small, strongly asymmetric leaf blades, short and partially concealed petioles, and solitary figs usually occurring in leaf axils.

16. *Ficus bambusifolia* Seem. Fl. Vit. 250, as *F. bambusaefolia*. t. 67. 1868; J. W. Parham, Pl. Fiji Isl. 92. fig. 41. 1964, ed. 2. 135. fig. 41. 1972.

FIGURE 57C & D.

Ficus sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Ficus bambusaefolia Seem. ex Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Corner in Gard. Bull. Singapore 21: 72. 1965, in Philos. Trans. Ser. B. 272: 363. fig. 12 (inset). 1975.

This very distinct species is a slender shrub or small tree 0.5–3 m. high, sometimes semiprostrate, with slender, flexible branches, found from near sea level to an elevation of 800 m. in dense or open forest along streams, sometimes locally abundant but

FIGURE 56. *Ficus fulvo-pilosa*, from *Gillespie 2461*; A, distal portion of branchlet, with foliage and maturing figs, $\times 1/3$; B, ♀ flower, with developing drupelet and stigma projecting from perianth, $\times 30$; C, maturing fig, $\times 4$; D, longitudinal section of receptacle, with maturing sessile and pedicellate ♀ flowers, $\times 4$.

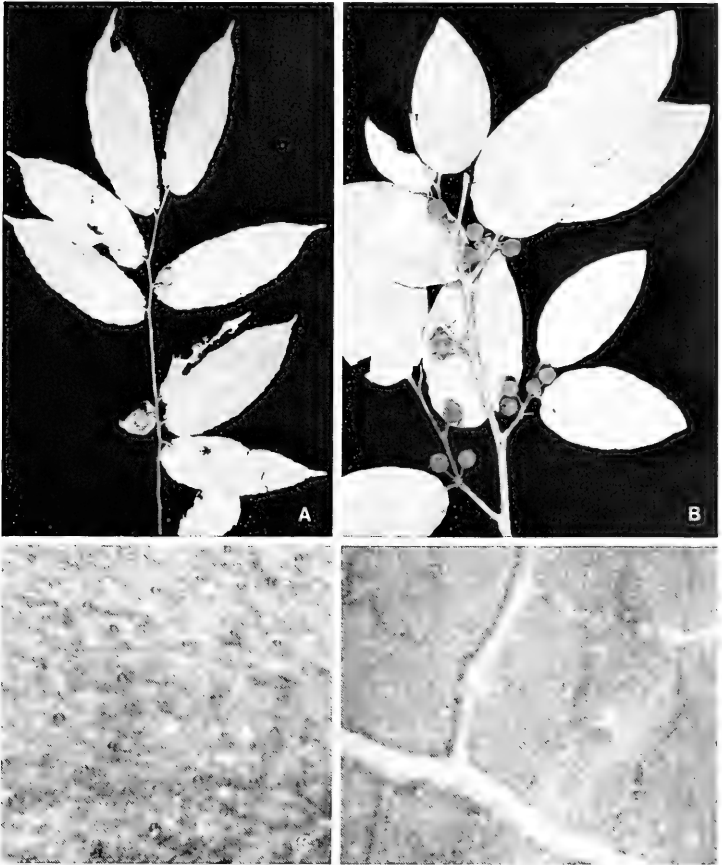


FIGURE 57. A, *Ficus barclayana*, distal portion of branchlet, with foliage and mature figs, $\times 1/3$. B, *Ficus tinctoria*, distal portion of branchlet, with foliage and mature figs, $\times 1/3$. C & D, *Ficus bambusifolia*; C, portion of upper surface of leaf blade, with cystoliths, $\times 40$; D, portion of lower surface of leaf blade, with cystoliths, $\times 40$. A from DA 11255, B from Smith 1296, C from Gillespie 3588, D from Smith 8327.

always near water. The figs are axillary and solitary, green and pink-tinged without and red within; they occur essentially throughout the year.

TYPIFICATION: The type is *Seemann 439* (K HOLOTYPE; ISOTYPE at BM), cited as "Banks of the Navua and Rewa rivers, Viti Levu." The holotype bears a field label with the notation "River Navu banks" and a printed label inscribed "Always growing on banks of rivers (Wai) with *Lindenia vitiensis*." Two branches are mounted on the sheet, and it may be that one of them came from along the Rewa River, or perhaps Seemann merely observed the species there. *Lindenia vitiensis* is known to occur along the Navua but has not been collected along the Rewa (cf. S. Darwin in J. Arnold Arb. 57: 443. 1976). For these reasons I believe that the type locality is best considered the banks of the Navua River, Serua Province, Viti Levu; Seemann ascended the Navua River on August 21 and descended it on September 3, 1860.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Taveuni.

LOCAL NAME: *Loselose ni wai*, indicating the occurrence of this particular *Ficus* only near streams.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1206*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4481*. SERUA: Inland from Namboutini, *DA 13768*, *DF 463*, *Damanu 112*; Mbuyombuyo, near Namboutini, *Tabualewa 15574*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2528*; near Namuamua, *Gillespie 3032*; without further locality, *DA 5908*. NAITASIRE: Between Sawani and Serea, *DA 11068*; Tholo-i-suva, *DA 10649*, *12056*, *13686*; Savura Creek, *DA 13353*, *Webster & Hildreth 14110*; Suva Pumping Station, *Degener & Ordonez 13742*; Tamavua, *H. B. R. Parham 283*, *300*; vicinity of Nasinu, *Gillespie 3588*. REWA: Base of Mt. Korombamba, *Parks 20093*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4760*; slopes of Mt. Manuka, east of Wairiki, *Smith 8327*. FIJI without further locality, *Yeoward 36* (or 30?).

17. *Ficus tinctoria* Forst. f. Fl. Ins. Austr. Prodr. 76. 1786; Seem. Viti, 441. 1862, Fl. Vit. 249. t. 63. 1868; Summerhayes in Bishop Mus. Bull. 141: 55. 1936; Yuncker in op. cit. 178: 48. 1943, in op. cit. 184: 36. 1945, in op. cit. 220: 101. 1959; Corner in Gard. Bull. Singapore 17: 475. 1960; J. W. Parham, Pl. Fiji Isl. 96. 1964, ed. 2. 139. 1972; Corner in Gard. Bull. Singapore 21: 74. 1965, in Philos. Trans. Ser. B. 253: 111, as subsp. *tinctoria*, fig. 36 (left). 1967; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 127, as subsp. *tinctoria*, 1970; St. John & A. C. Sm. in Pacific Sci. 25: 319. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 79. 1972; Corner in Philos. Trans. Ser. B. 272: 366. 1975.

FIGURE 57B.

Ficus sp. Seem. in Bonplandia 9: 259. 1861.

An epiphytic strangler, becoming a spreading banyan to 25 m. high, with scanty or copious white latex, the trunk sometimes to 3 m. in diameter and with prop roots; sometimes noted as a small tree or a shrub only 1 m. high. *Ficus tinctoria* in Fiji is typical of beach thickets or coastal rocky places, but sometimes it is found inland at elevations up to 500 m. in dense or open forest, frequently on steep slopes. The green or yellow figs become orange to dull red and finally purple, up to 17 mm. in diameter, and usually associated with the leaves; they may be expected throughout the year.

TYPIFICATION: The type is a Forster collection from the Society Islands; I could not locate any such specimen at BM, but there is a good specimen at K indicated as "Forster Herbarium: *Ficus tinctoria*, Taheitee, Foster" (sic). This may be taken as the lectotype: J. R. & G. Forster (K), collected on Tahiti during Cook's second voyage.

DISTRIBUTION: Corner indicates that *Ficus tinctoria* (including all its subspecies) is the most widespread species of *Ficus*, occurring from India, Ceylon, the Andaman and

Nicobar Islands, and southern China eastward throughout Malesia and into Polynesia. Of the four subspecies recognized by Corner, subsp. *tinctoria*, the only subspecies in our area, has the most easterly distribution, found from Formosa, Hainan, the Philippines, and Celebes eastward to Micronesia, northern Australia, and into Polynesia. To fix the eastern and northeastern boundaries more definitely, I may mention presumably indigenous occurrences from the Gilbert, Tokelau, and Danger Islands, the Societies, and the Austral Islands including Rapa; but the species may indeed be found beyond these boundaries. I have studied about 55 Fijian collections.

LOCAL NAMES AND USES: Recorded names in Fiji are *mbaka*, *mbaka ni Viti*, *nunu*, and *savirewa*. It has been noted that the plant juices and leaves are used as a dressing for broken bones, and a decoction is mentioned as an internal remedy for weakness after childbirth.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, west of Mbatinaremba, *St. John 18041*. MAMANUTHAS: NGGALITO ISLAND, Malolo Group, *O. & I. Degener 32241*. VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 304*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8872*; vicinity of Namosi Village, *Gillespie 2932*. TAILEVU: Nggelekuro, *DA 13599*; Matavatathou, *DA 8991*. REWA: Lami, *Meebold 16731*; Walu Bay, *H. B. R. Parham 123*. KANDAVU: Namalata isthmus region, *Smith 41*; Ono Island, *DA 14948*. OVALAU: North of Levuka, *Gillespie 4501*. KORO: West coast, *Smith 1077*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1699*. MATHUATA: Islands off coast, *Greenwood 685*. THAKAUNDOVE: Nasinu, Natewa Bay, *DA 16841*. TAVEUNI: Somosomo, *Seemann 437*; vicinity of Waiyevo, *Smith 8111*. TOTOYA: *Milne 89*. MATUKU: *Bryan 247*. VANUA MBALAVU: Lomaloma, *DA 13261*. MANGO: *Bryan 570*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 936*. KAMBARA: On limestone formation, *Smith 1296*. FULANGA: On limestone formation, *Smith 1138*. ONGEA LEVU: *Bryan 437*.

18. *Ficus theophrastoides* Seem. Fl. Vit. 252. t. 71. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Corner in Gard. Bull. Singapore 18: 38. 1960; J. W. Parham, Pl. Fiji Isl. 96. 1964, ed. 2. 139. 1972; Corner in Gard. Bull. Singapore 21: 84. 1965, in Philos. Trans. Ser. B. 253: 132. fig. 51, 52. 1967.

Ficus sp. Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862.

As it occurs in Fiji, *Ficus theophrastoides* is a slender, simple tree up to 5 m. high, with the leaves aggregated distally and the trunk hardly more than 8 cm. in diameter, sparsely occurring from near sea level to an elevation of 150 m. in forest, in clearings, or along the strand. The large figs are axillary and solitary or paired, sometimes borne on the stems; they have been collected between May and October.

TYPIFICATION: The type is *Seemann 441* (K HOLOTYPE; ISOTYPE AT BM), collected in October, 1860, in the vicinity of Port Kinnaird, Ovalau.

DISTRIBUTION: Solomon Islands and Fiji; in the latter archipelago it is infrequent, thus far known only from Viti Levu, Ovalau, and Nggamea. Corner (1967, cited above) was not sure of the nativity of the species in Fiji, but he saw only two Fijian collections; in view of the material now at hand I believe that the species is indigenous. Since Corner has recently described a var. *angustifolia* from Choiseul Island, the remainder of the species is to be referred to var. *theophrastoides*.

LOCAL NAMES AND USE: *Kuluva*; *vula*; *lolo tangane*; Weiner reports the last of these names as used on Nggamea, where the stem is considered part of an internal remedy for convulsions in children.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Central road, *Tothill 426*; Tholo-i-suva, *DA 91*; vicinity of Tamavua, *Gillespie 2405*; vicinity of Nasinu, *Gillespie 3505*. REWA: Vicinity of Lami, *Parks 20053*. NGGAMEA: Along strand, *Weiner 71-7-25*.

19. *Ficus vitiensis* Seem. Fl. Vit. 250. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 298. 1892; Summerhayes in Bishop Mus. Bull. **141**: 56. 1936; Corner in Gard. Bull. Singapore **18**: 38. 1960; J. W. Parham, Pl. Fiji Isl. 97. 1964, ed. 2. 139. 1972; Corner in Gard. Bull. Singapore **21**: 84. 1965, in Philos. Trans. Ser. B. **272**: (356). fig. 4 (right). 1975.

Ficus sp. Seem. in Bonplandia **9**: 259. 1861, Viti, 442. 1862.

Ficus harveyi Seem. Fl. Vit. 250. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Gibbs in J. Linn. Soc. Bot. **39**: 170. 1909; J. W. Parham, Pl. Fiji Isl. 94. 1964.

Ficus vitiensis is a slender tree or shrub 1–20 m. high, with abundant white latex and a trunk usually not exceeding 35 cm. in diameter, occurring at elevations from near sea level to 850 m. It is often locally abundant in open grassland, hillside thickets, and patches of dry forest in open areas; as seen in these habitats it is shrubby and seldom exceeds 10 m. in height. Frequently it is found in denser forest, sometimes on creek banks, and then it tends to be a larger tree. The figs are green, becoming yellow and up to 5 cm. in diameter, associated with the leaves or borne on stems and branches in clusters as broad as 15 cm.; they may be found throughout the year.

TYPIFICATION AND NOMENCLATURE: The holotype of *Ficus vitiensis* is *Seemann 447* (K), collected on Viti Levu but without further data. For *F. harveyi* Seemann cited three collections, his numbers 440 (from Viti Levu) and 444 (from Moturiki) and *Harvey* (without precise locality). *Seemann 444* is a sterile specimen; the *Harvey* collection is poor, with old fruits separated from the foliage, and in spite of the epithet this is not a good lectotype. Therefore I designate the best of the three specimens, *Seemann 440* (K), as the lectotype of *F. harveyi*; it was collected "at Namosi" (probably referring to Namosi Village, in which case the date would have been between Aug. 22 and Sept. 2, 1860), Namosi Province, Viti Levu. Seemann gives no reason for the simultaneous proposal of the two species; the descriptions are similar except for minor dimensional differences, and *F. vitiensis* is said to have solitary receptacles in contrast to the paired receptacles of *F. harveyi*. This is true of the type material, but ample collections show the character to be of no consequence. Corner (1965, cited above) reduced *F. harveyi* to *F. vitiensis*, apparently making the first choice between these competing epithets of the same date.

DISTRIBUTION: Endemic to Fiji and fairly frequent on several of the high islands; I have studied approximately 60 collections.

LOCAL NAMES AND USES: The name *lolo* is generally reserved for this distinctive species; it has also been reported as *lolo ndamu*, *komba*, and *mbombo*. The figs are considered the most edible among those of indigenous species of *Ficus*, the wood is utilized for firewood, and a decoction (of leaves?) is reported to provide an internal remedy for sprains.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 177*; slopes of escarpment north of Nandarivatu, *Smith 6049*; vicinity of Nandarivatu, *Gibbs 617*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5524*; vicinity of Mbelo, near Vatukarasa, *Degener 15224*. SERUA: North of Korovou, *St. John 18931*; hills east of Navua River, near Nukusere, *Smith 9076*. NAMOSI: Namosi Village, *Weiner 20B*. RA: Mountains near Penang, *Greenwood 1774*. NAITASIRI: Matawai-levu, Wainimala Valley, *St. John 18207*; upper Waindina River, *MacDaniels 1047*; vicinity of Nasinu, *Gillespie 3622*. REWA: Naikorokoro Creek, *Meebold 21947*; vicinity of Lami, *Parks 20892*. MBENGGA: Malambi, *Weiner 216*. KANDAVU: Namalata isthmus region, *Smith 21*. OVALAU: Valley of Mbureta and Lovoni Rivers, *Smith 7502*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7813*. VANUA LEVU: MBUA: Rukuruku Bay, *H. B. R. Parham 403*; Singasingau Creek, near Ndriti, *DA 15190*. MATHUATA: Vicinity of Lambasa, *Greenwood 494*; Mt. Ndelaikoro, *DA 12827*. THAKAUNDRIVE: Maravu, near Salt Lake, *Degener & Ordenez 14263*; Navonu Creek, Natewa Peninsula, *Howard 97*. TAVEUNI: Mt. Manuka, *Smith 775*; Mbouma, *Weiner 71-7-5A*. MOALA: *Bryan 331*. MATUKU: *Bryan 270*.

20. *Ficus pritchardii* Seem. Fl. Vit. 252. t. 70. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297. 1892; Summerhayes in Bishop Mus. Bull. **141**: 55. 1936; J. W. Parham, Pl. Fiji Isl. 94. 1964, ed. 2. 138. 1972; Corner in Gard. Bull. Singapore **21**: 34. 1965, in Philos. Trans. Ser. B. **259**: 400. fig. 9. 1970.

Ficus sp. Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862.

A cauliflorous tree 2–25 m. high, with white latex, found at elevations from near sea level to 1,150 m. in dense or open forest or on its edges and in thickets, sometimes on open slopes, and rarely on the inner edges of mangrove swamps. As far as noted, the inflorescences always arise from the main trunk and often very near its base; they are borne profusely on woody, slender, specialized branches 0.5–2 m. long, or sometimes in dense, compact masses as much as 1.5 m. in diameter. The figs turn from green to dark red or purplish brown when mature and attain a diameter of 30 mm.; they may be found throughout the year.

TIPIFICATION: The type is *Seemann 443* (K HOLOTYPE; ISOTYPE at BM), collected Sept. 6, 1860, on Mt. Mbuke Levu, Kandavu.

DISTRIBUTION: Endemic to Fiji and found in some abundance on many high islands; I have studied about 70 collections. A Graeffe collection at BM labelled as from Samoa unmistakably represents this species, which is otherwise unknown from Samoa; as in other cases this specimen must be mislabelled and a part of other Graeffe collections from Viti Levu.

LOCAL NAMES AND USES: This very distinctive species has been reported under a considerable number of local names: *masi*, *masimasi*, *masimasi ni veikau*, *losi*, *losilosilosi*, *loroloro*, *lorolori*, *nunu*, *waitamona*, *laweto*, *kandanu*, *neiviri*, *kamba*, and *vua ie ngauna*. The figs are said to be edible, and plant juices are reported to be applied to wounds.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: North of Yalombi, Olo Creek, *St. John 18013*. VITI LEVU: MBA: Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4425*; Waikumbukumbu Creek, *DA 7053*; vicinity of Nandarivatu, *Parks 20802*; Mt. Tomanivi, *DA 12736* (*Melville et al. 7127*). NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5502*; Nausori Highlands, *DA 11731*. SERUA: Upper Navua River, *DA 15514*; Mbuyombuyo, near Namboutini, *Tabualewa 15603*; north of Korovou, *St. John 18944*. NAMOSI: Korombasambasanga Range, *DA 2262*; Mt. Voma, *DA 11664*; vicinity of Namuamua, *Gillespie 3016*. RA: Ndombulevu, *DA 11891*; vicinity of Rewasa, near Vaileka, *Degener 15509*. NAITASIRI: Rarandawai, Wainamo–Wainisavulevu divide, Wainimala Valley, *St. John 18257*; Waindina River basin, *MacDaniels 1029*; Nasinu, *DA 8014*. TAILEVU: Vicinity of Wailotua, Wainimbuka River, *Howard 320*. REWA: Mt. Korombamba, *Gillespie 2385*. VITI LEVU without further locality, *Graeffe 53*, s. n. KANDAVU: Mt. Mbuke Levu, *Smith 235*; Kiombo, *DA 11929* (*DF 9*). OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7643*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7784*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1554*. MATHUATA: Mt. Ndelaikoro, *DA 13423*; vicinity of Lambasa, *Greenwood 532*. THAKAUNDOVE: Mt. Mariko, *Smith 429*; hills south of Natewa, Natewa Peninsula, *Smith 1971*. MOALA: Near Ndelaimoala, *Bryan 327*.

In his 1965 treatment Corner placed *Ficus pritchardii* in subgen. *Pharmacosycea* sect. *Oreosycea* ser. *Austrocaledonicae*. Reconsideration in 1970, however, caused him to retract the earlier placement and to suggest that *F. pritchardii* be placed for the time being in subgen. *Ficus* sect. *Sycocarpus* subsect. *Papuasycy* (Corner in Gard. Bull. Singapore **19**: 395. 1962). This subsection was based on two New Guinean species. It should be noted that the species of subgen. *Ficus* are normally dioecious; *F. itoana* Diels, the type species of subsect. *Papuasycy*, is thus dioecious, but *F. microdictya* Diels is monoecious and in this respect aberrant in subgen. *Ficus*; in other respects, including its gamophyllous perianth and lack of interfloral bracts, it is correctly placed with *F. itoana* in sect. *Sycocarpus*. *Ficus pritchardii* seems most closely related to *F.*

microdictya, although it differs from subject. *Papuasyce* as previously defined in its more infundibular stigma, shortly lobed perianth, and amphigenous cystoliths.

Corner suggests that the three species now referred to subject. *Papuasyce* (possibly together with a fourth, Philippine species) may merit subgeneric rank as a fifth subgenus of *Ficus*, but further study is required. Certainly *F. pritchardii* is an extremely distinct species in its habit as well as in the various characters mentioned in my key and discussed by Corner in 1970.

EXCLUDED SPECIES

Ficus habrophylla Bennett ex Seem. Fl. Vit. 248. 1868; Corner in Gard. Bull. Singapore 21: 33. 1965.

Ficus bennettii Seem. Fl. Vit. 250. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 297, as *F. bennettii*. 1892; J. W. Parham, Pl. Fiji Isl. 94. 1964, ed. 2. 136, as *F. bennettii*. 1972.

TIPIFICATION AND NOMENCLATURE: The holotype of *Ficus habrophylla* is Bennett s. n. (K), collected on Tanna, New Hebrides. *Ficus bennettii* is based on a plant said to have been obtained in Fiji, cultivated in the Botanic Gardens, Sydney. No material under this name is available at K or BM. *Ficus habrophylla* was also noted by Seemann to have been in cultivation at Sydney.

The species does not occur in Fiji, the provenance suggested by Seemann being inaccurate. Corner in 1965 was apparently the first to choose between these two competing binomials of the same date and should be followed; the species is known from the New Hebrides, New Caledonia, and the Loyalty Islands.

2. **MORUS** L. Sp. Pl. 986. 1753; Seem. Fl. Vit. 245. 1868.

Dioecious or sometimes monoecious unarmed trees or shrubs, without latex, the stipules narrow, caducous; leaves alternate, the blades entire or palmately incised, 3- or 5-nerved, serrate-dentate; inflorescences axillary, ebracteate, pedunculate spikes, the flowers with 4 broad tepals; ♂ flowers with 4 stamens, the filaments inflexed in bud, the anthers exerted at anthesis, the pistillode present, glabrous; ♀ flowers with imbricate, erect tepals, the 2 outer ones convex, the staminodes lacking, the ovary strongly compressed, glabrous, the style deeply 2-parted with linear-subulate branches; fruiting perianth thickened, fleshy, enveloping the drupe, the perianths joined into a syncarp; drupe with a crustaceous endocarp, the seeds small, compressed, often not developing.

LECTOTYPE SPECIES: *Morus nigra* L. (ING), one of seven species originally assigned to the genus by Linnaeus.

DISTRIBUTION: Tricentric, in America from eastern temperate North America to the Andes, in tropical Africa, and from southwestern Asia to Japan and Java, with ten or fewer species. One species is cultivated in Fiji.

1. ***Morus australis*** Poir. in Lam. Encycl. Méth. Bot. 4: 380. 1797; Nakai in J. Arnold Arb. 8: 236. 1927.

Morus indica sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862, Fl. Vit. 245. 1868; J. W. Parham, Pl. Fiji Isl. 98. 1964; non L.

Morus alba var. *indica* sensu Drake, Ill. Fl. Ins. Mar. Pac. 296. 1892; non sensu typi.

Morus alba sensu Yuncker in Bishop Mus. Bull. 220: 97. 1959; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 134. 1972; non L.

Morus japonica sensu J. W. Parham, Pl. Fiji Isl. ed. 2. 139. 1972; non auct.

Morus australis is sparingly cultivated near sea level in Fiji. It is a shrub or small tree 2-4 m. high, with leaf blades ovate-oblong, up to 20 × 12 cm., and entire or 2- or 3-lobed. The syncarp is at first light pink to red, at length becoming black or reddish

black and up to 3.5 cm. long and 1.5 cm. thick. The few specimens at hand have been fruiting in January and March.

TYPIIFICATION: Although the species is indigenous in southeastern Asia, the type was from a plant cultivated on the island of Bourbon (i. e. La Réunion, Mascarene Islands).

DISTRIBUTION: China, India, Ceylon, and probably adjacent areas of southeastern Asia; cultivated and sometimes naturalized elsewhere. In Fiji it was presumably introduced by early European settlers, but it has not been commonly cultivated. *Morus australis* is perhaps the species most often found in the southern Pacific, and it seems to be the only species cultivated in Fiji, Tonga, and Samoa.

LOCAL NAMES AND USE: *Mulberry*, *tut* (Arabic); the syncarps are edible but apparently are not highly regarded locally.

AVAILABLE COLLECTIONS: VITI LEVU: TAILEVU: Mbau Island, *Seemann 434*, p. p. REWA: Suva, in private garden, *DA 16100*. VANUA LEVU: MATHUATA: Ndreketi Plantations, *DA 14302*.

Nakai's review of *Morus alba* and its allies (in J. Arnold Arb. **8**: 234-238. 1927) points out that *M. australis* is the correct name for *M. indica* sensu Roxb. (non L.) and *M. acidosa* Griffith; it has also been confused with *M. alba* and *M. japonica*.

3. **STREBLUS** Lour. Fl. Cochinch. 599, 614. 1790; Corner in Gard. Bull. Singapore **19**: 215. 1962, in Phytomorphology **25**: 1. 1975.

Paratrophis Bl. Mus. Bot. Lugd.-Bat. **2**: 81. 1856.

Trophis sensu Seem. Fl. Vit. 257. 1868; non P. Br.

Pseudomorus Bureau in Ann. Sci. Nat. Bot. V. **11**: 371. 1869.

Uromorus Bureau in DC. Prodr. **17**: 236. 1873.

Monoecious or dioecious, unarmed or spiny trees or shrubs, with usually milky (sometimes watery) latex; leaves distichous, the blades denticulate to entire; inflorescences axillary, bisexual or unisexual, pedunculate, cymose to racemose, spicate, or capitate, or sometimes with solitary ♀ flowers; ♂ flowers usually 4-merous (sometimes 3- or 5-merous), the tepals free or shortly joined, essentially valvate, the stamens with filaments inflexed in bud, the anthers small, reniform, extrorse, the pistillode present; ♀ flowers 4-merous, the tepals decussate, imbricate, free or shortly joined, the ovary superior; drupe comparatively large, thinly fleshy, often with a thickened, fleshy base, dehiscent or not, invested by the thin tepals or not, the seed large, 4-12 mm. broad, subglobose, the endocarp membranous.

LECTOTYPE SPECIES: *Streblus asper* Lour. (ING).

DISTRIBUTION: Madagascar, southeastern Asia, throughout Malesia including the Philippines, and eastward to eastern Australia, New Zealand, and the Society Islands and Hawaii, with 22-25 species. Two indigenous species occur in Fiji.

USEFUL TREATMENTS OF GENUS: Corner, E. J. H. *Streblus* Lour. Gard. Bull. Singapore **19**: 215-229. 1962. Corner, E. J. H. The evolution of *Streblus* Lour. (Moraceae): with a new species of sect. *Bleekrodea*. Phytomorphology **25**: 1-12. 1975.

In the above-cited treatments, Corner has merged several genera with *Streblus*, presenting arguments against the microgeneric distinctions accepted by earlier authors and dividing *Streblus* into eight sections. Both species indigenous in Fiji fall into sect. *Paratrophis* (Bl.) Corner, a section with nine species.

KEY TO SPECIES

Petioles 15-65 mm. long; leaf blades oblong- to ovate-elliptic, smooth, 9-30 cm. long, 3-15 cm. broad, the lateral nerves 7-14 pairs, the basal nerves shorter than the lateral ones; ♂ and ♀ spikes 10-20 cm. long at anthesis, both many-flowered; cotyledons foliaceous, conduplicate. . . . 1. *S. anthropophagorum*

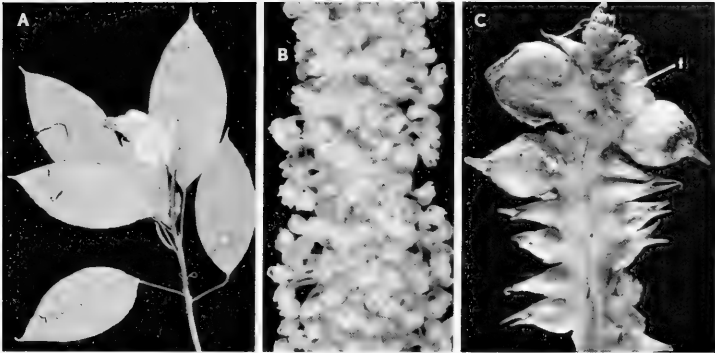


FIGURE 58. *Streblus anthropophagorum*; A, distal portion of branchlet, with foliage and young ♂ inflorescences, $\times 1/5$; B, portion of mature ♂ spike, $\times 4$; C, ♀ spike with maturing ovaries, fruits, and tepals (t) from which a fruit has fallen, $\times 2$. A from *Smith 540*, B from *Smith 7229*, C from *DA 15075*.

Petioles 2–10 mm. long; leaf blades ovate- to elliptic-lanceolate, often scabrid, 5–15 cm. long, 1–4.5 cm. broad (immature leaf blades sometimes only 3×0.3 cm. and sometimes lobed), the lateral nerves 5–12 pairs, the basal nerves often as long as the lateral ones; ♂ spike 2–18 cm. long; ♀ spike 0.5–2.2 cm. long, 2–9-flowered; cotyledons flat, small. 2. *S. pendulinus*

1. *Streblus anthropophagorum* (Seem.) Corner in *Gard. Bull. Singapore* **19**: 220. 1962; J. W. Parham, *Pl. Fiji Isl.* 98. *fig. 44*. 1964, ed. 2. 139. 1972; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 127. 1970; Corner in *Phytomorphology* **25**: 2. 1975.

FIGURE 58.

Trophis anthropophagorum Seem. in *Bonplandia* **9**: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862, *Fl. Vit.* 258. t. 73. 1868.

Caturus oblongatus Seem. *Fl. Vit.* 254. 1868.

Uromorus anthropophagorum Bureau in *DC. Prodr.* **17**: 236. 1873.

Paratrophis anthropophagorum Benth. & Hook. f. ex Drake, *Ill. Fl. Ins. Mar. Pac.* 296. 1892; Christophersen in *Bishop Mus. Bull.* **128**: 71. 1935; Yuncker in op. cit. **178**: 46. 1943.

As seen in Fiji, *Streblus anthropophagorum* occurs from near sea level to about 900 m. as a tree 2–11 m. high, often freely branched or slender, and with abundant white or watery latex; it has been noted in dense, open, or secondary forest and in crest thickets. The young inflorescences are pink to dull maroon, the tepals pink, the stamens white, and the fruits green, turning red at maturity. Flowers have been obtained in months scattered throughout the year, fruits only in January and May.

TYPEIFICATION AND NOMENCLATURE: The type of *Trophis anthropophagorum* is *Seemann 435* (K HOLOTYPE; ISOTYPE at BM), collected between Aug. 22 and Sept. 2, 1860, in the vicinity of Namosi Village, Namosi Province, Viti Levu. *Caturus oblongatus* was described by Seemann on the basis of two specimens from Tahiti: *Capt. Cook* (i. e. collected on one of the Cook voyages but doubtfully by Cook personally) (BM), and *Bidwill* (K); I herewith designate the first of these syntypes as the lectotype. No real differences between *Caturus oblongatus* and *Trophis anthropophagorum* are appar-

ent to me, and the reduction seems to be here first suggested. *Streblus tahitensis* (Nadeaud) Corner (in Gard. Bull. Singapore 19: 225. 1962) was indicated as a possible variety of *S. anthropophagorum*, but Corner saw no material. In neither of Corner's treatments is *Caturus oblongatus* mentioned, but the epithet has priority over Nadeaud's (*Pseudomorus brunoniana* var. *tahitensis* Nadeaud, Enum. Pl. Indig. Tahiti, 43. 1873) and of course also over *Uromorus tahitensis* (Nadeaud) Bureau in DC. Prodr. 17: 237. 1873. Since I have not seen type material of Nadeaud's variety, the name (as a trinomial and binomial) is not included in the above synonymy.

DISTRIBUTION: Material of the species is now known from Fiji, Samoa, Tonga, Niue, the Cook Islands, and the Society Islands. Only the two largest islands are represented by Fijian collections.

LOCAL NAMES AND USE: Seemann recorded the names *malavathi* or *malawathi*, which are probably incorrect, as those names ordinarily refer to *Acalypha* (Euphorbiaceae); he indicated that the leaves were used as a vegetable with human flesh, hence the epithet. More recent collectors have noted the names *ndreiviri*, *ndravula*, *tolenivia*, and *rewai*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandendeleva, DA 14848; Nauwangga, south of Nandari-vatu, Degener 14698. NANDRONGA & NAVOSA: Vicinity of Mbelo, near Vatukarasa, Degener 15251, 15313. SERUA: Inland from Namboutini, DF 159; inland from Ngaloa, DA 14700. NAMOSI: Vicinity of Namosi Village, Gillespie 2939. RA: Vicinity of Rewasa, near Vaileka, Degener 15513. NAITASIRI: Wainimala River above Nasauvere, DA 1453. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, Smith 7229; near copper mine, Wainivesi River, DA 13648. VANUA LEVU: MBUA: Navotuvotu, summit of Mt. Seatura, Smith 1657; lower Wainunu River Valley, Smith 1729. MATHUATA: Near Mbatiri, Ndreketi River, DA 13905; southern base of Mathuata Range, north of Natua, Smith 6770. MATHUATA-THAKAUNDRIVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, Smith 540. THAKAUNDRIVE: Navonu Creek, Natewa Peninsula, DA 15050; track to Natewa, DA 15075. FIJI without further locality, R. L. Holmes s. n. (K), DA L.13681 (LRD 1).

2. *Streblus pendulinus* (Endl.) F. v. Muell. Fragm. Phyt. Austral. 6: 192. 1868; Corner in Gard. Bull. Singapore 19: 222. 1962; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 139. 1972; Corner in Phytomorphology 25: 2. 1975. FIGURE 59.

Morus pendulina Endl. Prodr. Fl. Norfolk. 40. 1833.

Morus brunoniana Endl. Atakta Bot. t. 32. 1835.

Pseudomorus brunoniana Bureau in Ann. Sci. Nat. Bot. V. 11: 372. 1869, in DC. Prodr. 17: 249. 1873; Guillaumin in J. Arnold Arb. 13: 96. 1932; A. C. Sm. in Sargentia 1: 13. 1942.

In Fiji *Streblus pendulinus* occurs at elevations of 30–1,000 m. as a tree or shrub 1–3 m. high, with milky latex, in dry or thin forest on rocky forehills, in ravines, on ridges, and along streams. The young inflorescences are whitish, the perianth translucent greenish white, the anthers white, and the fruits purple. Flowering specimens have been obtained between September and April, and fruiting specimens at the same time or slightly later.

TYPIFICATION AND NOMENCLATURE: Both *Morus pendulina* and *M. brunoniana* are typified by plants from Norfolk Island, presumably collected by F. L. Bauer and deposited at w. Other synonyms, including *Pseudomorus sandwicensis* Degener, are listed in Corner's 1962 treatment.

DISTRIBUTION: New Guinea to Micronesia, southward to Norfolk Island and eastern Australia, and eastward to the New Hebrides, Fiji, Rapa, and Hawaii. In Fiji the species seems to be known only on Viti Levu.

LOCAL NAME: *Masimasi* has been recorded, but this name usually refers to species of *Ficus*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 55, 55A, 87, 349*; Saru Creek, Lautoka, *Greenwood 348B*; north of Lomolomo, *Degener & Ordonez 13646*; Thelau, west of Mba, O. & I. *Degener 32142*; Korovou, east of Tavua, *Degener 14956*; slopes of escarpment north of Nandarivatu, *Smith 6299*; vicinity of Nandarivatu, *Gillespie 3755, 4160.1, 4165.1, 4372*; Mt. Nanggaranambuluta, east of Nandarivatu, *Gillespie 4067*; Nandala, south of Nandarivatu, *Degener 14852*; Mt. Nukulevu, *DA 14821*. SERUA: Serua District, *Bola 50*. RA: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15419*. NAITASIRI: Vicinity of Viria, *Parks 20425*.

4. *ANTIARIS* Leschenault in *Ann. Mus. Hist. Nat. (Paris)* **16**: 478. 1810; Seem. in *Bonplandia* **10**: 3. 1862, *Fl. Vit.* 252. 1868; Corner in *Gard. Bull. Singapore* **19**: 244. 1962.

Monoecious, unarmed trees or shrubs, with milky latex, the stipules small, free; ♂ inflorescences axillary, solitary or 2-4 together, capitate, involucrate, pedunculate, many-flowered, the receptacle flat or convex, the flowers densely congested, with 4 tepals, these free, imbricate in bud, the stamens 4, with short filaments straight in bud, the anthers extrorse, erect, the pistillode lacking; ♀ inflorescences solitary or paired, urceolate, pedunculate, involucrate, the flower solitary, without tepals, the ovary enveloped by the receptacle and adnate to it, the style deeply bifid, with recurved, subulate branches; drupe connate to receptacle, fleshy, the seed with a thin, hard testa, without endosperm, the cotyledons thick, equal.



FIGURE 59. *Streblus pendulinus*; A, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/2$; B, foliage variation on immature branchlet, $\times 1/2$. A from *Gillespie 3755*, B from *DA 14821*.

TYPE SPECIES: *Antiaris toxicaria* Leschenault.

DISTRIBUTION: The 17 species previously described were combined into four species by Corner in 1962, these occurring from west and central Africa and Madagascar to southern China and eastward into Malesia and western Melanesia. In most of Melanesia and in western Polynesia the genus was presumably an aboriginal introduction.

USEFUL TREATMENT OF GENUS: Corner, E. J. H. *Antiaris* Lesch. Gard. Bull. Singapore **19**: 244-249. 1962.

This remarkable genus, best known for the upas tree, *Antiaris toxicaria*, was represented in Fiji only by introduced plants, but it may no longer persist there.

1. *Antiaris toxicaria* Leschenault in Ann. Mus. Hist. Nat. (Paris) **16**: 478. pl. 22. 1810; Corner in Gard. Bull. Singapore **19**: 248. 1962.

TIPIFICATION AND NOMENCLATURE: The species is based on a plant from Java. Leschenault's article deals with the plant's medicinal properties, but a formal Latin description is found in a footnote with the explanation of the plate. Corner considers the species to consist of three varieties, of which only var. *macrophylla* is recorded from Fiji.

DISTRIBUTION: The species as a whole is a primary rain forest tree of lowlands, with the widest and most continuous range of any moraceous plant, from west Africa to southern China and eastward to Fiji and Tonga (although certainly not indigenous east of the New Hebrides). It is absent from Madagascar, the Australian mainland, and New Caledonia.

A detailed account of the upas tree, as regards the poisonous qualities of its latex, the search for it by early European voyagers, its preparation into a poison used on darts and arrows, its uses for bark cloth, sacks, paper, cordage, and timber, and the action of its cardiac glucoside (antiarin), is provided by Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 175-185. 1966.

1a. *Antiaris toxicaria* var. *macrophylla* (R. Br.) Corner in Gard. Bull. Singapore **19**: 248. 1962; J. W. Parham, Pl. Fiji Isl. 88. fig. 38. 1964, ed. 2. 134. 1972; St. John & A. C. Sm. in Pacific Sci. **25**: 319. 1971.

Antiaris macrophylla R. Br. in Flinders, Voy. Terra Australis **2**: 602. t. 5. 1814.

Antiaris sp. Bennett, Gatherings of a Naturalist in Australasia, 403. 1860.

Antiaris bennettii Seem. in Bonplandia **9**: 259, nom. nud. 1861, Viti, 442, nom. nud. 1862, in Bonplandia **10**: 3. t. 7. 1862, in op. cit. **10**: 153. 1862, in Ann. Mag. Nat. Hist. III. **9**: 405, as *A. bennettii*. 1862, Fl. Vit. 253. t. 72 (as *A. bennettii*). 1868; Engl. in Bot. Jahrb. **7**: 451. 1886; Drake, Ill. Fl. Ins. Mar. Pac. **298**. 1892; Yuncker in Bishop Mus. Bull. **220**: 98. 1959.

A shrub or small tree (as cultivated, but up to 50 m. high in forest areas where indigenous), with a thick crown of foliage. The fruit is crimson, with white, viscid latex.

TIPIFICATION AND NOMENCLATURE: No Brown specimen was located at BM, but two specimens at K are probably isotypes of *Antiaris macrophylla*: Brown 3098 (numbered by Bennett) and "Ex Herb. R. Brown; Iter Australiense. Com. ... J. J. Bennett 8/80." In the protologue of the first valid publication of *A. bennettii*, Seemann cites: "Habitat in insula Ticopia vel Tucopia (G. Bennett! in Herb. Hook.) nec non in insulis Vitiensibus (Harvey! Seemann! n. 449)." The Bennett collection is from a cultivated plant from Tikopia, Santa Cruz Islands. Seemann 449 (also bearing a second label erroneously numbered 450) is represented at K by two sheets, said to have been obtained "about Namara" and on Moturiki. (Seemann visited parts of the old Namara Tikina on Viti

Levu, in the present Tailevu Province, between July 24 and Aug. 2, 1860; cf. Viti, 133. 1862.) The colored drawing made by Mrs. Smythe and reproduced by Seemann in both 1862 and 1868 is preserved at K on one of the two sheets of *Seemann 449*; this sheet is herewith indicated as the lectotype, although whether it came from Tailevu Province or Moturiki cannot be said. There is a sheet of *Seemann 449* at BM without data, which may or may not be an isolectotype. In spite of Seemann's specific epithet, it is obvious that his own collection was the principal basis of his description.

DISTRIBUTION: Corner indicates the distribution of var. *macrophylla* as "Philippine Isl. Molucca Isl., Timor, (? Flores, Solor Isl.), (? Soemba), New Guinea, Solomon Isl., New Hebrides, Fiji, Tonga, North Australia (Company's Isl. off Arnhem Land); lowland rain-forest." He is doubtless correct in suggesting that the shrubby plant of Melanesia was an aboriginal introduction. The specimens available to me from the Santa Cruz Islands, Fiji, Tonga (*Home*, Tongatapu), and the Wallis Islands (*Home*) were all obtained in 1860 or earlier, and one may be sure that the species is not indigenous east of the New Hebrides (and possibly not east of New Guinea). Whether it still persists in Fiji, Tonga, and the Wallis Islands would seem very questionable, since there seem to be no modern collections later than that of Naumann on Viti Levu, dated Nov. 30, 1875, and reported by Engler in 1886.

LOCAL NAME AND USES: The name recorded by Seemann was *mavu ni Tonga*, indicating that it was probably introduced from Tonga. In 1860 it was still to be found planted about temples, as well as in Fijian villages, and at that time its latex may have been used as an arrow poison. Apparently its poisonous qualities are not equal to those of the true upas tree (var. *toxicaria*). There is no indication that the bark or timber were used in Fiji.

AVAILABLE COLLECTIONS: FIJI without other locality, *U. S. Expl. Exped.*, in 1840, *Harvey*, Nov., 1855.

Antiaris toxicaria var. *macrophylla* differs from the other two varieties of the species in having ovate-elliptic and attenuate leaf blades and a larger drupe, up to 45 × 26 mm.

5. *MACLURA* Nuttall, Gen. N. Amer. Pl. 2: 233. 1818; Corner in Gard. Bull. Singapore 19: 235. 1962. Nom. cons.

Chlorophora Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 509. 1830.

(The following description refers in detail only to sect. *Chlorophora* Bureau in DC. Prodr. 17: 228. 1873; Corner in Gard. Bull. Singapore 19: 236. 1962.) Dioecious trees, sometimes spiny (but not our species); leaves spirally arranged to distichous, the blades simple; inflorescences bracteate, the bracts and tepals with immersed yellow glands; ♂ inflorescences spicate, with a sterile groove, the flowers 4-merous, the tepals free, the filaments inflexed in bud, the anthers small, extrorse to laterally dehiscent, the pistillode resembling a small, flattened ovary; ♀ inflorescences capitate or shortly spicate, the flowers sessile, the tepals 4, decussate, imbricate, free or joined proximally, fleshy in fruit, the ovary not embedded in sockets of receptacle, the style undivided, 8–10 mm. long; drupes enclosed in the perianth, concrescent proximally into a fleshy syncarp, this globose to short-oblong, not more than 2 cm. broad; seeds compressed, 2.5–4 mm. long, the endocarp ligneous, the embryo curved, the radicle accumbent, the cotyledons equal, flat, thin.

TYPE SPECIES: *Maclura aurantiaca* Nuttall. The type species of *Chlorophora* is *C. tinctoria* (L.) Don (*Morus tinctoria* L.).

DISTRIBUTION: The genus as a whole is composed of about twelve species and has a tricentric, largely tropical and subtropical, distribution. Section *Chlorophora*, to

which the single species cultivated in Fiji belongs, is restricted to America, Africa, and Madagascar and includes five species.

USEFUL TREATMENT OF GENUS: Corner, E. J. H. *Maclura* Nutt. Gard. Bull. Singapore 19: 235-240. 1962.

1. *Maclura excelsa* (Welw.) Bureau in DC. Prodr. 17: 231. 1873; Corner in Gard. Bull. Singapore 19: 237. 1962.

Morus excelsa Welw. in Trans. Linn. Soc. 27: 69. t. 23. 1869.

Chlorophora excelsa Benth. & Hook. f. Gen. Pl. 3: 363. 1880; J. W. Parham, Pl. Fiji Isl. ed. 2. 135. 1972.

As sparsely cultivated in Fiji, *Maclura excelsa* is a small tree (but is up to 50 m. high where indigenous), grown experimentally near sea level.

TYPIFICATION: *Morus excelsa* is based on *Welwitsch 1559*, from Angola.

DISTRIBUTION: Tropical Africa, and often cultivated elsewhere. In Fiji it has been introduced for trial by the Department of Forestry.

USE: A valuable timber tree, widely used for making furniture.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Kalambu, DA 16431.

6. BROUSSONETIA L'Hér. ex Vent. Tabl. Règne Vég. 3: 547. 1799; Seem. Fl. Vit. 246. 1868; Corner in Gard. Bull. Singapore 19: 233. 1962. Nom. cons.

(The following description refers in detail only to sect. *Broussonetia*.) Dioecious, unarmed trees or shrubs, with latex, the stipules membranous, caducous; leaves spirally arranged to distichous, the blades undivided to palmately lobed, membranous, dentate to entire; inflorescences axillary or borne on defoliate branchlets, solitary, pedunculate, the bracts and perianth without immersed yellow glands; ♂ inflorescen-

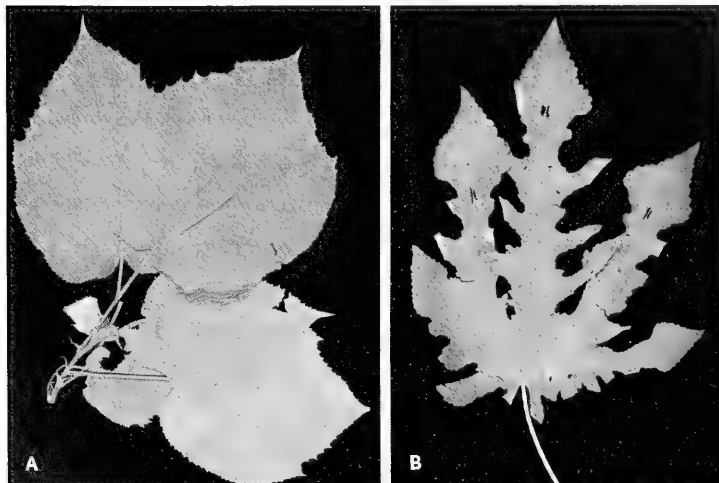


FIGURE 60. *Broussonetia papyrifera*; A, distal portion of branchlet, with foliage and stipules, $\times 1/4$; B, lobed and incised leaf blade, $\times 1/4$. A from Smith 1097, B from DA 15560.

ces racemose to spicate, with a sterile groove, the flowers short-pedicellate to sessile, the tepals 4, valvate, connate proximally, the stamens 4, with filaments inflexed in bud, the pistillode minute; ♀ inflorescences capitate, globose, without a sterile groove, the flowers with a utricular perianth, this with 2-4 small lobes or teeth, the ovary sessile or becoming stipitate in fruit, the style elongate, filiform, undivided, stigmatose throughout length; syncarp globose, 1-2.5 cm. broad, the flowers not connate; drupes thinly pulpy, invested by the perianth, the seeds ovoid, slightly compressed, papillate-asperate, crustaceous, with a keel double at base, 1.7-2.5 mm. long, the endocarp crustaceous to ligneous, the embryo curved, the cotyledons equal, flat, the radicle long, accumbent.

TYPE SPECIES: *Broussonetia papyrifera* (L.) Vent. (*Morus papyrifera* L.).

DISTRIBUTION: A genus of seven or eight species (including sect. *Allaeanthus* (Thw.) Corner with three species) from Ceylon, southeastern Asia, and Japan into Malesia including the Philippines, with one species widely cultivated throughout the Pacific.

USEFUL TREATMENT OF GENUS: Corner, E. J. H. *Broussonetia* L'Herit. ex Vent. Gard. Bull. Singapore 19: 233-235. 1962.

1. *Broussonetia papyrifera* (L.) Vent. Tabl. Règne Vég. 3: 547. 1799; Seem. Fl. Vit. 246. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 295. 1892; Christophersen in Bishop Mus. Bull. 128: 73. 1935; Yuncker in op. cit. 178: 46. 1943, in op. cit. 184: 35. 1945, in op. cit. 220: 97. 1959; J. W. Parham, Pl. Fiji Isl. 91. 1964, ed. 2. 135. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 124. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 134. 1972. FIGURE 60.

Morus papyrifera L. Sp. Pl. 986. 1753.

A slender, erect shrub or tree cultivated in or near villages near sea level. As seen in Fiji, *Broussonetia papyrifera* attains a height of about 4 m. and is then harvested for its bark; no fertile specimens have been observed. The species may attain a height of 12 m. where indigenous, bearing yellow to red drupes.

TIPIFICATION: Of the two prior references given by Linnaeus, probably the better lectotype is Kämpfer, Amoen. Exot. 471. 1712, especially if an illustration of Kämpfer's Japanese collection is available.

DISTRIBUTION: Indigenous in China and Japan, and probably also in Burma and Thailand, early spreading in cultivation throughout Malesia and the Pacific.

LOCAL NAMES AND USES: The most commonly used Fijian names are *masi*, *ai masi*, and *malo*; also reported are *masi ndina*, *ai masi vutu*, and *kalakalailea*. This was a very important economic plant in Fiji and elsewhere in the Pacific, where it was doubtless an early aboriginal introduction. Its bark was made into cloth that, either white or variously dyed and ornamented, served as the principal item of clothing. It is still widely made in Fiji and is used for ceremonial wear or decorative use. The cloth itself is often known as *ngatu*, or as *masi* or *malo* modified by various adjectives to indicate the intended use. Sometimes the Polynesian word *tapa* is used in Fiji for the finished product. Seemann (1868, cited above) provides an extensive discussion of the preparation and uses of the bark-cloth made from *Broussonetia papyrifera*, and he also uses the English name *paper mulberry*.

AVAILABLE COLLECTIONS: VITI LEVU: RA or TAILEVU: Wainimbuka River Valley, DA 5618. NAITASIRI: Central Agricultural Station, DA 3392. REWA: Langgere, DA 13899. KORO: East coast, Smith 1097. NGAU: Milne 155. TAVEUNI: Tavuki, near Wairiki, DA 8934. YATHATA: Yathata Village, DA 15559, 15560. VANUA MBALAVU: Lomaloma, Tothill 768. NAMUKA-I-LAU: Bryan 474. Seemann (1868) implies that he also collected specimens but did not provide a number, and no such material has been seen.

The leaf blades of specimens seen in Fiji are very variable, ranging from entire to 3- or 5 (or 7)-lobed with each lobe further deeply incised. The blades are scabrid above and densely pubescent beneath, serrate-dentate at margin, and up to 30 cm. long and broad, with petioles often exceeding 15 cm. in length.

7. MALAISIA Blanco, Fl. Filip. 789. 1837; Corner in Gard. Bull. Singapore 19: 240. 1962.

Caturus sensu Lour. Fl. Cochinch. 612. 1790; Seem. Fl. Vit. 254, p. p. 1868; non L.

Diocious, unarmed lianas, with milky latex, the stipules small; leaves alternate, short-petiolate, the blades oblong-elliptic, subcoriaceous, entire or undulate to crenulate-dentate; inflorescences axillary, pedunculate, solitary or 2-4 together; ♂ inflorescences spicate or narrowly racemose, the flowers numerous, with 3 or 4 tepals, these valvate, connate proximally, the stamens 3 or 4, the filaments inflexed in bud, the pistillode small; ♀ inflorescences capitate, small, with numerous, fleshy, pilose bracts, the flowers with a utricular perianth, this dentate at apex, the staminodes lacking, the ovary superior, the style deeply bifid with filiform, stigmatose branches; drupes 1-4, projecting from small syncarps formed by the accrescent receptacles, invested by the enlarged, thinly fleshy perianths, the seeds up to 7 mm. long, the endocarp membranous, the embryo curved, the cotyledons unequal, the larger one thick and folded, enveloping the smaller one.

TYPE SPECIES: *Malaisia tortuosa* Blanco (= *M. scandens* (Lour.) Planch.).

DISTRIBUTION: Composed of a single species distributed from southeastern Asia through Malasia including the Philippines and eastward to the Mariana Islands, Queensland, New Caledonia, Fiji, and Tonga.

1. *Malaisia scandens* (Lour.) Planch. in Ann. Sci. Nat. Bot. IV. 3: 293. 1855; Seem. Fl. Vit. 254, pro syn. 1868; Merr. in Trans. Amer. Philos. Soc. n. s. 24 (2): 132. 1935; J. W. Parham, Pl. Fiji Isl. 97. 1964, ed. 2. 139. 1972. FIGURE 61.

Caturus scandens Lour. Fl. Cochinch. 612. 1790.

Malaisia tortuosa Blanco, Fl. Filip. 789. 1837; Drake, Ill. Fl. Ins. Mar. Pac. 295. 1892.

Malaisia ? sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Caturus torulosus Seem. Fl. Vit. 254, sphalm. 1868.

Caturus pelagicus Seem. Fl. Vit. 255. 1868.

In Fiji *Malaisia scandens* occurs sparingly from near sea level to an elevation of about 400 m. as a liana with milky latex in dry or open forest. Its leaf blades are variable in size, 4-17 cm. long and 2-7 cm. broad, and its drupes are bright orange, borne on somewhat paler orange receptacles. Flowers have been noted only in September and fruits between December and February.

TIPIFICATION AND NOMENCLATURE: *Caturus scandens* is based on a Loureiro collection (BM HOLOTYPE) which in 1790 Loureiro noted as "Habitat in sylvis Cochinchinae," although Planchon in 1855 cited it as "China, près de Canton, Loureiro." *Malaisia tortuosa* is typified by a Philippine specimen not clearly indicated by Blanco. For *Caturus pelagicus*, Seemann cited three collections, including a MacGillivray specimen from New Caledonia and a Bidwill specimen from Australia, but it is obvious that his species is primarily based on his own Kandavu collection (K LECTOTYPE; ISOLECTOTYPE at BM). There is some uncertainty about the number, which is simply 434 at K and BM. In compiling his 1861 *Bonplandia* list, Seemann apparently discovered that he had numbered his specimens of both *Malaisia* and *Morus* as 434, and so he renumbered the *Malaisia* as 434a and the *Morus* as 434b. In *Flora Vitiensis* the *Morus* is cited as 434 and the *Malaisia* as 434B, but someone has pencilled "A" on the sheet of *Malaisia* at BM. To obviate this confusion I think it best to cite both the *Malaisia* and



FIGURE 61. *Malaisia scandens*, from O. & I. Degener 32150; A, distal portion of branchlet, with foliage and ♀ inflorescences, $\times 1/3$; B, young fruiting head, $\times 6$.

the *Morus* as *Seemann 434*, p. p. Several other synonyms not mentioned in Fijian literature are now considered referable to *M. scandens*.

DISTRIBUTION: As noted above for the genus.

LOCAL NAME: On Taveuni I was given the local name *aumitha*, but this may be of no consequence, as Fijians are unaware of this rare species.

AVAILABLE COLLECTIONS: MAMANUTHAS: NGGALITO ISLAND, Malolo Group, O. & I. Degener 32242. VITI LEVU: Mba: Mountains above Lautoka, *Greenwood 348*; Thelau, west of Mba, O. & I. Degener 32150. NAITASIRI: Waindina River, above Nanggali, *DA 907*. VANUA LEVU: MATHUATA: Vicinity of Lambasa, *Greenwood 348A*. TAVEUNI: Western slope, between Somosomo and Wairiki, *Smith 842*. FIJI without further locality, *Storck XVI*.

8. **ARTOCARPUS** J. R. & G. Forst. Char. Gen. Pl. 51. 1775, ed. 2. 101. 1776; Seem. Fl. Vit. 255. 1868; Fosberg in Amer. J. Bot. **26**: 231. 1939; Jarrett in J. Arnold Arb. **40**: 113. 1959; Corner in Gard. Bull. Singapore **19**: 233. 1962. Nom. cons.

Sitodum Parkinson, J. Voy. Endeavour, 45. 1773.

Rademachia Thunb. in Kongl. Vetensk. Acad. Handl. **37**: 251. 1776.

Monoecious trees, with thick, sticky, white latex; leaves spirally arranged or alternate and distichous, the blades simple and entire to pinnatifid or pinnate, penninerved; inflorescences unisexual, pedunculate, thick-spicate to clavate or capitate,

solitary or paired in leaf axils or rami- or cauliflorous, covered with minute sessile flowers, the perianths enclosing a single ovary or stamen, mixed with abundant interfloral bracts (these rarely lacking); ♂ flowers with tubular perianths, these 2-4-partite or merely perforate, the stamen 1, short- to long-exserted, the filament straight in bud, the anther locules globose to oblong, the pistillode lacking; ♀ flowers variously connate, the perianth tubular, thin-walled around the ovary, thick-walled around the style, partially or completely fused with one another to form a syncarp, the style apical to lateral, simple or bifid, the ovule subapical to lateral; mature syncarp more or less massive, fleshy, pulpy, or with pulpy pericarps, usually many-seeded, the seeds medium-sized to large, the testa membranous to pergamentaceous, the endosperm none, the embryo straight or slightly curved, the cotyledons thick, fleshy, equal or unequal, not folded.

TYPE SPECIES AND NOMENCLATURE: *Artocarpus communis* J. R. & G. Forst. is the type species of *Artocarpus*, *Sitodium altile* Parkinson of *Sitodium*, and *Rademachia incisa* Thunb. of *Rademachia* (the spelling subsequently corrected to *Rademachia*). Parkinson's 1773 "botanical" description is reproduced and discussed by Jarrett (in J. Arnold Arb. 40: 116, 117. 1959), who concludes that it is not valid or adequate as a generico-specific description. The same conclusion was reached by Merrill (in Chron. Bot. 14: 330. 1954), but it has appeared to Fosberg and many other authors that *Sitodium altile*, one of the few unquestionably recognizable plants discussed in Parkinson's *Journal*, may be considered valid as a descriptio generico-specifica. Jarrett's scholarly review of the correct name of the breadfruit (1959, cited above, pp. 116-119) is very informative, even though her rejection of the epithet *altilis* is not accepted by many recent authors. The inclusion of *Sitodium* in the ICBN as a nomen rejiciendum indicates at least a probability that its publication should be considered valid.

DISTRIBUTION: Ceylon, India, and southern China through Malesia to the Solomon Islands, absent from Australia and New Caledonia, but now (primarily two species) widely cultivated throughout the tropics. Jarrett (in the publication listed below) recognizes 47 species of *Artocarpus*, dividing it into two subgenera. All three species recorded from Fiji fall into subgen. *Artocarpus*, which includes 27 species.

USEFUL TREATMENT OF GENUS: Jarrett, F. M. Studies in *Artocarpus* and allied genera, I-V. J. Arnold Arb. 40: 1-37, 113-155, 298-368. 1959; op. cit. 41: 73-140, 320-340. 1960.

KEY TO SPECIES

- ♂ inflorescences short-obovoid to globose, 13-20 mm. broad; syncarp subglobose, 1-1.5 times as long as broad, to 13 cm. broad, the surface echinate with indurated processes, these hispidulous, elongate, 7-9 mm. long, tapering, acute; leaf blades 9-32 × 5-15 cm., becoming smooth or scabrid above, the margin at maturity entire or crenate (sect. *Duricarpus*). 1. *A. rigidus*
- ♂ inflorescences narrowly clavate to ellipsoid, 3-10 times as long as broad; syncarp ellipsoid to cylindrical or subglobose, 1-2 times as long as broad, the surface covered by more or less fleshy, firm or flexuose processes (sect. *Artocarpus*).
- Twigs 5-15 mm. thick, grayish appressed-pubescent; stipules 10-25 cm. long; adult leaf blades usually pinnatifid, 30-60 × 20-40 cm., puberulent to pubescent on both surfaces; syncarp cylindrical to subglobose, usually 15-30 cm. across, the processes to 15 × 5 mm.; ♂ inflorescences at anthesis usually 7-30 × 1.5-4 cm.; inflorescences solitary in leaf axils. 2. *A. altilis*
- Twigs 2-6 mm. thick, glabrous; stipules 1.5-8 cm. long; adult leaf blades entire, 5-25 × 3-12 cm., glabrous; syncarp cylindrical to clavate, extremely large at maturity, 30-100 × 25-50 cm., the processes 4-10 × 4 mm.; ♂ inflorescences at anthesis 2.5-10 × 1-3 cm.; cauliflorous or ramiflorous trees.

3. *A. heterophyllus*

1. *Artocarpus rigidus* Bl. Bijdr. Fl. Ned. Ind. 482, as *A. rigida*. 1825; Jarrett in J. Arnold Arb. 40: 150. 1959; J. W. Parham, Pl. Fiji Isl. ed 2. 135. 1972.

A small and infrequently cultivated tree in Fiji, but up to 35 m. high where indigenous.

TIPIFICATION: The type is *Blume 1364* (L HOLOTYPE; ISOTYPE at CAL), from Java.

DISTRIBUTION: Burma, Indochina, Malaya, and western Malesia; cultivated elsewhere. Two subspecies are recognized by Jarrett; our collection doubtless falls into subsp. *rigidus*.

LOCAL NAMES AND USES: No names or uses are recorded from Fiji, but Jarrett gives several Malesian names and indicates that the tree is cultivated for the edible, sweet, pulpy, waxy perianths surrounding the seeds of its syncarp. It also provides timber. Presumably it was introduced into Fiji as a potentially useful tree, but the introduction may not have succeeded.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRE: Nasinu Experiment Station, DA 1546.

2. *Artocarpus altilis* (Parkinson) Fosberg in J. Wash. Acad. Sci. **31**:95. 1941; Yuncker in Bishop Mus. Bull. **178**:46. 1943, in op. cit. **184**:35. 1945, in op. cit. **220**:97. 1959; J. W. Parham in Agr. J. Dept. Agr. Fiji **29**:31. 1959, Pl. Fiji Isl. **89**. fig. 39. 1964, ed. 2. 134. 1972; Koroiveibau in Dept. Agr. Fiji Bull. **46**:1. 1967; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**:123. 1970; St. John in Biol. J. Linn. Soc. **4**:309. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**:137. 1972; St. John in Phytologia **36**:369. 1977.

Sitodidum altile Parkinson, J. Voy. Endeavour, 45. 1773; "Parkinson ex Z" in Naturforscher (Halle) **4**:244. t. 2. 1774.

Artocarpus communis J. R. & G. Forst. Char. Gen. Pl. 51. t. 51, 51a. 1775, ed. 2. 102. t. 51, 51a. 1776; Christophersen in Bishop Mus. Bull. **128**:72. 1935; J. W. Parham in Agr. J. Dept. Agr. Fiji **19**:99. 1948; Jarrett in J. Arnold Arb. **40**:307. 1959.

Rademachia incisa Thunb. in Kongl. Vetensk. Acad. Handl. **37**:253. 1776.

Artocarpus incisus L. f. Suppl. Pl. 411. 1781; Corner in Gard. Bull. Straits Settlement. **10**:280. 1939.

Artocarpus incisa Forst. f. Pl. Esc. Ins. Oc. Austr. 23. 1786, Fl. Ins. Austr. Prodr. 64. 1786; Seem. Fl. Vit. 255. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 298. 1892; Guillaumin in J. Arnold Arb. **13**:106. 1932.

Artocarpus incisa var. *integrifolia* Seem. in Bonplandia **9**:259, nom. nud. 1861, Viti, 442, nom. nud. 1862.

Artocarpus incisa var. *pinnatifida* Seem. in Bonplandia **9**:259, nom. nud. 1861, Viti, 442, nom. nud. 1862.

Artocarpus incisa var. *bipinnatifida* Seem. in Bonplandia **9**:259, nom. nud. 1861, Viti, 442, nom. nud. 1862.

The breadfruit is widely cultivated in and about villages in Fiji, perhaps sometimes naturalizing, usually near sea level; it is a tree with copious white latex, seldom exceeding 15 m. in height (but up to 35 m. where indigenous). The syncarps are usually yellow-green to yellow-brown when mature. Although the principal season for ripe syncarps is in March and April, different cultivars ripen at other times, and edible fruit may be found throughout the year.

TIPIFICATION AND NOMENCLATURE: For *Sitodidum altile* the Parkinson description may presumably be taken as the type. The binomials in Parkinson's *Journal* certainly originated with Solander (cf. Merrill in Chron. Bot. **14**:328. 1954) and were used without authorization, but this is not indicated in the *Journal* and therefore it seems inadvisable to use the cumbersome authorship "Solander ex Parkinson." There may be Tahitian collections of the breadfruit at BM from the first Cook voyage, but it would seem unwarranted to consider any of them a holotype. For *Artocarpus communis*, there is a Forster collection at BM, consisting of a single leaf, which Jarrett has annotated as the holotype; an apparent duplicate at K gives the locality as Tahiti. *Rademachia incisa* is typified by a specimen from Java, *Thunberg s. n.* (UPS HOLOTYPE). Each of the three epithets here discussed has been defended by a number of scholars as

the correct one, the above citations, pertaining primarily to the Fijian Region, being a small fraction of those available.

DISTRIBUTION: The basic seeded form of *Artocarpus altilis* is probably indigenous in New Guinea, where it is scattered in primary rain forest; possibly it is also indigenous in the Moluccas, western Melanesia, and Micronesia. The seedless form and to a lesser extent the seeded form are now cultivated throughout the tropics.

LOCAL NAMES AND USES: The basic names used in Fiji are *breadfruit*, *uto*, *uto ndina*, and *uto mbutho*. However, there are a multitude of other names for different cultivars (often called varieties, but scarcely so in the technical sense). Thirteen of these were discussed by Seemann (1868, cited above), and 70 are described and classified in the valuable survey by Dominiko Koroiveibau (Some Fiji breadfruit varieties. Dept. Agr. Fiji Bull. **46**: 1-31. 1967). Many other cultivars from a wider geographical area are discussed by J. W. Parham (Coconut and breadfruit surveys in the South Pacific region. South Pac. Comm. Techn. Inform. Pap. **1**: 40-58. App. II, IIIB. 1966). Some of the many cultivars of breadfruit in Fiji yield ripe seeds, which are edible when boiled or roasted, but the more favored ones are seedless. As throughout the Pacific, the breadfruit is an important staple food, especially on the smaller and less accessible islands. The ripe syncarp may be boiled, baked, roasted, and eaten plain or combined with other ingredients into a great variety of dishes. The former custom of preserving syncarps underground, later to be made into *mandrai* (bread), is now seldom observed. Formerly the wood was used for building or for canoes, and the *ndrenga* (exuded gum) was used for caulking canoes. Bark cloth from *Artocarpus* was probably not made in Fiji, as it was in some parts of the Pacific.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Between Namuamua and Namosi, *Weiner 9B*. NAITASIRI: Nanduruloulou, *DA 3393*; Koronivia, *DA 12128*. TAILEVU: Navunisolou Village, *DA 11099-11103* (coll. *J. Barrau*). REWA: Rewa Village and vicinity, *Seemann 452, 453, 455, 457-460*. VITI LEVU without further locality, *Graeffe 1543*. MBENGGGA: Malambi, *Weiner 222*. OVALAU: *Denham* (H. M. S. *Herald*), in 1854. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7966*. "TAVEUNI and VITI LEVU:" Somosomo and Rewa, *Seemann 450*. TAVEUNI: Somosomo, *Seemann 451*; Songgulu Estate, *Weiner 71-7-7A*. FLJI without further locality, *Williams s. n.*, *Seemann 454, 456*. Additionally, vouchers from many parts of Fiji collected by *Koroiveibau* support his work of 1967 (cited above): *DA 16205-16207, 16328-16334, 16336-16400*.

A very small percentage of the available botanical literature pertaining to the breadfruit is discussed above. Jarrett's treatment (in *J. Arnold Arb.* **40**: 307-323. 1959) is very detailed and should be consulted for a thorough discussion of nomenclature, variability, uses, etc.

3. *Artocarpus heterophyllus* Lam. *Encycl. Méth. Bot.* **3**: 210, as *A. heterophylla*. 1789; Jarrett in *J. Arnold Arb.* **40**: 334. 1959; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 123. 1970.

Artocarpus integer (often as "*integra*") sensu Merr. *Interpret. Rumph. Herb. Amb.* 190. 1917 (non sensu typi); Christophersen in *Bishop Mus. Bull.* **128**: 73. 1935; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* **13**: 47. 1942; Yuncker in *Bishop Mus. Bull.* **220**: 98. 1959; J. W. Parham, *Pl. Fiji Isl.* **91**. 1964, ed. 2. 135. 1972; Koroiveibau in *Dept. Agr. Fiji Bull.* **46**: 1. 1967; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 138. 1972; non sensu *Rademachia integra* Thunb. in *Kongl. Vetensk. Acad. Handl.* **37**: 254. 1776.

Artocarpus integrifolia sensu J. W. Parham in *Agr. J. Dept. Agr. Fiji* **19**: 99. 1948, in op. cit. **29**: 31. 1959; non L. f.

A tree to 20 m. high or more at maturity where indigenous, with white, resinous latex, occasionally cultivated in Fiji near sea level. The gigantic syncarp is probably the largest of all cultivated fruits.

TYPIIFICATION AND NOMENCLATURE: The lectotype of *Artocarpus heterophyllus* as indicated by Jarrett (1959) is *Commerson s. n.* (P-JU), from Mauritius. There has been much confusion as to the correct botanical names of the *jakfruit* and the *chempedak*, which has been clarified by Corner (in Gard. Bull. Straits Settlement. 10: 56-81. 1939) and Jarrett (1959, cited above, pp. 119-121, 329-338). The *chempedak* is indeed *A. integer* (Thunb.) Merr. in the nomenclatural sense (as based on *Rademachia integra* Thunb., for which *A. integrifolia* L. f. is an illegitimate name), but not in the sense of Merrill's actual interpretation in 1917.

DISTRIBUTION: Indigenous in southeastern Asia, of ancient cultivation in India and early spreading to eastern Africa, now cultivated throughout the tropics. It is more frequently grown in Fiji than suggested by the single available voucher.

LOCAL NAMES AND USES: *Jakfruit, uto ni India, Indian breadfruit, kaihal*; the pulp of the ripe syncarp may be eaten fresh or preserved in syrup, the large seeds are edible when boiled or roasted, and the heartwood is a valuable timber. Other uses in India and Ceylon are detailed by Purselove (Trop. Crops, Dicot. 384. 1968).

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Singatoka, DA 9663.

FAMILY 65. URTICACEAE

URTICACEAE Juss. Gen. Pl. 400, as *Urticae*. 1789.

Monoecious, dioecious, or polygamous herbs, undershrubs, or soft-wooded trees, anemophilous, without latex or with watery latex, very rarely climbing, usually with indument, often armed with stinging hairs, the stems often fibrous; stipules present, free or connate, very rarely absent; leaves alternate (distichous or spirally arranged) or opposite, simple, petiolate, the blades pinnate- or palmate-nerved, with epidermal cells mostly with prominent cystoliths, these usually linear or punctiform; inflorescences axillary, rarely terminal, basically cymose, bracteate, often condensed into pseudo-heads; flowers small, unisexual, rarely hermaphrodite, usually actinomorphic; ♂ flowers short-pedicellate or sessile, the perianth segments 2-5 (-6), free or united, valvate or subimbricate; stamens the same number as perianth lobes and opposite them, rarely reduced to 1, the filaments inflexed in bud, springing back and thus causing anthers to release pollen, the anthers dorsifixed, 2-locular, dehiscent longitudinally, a pistil vestige usually present; ♀ flowers with 3 or 4 (or 5) tepals or the perianth tubular, lageniform, or cupular (and then short-dentate), rarely absent; staminodes scalelike and opposite perianth lobes or absent; ovary superior, free or adnate to perianth, sessile or short-stipitate, unilocular, the ovule solitary, basal, erect, orthotropous, the style present or absent, unbranched, the stigma often penicillate or linear or a filiform prolongation of style; fruit usually a laterally compressed or ovoid achene, rarely drupaceous, sometimes surrounded by the accrescent perianth and dispersed with it, the seed mostly with endosperm, the embryo small, straight.

DISTRIBUTION: Pantropical, subtropical, and temperate, with 45-49 genera and 800-1,900 species; there is substantial disagreement as to the number of species in the family.

USEFUL TREATMENTS OF FAMILY: Backer, C. A., & R. C. Bakhuizen van den Brink, Jr. *Urticaceae*. Fl. Java 2: 36-51. 1965. Hutchinson, J. *Urticaceae*. Gen. Fl. Pl. 2: 178-195. 1967.

The Urticaceae are of little economic importance except for *Boehmeria nivea*, which produces ramie fiber. The family includes various noxious weeds and a few plants that are considered ornamentals. In Fiji eleven genera are represented, eight of them having indigenous species.

KEY TO GENERA

- Stinging or prurient hairs present; stipules intrapetiolar, connate; leaves alternate; perianth of ♀ flowers 4-partite or 4-lobed; staminodes absent; stigma linear.
- Trees (infrequently shrubs); stipules wholly connate; cystoliths punctiform; ♂ flowers usually 4-merous; achene nitid, smooth, not marginate. 1. *Dendrocnide*
- Herbs; stipules connate but bifid; cystoliths linear; ♂ flowers usually 5-merous; achene pitted and verrucose, marginate. 2. *Laportea*
- Stinging or prurient hairs absent.
- Perianth of ♀ flowers 3-5-partite, sometimes very small; stigma shortly penicillate, caducous; stipules intrapetiolar, connate; leaves opposite or appearing alternate by reduction of one of each pair; cystoliths mostly linear, rarely punctiform, sometimes absent.
- Leaves seemingly alternate but actually opposite and anisophyllous, with one of each pair greatly reduced, minute, caducous, the blades oblique, the distal side the smaller.
- ♀ flowers congested on a flattened, discoid, or lobed receptacle, this mostly involucrate; staminodes usually present in ♀ flowers, incurved in bud; ♂ flowers densely cymose or subcapitate. 3. *Elatostema*
- ♀ flowers capitate on a sessile or pedunculate, globose or clavate, fleshy receptacle, this not involucrate; staminodes absent from ♀ flowers; ♂ flowers in a lax or congested cyme. 4. *Procris*
- Leaves opposite, often unequal but the smaller one of a pair not minute or caducous, the petioles of different lengths, the blades equal-sided or nearly so; flowers laxly cymose or in clusters; perianth of ♀ flowers 3-partite, one segment larger than the others. 5. *Pilea*
- Perianth of ♀ flowers usually tubular or lageniform and short-dentate, rarely cupuliform or absent, free or united with ovary; staminodes none; stigma not penicillate; ♂ flowers with 3-5 stamens; cystoliths punctiform or absent.
- ♀ flowers with the perianth well developed, tubular or lageniform, enveloping the ovary; flowers mostly 4-merous, rarely 3- or 5-merous.
- Mature ♀ perianth dry, sometimes immersed in the fleshy receptacle.
- Achene not combined with receptacle into a fleshy spurious fruit; ♂ perianth lobes convex or short-corniculate at apex, not induplicate in bud; leaf blades pinnate-nerved above the 3-nerved base.
- Stigma semipersistent on fruit, filiform, pilose on one side; flower clusters mostly combined into spikes or panicles, sometimes axillary; ♂ perianth lobes often short-corniculate at apex; leaf blades serrate; stipules usually lateral and free, less often intrapetiolar and basally connate; shrubs or slender trees. 6. *Boehmeria*
- Stigma caducous after anthesis; flower clusters axillary, not in spikes or panicles; ♂ perianth lobes convex at apex; leaf blades entire or serrate; stipules lateral, free; herbs (our species). 7. *Pouzolzia*
- Achene immersed in a globose, fleshy receptacle, together with it forming a spurious fruit; flower clusters in panicles, less often in spikes; stigma caducous; stipules intrapetiolar, connate; shrubs or trees. 8. *Pipturus*
- Mature ♀ perianth somewhat fleshy or juicy; stigma recurved, semipersistent; flower clusters axillary or at defoliate nodes of branchlets, sessile, semiglobose, many-flowered; leaves opposite, decussate, the blades often bullate-rugose, not white-tomentose beneath, serrate; stipules lateral, free; shrubs or small trees. 9. *Cypholophus*
- ♀ flowers with the perianth minute and cupuliform or absent; ♂ flowers 5-merous; all flowers in pedunculate heads, these simple or arranged in cymes; leaf blades white-tomentose beneath; cystoliths present, punctiform; stipules intrapetiolar, connate; shrubs or small trees.
- Stipules 2-lobed or almost completely united; flower heads on simple peduncles; perianth of ♀ flowers minute, cupuliform. 10. *Leucosyke*
- Stipules usually deeply bifid; flower heads small, in lax cymes; perianth of ♀ flowers absent or minute. 11. *Maoutia*

1. DENDROCNIDE Miq. Pl. Junghuhn. 29. 1851; Chew in Gard. Bull. Singapore 21: 201. 1965, in op. cit. 25: 7. 1969.

Laportea sect. *Dendrocnide* Wedd. in Arch. Mus. Hist. Nat. 9: 133. 1856, in DC. Prodr. 16: (1): 85. 1869. *Laportea* sensu Seem. Fl. Vit. 238. 1868; non Gaud.

Usually dioecious, soft-wooded trees or shrubs, with stinging or prurient hairs, the stipules large, intrapetiolar, wholly connate into an axillary scale, dorsally bicarinate; leaves alternate, the petioles long, the blades often coriaceous, pinnate-nerved, entire,

dentate, or serrate, with punctiform cystoliths on upper surface; inflorescences unisexual, solitary, axillary, paniculate, bracteate; ♂ flowers with the perianth usually with 4 (sometimes 5) tepals, these slightly imbricate or subvalvate, the stamens usually 4 (sometimes 5), the rudimentary ovary clavate or subglobose; ♀ flowers with the perianth 4-partite or 4-lobed, the segments sometimes unequal, sometimes with one minute or absent, the staminodes absent, the ovary becoming oblique, the stigma linear, papillose on one side, persistent, often becoming reflexed; achene obliquely ovoid to ellipsoid, slightly laterally compressed, smooth, nitid, the seed with thin endosperm or none, the cotyledons broad.

LECTOTYPE SPECIES: *Dendrocnide costata* Miq. (= *D. stimulans* (L. f.) Chew); cf. Chew in Gard. Bull. Singapore 21: 202. 1965.

DISTRIBUTION: China, India, and Ceylon through Malesia to Australia and into the Pacific to Tonga, Niue, and Samoa, with 36 species. Two species are indigenous in Fiji.

USEFUL TREATMENTS OF GENUS: Chew Wee-Lek. *Laportea* and allied genera (Urticaceae). Gard. Bull. Singapore 21: 195-208. 1965. Chew Wee-Lek. A monograph of *Dendrocnide* (Urticaceae). Gard. Bull. Singapore 25: 1-104. 1969.

Chew (1969, cited above) divides the genus into sect. *Dendrocnide*, with ten species, and sect. *Sarcopus* (Wedd.) Chew (in Gard. Bull. Singapore 25: 7. 1969, based on *Laportea* sect. *Sarcopus* Wedd. in Arch. Mus. Hist. Nat. 9: 129. 1856, in DC. Prodr. 16 (1): 82. 1869), with 26 species; the Fijian species belong to the latter section.

The two species of *Dendrocnide* that occur in Fiji are greatly respected by all who have come into inadvertent contact with them, as they bear stinging hairs that can cause a very painful irritation. These hairs are most abundant on the inflorescences, but the leaves of many individuals are also to be treated with great caution. Probably *D. harveyi* is the greater offender than *D. vitiensis*, usually having a more abundant indument, but most collectors do not care to experiment. Sykes, however (1970, cited below), suggests that in Niue the leaves of *D. harveyi* bear few hairs and are not irritating to the touch. In Fiji some collectors have noted that *D. harveyi* causes painful stings, while others have reported their material as "not stinging." One may conclude that individuals with copious foliar indument (mostly of *D. harveyi*) are the more notably irritating, but experimentation along these lines with any species of *Dendrocnide* is not to be recommended.

In Fiji the two species are nearly equally abundant; there seem to be more available herbarium specimens of *Dendrocnide vitiensis* than of *D. harveyi*, perhaps due to collectors' caution. Outside of Fiji, *D. harveyi* is known to occur in Tonga, Niue, and Samoa, while *D. vitiensis* is known only from Samoa, there being somewhat the more common of the two species.

KEY TO SPECIES

- Petioles 2-12 (-15) cm. long; leaf blades prevailing broadly ovate and 1-1.5 times as long as broad, up to 40 × 30 cm., usually obviously cordate at base, with 3 or usually 5 nerves from base, the upper nerves 3-7 (-10) pairs, the margins usually dentate to crenulate but sometimes nearly entire; stipules 1-3 cm. long; ♂ flowers pedicellate; ♀ flowers sessile, the achenes about 2 × 1.5 mm. 1. *D. harveyi*
- Petioles (1-) 2-7 cm. long; leaf blades prevailing ovate-pentagonal and 2-2.5 times as long as broad, up to 22 × 11 cm., rounded or inconspicuously cordate at base, with 3 nerves arising from or near base, the upper nerves 5-10 pairs, the margins mostly entire but sometimes crenulate; stipules about 0.5 cm. long, early caducous; ♂ flowers sessile or subsessile; ♀ flowers pedicellate, the achenes about 3 × 2 mm. 2. *D. vitiensis*

1. *Dendrocnide harveyi* (Seem.) Chew in Gard. Bull. Singapore 21: 203. 1965, in op. cit. 25: 88. fig. 36. 1969; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200:

209. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 140. fig. 43. 1972.

FIGURE 80 (lower).

Laportea harveyi Seem. in Bonplandia 9: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862, Fl. Vit. 238. t. 59. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 299. 1892; Yuncker in Bishop Mus. Bull. 178: 48. 1943, in op. cit. 220: 101. 1959; J. W. Parham, Pl. Fiji Isl. 100. fig. 45. 1964.

Laportea milnei Seem. Fl. Vit. 238. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 299. 1892; J. W. Parham, Pl. Fiji Isl. 100. 1964.

Urticastrum harveyi Kuntze, Rev. Gen. Pl. 2: 635. 1891.

Urticastrum milnei Kuntze, Rev. Gen. Pl. 2: 635. 1891.

Dendrocnide milnei Chew in Gard. Bull. Singapore 21: 204. 1965.

A tree 5–20 m. high, occurring from near sea level to an elevation of 1,150 m. in forest or on its edges, in thickets, and sometimes along creeks. The inflorescence bracteoles are purplish, the pedicels translucent-white, the perianth lobes pale green or greenish white, and the anthers, achenes, and styles white. In Fiji flowers and fruits occur throughout the year.

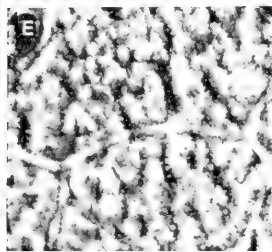
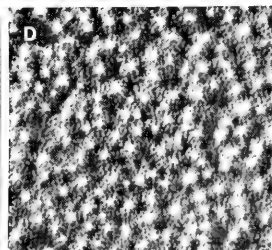
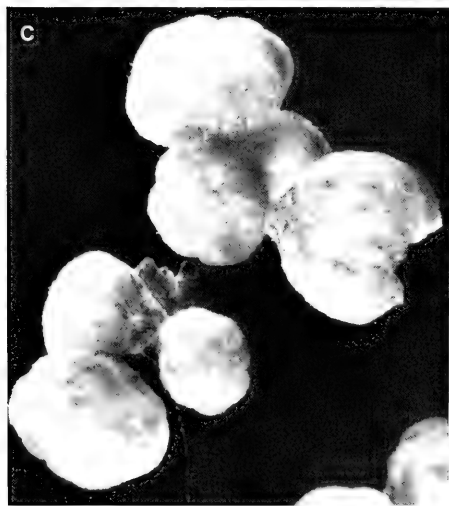
TIPIFICATION AND NOMENCLATURE: In his 1868 protologue of *Laportea harveyi*, Seemann listed three collections: his own 426 (BM, K), collected in May, 1860, near Somosomo, Taveuni; *Harvey* (BM, K), obtained in November, 1855, near Nandi Bay, Mbua Province, Vanua Levu; and *Home* (BM), from Fiji without further data, presumably collected in 1852. Chew in 1969 indicated the BM sheet of *Harvey* as the lectotype. However, there are two specimens of this at K, which taken together make up an excellent collection, and they were doubtless the principal source of Seemann's study; in view of the epithet this collection seems the appropriate lectotype. I prefer to designate this as *Harvey* (K LECTOTYPE; ISOLECTOTYPE at BM). The type of *Laportea milnei* is *Milne s. n.* (BM), collected in Fiji without further locality during one of the visits of H. M. S. *Herald*. As seen by Seemann, this specimen was a scrap preserved in spirits, but it has now been mounted and placed in a type cover at BM, consisting of a branchlet tip with one small leaf and a partial ♀ inflorescence. Although Chew, in his preliminary paper of 1965 on *Dendrocnide*, made a combination in the genus for *Laportea milnei*, he referred it to the synonymy of *D. harveyi* in 1969, thus choosing between the two competing epithets of the same date. To combine them is unquestionably correct.

DISTRIBUTION: Fiji, Tonga, Niue, and Samoa; in Tonga and Niue this seems to be the only species of *Dendrocnide*, while in Samoa it is somewhat the less frequent of the two species occurring there. I have examined 31 Fijian collections of *D. harveyi*.

LOCAL NAMES: *Salato, salato vula*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Loloti, in mountains near Lautoka, *Greenwood 74*; slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4428*; vicinity of Nandarivatu, *Gillespie 4163*; Mt. Tomanivi, *DA 12680 (Melville et al. 7058)*. SERUA: Inland from Namboutini, *DA*, July 3, 1962 (*Damanu 76*). NAMOSI: Vicinity of Namosi Village, *Gillespie 2610*; vicinity of Namuamua, *Gillespie 3076*. RA: Mountains near Penang, *Greenwood 766*. NAITASIRI: Vicinity of Matawailevu, Wainimala River, *St. John 18228*; vicinity of Tamavua, *Tothill 785*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuvivuna, *Smith 7221*. REWA: Walu Bay, *DA 8578*. MBENGGGA: Rukua Beach, *DA 6051*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 45*. OVALAU: Hills southeast of valley of Mbureta River,

FIGURE 62. *Dendrocnide vitiensis*; A, distal portion of branchlet, with foliage and ♀ inflorescence, × 1/3; B, portion of ♀ inflorescence, × 15; C, portion of young ♂ inflorescence, × 15; D, portion of upper surface of leaf blade, with punctiform cystoliths, × 30; E, portion of lower surface of leaf blade, × 30. A, B, D, & E from *Smith 359*, C from *Smith 1595*.



Smith 7395. VANUA LEVU: THAKAUNDOVE: Vurendongo, *DA 13141*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4705*. VANUA MBALAVU: Slopes of Korolevu, near Lomaloma, *Garnock-Jones 1038*. MANGO: Bryan, Sept. 18, 1924. LAKEMBA: Near airport, *Garnock-Jones 865*.

2. *Dendrocnide vitiensis* (Seem.) Chew in Gard. Bull. Singapore **21**: 207. 1965, in op. cit. **25**: 62. fig. 25. 1969; J. W. Parham, Pl. Fiji Isl. ed. 2. 140. 1972.

FIGURE 62.

Laportea vitiensis Seem. in Bonplandia **9**: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862, Fl. Vit. 239. t. 60. 1868, op. cit. 432. 1873; J. W. Parham, Pl. Fiji Isl. 100. 1964.

Laportea photiniphylla sensu Drake, Ill. Fl. Ins. Mar. Pac. 299, p. p. 1892; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 107. 1972; non Wedd.

An often slender tree 2–20 m. high, found at elevations from 100 to 1,150 m. in dense or light forest or on its edges. The perianth has been recorded as greenish white to pale green or pink-tinged; the anthers and styles are white, the filaments pale green, and the achene yellow. Flowers and fruits are found at any season.

TIPIFICATION AND NOMENCLATURE: The type is *Seemann 427* (K HOLOTYPE; ISOTYPE at BM), collected in October, 1860, along the coast of Mathuata Province, Vanua Levu. This species has sometimes been confused in herbaria with *Dendrocnide photiniphylla* (Kunth) Chew, which is endemic to Queensland and New South Wales. The confusion probably dates from Weddell's reduction (in DC. Prodr. **16** (1): 83. 1869) of *Laportea vitiensis* to *L. photiniphylla* (Kunth) Wedd. Chew (1969, cited above) indicates that the two species are closely related, but *D. vitiensis* differs from the Australian species in its larger leaf blades being ovate-pentagonal (rather than elliptic to ovate) and with more numerous lateral nerves, and in having its peduncles and inflorescences with more obvious irritant hairs.

DISTRIBUTION: Fiji and Samoa; a collection from Lifou Island, Loyalty Islands, was also listed by Chew but was not seen by him, and therefore this record has no firm basis. Fifty Fijian collections have been studied.

LOCAL NAMES AND USE: This species seems to have more local names than *Dendrocnide harveyi*, which may indicate an uncertainty as to whether it is a true *salato*; in addition to that name, recorded by only one collector, *D. vitiensis* has been noted as *salato mbaumbau*, *salato mbombo*, *salato ndroundrou*, *mbolovatu*, *ndowa*, *mothelolo*, and *tumbo ni kalakalambuthi*. There is one report that a liquid made from the bark of its root is taken internally for chest complaints.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Loloti, in mountains near Lautoka, *Greenwood 292*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4450*; vicinity of Nandarivatu, *Parks 20531*; slopes of Mt. Tomani, *Smith 5127*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13382*; vicinity of Nakalavo, *H. B. R. Parham 260*; northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5442*. SERUA: Waimbale, near Namboutini, *Degener 15479*. NAMOSI: Northern base of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8658*; Saliandrau, Wayauyau Creek, *DA 14996*; Mt. Voma, *DA 11641*. NAITASIRI: Wainamo Creek, Wainimala Valley, *St. John 18255*; valley of Waimanu River, *DA 15437*. REWA: Vicinity of Suva, *Yeoward 81*. OVALAU: Main range west of Levuka, *Gillespie 4425*. KORO: Eastern slope of main ridge, *Smith 985*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7835*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1595*. THAKAUNDOVE: Nasuvasuva, south of Nakula Valley, *Smith 359*. TAVEUNI: Nangelelendamudamu, near Nggeleli, *DA 15870*; slopes of Mt. Manuka, east of Wairiki, *Smith 8315*.

2. LAPORTEA Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 498. 1830; Chew in Gard. Bull. Singapore **21**: 198. 1965, in op. cit. **25**: 115. 1969. Nom. cons.

Urticastrum Heister ex Fabric. Enum. Meth. Pl. 204. 1759. Nom. rejic.

Fleurya Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 497. 1830; Seem Fl. Vit. 237. 1868.

Usually annual herbs, the aerial branches and often the leaf blades with stinging or prurient hairs, the stipules comparatively small, connate into an axillary, bifid scale; leaves alternate, the blades chartaceous, ovate, 3-nerved from base and also pinnate-nerved distally, dentate or serrate, with linear cystoliths on upper surface; inflorescences axillary, composed of flower clusters combined into lax, bracteate, cymose panicles, these usually unisexual, the flowers often sharply reflexed; ♂ flowers sessile or pedicellate, with 4 or usually 5 tepals, these ovate or lanceolate, subvalvate, the stamens 4 or usually 5, with long, reflexed filaments, the rudimentary ovary globose or subclavate; ♀ flowers pedicellate, with 4 free tepals, these imbricate, unequal in pairs, the abaxial one sometimes hooded, the staminodes absent, the ovary straight, becoming oblique, the style apical but becoming lateral, the stigma subulate, obliquely ovate or linear, short-papillose, rarely trifid, persistent; achene small, obliquely ovoid, strongly laterally compressed, deflexed, pitted and verrucose, marginate, exerted from the slightly enlarged perianth, the seed with very little endosperm, the cotyledons broad, the fruiting pedicel long and winged.

TYPE SPECIES: The type species of *Laportea* is *L. canadensis* (L.) Wedd. (*Urtica canadensis* L.); that of *Fleurya* is *F. spicata* Gaud. (= *L. interrupta* (L.) Chew).

DISTRIBUTION: Madagascar and Africa to temperate eastern Asia, throughout Malasia, and into Polynesia; also in tropical America and northward into temperate regions; 22 species are recognized by Chew (1969, cited above). One species occurs in Fiji and Polynesia.

USEFUL TREATMENTS OF GENUS: Chew Wee-Lek. *Laportea* and allied genera (Urticaceae). Gard. Bull. Singapore 21: 195-208. 1965. Chew Wee-Lek. A monograph of *Laportea* (Urticaceae). Gard. Bull. Singapore 25: 111-178. 1969.

Chew (1969, cited above) divides the genus into sect. *Laportea*, with ten species, and sect. *Fleurya* (Gaud.) Chew (in Gard. Bull. Singapore 21: 199. 1965, in op. cit. 25: 115. 1969), with twelve species. The Pacific species belongs to the latter section, which differs from sect. *Laportea* in having the pedicels of its ♀ flowers winged dorsiventrally and asymmetrically (rather than laterally and symmetrically) and in having its achenes not articulated on the pedicels (rather than articulated).

1. *Laportea interrupta* (L.) Chew in Gard. Bull. Singapore 21: 200. 1965, in op. cit. 25: 145. fig. 12. 1969; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 210. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 322. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 143. 1972.

Urtica interrupta L. Sp. Pl. 985. 1753.

Fleurya spicata Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 497. 1830.

Fleurya interrupta Wight, Icon. Pl. Ind. Orient. 6: 10. t. 1975. 1853; Seem. Fl. Vit. 237. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 298. 1892; Christophersen in Bishop Mus. Bull. 128: 74. 1935; Yuncker in op. cit. 178: 49. 1943, in op. cit. 184: 36. 1945, in op. cit. 220: 102. 1959; J. W. Parham, Pl. Fiji Isl. 100. 1964; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 70. 1972.

Fleurya spicata var. *interrupta* Wedd. ex Seem. in Bonplandia 9: 259, as *Fleurya*, sphalm. 1861, Viti, 441. 1862.

Schychowskia interrupta W. F. Wight in Safford in Contr. U. S. Nat. Herb. 9: 371. 1905.

Laportea interrupta occurs in Fiji from near sea level to about 525 m. as a weed of villages, roadsides, waste places, pastures, and cultivated areas, sometimes being found along forest trails or on hillsides. It is an herb 10-65 cm. high, found in flower and fruit throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: Chew (1969, cited above) designated *Hermann s. n.* (BM), from Ceylon, as the type; this should have been indicated as the lectotype, since Linnaeus originally listed five prior references. The holotype of

Fleurya spicata is *Gaudichaud* (G), from Pisang Island in the Moluccas. The two concepts do not differ materially.

DISTRIBUTION: Although *Laportea interrupta* now has a very wide distribution, from Africa to Japan and China and eastward to Queensland and into the Pacific as far as Hawaii, its native area is questionable; probably southeastern Asia is a reasonable guess. It was established in the Society Islands before 1769 (cf. Merrill in Chron. Bot. 14: 219. 1954) and was almost certainly an inadvertent aboriginal introduction throughout the Pacific portion of its range.

LOCAL NAMES AND USE: Although sometimes referred to simply as *salato*, the more appropriate Fijian names are *salato ni koro* and *salato vutivali*. One collector notes that the young shoots are part of an internal remedy for influenza.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Ambatha Village, *DA 14194*; slopes of Mt. Evans Range, *Greenwood 147*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2577*. TAILEVU: Hills east of Wainimbuka River, vicinity of Waitotua, *Smith 7244*. MBENGGGA: Rukua, *Weiner 72-7-14C*. KANDAVU: Near Ndaku, *DA 2969*. OVALAU: Lovoni Village, *Smith 7480*. NAIRAI: *Milne 156*. VANUA LEVU: THAKAUNDROVE: Savusavu, *DA 14364*; near Salt Lake, *Bierhorst F202*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4704*; Tavuki, *DA 8393*; Vuna, *DA 5739*. MOALA: *Milne 109*. FIJI without further locality, *U. S. Expl. Exped., Seemann 428, Horne 119, Yeoward 40, DA 934, 3931*.

3. ELATOSTEMA J. R. & G. Forst. Char. Gen. Pl. 53. 1775, ed. 2. 105. 1776; Seem. Fl. Vit. 240. 1868; Schröter & Winkler in Repert. Sp. Nov. Beih. 83 (1): 1. 1935, in op. cit. 83 (2): 1. 1936; A. C. Sm. in Sargentina I: 13. 1942. Nom. cons.

Pellionia Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 494. 1830; Seem. Fl. Vit. 239. 1868. Nom. cons.

Monoecious or dioecious, annual or perennial herbs or shrubs, erect or prostrate, the stipules intrapetiolar, undivided; leaves opposite and anisophyllous but appearing alternate, one leaf of each pair greatly reduced and caducous, the blades of the persisting leaves oblique, unequal-sided at base with the distal side the smaller, often 3-nerved at base and sometimes pinnate-nerved, entire to coarsely serrate, usually with linear, angled, stellate, or punctiform cystoliths; ♂ flowers densely cymose or subcapitate, the perianth 4- or 5-partite, the segments slightly imbricate, often tuberculate or shortly appendaged below apex, the stamens 4 or 5, the rudimentary ovary small; ♀ flowers congested on a flattened, discoid, or lobed receptacle, this sometimes involucrate, the perianth 3-5-partite with subequal lobes, the staminodes small, scalelike, incurved, sometimes absent, the ovary straight, the stigma sessile, penicillate, caducous; achene compressed or ovoid, the seed often without endosperm, the cotyledons ovate.

TYPE SPECIES AND NOMENCLATURE: The type species of *Elatostema* is *E. sessile* J. R. & G. Forst. (typ. cons.), that of *Pellionia* is *P. elatostemoides* Gaud. (typ. cons.). Both genera and their types appear to have been conserved because some authors retain both, but probably most recent students prefer to combine them, following Schröter and Winkler in recognizing *Elatostema* as composed of four subgenera.

DISTRIBUTION: Tropical Africa and Asia and eastward into Polynesia, with 250-350 species. In the present treatment 14 species are recognized from Fiji, all believed to be endemic.

LOCAL NAMES: *Mbeta* and *ndraindrai* are used somewhat indiscriminately for any Fijian species; however, under each species below I list whatever names have been given by collectors.

USEFUL TREATMENTS OF GENUS: Schröter, H., & H. Winkler. Monographie der Gattung *Elatostema* s. l. Repert. Sp. Nov. Beih. 83 (1): 1-56. 1935, op. cit. 83 (2): 1-174. 1936. Smith, A. C. *Elatostema* J. R. & G. Forst. Sargentina I: 13-23. 1942.

The genus *Elatostema* has proved very difficult for taxonomists working with Pacific plants. One reason lies in the inherent complexities of subgen. *Elatostema* (*Euelatostema* of Schröter and Winkler, not treated in detail in their monograph of 1935 and 1936). A second reason is the apparent absence of type specimens and other critical material from certain herbaria; it seems probable that many such specimens were still on loan to Schröter and Winkler at Breslau (now WRSL) at the outbreak of World War II and were subsequently destroyed. Therefore careful lectotypification or neotypification of many species of *Elatostema* by a future specialist will be required. Thirdly, students of the genus in the Pacific are perhaps too ready to assign a high degree of archipelagic endemism to species of the genus, although indeed most species do appear quite restricted in distribution. In my own review of the Fijian species I have sought similarities with those of Samoa, from which at least 20 have been described; this is complicated by the loss of certain authentic material. However, on the basis of available Samoan material and descriptions, it would seem that Fiji and Samoa have no species of *Elatostema* in common, a situation that nevertheless requires further consideration.

KEY TO SPECIES

Inflorescences exinvolucrate; perianth segments of ♀ flowers obvious, subequal in length to ovary or achene.

Perianth segments not spurred; staminodes present in ♀ flowers; leaf blades 11–35 cm. long, (1.5–) 3.5–12.5 cm. broad; stipules conspicuous, 1–5 cm. long (subgen. *Elatostemoides*). . . 1. *E. australe*

Perianth segments dorsally spurred, those of ♀ flowers sometimes with the spurs reduced to mere thickenings; staminodes usually absent; leaf blades not exceeding 10 cm. in length and 3 cm. in breadth; stipules comparatively small, less than 1 cm. long (subgen. *Pellionia*).

Leaf blades elliptic-oblong, 3–5 times as long as broad, 0.6–9 (–10) cm. long, 2–25 (–30) mm. broad, obtuse to obtusely acuminate at apex, the marginal crenations 2–15 per side; ♂ inflorescences 2–20-flowered.

♂ inflorescences 6–20-flowered, the perianth segments inconspicuously carinate-spurred; leaf blades elliptic-oblong, 3–4 times as long as broad, (1.5–) 3–9 (–10) cm. long, (5–) 8–25 (–30) mm. broad, obtuse to obtusely acuminate at apex, the marginal crenations (4–) 5–15 per side.

2. *E. vitiense*

♂ inflorescences 2–10-flowered, the perianth segments conspicuously corniculate; leaf blades narrowly oblong, 3–5 times as long as broad, 0.6–2.5 (–3) cm. long, 2–8 mm. broad, obtuse at apex, the marginal crenations 2–4 per side. 3. *E. filicoides*

Leaf blades linear-lanceolate, about 7 times as long as broad, 4–8 cm. long, 5–11 mm. broad, gradually narrowed to an acuminate apex, the marginal crenations 5–10 per side; ♂ inflorescences 2–4-flowered, the perianth segments conspicuously corniculate. 4. *E. comptonioides*

Inflorescences involucre; perianth segments of ♀ flowers inconspicuous, minute, much shorter than ovary or achene (subgen. *Elatostema*).

Leaf blades without cystoliths on upper surface, hispid on both surfaces, large, 20–40 cm. long, 6–16 cm. broad; stipules conspicuous, 2–7 cm. long; receptacles large, (8–) 20–50 mm. in diameter; bracteoles 4–7 mm. long. 5. *E. nemorosum*

Leaf blades with obvious cystoliths on upper surface.

Cystoliths of upper leaf blade surface linear, straight, not branched, rarely slightly angled.

Coarse or suffruticose herbs or shrubs, usually more than 1 m. high; cystoliths of upper leaf blade surface 0.25–0.5 mm. long; petioles 1–15 mm. long.

Leaf blades up to 21 cm. long and 8.5 cm. broad, the secondary nerves 3–8 per side.

Petioles 6–15 mm. long; leaf blades 12–21 cm. long, 4.5–8.5 cm. broad, usually 2–2.5 times as long as broad; receptacles 5–20 mm. broad; ♂ bracteoles about 3 mm. long.

6. *E. fruticosum*

Petioles 1–8 mm. long; leaf blades 5–15 cm. long, 1.2–4 cm. broad, usually 3–4 times as long as broad; receptacles 5–8 mm. broad; ♂ bracteoles 1.7–2 mm. long. . . 7. *E. greenwoodii*

Leaf blades (11–) 15–30 cm. long, (3–) 4–9.5 cm. broad, about 3 times as long as broad, the secondary nerves 8–15 per side; receptacles 6–30 mm. broad; ♂ bracteoles 3–4 mm. long.

8. *E. insulare*

Low herbs, the stems up to 80 cm. high, often subprostrate at base; cystoliths of upper leaf blade surface 0.1–0.3 mm. long; leaves subsessile or petioles not exceeding 8 mm. in length.

Leaf blades obovate, 8–16 cm. long, 3–6 cm. broad, essentially sessile, strongly auriculate on proximal margin at base, the auricle projecting over stem; receptacles 8–18 mm. broad.

9. *E. palustre*

Leaf blades oblong-lanceolate, 4–11 (–15) cm. long, 0.7–1.8 (–3) cm. broad, inaequilaterally attenuate at base but not auriculate; petioles obvious, 2–8 mm. long; receptacles 2–16 mm. broad. 13. *E. humile*

Cystoliths of upper leaf blade surface stellate (3–5-parted) or punctiform, occasionally merely angled, very rarely straight and linear.

Leaf blades 5–18 cm. long, 2–7 cm. broad, conspicuously serrate along entire margin, strongly inaequilateral at base, the proximal margin conspicuously the longer and sometimes subauriculate and projecting over stem, the free petiole (i. e. on proximal margin) 0–2 mm. long; low or coarse herbs up to 3 m. high, the stem often subprostrate toward base; receptacles variable in size, 2–30 mm. broad. 10. *E. tenellum*

Leaf blades less strongly inaequilateral at base, the petiole obvious (or if winged to base, then the leaf blades and receptacles much larger than those of sp. no. 10).

Coarse herbs 0.4–3 m. high; leaf blades comparatively large, 14–40 cm. long, 3–15 cm. broad.

Leaf blades narrowly obovate-oblong, 14–27 cm. long, 3–7 cm. broad, 4–5 times as long as broad; receptacles 4–15 mm. in diameter. 11. *E. gillespiei*

Leaf blades elliptic or obovate-elliptic, 18–40 cm. long, 6–15 cm. broad, 2–3 times as long as broad; receptacles 15–50 mm. in diameter. 12. *E. seemannianum*

Herbs up to 0.4 m. high or climbing epiphytes; leaf blades comparatively small, 4–11 (–15) cm. long, 0.7–2 (–3) cm. broad.

Terrestrial herbs up to 0.4 m. high; ♂ receptacles 2–16 mm. broad but with lateral spurs, if present, inconspicuous and less than 2 mm. long; petioles 2–8 mm. long, the leaf blades serrate with teeth 1–3 per centimeter. 13. *E. humile*

Epiphytic climber, the stem appressed to tree trunks; ♂ receptacles 7–8 mm. broad but with conspicuous lateral spurs about 8 mm. long; petioles 1–2 mm. long, the leaf blades coarsely serrate with teeth about 1 per centimeter. 14. *E. epallocaulum*

1. *Elatostema australe* (Wedd.) Hall. f. in Ann. Jard. Bot. Buitenzorg 13: 316. 1896; Schröter & Winkler in Repert. Sp. Nov. Beih. 83 (2): 122. pl. 33. 1936; A. C. Sm. in Sargentia 1: 15. 1942; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 140. 1972.

FIGURE 63.

Pellionia elatostemoides sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862, Fl. Vit. 239. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 300, p. p. 1892; Gibbs in J. Linn. Soc. Bot. 39: 171. 1909; non Gaud.

Pellionia australis Wedd. in DC. Prodr. 16 (1): 169. 1869; Seem. Fl. Vit. 432. 1873.

Pellionia elatostemoides var. *pubescens* Turrill in J. Linn. Soc. Bot. 43: 39. 1915.

The most abundant species of *Elatostema* in Fiji, *E. australe* occurs as a shrub or coarse herb 0.3–3 m. high at elevations from near sea level to 1,150 m., in dense, open, or secondary forest in shady places; it is to be expected on most of the high islands. Its inflorescence branches and pedicels are white to pale pink; its often translucent perianth varies from dull or rich pink to dull yellow, white, or greenish white; and its stamens usually have pinkish white filaments and white anthers. Flowers and fruits occur throughout the year.

TYPIFICATION AND NOMENCLATURE: The type was collected by Vieillard on Ovalau in 1855 and the holotype is presumably at P (originally deposited in the Lenormand Herbarium at CN); a presumptive isotype is at K, although it does not bear Vieillard's name. The holotype of *Pellionia elatostemoides* var. *pubescens* is *im Thurn 286* (K), collected Nov. 26, 1906, at Nandarivatu, Mba Province, Viti Levu. Discussing this species in 1942 I indicated the variation in the indument of the lower surfaces of leaf blades (cf. FIGURE 63C & D); all intermediates are found between obviously pilose and essentially glabrous conditions, and the character does not seem usable as a basis to subdivide the taxon. The two types concerned both have reasonably copious indument.

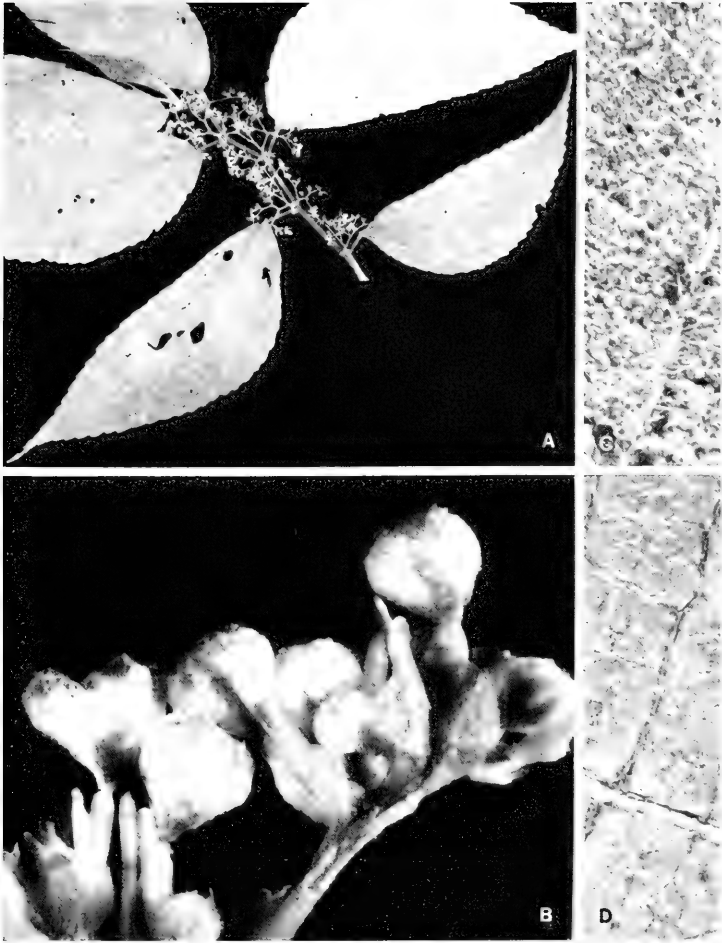


FIGURE 63. *Elatostema australe*; A, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$; B, portion of ♂ inflorescence, $\times 10$; C, portion of lower surface of leaf blade, with indument nearly concealing cystoliths, $\times 10$; D, portion of lower surface of leaf blade, lacking indument, the cystoliths obvious, $\times 10$. A & B from *Smith 280*, C from *St. John 18256*, D from *DA 11666*.

DISTRIBUTION: Apparently endemic to Fiji, although Schröter and Winkler also cited specimens from Samoa and the Solomon Islands. Their Samoan record was *Graeffe 1448* (HBG), from Upolu; I have not seen any specimens of the species collected by Graeffe, but many of his collections noted as from Samoa actually came from Fiji. Their Solomon Islands material was *Comins 254* (κ) and *256* (κ), from Ulawa. I neglected to examine these specimens, but other Solomon Islands collections of this general relationship (such as *Brass 2643*, from San Cristoval) have the ♀ inflorescences too densely pilose to fit a reasonable concept of *Elatostema australe*. Pending detailed study by a specialist, I believe the species limited to Fiji. More than 80 collections are at hand.

LOCAL NAMES: *Mbeta, ndrainedrai, ndrainedrau, raula.*

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1087*; Waikumbukumu Creek, *Gibbs 725*; Nandarivatu, *in Thurn 266*; slopes of Mt. Tomanivi, *Smith 5237*. NADRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5634*; vicinity of Mbelo, near Vatukarasa, *Degener 15230*. SERUA: Waimbale, near Namboutini, *Degener 15483*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8418*; vicinity of Namosi Village, *Seemann 429* (some specimens of this number were from Taveuni); Mt. Voma, *DA 11666*. RA: Mountains near Penang, *Greenwood 768*. NAITASIRI: Wainimala River, below Matawailevu, *St. John 18256*; Waimanu River Valley, *DA 15431*. REWA: Vicinity of Lami, *H. B. R. Parham 71*. KANDAVU: Summit of Mt. Mbuke Levu, *Smith 280*. OVALAU: *U. S. Expl. Exped., Milne 251*; slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8090*. VANUA LEVU: MATHUATA: Mt. Numbuiloa, east of Lambasa, *Smith 6393*. THAKAUNDROVE: Mt. Mariko, *Bierhorst F155*; Wainigata Station, *DA 13104*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4706*; slopes of Mt. Manuka, east of Wairiki, *Smith 8131*. FIJI without further locality, *Harvey s. n., Williams s. n.*

2. *Elatostema vitiense* (Wedd.) A. C. Sm. in *Sargentia* 1: 16. 1942; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972. FIGURE 64A & B.

Pellionia vitiensis A. Gray ex Wedd. in DC. Prodr. 16 (1): 167. 1869; Gibbs in J. Linn. Soc. Bot. 39: 171. 1909.

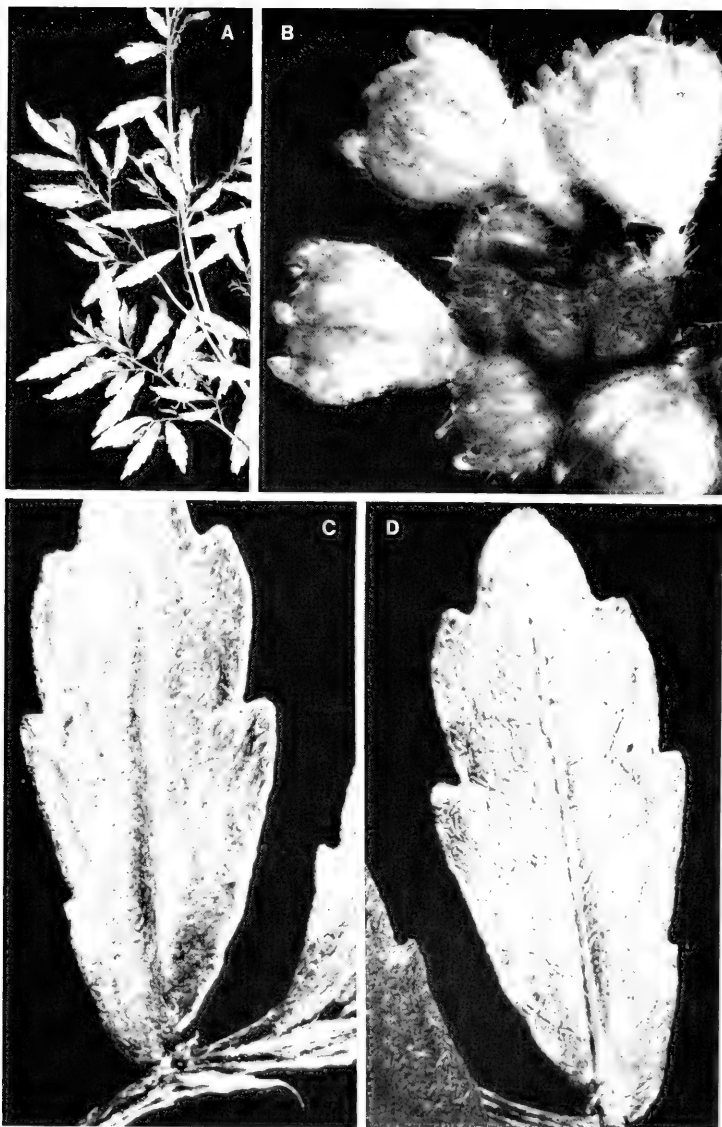
Elatostema filicoides var. *vitiense* Schröter in Repert. Sp. Nov. Beih. 83 (2): 60. 1936.

A shrub or herb, somewhat subprostrate and woody at base, 0.2–3 m. high, found at elevations from near sea level to 850 m. in dense forest, often in wet places or among rocks in dry stream beds, and often locally frequent. The inflorescence branches are white to pink, the perianth dull white to greenish white, pink-tinged or with orange spots, the filaments white or greenish white and pink-tinged, and the anthers white. Flowers and fruits may be expected in any month.

TIPIFICATION AND NOMENCLATURE: The only specimen originally cited by Weddell and hence the holotype is *Harvey s. n.* (κ), collected in November, 1855, in Fiji without further data. As mentioned in my discussion of 1942, Gray had annotated several *U. S. Expl. Exped.* specimens as "*Pellionia vitiensis* sp. nov." and for this reason Weddell may have ascribed his binomial to Gray. The earlier specimens, however, represent *Elatostema australe* and have no nomenclatural status; therefore Gray's name seems best dropped from the authorship of *Pellionia vitiensis* as understood by Weddell.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands. Because this species and the following are not too clearly separable, I here cite all the specimens of each that I have examined.

FIGURE 64. A & B, *Elatostema vitiense*; A, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/3; B, portion of young ♂ inflorescence, × 15. C & D, *Elatostema filicoides*; C, stipules and upper surface of leaf, × 10; D, lower surface of leaf, × 10. A from *DA 16586*, B from *Smith 6755*, C & D from *Smith 4894*.



AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1086*; inland from Tavua, *O. & I. Degener 32131*; between Waikumbukumbu and Nandarivatu, *Gibbs 693*; vicinity of Nandarivatu, *Tothill 791* (coll. *W. Teulon*), *Degener & Ordenez 13560*; Mba without further locality, *Gillespie*, Nov. 17, 1927. NANDRONGA & NAVOSA: Near Nakalavo, *H. B. R. Parham 235a*; Mbulu, near Sovi Bay, *Degener 15033*; vicinity of Mbalo, near Vatukarasa, *Degener 15288*. SERUA: Track to Mt. Tuvutau, *DA 14493*; Ngaloa Nature Reserve, *DA 16586*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8695*; Korombasambasanga Range, *DA 2213*; vicinity of Namosi Village, *Parks 20212*. NAITASIRI: Between Viria and Namuama, *DA 459*; Suva Pumping Station, *Degener & Ordenez 13754*. TAILEVU: Namburua Creek, *DA 1023*. KANDAVU: Mt. Mbuke Levu, *Smith 245*. OVALAU: *Horne 21, 51*; Mt. Tana Lailai, *Graeffe*, Dec., 1864; hills east of Lovoni Valley, *Smith 7346*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6755, 6848*. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 374*; vicinity of Maravu, near Salt Lake, *Degener & Ordenez 14176*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8331*. FIJI without further locality, *Williams s. n., Tothill 760*.

3. *Elatostema filicoides* (Seem.) Schröter in Repert. Sp. Nov. Beih. 83 (2): 59. 1936; P. S. Green in Kew Bull. 23: 344. 1969; J. W. Parham, Pl. Fiji Isl ed. 2. 142. 1972.

FIGURE 64C & D.

Elatostemma (sic) *filicoides* Seem. in Bonplandia 9: 259, nom. nud. 1861.

Pellionia filicoides Seem. Fl. Vit. 239. 1868, op. cit. 432. 1873; Wedd. in DC. Prodr. 16 (1): 168. 1869; Drake, Ill. Fl. Ins. Mar. Pac. 300. 1892; A. C. Sm. in Sargentia 1: 23. 1942.

Elatostema filicoides var. *eufileicoides* Schröter in Repert. Sp. Nov. Beih. 83 (2): 59. 1936.

Elatostema archboldianum A. C. Sm. in Sargentia 1: 17. 1942; J. W. Parham, Pl. Fiji Isl. 98. 1964.

A shrub or sprawling, subliguous herb 0.1–3 m. high, occurring in usually dense, wet forest, sometimes locally abundantly, at elevations of 100–1,130 m. (but usually above 500 m.). The peduncles are dull pink, the perianth segments white to dull pink and translucent like the filaments, and the anthers white. Fertile material has been found between March and November, but flowers and fruits are inconspicuous and often specimens are collected in sterile condition.

TIPIFICATION AND NOMENCLATURE: The holotype of *Pellionia filicoides* is *Seemann 421* (κ), collected in August or September, 1860, on the banks of the Navua River, Serua Province, Viti Levu. Seemann remarked that the species had also been obtained by Williams and Harvey (but their specimens actually represent *Elatostema vitiense*); these specimens are merely added in a comment and I do not believe that lectotypification is required in this case. In interpreting *Pellionia filicoides* in 1942 I had examined only the GH specimen of *Seemann 421*, which represents sterile pinnae of the fern *Lomagramma polyphylla* Brack. (cf. Brownlie in Nova Hedwigia Beih. 55: 342. pl. 34 (3). 1977), and therefore I excluded the species from *Elatostema* and described *E. archboldianum*. Green (1969, cited above) correctly pointed out that the holotype of Seemann's species indeed represents *Elatostema*, although a few pinnales of the fern are mixed with it. The unnecessarily described *E. archboldianum* is typified by *Degener 14429* (A HOLOTYPE; ISOTYPES AT BISH, K, US), collected Feb. 18, 1941, on Mt. Matomba, Nandala, south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES: *Mbeta, mbeta othi, lara*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 109, 1159*; slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4031*; Mbatilamu, *DA 14815*; Mt. Koroiolo, *DA 14817*; vicinity of Nandarivatu, *Tothill 794, 795* (both coll. *W. Teulon*), *796, Gillespie 3717, Degener & Ordenez 13559, Degener 14328*; Mt. Nanggaranambuluta, east of Nandarivatu, *Gillespie 3912.5, Smith 4894, Vaughan 3248*; hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 5977*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5544*; Nausori Highlands, *DA 12674* (*Melville et al. 7050*). SERUA: Inland from Namboutini, *DA 13986*; Tawavulu Creek, north of Ngaloa, *Webster & Hildreth 14344*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8694*; Mt. Voma, *DA 590*. NAITASIRI:

Vicinity of Mataniwailevu Village, *DA 18009*; Prince's Road, *Vaughan 3295*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7189*. FIJI without further locality, *U. S. Expl. Exped., in Thurn s. n., Gillespie, Nov. 12, 1927, 2608, DA 1391*.

Elatostema filicoides and *E. vitiense* approach one another in leaf size and shape, and perhaps a few collections are arbitrarily placed. Normally, however, the two taxa are distinguished without difficulty, as indicated in the above key, and to assign them varietal status, as suggested by Schröter, would not clarify their relationship.

4. *Elatostema comptonioides* A. C. Sm. in *Sargentina* 1: 17. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 141. 1972. FIGURE 65A.

This rare species is a shrub 0.5–2 m. high, occurring in dense forest at an elevation of 600–820 m. The inflorescence is noted as uniformly white.

TYPEFICTION: The type is *Smith 1977* (GH HOLOTYPE; many ISOTYPES), collected June 15, 1934, on Mt. Uluingala, Natewa Peninsula, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

The species seems very distinct from its only close relatives, the two preceding species, as pointed out in the key. It is perhaps not surprising that it has not been recollected, since the higher parts of the Natewa Peninsula seem not to have been visited by other collectors.

5. *Elatostema nemorosum* Seem. Fl. Vit. 240. t. 61. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 301. 1892; A. C. Sm. in *Sargentina* 1: 18. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972.

Elatostemma nemorosa (sic) Seem. in *Bonplandia* 9: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862.

A coarse herb 1–2 m. high, usually with a simple, succulent stem, occurring in dense, wet forest at elevations of 150–1,190 m. The greenish heads are large, usually 2–5 cm. in diameter, and the styles are white. Flowering and fruiting specimens have been obtained in scattered months.

LECTOTYPIFICATION: The species was based on *Seemann 422*, collected in 1860 on the island of Taveuni. No specimen of this is to be found at κ ; it may have been on loan to Schröter and lost. Therefore I designate as lectotype the BM specimen, which is excellent; there is an isoelectotype at GH.

DISTRIBUTION: Endemic to Fiji and thus far known only from the four largest islands.

LOCAL NAME: *Mbeta*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 317*; vicinity of Nandarivatu, *Parks 20788*; Mt. Nanggaranambuluta, east of Nandarivatu, *Tothill 792, Smith 4838, DA 13558*; slopes of Mt. Tomanivi, *Smith 5304, DA 12759 (Melville et al. 7151), 13043, Webster & Hildreth 14175*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14887*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8878*; vicinity of Namosi Village, *Parks 20273*; Mt. Voma, *DA 548*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5727*. REWA: Mt. Korombamba, *Meebold 16661*. VITI LEVU without further locality, *Parks 20129*. KANDAVU: Mt. Mbuke Levu, *DA 14938*. VANUA LEVU: THAKAUNDROVE: Mt. Mariko, *Smith 464, Bierhorst F145*. TAVEUNI: Hills east of Somosomo, west of old crater occupied by small swamp and lake, *Gillespie 4824, Smith 8394*.

Seemann's illustration excellently portrays this very distinct species, which is characterized by its large stipules, leaves, and receptacles, its lack of foliar cystoliths, its usually abundant indument, and the very long and narrow bracteoles subtending its ♀ flowers.

6. *Elatostema fruticosum* Gibbs in J. Linn. Soc. Bot. 39: 171. pl. 16. 1909; A. C. Sm. in Sargentia 1: 19. 1942, in J. Arnold Arb. 31: 150. 1950; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972.

A freely branching shrub or a coarse and subligneous herb, sometimes with succulent stems, 0.5–4 m. high, occurring in dense forest, often in wet and dark places, or in crest thickets, at elevations of 150–1,150 m. Its whitish flowering heads often attain a diameter of 2 cm., its perianth and filaments are translucent, and its anthers and styles are white. Flowering and fruiting specimens have been collected between April and October.

TYPIFICATION: Gibbs cited her collections 609 and 678, collected respectively in August and September, 1907, at Nandarivatu, Mba Province, Viti Levu. Neither of these collections is now to be found at BM, and no duplicates have been located. In this case I believe that Gibbs's excellent illustration and description may be taken as the type (ICBN, Art. 9.3); several good topotypes are available. Possibly the Gibbs specimens were on loan to Schröter and have been lost.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES: *Mbeta*, *ndraindrai*, *ndraindraia*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4099*; Mangondro Tikina (Nausori Highlands), *Webster & Hildreth 14292*; vicinity of Nandarivatu, *Tohill 789* (coll. *W. Teulon*), *Parks 20543*, *Degener & Ordonez 13522*, *Smith 5034*, *DA 8511*; Mt. Nanggaranambuluta, *Vaughan 3251*, *Smith 4764*, *DA 10382*, *13545*, *Webster & Hildreth 14222*; hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 5976*; slopes of Mt. Tomanivi, *Smith 5092*, *DA 12709* (*Melville et al. 7097*). NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5513*; between Nandrau and Rewasau, *Smith 5598*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8621*. NAITASIRI: Near Waindrandra Creek, *Horne 991*. VITI LEVU without further locality, *Parks 20179*.

This species and the three following have essentially straight, linear cystoliths very apparent on the upper leaf blade surfaces, whereas the final five species in my treatment have the cystoliths stellate or punctiform; only in the very distinct *Elatostema humile* is the cystolith character somewhat variable.

7. *Elatostema greenwoodii* A. C. Sm. in J. Arnold Arb. 27: 319. 1946, in op. cit. 31: 151. 1950; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972.

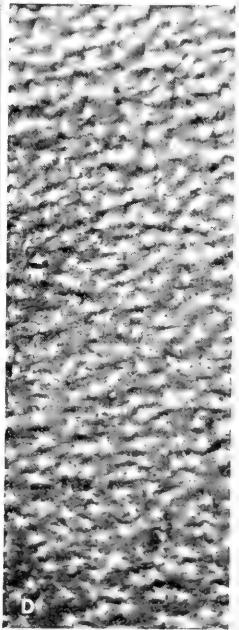
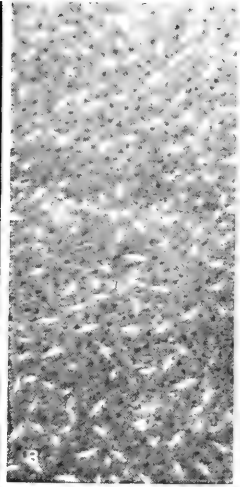
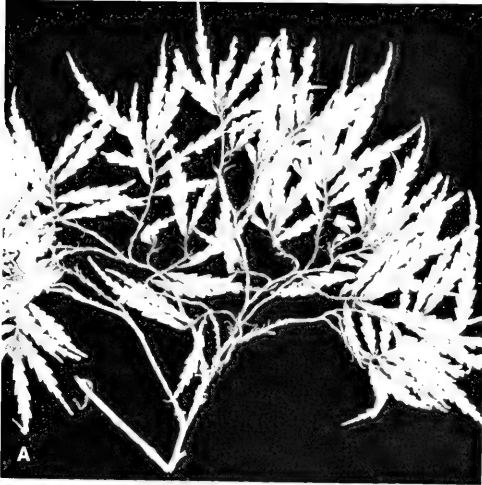
A shrub 1.5–3 m. high, found in a restricted area of dense forest at elevations of 900–1,050 m. Only flowering specimens, obtained in May and September, are known, and the heads are white.

TYPIFICATION: The type is *Greenwood 1083* (A HOLOTYPE; ISOTYPES at BISH, K), collected Sept. 24, 1944, in the Mt. Evans Range, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the Mt. Evans Range of northwestern Viti Levu, where, although represented by only two collections, it seems to be locally abundant.

AVAILABLE COLLECTION: VITI LEVU: MBA: Eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4143*.

FIGURE 65. A, *Elatostema comptonioides*, from *Smith 1977*; distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$. B, *Elatostema insulare*, from *Smith 8213*; portion of upper surface of leaf blade, with linear or slightly angled cystoliths, $\times 10$. C & D, *Elatostema gillespiei*, from *DA 13969*; C, distal portion of branchlet, with foliage and ♀ inflorescences, $\times 1/3$; D, portion of upper surface of leaf blade, with stellate cystoliths, $\times 20$.



8. *Elatostema insulare* A. C. Sm. in *Sargentia* 1: 19. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972. FIGURE 65B.

A coarse herb 1–2 m. high, usually succulent, often subligneous toward base, occurring in dense forest, and often in damp places, at elevations of 200–830 m. The whitish heads may be as much as 3 cm. broad; the perianth and stamens are white and translucent. Flowers and fruits have been obtained in months scattered throughout the year.

TIPIFICATION: The type is *Gillespie 4727* (A HOLOTYPE; ISOTYPE at BISH), collected Feb. 27, 1928, on the slopes east of Waivevo, Taveuni.

DISTRIBUTION: Endemic to Fiji and known from scattered locations on several of the high islands.

AVAILABLE COLLECTIONS: VITI LEVU: TAILEVU: Near Wailotua Cave, *DA 9406A*. KANDAVU: Mt. Mbuke Levu, *Smith 238*. KORO: Eastern slope of main ridge, *Smith 1064*. VANUA LEVU: THAKAUNDROVE: Vatunivumonde Mt., Savusavu Bay region, *Degener & Ordenez 14004*. TAVEUNI: Summit and slopes of Mt. Manuka, east of Wairiki, *Smith 8145, 8160, 8213*.

9. *Elatostema palustre* A. C. Sm. in *Sargentia* 1: 20. 1942, in *J. Arnold Arb.* 31: 151. 1950; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972.

A succulent herb 30–80 cm. high, simple-stemmed or rarely branched, found in wet places in dense forest at elevations of 870–1,150 m. The heads may be up to 18 mm. broad, the perianth segments and filaments are translucent, and the anthers are white. Flowering material has been obtained in August and September and fruits only in the former month.

TIPIFICATION: The type is *St. John 18337* (A HOLOTYPE; ISOTYPE at BISH), collected Aug. 18, 1937, on the central plateau between the Singatoka and Wainimala River drainage systems, on the Numbulolo–Wainisavulevu divide, near the boundary between Nandronga & Navosa and Naitasiri Provinces, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from only two collections, the second being from slightly north of the type locality on Viti Levu.

LOCAL NAME AND USE: *St. John* reported the name *mbeta*, indicating that the leaves are used to catch grated *kaile* (*Dioscorea* sp.).

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5769*.

This species is superficially similar to the next, *Elatostema tenellum*, but the hispid indument and straight cystoliths of its leaf blades distinguish it.

10. *Elatostema tenellum* A. C. Sm. in *Sargentia* 1: 22. 1942, in *J. Arnold Arb.* 31: 151. 1950; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972. FIGURE 67A–C.

Elatostema sessile sensu Gibbs in *J. Linn. Soc. Bot.* 39: 171. 1909; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 143. 1972; non J. R. & G. Forst.

Elatostema eximium A. C. Sm. in *Sargentia* 1: 21. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972.

A succulent herb 0.1–3 m. high, sometimes coarse, subprostrate, or sprawling, and sometimes with reddish stems, occurring at elevations of 100–1,323 m. in dense forest, often in wet places, or in crest thickets, and sometimes on limestone cliffs. The heads are variable in size, sometimes as much as 3 cm. broad, and are basically white, although their bracts may vary from dull pink to red; the stamens are white and the style greenish white. Flowering and fruiting material has been obtained between May and November.

TIPIFICATION AND NOMENCLATURE: The type of *Elatostema tenellum* is *Smith 471* (GH HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, on Mt. Mariko, Thakau-

ndrove Province, Vanua Levu. The type of *E. eximium* is *Tabualewa 15578* (A HOLOTYPE; ISOTYPES at BISH, K, US), obtained June 17, 1941, at Mbuyombuyo, near Namboutini, Serua Province, Viti Levu. In my 1950 discussion of *E. tenellum*, I mentioned two colonies on Viti Levu (represented by *Smith 4873* and *5728*) that weakened the distinctions between *E. tenellum* and *E. eximium*, which, on the basis of the few available specimens when they were described in 1942, seemed distinct in habit and leaf size. With many more collections now at hand, it is apparent that such characters are of little consequence; the sessile or subsessile leaf blades, often strongly auriculate at base and conspicuously serrate along the entire margin, provide a more dependable basis for the taxon. Combining these names of simultaneous publication, I utilize the epithet *tenellum*.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands. Because of the variability in habit and leaf size I here cite all collections studied.

LOCAL NAME: *Mbeta*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gibbs 633, Tothill 793*; hills east of Nandala Creek, *Smith 6231*; Mt. Nanggaranambuluta, *Smith 4873, DA 13559*; Mt. Tomanivi, *Smith 5196* (summit), *DA 12739* (*Melville et al. 7131*), *13053*. SERUA: Track to Mt. Tuvutau, *DA 14490*; Tawavulu Creek, north of Ngaloa, *Webster & Hildreth 14338, 14355*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8696, 8714, 8741*; vicinity of Namosi Village, *Parks 20209, 20209a*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5686, 5728*. TAILEVU: Near Wailotua Cave, *DA 9406*. NAITASIRE: Vatavula, summit of Mt. Nambauthara, *Gibbs 523*. REWA: Vicinity of Lami, *Parks 20055*; near Suva, *Tothill 790*. OVALAU: *U. S. Expl. Exped.*; hills east of Lovoni Valley, *Smith 7347*; summit of Mt. Ndelaivalau and adjacent ridge, *Smith 7591*. TAVEUNI: Mt. Manuka, east of Wairiki, *Smith 8164*; valley between Mt. Manuka and summit ridge of island, *Smith 8279*; above Nggathavulo Estate, *DA 16912, 16916*.

11. *Elatostema gillespiei* A. C. Sm. in *Sargentia* 1: 20. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972. FIGURE 65C & D.

A succulent herb (height not stated), or suffruticose toward base, found in dense forest at elevations of 425–900 m. Flowering material has been obtained in June and August and fruit only in the latter month.

TYPIFICATION: The type is *Gillespie 2402* (A HOLOTYPE; ISOTYPE at BISH), collected Aug. 24, 1927, near the summit of Mt. Korombamba, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from southeastern Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: NAMOSI: Mt. Voma, *DA 13969*.

In spite of the paucity of material and data, this species seems very distinct from its only close relative, *Elatostema seemannianum*, in its proportionately narrow leaf blades and smaller receptacles.

12. *Elatostema seemannianum* A. C. Sm. in *Bishop Mus. Bull.* 141: 58, fig. 27. 1936, in *Sargentia* 1: 21. 1942; J. W. Parham, Pl. Fiji Isl. 99. 1964, ed. 2. 142. 1972. FIGURE 66.

Elatostema macrophyllum sensu Seem. Fl. Vit. 241, excl. syn. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 300. 1892; Gibbs in J. Linn. Soc. Bot. 39: 172. 1909; non Brongn.

A coarse herb 0.4–3 m. high, usually succulent and with simple stems up to 2 cm. in diameter, occurring at elevations of 150–1,050 m. in dense or open forest, usually in wet places and sometimes forming conspicuous thickets. The whitish heads may be as much as 5 cm. broad; the perianth and style are white or greenish white, and the anthers are white. Flowering and fruiting material has been noted throughout the year.

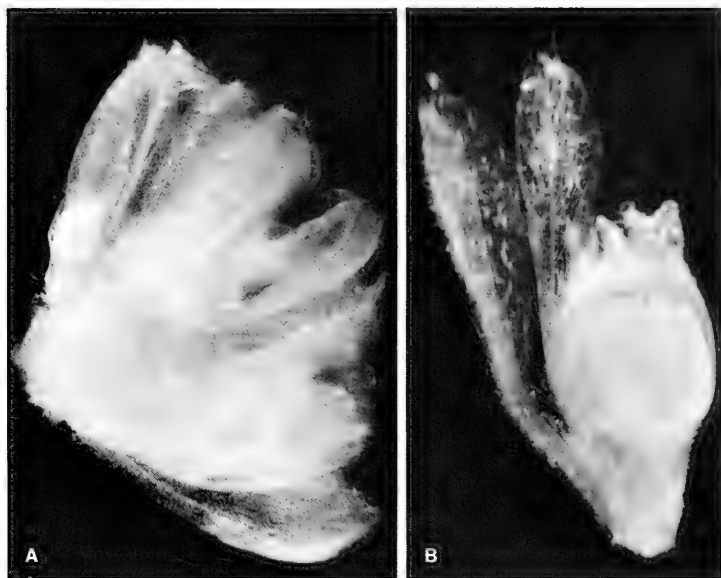


FIGURE 66. *Elatostema seemannianum*, from *Smith 7548*; A, cluster of flowers, subtended by bracteoles, from a ♂ head, some flowers sessile, some pedicellate, $\times 10$; B, ♂ flower subtended by bracteoles, $\times 30$.

TYPEIFICATION: The type is *Smith 982* (BISH HOLOTYPE; ISOTYPE at NY), collected Jan. 29, 1934, on the eastern slope of the main ridge of Koro.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands.

LOCAL NAME: *Mbeta*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 311, 1296*; eastern slope of Mt. Koroyanitu, Mt. Evans Range, *Smith 4142*; slopes of escarpment north of Nandarivatu, *Smith 6283*; Savundamataua Creek, west of Nandarivatu, *Webster & Hildreth 14249*; vicinity of Nandarivatu, *Gibbs 862, Gillespie 4256, Degener & Ordonez 13600*; valley of Nggaliwana Creek, north of Navai, *Smith 5376*; hills between Nggaliwana and Nandala Creeks, south of Nauwangga, *Smith 5849*; Mt. Tomanivi, *DA 13069*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14923*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5509*. SERUA: Upper Navua River, *DA 15525*; Waimbale, near Namboutini, *Degener 15470*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8622*. NAITASIRI: Vicinity of Viria, *Meebold 16431*. KANDAVU: Mt. Mbuke Levu, *DA 14938A*. OVALAU: *U. S. Expl. Exped., Bryan 610*; hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7548*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7859*. VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 11495*. FIJI without further locality, *Harvey, Nov., 1855*.

13. *Elatostema humile* A. C. Sm. in *Sargentia* 1: 22. 1942; J. W. Parham, *Pl. Fiji Isl.* 99. 1964, ed. 2. 142. 1972. FIGURE 67D.

A succulent herb to 0.4 m. high, occurring at elevations of 200–700 m. in dense or open forest, in moist places or on rocks in dry stream beds. The perianth and style are

greenish white and the stamens are white. Flowering and fruiting material has been obtained in February and August.

TYPIFICATION: The type is *Gillespie 4731.5* (A HOLOTYPE; ISOTYPE at BISH), collected Feb. 27, 1928, on the slope east of Waiyevo, Taveuni.

DISTRIBUTION: Endemic to Fiji and thus far known only sparingly from Viti Levu and Taveuni.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Prince's Road, near source of Nasinu River, *Vaughan 3298*. REWA: Near summit of Mt. Korombamba, *Gillespie 2403*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8332*; valley between Mt. Manuka and summit ridge of island, *Smith 8270*.

14. *Elatostema epallocaulum* A. C. Sm. in *J. Arnold Arb.* **31**: 152. 1950; J. W. Parham, *Pl. Fiji Isl.* **99**. 1964, ed. 2. 141. 1972.

An epiphytic climber, with the somewhat woody stem appressed to tree trunks, found in dense forest at an elevation of 1,050–1,120 m. The perianth and anthers are white.

TYPIFICATION: The type is *Smith 5692* (A HOLOTYPE; ISOTYPES at BISH, US), collected Aug. 18, 1947, on the ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, Ra Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection, from a plant with ♂ inflorescences.

EXCLUDED SPECIES

Elatostema peltatum Hemsl. in *Kew Bull.* **1901**: 143. 1901; A. C. Sm. in *Sargentia* **1**: 23. 1942.

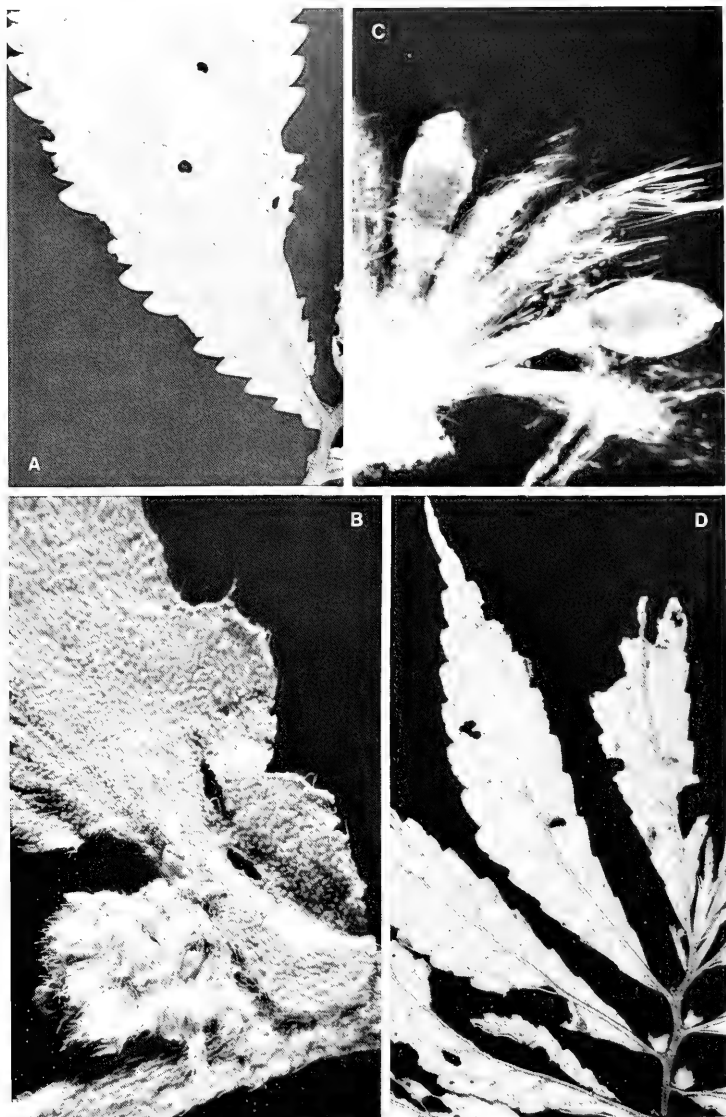
TYPIFICATION: The species was typified by *Horne s. n.* (K HOLOTYPE), collected between Waiwai and Lomaloma, Mathuata or Thakaundrove Province, Vanua Levu. No such specimen has been located at K; possibly it was sent on loan to Schröter and has been lost, or possibly it has been referred to a more likely situation in the herbarium.

Described as having peltate leaf blades and a petiole 1.5–2 inches long, this specimen can scarcely represent *Elatostema* or any other genus of Urticaceae. It does not suggest any species of *Peperomia* known to me, and probably its identity will remain a puzzle.

4. *Procris* Commerson ex Juss. *Gen. Pl.* 403. 1789; Seem. *Fl. Vit.* 241. 1868; Schröter in *Repert. Sp. Nov.* **45**: 179. 1938; A. C. Sm. in *Sargentia* **1**: 24. 1942.

Monocious or dioecious shrubs or herbs, often with succulent stems, sometimes epiphytic or scandent, the stipules intrapetiolar, undivided; leaves opposite and anisophyllous but appearing alternate, one leaf of each pair greatly reduced and caducous, the blades of the persisting leaves short-petiolate, usually carnose, pinnate-nerved, entire or serrulate, unequal-sided at base, usually with obvious, linear cystoliths; ♂ flowers in lax or congested, pedunculate cymes, the perianth 4- or 5-partite, the segments membranous, valvate or slightly imbricate, not appendaged, the stamens 4 or 5, the rudimentary ovary globose or obovoid; ♀ flowers capitate on a carnose, sessile or pedunculate, globose or clavate receptacle, this not involucrate, the perianth small, cyathiform or 3–5-partite, the segments obovate, the staminodes lacking, the ovary straight, the stigma sessile, penicillate, caducous; achene ovoid, nearly covered by the perianth or exerted from it, the seed without endosperm, the cotyledons ovate.

TYPE SPECIES: *Procris axillaris* J. F. Gmelin (ING).



DISTRIBUTION: Old World tropics, eastward into Polynesia, with 25-40 species. Four species are indigenous in Fiji, three of them believed to be endemic.

USEFUL TREATMENTS OF GENUS: Schröter, H. Monographie der Gattung *Procris*. Repert. Sp. Nov. 45: 179-192, 257-300. 1938. Smith, A. C. *Procris* Commers. Sargentia 1: 24-26. 1942.

KEY TO SPECIES

- ♀ inflorescences sessile; petioles 2-12 mm. long; leaf blades narrowly elliptic to obovate, 6-15 cm. long, 2-4.5 cm. broad, usually obviously unequal-sided at base, the secondary nerves 5-12 per side. 1. *P. pedunculata*
- ♀ inflorescences obviously pedunculate; leaf blades oblong-elliptic, essentially equal-sided at base. Cystoliths of leaf blades inconspicuous, very few and scattered on upper surface, absent from lower surface; petioles 5-10 mm. long; leaf blades 8-12 cm. long, 2-4 cm. broad, obscurely pellucid-punctate, the glands copious, often faintly depressed above, pale and crowded beneath, the secondary nerves 5 or 6 per side. 2. *P. anfracta*
- Cystoliths of leaf blades obvious and copious on both surfaces. Petioles 4-10 mm. long; leaf blades 4-11 cm. long, 1.5-3 cm. broad, thick, not pellucid-punctate, the glands often depressed above, obscure beneath, the secondary nerves 5-7 per side; cystoliths 0.1-0.25 mm. long, those of upper surface 8-12 per square millimeter, those of lower surface 35-50 per square millimeter. 3. *P. archboldiana*
- Petioles 8-30 mm. long; leaf blades (8-) 10-20 cm. long, 3.5-7 cm. broad, minutely scrobiculate on upper surface, the lower surface with superficial, minute, brown, scattered glands, the secondary nerves 7-10 per side; cystoliths 0.2-0.5 mm. long, those of upper surface 4-12 per square millimeter, those of lower surface 5-14 per square millimeter. 4. *P. goepeliana*

1. *Procris pedunculata* (J. R. & G. Forst.) Wedd. in DC. Prodr. 16 (1): 191. 1869; Schröter in Repert. Sp. Nov. 45: 259. 1938; A. C. Sm. in Sargentia 1: 24. 1942.

Schröter and other botanists have interpreted *Procris pedunculata* very broadly, although recognizing some infraspecific taxa. Schröter considers *P. cephalida* Commerson (ex Poir. in Lam. Encycl. Méth. Bot. 5: 629. 1804) a direct synonym, probably referable to her var. *eupedunculata*. Commerson's type (p) is from Bourbon (i. e. La Réunion, Mascarene Islands), and it seems unlikely that it falls into the typical variety of the species. This is pertinent to the present treatment only because Seemann used the name *P. cephalida* for his Fijian material.

DISTRIBUTION: It is difficult to assign a total distribution to *Procris pedunculata*, but it doubtless extends from Polynesia westward to Malesia, and possibly to south-eastern Asia and Africa as well. In the Fijian Region two infraspecific taxa, perhaps worthy of varietal rank, are distinguishable.

KEY TO VARIETIES

- Leaf blades usually pellucid-punctate, or at least with obvious glands often depressed on upper surface; cystoliths of upper leaf blade surface 0.13-0.25 mm. long and 8-20 per square millimeter, those of lower surface 0.2-0.5 mm. long and 5-17 per square millimeter. 1a. var. *pedunculata*
- Leaf blades thicker, not or scarcely pellucid-punctate, the glands obscure; cystoliths of upper leaf blade surface 0.13-0.6 mm. long and 18-45 per square millimeter, those of lower surface 0.16-0.7 mm. long and 12-35 per square millimeter. 1b. var. *ornata*

FIGURE 67. A-C, *Elatostema tenellum*; A, basal portion of leaf, lower surface, × 1; B, basal portion of leaf, upper surface, and maturing ♀ inflorescence, × 10; C, maturing ♀ flowers, with subtending bracteoles, pedicels, minute perianth lobes, and achenes, × 30. D, *Elatostema humile*; distal portion of branchlet, with foliage and ♂ inflorescences, × 1. A from Smith 5728, B & C from Smith 471, D from Gillespie 2403.

1a. *Procris pedunculata* (J. R. & G. Forst.) Wedd. var. *pedunculata*; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 144. 1972. FIGURE 68A.

Elatostema pedunculatum J. R. & G. Forst. Char. Gen. Pl. 53. t. 53. 1775, ed. 2. 106. t. 53. 1776.

Dorstenia lucida Forst. f. Fl. Ins. Austr. Prodr. 11, nom. illeg. 1786.

Procris pedunculata sensu Guillaumin in J. Arnold Arb. 13: 107. 1932; Christophersen in Bishop Mus. Bull. 128: 74. 1935; Yuncker in op. cit. 184: 36. 1945; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 36. 1972.

Procris pedunculata var. *eupedunculata* Schröter in Repert. Sp. Nov. 45: 260, quoad typum. 1938; A. C. Sm. in Sargentia 1: 25. 1942.

As it occurs in Fiji, the typical variety of *Procris pedunculata* is a succulent herb, sometimes ligneous toward base, or a liana, occurring at elevations from near sea level to about 760 m. It is more frequently found at lower elevations, often on limestone areas, along rocky coasts, on cliffs, in open forest, and sometimes as an epiphyte. The perianth is greenish white. Flowering and fruiting material may be expected throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: The type was collected in the Society Islands by J. R. & G. Forster during Cook's second voyage; usually the holotypes of such species are deposited at BM, but in this case I have been unable to find any such specimen there and therefore assume that it may have been lost while out on loan. However, a specimen exists at K indicated as collected on Tahiti by J. R. & G. Forster, from the Forster Herbarium and marked "*Dorstenia lucida*." A pencilled note (in an unrecognized hand) has been added: "This is almost certainly the Type Specimen of *Elatostema pedunculatum* J. & G. Forst. = *Procris pedunculata* Wedd." This specimen is herewith indicated the lectotype of the species. In describing *Dorstenia lucida*, G. Forster cited *Elatostema pedunculatum* as a synonym.

DISTRIBUTION: The typical variety of *Procris pedunculata* probably has a very extensive distribution, occurring in most archipelagoes of the southern Pacific from the Marquesas and Tuamotus westward at least to Micronesia and the Solomon Islands, and probably throughout Malesia; whether it extends to continental Asia and to Africa remains to be seen. Apparently Schröter believed the typical variety to have essentially the specific range.

AVAILABLE COLLECTIONS: KANDAVU: Namalata Isthmus region, *Smith 33*; Ono Island, *DA 14955*; Kandavu without further locality, *Tohill 762*. KORO: Rocky west coast, *Smith 1076*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7928*. VANUA LEVU: THAKAUNDROVE: Track to Mt. Soro Levu, *DA 17142*. MOALA: Forest above Maloku, *Smith 1373*. VANUA MBALAVU: Nambavatu, *Tohill 763*; southern limestone section, *Smith 1441*. KAMBARA: On limestone formation, *Smith 1283*. FULANGA: On limestone formation, *Smith 1140*. ONGEA NDRIKI: *Bryan 414*.

The specimens cited above agree very closely in foliage characters with the lectotype and other material of the typical variety from Tahiti, as well as with specimens from Samoa, the New Hebrides, etc. In Fiji the typical variety seems to favor the smaller islands and a limestone substrate, but its range and that of the following variety are not entirely mutually exclusive.

1b. *Procris pedunculata* var. *ornata* A. C. Sm. in Sargentia 1: 25. 1942; Yuncker in Bishop Mus. Bull. 220: 102. 1959; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 144. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 212. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 322. 1971. FIGURE 68B.

Procris integrifolia sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862; non auct.

Procris cephalida sensu Seem. Fl. Vit. 241. 1868; non Commerson ex Poir.

Procris pedunculata sensu Drake, Ill. Fl. Ins. Mar. Pac. 301, quoad spec. vit. 1892; Yuncker in Bishop Mus. Bull. 178: 49. 1943; non sensu typi.

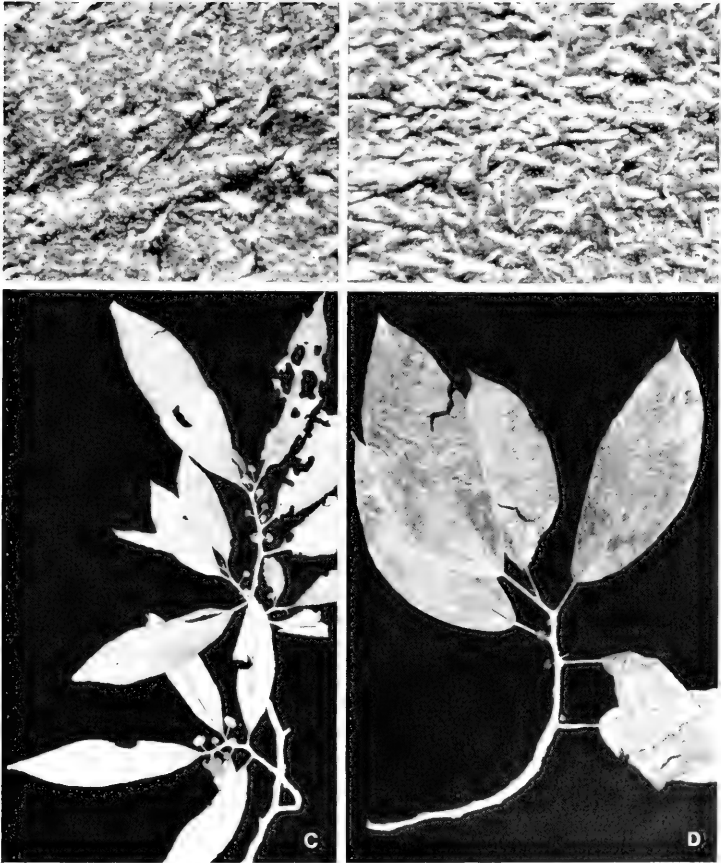


FIGURE 68. A, *Procris pedunculata* var. *pedunculata*, from Smith 1441; portion of upper surface of leaf blade, with comparatively spaced cystoliths, $\times 30$. B, *Procris pedunculata* var. *ornata*, from Smith 9637; portion of upper surface of leaf blade, with comparatively congested cystoliths, $\times 30$. C, *Procris anfracta*, from Smith 744; distal portion of branchlet, with foliage and ♀ inflorescences, $\times 1/3$. D, *Procris goepeliana*, from DA 14997; distal portion of branchlet, with foliage and ♀ inflorescences, $\times 1/3$.

Procris pedunculata var. *ornata*, in Fiji, is a succulent herb or low shrub, occasionally epiphytic, occurring from near sea level to an elevation of 1,130 m. in dry or dense forest, often in rocky places, and frequently along streams and on cliffs. The perianth is white or greenish, the stamens white, and the fruiting heads dull pink, becoming bright orange or red and with whitish achenes. Flowers and fruits do not appear to be seasonal.

TYPEIFICATION: The type is *Degener 14826* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected March 13, 1941, near Nauwangga, south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Fiji, Tonga, Niue, and the Horne Islands; possibly some of the collections from the New Hebrides and the Solomons belong here also, but the complex species requires more careful study. In Fiji var. *ornata* occurs on the high islands and often at higher elevation than the typical variety, and it has not been noted in Lau. I have studied about 40 Fijian collections.

LOCAL NAMES: The names *kau tho* and *tokai* have each been reported once, but they are definitely to be questioned as applying to *Procris*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Mt. Evans Range, *Greenwood 1281*; slopes of escarpment north of Nandarivatu, *Smith 6272*; vicinity of Nandarivatu, *Gillespie 4297*; Mt. Nanggaranambuluta, east of Nandarivatu, *Stauffer & Koroiveibau 5833*; Mt. Tomanivi, *DA 12748* (*Melville et al. 7140*). NANDRONGA & NAVOSA: Nausori Highlands, *O. & I. Degener 32170*; Ruwailevu, Singatoka Valley, *Webster & Hildreth 14376*. SERUA: Mbuyombuyo, near Namboutini, *Tabualewa 15573*; hills between Waininggere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9637*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8859*; vicinity of Namosi Village, *Seemann 430* (in part also from Taveuni). RA: Vicinity of Nasukamai, *Gillespie 4393*; Vatundamu, vicinity of Rewasa, near Vaileka, *Degener 15402*. TAILEVU: Hills east of Wainimbuka River, vicinity of Wailotua, *Smith 7252*. REWA: Vicinity of Lami, *Meebold 16664*. OVALAU: Slopes above Levuka, *Gillespie 4483*. NGAU: Hills east of Herald Bay, inland from Sawaiieke, *Smith 7846*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6855*. THAKAUNDOVE: Southwestern slope of Mt. Mbatini, *Smith 599*; Namali, *DA 16861*. TAVEUNI: Nanggelendamundamu, Ngeleni, *DA 15882*.

2. *Procris anfracta* (A. C. Sm.) A. C. Sm. in *Sargentia* 1: 25. 1942; J. W. Parham, Pl. Fiji Isl. 101. 1964, ed. 2. 144. 1972. FIGURE 68C.

Elatostema anfractum A. C. Sm. in *Bishop Mus. Bull.* 141: 58. fig. 26. 1936.

A liana or scrambling vine, somewhat succulent, occurring at elevations of 600-900 m. in dense forest. The flowering heads are white, the perianth pale green, and the fruiting heads bright red. Flowering material has been obtained in August and December and fruiting material only in December. The original description having been based on ♀ material, the following supplementary notes are now added from *Smith 8268* (unicate at US): ♂ inflorescences glabrous, 1-3 in leaf axils or at defoliate nodes, the cymes simple, the peduncles slender, 4-7 mm. long, obscurely bracteate at base, the receptacle swollen and irregularly glandular; flowers usually 8-12 per cyme, the pedicels slender, 3-4 mm. long; perianth segments 5, membranaceous, oblong, about 1.5 × 1 mm.; stamens 5, the filaments about 0.7 mm. long, the anthers oblong and equalling the filaments in length.

TYPEIFICATION: The type is *Smith 744* (BISH HOLOTYPE; many ISOTYPES), collected Dec. 14, 1933, on the western slope of Taveuni, between Somosomo and Wairiki.

DISTRIBUTION: Endemic to Fiji and thus far known sparingly only from the island of Taveuni.

AVAILABLE COLLECTIONS: TAVEUNI: Valley between Mt. Manuka (east of Wairiki) and summit ridge of island, *Smith 8268, 8280*.

This apparently rare and local species is readily distinguished from other Fijian species with pedunculate ♀ inflorescences by its essentially lacking foliar cystoliths, at least from lower leaf blade surfaces. The following species, known only from Viti Levu,

is quite similar in general appearance but its leaf blades have copious and obvious cystoliths.

3. *Procris archboldiana* A. C. Sm. in *Sargentia* 1: 25. 1942, in *J. Arnold Arb.* 31: 153. 1950; J. W. Parham, *Pl. Fiji Isl.* 101. 1964, ed. 2. 144. 1972. FIGURE 69.

Procris montana sensu Gibbs in *J. Linn. Soc. Bot.* 39: 172. 1909; Turrill in op. cit. 43: 39. 1915; non Steudel.

An often high-climbing liana, with the lower parts of stems sometimes appressed to tree trunks, or sometimes appearing to be an epiphytic shrub, found at elevations of 725–1,250 m. in dense forest or in the mossy forest of high ridges. The perianth is pale green, the anthers white, and the fruiting heads red and somewhat translucent or pinkish. Both flowers and fruits have been obtained between February and September.

TYPEFICTION: The type is *Degener 14354* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected Feb. 13, 1941, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES: *Ndraindrai* and *sundro* are names recorded only for *Gillespie 3396*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6182*; vicinity of Nandarivatu, *Gibbs 661, 735, im Thurn 283, Gillespie 3396*; summit of Mt. Nangaranambuluta, east of Nandarivatu, *Smith 4819, 4863*; hills between Ngaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 5984, 5987*; upper slopes of Mt. Tomanivi, *Smith 5206, DA 12706 (Melville et al. 7094A & B)*. NANDRONGA & NAVOSA: Above Naloka, Singatoka River Valley, *DA 1429*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5758*. VITI LEVU without further locality, *Parks 20838*.

Procris archboldiana, apparently with a very restricted range, is one of the most striking plants of the upland forest of northern Viti Levu, its small, red, fruiting heads being conspicuous along the stems of the lianas that are often closely appressed to tree trunks.

4. *Procris goepeliana* (A. C. Sm.) A. C. Sm. in *Sargentia* 1: 26. 1942; J. W. Parham, *Pl. Fiji Isl.* 102. 1964, ed. 2. 144. 1972. FIGURE 68D.

Pellionia goepeliana A. C. Sm. in *Bishop Mus. Bull.* 141: 56. fig. 25. 1936.

A siliquaceous herb or slender shrub 1–2 m. high, or more often a high-climbing liana, occurring at elevations of 300–866 m. in dense forest or in the dense thickets of crests. The perianth is pale green, the anthers white, and the fruiting heads pale pink and eventually bright red. Flowers have been obtained between November and April and fruits between April and June.

TYPEFICTION: The type is *Smith 519* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 21, 1933, on the southern slope of the Korotini Range, below Navitho Pass, Thakaundrove Province, Vanua Levu.

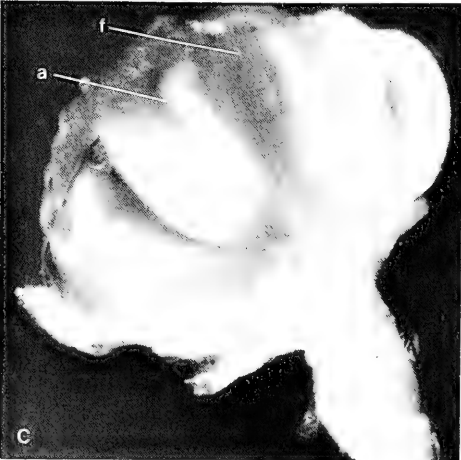
DISTRIBUTION: Endemic to Fiji and known from several of the high islands.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Vunimbua Creek, near Nambukelevu, upper Navua River, *DA 14867*. NAMOSI: Saliandrau, Wayayau Creek, *DA 14997*. REWA: Mt. Korombamba, *Parks 20144, 20343*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7714*. KORO: Eastern slope of main ridge, *Smith 979*. VANUA LEVU: THAKAUNDRIVE: Mt. Mariko, *Smith 433*.

Of the three Fijian species of *Procris* with pedunculate ♀ inflorescences, *P. goepeliana* seems to be the most widespread; all three, as far as now known, have discrete distributions.

5. *PILEA* Lindl. *Collect. Bot. ad t. 4.* 1821. *Nom. cons.*

Monoecious or dioecious annual or perennial herbs, sometimes creeping, the stipules intrapetiolar, connate; leaves opposite, equal or unequal in pairs, the petioles



of a pair of different lengths, the blades usually 3-nerved, equal-sided or nearly so, entire or serrate, with usually linear cystoliths; inflorescences composed of axillary, pedunculate or sessile, solitary cymes, these in dense clusters or lax and paniculiform, usually with small bracts; ♂ flowers with the perianth (2-) 4-partite, the segments concave, subvalvate or connate, often mucronate or appendaged dorsally, the stamens (2-) 4, the rudimentary ovary conical or oblong; ♀ flowers with the perianth 3-partite, the segments unequal, the largest one sometimes gibbous or cucullate, the staminodes opposite perianth segments, inflexed, scalelike, sometimes minute or inconspicuous, the ovary straight, the stigma sessile, short-penicillate, usually caducous; achene ovoid or orbicular, compressed, slightly oblique, not or only partly enclosed by the perianth and often forcefully ejected from it by the staminodes, the seed nearly lacking endosperm, the cotyledons broad.

TYPE SPECIES: *Pilea muscosa* Lindl., nom. illeg. = *P. microphylla* (L.) Liebm. (*Parietaria microphylla* L.).

DISTRIBUTION: Pantropical and sometimes extending into temperate areas, with more than 600 species. Two species are recorded from Fiji, both in cultivation and one also a frequent adventive.

KEY TO SPECIES

- Coarse herb, to 40 cm. high; leaf blades ovate, up to 9 × 5 cm., with pale green or silvery blotches, the petioles 2-3 cm. long. 1. *P. cadierei*
 Delicate herb, often sprawling or prostrate, seldom as much as 30 cm. high; larger leaf blades up to 6 × 2 mm., green, the petioles minute. 2. *P. microphylla*

1. *Pilea cadierei* Gagnep. & Guillaumin in Bull. Mus. Hist. Nat. (Paris) II. 10: 629. 1939; J. W. Parham, Pl. Fiji Isl. ed. 2. 143. 1972.

A succulent herb 30-40 cm. high, cultivated and to be expected from near sea level to about 250 m. The leaves characteristically have pale green blotches or silvery areas, and the perianth segments are dull white or slightly pink-tinged. Flowers in Fiji have been noted only in March.

TIPIFICATION: The type is cited as "R. P. Cadière, f. 11. 1938" (HOLOTYPE doubtless at P), collected in central Annam, Vietnam, at an elevation of 600 m.

DISTRIBUTION: This decorative plant is now fairly widespread in cultivation.

LOCAL NAME AND USE: *Aluminum plant*; a popular ornamental in gardens.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Toninaiwau, Tholo-i-suva, DA 16766. REWA: Lami, in private garden, DA 16475.

2. *Pilea microphylla* (L.) Liebm. in Kongel. Dansk Vidensk.-Selsk. Skr. V. 2: 296. 1851; Christophersen in Bishop Mus. Bull. 128: 74. 1935; Yuncker in op. cit. 178: 49. 1943; Greenwood in J. Arnold Arb. 25: 397. 1944, in op. cit. 30: 81. 1949; Yuncker in Bishop Mus. Bull. 220: 102. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 96. 1959, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 210. 1970; St. John & A. C. Sm. in Pacific Sci.

FIGURE 69. *Procris archboldiana*; A, distal portion of branchlet, with foliage and ♀ inflorescences, × 1; B, portion of young ♂ inflorescence, × 10; C, young ♂ flower, with some perianth segments removed, showing reflexed anthers (a) and a filament (f), × 30; D, maturing ♀ inflorescence, showing developing achenes and fleshy perianth segments, × 6. A from *Smith 6182*, B & C from *Smith 5987*, D from *Degener 14354*.

25: 322. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 122. 1972.

Parietaria microphylla L. Syst. Nat. ed. 10. 1308. 1759.

Pilea muscosa Lindl. Collect. Bot. t. 4, nom. illeg. 1821; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 104. 1948.

In Fiji *Pilea microphylla* is sometimes cultivated as a diminutive, erect, border plant, but more frequently it is seen as a sprawling or prostrate weed, often subliguous at base, on damp rocks and along shaded creeks, often near dwellings. Its minute flowers are white and are to be found throughout the year.

TYPIIFICATION: Linnaeus's only citation in 1759 was "*Sloan. jam. t. 93. 2.*" The type, therefore, should be a Sloane specimen at BM. *Pilea muscosa* is an illegitimate name because Lindley cited *Parietaria microphylla* as a synonym.

DISTRIBUTION: A native of tropical America, *Pilea microphylla* is now widespread as a weed throughout the tropics.

LOCAL NAMES AND USE: *Artillery plant* and *gunpowder plant*, widely used for this diminutive species, presumably refer to the forcible ejection of its minute achene from the perianth by the staminodes, or to the explosive action of the anthers in releasing pollen. The species is sometimes used as an ornamental in garden borders, but as a weed it is considerably more frequent than indicated below.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 1002B*. NAMOSI: Hills east of Serua River, *Greenwood 1002*. REWA: Suva, *Meebold 8205, DA 12264*; Department of Agriculture compound, Suva, *DA 11593*.

6. BOEHMERIA Jacq. Enum. Syst. Pl. Carib. 9. 1760; Seem. Fl. Vit. 241. 1868.

Monoecious (or dioecious or rarely polygamous) small trees or shrubs, often with indument, the stipules usually lateral and free, less often intrapetiolar and basally connate, caducous; leaves alternate or opposite, sometimes unequal and with petioles of different lengths, the blades equal- or unequal-sided, serrate, 3-nerved at base, pinnate-nerved distally, rarely 2-lobed, with punctiform, hypergenous cystoliths; inflorescences bisexual or unisexual, spicate or paniculate or fasciculate, axillary or at defoliate nodes, with small, scarious bracts; ♂ flowers with the perianth 4-lobed or 4-partite (rarely 3- or 5-partite), the segments valvate, often short-corniculate below apex, the stamens 4 (rarely 3 or 5), the rudimentary ovary clavate or subglobose; ♀ flowers with the perianth tubular or lageniform, compressed or ventricose, often oblique, often contracted distally, 2-4-dentate, hispid, dry at maturity, the staminodes none, the ovary sessile or stipitate, the stigma elongate-filiform, pilose on one side, semipersistent in fruit; achene enclosed by the withered perianth, thin- or hard-walled, the seed with sparse endosperm, the cotyledons elliptic or ovate.

TYPE SPECIES: *Boehmeria ramiflora* Jacq.

DISTRIBUTION: Pantropical and extending into temperate regions, with about 100 species. Two species occur in Fiji, one cultivated (and sometimes naturalizing) and one indigenous.

KEY TO SPECIES

- Shrubby plant 1-3 m. high; ♀ flower clusters in branched panicles 3-8 cm. long; petioles 6-12 cm. long; leaf blades broadly ovate-deltoid, (6-) 8-16 cm. long, (5-) 7-13 cm. broad, slightly longer than broad, rounded to subcordate at base, sparsely hispidulous above, white- to greenish-tomentose beneath; cultivated and sparingly naturalized. 1. *B. nivea*
- Shrub or slender tree 1-5 (-12) m. high; ♀ flower clusters in elongate spikes 15-45 cm. long at maturity; ♂ flower clusters in branched panicles usually 10-15 cm. long at maturity; petioles 2-13 cm. long; leaf blades ovate to elliptic, (8-) 10-25 cm. long, (4-) 6-11 cm. broad, about twice as long as broad, rounded to obtuse at base, concolorous or slightly paler beneath, inconspicuously appressed-pilose to uniformly soft-pilose beneath; indigenous. 2. *B. virgata*

1. *Boehmeria nivea* (L.) Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 499. 1830; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 140. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 106. 1972.

Urtica nivea L. Sp. Pl. 985. 1753.

A shrub to 3 m. high, sparingly cultivated and rarely naturalizing along roadsides near sea level. The only Fijian specimen in flower was obtained in September.

TYPIFICATION: Among the three references listed for *Urtica nivea*, Linnaeus included *Hortus Cliffortianus*, 441; the best lectotype therefore would be the corresponding specimen at BM.

DISTRIBUTION: Indigenous in eastern Asia from Japan and China to Malesia, now cultivated there and elsewhere for commercial production.

LOCAL NAMES AND USES: *Ramie* and *rhea* are the most widely used names. The stem yields an exceptionally long, strong, lustrous, and durable bast fiber, used in a manner similar to flax and hemp, for twine, thread, nets, cloth, mats, etc. However, the species often fails to grow well in cultivation, and separation of the fibers is difficult. An interesting account of the uses and introduction of *ramie* is found in Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 344-346. 1966.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Research Station, Koronivia, DA 10145; near Tamava Depot, upper Waimanu Road near Suva, H. B. R. Parham 120. VANUA LEVU: THAKAUNDROVE: Along Hibiscus Highway leading from Savusavu, Bierhorst F178. TAVEUNI: Near Somosomo, DA 11516.

Of the two best known varieties of this species, var. *nivea* is the one usually cultivated in China and other temperate areas, while var. *tenacissima* (Roxb.) Miq. is the more frequently grown in warm areas. The latter is doubtless the variety brought into Fiji for experimental cultivation, but at least one of the Fijian specimens represents var. *nivea*. In the typical variety the adult leaf blades are thickly white-tomentose beneath, somewhat smaller and less coarsely serrate than those of var. *tenacissima*, the leaf blades of which have the tomentum less copious and more greenish.

2. *Boehmeria virgata* (Forst. f.) Guillemin in Ann. Sci. Nat. Bot. II. 7: 182. 1837; A. C. Sm. in Sargentia 1: 26. 1942; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 140. 1972.

FIGURE 70.

Urtica virgata Forst. f. Fl. Ins. Austr. Prodr. 66. 1786.

Boehmeria platyphylla var. *virgata* Wedd. in Arch. Mus. Hist. Nat. 9: 366. 1856; Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862; Wedd. in DC. Prodr. 16 (1): 210. 1869; Drake, Ill. Fl. Ins. Mar. Pac. 301. 1892.

Boehmeria platyphylla sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862, Fl. Vit. 242. 1868; Gibbs in J. Linn. Soc. Bot. 39: 173. 1909; Guillaumin in J. Arnold Arb. 13: 107. 1932; Christophersen in Bishop Mus. Bull. 128: 75. 1935; non D. Don.

As it occurs in Fiji, *Boehmeria virgata* is a shrub or slender tree 1-5 (rarely to 12) m. high, found at elevations between 50 and 1,200 m. in dense, open, dry, or secondary forest or on its edges. The perianth, stamens, and styles are pale green to white, and the achene turns from yellowish white to brown. Flowering and fruiting material occurs throughout the year.

LECTOTYPIFICATION: The type was obtained by J. R. & G. Forster in the Society Islands during Cook's second voyage. At BM there is a specimen from G. Forster's herbarium indicated as "*Urtica virgata* Prodr. 345," which may be taken as the lectotype, although it bears no locality data. A presumptive isolectotype at K is indicated as from "Tongo-Tabo-Tahietee;" the Tongatapu locality is doubtless superfluous, since the specimen is a precise match for that at BM.

DISTRIBUTION: From the Marquesas and Society Islands westward at least to the New Hebrides and Caroline Islands; I have seen no specimens from farther west that I would refer here, but of course the genus needs a modern revision. Although *Boehmeria virgata* is present in Samoa, no collections of it have been noted from Tonga or Niue. Sixty Fijian collections have been studied.

LOCAL NAMES AND USES: A plant well known to Fijians, *Boehmeria virgata* is reported under the names *kalolo*, *kaulolo*, *ndongosele*, *ndrendre*, *rambe*, *rambi*, and *tautau*. The leaves have many alleged medicinal uses: they may be used as a dressing for broken bones, mixed with oil and used as a massage, used as a remedy for boils, or combined with the fronds of the fern *Macrothelypteris torresiana* (Gaud.) Ching and used in treating the early stages of dysentery.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Natalau, near Lautoka, *Degener 15008*; Mt. Evans Range, *Greenwood 459*; vicinity of Nandarivatu, *Gibbs 638*; Mt. Nanggaranambuluta, *DA 10378*; Mt. Tomanivi, *DA 12766* (*Melville et al. 7158*). NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8761*; Navunikambi, Wainikoroiluva River, *DA 14987*; hills southeast of Namosi Village, *Gillespie 2833*. RA: Mountains near Penang, *Greenwood 172A*; vicinity of Rewasa, near Vaileka,



FIGURE 70. *Boehmeria virgata*, from *DA 10378*; A, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$; B, branchlet of inflorescence with clusters of ♂ flowers, $\times 6$.

Degener 15337. NAITASIRI: Vicinity of Matawailevu, Wainimala River, *St. John 18176*; Tholo-i-suva, *Parks 20079*. KANDAVU: *Seemann 433*; summit of Mt. Mbuke Levu, *Smith 284*. OVALAU: *Horne 303*; hills east of Lovoni Valley, *Smith 7362*. KORO: Eastern slope of main ridge, *Smith 944*. NGAU: *Milne 156, 159, 223*. VANUA LEVU: MBUA: Above Nandi Bay, *Milne 247*. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 393*. TAVEUNI: Somosomo, *Seemann 432* (some sheets indicated as from Kandavu); valley between Mt. Manuka and main ridge of island, *Smith 8289*. FIJI without further locality, *U. S. Expl. Exped., Graeffe s. n.*

In 1942 I noted the variation in the leaf blade indument. Some Fijian specimens have the blades glabrous above and inconspicuously appressed-strigose on the nerves beneath; Forster's type material resembles this form. Other Fijian specimens have the blades appressed-strigose above and uniformly soft-pilose beneath. There are so many intergrading forms that the type and degree of indument now seem inconsequential.

7. *POUZOLZIA* Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 503. 1830.

Monoecious (or rarely dioecious) herbs or shrubs, the stipules lateral, free, often persistent; leaves alternate or the lower ones opposite, the blades entire or serrate, 3-nerved at base, pinnate-nerved distally, with punctiform cystoliths; inflorescences axillary, clustered, with small bracts; ♂ flowers with the perianth 4-lobed or 4-partite (rarely 3- or 5-partite), the segments valvate, convex at apex or abruptly inflexed and transversely plicate dorsally, the stamens 4 (rarely 3 or 5), the rudimentary ovary clavate or oblong; ♀ flowers with the perianth tubular, contracted distally, 2-4-dentate, dry at maturity, the staminodes none, the ovary included in perianth, the stigma filiform, villose on one side, caducous after anthesis; achene enclosed by the accrescent perianth and often free from it, the seed with sparse endosperm, the cotyledons ovate.

TYPE SPECIES: *Pouzolzia laevigata* (Poir.) Gaud. ex Wedd. (*Parietaria laevigata* Poir., as *P. levigata*).

DISTRIBUTION: Pantropical, with 50-100 species. Two species have been noted in Fiji, both adventive and perhaps evanescent.

KEY TO SPECIES

- Petioles of largest leaves 3-6 cm. long; leaf blades ovate, 2.5-6.5 cm. long, 1.5-3.5 cm. broad, the larger ones conspicuously acuminate. 1. *P. erythraeae*
 Petioles less than 0.5 cm. long (in our specimen, but variable and up to 3 cm. long where indigenous); leaf blades ovate to elliptic or ovate-lanceolate, 1-2 cm. long and 0.5-1 cm. broad (in our specimen, but variable and up to 6 × 3 cm. where indigenous), obtusely cuspidate at apex. 2. *P. rubricaulis*

1. *Pouzolzia erythraeae* Schweinfurth in Bull. Herb. Boissier 4, App. 2: 146. 1896; J. W. Parham, Pl. Fiji Isl. ed. 2. 144. 1972.

An herb 30-40 cm. high, probably repent basally, occurring as a weed in waste places. The only available Fijian specimen had axillary glomerules of flowers and fruits in July.

TYPIFICATION: The type is *Schweinfurth 1658* (place of deposit?), collected in Eritrea, without indication of further locality, in April, 1891.

DISTRIBUTION: Presumably indigenous in eastern Africa.

AVAILABLE COLLECTION: VITI LEVU: REWA: Department of Agriculture grounds, Suva, *DA 14755*.

Although I have not compared the Fijian specimen with the type, it agrees excellently with the original description and is also essentially identical to *A. Pappi 4033* (US), from Valle di Ghinda, Eritrea, so identified by E. Chiovenda. This East African species may have reached Fiji as a chance seed in ship ballast. The cited locality is adjacent to the wharf area in Suva, and it is unlikely that the species will persist in Fiji.

2. *Pouzolzia rubricaulis* (Bl.) Wedd. in DC. Prodr. 16(1): 229. 1869; Backer & Bakh. f. Fl. Java 2: 47. 1965; J. W. Parham, Pl. Fiji Isl. ed. 2. 144. 1972.

Leptocnide rubricaulis Bl. Mus. Bot. Lugd.-Bat. 2: 194. t. 57. 1857.

As seen in Fiji, this probably evanescent weed is an herb 15–20 cm. high, with the branches sprawling at base, found near sea level. The inflorescence bracts are reddish and the anthers are white; flowering material was obtained in November.

TYPIFICATION: The holotype (probably at L) was collected "in Java occidentali prope Tjanjor," presumably by Blume.

DISTRIBUTION: Perhaps only in Java.

AVAILABLE COLLECTION: VITI LEVU: REWA: Samambula, Suva, DA L.11435.

Like the preceding, this species is probably an evanescent weed in Fiji; the locality is not far from Suva Harbor. Although the leaf blades of our specimen are somewhat smaller than those described in *Flora of Java*, it keys only to *Pouzolzia rubricaulis*, agrees closely with Blume's original plate, and seems identical with *Neth. Ind. For. Serv. 7047* (GH, NY), from Java, so identified by van Steenis.

8. *PIPTURUS* Wedd. in Ann. Sci. Nat. Bot. IV. 1: 196. 1854; Seem. Fl. Vit. 243. 1868; Skotts. in Acta Horti Gothob. 7: 43. 1932; A. C. Sm. in Sargentia 1: 27. 1942.

Dioecious (or rarely monoecious) trees or shrubs, the stipules intrapetiolar, connate, caducous; inflorescences axillary, panicle or raceme, the flowers clustered, the bracts small; ♂ flowers with the perianth 4- or 5-lobed, the lobes valvate, acute, the stamens 4 or 5, the rudimentary ovary often tomentose; ♀ flowers with the perianth tubular, narrowed at apex, minutely 4- or 5-dentate, the staminodes none, the ovary enclosed by perianth, the stigma filiform, exserted, villose on one side, caducous after anthesis; receptacle below fruit globose, fleshy, sometimes villose; achene closely enclosed by the slightly enlarged perianth and free from it, immersed in the receptacle and together with it forming a spurious fruit, the seed with sparse endosperm, the cotyledons broad.

LECTOTYPE SPECIES: Weddell included nine species in his genus in 1854. The current ING card does not indicate a lectotype species, but Hutchinson (Gen. Fl. Pl. 2: 189. 1967) so denotes *Pipturus argenteus* (Forst. f.) DC. (the combination is usually accredited to Weddell).

DISTRIBUTION: Mascarene Islands to Malesia and Australia and eastward into Polynesia, with 40–50 species. Three indigenous species occur in Fiji.

USEFUL TREATMENTS OF GENUS: Skottsberg, C. Remarks on *Pipturus argenteus* and *P. incanus* of Weddell. Acta Horti Gothob. 7: 43–63. 1932. Smith, A. C. *Pipturus* Wedd. Sargentia 1: 27–29. 1942.

KEY TO SPECIES

- Leaf blades densely lanate or pilose beneath; ♀ perianth minutely sericeous or hispid to strigose.
 Indument of ♀ perianth minutely sericeous with hairs 0.05–0.15 mm. long; leaf blades conspicuously discolored, densely white- or grayish-lanate beneath with a closely appressed layer of weak, tangled hairs, sparsely hispid-setose above with pale hairs 0.4–1 mm. long, or sometimes essentially glabrous above. 1. *P. argenteus* var. *lanosus*
 Indument of ♀ perianth hispid to strigose with hairs 0.15–0.25 mm. long; leaf blades essentially concolorous, densely pilose beneath with cinereous, erect hairs 0.25–1 mm. long (these not tangled into an appressed layer), similarly pilose above or with the hairs strigose, or sometimes essentially glabrous above. 2. *P. platyphyllus*
 Leaf blades concolorous, superficially appearing glabrous but inconspicuously short-strigillose beneath (hairs pale, minute, not more than 0.2 mm. long, sometimes scarcely apparent), glabrous above or with a few inconspicuous, appressed hairs seldom longer than 0.3 mm.; ♀ perianth inconspicuously puberulent-sericeous with minute hairs not more than 0.1 mm. long. 3. *P. vitiensis*

1. *Pipturus argenteus* (Forst. f.) Wedd. var. *lanosus* Skotts. in Acta Horti Gothob. 7: 62. fig. 46-49. 1932; A. C. Sm. in Sargentia 1: 28. 1942; Yuncker in Bishop Mus. Bull. 220: 103. 1959; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 211. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 31. 1972.

FIGURE 71A & B.

Pipturus propinquus sensu Seem. Fl. Vit. 244. 1868; non Wedd.

Pipturus velutinus sensu Seem. Fl. Vit. 433. 1873; non Wedd.

Pipturus argenteus sensu Drake, Ill. Fl. Ins. Mar. Pac. 303, quoad spec. vit. 1892; Gibbs in J. Linn. Soc. Bot. 39: 173. 1909; Christophersen in Bishop Mus. Bull. 128: 75, p. p. 1935; Yuncker in op. cit. 178: 49. 1943, in op. cit. 184: 36. 1945; non sensu typi.

As it occurs in Fiji, *Pipturus argenteus* var. *lanosus* is an often spreading shrub or tree 2-6 m. high, sometimes with the trunk up to 20 cm. in diameter, found from near sea level to an elevation of 1,000 m. in dense, dry, or open forest or on its edges or in coastal thickets. The fruiting clusters are white-sericeous and the achenes brown. Flowering and fruiting specimens have been obtained throughout the year.

TYPIFICATION AND NOMENCLATURE: The type of *Pipturus argenteus* (Forst. f.) Wedd. (*Urtica argentea* Forst. f. Fl. Ins. Austr. Prodr. 65. 1786) was obtained in the Society Islands by J. R. & G. Forster during Cook's second voyage. Skottsberg in his 1932 discussion was noncommittal as to the range of the typical variety, but he excluded the Society Islands material from his var. *lanosus*. For the latter he gave a Latin description but cited no type; his four figures illustrate indument from material obtained in the Philippines, Queensland, Tonga, and Sumatra. Variety *lanosus* should be lectotypified, presumably by one of the illustrated collections, but this should be done by a specialist on the family.

DISTRIBUTION: In the Fijian Region *Pipturus argenteus* var. *lanosus* may confidently be assigned a distribution including the New Hebrides, Fiji, Rotuma, Tonga, Niue, and Samoa; Skottsberg would extend this distribution westward to include Malasia and Queensland. Such species as *P. propinquus*, *P. velutinus*, and *P. incanus* have been ascribed to Fiji by various authors, but seemingly on the basis of misidentifications. Because of past confusions as to the identities of Fijian populations, I cite all specimens available to me representing the three distinct taxa that occur there.

LOCAL NAMES AND USES: Names recorded in Fiji are *ronga*, *rongga*, *tandau*, *feu*, and *rema*. Unspecified parts of the plant are reported to be used as a laxative, to treat skin diseases, and to quicken slow childbirths. In other areas the bast fibers are used in making string, as they have great tensile strength; the same is perhaps true for most species of *Pipturus*.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Wailevu Creek, *St. John* 18077. VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez* 13654; north of Natalau, *Degener* 15007; Korovou, east of Tavua, *Degener* 14947; vicinity of Nandarivatu, *Tohill* 786. DA 9730; western slope of Mt. Nanggaranambuluta, *Smith* 6315; near Matathuli, head of Nandala Creek, *Gibbs* 835; summit of Mt. Matomba, near Nandala, *Degener* 14462; slopes of Mt. Tomanivi, DA 12771 (*Melville et al.* 7163). NAMOSI: Hills east of Wainikoroi-luva River, near Namuama, *Smith* 9064. NAITASIRE: Nasauvere, Wainimala River, DA 14028; Waindina River Basin, *Tohill* 802 (coll. *MacDaniels*), *MacDaniels* 1048. OVALAU: Without further locality, *Gillespie* 4561.5. KORO: West coast, *Smith* 1078. VANUA LEVU: MBUA: Nandi Bay, *Harvey s. n.* FIJI without further locality, *U. S. Expl. Exped.*, *Harvey*, Nov., 1855; *Horne* 59, 345.

2. *Pipturus platyphyllus* Wedd. in DC. Prodr. 16 (1): 235¹⁹. 1869; Seem. Fl. Vit. 433. 1873; A. C. Sm. in Sargentia 1: 28. 1942; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972.

FIGURE 71C.

Pipturus velutinus sensu Gibbs in J. Linn. Soc. Bot. 39: 173. 1909; non Wedd.

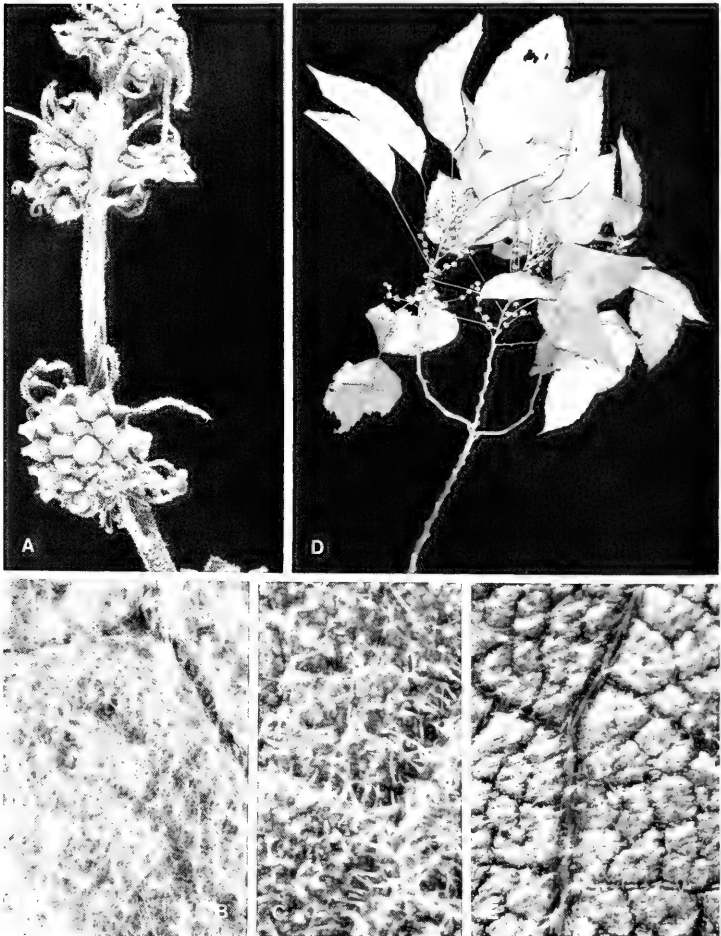


FIGURE 71. A & B, *Pipturus argenteus* var. *lanosus*; A, portion of inflorescence with clusters of fruits, $\times 6$; B, portion of lower surface of leaf blade, $\times 30$. C, *Pipturus platyphyllus*; portion of lower surface of leaf blade, $\times 30$. D & E, *Pipturus vitiensis*; D, distal portion of branchlet, with foliage and f inflorescences, $\times 1/3$; E, portion of lower surface of leaf blade, $\times 30$. A from *St. John* 18077, B from *Degener* 15007, C from *St. John* 18226, D from *Smith* 1108, E from *Smith* 1233.

A shrub or tree 1–6 m. high, often much-branched, with the trunk up to 10 cm. in diameter, found at elevations from near sea level to 800 m. in forest and thickets and on grassy slopes. The perianth segments are white to greenish, the anthers pale yellow, the stigma greenish yellow or pale green, and the achenes white. Flowering material has been obtained between August and January and fruits slightly later.

TIPIFICATION: The holotype is *Vieillard s. n.*, collected on Ovalau in 1855 and deposited in the Lenormand Herbarium (CN, now presumably transferred to P).

DISTRIBUTION: At present it is probably advisable to consider *Pipturus platyphyllus* a Fijian endemic, but it is quite possible that some of the Samoan specimens that Christophersen (in Bishop Mus. Bull. 128: 75–77. 1935) refers to his broad concept of *P. argenteus* actually represent *P. platyphyllus*, a very distinct species on the basis of Fijian material. In Tonga and Niue the genus seems to be represented only by *P. argenteus* var. *lanosus*.

LOCAL NAMES AND USE: The names *tangitha*, *rema*, and *ngala* have been recorded, and there is one record of the bark being used as a dye for native cloth.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez 13653*; Mt. Evans Range, *Greenwood 453*; vicinity of Nandarivatu, *Smith 6048*. MBA OF NAITASIRI: Between Navai and Nasonggo, *Gibbs 544*. SERUA: Flat coastal strip in vicinity of Ngaloa, *Smith 9449*. NAITASIRI: Vicinity of Matawailevu, Wainimala River, *St. John 18226*; Waimanu River, *DA 979*. REWA: Base of Mt. Korombamba, *H. B. R. Parham 131*; Vatuwanga hill, Suva, *H. B. R. Parham 110*. VANUA LEVU: MATHUATA: Interior mountains, *Greenwood 453A*; Mt. Numbuiloa, east of Lambasa, *DA 14626*. THAKAUNDRUVE: Mt. Uluinambathi, Savusavu Bay region, *Degener & Ordenez 13928*; Maravu, near Salt Lake, *Degener & Ordenez 14230*; Wainigata Station, *DA 12012*; Tunuloa Tikina, Natewa Peninsula, *Horne 533*. VANUA LEVU without further locality, *U. S. Expl. Exped. FIJI* without further locality, *Horne 1142*, *Gillespie*, Dec. 29, 1927.

3. *Pipturus vitiensis* A. C. Sm. in *Sargentia* 1: 29. 1942; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 144. 1972. FIGURE 71D & E.

Pipturus velutinus sensu Seem. Fl. Vit. 243. 1868; non Wedd.

Pipturus gracilipes A. Gray ex Wedd. in DC. Prodr. 16 (1): 235²⁰, nom. nud. 1869; Seem. Fl. Vit. 433, nom. nud. 1873.

Pipturus incanus sensu Drake, Ill. Fl. Ins. Mar. Pac. 303, quoad spec. vit. 1892; non. Wedd.

A shrub or slender tree 1–6 m. high, occurring at elevations from near sea level to 100 m., in thickets, on the edge of forest, and in coconut plantations, usually on limestone. Flowers and fruits have been obtained only in February and March.

TIPIFICATION AND NOMENCLATURE: The type is *Smith 1233* (GH HOLOTYPE; many ISOTYPES), collected March 2, 1934, on limestone formation on the island of Kambara. The source of the name *Pipturus gracilipes* is *U. S. Expl. Exped.* (GH, US); this name has no nomenclatural status and the specimens, although from Fiji, are without other locality.

DISTRIBUTION: Endemic to Fiji and limited to coastal situations; it is the only species of *Pipturus* definitely known to occur in the Lau Group.

LOCAL NAMES: *Ronga*, *ndongosele*.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 305*. TOTOYA: *Milne 92*. YATHATA: Naveranavula, *DA 15542*. VANUA MBALAVU: Nambavatu, *Tothill 764*; Namalata Islet, southern limestone section, *Smith 1456*. FULANGA: *Tothill 765*; on limestone formation, *Smith 1108*.

It seems likely that this species also occurs on the Lau island of Matuku, represented by *Naumann*, Nov. 24, 1875, collected during the S. M. S. *Gazelle* expedition, and reported by Engler (in Bot. Jahrb. 7: 451. 1886) as *Pipturus incanus*. The specimen has probably been destroyed, but no other species of *Pipturus* is known from the Moala Group of Lau.

9. *CYPHOLOPHUS* Wedd. in Ann. Sci. Nat. Bot. IV. 1: 198. 1854; Seem. Fl. Vit. 242. 1868.

Monoecious or dioecious shrubs or small trees, the stipules lateral, free, deciduous; leaves opposite, decussate, the blades often unequal in each pair, on petioles of different lengths, often bullate-rugose, serrate, pinnate-nerved, with punctiform cystoliths; inflorescences axillary or at defoliate nodes of branchlets, sessile, semiglobose, composed of often numerous and densely clustered flowers; ♂ flowers with the perianth 4-partite, the segments valvate, sometimes mucronate toward apex, the stamens 4, the rudimentary ovary obovoid; ♀ flowers with the perianth tubular-ventricose, contracted at apex, 2-dentate or unequally 4-dentate, becoming fleshy or subbaccate at maturity, the staminodes none, the ovary tightly enclosed by perianth, the stigma filiform, recurved, papillose to fimbriate on one side, semipersistent; achene immersed in the mature perianth, the seed with endosperm, the cotyledons elliptic.

LECTOTYPE SPECIES: Weddell included two new species, *Cypholophus macrocephalus* and *C. rufescens*, in his genus in 1854. The current ING card does not suggest a lectotype species, but Hutchinson (Gen. Fl. Pl. 2: 189. 1967) so indicates *C. macrocephalus*.

DISTRIBUTION: Malesia, including the Philippines, and eastward into Polynesia, with 30-35 species. Two indigenous species are represented in Fiji.

KEY TO SPECIES

- Larger leaves with petioles 1-5 cm. long, the blades lanceolate to narrowly ovate-elliptic, 5-21 cm. long, (1.5-) 2-7.5 cm. broad, 2-3 times as long as broad, bullate-rugose, finely crenulate-serrate with 4-6 teeth per centimeter, pale-hispidulous on both surfaces with hairs 0.3-1 mm. long; fruiting heads 5-10 mm. in diameter. 1. *C. heterophyllus*
- Larger leaves with petioles 3-15 cm. long, the blades broadly elliptic to ovate-orbicular, 15-25 cm. long, 10-17 cm. broad, about 1.5 times as long as broad, comparatively smooth, coarsely serrate with 2-4 teeth per centimeter, copiously pale-pilose on both surfaces with hairs often 1-2 mm. long; fruiting heads 10-20 mm. in diameter. 2. *C. macrocephalus* var. *mollis*

1. *Cypholophus heterophyllus* (Wedd.) Wedd. in DC. Prodr. 16(1): 235¹¹. 1869; Seem. Fl. Vit. 432. 1873; Engl. in Bot. Jahrb. 7: 450. 1886; J. W. Parham, Pl. Fiji Isl. 98. 1964, ed. 2. 140. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 31. 1972. FIGURE 72A.

Cypholophus macrocephalus var. *heterophyllus* Wedd. in Arch. Mus. Hist. Nat. 9: 435. 1857.

Boehmeria harveyi Seem. in Bonplandia 9: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862, Fl. Vit. 242, pro syn. t. 62. 1868.

Cypholophus macrocephalus sensu Seem. Fl. Vit. 242. 1868, op. cit. 432. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 302, quoad spec. vit. 1892; non Wedd.

As it occurs in Fiji, this locally frequent species is a shrub or small tree 1-5 m. high, often much branched or with slender branches, found at elevations from near sea level to 1,150 m. in dense or open forest or on its edges, hillside thickets, pastures, and occasionally in beach thickets. Its ♂ pedicels are rich pink, its perianth red to dull or rich pink, its anthers white, and its styles red. Flowering and fruiting specimens are seen throughout the year.

TYPIFICATION AND NOMENCLATURE: In the protologue of *Cypholophus macrocephalus* var. *heterophyllus*, Weddell cited: "in sylvis et ruderalis ins. Fidji (Milne) et Viti (Jacquinot)." Three Milne specimens have been placed in the type cover at κ , nos. 54 and 250 from Ovalau and no. 160 from Ngau; none of these were annotated by Weddell. The Jacquinot specimen was probably collected on Ovalau in October, 1838, and is presumably at ρ together with Milne duplicates. A lectotype should be chosen

from the P specimens studied by Weddell. Seemann intended to place his manuscript name *Boehmeria harveyi* in the synonymy of *C. macrocephalus*, but the name was validated by the publication of his *t.* 62, with analytic details (ICBN, Art. 44.1). The Fijian specimens cited are *Seemann 431* (from Kandavu), *Graeffe 20* (BM, Fiji without further locality), *Harvey s. n.* (Fiji without further locality), and *Milne* (doubtless referring to the Ovalau and Ngau specimens mentioned above). The sketches for Seemann's illustration are on the Harvey specimen, and in view of the epithet also this should be taken as the lectotype of *Boehmeria harveyi* (K LECTOTYPE; ISOLECTOTYPE at BM).

DISTRIBUTION: *Cypholophus heterophyllus* is doubtless a widespread species, specimens having been seen from the Societies, Samoa, and the Philippines; no doubt it occurs in other Pacific and Malesian archipelagoes. However, no representatives of it are recorded from Tonga or Niue. More than 40 Fijian collections have been studied and the species probably occurs on most of the high islands.

LOCAL NAMES AND USES: Recorded names are *kalolo*, *kaulolo*, *rere*, *rambe*, *ai lambaniituna*, and *mataulomboroko*. The leaves are said to be used with oil as a massage for broken bones, and the inner bark is sometimes used for making cloth. In Samoa the bast fibers are highly valued for making fine mats, as discussed by Seemann and B. E. V. Parham (cited above).

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Wailevu Creek, *St. John 18076*. VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 38*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4357*; vicinity of Nandarivatu, *Vaughan 3224*; Mt. Nanggaranambuluta, *DA 13544*; valley of Nggaliwana Creek, near Navai, *Webster & Hildreth 14123*; slopes of Mt. Tomanivi, *Smith 5221*. NAMOSE: Mt. Voma, *DA 564*. NAITASIRI: Matawailevu, Wainimala River, *St. John 18215*; Suva Pumping Station, *Degener & Ordenez 13741*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 195*; Ono Island, *DA 14956*. OVALAU: Vicinity of Levuka, *Parks 20496*. VANUA LEVU: MATHUATA: Mountains of interior, *Greenwood 38A*. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 390*. Also collected on MATUKU, *Naumann*, Nov. 24, 1875, noted by Engler (1886, cited above).

The leaves of this distinctive taxon are often unequal in each pair, the smaller ones being sessile and with ovate blades 1–4 cm. long; sometimes, however, the leaves are equal and of the larger type, as shown in Seemann's 1868 illustration.

2. *Cypholophus macrocephalus* Wedd. var. *mollis* (Wedd.) Wedd. in Arch. Mus. Hist. Nat. 9: 435. 1857, in DC. Prodr. 16 (1): 235¹⁰. 1869. FIGURE 72B.

Boehmeria mollis Wedd. in Ann. Sci. Nat. Bot. IV. 1: 203. 1854.

As it infrequently occurs in Fiji, *Cypholophus macrocephalus* var. *mollis* is a sometimes slender shrub 1–3 m. high, found in dense forest at elevations of 300–650 m. Its fruiting heads are red or crimson. Flowers and fruits have been obtained in April, June, and November.

TYPIIFICATION AND NOMENCLATURE: In his protologue of 1854 Weddell cited only: "Ins. Taiti," but in making his 1857 combination he expanded this to: "in locis udis excelsisque ins. Taiti (Panchet). - v. s." The holotype is therefore a Panchet specimen from Tahiti, probably at P. It may be noted that in his 1869 reference to the variety, Weddell cited as a synonym *Boehmeria moluccana* Bl., referring to: "In ins. Moluccis et Sandwicensibus." However, these data affect neither the typification nor the probable distribution.

DISTRIBUTION: The only specimens I have seen that appear definitely referable to *Cypholophus macrocephalus* var. *mollis* are from the Societies, Cook Islands, Samoa,

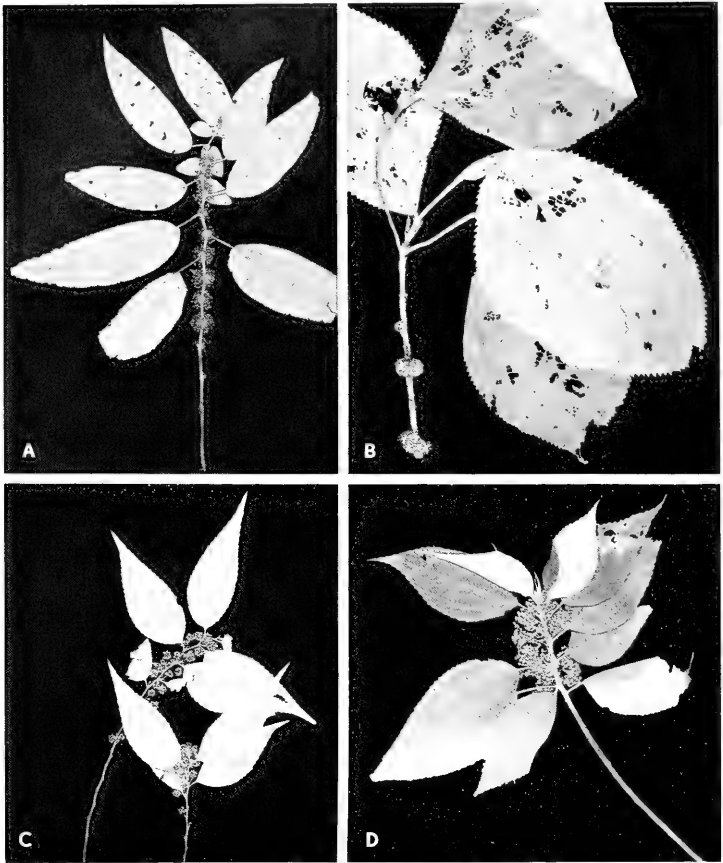


FIGURE 72. A, *Cypholophus heterophyllus*, from DA 564; distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/4$. B, *Cypholophus macrocephalus* var. *mollis*, from Smith 1855; distal portion of branchlet, with foliage and fruiting inflorescences, $\times 1/4$. C, *Leucosyke corymbulosa*, from Smith 20; distal portions of branchlets, with foliage and fruiting inflorescences, $\times 1/4$. D, *Maoutia australis*, from Smith 183; distal portion of branchlet, with foliage and fruiting inflorescences, $\times 1/4$.

and Fiji, but its distribution may be wider than this. The distribution of the typical variety of *Cypholophus macrocephalus* Wedd. (in Ann. Sci. Nat. Bot. IV. 1: 198. 1854) is also uncertain, but it may replace var. *mollis* westward of Fiji. In Fiji var. *mollis* is known only from Vanua Levu.

LOCAL NAME: *Lawa* (recorded for *Smith 515*).

AVAILABLE COLLECTIONS: VANUA LEVU: THAKAUNDROVE: Southern slope of Korotini Range, below Navitho Pass, *Smith 515*; Navavau, *DA 16047*; eastern buttress of Mt. Ndikeva, *Smith 1855*.

Cypholophus macrocephalus has not previously been reported from Fiji, but the specimens listed above are very distinct from *C. heterophyllus* and agree well with material from Samoa, the Cook Islands, and the Societies referred to var. *mollis*.

10. LEUCOSYKE Zoll. ex Moritz, Syst. Verz. Zollinger, 76. 1845 or 1846.

Missiessya Gaud. ex Wedd. in Ann. Sci. Nat. Bot. IV. 1: 194. 1854; Seem. Fl. Vit. 244. 1868.

Diocious shrubs or small trees, the stipules intrapetiolar, connate, 2-lobed or almost completely united, caducous; leaves alternate, the blades crenate or serrate to nearly entire, 3-nerved, white-tomentose beneath, with punctiform cystoliths; inflorescences pseudoaxillary, globose-glomerulate or capitate, borne on simple peduncles, the receptacle becoming fleshy at maturity; ♂ flowers with scarious bracts, the perianth 5-partite, the segments valvate, the stamens 5, the rudimentary ovary pilose; ♀ flowers with the perianth minute, cupuliform, 4- or 5-dentate or -lobed, the staminodes none, the ovary obliquely ovoid, exceeding the perianth, the stigma capitate, densely papillose or ciliate; achene ovate, somewhat compressed, the perianth not enlarged, the seed with sparse endosperm, the cotyledons elliptic.

TYPE SPECIES: *Leucosyke javanica* Zoll. ex Moritz. No lectotype species is indicated for *Missiessya* on the current ING card.

DISTRIBUTION: Malesia and eastward into Polynesia, with 35-40 species. A single indigenous species occurs in Fiji.

1. *Leucosyke corymbulosa* (Wedd.) Wedd. in DC. Prodr. 16(1):235¹⁰. 1869; Seem. Fl. Vit. 433. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 303. 1892; Guillaumin in J. Arnold Arb. 14: 61. 1933; Christophersen in Bishop Mus. Bull. 128: 79. 1935; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972; St. John & A. C. Sm. in Pacific Sci. 25: 322. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 13. 1972.

FIGURE 72C.

Missiessya corymbulosa Wedd. in Arch. Mus. Hist. Nat. 9: 475. 1857; Seem. in Bonplandia 9: 259, as *Missiessya c.* 1861, Viti, 441. 1862, Fl. Vit. 244. 1868; Turrill in J. Linn. Soc. Bot. 43: 39, as *Misseissya c.* 1915.

Abundant in Fiji, this species is a shrub or tree 2-8 m. high, often slender and freely branched, found from near sea level to an elevation of 1,000 m. in dense, dry, or open forest or on its edges, and in thickets often near the coast. Its anthers and achenes are white. Flowers and fruits occur throughout the year.

TYPIFICATION: In his 1857 publication Weddell cited: "Hab.-In insulis *Viti s. Fidji* (Cunningham, Milne, Wilkes, etc.).-(v. s. in Herb. Hooker.)" I was unable to locate any of these specimens at K, nor are they duplicated at BM. A *U. S. Expl. Exped.* (i. e. Wilkes) specimen is available at US, but at the moment I prefer not to designate a lectotype.

DISTRIBUTION: Specimens are at hand from the New Hebrides, Horne Islands, Samoa, and Cook Islands as well as Fiji, but the species may indeed occur to the east or

west of these archipelagoes. In Fiji it is often so locally abundant as to seem like a "weed tree," but it is doubtless indigenous. No collections have been recorded from Tonga or Niue. About 60 collections are available from Fiji.

LOCAL NAMES AND USES: This common species has been recorded under a plethora of names: *kalakuro*, *karokarokuro*, *matandra*, *mataulomboroko*, *mbotheu*, *molatha*, *ndongosele*, *ndraningata*, *ndrauningata*, *ndrokonangata*, *nggarokarokuro*, *rokovukovu*, *tavitanggai*, *veu*, and *vusui*; I cannot say which of these represent informants' pleasantries. Tea is made from the leaves, and juice extracted from the leaves is used medicinally for earache and for flesh wounds.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Waroro Creek, *St. John 18065*. VITI LEVU: M̄BA: Near Lautoka, *Greenwood 72*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4358*; vicinity of Nandarivatu, *im Thurn 69*; Mt. Nanggaranambuluta, *Gillespie 4075*. NANDRONGA & NAVOSA: Singatoka River Valley, *DA 16028*; Nakalavo, *H. B. R. Parham 212*. SERUA: Without further locality, *DA 12470 (DF 119)*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8580*; Navunikambi, Wainikoroiluva River, *DA 14993*. RA: Mountains near Penang, *Greenwood 43B*; Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15387*. NAITASIRI: Mata-wailevu, Wainimala River, *St. John 18201*; Tholo-i-suva, *DA 64*. TAILEVU: Naingani Island, *DA 3340*. REWA: Mt. Korombamba, *DA 3841*; vicinity of Suva, *Meebold 16699*. KANDAVU: Namalata Isthmus region, *Smith 20*. MAKONDRONGA: *Degener & Ordenez 13809*. NGAU: *MacGillivray*, Sept., 1854; hills east of Herald Bay, inland from Sawaieke, *Smith 7810*. VANUA LEVU: MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6727*; Wainggili, Lambasa, *DA 13756 (DF 240)*. THAKAUDROVE: Southern slope of Valanga Range, *Smith 380*; near Salt Lake, *Bierhorst F197*. MATUKU: Near mangrove swamp, *Bryan 245*. VANUA MBALAVU: Central volcanic section, near Lomaloma, *Smith 1419*. LAKEMBA: Tumbou River forks, *Garnock-Jones 851*. FIJI without further locality, *U. S. Expl. Exped., Home*, in 1852, *Harvey*, in 1855, *Seemann 424*.

The leaf blades of *Leucosyke corymbulosa* and *Maoutia australis* have the same type of white, tangled, appressed indument on the lower surfaces that is so characteristic of *Pipturus argenteus* var. *lanosus*, but obvious inflorescence characters make the three taxa readily distinguishable. The leaves of *Leucosyke corymbulosa* are very variable in size, and in forest shade their blades may be as large as 20 × 5.5 cm.

11. MAOUTIA Wedd. in Ann. Sci. Nat. Bot. IV. 1: 193. 1854; Seem. Fl. Vit. 244. 1868.

Monoecious shrubs or small trees, the stipules intrapetiolar, connate and usually deeply bifid; leaves alternate, the blades crenate to serrate, 3-nerved at base, pinnate-nerved distally, white-tomentose beneath, with punctiform cystoliths; inflorescences axillary or arising from defoliate branches, lax, cymose, often paired, bearing small, few-flowered heads; ♂ flowers with the perianth depressed-globose in bud, 5-partite, the segments valvate or inflexed-imbricate, the stamens 5, the rudimentary ovary tomentose; ♀ flowers lacking a perianth or this minute and obliquely cupuliform, the staminodes none, the ovary straight, appressed-pilose, the stigma capitellate, pilose, persistent; achene ovate, compressed or subtrigonal, the seed with sparse endosperm, the cotyledons elliptic or oblong.

LECTOTYPE SPECIES: Seven species (one of them dubious) were included by Weddell in 1854. The current ING card does not indicate a lectotype species, but Hutchinson (Gen. Fl. Pl. 2: 192. 1967) denotes *Maoutia platistigma* Wedd. as the type (i. e. lectotype) species.

DISTRIBUTION: India to Malesia and eastward into Polynesia, with about 15 species. One indigenous species occurs in Fiji.

1. *Maoutia australis* Wedd. in Arch. Mus. Hist. Nat. 9: 480. 1857; Seem. Fl. Vit. 245. 1868; Wedd. in DC. Prodr. 16 (1): 235³². 1869; Engl. in Bot. Jahrb. 7: 451. 1886;

Drake, Ill. Fl. Ins. Mar. Pac. 304. 1892; Gibbs in J. Linn. Soc. Bot. **39**: 173. 1909; Yuncker in Bishop Mus. Bull. **184**: 37. 1945; J. W. Parham, Pl. Fiji Isl. 100. 1964, ed. 2. 143. 1972; P. S. Green in Kew Bull. **23**: 345. 1969; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 94. 1972; St. John in Phytologia **36**: 369. 1977. FIGURE 72D.

Maotia (sic) *tahitensis* Wedd. ex Seem. in Bonplandia **9**: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862.

An often slender shrub or small tree 1–8 m. high, occurring between sea level and 1,100 m. in dry or secondary forest or on its edges, in hillside thickets, and among reeds. The inflorescences have a pale pink or pinkish brown cast, and the ♂ perianth is greenish brown or pinkish. Flowers and fruits occur at all seasons.

TIPIFICATION: In 1857 Weddell cited: "Hab.—In insulis oceanicis *Fidji* s. *Viti* (Milne, Jacquinet, Le Guillou), Societatis (Bidwill) et *Taiti* (secund. specim. in Herb. Jaubert).—(v. s.)" A lectotype should be selected from among the specimens at p annotated by Weddell.

DISTRIBUTION: Specimens have been seen from Tonga, the Horne Islands, Samoa, and the Societies, as well as Fiji, but the species may also occur in adjacent areas. In Fiji it is fairly abundant on several of the high islands, about 35 collections being at hand.

LOCAL NAMES AND USE: Recorded names are *ndangasele*, *ndongosele*, *nggala*, *ngwala*, *ngwaila*, *ronga*, *sinu*, *waila*, and *waluwalu*. The species is medicinally used in an unspecified manner for lumps in the groin (*St. John 18225*).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MUA: Mountains near Lautoka, *Greenwood 346*; Savundamatau Creek, west of Nandarivatu, *Webster & Hildreth 14244*; vicinity of Nandarivatu, *Gibbs 639*; western slope of Mt. Nanggaranambuluta, *Smith 4808*; vicinity of Nandala, *O. & I. Degener 32108*. NANDRONGA & NAVOSA: Upper Singatoka River Valley, *DA 10827*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5586*. SERUA: Vicinity of Namboutini, *DF 388*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2561*. NAITASIRE: Matawailevu, Wainimala River, *St. John 18225*; vicinity of Nandurulou-lou, *DA 650*. KANDAVU: Namalata Isthmus region, *Smith 183*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7668*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7823*. VANUA LEVU: MUA: Vicinity of Nandi Bay, *Harvey*, Nov., 1855. THAKAUNDROVE: Southern slope of Valanga Range, *Smith 366*; Wainigata, *DA 13107*. MATUKU: *Bryan 264*. FIJI without further locality, *Seemann 425*.

ORDER CASUARINALES

Practically all recent phylogenists consider the family Casuarinaceae to be highly isolated and to require its own order. In many respects the family is one of the most reduced, and thus highly evolved, of the woody, often apetalous alliance that seems ultimately derived from a hamamelid ancestry.

FAMILY 66. CASUARINACEAE

CASUARINACEAE R. Br. in Flinders, Voy. Terra Australis **2**: 571, as *Casuarineae*. 1814.

Monoecious or dioecious, anemophilous trees or shrubs, lacking stipules, with slender, articulate, green branchlets, these cylindrical and grooved or angular, bearing at nodes whorls of 4–16 scale leaves, these basally connate and alternating at successive nodes; ♂ inflorescences simple or compound spikes with short internodes, borne toward ends of branchlets, at each node bearing a cup formed of combined floriferous bracts, each flower subtended also by 2 bracteoles and composed of 2 tepals and a solitary stamen, the filament elongating at anthesis, the anther basifixed, 2-locular, longitudinally dehiscent; ♀ inflorescences spherical or ovoid heads borne laterally at tips of branchlets, each flower subtended by 1 bract and 2 free bracteoles, the perianth lacking, the ovary small, superior, bilocular but soon becoming unilocular by abor-

tion, the ovules usually 2 (only 1 fertile), collateral on a parietal placenta, the style deeply bifid, the basal portion short, the stigmatic branches elongated, linear; fruits crowded into a woody head with persistent bracteoles, these separating at maturity to expose the fruit; fruit a flattened, terminally winged nut, the seed solitary, without endosperm, often polyembryonic, the embryo(s) straight, with large, flat cotyledons.

DISTRIBUTION: Southeastern Asia, Malesia, and Australia eastward into Polynesia, with four genera and about 65 species.

USEFUL TREATMENTS OF FAMILY: Moseley, M. F., Jr. Comparative anatomy and phylogeny of the Casuarinaceae. Bot. Gaz. 110: 231-280. 1948. Swamy, B. G. L. A contribution to the life history of *Casuarina*. Proc. Amer. Acad. Arts 77: 1-32. 1948. Johnson, L. A. S. Notes on Casuarinaceae. Telopea 2 (1): 83-84. 1980.

Long considered to be composed of a single genus, the Casuarinaceae are now taken by their principal current student, L. A. S. Johnson, to include four genera, two of which still remain to be formally described. Two genera are each represented in Fiji by a single indigenous species, and a representative of a third genus has been cultivated in Fiji and may still persist there. I am greatly indebted to Dr. Johnson for suggestions here incorporated, pending publication of his detailed discussions of the family. His 1980 preliminary note, cited above, was kindly prepared in order to validate names here used.

KEY TO GENERA

- Distal branchlets cylindrical or angular, with deep, pilose grooves in which the stomata are concealed; leaves and bracts of ♂ inflorescences in whorls of 6-16; bracts and paired bracteoles of ♀ inflorescences usually in more than 8 vertical rows. 1. *Casuarina*
- Distal branchlets quadrangular, usually glabrous, the intercostal furrows shallow and open, exposing the stomata; leaves and bracts of ♂ inflorescences in whorls of 4; bracts and paired bracteoles of ♀ inflorescences in 8 vertical rows. 2. *Gymnostoma*

1. CASUARINA Adanson, Fam. Pl. 2: 481. 1763; Seem. Fl. Vit. 262, p. p. 1868.

Distal branchlets cylindrical or angular and deeply grooved, the bases of the grooves puberulent or pilose, the stomata borne within the grooves; leaves and floriferous bracts of ♂ inflorescences in whorls of 6-16; ♀ inflorescences with bracts and paired bracteoles usually in more than 8 vertical rows.

TYPE SPECIES: *Casuarina equisetifolia* J. R. & G. Forst.; see comment below.

DISTRIBUTION: That of the family, with about 45 species.

The authorship of the genus and the correct name of its type species have been subjects of disagreement. Adanson's publication of 1763 is cited as the first valid generic use by ING, and *Casuarina equisetifolia* J. R. & G. Forst. is considered the first valid name for the type species by L. A. S. Johnson and most other concerned botanists. However, Merrill (Interpret. Rumph. Herb. Amb. 180. 1917) indicated that Linnaeus (Amoen. Acad. 4: 123, 143. 1759) had adequately referred to Rumphius's Herb. Amb. 3: 86. t. 57. 1743, and that Linnaeus should be considered the author of the genus and species (as *C. "equiseifolia"*). More recently, Fosberg and Sachet (in Smithsonian Contr. Bot. 24: 4. 1975) have accepted as valid the reference to Rumphius given by Linnaeus, Herb. Amb. 12, as *Casaarina*. 1754, which would require use of the binomial *C. litorea* L. in place of *C. equisetifolia*. I am inclined to agree that the 1754 publication of *Casuarina litorea* meets the requirements of ICBN, Arts. 32.3 and 42.1. However, in deference to Dr. Johnson's long experience with the family, I here follow his suggestions in respect to the generic and specific nomenclature. He has in preparation a detailed discussion of the complex nomenclatural problems involved in this case, pending consideration of which it seems advisable to follow well-established usage.

1. *Casuarina equisetifolia* J. R. & G. Forst. Char. Gen. Pl. 52. t. 52. 1775, ed. 2. 104. t. 52. 1776; Seem. in Bonplandia 9: 259. 1861, Viti, 442. 1862, Fl. Vit. 263. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 304. 1892; Gibbs in J. Linn. Soc. Bot. 39: 173. 1909; Guillaumin in J. Arnold Arb. 13: 109. 1932; Yuncker in Bishop Mus. Bull. 178: 44. 1943, in op. cit. 184: 34. 1945, in op. cit. 220: 92. 1959; J. W. Parham, Pl. Fiji Isl. 88. fig. 36. 1964, ed. 2. 131. fig. 38. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 58. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 318. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 128. 1972; L. A. S. Johnson in Telopea 2 (1): 84. 1980. FIGURE 81 (upper).

"*Casuarina*" *litorea* L. Herb. Amb. 12. 1754.

Casuarina "*equisetifolia*" L. Amoén. Acad. 4: 143. 1759.

As it occurs in Fiji, *Casuarina equisetifolia* is an abundant tree 3–20 m. high, with a trunk to 80 cm. or more in diameter and with often drooping branches and branchlets, occurring between sea level and about 475 m. in dry seaside areas such as sandy beaches, rocky coasts, and coastal forest, and inland on grass- and reed-covered hills and in open forest. It is characteristic of areas of poor soil that are volcanic in origin, although sometimes it occurs on limestone. Its ♂ flowers have red filaments and red-brown or yellowish anthers, its ♀ flowers have red styles, and its fruiting heads are at first green and eventually brown. It may be found throughout the year in flower and fruit.

TYPIFICATION: In proposing the binomial *Casuarina equisetifolia*, the Forsters cited "*Casuarina littorea* Rumph. amb. III. lib. iv. c. 50 tab. 57."

DISTRIBUTION: Essentially that of the genus, except that in Australia it is confined to northern and northeastern littoral areas and is absent from the rest of the continent, where many other species of the genus occur. In Polynesia it is difficult to tell whether or not *Casuarina equisetifolia* is always indigenous; in Hawaii and probably in most equatorial archipelagoes it was an introduction, as in many other tropical and subtropical areas. I have examined about 55 Fijian collections, but even these do not give a true picture of its abundance in certain habitats.

LOCAL NAMES AND USES: The usual Fijian name is *nokonoko*, but also recorded are *nokonoko ndamu*, *nggaro*, *thau*, *velau*, and *nakure*, some of these names also being used for *Gymnostoma vitiense*. The English names *ironwood* and *she oak* are sometimes used. The hard wood, once prized for war clubs, is now considered suitable for timbers such as house posts and pit props in mines. The bark is sometimes used medicinally, providing an extract taken internally for rheumatism or as an emetic. The somber aspect of *nokonoko* and the sighing sound of wind through its branches have caused it to be planted extensively near burial places.

REPRESENTATIVE COLLECTIONS: YASAWAS: NATHULA: Naisilisili Village, *Weiner 241*. WAYA: Nakawa Gulch, *St. John 18155*. VITI LEVU: MBA: Lautoka, *Greenwood 220*; vicinity of Tumbenasolo, valley of Namosi Creek, *Smith 4630*. NANDRONGA & NAVOSA: Kumbuna River, *DF 294 (Damani 22)*; Vatukarasa, *O. & I. Degener 32201*. RA: Narewa, *DA 9495*; Rakiraki, *DA 9674*. TAILEVU: Matavatathou, *DA 11281*; Nakalawatha, *DA 1372*. KANDAVU: Western end of island, near Cape Washington, *Smith 316*. OVALAU: Near Levuka, *Gibbs 861*. NGAU: *Milne 126*. VANUA LEVU: MBUA: Sekethi Creek, *H. B. R. Parham 443*. MATHUATA: Sarava, Lambasa, *DF 689 (Damani L.18)*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6430*. THAKAUNDROVE: Maravu, near Salt Lake, *Degener & Ordóñez 14127*. TAVEUNI: Between Waiyevo and Wairiki, *Gillespie 4710*. MOALA: *Milne 127*. MATUKU: On edge of lowland forest, *Bryan 253*. TOTOYA: *Milne 94*. VANUA MBALAVU: Northern limestone section, *Smith 1493*; near Lomaloma, *Garnock-Jones 1078*. LAKEMBA: Nukunuku Village, *Garnock-Jones 815*. NAVUTU-I-RA: *Bryan 468*. FIJI without further locality, *Seemann 570*.

2. *Casuarina torulosa* Ait. Hort. Kew. 3: 320. 1789; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 10: 113. 1939.

A shapely tree to 25 m. or more high where indigenous, with a trunk diameter of 45–60 cm. or more, the outer bark thick and corky, the lower branches often drooping, the crown spreading and open.

TYPIFICATION: The species was described from a plant cultivated at Kew, introduced in 1772 and originally obtained in New South Wales, Australia, by Banks on the first Cook voyage.

DISTRIBUTION: The species is widespread in eastern New South Wales and Queensland and is cultivated elsewhere, including Hawaii. No herbarium voucher supports the Fijian record, but Parham in 1939 stated that the species had been introduced in 1927 and was growing well on the property of W. L. Wallace on Tovu Island, Ra Province, Viti Levu. It may still persist in that area.

LOCAL NAMES: The names *mountain oak* and *red oak* were mentioned by Parham; the usual name in Australia is *forest oak*, and in Hawaii the species is known as *ruddy ironwood* or *corkbark ironwood*.

Casuarina torulosa is not accounted for in my key; in fact it is not a true *Casuarina* but will be placed in a new genus, with many other strictly Australian species, by L. A. S. Johnson. It differs from species of *Casuarina* in having its leaves and bracts in whorls of 4 (or 5 on ♀ inflorescence-bearing branches) and in various other features to be elaborated by Dr. Johnson.

2. *Gymnostoma* L. A. S. Johnson in *Telopea* 2 (1): 83. 1980.

Distal branchlets quadrangular, usually glabrous, the surfaces between ridges concave and bearing exposed stomata; leaves and floriferous bracts of ♂ inflorescences in whorls of 4; ♀ inflorescences with bracts and paired bracteoles in 8 vertical rows.

TYPE SPECIES: *Gymnostoma nodiflorum* (Thunb.) L. A. S. Johnson, a New Caledonian endemic.

DISTRIBUTION: About 18 species from western Malesia to northeastern Australia, New Caledonia, and Fiji, where the generic range terminates with a single endemic species.

1. *Gymnostoma vitiense* L. A. S. Johnson in *Telopea* 2 (1): 84. 1980.

FIGURE 81 (lower).

Casuarina nodiflora sensu Seem. in *Bonplandia* 9: 259. 1861, Viti, 442. 1862, Fl. Vit. 262. 1868; Drake, Ill. Fl. Ins. Mar. Pac. 304. 1892; Gibbs in *J. Linn. Soc. Bot.* 39: 173. 1909; J. W. Parham, *Pl. Fiji Isl.* 88 (excl. fig. 37). 1964, ed. 2. 131 (excl. fig. 39). 1972; non Thunb. nec Forst. f.

The endemic Fijian *Gymnostoma*, only very recently described, is a tree 3–27 m. high, occurring from near sea level to an elevation of 900 m. in dense or open forest, in ridge forest, in grassland thickets, and rarely on open forehills. It is often locally abundant and even dominant in certain areas, with a straight trunk up to 2 m. in diameter and with a somewhat flattened crown. Mature fruiting heads may attain a diameter of 3.5 cm. Flowers have been noted between December and May, while fruits may be expected throughout the year.

TYPIFICATION: The type is *L. A. S. Johnson* (NSW 143813 HOLOTYPE), collected Aug. 20, 1969, at Tholo-i-suva, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands; I have examined 60 collections.

LOCAL NAMES AND USES: *Thaukuro* (*thaukoro*) and *velau* (*velao*) are the usual Fijian names, but also recorded are *thau*, *kuthau*, *ngunungunu*, and *yaongunu*. *Thaukuro* is a well-regarded timber tree, its tough wood, like that of *nokonoko*, having

once been used for war clubs but now used primarily for house timbers. Saplings are said to be suitable for fishing rods.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 193*; vicinity of Nandarivatu, *Gibbs 770*; Nandala Creek, *Vaughan 3390*. NANDRONGA & NAVOSA: Nausori Highlands, *Damanu NH.27*; southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4561*; near Korolevu, *Krauss*, Jan., 1958. SERUA: Inland from Namboutini, *DF 725 (S1420/2)*; Korovisilou Creek, *Damanu KL.7*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9467*; Taunovo River, *DA 13779 (DF 183)*. NAMOSI: Near summit of Mt. Vakarongasiu, *Gillespie 3290*; Nambukavesi Creek, *DF 406 (Damanu 78)*. NAITASIRI: Near Viria, *Meebold 16520*; Waimanu River, *DA L.13259 (Berry 50)*; Tholo-i-suva, *Stauffer & Kuruvoli 5853*. REWA: Namboro, *DA 5927*; Mt. Korombamba, *Parks 20248*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 90*; Naikorokoro, *DF 1020 (S1420/5)*. "OVALAU and VITI LEVU:" *Seemann 571* (in part from Port Kinnaird, Ovalau). NGAU: *Milne 228*. VANUA LEVU: MBUA: Koromba Forest, Wairiki, *DA 15134*; Nandi Bay, *Milne 207*. MATHUATA: Korovuli River, *DA 13491*; southern base of Mt. Numbuiloa, east of Lambasa, *Smith 6487*. THAKAUNDOVE: Mt. Kasi, Yanawai River region, *Smith 1829*; Maravu, near Salt Lake, *Degener & Ordonez 14128*. TAVEUNI: Waitavala Estate, *Weiner 71-7-31A*. FIJI without further locality, *U. S. Expl. Exped., Home, Williams, Horne 445*.

Although the Fijian *Gymnostoma* in all treatments of Fijian plants has been referred to the New Caledonian *Casuarina nodiflora* (now to be known as *Gymnostoma nodiflorum* (Thunb.) L. A. S. Johnson), it is more closely related to certain New Guinean species and to the New Caledonian species currently indicated as *Casuarina chamaecyparis* Poisson (Johnson, in litt.).

ORDER BALANOPALES

The very distinct and apparently long-isolated family Balanopaceae suggests the Fagaceae, Betulaceae, and Myricaceae as much as any other families. Its ♀ flowers are solitary, and its fruit superficially suggests an acorn, although subtended by involucre bracts that do not become conerescent. The Balanopaceae differ from the three mentioned families in having seeds with endosperm and also from each in various combinations of other characters (Carlquist, 1980, cited below). It seems advisable to follow Takhtajan in recognizing the four mentioned families as composing four separate orders.

FAMILY 67. BALANOPACEAE

BALANOPACEAE Benth. in Benth. & Hook. f. Gen. Pl. 3: 341, as *Balanopseae*. 1880.

Dioecious trees or shrubs, the stipules present as a pair of minute, inconspicuous teeth at base of petiole, the leaves alternate or pseudovercillate, with simple, often denticulate blades; ♂ inflorescences racemose or spicate, axillary or borne on defoliate branches, usually solitary, the peduncle inconspicuous, the flowers several to many, subtended by small bracts, the proximal flowers short-pedicellate, the distal ones sessile, the receptacle bearing a much reduced perianth composed of 1 or more teeth, these often fewer than stamens; stamens 1-12 (usually 3-6), the filaments short, sometimes succulent, the anthers oblong-ellipsoid, dehiscing by lateral clefts, the rudimentary ovary usually lacking; ♀ flowers solitary, axillary, the pedicels with several, small, dispersed bracts, surmounted by several larger, involucre, persistent bracts subtending the ovary, the staminodes none, the ovary imperfectly 2- or 3-locular, the ovules 2 in each locule, basal, apotropous (anatropous with the raphe ventral), the styles 2 or 3, proximally connate, distally divergent and bipartite, subsistent; fruit drupaceous, with 1-3 pyrenes, the seeds solitary in each pyrene, erect, with fleshy endosperm (crushed in mature fruits) and a large, straight embryo.

DISTRIBUTION: Queensland, New Caledonia, the New Hebrides, and Fiji, composed of a single genus with nine species. The species indigenous in the New Hebrides and Fiji terminates the range of the family.

USEFUL TREATMENTS OF FAMILY: Hjelmqvist, H. Studies on the floral morphology and phylogeny of the Amentiferae. Bot. Not. Suppl. 2: 1-171. 1948. Carlquist, S. Anatomy and systematics of Balanopaceae. Allertonia 2: 191-246. 1980.

1. *Balanops* Baill. in *Adansonia* 10: 117. 1871; A. C. Sm. in *J. Arnold Arb.* 36: 276. 1955; Carlquist in *Allertonia* 2: 207. 1980.

Trilocularia Schlechter in *Bot. Jahrb.* 39: 94. 1906.

Characters and distribution of the family.

TYPE SPECIES: The type species of *Balanops* is *B. vieillardii* ("Vieiard?") Baill. (vide Bullock in *Kew Bull.* 14: 40. 1960); that of *Trilocularia* is *T. sparsifolia* Schlechter. The genera were considered distinct on the basis of the first having a bilocular ovary and two styles, the second a trilocular ovary and three styles; further study, however, has shown both conditions to exist in the same species.

1. *Balanops pedicellata* (Guillaumin) Hjelmqvist in *Bot. Not.* 113: 376. 1960; Carlquist in *Allertonia* 2: 209. fig. 5, 6, 61, 62, 87, 88, 102. 1980. FIGURES 73, 74.

Ternstroemiaecearum gen. nov. Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862.

Ternstroemiaecearum nov. gen. Seem. ex A. Gray in *Proc. Amer. Acad. Arts* 5: 315. 1862.

Ternstroemia vitiensis Seem. *Fl. Vit.* 14. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 116. 1890.

Trilocularia pedicellata Guillaumin in *J. Arnold Arb.* 13: 95. 1932.

Trilocularia vitiensis A. C. Sm. in *Sargentina* 1: 11. fig. 2. 1942.

Balanops vitiensis Hjelmqvist in *Bot. Not. Suppl.* 2: 64. fig. 24, G-K. 25, e. 1948; A. C. Sm. in *J. Arnold Arb.* 31: 149. 1950, in op. cit. 36: 277. 1955; Hjelmqvist in *Bot. Not.* 113: 376. 1960; J. W. Parham, *Pl. Fiji Isl.* 87. 1964, ed. 2. 130. 1972; Evans in *Kew Bull.* 20: 303. 1966.

A tree, sometimes with a compact crown and sometimes slender, 3-15 m. high, or a gnarled shrub 2 m. high, occurring from near sea level to the highest point of Fiji, 1,323 m., in dense, dry, or open forest or on its edges, in the mossy forest of crests and ridges, in the forest-grassland transitional zone, and sometimes in coastal thickets. The bracteoles and flower-subtending bracts are pale green, the anthers yellow to pale green, and the fruit turning from green or dull yellow to orange at maturity, with orange styles.

TIPIFICATION AND NOMENCLATURE: The oldest binomial for this taxon is *Ternstroemia vitiensis*, typified by *Seemann 45* (K HOLOTYPE; ISOTYPE at BM), collected May 30, 1860, near the lake and old crater east of Somosomo, Taveuni. The type of *Trilocularia pedicellata* is *Kajewski 476* (A HOLOTYPE), collected July 12, 1928, on Vanua Lava, Banks Group, New Hebrides; that of *Trilocularia vitiensis* is *Degener 15356* (A HOLOTYPE; ISOTYPES at BISH, K, US), obtained May 28, 1941, near Mataimeravula, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu. In describing *Trilocularia vitiensis* in 1942 I did not take Seemann's binomial into account, as his description of his fruiting specimen does not particularly suggest Balanopaceae and as I had not yet examined his type. Hjelmqvist based his 1948 combination on *Trilocularia vitiensis*.

FIGURE 73. *Balanops pedicellata*; A, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/3; B, ♂ inflorescence, × 4; C, distal portion of branchlet, with foliage and ♂ inflorescences, × 1; D, foliage, × 1/2. A & B from *DA 3417*, C from *Smith 5194*, D from *Smith 5986*.



When I had an opportunity to see Seemann's type the identity of the two taxa was at once apparent, as also pointed out by Evans in 1966. However, *Ternstroemia vitiensis* cannot now become the basionym of a valid combination in either *Balanops* or *Trilocularia* (ICBN, Art. 54.1 (a)), and therefore Seemann cannot be cited as the parenthetical author. My 1942 comparison of *Trilocularia vitiensis* with the New Hebridean *T. pedicellata* was based on only four Fijian collections, but it is now evident, as pointed out by Carlquist in 1980, that the full range of leaf variability now known in Fijian collections makes necessary their incorporation into the New Hebridean taxon, which has nomenclatural priority.

DISTRIBUTION: The New Hebrides (known from Vanua Lava, Espiritu Santo, and Aneityum) and Fiji (known from five of the high islands). Some 50 Fijian collections are now available, indicating that the species is much more frequent than I originally assumed, although none of the nineteenth century collectors except Seemann and Horne seem to have obtained it.

LOCAL NAMES: Recorded names are *kau ndrai vua*, *mataumasima*, and *wailanga*.

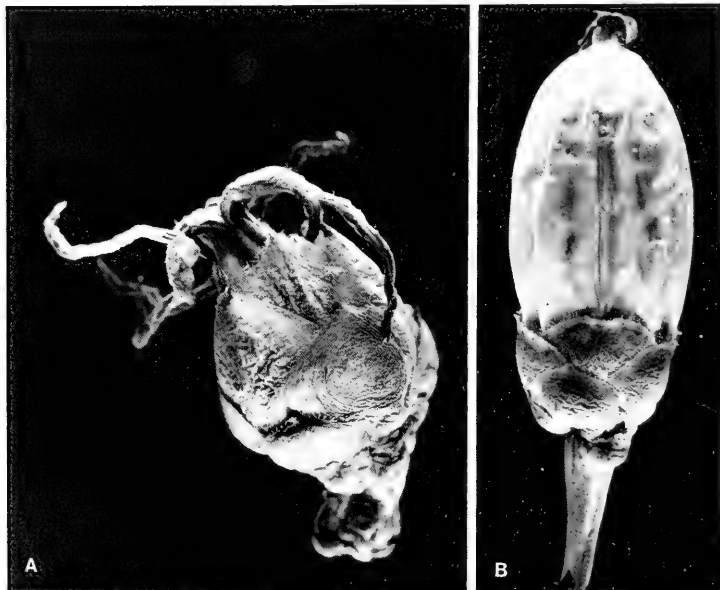


FIGURE 74. *Balanops pedicellata*; A, ♀ flower, × 6; B, mature fruit, × 4. A from Smith 5986, B from Smith 6693.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Lewa, Nukunuku Creek, *DA 14459*; slopes of Mt. Yoö, west of Nandarivatu, *Webster & Hildreth 14149*; vicinity of Nandarivatu, *Gillespie 4025*; Nandala, south of Nandarivatu, *O. & I. Degener 32139*; hills between Nggaliwana and Tumbendreketi Creeks, east of the sawmill at Navai, *Smith 5986*; summit of Mt. Tomanivi, *Smith 5194*. NADRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5404*; Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15630*. SERUA: Inland from Namboutini, *DA 13710*; coastal hills in vicinity of Taunovo River, east of Wainiyambia, *Smith 9577*; Vunindilo Beach, near Navua, *DA 3417*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2507*; vicinity of Mau, *DA 13739 (DF 220)*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5699*; vicinity of Rewasa, near Vaileka, *Degener 15519*. NAITASIRE: Nambuumbutha Creek, *Horne 930*; vicinity of Viria, *Meebold 17058*; Navuso Forest, *DA 28*. TAILEVU: King's Road Forest Reserve, *DA 858*. REWA: "Suva," *Meebold 17027*. KANDAVU: Mt. Mbuke Levu, *Smith 233*; Kiombo, *DA 13841*. OVALAU: Summit and adjacent slopes of Mt. Korotolotolu, west of Thawathi, *Smith 8042*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1551*. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6693*; summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6461*.

In 1950, with 15 collections available, I pointed out the remarkable variability of *Balanops vitiensis*, suggesting that an individual from the summit of Mt. Tomanivi (*Smith 5194*) seemed so extremely reduced in its leaves and ♂ inflorescences that it might possibly suggest a basis for further dividing the taxon. The specimens now available include three others from Mt. Tomanivi (*Gillespie 4114* and *4126*, *Carlquist 15617*), many others from high and intermediate elevation, and several from the coastal areas of Serua Province. The additional collections have only intensified the diversity. Specimens from higher elevations (FIGURE 73C) may have the petioles only 1 mm. long, the leaf blades oblong- to obovate-elliptic and occasionally as small as 1.5×1 cm., and the ♂ inflorescences sometimes less than 1 cm. long. Specimens from coastal thickets (FIGURE 73A) and middle elevations are inclined to have the petioles 5–10 mm. long, the leaf blades lanceolate to narrowly elliptic, $6-11 \times 2.5-6$ cm., and the ♂ inflorescences 2–3 cm. long. But the correlation between altitude and leaf size is very erratic; some specimens from middle elevation forest (FIGURE 73D) have the petioles as much as 20 mm. long and the leaf blades broadly elliptic and up to 17×10.5 cm. Length of pedicel (of both ♂ and ♀ flowers) and fruit size and shape are also highly variable, seemingly uncoordinated with altitude or habitat. Therefore I must again conclude that the variability in this species is without a clear enough pattern to permit any further division.

SUBCLASS CARYOPHYLLIDAE

The subclass Caryophyllidae is characterized by having its pollen always trinu- cleate when shed, by the frequent (but not universal) presence of betalains (betacyanins and betaxanthins) instead of anthocyanins, by often having free-central or basal placentation, by ovules that are bitegmic and crassinucellate, by seeds that frequently have an evident perisperm (albumen formed outside the embryo sac) rather than endosperm (albumen deposited within the embryo sac), and by a predominantly herbaceous habit. While these characters are neither constant (except for the trinucleate pollen and the ovule condition) nor very useful to field and herbarium botanists, they serve to delimit a coherent group of families.

Families sometimes included in the Caryophyllidae are the Bataceae and Gyrostemonaceae (neither in Fiji), which are better placed in the subclass Rosidae in or near the order Sapindales (cf. *Carlquist, S. Wood anatomy and relationships of Bataceae, Gyrostemonaceae, and Stylobasiaceae. Allertonia 1: 297-330. 1978.* Also to be excluded is the family Theligonaceae (not in Fiji), perhaps better referred to the

Rubiaceae (cf. Darwin, S. The subfamilial, tribal and subtribal nomenclature of the Rubiaceae. *Taxon* 25: 595-610. 1976). Exclusion from the Caryophyllidae of the three mentioned families is also discussed by J. W. Nowicke and J. J. Skvarla (Pollen morphology and the relationship of the Plumbaginaceae, Polygonaceae, and Primulaceae to the order Centrospermae. *Smithsonian Contr. Bot.* 37: 1-64. 1977). With these exclusions, both Cronquist (1968) and Takhtajan (1969) would place only three orders in the Caryophyllidae, the former recognizing 13 families and the latter 16 families.

Recently Nowicke and Skvarla (in the 1977 study cited in the preceding paragraph) have discussed palynological data and plastid characteristics that would seem to exclude the orders Polygonales and Plumbaginales from a close relationship with the Caryophyllales (Centrospermae). However, unless a better alignment can be proposed and established, it seems advisable to retain (with the definite exclusions mentioned above) the Caryophyllidae essentially as outlined by Cronquist and Takhtajan.

KEY TO ORDERS

- Plants often with anomalous secondary thickening (resulting in the formation of concentric rings of vascular bundles), often succulent; betalains often present (lacking in Molluginaceae and Caryophyllaceae, these with anthocyanins); ovary often compound, with free-central or basal placentation, the ovule sometimes solitary; ovules campylotropous or amphitropous, seldom anatropous; seeds with very scanty or no true endosperm, but very often with evident perisperm, the embryo curved and typically peripheral to well-defined perisperm. CARYOPHYLLALES (FAMILIES 68-77)
- Plants without anomalous secondary thickening; anthocyanins present, not betacyanins; ovary compound, unilocular, with a single basal ovule; ovules anatropous or orthotropous, not campylotropous or amphitropous; seeds with more or less copious endosperm, but without perisperm, the embryo straight or curved, peripheral or often embedded in endosperm.
- Perianth with 3-6 tepals, cyclic or acyclic, not dichlamydeous or sympetalous; stamens usually 6 or 9, in 2 or 3 cycles; carpels often 3 (sometimes 2 or 4); ovules orthotropous; petioles often dilated at base into membranous sheaths (ocreae). POLYAGONALES (FAMILY 78)
- Perianth differentiated into calyx and corolla, the corolla sympetalous; stamens 5, opposite corolla lobes; carpels 5; ovules anatropous; stipules lacking. PLUMBAGINALES (FAMILY 79)

ORDER CARYOPHYLLALES

KEY TO FAMILIES OCCURRING IN FIJI

- Gynoecium with separate carpels or composed of 1 carpel only, or if composed of united carpels then usually with as many locules as carpels; ovules 1 per locule; flowers hermaphrodite or less often unisexual.
- Tepals free or nearly so, seldom petaloid; carpels 2-several (occasionally only 1); inflorescences racemose or spicate; leaves alternate (or rarely opposite); stems seldom with anomalous secondary thickening. 68. PHYTOLACCACEAE
- Tepals forming a tube, often corolline in aspect, sometimes subtended by colored bracts simulating a calyx; carpel 1; inflorescences usually cymose; leaves usually opposite, sometimes alternate; stems often with anomalous secondary thickening. 69. NYCTAGINACEAE
- Gynoecium usually composed of 2 or more united carpels, either unilocular or with the ovules more numerous than the locules or with both conditions.
- Tepals and stamens usually numerous; ovary often inferior; plants succulent.
- Leaf-succulents, not spiny; ovary superior to inferior, 2-many-locular, or if unilocular then with free-central placentation. 70. AIZOACEAE
- Spiny stem-succulents with much reduced leaves; ovary unilocular, inferior (with few exceptions), with parietal placentation. 71. CACTACEAE
- Tepals and stamens usually free and whorled; ovary superior; plants sometimes with succulent leaves but not spiny or cactuslike.
- Perianth usually biseriate or seemingly so (except in some Molluginaceae, these with axile placentation).
- Sepals 4 or 5 (rarely 3 or 6); stamens not simultaneously as many as and opposite petals; plants sometimes with anomalous secondary thickening; betalains lacking, but anthocyanins usually present.

- Ovary 2-5-locular, with axile (rarely basal) placentation; petals (staminodial in origin) much reduced or lacking; leaves opposite, alternate, or subverticillate. . . . 72. MOLLUGINACEAE
- Ovary unilocular (or incompletely divided at base), with free-central or basal placentation; petals usually well developed; leaves opposite. . . . 73. CARYOPHYLLACEAE
- Sepals (or sepaloïd bracteoles) usually 2, seldom more; stamens usually as many as and opposite petals (or petaloïd sepals) or sometimes more numerous; plants without anomalous secondary thickening; betalains present.
- Ovules usually 2-many (rarely 1); fruit usually capsular; plants not climbing; stems usually lacking internal phloem. . . . 74. PORTULACACEAE
- Ovules solitary; fruit indehiscent; stems climbing, with internal phloem. . . . 75. BASELLACEAE
- Perianth uniseriate, often small, sometimes obsolete; ovules usually solitary (rarely several) on a basal placenta; plants usually with anomalous secondary thickening.
- Tepals entirely or marginally scarious; flowers usually hermaphrodite, less often unisexual, the filaments usually connate proximally into a cup or tube, with or without alternating pseudo-staminodes. . . . 76. AMARANTHACEAE
- Tepals often green, not scarious; flowers hermaphrodite or unisexual, the filaments usually free. . . . 77. CHENOPODIACEAE

FAMILY 68. PHYTOLACCACEAE

PHYTOLACCACEAE R. Br. in Tuckey, Narr. Exped. Congo, 454, as *Phytolaceae*. 1818.

Herbs, shrubs, or rarely trees, erect or scandent, usually without stipules; leaves alternate or sometimes opposite or whorled, the blades simple, entire, pinnate-nerved; inflorescences terminal, leaf-opposed, or axillary, spicate or racemose, with small bracts and bracteoles, the flowers usually actinomorphic, hermaphrodite or rarely unisexual; calyx 4- or 5-partite, the tepals or segments equal or unequal; petals lacking; stamens 3-many, the filaments free or proximally connate, the anthers 2-locular, basio- or dorsifixed, longitudinally dehiscent; gynoecium composed of 1-16 carpels, these free or connate, the ovary sometimes unilocular, rarely inferior, the ovules solitary in each carpel, basal, campylotropous or amphitropous, the stigmas as many as carpels, free or proximally connate into a short style; fruit composed of free or connate carpels, often fleshy or drupaceous, the seeds more or less reniform, sometimes arillate, the embryo curved, enveloping the mealy perisperm.

DISTRIBUTION: Pantropical and subtropical, mostly American, with about 17-20 genera.

USEFUL TREATMENTS OF FAMILY: Walter, H. *Phytolaccaceae*. *Pflanzenr.* **39** (IV. 83): 1-154. 1909. Heimerl, A. *Phytolaccaceae*. *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **16c**: 135-164. 1934. Backer, C. A. *Phytolaccaceae*. *Fl. Males.* **1**: 4: 228-232. 1951.

1. *Rivina* L. Sp. Pl. 121. 1753; Walter in *Pflanzenr.* **39** (IV. 83): 101. 1909.

Erect herbs, often woody toward base, without stipules; leaves sometimes long-petiolate; inflorescences racemose, terminal and axillary; flowers hermaphrodite, 4-merous, the pedicels with distal bracteoles, the perianth appearing corolline, composed of tepals becoming slightly accrescent and green; stamens 4, alternating with tepals and shorter, the anthers dorsifixed; ovary hypogynous, subglobose, unilocular, uniovulate, the style short, the stigma capitate; fruit a globose berry.

TYPE SPECIES: *Rivina humilis* L., the only original species, in which Linnaeus recognized three varieties.

DISTRIBUTION: Tropical and subtropical America, with three species. One species occurs in Fiji as a naturalized adventive.

1. *Rivina humilis* L. Sp. Pl. 121. 1753; Walter in *Pflanzenr.* **39** (IV. 83): 102. *fig. 30*. 1909; Heimerl in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **16c**: 147. *fig. 67*. 1934; Greenwood in *Proc. Linn. Soc.* **154**: 103. 1943; Backer in *Fl. Males.* **1**: 4: 229. *fig. 1*.

1951; Yuncker in Bishop Mus. Bull. 220: 110. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 46. 1959. Pl. Fiji Isl. 226. 1964, ed. 2. 314. 1972.

In Fiji *Rivina humilis* is a naturalized weed occurring near sea level along roadsides, in fields, pastures, gardens, etc., sometimes locally frequent in shady places. It is seen as a subligneous herb 35–100 cm. high; the tepals are white to pinkish at anthesis, becoming green, and the fruit is bright red and 3–4 mm. in diameter. It has been noted to bear flowers and fruits in months scattered throughout the year.

TYPEFICTION: Although Linnaeus gives several references for his three varieties, only two references are given for the "species" itself, and a suitable lectotype is probably a Clifford specimen at BM.

DISTRIBUTION: Tropical America, but now also widely naturalized in Indo-Malesia and in the Pacific. In addition to the Fijian collections here cited, material has been noted from New Caledonia, the New Hebrides, Tonga, and Hawaii, but the species surely occurs in other archipelagoes.

LOCAL NAME: *Coral berry*.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Vicinity of Thuvu, west of Singatoka, *Greenwood 823A, DA 10275, 11416*; Lawangga, Singatoka, *Greenwood 823, DA 9780*; Volivoli, near Singatoka, *DA 10666*. REWA: Botanical Gardens, Suva, *DA 12169*.

The species is probably of comparatively recent occurrence in Fiji and is very much localized in and near Singatoka; the earliest collection of those cited is *Greenwood 823*, December, 1939. Parham states that the species is reported to cause tainting of milk.

FAMILY 69. NYCTAGINACEAE

NYCTAGINACEAE Juss. Gen. Pl. 90, as *Nyctagines*. 1789.

Herbs, trees, or shrubs, sometimes scandent, without stipules; leaves alternate or opposite, sometimes unequal, simple, the blades entire, pinnate-nerved; inflorescences axillary or terminal, sometimes cauliflorous, usually cymose, the flowers sometimes reduced to 1–3 and sometimes surrounded by colored bracts, these occasionally simulating a calyx; flowers actinomorphic, hermaphrodite or unisexual, the perianth uniseriate; calyx tubular, often corolline in aspect, contorted or plicate in bud, 3–5-lobed, the distal part often caducous in fruit; petals lacking; stamens 1–many, often 5, hypogynous, sometimes perigynous, free or with proximally connate filaments, the anthers 2-locular, basifixed, dehiscent lengthwise; ovary superior, unilocular, the ovule solitary, basal, campylotropous or sometimes anatropous, the style filiform, the stigma widened; fruit an indehiscent anthocarp, usually enclosed in the persistent calyx base, often glandular; seeds with copious or scanty, mealy periderm, the embryo straight or curved.

DISTRIBUTION: Pantropical, mostly in tropical, subtropical, and temperate America, with 26–30 genera.

USEFUL TREATMENTS OF FAMILY: Heimerl, A. Nyctaginaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16: 86–134. 1934. Stemmerik, J. F. Nyctaginaceae. Fl. Males. I. 6: 450–468. 1964.

The family includes some genera of horticultural interest, notably *Bougainvillea* and *Mirabilis*.

KEY TO GENERA

- Herbs, unarmed, the leaves opposite; perianth constricted above base, the limb scarcely incised, plicate in bud.
 Perianth above constriction more than 2 cm. long, in our species solitary within a calyxlike involucre of bracts; anthocarp faintly ribbed or tuberculate, not viscid. 1. *Mirabilis*
 Perianth above constriction less than 0.5 cm. long; flowers not solitary within calyxlike bracts, often subtended by minute bracteoles; anthocarp ribbed, mostly viscid. 2. *Boerhavia*

Trees, shrubs, or climbers, spiny or unarmed, the leaves opposite and partly spirally arranged (alternate) or verticillate.

Flowers 3 (sometimes 1-4) per ultimate unit of inflorescence, each adnate to midrib of a large, colored bract; anthocarp not viscid; ornamental climbing or scrambling plants, less often shrubby, often spiny. 3. *Bougainvillea*

Flowers in cymes, without conspicuous bracts; anthocarp usually viscid; unarmed shrubs or trees or less often spiny shrubs. 4. *Pisonia*

1. *MIRABILIS* L. Sp. Pl. 177. 1753.

Unarmed, erect herbs, sometimes suffrutescent, the leaves opposite; inflorescences corymbose, leafy, axillary; flowers hermaphrodite, 1-many per inflorescence, borne within a 5-parted, green involucre; perianth variously colored, white to red or purple, the tube infundibuliform, plicate in bud; stamens 3-6, the filaments unequal, connate proximally; ovary sessile, ellipsoid, the style exerted, the stigma divided; anthocarp ellipsoid, costate or tuberculate.

TYPE SPECIES: *Mirabilis jalapa* L., the only original species.

DISTRIBUTION: Tropical America, with about 60 species. One species is cultivated and sometimes naturalized in Fiji.

1. *Mirabilis jalapa* L. Sp. Pl. 177. 1753; Christophersen in Bishop Mus. Bull. 128: 83. 1935; Yuncker in op. cit. 178: 52. 1943; Greenwood in Proc. Linn. Soc. 154: 103. 1943, in J. Arnold Arb. 25: 402. 1944; J. W. Parham in Dept. Agr. Fiji Bull. 35: 54. 1959, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972; Stemmerik in Fl. Males. I. 6: 451. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 139. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 100. 1972.

Mirabilis jalapa in Fiji is cultivated in towns and villages and is also naturalized in cultivated fields, including canefields, and along roadsides near sea level. It is seen as an herb or shrubby plant 0.5-1 m. high, or creeping when juvenile. The perianth (resembling a corolla but actually uniseriate) is white to yellowish, often pinkish or pale red distally; the stamens are exerted at anthesis, with white filaments and yellow anthers; and the subglobose fruit is black. Flowers and fruits do not appear to be seasonal.

TYPEIFICATION: Linnaeus gives several references, including one to *Hortus Cliffortianus*, but I have not noted a lectotypification.

DISTRIBUTION: A native of tropical America, probably of Peru, the species was brought into cultivation early as an ornamental and is now widely naturalized throughout the tropics.

LOCAL NAMES AND USES: In addition to the usual English name *four o'clock*, the Fijian names *lalawavu*, *lali vau*, *laweivou*, *vakarau ni lali*, and *ronggolali* have been noted. The species is a frequent ornamental. In some countries it is reputed to have medicinal uses, but this has not been recorded for Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nawaka, Nandi, DA 8987. NANDRONGA & NAVOSA: Vicinity of Thuvu, west of Singatoka, Greenwood 924, DA 14010; Volivoli, near Singatoka, DA 10662. SERUA: Flat coastal strip in vicinity of Ngaloa, Smith 9503. REWA: Botanical Gardens, Suva, DA 12343. MOALA: Naro'i Village, Smith 1384.

2. *BOERHAVIA* L. Sp. Pl. 3. 1753; Seem. Fl. Vit. 196, as *Boerhaavia*. 1866.

Erect or prostrate herbs, the leaves opposite, those of each pair often unequal; inflorescences axillary and pseudoterminal, umbelliform or subcapitate, united into branching panicles; flowers with articulate pedicels, subtended by small bracteoles, hermaphrodite, the perianth infundibular, constricted above ovary, plicate in bud, the

lobes 4 or 5; stamens 1-6; ovary short-stipitate, the stigma capitate; anthocarp small, ellipsoid to obpyramidal, often glandular, 3-5(-10)-ribbed.

LECTOTYPE SPECIES: *Boerhavia erecta*, one of Linnaeus's four original species (vide Standley in Contr. U. S. Nat. Herb. **12**: 375. 1909). The generic name, honoring Herman Boerhaave, is often spelled *Boerhaavia* or *Boerhaavea*, which are to be considered orthographic variants (ING). In the following references to *Boerhavia diffusa* I have not listed such variants separately.

DISTRIBUTION: Tropical and subtropical, usually considered to have about 40 species. Stemmerik (1964, cited above under the family) considers that there are only three variable species. One pantropical species occurs indigenously in Fiji.

1. *Boerhavia diffusa* L. Sp. Pl. 3. 1753; Seem. Fl. Vit. 196. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 267. 1892; Christophersen in Bishop Mus. Bull. **128**: 84. 1935; Greenwood in Proc. Linn. Soc. **154**: 103. 1943; Yuncker in Bishop Mus. Bull. **178**: 52. 1943, in op. cit. **184**: 38. 1945, in op. cit. **220**: 109. 1959; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 53. 1959, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972; Stemmerik in Fl. Males. I. **6**: 454. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 138. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 136. 1972.

Boerhavia diffusa var. *pubescens* Seem. in Bonplandia **9**: 258, nom. nud. 1861, Viti, 440, nom. nud. 1862.

In Fiji *Boerhavia diffusa* is found at or near sea level on sand or coral beaches, in pockets of soil on rocky slopes, or as a weed in villages. It is a prostrate or subsascending herb, with stems 10-100 cm. long; the perianth is white or pink, sometimes red to purplish, and the fruit is green. Flowering and fruiting material has been collected in scattered months.

TIPIFICATION: Linnaeus gives several prior references, and perhaps the best lectotype would be the specimen mentioned in his Fl. Zeyl. 10. 1747.

DISTRIBUTION: Pantropical; if varieties are recognized, that occurring in most Pacific archipelagoes is probably var. *diffusa*.

USE: The roots, young stems, and leaves are said to be edible.

AVAILABLE COLLECTIONS: YASAWAS: YASAWA: Mbukama, DA 13651. NAVITI: Muira, DA 11766. VITI LEVU: MBA: Nasavusavu, near Lautoka, Greenwood 732; Viseisei Beach, near Lautoka, Greenwood 827. OVALAU: Port Kinnaird, Seemann 365 (err. label as 265). WAKAYA: Milne 379. LATE-I-VITI: Northern and western rocky slopes, Bryan 540. NAYAMBO: On beach, Bryan 451. FIJI without further locality, Harvey, Nov., 1855, Horne 1023.

3. *BOUGAINVILLEA* Commerson ex Juss. Gen. Pl. 91, as *Buginvillea*. 1789; corr. Spach, Hist. Nat. Vég. Phan. **10**: 516. 1841. Nom. cons.

Stout climbers with axillary spines, sometimes shrubby, with drooping branches, or even treelike, the leaves alternate; inflorescences axillary, composed of units of usually 3 flowers arranged in pedunculate cymes, these forming leafy, terminal panicles; flowers hermaphrodite, the pedicels almost entirely united with midrib of a leafy, nerved, colored (in our species), persistent bract, the perianth tubular, constricted above a 5-angled base, the limb spreading, 5-lobed, the lobes often coalescent by thinner tissue, the apex of tube after anthesis sinistrorsely twisted; stamens 4-14, the filaments shortly connate proximally, unequal; ovary short-stalked, the style short, the stigma unilateral and often irregularly lobed; anthocarp acutely 5-angled, not viscid, caducous while joined to the dry bract.

TYPE SPECIES: In ICBN (vide also Rickett and Stafleu in Taxon **8**: 268. 1959) the conserved type of *Bougainvillea* is indicated as *B. spectabilis* Willd. Sp. Pl. 2: 348. 1799. This binomial, however, did not originate with Willdenow, who referred to the

earlier publication of Lamarck (Tabl. Encycl. Méth. 2: 433, as *Buginvillaea* s., pl. 294, as *Buginvillaea*. 1792). It appears to me that the correct author of the binomial is Lamarck.

DISTRIBUTION: Tropical America, with about 18 species. Several species probably hybridize and innumerable cultivars are widespread as ornamentals. Apparently two of the common species, with cultivars or perhaps hybrids, are cultivated in Fiji.

It is practically impossible confidently to refer individual cultivated plants of *Bougainvillea* to a species, since most of them are quite changed from their progenitors through hybridization and selection. The usual range of forms is to be seen in Fijian gardens, the following two species probably entering into their background.

KEY TO SPECIES

Leaf blades elliptic, sparsely puberulent on both surfaces; bracts commonly red, but variable in color; perianth swollen and 5-angled below constriction; anthocarp glabrous, commonly 7-13 mm. long.

1. *B. glabra*

Leaf blades ovate, tomentose beneath and often above; bracts commonly purple; perianth comparatively slender and indistinctly angled; anthocarp densely pilose, commonly 11-14 mm. long.

2. *B. spectabilis*

1. ***Bougainvillea glabra*** Choisy in DC. Prodr. 13 (2): 437. 1849; Stemmerik in Fl. Males. I. 6: 457. 1964; J. W. Parham, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972.

The ornamental red *Bougainvillea* is to be seen frequently in gardens near sea level, as a scandent shrub with predominantly rose-red bracts. However, the only available herbarium voucher is a plant with pure white bracts, which in other respects seems referable to *B. glabra* sensu lato, although it is doubtless a cultivar.

TYPIFICATION: Several Brazilian collections were originally cited by Choisy, but I have not searched the literature for a lectotypification.

DISTRIBUTION: Although originally from Brazil, the species was presumably cultivated there and not necessarily indigenous. It (including hybrids and cultivars) is now grown throughout the tropics.

LOCAL NAME AND USE: *Red bougainvillea*; ornamental.

AVAILABLE COLLECTION: VANUA LEVU: THAKAUNDOVE: Namali, in private garden, DA 16857 (with white bracts).

2. ***Bougainvillea spectabilis*** Lam. Tabl. Encycl. Méth. 2: 433, as *Buginvillaea* s., pl. 294, as *Buginvillaea*. 1792; Willd. Sp. Pl. 2: 348. 1799; Yuncker in Bishop Mus. Bull. 178: 52. 1943, in op. cit. 220: 110. 1959; Stemmerik in Fl. Males. I. 6: 457. 1964; J. W. Parham, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 139. 1970.

The ornamental scrambling *Bougainvillea* with predominantly purplish bracts is often grown in gardens near sea level.

TYPIFICATION: Lamarck did not cite a type, but his description and plate may be taken as the type, unless a specimen so annotated is to be found in the Lamarck herbarium at P.

DISTRIBUTION: Probably indigenous in Peru, the species is now cultivated throughout the tropics.

LOCAL NAME AND USE: *Purple bougainvillea*; ornamental.

AVAILABLE COLLECTION: VITI LEVU: REWA: Department of Agriculture compound, Suva, DA 12188.

4. **PISONIA** L. Sp. Pl. 1026. 1753; Seem. Fl. Vit. 194. 1866; Stemmerik in Blumea 12:

275. 1964, in *Fl. Males. I.* 6: 457. 1964.

Ceodes J. R. & G. Forst. *Char. Gen. Pl.* 71. 1775, ed. 2. 141. 1776.

Unarmed shrubs or trees, or sometimes subsucculent, spiny shrubs, the leaves opposite, sometimes subverticillate or partly spirally arranged; inflorescences usually small, axillary or subterminal cymes, many-flowered; flowers hermaphrodite or unisexual, the pedicels short, accrescent after anthesis, the perianth bracteate or not, forming an obconical or campanulate tube, the limb usually 4-6-lobed, marcescent, the apical part caducous after anthesis, the lobes short, induplicate-valvate, often alternating with minute teeth, at length recurved; stamens (2-) 5-13 (-40), the filaments proximally connate, unequal, the anthers exerted (in ♀ and ♂ flowers) or included (in ♀ flowers); ovary sessile or short-stalked, the style obvious, the stigma broadened, entire or lacerate; anthocarp often elongate and with stalked, viscid glands, sometimes muricate or grooved.

LECTOTYPE SPECIES: *Pisonia aculeata* L., one of Linnaeus's two original species (vide Standley in *N. Amer. Fl.* 21: 186. 1918). The type species of *Ceodes* is *C. umbellifera* J. R. & G. Forst., the only original species. *Ceodes* is sometimes considered a separate genus, but Stemmerik (1964, cited below) combines it with *Pisonia*, following most recent authors.

DISTRIBUTION: Pantropical and subtropical, with 35-50 species. Three indigenous species are reported from Fiji.

USEFUL TREATMENT OF GENUS: Stemmerik, J. F. *Florae Malesianae Precursores XXXVIII. Notes on Pisonia L. in the Old World (Nyctaginaceae)*. *Blumea* 12: 275-284. 1964.

KEY TO SPECIES

Plants unarmed, erect.

Perianth without distinct black glands in 5 lengthwise rows; anthocarp without prickles; leaf blades without distinct secondary nerves, glabrous on lower surface. 1. *P. umbellifera*

Perianth with 5 rows of distinct, prominent, black glands; anthocarp with prickles; leaf blades with distinct secondary nerves, these (or at least the lateral surfaces of costa) pilose on lower leaf surface.

2. *P. grandis*

Plants spinose, climbing; perianth limb with 5 large lobes alternating with 5 smaller ones; anthocarp with 5 rows of biserial prickles. 3. *P. aculeata*

1. *Pisonia umbellifera* (J. R. & G. Forst.) Seem. in *Bonplandia* 10: 154, as *P. umbellata*, sphalm. 1862, in *J. Bot.* 1: 246. 1863, *Fl. Vit.* 195. 1866; Drake, *Ill. Fl. Ins. Mar. Pac.* 268. 1892; Yuncker in *Bishop Mus. Bull.* 184: 38. 1945; Stemmerik in *Blumea* 12: 280. 1964, in *Fl. Males. I.* 6: 460. 1964; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 152. 1972.

FIGURE 75A-C.

Ceodes umbellifera J. R. & G. Forst. *Char. Gen. Pl.* 71. t. 71. 1775, ed. 2. 142. t. 71. 1776; Skottsbo. in *Svensk Bot. Tidskr.* 30: 723. fig. 1-3. 1936.

Ceodes umbellata Forst. f. *Fl. Ins. Austr. Prodr.* 93, sphalm. 1786.

Pisonia excelsa Bl. *Bijdr. Fl. Ned. Ind.* 735. 1826.

Pisonia viscosa Seem. in *Bonplandia* 9: 258, nom. nud. 1861, Viti, 440, nom. nud. 1862.

Ceodes excelsa Skottsbo. in *Acta Horti Gothob.* 2: 231. 1926; Christophersen in *Bishop Mus. Bull.* 128: 84. 1935.

Ceodes umbellifera f. *acuminata* Heimerl in *Occas. Pap. Bishop Mus.* 13: 41. fig. 6. 1937.

Ceodes umbellifera var. *acuminata* Heimerl ex J. W. Parham, *Pl. Fiji Isl.* 107. 1964.

Pisonia umbellifera occurs in Fiji at elevations from near sea level to 825 m. as a tree 5-15 m. high, with a trunk 30 cm. or more in diameter; it is occasionally mentioned as a shrub as small as 2 m. high. Although frequently found in coastal areas exposed to wind, it is also noted in dense or open forest, on rocky slopes, and on limestone ridges. Its perianth is white to greenish yellow, becoming dark red; its stamens and gynoecium are white, and its fruit is purple-tinged and very viscid. Flowering material has been collected between December and August, fruiting material between February and June.

LECTOTYPIFICATION AND NOMENCLATURE: There are three Forster collections in the type cover at BM: (1) "Tanna. JR & G Forster" (marked as *type specimen*), (2) "Tana. Capt. Cook, 1775" (annotated by Skottsberg as "♂ part of type material"), and (3) "G. Forster's Herbarium. Ceodes umbellata." All three are in flower, but the first is the best and may be designated as the lectotype of *Ceodes umbellifera*: J. R. & G. Forster (BM), collected on Tanna, New Hebrides, during Cook's second voyage. *Ceodes umbellata* Forst. f. refers to the original publication, and his binomial may be taken as a simple sphaema, as may Seemann's first combination in *Pisonia* using the epithet *umbellata*. *Pisonia excelsa*, according to Stemmerik, is lectotypified by Blume s. n. in herb. L 908.157-350, from G. Salak, W. Java. The source of the name *P. viscosa* Seem. is Seemann 364, collected on Ovalau in 1860. The holotype of *C. umbellifera* f. *acuminata* Heimerl is Gillespie 4737 (BISH), collected Feb. 27, 1928, in the vicinity of Waiyevo, Taveuni. The full and complex synonymy of *P. umbellifera* is discussed by Stemmerik in his 1964 treatment in *Blumea*. Gibbs referred to *P. umbellifera* in J. Linn. Soc. Bot. 39: 161. 1909, but mentions only her collection no. 546, which represents a species of *Psychotria* (Rubiaceae).

DISTRIBUTION: Madagascar to the Ryukyu Islands and eastward to northern Australia and into Polynesia as far as Pitcairn Island and Hawaii.

LOCAL NAMES: Although the species is reasonably frequent in Fiji, the only noted names are *roro* and *ndainga*.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Mountains near Lautoka, *Greenwood 1084*; Naloto Range, *DA 14771*. NANDRONGA & NAVOSA: Nakoronolase, vicinity of Nandrau, *DF 1180*. NAMOSI: Saliandrau, Wayauyau Creek, *DA 14998*; vicinity of Namosi Village, *Parks 20264*; without further locality, *DA 14237*. NAITASIRI: Tholo-i-suva, *DA 11878*. OVALAU: Hills east of Lovoni Valley, *Smith 7358*. KORO: Main ridge, *Smith 1050*. VANUA LEVU: THAKAUNDROVE: Namoliwawa, *DA 13161*. TAVEUNI: Track to lake east of Somosomo, *DA 14065*. AIWA: *Bryan 527*. YANGASA LEVU: *Bryan 461*.

2. *Pisonia grandis* R. Br. Prodr. Fl. Nov. Holl. 422. 1810; Yuncker in Bishop Mus. Bull. 178: 52. 1943, in op. cit. 184: 38. 1945; St. John in Webbia 8: 225. 1951; Yuncker in Bishop Mus. Bull. 220: 110. 1959; Stemmerik in *Blumea* 12: 283. 1964, in Fl. Males. I. 6: 464. 1964; J. W. Parham, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 139. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 105. 1972.

FIGURE 75D & E.

Pisonia brunoniana sensu Seem. in Bonplandia 9: 258. 1861. Viti, 440. 1862; non Endl.

Pisonia inermis sensu Seem. in J. Bot. 1: 246. 1863, Fl. Vit. 195. 1866; non Jacq.

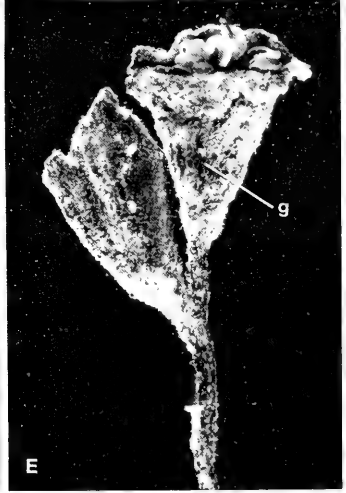
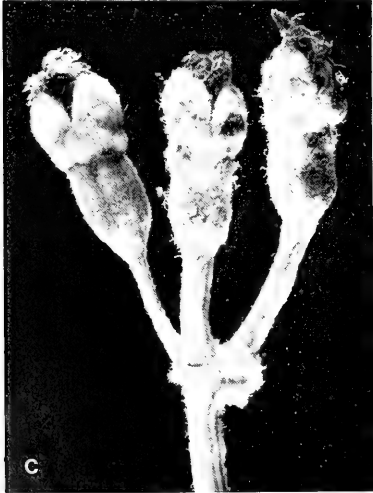
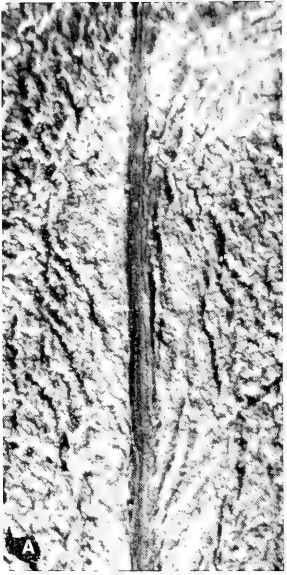
Plectronia mconnelli Horne, A Year in Fiji, 266, nom. nud. 1881.

Plectronia mconnelli Horne ex Baker in J. Linn. Soc. Bot. 20: 363, pro syn. 1883.

As it occurs in Fiji, *Pisonia grandis* is a tree 2-20 m. high, with a trunk up to 40 cm. in diameter, often stunted and forming solid thickets on islets and in open forest, found comparatively infrequently at elevations between sea level and about 370 m. Its flowers have been noted as fragrant, the perianth being white or greenish yellow distally. Flowers have been collected in August and November and fruits only in the latter month.

TYPIFICATION: The holotype is a Brown specimen (BM), collected on the north coast of Australia. *Plectronia mconnelli* (or *mconnelli*), never described, is based on an unnumbered Horne specimen from Fiji; I have located no Horne collections of *Pisonia*, and the name is here listed only on the authority of Baker.

DISTRIBUTION: Madagascar to Formosa and eastward to Queensland and into Polynesia as far as the Tuamotus and several equatorial archipelagoes. In Fiji the



available material shows *Pisonia grandis* to be less frequent than *P. umbellifera*, although it may be locally abundant, as on the Lau island of Nayambo, where Bryan has noted it as the only species of tree on the island.

LOCAL NAMES: Only the names *mbuka* and *talatalambia* have been recorded.

AVAILABLE COLLECTIONS: KANDAVU: *Seemann 363*. VANUA LEVU: MATHUATA: Mt. Uluimbau, south of Lambasa, *Smith 6598*. NAYAMBO: In center of island, *Bryan 450*.

3. *Pisonia aculeata* L. Sp. Pl. 1026. 1753; Greenwood in J. Arnold Arb. **25**: 402. 1944; Yuncker in Bishop Mus. Bull. **220**: 109. 1959; Stemmerik in *Blumea* **12**: 284. 1964, in Fl. Males. I. **6**: 467. 1964; J. W. Parham, Pl. Fiji Isl. 107. 1964, ed. 2. 152. 1972.

An overhanging climber with recurved, axillary thorns; the perianth is yellowish white, becoming brown, and short-pilose.

LECTOTYPIFICATION: From among the several prior references given by Linnaeus, Stemmerik (1964, in *Blumea*, cited above) indicates as the lectotype Plumier, Nov. Gen. *7. pl. 11*. 1703.

DISTRIBUTION: Circumtropical, including Africa and northern Australia, and eastward in the Pacific as far as Fiji and Tonga.

AVAILABLE COLLECTION: VITI LEVU: Mba: Between Mba and Tavua, *Greenwood 741*.

This species is known in Fiji only from the cited Greenwood collection, dated Sept. 29, 1927, which seems to be correctly identified, as are the very few known collections from Tonga. These collections appear to be from indigenous plants.

FAMILY 70. AIZOACEAE

AIZOACEAE Rudolphi, Syst. Orb. Veg. 53, as *Aizoideae*. 1830.

Erect or prostrate herbs or low shrubs, with or without stipules, the leaves alternate or opposite, sometimes minute, often succulent, usually simple; inflorescences usually axillary, cymose or composed of solitary, clustered, or fascicled flowers, these actinomorphic, usually hermaphrodite; calyx tube free or adnate to ovary, the lobes (3-) 5-8, imbricate or quincuncial; petals (sometimes considered petaloid staminodes) numerous, 1- to several-seriate, inserted in calyx tube, sometimes lacking; stamens perigynous, usually numerous in several series, sometimes few (rarely 1), the filaments free or proximally united into bundles, the anthers small, 2-locular, dehiscing longitudinally; ovary superior to inferior, (1-) 2-many-locular, the ovules campylotropous or anatropous, solitary to many per locule, basal, apical, or axile, the styles or stigmas as many as carpels, usually radiating; fruit a capsule or drupaceous, often clasped by the persistent calyx, the seeds 1-many per locule, the embryo large, enveloping the perisperm.

DISTRIBUTION: Chiefly southern African, but also pantropical and subtropical or sometimes temperate, with about 130 genera (mostly segregates from *Mesembryanthemum*) or 11-16 genera in the most conservative sense.

USEFUL TREATMENTS OF FAMILY: Pax, F., & K. Hoffmann. *Aizoaceae*. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **16c**: 179-233 (excl. trib. Molluginaceae). 1934. Backer, C. A. *Aizoaceae*. Fl. Males. I. **4**: 267-275 (excl. *Mollugo*, *Glinus*). 1951.

FIGURE 75. A-C, *Pisonia umbellifera*; A, lower surface of leaf blade along costa, $\times 10$; B, anthocarp, $\times 2$; C, \varnothing flowers, showing lacerate stigmas, $\times 8$. D & E, *Pisonia grandis*; D, lower surface of leaf blade along costa, $\times 10$; E, flowers with exerted anthers and perianth glands (g), $\times 8$. A from *Greenwood 1084*, B from *Smith 7358*, C from *DA 14771*, D from *Smith 6598*, E from *Bryan 450*.

1. *SESUVIUM* L. Syst. Nat. ed. 10. 1052, 1058, 1371. 1759.

Herbs or subshrubs, prostrate or ascending, glabrous, the leaves opposite, subequal, entire, the petioles dilated, the blades succulent, nearly cylindrical to flattened; flowers hermaphrodite, solitary or clustered, terminal but appearing axillary; sepals 5, united proximally, hooded distally and with a subapical mucro; petals lacking; stamens 5 and alternate with sepals or numerous in fascicles, persistent, the filaments filiform or subulate; ovary superior, 2-5-locular, the ovules numerous, axile, the styles 2-5, with longitudinal, papillose stigmas; capsule membranous, circumscissile near middle, the seeds numerous, rotund-reniform, black, arillate.

TYPE SPECIES: *Sesuvium portulacastrum* (L.) L. (*Portulaca portulacastrum* L.), the only original species.

DISTRIBUTION: Pantropical and subtropical (sometimes temperate), with about eight species usually occurring in saline or disturbed coastal areas. One species occurs indigenously in Fiji.

1. *Sesuvium portulacastrum* (L.) L. Syst. Nat. ed. 10. 1058. 1759; A. Gray, Bot. U. S.

Expl. Exped. 1: 142. 1854; Seem. Viti, 432. 1862; Christophersen in Bishop Mus. Bull. 128: 84. 1935; Greenwood in Proc. Linn. Soc. 154: 99. 1943, in J. Arnold Arb. 25: 400. 1944; Yuncker in Bishop Mus. Bull. 184: 38. 1945, in op. cit. 220: 111. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 44. 1959, Pl. Fiji Isl. 225. 1964, ed. 2. 313. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 40. 1970.

Portulaca portulacastrum L. Sp. Pl. 446. 1753.

A prostrate, succulent herb, with basally subligneous reddish stems 20-80 cm. long, found at and near sea level on sand and coral beaches and on limestone headlands. The sepals are pink to lavender to reddish purple (or perhaps sometimes white) within and green without, the stamens have pale purple anthers, the styles are white, and the seeds are black and shining. Flowers and fruits have been noted only in February and May, but they may be expected throughout the year.

TYPIFICATION: The only citation given by Linnaeus for *Portulaca portulacastrum* is Herm. Parad. Bat. 212. t. 212. 1698, apparently based on a plant from Curaçao.

DISTRIBUTION: Pantropical. It is doubtless more frequent in Fiji than suggested by the few cited collections.

LOCAL NAME: The only name I have noted is *jale* (perhaps better spelled *djale*), from my Fulanga collection.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, Greenwood 919; vicinity of Singatoka, Greenwood 784. NAYAMBO: Bryan 453. FULANGA: On limestone formation, Smith 1206. FIJI without further locality, U. S. Expl. Exped.

FAMILY 71. CACTACEAE

CACTACEAE Juss. Gen. Pl. 310, as *Cacti*. 1789.

Fleshy perennials, diverse in habit, highly specialized, the stems terete, subglobose, flattened, or grooved, usually with much reduced leaves and spiny, the spines and flowers arising from cushionlike areoles; flowers solitary, less often clustered, usually sessile, hermaphrodite, and actinomorphic; receptacle tubular, usually with scales, hairs, or spines, bearing tepals and stamens; tepals spirally arranged, usually very numerous, sepaloid to petaloid; stamens numerous, inserted in throat and receptacle tube, free or the inner ones connate, the anthers 2-locular, splitting longitudinally; ovary inferior (with few exceptions), unilocular, the placentas 3-many, parietal, the ovules numerous, usually campylotropous, the style usually 1, the stigmas 3-many, radiating, variously papillose; fruit baccate, juicy or dry, often with scales, hairs, or

spines, indehiscent or rarely dehiscent, the seeds numerous, immersed in pulp, often arillate or strophiolate, the perisperm abundant to lacking, the embryo curved or rarely straight, the cotyledons usually reduced or vestigial.

DISTRIBUTION: America, chiefly in the drier regions, from British Columbia to Patagonia, with more than 2,000 species. The number of genera to be recognized in the family is controversial, ranging from about 50 to 220. Buchheim (1964, cited below) discusses 167 genera, Hunt (1967, cited below) 84 genera. Species of *Rhipsalis* have been noted from Africa to Ceylon but are usually considered doubtfully indigenous.

USEFUL TREATMENTS OF FAMILY: Buchheim, G. *Cactaceae*. In: Melchior, H. *Engl. Syll. Pflanzenfam.* ed. 12. 2: 102-108. 1964. Hunt, D. R. In: Hutchinson, J. *Gen. Fl. Pl.* 2: 427-467. 1967.

KEY TO GENERA

Internodes abundantly spiny; tepals somewhat divergent; stamens shorter than tepals; style tapering toward base, shorter than tepals. 1. *Opuntia*
 Internodes usually not spiny; tepals erect; stamens much longer than tepals; style discoid above base, exerted from perianth. 2. *Nopalea*

1. *OPUNTIA* Mill. *Gard. Dict. Abridg.* ed. 4. 1754.

Erect, often freely branching plants, the stem articulate, the internodes flat, abundantly spiny, the areoles of stem lanate and with barbed bristles; flowers borne near margins of distal half of internodes; tepals often spreading; stamens shorter than tepals; ovary tuberculate, the style tapering toward base, shorter than tepals; fruit pyriform to obovoid, the seeds globose-reniform.

LECTOTYPE SPECIES: *Opuntia vulgaris* Mill. (*Cactus opuntia* L.) (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 571. 1913).

DISTRIBUTION: America, from Canada to Argentina, with 200-250 species. At least one species has become a noxious weed in parts of the Old World, including Fiji.

1. *Opuntia vulgaris* Mill. *Gard. Dict.* ed. 8. 1768; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* 18: 56. 1947; Greenwood in *J. Arnold Arb.* 30: 77. 1949; Mune & J. W. Parham in *Dept. Agr. Fiji Bull.* 31: 14. fig. 2. 1957; J. W. Parham in *op. cit.* 35: 56. fig. 21. 1959, *Pl. Fiji Isl.* 113. 1964, ed. 2. 161. 1972; Mune & J. W. Parham in *Dept. Agr. Fiji Bull.* 48: 24. fig. 6. 1967; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 54. 1972.

Cactus opuntia L. *Sp. Pl.* 468. 1753.

In Fiji this species has become a frequent adventive as a perennial shrub 0.5-4 m. high, often found in agricultural areas or on waste land near sea level. Its tepals are yellow and its fruits bright red.

TYPIFICATION: Miller based his concept on J. Bauhin, *Hist. Pl. Univ.* 1: 154. 1650. This being one of the several references given by Linnaeus for *Cactus opuntia*, Miller's indication is perhaps to be considered a lectotypification.

DISTRIBUTION: Tropical America, but now widely distributed throughout tropical countries. No herbarium vouchers from Fiji are available, and according to J. W. Parham the species has become virtually eradicated there. Nevertheless, an occasional individual may be seen here and there in dry areas.

LOCAL NAME AND USES: *Prickly pear*. The species is believed to have been introduced by early European settlers to use in hedges. All species of *Opuntia* are now declared noxious weeds in Fiji and Samoa, but this is the only species with a published record in Fiji. It is one of the worst potential weeds to have been introduced into Fiji; information on its control is given by Mune and Parham (1967, cited above).

2. *Nopalea* Salm-Dyck, Cact. Hort. Dyck. 1849: 63. 1850.

Erect plants resembling species of *Opuntia*, the internodes (in our species) not spiny; tepals erect, free; stamens much longer than tepals; ovary tuberculate, the style discoid just above base and exerted from perianth; fruit pyriform, the seeds oblong, compressed.

LECTOTYPE SPECIES: *Nopalea cochenillifera* (L.) Salm-Dyck (*Cactus cochenillifer* L.) (vide Britton & Rose, Cact. 1: 33. 1919).

DISTRIBUTION: Mexico and Central America, with about nine species. The genus is often submerged in *Opuntia* (as by Hunt, 1967, cited above under the family). However, it is maintained as distinct by many students, for instance by Lawrence, Tax. Vascular Pl. 623. 1951, by Backer and Bakhuizen van den Brink, Jr., Fl. Java 1: 316. 1963, by Buchheim (1964, cited above under the family), and by Hutchinson, Fam. Fl. Pl. ed. 3. 304. 1973.

1. *Nopalea cochinellicifera* (L.) Salm-Dyck, Cact. Hort. Dyck. 1849: 64, as *N. coccinellifera*. 1850; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 17: 22. 1946.

Cactus cochenillifer L. Sp. Pl. 468. 1753.

The cochineal cactus, sparingly grown in Fiji, has conspicuously articulate stems and flat internodes, like those of *Opuntia*. Its inner tepals are red, its filaments red-tipped, its style white with greenish stigmas, and its fruit red.

TYPIFICATION: Linnaeus gave several prior references, but I have not noted a lectotypification.

DISTRIBUTION: Probably originally from Mexico, *Nopalea cochinellicifera* is now cultivated in tropical areas as the principal food plant (among other species of cactus) of the cochineal insect. The dried bodies of these insects are utilized in some areas as the source of a red dyestuff used as a biological stain.

LOCAL NAME AND USES: *Cochineal cactus*. Not truly naturalized, the species is grown in various parts of Fiji as an ornamental and for medicinal purposes, being used by some of the Indian population as a poultice. Apparently the cochineal insect has not been cultivated in Fiji.

AVAILABLE COLLECTION: OVALAU: Levuka, DA 3002 (coll. L. H. Dietrich).

FAMILY 72. MOLLUGINACEAE

MOLLUGINACEAE Hutchinson, Fam. Fl. Pl. 1: 128. 1926.

Herbs or rarely shrubs, the stipules lacking or fugacious, the leaves simple, opposite or subverticillate to alternate, the blades pinnate-nerved, sometimes fleshy; inflorescences axillary or terminal, usually cymose, sometimes composed of solitary flowers, these actinomorphic, hermaphrodite (rarely unisexual), usually small; perianth uniseriate, inconspicuous; sepals 4 or 5, free or shortly united, imbricate or quincuncial, usually persistent in fruit; petals (staminodial in origin) small, much reduced, or lacking; stamens 3-10 (-20), hypogynous or slightly perigynous, sometimes partially staminodial, the filaments free or proximally connate, the anthers 2-locular, dehiscing longitudinally; disk sometimes present and annular; ovary syncarpous (rarely apocarpous) and 2-5-locular with axile (rarely basal)-placentation, the ovules campylotropous (rarely anatropous), usually more than 1 per locule, the styles or sessile stigmas as many as locules, short, free; fruit a schizocarp or loculicidally dehiscent capsule, rarely indehiscent, the seeds with the embryo curved, often peripheral to perisperm.

DISTRIBUTION: Pantropical or subtropical, especially in Africa, with about 14 genera.

USEFUL TREATMENT OF FAMILY: Eckardt, T. Fam. Molluginaceae. In: Melchior, H. Engl. Syll. Pflanzenfam. ed. 12. 2: 86-87. 1964.

1. MOLLUGO L. Sp. Pl. 89. 1753; Seem. Fl. Vit. 200. 1867.

Mostly annual, glabrous herbs, erect or spreading, the stipules membranous, undivided, fugacious, the leaves usually subverticillate; inflorescences axillary, fasciculate, cymose, or subracemose, the flowers hermaphrodite; sepals 5; petals lacking; stamens 3-5 or rarely more, often mixed with subulate staminodes; ovary 3-5-locular, the ovules numerous, axile, the styles linear or clavate; fruit a membranous capsule, enclosed by the calyx, the seeds 1 or more in each locule, sometimes with a small aril.

LECTOTYPE SPECIES: *Mollugo verticillata* L., one of Linnaeus's four original species (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 35. 1913).

DISTRIBUTION: Pantropical and subtropical, with 15-20 species. One apparently indigenous species occurs sparingly in Fiji.

1. **Mollugo pentaphylla** L. Sp. Pl. 89. 1753; Backer in Fl. Males. 1. 4: 268. 1951; J. W. Parham, Pl. Fiji Isl. 225. 1964, ed. 2. 313. 1972.

Mollugo stricta L. Sp. Pl. ed. 2. 131. 1762; A. Gray, Bot. U. S. Expl. Exped. 1: 130. 1854; Seem. ex A. Gray in Bonplandia 10: 36, as *M. striata*. 1862; Seem. Viti, 432, as *M. striata*. 1862, Fl. Vit. 200. 1867.

Hedyotis burmanniana sensu Seem. in Bonplandia 9: 256. 1861; non auct.

A weedlike, sprawling, annual herb, widely branched or subsending to 35 cm., occurring sparingly in or near cultivated areas or on waste ground near sea level. The sepals are green without and white within, turning brown, the styles are white, and the seeds are dark brown.

LECTOTYPIFICATION: Under *Mollugo pentaphylla* Linnaeus cited two references to Ceylon plants; probably the better lectotype would be a Hermann specimen (BM) indicated in L. Fl. Zeyl. 51. 1747.

DISTRIBUTION: Tropical and subtropical portions of the Old World, eastward in the Pacific to the Caroline Islands and at least to the Solomons. Although the available Fijian material suggests that the plant is an adventive, in that the collections come from or near areas of cultivation, there is really no reason to doubt that the species is indigenous eastward to Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Wainandoi River area, DA 8369. NAITASIRI: Nanduruloulou Station, DA 716. OVALAU: Without detailed localities, U. S. Expl. Exped., MacGillivray, Oct., 1854, Seemann 230. VANUA LEVU: MBUA: Mbua Bay, U. S. Expl. Exped.

FAMILY 73. CARYOPHYLLACEAE

CARYOPHYLLACEAE Juss. Gen. Pl. 299, as *Caryophylleae*. 1789.

Annual or perennial herbs (rarely undershrubs), lacking stipules or these present and membranous, the stem often swollen at nodes; leaves opposite, simple, the petioles often connected at base by a transverse line, the blades entire; inflorescences usually terminal, cymose or developing into cincinni or with solitary flowers, these actinomorphic, usually hermaphrodite; sepals 3-6, usually 5, free and imbricate or united, often with membranous margins; petals as many as sepals, often clawed, often small, rarely lacking; stamens 2-12, in 1 or 2 series, sometimes partly staminodial, the filaments free or shortly connate, the anthers bilocular, dehiscing longitudinally; ovary superior, sessile or short-stipitate, unilocular or incompletely divided at base, the placentation free-central or basal, the ovules usually numerous (rarely few or reduced

to 1) and campylotropous, the styles free or proximally connate; fruit usually a dry capsule dehiscent by splitting from apex, sometimes an achene or berry, the seeds often numerous, the embryo curved, peripheral to perisperm.

DISTRIBUTION: A cosmopolitan family of 70-80 genera.

USEFUL TREATMENT OF FAMILY: Pax, F., & K. Hoffmann. Caryophyllaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16c: 275-364. 1934.

The family contains a large number of well-known ornamentals (*Dianthus*, *Gypsophila*, etc.), although in this respect it is better known in temperate than in tropical areas.

1. *DRYMARIA* Willd. ex Roemer & Schultes, Syst. Veg. 5: xxxi, 406. 1819 or 1820.

Slender herbs, with subulate or filiform stipules, the leaf blades often ovate-reniform; inflorescences cymose, often with cincinnous branches; flowers 5-merous; sepals free, scarious-margined; petals bifid, persistent; stamens 2-5; ovary short-stalked, the style 3-parted; capsule thin-walled, 3-valved from apex to base, the valves entire, the seeds usually numerous (rarely only 1), verrucose.

LECTOTYPE SPECIES: *Drymaria cordata* (L.) Willd. ex Roemer & Schultes (*Holosteum cordatum* L.) (vide Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16c: 307. 1934).

DISTRIBUTION: Cosmopolitan, mostly tropical and American, with 50-70 species. One species occurs in Fiji as a recent adventive.

USEFUL TREATMENT OF GENUS: Mizushima, M. A revision of *Drymaria cordata* Willd. (Critical studies on Japanese plants 3). J. Jap. Bot. 32: 69-81. 1957.

1. *Drymaria cordata* (L.) Willd. ex Roemer & Schultes var. *pacifica* Mizushima in J. Jap. Bot. 32: 78. 1957; J. W. Parham, Pl. Fiji Isl. ed. 2. 313. 1972.

An infrequent prostrate herb, found along roadsides or in plantations near sea level; the petals are white. Flowering has been noted only in July, doubtless due to the paucity of Fijian collections.

TYPIIFICATION: The holotype is *Svenson 65* (GH), collected April 1, 1930, at Academy Bay, Indefatigable Island, Galapagos Islands.

DISTRIBUTION: According to its author, var. *pacifica* is probably indigenous in the Galapagos Islands and in lowland areas of Colombia, Peru, and Bolivia, and adventive in Hawaii, the Bonin Islands, and the Idzu Islands. Its introduction into Fiji was doubtless inadvertent and recent, and it may be sought in other Pacific archipelagoes.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nanduruloulou, along roadsides in Cocoa Station, DA 14414; Koronivia, in banana plantation, DA 13274.

Mizushima's study of *Drymaria cordata* (1957, cited above) points out differences between the American *D. cordata* and the Old World *D. diandra*. *Drymaria cordata* is based on *Holosteum cordatum*, which Mizushima lectotypifies by the Linnaean reference to *Hortus Upsaliensis* (1745) and specimen no. 109-1 in the Linnaean Herbarium, presumably originally from Jamaica and cultivated in the Uppsala Botanic Garden. Differences between the American species and *D. diandra* Bl. (Bijdr. Fl. Ned. Ind. 62. 1825) are discussed by Mizushima (pp. 75-76, fig. 1), although sometimes these taxa are united (cf. Backer & Bakh. f. Fl. Java 1: 209. 1963). If one accepts Mizushima's distinctions (pp. 71-75), the Fijian material seems to represent *D. cordata* var. *pacifica*.

FAMILY 74. PORTULACACEAE

PORTULACACEAE Juss. Gen. Pl. 312, as *Portulacaeae*. 1789.

Annual or perennial herbs or undershrubs, the stipules scarious or represented by axillary bundles of hairs or lacking; leaves alternate or opposite, often rosulate, simple, the blades often succulent; inflorescences axillary or terminal, usually cymose, often cincinnous, or racemiform or paniculiform or with solitary flowers, these actinomorphic, hermaphrodite; sepals usually 2, imbricate, free or united at base, green; petals (2-) 4-6 or more, frequently 5, imbricate, free or connate at base, often colored; stamens as many as petals and opposite them or more numerous by splitting, free or epipetalous, the filaments filiform, the anthers bilocular, longitudinally dehiscent; ovary superior or half-inferior or inferior, unilocular, the placentation basal or free-central, the ovules (1-) 2-many, amphitropous or anatropous, the style usually divided, sometimes lacking, the stigmas 2-5 (-9); fruit a capsule, dehiscent by 2 or 3 valves or by a circumscissile operculum, rarely an achene, the seeds (1-) 2-many, globose-reniform, the embryo curved or annular around the copious perisperm.

DISTRIBUTION: Cosmopolitan but mostly American, with 15-31 genera. The family includes some garden ornamentals and plants edible as vegetable or salad greens.

USEFUL TREATMENTS OF FAMILY: Pax, F., & K. Hoffmann. *Portulacaceae*. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16: 234-262. 1934. Geesink, R. *Portulacaceae*. Fl. Males. I. 7: 121-133. 1971. McNeill, J. Synopsis of a revised classification of the *Portulacaceae*. Taxon 23: 725-728. 1974.

KEY TO GENERA

- Ovary inferior or half-inferior; style 2-9-divided; petals 4-6 (-8); stamens 4-numerous; capsule dehiscent by a circumscissile operculum; stipules present, scarious or composed of tufts of hairs. . . 1. *Portulaca*
 Ovary superior; style usually with 3 divergent branches; petals usually 5; stamens usually 5-numerous; capsule dehiscent by 3 valves; stipules absent. 2. *Talinum*

1. PORTULACA L. Sp. Pl. 445. 1753; Seem. Fl. Vit. 8. 1865; Geesink in *Blumea* 17: 283. 1969.

Annual or perennial herbs, with often minute stipules, these scarious or reduced to hairs; leaves alternate to opposite, the upper ones sometimes involucrate around flowers, the blades succulent, linear to orbicular; flowers terminal, sessile or subsessile, in 2-30-flowered heads (capituli or condensed cymes) or solitary; sepals 2, united proximally; petals 4-6 (-8), free or basally connate, often obovate; stamens 4-many, perigynous, the filaments usually puberulent proximally; ovary half-inferior to inferior, the ovules numerous, amphitropous, borne on a simple or branched free-central placenta, the style 2-9-divided; capsule membranaceous, circumscissile at or above base, the seeds numerous, tuberculate, nitid.

LECTOTYPE SPECIES: *Portulaca oleracea* L., one of Linnaeus's four original species (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 39. 1913).

DISTRIBUTION: Pantropical and subtropical, with 100-200 species. Geesink (1969, cited below) considers the genus to be composed of about 40 species, but many of these seem very polymorphic and are considered species complexes by other authors.

USEFUL TREATMENT OF GENUS: Geesink, R. An account of the genus *Portulaca* in Indo-Australia and the Pacific (*Portulacaceae*). *Blumea* 17: 275-301. 1969.

In the present treatment I recognize six species in Fiji. Many of these have the appearance of being weeds, but, since their accidental introduction is difficult to establish, I treat five of them as indigenous. *Portulaca grandiflora* occurs only in cultivation. Geesink, unlike most previous students, does not consider the axillary hairs of *Portulaca* to be homologues of stipules.

KEY TO SPECIES

All leaves opposite, the blades oblong, 3-10 × 1.2-3.5 mm.; hairs intra- and interpetiolar (i. e. all around the node); membranous bracteoles absent; flowers solitary, surrounded by an involucre of 4 cauline leaves; petals 4, bright yellow, often purplish without. 1. *P. quadrifida*

At least the middle cauline leaves spirally arranged; hairs only axillary (and in the capitulum); bracteoles membranous; flowers rarely solitary; petals 5.

Leaf blades obovate to spatulate, 2-40 × 1.5-15 mm.; axillary hairs inconspicuous; sepals distinctly carinate; petals yellow.

Capituli 1- or 2-flowered (rarely to 6-flowered); stamens 18-50; fruit about 7 mm. long. 2. *P. lutea*

Capituli 3-30-flowered (rarely only 2-flowered); stamens 7-15; fruit about 4 mm. long.

3. *P. oleracea*

Leaf blades linear to elliptic or lanceolate, narrowed at apex; axillary hairs conspicuous; sepals not carinate; petals not always yellow; capituli usually 2-8-flowered.

Petals up to 12 mm. long; sepals about 4 mm. long; stamens usually 20-30, the anthers 0.4-0.7 mm. long; style branches 3-6; fruit usually 2-3 mm. in diameter; leaf blades narrowly lanceolate-subulate, 10-20 × 1-4 mm.

Axillary hairs very conspicuous, often 10 mm. long or more, nearly concealing the leafy parts of stems; petals pink to red-purple; seeds blue, the testa cells stellate, with pyramidal tubercles.

4. *P. pilosa*

Axillary hairs up to 5 mm. long, not concealing the leafy parts of stems; petals yellow; seeds dark gray, the testa cells elliptic-lobed, stellate at margin, with elevated tubercles. 5. *P. samoensis*

Petals 12-30 mm. long, variable in color from red or orange to yellow or white; sepals 5-12 mm. long; stamens 40-75, the anthers about 1.4 mm. long; style branches 5-9; fruit about 5 mm. in diameter; axillary hairs up to 5 mm. long, not concealing the leafy parts of stems; leaf blades linear-subulate, 12-35 × 1-4 mm. 6. *P. grandiflora*

1. ***Portulaca quadrifida*** L. Mant. Pl. 73. 1767; A. Gray, Bot. U. S. Expl. Exped. 1: 140. 1854; Seem. in Bonplandia 9: 254. 1861, in op. cit. 10: 295. 1862, Viti, 432. 1862, Fl. Vit. 9. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 111. 1890; Christophersen in Bishop Mus. Bull. 128: 85. 1935; Greenwood in J. Arnold Arb. 25: 398. 1944; Yuncker in Bishop Mus. Bull. 220: 112. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 45. 1959; Backer & Bakh. f. Fl. Java 1: 218. 1963; J. W. Parham, Pl. Fiji Isl. 225. 1964, ed. 2. 313. 1972; Geesink in Blumea 17: 290. pl. 1, fig. 6. 1969, in Fl. Males. I. 7: 127. fig. 4. 1971.

A creeping herb, rooting at nodes, found in coastal areas near sea level. The petals are usually bright yellow and the fruit pale yellow. There are too few Fijian collections to suggest any seasonality.

LECTOTYPIFICATION: Linnaeus cited a number of references, indicating "Hab. in Aegypto." Geesink in 1969 considered a specimen in the Linnaean herbarium to be a suitable lectotype.

DISTRIBUTION: Pantropical, occurring in the Pacific as far east as the Gilbert Islands, Samoa, and Tonga, but apparently absent from Australia.

LOCAL NAME: *Tuakuku ni vuaka*. Although the species is considered a weed in Fiji, its occurrence is probably indigenous.

AVAILABLE COLLECTIONS: NAIRAI: *Tothill 21*. VANUA LEVU: MATHUATA: Islands off Mathuata coast, Greenwood 681. FIJI without further locality, U. S. Expl. Exped., Seemann 14, Storck 868, Horne s. n.

2. ***Portulaca lutea*** Solander ex Forst. f. Pl. Esc. Ins. Oc. Austr. 72. 1786, Fl. Ins. Austr. Prodr. 90. 1786; Solander ex Seem. Fl. Vit. 9. 1865; Christophersen in Bishop Mus. Bull. 128: 85. 1935; Yuncker in op. cit. 178: 53. 1943, in op. cit. 184: 38. 1945; Geesink in Blumea 17: 291. pl. 1, fig. 10-13. 1969; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 171. 1970; Geesink in Fl. Males. I. 7: 129. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 313. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 122. 1972.

Portulaca fosbergii Poelln. var. *substellata* Poelln. in Occas. Pap. Bishop Mus. **12** (9): 4. 1936; J. W. Parham, Pl. Fiji Isl. 225. 1964.

A prostrate or subsascending herb usually 15–30 cm. high, perhaps sometimes to 70 cm. high, occurring near sea level on sand or coral beaches or in small pockets on rough limestone rocks. Its petals are yellow, shading to pale yellow or nearly white, its anthers are sometimes red, and its fruit is pale yellow. It is infrequent in Fiji, being known from only two collections from the Lau Group, obtained in flower in August and September.

LECTOTYPIFICATION AND NOMENCLATURE: Geesink notes the authority for *Portulaca lutea* to be "Solander ex Seem.," apparently taking Seemann's 1865 description as the first valid one. However, Forster's 1786 description seems to meet requirements of the ICBN; it was cited by Seemann, who may have thought the description inadequate and therefore provided a more extended one. Forster's second mention in 1786 merely lists the name. There appears to be no extant specimen from the first Cook voyage, but there is a Parkinson drawing (BM) which may serve as the type. The only locality listed by Forster was the island of Huahine, but Seemann also mentions Tahiti, Raiatea, and Tahaa; probably it cannot be said from which of the Society Islands Parkinson obtained the model for his illustration. Von Poellnitz cited two Bryan collections as syntypes of *P. fosbergii* var. *substellata*, which I believe to be correctly reduced to *P. lutea* by Geesink. Geesink indicated as the lectotype *Bryan 452* (BISH), collected Aug. 7, 1924, on Nayambo, Lau Group; there is an isolectotype at κ.

DISTRIBUTION: Pacific islands from New Caledonia eastward to Pitcairn Island and northward to several equatorial archipelagoes. In Fiji it seems to be rare, but it may merely have been overlooked by the few collectors who have worked in the Lau Group.

AVAILABLE COLLECTION: BACON ISLAND (Argo Reefs, Lau Group): *Bryan 539* (BISH only, the second of von Poellnitz's syntypes).

3. *Portulaca oleracea* L. Sp. Pl. 445. 1753; Seem. in Bonplandia **9**: 254. 1861, Viti, 432. 1862, Fl. Vit. 9. 1865; Drake, Ill. Fl. Ins. Mar. Pac. **111**. 1890; Christophersen in Bishop Mus. Bull. **128**: 85. 1935; Greenwood in Proc. Linn. Soc. **154**: 94. 1943; Yuncker in Bishop Mus. Bull. **178**: 53. 1943, in op. cit. **184**: 38. 1945, in op. cit. **220**: 112. 1959; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 45. 1959; Backer & Bakh. f. Fl. Java **1**: 218. 1963; J. W. Parham, Pl. Fiji Isl. 225. 1964, ed. 2. 313. 1972; Geesink in Blumea **17**: 292. pl. 1, fig. 8, 9. 1969; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 171. 1970; Geesink in Fl. Males. I. **7**: 129. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 121. 1972.

An abundant, semiprostrate, succulent herb, rarely ascending to 1 m. in height, found near sea level along roadsides, in waste places, canefields, and other cultivated areas. The petals are yellow and the fruit pale yellow. Flowers and fruits occur throughout the year.

LECTOTYPIFICATION: Linnaeus mentioned several prior references; Geesink indicates as lectotype a specimen in the Linnaean Herbarium.

DISTRIBUTION: A pantropical weedlike plant, usually mentioned as being adventive in the Pacific, where it occurs widely. It may just as likely have attained its wide distribution by natural means.

LOCAL NAMES AND USE: *Pigweed*; *taukuku ni vuaka* or *taukuka ni vuaka*; *amlonia* (Hindi). The entire plant is edible as a green potherb.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood* 416; Ndrasa, near Lautoka, *DA 10334*; Korovuto, Nandi, *DA 10694*; Votua, vicinity of Mba, *DA 10439*. NANDRONGA & NAVOSA: Loma, Singatoka, *DA 11316*; Korotongo Beach, *DA 17320*. RA: Ndombulevu: *DA 10945, 11005*. NAITASIRI: Laggere, *DA 11183*; Koronivia, *DA 3997*; Central Agricultural Station, *DA 2543*; Tamavua, *DA 11225*; Nasinu, *DA 16617*. REWA: Department of Agriculture compound, Suva, *DA 11566*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood* 468. THAKAUNDRIVE: Savusavu, *DA 11535*. FIJI without further locality, *Seemann* 13.

4. *Portulaca pilosa* L. Sp. Pl. 445. 1753; Backer & Bakh. f. Fl. Java 1: 218. 1963; Geesink in Blumea 17: 294, p. p. 1969, in Fl. Males. I. 7: 131, p. p. 1971.

Portulaca pilosa L. subsp. *pilosa*; Geesink in Blumea 17: 295, p. p. *pl. 2, fig. 1*. 1969, in Fl. Males. I. 7: 131, p. p. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 313. 1972.

Portulaca pilosa L. subsp. *pilosa* race "pilosa" Geesink in Blumea 17: 296. 1969.

A semiprostrate herb occurring near sea level on grassy sand dunes, along dry roadsides, and in canefields. It is readily distinguished by its extremely long axillary hairs and its pink to purplish red petals.

TYPIFICATION: Linnaeus mentioned several prior references, but I have not noted a definite lectotypification.

DISTRIBUTION: Presumably pantropical.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Tavukumbu, near Lautoka, *DA 10725*; outskirts of Tavua, O. & I. Degener 32026. NANDRONGA & NAVOSA: Vatukarasa, *Tabualewa* 15563.

Geesink (1969, cited above) includes some 150 names in his concept of *Portulaca pilosa*, which he interprets as a very variable species divisible into many subspecies and races. Eight subspecies are recognized in the Indo-Australian-Pacific area. No doubt the complex is very intricate, but, like many other students, I believe that clarification is not enhanced by wholesale reduction. At least *P. grandiflora* seems too distinct to be included, and in the Pacific *P. samoensis* also seems clearly separable from *P. pilosa*.

5. *Portulaca samoensis* Poelln. in Repert. Sp. Nov. 33: 163. 1933, in Occas. Pap. Bishop Mus. 12 (9): 6. 1936; Yuncker in Bishop Mus. Bull. 184: 38. 1945, in op. cit. 220: 112. 1959; J. W. Parham, Pl. Fiji Isl. 225. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 171. 1970.

Portulaca pilosa L. ssp. *pilosa* race "tuberosa" Geesink in Blumea 17: 297, p. p. 1969.

A succulent, prostrate herb, sometimes subsending to 20 cm. high, found between sea level and 200 m. on rocky shores and islets, in crevices of basalt ledges, on rocks of open hillsides, near roads, and sometimes in tern guano. Its petals are yellow to bright yellow, and flowers have been obtained in Fiji between February and September.

TYPIFICATION: The type is *Vaupel* 178 (B HOLOTYPE, perhaps destroyed; ISOTYPE at BISH), collected Dec. 24, 1904, in the vicinity of Matautu, Upolu, Samoa. It is possible that further study of *Portulaca* will demonstrate that this taxon is referable to *P. australis* Endl. (Atakta Bot. 7. t. 6. 1833), typified by the original illustration by Ferdinand Bauer of a plant from the Gulf of Carpentaria, northern Australia, but it should scarcely be left in a reasonable concept of *P. pilosa*.

DISTRIBUTION: New Guinea to Fiji, Samoa, Tonga, and Niue.

LOCAL NAMES AND USE: *Ndomindomi* (Yasawas) and *kutu* (Moala) have been recorded. In the Yasawas the plant is pounded and used as a medicinal poultice.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nakawa Gulch, west side of Mbatinaremba, *St. John* 18152. VITI LEVU: MBA: Hills near Saweni, south of Lautoka, *Greenwood* 667A. OVALAU: Vicinity of Thawathi, *Smith* 8096. NGAU: Hills east of Herald Bay, inland from Sawaieke, on slopes of Mt. Vonda and toward Waikama, *Smith* 7953. VANUA LEVU: MATHUATA OF THAKAUNDRIVE: Between Lambasa and

Savusavu, *Greenwood 667*. THAKAUNDRIVE: Savusavu, *DA 11534*. MOALA: North coast, *Smith 1394*. KARONI: Islet off northwestern point, *Bryan 481*. FULANGA: On limestone formation, *Smith 1162*.

6. ***Portulaca grandiflora*** Hook. in *Bot. Mag.* **56**: t. 2885. 1829; Backer & Bakh. f. *Fl. Java* **1**: 218. 1963; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 170. 1970.

Portulaca pilosa subsp. *grandiflora* Geesink in *Blumea* **17**: 297. 1969, in *Fl. Males. I.* **7**: 131. 1971.

A semiprostrate herb, cultivated near sea level, the petals variable in color from red or orange to yellow or white, or often reddish with streaks of yellow or white. The only available herbarium voucher was flowering in September.

TYPIFICATION: The type, presumably collected by *W. J. Hooker* (κ), was obtained between Rio del Saladillo and the foot of the mountains near Mendoza, Argentina.

DISTRIBUTION: Tropical America, but now widely cultivated in tropical and subtropical gardens. It is more frequently seen in Fijian gardens than suggested below.

LOCAL NAME AND USE: *Purslane*; ornamental ground cover.

AVAILABLE COLLECTION: VITI LEVU: REWA: Botanical Gardens, Suva, *DA 12179*.

2. **TALINUM** Adans. *Fam. Pl.* **2**: 245. 1763; Seem. *Fl. Vit.* **9**: 1865. *Nom. cons. prop.*

Perennial, glabrous herbs or shrubs, without stipules, the leaves usually alternate; inflorescences usually terminal, cymose but often racemiform or paniculiform; sepals 2, ovate, often caducous; petals 5 (rarely more), subsistent, sometimes showy; stamens 5-many; ovary superior, the ovules numerous, amphitropous on a free-central placenta, the style elongate and usually with 3 divergent branches; capsule chartaceous, globose to ellipsoid, 3-valved from apex to base, the seeds numerous, verrucose or costate, nitid.

TYPE SPECIES: *Talinum triangulare* (Jacq.) Willd. *Sp. Pl.* **2**: 862. 1800 (*Portulaca triangularis* Jacq.) (vide McNeill in *Taxon* **26**: 147. 1977). *Typ. cons. prop.*

DISTRIBUTION: Pantropical and subtropical, with a principal center in Mexico, with about 50 species. One adventive species is established in Fiji.

The conservation of *Talinum*, with a proposed conserved type species, was accepted by the Committee for Spermatophyta (cf. *Taxon* **27**: 545. 1979), but this is not yet reflected in the ICBN.

1. ***Talinum paniculatum*** (Jacq.) Gaertn. *Fruct. Sem. Pl.* **2**: 219. t. 128. 1791; Poelln. in *Repert. Sp. Nov.* **35**: 10. 1934; A. C. Sm. in *Bull. Torrey Bot. Club* **70**: 537. 1943; Greenwood in *J. Arnold Arb.* **30**: 75. 1949; J. W. Parham in *Dept. Agr. Fiji Bull.* **35**: 44. 1959, *Pl. Fiji Isl.* 225. 1964, ed. 2. 314. 1972; Geesink in *Fl. Males. I.* **7**: 124. 1971.

Portulaca paniculata Jacq. *Enum. Syst. Pl. Carib.* **22**. 1760.

Portulaca patens L. *Mant. Pl. Alt.* 242, nom. illeg. 1771.

Talinum patens Willd. *Sp. Pl.* **2**: 863, nom. illeg. 1799; Seem. in *Bonplandia* **9**: 254. 1861, *Viti*, 432. 1862, *Fl. Vit.* **10**. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* **112**. 1890.

As seen in Fiji, *Talinum paniculatum* is a coarse herb or suffruticose plant 0.4-1 m. high, occurring from sea level to about 50 m. elevation as a weed in villages or along roadsides. Its petals are pink or infrequently yellowish, and its fruit is yellow to pink. It may be expected in flower and fruit throughout the year.

TYPIFICATION AND NOMENCLATURE: The species was doubtless based on a Jacquin collection from the West Indies, which may not have been preserved. *Portulaca patens* is an illegitimate name because Linnaeus cited *P. paniculata* in his synonymy.

DISTRIBUTION: Tropical America, now a widespread weed throughout the tropics.

LOCAL NAME AND USES: The only Fijian name I have noted is *varataisi*. Sometimes the plant is considered edible, and its wide distribution may be a result of its introduction into cultivation.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Wainawangga, Waindina River, *DA 1841*. KANDAVU: Rakiraki, Yale Bay, *DA 2965*. OVALAU: Lovoni Village, *Smith 7472*; Vuma, north of Levuka, *DA 17402*; coastal road north of Levuka, *Gillespie 4495*; vicinity of Levuka, *Seemann 15*. TAVEUNI: Vatuwiri, *DA 8917*.

FAMILY 75. BASELLACEAE

BASELLACEAE Moq. *Chenopod. Monogr. Enum. x. 1840*.

Perennial, glabrous herbs, sometimes suffrutescent, with slender, climbing stems arising from rhizomes or tubers, without stipules; leaves alternate, the blades somewhat succulent, entire, pinnate-nerved; inflorescences axillary or terminal, spicate, racemose, or panicle, with small bracts; flowers hermaphrodite (rarely unisexual), actinomorphic, hypogynous or perigynous, the pedicels with 2 distal (sepaloid) bracteoles subtending each flower; sepals 5 (petaloid), free or proximally connate, often colored, usually persistent, the lobes imbricate or quincuncial; petals lacking; stamens 5, inserted at base of and opposite sepals, the filaments short, free, erect or reflexed in bud, the anthers bilocular, dorsifixed, dehiscing by oblique pores or longitudinal clefts; ovary superior, unilocular, with a solitary, basal, campylotropous ovule, the style terminal, often deeply divided into 3 stigmas; fruit a fleshy berry or drupe, surrounded by the persistent, often fleshy calyx or bracteoles, the seed solitary, subglobose, the embryo spirally twisted or semiannular, the perisperm usually copious.

DISTRIBUTION: Pantropical, with four or five genera.

USEFUL TREATMENTS OF FAMILY: Ulbrich, E. *Basellaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16:* 263-271. 1934. Steenis, C. G. G. J. van. *Basellaceae. Fl. Males. I. 5:* 300-304. 1957.

The two appendages subtending the flower are usually considered bracteoles and the five perianth segments sepals, but sometimes these whorls are considered sepals and petals respectively. The latter interpretation seems to be the more usual one in the Portulacaceae.

I. *Basella* L. *Sp. Pl. 272. 1753.*

Succulent, rhizomatous herbs with scandent stems; inflorescences spicate, sometimes branched; flowers hermaphrodite, subsessile, the bracteoles enclosing the perianth fleshy, scarcely open at anthesis, the sepals fleshy, enclosing the fruit; filaments erect in bud, the anthers dehiscing longitudinally; style deeply divided into 3 linear stigmas; seed with the embryo spirally twisted.

LECTOTYPE SPECIES: *Basella rubra* L., one of Linnaeus's two original species (vide Hitchcock, *Prop. Brit. Bot. 143. 1929*).

DISTRIBUTION: Tropical Asia, Africa, and Madagascar, with about five species. One species is often cultivated in Fiji.

I. *Basella alba* L. *Sp. Pl. 272. 1753*; Ulbrich in *Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16:* 267. *fig. 117, A-F. 1934*; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji 13:* 43. 1942; van Steenis in *Fl. Males. I. 5:* 300. *fig. 1. 1957*; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull. 200:* 49. 1970.

Basella rubra L. *Sp. Pl. 272. 1753*; Greenwood in *Proc. Linn. Soc. 154:* 103. 1943; J. W. Parham, *Pl. Fiji Isl. 228. 1964, ed. 2. 316. 1972*.

As cultivated in Fiji, *Basella alba* is found from near sea level to an elevation of about 250 m. as a semiprostrate or climbing succulent vine, sometimes with the stem to 1 cm. in diameter. The spikes have a red or green rachis; the sepals are white and pink-tinged to purple proximally; and the mature fruit is black and shining. Flowers and fruits have been collected between March and July.

TYPIFICATION AND NOMENCLATURE: Linnaeus gave a single reference to *Basella alba*: "*Thran. carol. 11. Habitat in Syria?*" For *Basella rubra* he gave three references, and perhaps the specimen referred to in L. Fl. Zeyl. 119. 1747 would provide a logical lectotype. Apparently the first author to unite the two Linnaean species was Graham (Cat. Pl. Bombay, 170. 1839), whose choice of *B. alba* must be followed (cf. van Steenis, 1957, cited above).

DISTRIBUTION: Indigenous in tropical Asia or Africa, but the species has been so widely cultivated that its nativity is scarcely discernible.

LOCAL NAMES AND USE: The usual names *Malabar nightshade* and *Ceylon spinach* have not been noted in Fiji, where the species is called *Indian spinach*, *country spinach*, or merely *spinach*; when cooked it is sometimes called *poi* (presumably a borrowed word). It is moderately commonly cultivated and is sometimes seen in markets; the leaves and branch tips are edible as a cooked green vegetable or may be eaten raw.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 394, Tothill s. n.* NAITASIRI: Toninai-wau, Tholo-i-suva, *DA 16745*; Koronivia Research Station, *DA 14430*. TAILEVU: Matavatathou, *DA 9241 (McKee 2806)*. REWA: Suva, in private garden, *DA 17392*.

FAMILY 76. AMARANTHACEAE

AMARANTHACEAE Juss. Gen. Pl. 87, as *Amaranthi*. 1789.

Annual or perennial, erect, prostrate, or scandent herbs or shrubs, without stipules; leaves opposite or alternate, the blades entire or shallowly serrate-dentate; inflorescences composed of clustered or solitary flowers in heads, racemes, spikes, or panicles; flowers hermaphrodite or unisexual (plants then dioecious or polygamodioecious) or partly difform or neutral, actinomorphic, borne in axils of persistent bracts, usually bibracteolate at base, the perianth uniseriate; tepals 3-5, free or partially connate, like bracts and bracteoles entire or marginally scariose, the bracteoles falling off with perianth or persistent, the perianth usually enclosing fruit and falling off with it, rarely persistent; stamens as many as tepals and opposite them, rarely fewer, the filaments free or connate proximally into a cup or tube, with or without alternating pseudostaminodes, these dentiform, filiform, linear, or short and broad, the anthers dorsifixed, 1- or 2-celled (2- or 4-loculed), longitudinally dehiscent; ovary superior, unilocular, the ovules 1 or more, campylotropous, basal, borne on short or long funicles, the styles present or absent, the stigmas 1-4, capitate, clavate, or filiform; fruit often a utricle (surrounded by perianth), sometimes baccate or crustaceous, circumscissile or irregularly dehiscent or indehiscent, the seeds 1-many, often lenticular or subreniform, smooth or verruculose, the embryo annular, often enveloping the abundant perisperm.

DISTRIBUTION: Pantropical and temperate, with centers of diversity in America and Africa, with about 65 genera.

USEFUL TREATMENTS OF FAMILY: Schinz, H. *Amaranthaceae*. Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2. 16c: 7-85. 1934. Backer, C. A. *Amaranthaceae*. *Fl. Males.* 1. 4: 69-98. 1949.

The family includes a few garden ornamentals, food products such as grains and edible herbage, and also some noxious weeds. Eight genera occur in Fiji, but only one (*Deeringia*) seems to be truly indigenous.

KEY TO GENERA

Leaves alternate; anthers 2-celled (4-loculed).

Scandent shrubs or lianas; flowers hermaphrodite, borne singly or in clusters along the rachis of simple or paniced racemes or spikes; filaments united proximally into a cup, the free parts filiform-subulate, without alternating pseudostaminodes; style very short or none, the stigmas 2 or 3, rarely 4, linear or clavate, spreading or recurved; fruit an indehiscent berry falling out of the persistent perianth when ripe; seeds usually 5-10 or more. 1. *Deeringia*

Annual herbs; fruit utricular, usually dehiscent.

Fruit usually 2-many-seeded, circumscissile; flowers hermaphrodite; stamens 5, the filaments proximally united into a small cup, the free parts often alternating with minute pseudostaminodes; ovules numerous; style 1, filiform, the stigma capitate, faintly 2- or 3-lobed. 2. *Celosia*

Fruit 1-seeded, circumscissile or irregularly dehiscent or sometimes falling off unopened together with perianth; flowers unisexual; stamens 3 or 5, rarely 4, the filaments free, without alternating pseudostaminodes; ovules solitary; style short or none, the stigmas 2-4, often 3, linear. 3. *Amaranthus*

Leaves opposite; ovule and seed solitary; fruit utricular, indehiscent.

Proximal flowers of inflorescence accompanied by fascicled hooks (difformed, sterile flowers); free parts of filaments alternating with shorter pseudostaminodes; anthers 2-celled (4-loculed); style filiform, the stigma capitate; old flowers deflexed, accompanied by fascicled hooks. 4. *Cyathula*

Proximal flowers of inflorescence not accompanied by fascicled hooks (difformed, sterile flowers).

Anthers 2-celled (4-loculed); flower-subtending bracteoles consisting of a long spine and bearing on each side of base a shorter, membranous, nerveless wing; stamens 5, the filaments connate into a short cup, their free portions alternating with short, broad pseudostaminodes; style filiform, short, the stigma capitate. 5. *Achyranthes*

Anthers 1-celled (2-loculed), or the stamens partly anantherous or in ♀ flowers reduced to minute staminodes.

Stigma 1, capitate; inflorescences capitate or short-spicate; flowers hermaphrodite or by malformation ♀; stamens normally 2-5, sometimes partly anantherous. 6. *Alternanthera*

Stigmas 2, erect or spreading, sometimes inconspicuous.

Flowers hermaphrodite; inflorescences capitate or short-spicate; stamens 5; stigmas short, sometimes inconspicuous. 7. *Gomphrena*

Flowers hermaphrodite or unisexual (the plant then dioecious); inflorescences paniculiform, with spiciform ultimate branches; stamens in ♀ flowers reduced to minute staminodes; stigmas subulate. 8. *Iresine*

1. *DEERINGIA* R. Br. Prodr. Fl. Nov. Holl. 413. 1810; A. C. Sm. in J. Arnold Arb. 36: 277. 1955.

Erect herbs or (our species) scandent shrubs or lianas, unarmed; leaves alternate, petiolate, the blades ovate to lanceolate, acute, entire; inflorescences frequently paniced racemes or spikes, axillary and terminal; flowers hermaphrodite, solitary in the axils of bracts, subtended by 2 bracteoles; tepals 5 (rarely 4), ovate-oblong, glabrous, 1-nerved, scariose-margined; stamens 5 (rarely 4), the filaments proximally united into a cup, the free parts filiform-subulate, without alternating pseudostaminodes, the anthers 2-celled (4-loculed); ovary sessile or short-stalked, the ovules few to many, borne on long funicles, the stigmas essentially sessile, 2 or 3, rarely 4, linear or clavate, spreading or recurved; fruit baccate, thin-walled, subglobose, falling out of persistent perianth when ripe; seeds 5 or more (rarely lacking), on long, pale funicles, subglobose or reniform, shining black or brownish, verruculose or essentially smooth.

TYPE SPECIES: *Deeringia celosioides* R. Br., nom. illeg. (*D. baccata* (Retz.) Moq.).

DISTRIBUTION: Paleotropical, from Madagascar to Malesia and Australia and eastward in the Pacific to the Mariana Islands and Fiji, where the generic range terminates, with 7-12 species.

1. *Deeringia amarantoides* (Lam.) Merr. Interpret. Rumph. Herb. Amb. 211. 1917; A. C. Sm. in Sargentia 1: 30. 1942; Backer in Fl. Males. I. 4: 71. fig. 1. 1949; A. C. Sm. in J. Arnold Arb. 36: 277. 1955; J. W. Parham, Pl. Fiji Isl. 227. 1964, ed. 2. 316. 1972.

FIGURE 76.



FIGURE 76. *Deeringia amaranthoides*; A, distal portions of branchlets, with foliage and infructescences, $\times 1/3$; B, portion of inflorescence, $\times 8$. A from *Smith 1032*, B from *DA 7169*.

Achyranthes amaranthoides Lam. *Encycl. Méth. Bot.* 1: 548. 1785.

A scandent shrub or liana, often with long, pendulous branches, occurring at elevations from near sea level to 200 m., in thickets or in open forest, often in rocky places. The inflorescences are often divaricately branched with the distal racemes forming a terminal panicle; the tepals, like the stamens, become reflexed and are pale green or yellowish, white-margined, often red-tinged at maturity; the three stigmas are greenish white; and the mature fruit is rich pink to bright red and 4–7 mm. in diameter. Flowers and fruits have been obtained between January and July.

TYPIFICATION: Lamarck described *Achyranthes amaranthoides* from a living plant at the Jardin du Roi, said to have come from Java and the Moluccas; as a synonym he cited *Blitum frutescens* Rumph. *Herb. Amb.* 5: 235. *t.* 83, *fig.* 2. 1747. Merrill (1917, cited above) indicates that Lamarck had specimens of this species collected by Sonnerat.

DISTRIBUTION: Southeastern Asia through Malesia to the Mariana Islands and Fiji; I have seen collections from the Mariana and Solomon Islands but not from the New Hebrides.

LOCAL NAMES AND USE: *Tokoi*, *mborowa*; the leaves are reported to be edible when cooked.

AVAILABLE COLLECTIONS: VITI LEVU: RA: Vatundamusewa, vicinity of Rewasa, near Vaileka, *Degener 15463*. KORO: East coast, *Smith 1032*. NAYAU: Nanduthia, *DA 7169*. FULANGA: *Tothill 209*. ONGEA LEVU: Near west coast, *Bryan 428*. FIJI without further locality, *U. S. Expl. Exped.*

2. CELOSIA L. Sp. Pl. 205. 1753.

Erect, glabrous annuals, the stem angular-ribbed; leaves alternate, the blades entire or subentire; inflorescences terminal or axillary, spicate (in cultivated forms sometimes cristate) or paniculate; flowers hermaphrodite, solitary in axils of bracts, subtended by 2 bracteoles; tepals 5, free, ovate-oblong, scarious, longitudinally nerved, before and after anthesis erect but during anthesis often spreading; stamens 5, the filaments proximally connate into a small cup, the free parts linear from a deltoid base, often alternating with minute pseudostaminodes, the anthers oblong-linear, 2-celled (4-loculed); ovary sessile, broad-based, the ovules numerous, borne on short funicles, the style 1, filiform, persistent, the stigma capitate, faintly 2- or 3-lobed; utricle thin-walled, circumscissile, the (1-) 2-many seeds lenticular, black, shining.

LECTOTYPE SPECIES: *Celosia argentea* L., one of Linnaeus's five original species (vide Hitchcock, *Prop. Brit. Bot.* 135. 1929).

DISTRIBUTION: Mostly in subtropical and temperate regions of Africa and America, with about 60 species. One species is sparingly naturalized in Fiji and is also cultivated.

1. *Celosia argentea* L. Sp. Pl. 205. 1753; Backer in *Fl. Males. I.* 4: 73. 1949; St. John & A. C. Sm. in *Pacific Sci.* 25: 322. 1971.

Celosia argentea L. var. *argentea*; J. W. Parham, *Pl. Fiji Isl. ed.* 2. 316. 1972.

A succulent coarse herb, infrequently naturalized at low elevations and near streams, up to 1 m. high and with the green or reddish stem strongly ribbed. In the naturalized form the species has its bracts, bracteoles, and perianth white and pink-tipped or entirely pale to rich pink, becoming white when withering; the style is pink to purple. No flowering season is apparent.

TIPIFICATION: Of the three prior references given by Linnaeus, that of *Hortus Cliffortianus* is marked with an asterisk, and therefore a Clifford specimen at BM is probably the best lectotype.

DISTRIBUTION: Probably originally from tropical Africa (Backer, 1949, cited above), but spreading early throughout tropical Asia and Malesia; many cultivars are widely grown in tropical and subtropical areas. If the species is divided into varieties, the common weedy form is doubtless to be designated as var. *argentea*.

KEY TO INFRASPECIFIC TAXA

- Inflorescences spicate, not cristate; bracts, bracteoles, and perianth white and pink-tipped or entirely pale to rich pink; leaf blades not blotched. 1a. *C. argentea*
 Main axis of inflorescences with thick, sinuous crests, often lobed; entire inflorescence usually red-purple to orange or yellow; leaf blades often with a large, bright red blotch. 1b. *C. argentea* cv. 'Cristata'

1a. *Celosia argentea*

DISTRIBUTION: The naturalized, weedy form is probably widespread, but in the Pacific outside of Malesia I have noted specimens only from the Caroline Islands, Horne Islands, and Fiji, where it is not common enough to have received a local name.

AVAILABLE COLLECTIONS: VITI LEVU: RA: Ndombuilevu, *DA 3003*. OVALAU: Valley of Mbureta and Lovoni Rivers, *Smith 7391*.

1b. *Celosia argentea* cv. 'Cristata'; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 41. 1970.

Celosia cristata L. Sp. Pl. 205. 1753.

Celosia argentea var. *cristata* Kuntze, Rev. Gen. Pl. 2: 541. 1891; J. W. Parham, Pl. Fiji Isl. 227. 1964; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 73. 1972.

TYPIIFICATION: Among Linnaeus's several references, the one to *Hortus Cliffortianus*, although not marked with an asterisk, suggests the suitable lectotype.

DISTRIBUTION: The fasciated form of *Celosia argentea*, with many variations, is widely cultivated throughout the tropics and subtropics.

LOCAL NAME: *Cockscomb*.

Although no herbarium vouchers are available, this form is frequent in Suva gardens and doubtless elsewhere in Fiji. It is perhaps the most often cultivated form of the species and seems to be better designated as a cultivar than as a variety.

3. AMARANTHUS L. Sp. Pl. 989. 1753; Seem. Fl. Vit. 196. 1866.

Monococious, erect or prostrate or subscenting annuals, unarmed or spiny; leaves alternate, the blades entire; inflorescences axillary or terminal, spicate or paniculate or composed of axillary flower clusters; flowers unisexual, solitary in the axils of bracts, subtended by 2 bracteoles; tepals 3 or 5, rarely 4, erect or obliquely spreading, free, subequal, membranous, after anthesis sometimes indurated at base; stamens as many as tepals, the filaments free, filiform, without alternating pseudostaminodes, the anthers 2-celled (4-loculed); ovary ovoid or oblong, the ovule 1, sessile, erect, the style short or none, the stigmas 2-4, often 3, linear, erect or spreading to recurved; utricle laterally compressed, membranous, circumscissile when ripe or irregularly dehiscent or indehiscent and falling off together with the perianth, the seed 1, erect, lenticular, shining, black or brown.

LECTOTYPE SPECIES: *Amaranthus caudatus* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2: 1. 1913), one of Linnaeus's eleven original species.

DISTRIBUTION: Pantropical and temperate, with about 75 species. Five species are believed to occur in Fiji either as naturalized adventives or as cultivated plants.

USEFUL TREATMENTS OF GENUS: Sauer, J. D. The grain amaranths: a survey of their history and classification. Ann. Missouri Bot. Gard. **37**: 561-632. 1950. Sauer, J. D. The grain amaranths and their relatives: a revised taxonomic and geographic survey. Ann. Missouri Bot. Gard. **54**: 103-137. 1967.

KEY TO SPECIES

- Ripe utricles strongly corrugated, irregularly dehiscent or indehiscent, the seed-containing part entirely included by the perianth, only the seedless apex exerted from the perianth; tepals 3 (rarely 4), short-mucronate, with a green median band; stigmas short, less than 0.7 mm. long, erect or suberect; plants unarmed. 1. *A. gracilis*
- Ripe utricles circumscissile slightly below middle; stigmas 0.7-2.5 mm. long, often recurved.
- Tepals 3, long-acuminate or awned, with a green or purple median band; leaf blades green, or in ornamental forms purple or blotched with purple or variegated with red, yellow, and green; plants unarmed. 2. *A. tricolor*
- Tepals usually 5, sometimes 4, only very rarely 3, short-mucronate.
- Flower clusters mostly axillary, but others aggregated into spikes or panicles terminating the stem and lateral branches; tips of tepals incurved against utricles; bract and all tepals approximately equal in length.
- Axillary flower clusters entirely ♀, those of spikes and panicles entirely or mostly ♂; tepals short-mucronate, with a green or red or purple median band, the midrib not strongly thickened distally; ♀ flower clusters usually armed with 2 sharp spines 0.5-2 cm. long. 3. *A. spinosus*
- Terminal spike of main stem almost exclusively composed of ♀ flowers, the other spikes and panicles with lower flowers ♂ and often with apical flowers ♀; tepals minutely mucronate, with a green median band, the midrib strongly thickened distally; plants unarmed. 4. *A. dubius*
- Flower clusters all aggregated into terminal or axillary panicles; tepals red, the tips straight, the margins not or scarcely overlapping, the inner tepals shorter than the outer tepals and bract; in Fiji known only in cultivation or as a garden escape. 5. *A. hybridus*

1. *Amaranthus gracilis* Desf. Tabl. École Bot. Mus. Hist. Nat. 43. 1804; Backer in Fl. Males. I. 4: 76. 1949.

Amaranthus viridis L. Sp. Pl. ed. 2. 1405, p. p. 1763; Christophersen in Bishop Mus. Bull. 128: 82. 1935; Greenwood in Proc. Linn. Soc. 154: 103. 1943; Yuncker in Bishop Mus. Bull. 178: 51. 1943, in op. cit. 184: 37. 1945, in op. cit. 220: 107. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 47. fig. 17. 1959, Pl. Fiji Isl. 227. 1964, ed. 2. 316. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 41. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 19. 1972; videtur non sensu lectotypi. *Chenopodium caudatum* Jacq. Collect. 2: 235. 1789; non *Amaranthus caudatus* L. *Euxolus caudatus* Moq. in DC. Prodr. 13 (2): 274. 1849; Seem. Fl. Vit. 198. 1867. *Euxolus viridis* sensu Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862; non Moq.

An unarmed, annual herb usually 0.3–1 m. high, with a long taproot, erect, ascending, or rarely prostrate, occurring near sea level as a naturalized weed of cultivation and waste places, often locally abundant, common along roadsides and in gardens, plantations, and canefields. The leaf blades seldom exceed 9×6.5 cm.; the perianth segments have a green median band and transparent, white margins; and the seeds are black. Flowers and fruits are found throughout the year.

TYPIFICATION AND NOMENCLATURE: I have not been able to ascertain the typification of *Amaranthus gracilis*, and in accepting that binomial to replace the species so frequently identified as *A. viridis* I follow much current herbarium usage and also Backer's (1949, cited above) treatment. In his protologue of *A. viridis*, Linnaeus cited a number of references including works of Bauhin, Sloane, and Tournefort, mentioning occurrence of the species in Europe and Brazil. Apparently the species is now lectotypified or interpreted in a way that excludes the tropically ubiquitous weed here referred to *A. gracilis*. Concerning *Chenopodium caudatum*, Jacquin gave only the information "In Guinea Africae crescit." His binomial was not based on *Amaranthus caudatus* L., which Sauer (1967, cited above under the genus, pp. 126–130) discusses as a domesticated species probably derived from *A. quitensis* H. B. K. However, the basionym of *Euxolus caudatus* Moq. is the Jacquin binomial.

DISTRIBUTION: The species is common in most tropical countries, and its place of nativity is probably not to be ascertained. It occurs in most Pacific archipelagoes as an obvious adventive.

LOCAL NAMES AND USE: *Ndriti*, *tumbua*, and *ngasau ni vuaka* are recorded Fijian names; Hindi names are *choroiya* or *chauraiya*. The leaves are edible when cooked.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka and vicinity, *Greenwood 166*, *Tothill 463*, *DA 10328*; vicinity of Nandi, *DA 8557*, *9745*; *Votualevu, DA 9715*; *Ndramasu, DA 9475*; *Tavua, DA 3283*. NANDRONGA & NAVOSA: Loma, Singatoka, *DA 11318*. RA: *Ndombuilevu, DA 9552*, *11004*. NAITASIRI: *Vunindawa, DA 10040*; *Nanduruloulou, DA 9571*; *Nasinu, DA 11092*. REWA: *Suva, DA 447*, *7419*. VANUA LEVU: *THAKAUNDROVE*: Vicinity of Savusavu, *DA 8952*. *TAVEUNI*: *Wairiki, DA 8878*; *Vuna, DA 5743*. *MOALA*: *Milne 111*. FIJI without further locality, *Seemann 368*, *Horne 397*, *DA 3986*.

2. *Amaranthus tricolor* L. Sp. Pl. 989. 1753; Fosberg in J. Wash. Acad. Sci. 31: 94. 1941; Yuncker in Bishop Mus. Bull. 178: 51. 1943; Backer in Fl. Males. I. 4: 77. fig. 2. 1949; J. W. Parham, Pl. Fiji Isl. 227. 1964, ed. 2. 315. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 41. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 131. 1972.

Amaranthus melancholicus L. Sp. Pl. 989. 1753; Drake, Ill. Fl. Ins. Mar. Pac. 269, as *Amarantus m.* 1892. *Amaranthus tricolor* var. *melancholicus* Lam. Encycl. Méth. Bot. 1: 115. 1783; Christophersen in Bishop Mus. Bull. 154: 7. 1938.

Amaranthus melancholicus var. *tricolor* Lam. ex Moq. in DC. Prodr. 13 (2): 262. 1849; Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862, Fl. Vit. 197. 1867.

An unarmed coarse weed usually 0.3–1.2 m. high, with a long taproot, erect or ascending, occurring near sea level, cultivated as an ornamental (form with purple, red,

or variegated leaf blades) or as a potherb (form with green leaves, often naturalizing). The larger leaf blades are often 10–25 × 3–12 cm., and the tepals have a green or purple median band and broad, transparent margins. Flowers and fruits occur at all seasons.

TYPIFICATION AND NOMENCLATURE: Both Linnaean species are indicated as: "*Habitat in India*" and both are based on prior references, but I have not noted lectotypifications. They are treated as varieties by some authors; apparently Lamarck was the first so to combine them, and therefore *A. tricolor* has nomenclatural priority. Fosberg (1941, cited above) has discussed the status of several more synonyms than here mentioned.

DISTRIBUTION: Now tropically ubiquitous, the species was possibly indigenous in tropical Asia (Backer, 1949, cited above).

LOCAL NAMES AND USES: Green-leaved forms are usually known as *tumbua* and the leaves are used as a potherb; forms with colored leaves are often known as *ndriti ndamundamu* and are cultivated as garden ornamentals.

AVAILABLE COLLECTIONS: Green-leaved forms: VITI LEVU: MBA: Saweni, Lautoka, DA 10307, 10308; Votua, vicinity of Nandi, DA 10441. NANDRONGA & NAVOSA: Singatoka and vicinity, DA 2372, 5956, 11315. RA: Mburotu Valley, DA 9503. NAITASIRI: Ndavuilevu, DA 412. VANUA LEVU: THAKAUNDROVE: Savu-savu, DA 8853; Thavanandi, DA 10774. MATUKU: Moseley, July, 1874. Forms with colored leaves: VITI LEVU: MBA: Nandi airport, DA 10680, 10681. VANUA LEVU: Without further locality, Seemann 366.

There seem to be two major forms of *Amaranthus tricolor*, one with green leaves that is cultivated for use as a potherb and is often naturalized, and one with purple, red, or variegated leaves that is cultivated as a garden ornamental. The first is apparently what Linnaeus intended as *A. tricolor*, the second as *A. melancholicus*. However, there are so many intermediate forms that a complex of cultivars blurs nomenclatural distinctions. The green-leaved forms are often confused with *A. gracilis*, but the conspicuously subulate tepals, usually more robust habit, and usually larger leaves distinguish *A. tricolor*, in addition to fruiting and stigmatic characters.

3. *Amaranthus spinosus* L. Sp. Pl. 991. 1753; Backer in Fl. Males. I. 4: 78. 1949; J. W. Parham in Dept. Agr. Fiji Bull. 35: 47. 1959, Pl. Fiji Isl. 227. 1964, ed. 2. 315. 1972.

An annual herb usually 30–100 cm. high, with a long taproot, erect, much-branched, occurring sparsely near sea level as a naturalized weed of waste places near the shore. The stem is green or somewhat suffused with purple, and the larger leaf blades are 3.5–11 × 1.2–4.5 cm. The 5 tepals are short-mucronate, with a green or purple median band and transparent margins. Each ♀ flower cluster is usually armed with 2 sharp spines, making this potentially noxious weed very recognizable. Flowers and fruits have been seen in March and November.

TYPIFICATION: Linnaeus gave several prior references, including his *Hortus Cliffortianus* and *Flora Zeylanica*.

DISTRIBUTION: As it is now tropically ubiquitous, the precise nativity of this weed may remain unknown. However, Sauer (1967, cited above under the genus, p. 107) suggests that it originated in the New World tropical lowlands as a close relative of the following species.

LOCAL NAME: *Spiny amaranthus*.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Chief chemist cement factory, DA L.26246. VANUA LEVU: THAKAUNDROVE: Ndevo, Natewa Peninsula, DA 9110. TAVEUNI: Nggathavulo Estate, DA 8881.

The species is apparently a recent introduction into Fiji, the earliest known collection being that made on Taveuni, cited above, in November, 1954, by J. W. Parham.

4. *Amaranthus dubius* Mart. Pl. Hort. Acad. Erlang. 197, nom. nud. 1814; Mart. ex Thell. in Aschers. & Graebn. Syn. Mitteleur. Fl. 5 (1): 265. 1914; Backer in Fl. Males. I. 4: 79. 1949.

Amaranthus paniculatus sensu Yuncker in Bishop Mus. Bull. 220: 107. 1959; J. W. Parham, Pl. Fiji Isl. 227. 1964, ed. 2. 315. 1972; non L.

An erect, annual herb 0.5–1 m. high, occurring near sea level as a weed in clearings, gardens, waste places, and along roadsides. The larger leaf blades are 6–20 × 4–10 cm., and the tepals have a green median band. Specimens are too few to suggest seasonal flowering.

TIPIFICATION: In the first valid description of *Amaranthus dubius*, Thellung in 1914 cited several collections, probably from plants cultivated in European botanical gardens.

DISTRIBUTION: Tropical America; now occasionally found in the Old World tropics as a weed.

LOCAL NAME AND USE: The only available notes are from the Kandavu collection cited below: *Toyala*; leaves edible when cooked.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 66A*. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 66*. KANDAVU: Western end of island, near Cape Washington, *Smith 303*.

5. *Amaranthus hybridus* L. Sp. Pl. 990. 1753; Sauer in Ann. Missouri Bot. Gard. 54: 108. 1967.

Amaranthus hypochondriacus L. Sp. Pl. 991, as *A. hypochondriacus*. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 315. 1972.

Amaranthus cruentus L. Sp. Pl. ed. 2. 1406. 1763.

Amaranthus paniculatus L. Sp. Pl. ed. 2. 1406. 1763.

Amaranthus paniculatus var. *cruentus* Moq. in DC. Prodr. 13 (2): 257. 1849; Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862, Fl. Vit. 197. 1867.

Amaranthus paniculatus var. *tricolor* Moq. sensu Drake, Ill. Fl. Ins. Mar. Pac. 269. 1892; non *A. tricolor* L.

Amaranthus hybridus subsp. *cruentus* var. *paniculatus* Thell. in Aschers. & Graebn. Syn. Mitteleur. Fl. 5 (1): 247. 1914; Backer in Fl. Males. I. 4: 79. 1949.

An annual coarse herb 1–3 m. high, occurring near sea level in cultivation or as a garden escape. The stems are sometimes suffused with purple, as are the leaf blades, and the tepals are usually dark purple. The only dated specimen from Fiji was flowering in September.

TIPIFICATION AND NOMENCLATURE: Sauer (1967, cited above) lists three specimens of *Amaranthus hybridus* available for typification without actually indicating a lectotype; the type locality was presumably Virginia. *Amaranthus hypochondriacus* is discussed by Sauer (1967, pp. 110–122) as a domesticated species derived mainly from *A. powellii* S. Wats., with genetic admixture from *A. hybridus* and *A. cruentus*. *Amaranthus cruentus* (synonym: *A. paniculatus*) is discussed by Sauer (1967, pp. 122–126) as a probably domesticated derivative of *A. hybridus* originating in southern Mexico or Guatemala.

DISTRIBUTION: Apparently indigenous to mild, moist regions from eastern North America to northern South America, the species has now acquired a broad distribution as a naturalized weed as well as a domesticated grain source (if *Amaranthus hypochondriacus* and *A. cruentus* are included) and as an ornamental.

LOCAL NAME AND USE: *Ndriti*; an ornamental plant sometimes seen in gardens in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Botanical Gardens, Suva, *DA 12182*. "OVALAU and VITI LEVU:" *Seemann 367*.

The Linnaean binomials discussed above are often combined under *Amaranthus hybridus*, one of the progenitors of the domesticated species (although Sauer, 1967, maintains *A. hypochondriacus* and *A. cruentus* as distinct, cultivated species). In Fiji *A. hybridus* is probably represented by subsp. *incurvatus* (Gren. & Godr.) Brenan var. *paniculatus* (L.) Mansf., the quadrinomial considered correct for the cultivated ornamental and sometimes naturalized plant of Malesia that Backer (1949, cited above) and Backer and Bakhuizen van den Brink, Jr. (Fl. Java 1: 235. 1963) referred to *A. hybridus* L. subsp. *cruentus* (L.) Thell. var. *paniculatus* (L.) Thell. A discussion of the pertinent quadrinomials is given by Bakhuizen van den Brink, Jr., in Fl. Males. I. 6: 915. 1972.

4. *CYATHULA* Bl. Bijdr. Fl. Ned. Ind. 548. 1825 or 1826; Seem. Fl. Vit. 199. 1867. Nom. cons.

Perennial herbs or undershrubs; leaves opposite, the blades entire; flowers clustered, the clusters (in our species) on rachis of a long raceme on short, jointed stalks, deflexed after anthesis, the perfect flowers in each cluster 1-3, accompanied by 1 or more imperfect, sterile flowers reduced to fascicled hooks, the distal flowers solitary, without hooks; tepals of perfect flowers 5, oblong, short-acuminate, with scarioso margins, longitudinally nerved; stamens 5, the filaments proximally connate into a short cup, the free parts alternating with shorter, dentate or lacerate pseudostaminodes, the anthers 2-celled (4-loculed); ovary obovoid, the ovule 1, pendulous from a long funicle, the style filiform, the stigma capitate; utricle ellipsoid, thin-walled, indehiscent, 1-seeded.

TYPE SPECIES: *Cyathula prostrata* (L.) Bl. (*Achyranthes prostrata* L.).

DISTRIBUTION: Africa and Madagascar to China and Malesia, with 25-30 species. One species occurs in Fiji as a naturalized weed.

1. *Cyathula prostrata* (L.) Bl. Bijdr. Fl. Ned. Ind. 549. 1825 or 1826; Christophersen in Bishop Mus. Bull. 128: 82. 1935; Yuncker in op. cit. 184: 37. 1945; Backer in Fl. Males. I. 4: 82. fig. 4. 1949; Yuncker in Bishop Mus. Bull. 220: 108. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 48. 1959, Pl. Fiji Isl. 227. 1964, ed. 2. 316. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 49. 1972.

Achyranthes prostrata L. Sp. Pl. ed. 2. 296, as *Achirantes* p. 1762.

Cyathula prostrata var. *debilis* Moq. in DC. Prodr. 13 (2): 326. 1849; Seem. Fl. Vit. 199. 1867.

In Fiji *Cyathula prostrata* is seen as an herb 0.3-1 m. high, subligneous toward base and with a long taproot, at elevations from near sea level to about 1,200 m., as a naturalized weed on seashores and along roadsides and forest trails. Flowers and fruit occur throughout the year.

TIPIFICATION AND NOMENCLATURE: Linnaeus gave two citations for *Achyranthes prostrata*, but I have not noted a lectotypification. For var. *debilis* Moquin-Tandon cited many specimens from scattered New and Old World localities. In view of the normal variation seen in this readily dispersed, weedy plant, varieties seem inadvisable.

DISTRIBUTION: Africa to China and Australia, probably introduced into tropical America (cf. Backer, 1949, cited above). In the Pacific it is widely dispersed, eastward at least to the Society and Marquesas Islands.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Loloti, in mountains near Lautoka, Greenwood 347; Nandarivatu, DA 2105; slopes of Mt. Tomanivi, DA 7108, 13063. NAMOSI: Mt. Voma, DA 11643. TAILEVU: Matavatathou, DA 7754; entrance to Waitouta Cave, DA 9418. VITI LEVU without further locality, Milne 415. NGAU: MacGillivray, September, 1854. VANUA LEVU: THAKAUNDROVE: Verevere, DA 8849. MOALA: Milne 114. FIJI without further locality, Horne 108, 736.

5. *Achyranthes* L. Sp. Pl. 204. 1753; Seem. Fl. Vit. 198. 1867.

Erect or ascending herbs or shrubs; leaves opposite, the blades entire; inflorescences terminal and axillary, spicate, erect, many-flowered, becoming elongate, with only a few flowers open at the same time; flowers hermaphrodite, solitary in axils of acute, membranous, persistent bracts, subtended by 2 bracteoles, deflexed after anthesis, the bracteoles consisting of a long spine and bearing on each side of base a shorter, membranous, nerveless wing; tepals 5, spreading during anthesis, before and after anthesis erect, membranous or herbaceous, 1- or more-nerved, acute, sometimes pungent in fruit; stamens 5, much shorter than perianth, the filaments proximally connate into a short cup, the free parts alternating with short, broad pseudostaminodes, the anthers oblong, 2-celled (4-loculed); ovary glabrous, the ovule 1, pendent from a long funicle, the style filiform, short, the stigma capitate; utricle falling off together with perianth and bracteoles, ellipsoid, indehiscent, 1-seeded, with truncate or depressed apex, thin-walled, the seed erect.

LECTOTYPE SPECIES: *Achyranthes aspera* L., one of Linnaeus's five original species (vide Steudel, Nomencl. Bot. ed. 2. 1: 15. 1840).

DISTRIBUTION: Tropical and subtropical, mostly in Africa and Asia, with about 100 species or perhaps fewer. One widespread weed occurs in Fiji.

1. *Achyranthes aspera* L. Sp. Pl. 204. 1753; Seem. Fl. Vit. 199. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 271. 1892; Guillaumin in J. Arnold Arb. 13: 81. 1932; Christophersen in Bishop Mus. Bull. 128: 82. 1935; Yuncker in op. cit. 178: 51. 1943; Greenwood in Proc. Linn. Soc. 154: 103. 1943; Yuncker in Bishop Mus. Bull. 184: 37. 1945; Backer in Fl. Males. I. 4: 88. 1949; Yuncker in Bishop Mus. Bull. 220: 108. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 48. fig. 18. 1959, Pl. Fiji Isl. 226. 1964, ed. 2. 315. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 40. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 322. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 62. 1972.

Cyathula prostrata sensu Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862; non Bl.

A coarse, ligneous herb or shrub 0.8–4 m. high, sometimes almost treelike, occurring from near sea level to about 900 m. elevation as an abundantly naturalized weed on rocky shores, limestone islets, and grassy slopes, in coastal thickets, cultivated areas, and waste places, and along roadsides and forest trails. The tepals are white to pale lavender, the filaments white to rich pink, and the fruit orange to reddish purple or brown. Flowers and fruits are found throughout the year.

TYPIFICATION: Linnaeus gave three earlier references, among which are his *Flora Zeylanica* and *Hortus Cliffortianus*, one of which should provide a lectotype.

DISTRIBUTION: Probably indigenous in southeastern Asia and now a ubiquitous weed, found in Pacific archipelagoes eastward to the Tuamotus. About 30 Fijian collections are at hand.

LOCAL NAME: The name *sono ivi* was applied to my Moala collection.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Saweni Beach, Lautoka, DA 11755; vicinity of Nandi, DA 9683. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, Greenwood 61. NAMOSI: Mt. Voma, DA 13974. RA: Yanggara, DA 11866; Ellington, Greenwood 61A. TAILEVU: Navuloa, DA 9332. REWA: Near Suva, H. B. R. Parham 43. MBENGA: Malambi, Weiner 223. KANDAVU: Without further locality, Tohill 665. KORO: Without further locality, Tohill 664. VANUA LEVU: THAKAUNDROVE: Nggararavovo, Natewa Bay, DA 16055. TAVEUNI: Vicinity of Waiyevo, Smith 8114. MOALA: North coast, Smith 1396. MATUKU: Bryan 234. VANUA MBALAVU: Tohill 666. MANGO: Bryan 563. BACON ISLAND (Argo Reefs, Lau Group): Bryan 538. FIJI without further locality, Seemann 369.

6. *ALTERNANTHERA* Forssk. Fl. Aegypt.-Arab. 28. 1775.

Annual or perennial, erect, ascending, trailing, creeping, or clambering herbs, with smooth or dentate hairs; leaves opposite, the blades entire; inflorescences axillary or rarely terminal, capitate or short-spicate; flowers hermaphrodite or by malformation ♀, each solitary in axils of bracts, subtended by 2 bracteoles, the bracts and bracteoles scarious; tepals in normal flowers 5, free, equal or subequal, glabrous or pilose; stamens normally 2-5, sometimes partly anantherous, the filaments proximally united into a tube or short cup, the free parts short, usually alternating with pseudostaminodes, these sometimes very minute, entire, dentate, or lacinate, the anthers small, 1-celled (2-loculed); ovary compressed or not, the ovule 1, pendulous from a long funicle, the style short, the stigma capitate; utricle indehiscent, falling off with perianth and sometimes with bracteoles, 1-seeded.

TYPE SPECIES: Although *Alternanthera achyranthes* Forssk. is indicated as the type species by the current ING card, Mears (1977, cited below) questions this. Forsskål's description of *Alternanthera* was not in the strict sense a descriptio generico-specifica; the only specific epithet mentioned in Forsskål's 1775 work as representing *Alternanthera* is listed on his p. 59 as "*Alternanthera achyranth.*" The first binomial definitely based on Forsskål's generic description was *A. triandra* Lam. Mears (1977, pp. 3, 6) therefore considers the type species of *Alternanthera* to be *A. triandra* Lam. (= *A. sessilis* (L.) R. Br. ex DC.).

DISTRIBUTION: Pantropical and subtropical, centering in America, probably with 100-200 species. Two species occur in Fiji, neither one indigenous.

USEFUL TREATMENTS OF GENUS: Mears, J. A. The nomenclature and type collections of the widespread taxa of *Alternanthera* (Amaranthaceae). Proc. Acad. Nat. Sci. Philadelphia 129: 1-21. 1977. Veldkamp, J. F. A proposal (449) to reject the name *Alternanthera ficoidea* (Linné) Beauv. (Amaranthaceae) in favour of *A. tenella* Colla. Taxon 27: 310-314. 1978.

KEY TO SPECIES

- Leaf blades green; flowers abundant; tepals equal or subequal, the pubescence none or sparse; anthers 3-5, round, small; pseudostaminodes ligulate or irregularly dentate; adventive. 1. *A. sessilis*
 Leaf blades green, yellow, or red, linear to ovate, acute; flowers usually only on older parts of plant; tepals marginally chartaceous, mostly white, somewhat pubescent; anthers 5, oblong; pseudostaminodes regularly fimbriate apically; cultivated only. 2. *A. tenella* cv. 'Betzickiana'

1. *Alternanthera sessilis* (L.) R. Br. ex DC. Cat. Pl. Hort. Bot. Monspel. 4, 77. 1813; Christophersen in Bishop Mus. Bull. 128: 83. 1935; A. C. Sm. in Sargentia 1: 31. 1942; Yuncker in Bishop Mus. Bull. 184: 37. 1945; Backer in Fl. Males. I. 4: 92. fig. 7. 1949; Yuncker in Bishop Mus. Bull. 220: 108. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 49. 1959, Pl. Fiji Isl. 227. 1964, ed. 2. 315. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 144. 1972; Mears in Proc. Acad. Nat. Sci. Philadelphia 129: 3. 1977; St. John in Phytologia 36: 369. 1977.

Gomphrena sessilis L. Sp. Pl. 225. 1753.

Illecebrum sessile L. Sp. Pl. ed. 2. 300. 1762.

Alternanthera triandra Lam. Encycl. Méth. Bot. 1: 95. 1783; Greenwood in Proc. Linn. Soc. 154: 103. 1943.

Alternanthera nodiflora R. Br. Prodr. Fl. Nov. Holl. 417. 1810; Gibbs in J. Linn. Soc. Bot. 39: 161. 1909.

A prostrate or sprawling herb to 40 cm. high, sometimes with stems as long as 1 m., occurring from sea level to about 500 m. elevation as a naturalized weed in villages, gardens, plantations, and canefields, on open gravel banks, along roadsides, and often in wet places at edges of ponds, etc. Its bracts and bracteoles are greenish white, and its tepals vary from white to purplish. Flowers and fruits are found throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: The lectotype of *Gomphrena sessilis* (and *Illecebrum sessile*) is designated by J. A. Mears (in Taxon 29: 89, 1980) as the Hermann material on page 9 of volume 2 of the Sloane Herbarium (BM). Lamarck's description of *Alternanthera triandra* was based on Forsskål's generic description, and therefore Forsskål's collection is the type, as discussed by Mears (1977, cited above, p. 3, where isotypes are listed from BM, P, and ST). The type of *A. nodiflora* is a Brown collection from Australia (BM HOLOTYPE; ISOTYPES at GH, P). A full and detailed discussion of the very complex synonymy of *A. sessilis* is provided by Mears (1977, cited above, pp. 3-6). Mears indicates that de Candolle did not credit Brown with the combination *A. sessilis*. This is true as to p. 77 of the 1813 publication, but on p. 4 de Candolle did indicate Brown as the combining author (D. H. Nicolson, in litt.).

DISTRIBUTION: *Alternanthera sessilis* now occurs so widely as a weed that its nativity is doubtful; perhaps it is indigenous in southern Asia. In the Pacific I have noted material from as far east as Samoa and Hawaii. About 30 Fijian collections are available.

LOCAL NAME AND USE: *Geluti* (Hindi); the leaves are used as a potherb.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 95*; road to Waikumbukumbu, *Gibbs 688*. NANDRONGA & NAVOSA: Mbelo, near Vatukarasa, *Degener 15216*. SERUA: Flat coastal strip in vicinity of Ngaloa, *Smith 9504*. NAMOSI: Hills east of Wainikoroiuva River, near Namuamua, *Smith 9067*. RA: Ndombulu, *DA 11007*. NAITASIRI: Viria, *DA 11582*; Nanduruloulou, *DA 9585*; vicinity of Nasinu, *Gillespie 3543a*. TAILEVU: Vicinity of Ndakuivuna, *Smith 7085*; near Nausori, *Greenwood 1141*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7997*. VANUA LEVU: MATHUATA: Seanggangga Plateau, vicinity of Natua, *Smith 6662*; Lambasa, *Greenwood 95A*. THAKAUNDRUVE: Vicinity of Savusavu, *DA 8951*. TAVEUNI: Mt. Vernon Estate, *DA 11521*.

This weed seems to be a comparatively recent introduction into Fiji, the earliest collection known being *Gibbs 688*, obtained in September, 1907.

2. *Alternanthera tenella* Colla cv. 'Betzickiana'

Telanthera betzickiana Regel, Ind. Sem. Petrop. 28. 1862, in *Gartenflora* 11: 178. 1862.

Alternanthera betzickiana Nicholson, Ill. Dict. Gard. 1: 59, as *A. betzickiana*. 1884; Voss in Sieb. & Voss, *Vilmorin's Blumeng.* ed. 3. 2: 865, as *A. betzickiana*. 1895; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 40. 1970; Bakh. f. in *Fl. Males.* 1. 6: 916. fig. 1 (1-4). 1972; Mears in *Proc. Acad. Nat. Sci. Philadelphia* 129: 16, as *A. betzickiana*. 1977.

Alternanthera ficoidea var. *betzickiana* Backer in *Fl. Males.* 1. 4: 93, as *A. ficoidea* var. *b.* 1949; Backer & Bakh. f. *Fl. Java.* 1: 238. 1963; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 315. 1972.

Alternanthera tenella subsp. *tenella* var. *betzickiana* Veldkamp in *Taxon* 27: 313. 1978.

This cultivated plant is a perennial, sprawling herb 10-50 cm. high, known to occur at elevations from near sea level to about 500 m. Its leaf blades are cream-colored and green or reddish or variegated with brownish red, bright red, pink, or yellow; its bracts and bracteoles are green to whitish; and its normal tepals are white to yellowish. Available specimens show it to flower in March, July, and November.

TYPIIFICATION AND NOMENCLATURE: The holotype (LE) of *Telanthera betzickiana* was presumably taken from a cultivated plant, said to have come originally from Brazil. *Alternanthera tenella* Colla (in *Mem. Reale Accad. Sci. Torino* 33: 131. t. 9. 1829) is lectotypified by *Colla s. n.* (P), the provenance of which is not indicated by either Mears or Veldkamp. As indicated by the above abbreviated synonymy, the present taxon has been treated as a separate species, as a variety of *A. ficoidea*, and as a variety of *A. tenella*. Its much fuller and more complex synonymy is discussed by Mears (1977, cited above, pp. 16-19), who treats it as a species most closely related to *A. tenella*. Mears (p. 19) discusses reasons why *A. ficoidea* cannot be utilized, and Veldkamp (1978, cited above) further elaborates the argument for rejecting the name

A. ficoidea. I am indebted to J. A. Mears and D. H. Nicolson for correspondence discussing the status of the taxon. The epithet has been spelled both as *bettzickiana* and *bettzichiana*. The individual honored was mentioned by Regel as Herr Bettzick, head gardener for "Grossfürsten Nicolai-Nicolajevitsch zu Snaminsk." Elsewhere, even by Regel, the name has sometimes been spelled "Betzich." Although the matter is trivial, I follow the suggestion of Nicolson (in litt.) and adopt the first spelling used by Regel. It would seem advisable to relegate the taxon to the status of a cultivar of *A. tenella*, a solution that now seems acceptable to both Mears (in litt.) and Nicolson (in litt.).

DISTRIBUTION: Although it is usually considered indigenous in Brazil, this taxon is now extensively cultivated as an ornamental and may have originated by selection from *A. tenella* more than once.

LOCAL NAME AND USE: *Joyweed* is the commonly used garden name in Fiji as elsewhere. The plant is an attractive ornamental commonly cultivated in garden borders and low hedges.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nalotawa, eastern base of Mt. Evans Range, *Smith 4327*. NAITASIRI: Toninaiwau, Tholo-i-suva, *DA 16758*; Koronivia, *DA 12125*. REWA: Suva, in private garden, *DA 12263*.

7. *GOMPHRENA* L. Sp. Pl. 224. 1753.

Annual or less often perennial herbs; leaves opposite, sessile or short-petiolate; inflorescences terminal, solitary, sessile or subsessile, capitate or short-spicate, the receptacle cylindrical or swollen; flowers hermaphrodite, solitary in axils of persistent bracts, subtended by 2 bracteoles, the bracts and bracteoles scarious, glabrous, the bracteoles erect, navicular, often colored, with or without a dorsal crest, surrounding the flower and falling off with perianth; tepals 5, erect, free or nearly so, tomentose at base dorsally; stamens 5, the filaments united into a long or short tube, this shortly 5-lobed, the free parts of filaments with or without alternating pseudostaminodes, the anthers introrse, 1-celled (2-loculed); ovary compressed, glabrous, the ovule pendulous from a long, erect funicle, the style short, the stigmas 2, erect or spreading, short, sometimes inconspicuous; utricle compressed, indehiscent, 1-seeded.

LECTOTYPE SPECIES: *Gomphrena globosa* L., one of Linnaeus's nine original species (vide Hitchcock, *Prop. Brit. Bot.* 137. 1929).

DISTRIBUTION: Tropical and subtropical, centering in America but with some species indigenous in Australia and Malesia, with about 100 species. One species is found in Fiji, cultivated and sparingly naturalized.

1. *Gomphrena globosa* L. Sp. Pl. 224. 1753; Seem. *Fl. Vit.* 199. 1867; Christophersen in *Bishop Mus. Bull.* 128: 83. 1935; Yuncker in op. cit. 178: 51. 1943, in op. cit. 184: 37. 1945; Backer in *Fl. Males. I.* 4: 95. *fig. 8.* 1949; Yuncker in *Bishop Mus. Bull.* 220: 109. 1959; J. W. Parham, *Pl. Fiji Isl.* 227. 1964, ed. 2. 316. 1972; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 42. 1970; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 71. 1972.

A coarse, annual herb 0.5–1 m. high, cultivated and sparingly naturalized near sea level. The stems are often tinged with red; the bracts in our form are rich pink (but in other forms may be white to yellow or deep purple); and the tepals are yellowish green. Probably it is in flower most of the year.

LECTOTYPIFICATION: In reviewing the Linnaean species of *Gomphrena*, J. A. Mears (in *Taxon* 29: 86. 1980) designates the plant material on page 86 of the bound *hortus siccus* of Clifford (BM) as the lectotype of *G. globosa*.

DISTRIBUTION: Tropical America, now widely distributed as an ornamental. It was probably introduced into Fiji by J. B. Thurston, since the name appears in his 1886 catalogue (cf. Vol. 1 of this *Flora*, pp. 47, 87).

USE: A garden ornamental, as in most Pacific archipelagoes.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Mbemana, H. B. R. Parham 167. REWA: Suva, a garden escape along streets, DA 16735.

8. *IRESINE* P. Br. Hist. Jam. 358. 1756. Nom. cons.

Sometimes dioecious, erect, ascending or scandent herbs or undershrubs; leaves opposite, petiolate, the blades entire or subentire; inflorescences terminal or subterminal, paniculiform, with spiciform ultimate branches, many-flowered, bearing solitary or clustered, minute flowers, these unisexual or hermaphrodite, solitary in axils of bracts, subtended by 2 bracteoles; tepals 5, oblong or ovate-oblong, acute; stamens (in ♀ flowers reduced to minute staminodes) 5, the filaments proximally connate into a shallow cup, the free parts filiform, with or without alternating pseudostaminodes, these if present usually short and broadly deltoid, the anthers 1-celled (2-loculed); ovary (lacking in ♂ flowers) compressed, the ovule 1, pendulous from an erect funicle, the style very short or lacking, the stigmas 2, subulate, erect-ascending; utricle orbicular, compressed, thin-walled, indehiscent, 1-seeded, the seed lenticular or reniform, shining.

TYPE SPECIES: *Iresine celosioides* Nuttall (*Celosia paniculata* L. = *I. paniculata* (L.) Kuntze; non Poir.).

DISTRIBUTION: Tropical America and Australasia, with about 80 species. One species is cultivated and naturalized in Fiji.

1. *Iresine herbstii* Hook. in Gard. Chron. 1864: 654. 1864, in Bot. Mag. 91: t. 5499. 1865; Gibbs in J. Linn. Soc. Bot. 39: 161. 1909; Greenwood in J. Arnold Arb. 30: 81. 1949; Backer in Fl. Males. I. 4: 97. 1949; J. W. Parham, Pl. Fiji Isl. 227. 1964, ed. 2. 316. 1972.

A coarse herb 0.5–4 m. high, found at elevations from near sea level to about 1,050 m., cultivated or often abundantly naturalized locally along rocky river banks and forest trails. The stem and leaves are pink to deep red, and the bracts, bracteoles, and tepals are greenish white. In cultivation often only ♀ plants are seen and fruits are not produced. Flowers have been collected only in July and August.

TYPIFICATION: In his first publication Hooker indicated that the species was exhibited by Messrs. Herbst and Stenger at a Royal Horticultural show, without noting its origin. However, in 1865 he described the species as introduced into England and cultivated at Kew by Herbst, stating that it was a native of Brazil, although he also had a fine specimen from Moyabamba, Peru (*Mathews 1616*).

DISTRIBUTION: Tropical America, now widely cultivated in tropical areas and often naturalized. In Fiji it is known only from Viti Levu.

LOCAL NAME AND USE: St. John (no. 18229) records the name *mbeta* and states that the plant was used to make wreaths by dancers.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes and summit of Mt. Ndelaiyoö, on the escarpment west of Nandarivatu, *Smith 5083*; Nandarivatu, *Vaughan 3424*, *Reay 21*. MBA or NAITASIRI: Between Navai and Nasonggo, *Gibbs 865*. NAITASIRI: South of Matawailevu, Wainimala Valley, *St. John 18229*; Toninaiwau, Tholo-i-suva, *DA 16741*; Koronivia, *DA 12122*. FIJI without further locality, *DA 3877*.

The first Fijian collection seems to have been that of Gibbs, in August, 1907. She observed it along telephone lines through the forest on the spurs of Mt. Tomanivi, remarking: "It would be difficult to exaggerate the magnificent effect of these straight

lines, about 5 m. wide, one dense mass of brilliant carmine foliage, bordered by the dark green forest." More recently I did not note the species in the area mentioned, perhaps because telephone line clearings there have now been replaced by lines around the coast of Viti Levu.

FAMILY 77. CHENOPODIACEAE

CHENOPODIACEAE Vent. Tabl. Règne Vég. 2: 253, as *Chenopodae*. 1799.

Annual or perennial herbs (rarely shrubs or small trees), often halophytic, without stipules, the stems sometimes jointed; leaves alternate (rarely opposite), simple; inflorescences composed of cymose units variously arranged; flowers hermaphrodite or unisexual (plants then dioecious or monoecious), usually actinomorphic, small; perianth usually 3- or 5-parted (rarely lacking), the tepals often green, not scarious, usually persisting in fruit; petals lacking; stamens often as many as tepals and opposite them, hypogynous or inserted on a disk or on tepals, the filaments usually free, the anthers 2-locular, incurved in bud, longitudinally dehiscent; ovary superior (rarely semi-inferior), unilocular, the ovule solitary, basal or suspended from a basal funicle, campylotropous, the stigmas usually 2 or 3; fruit usually a nut or achene, often utricular, the seed often erect, the embryo peripheral, surrounding the perisperm.

DISTRIBUTION: Pantropical and temperate, with about 102 genera, mostly occurring in areas suitable for xerophytic and halophytic plants.

USEFUL TREATMENTS OF FAMILY: Ulbrich, E. *Chenopodiaceae*. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 16: 379-584. 1934. Backer, C. A. *Chenopodiaceae*. Fl. Males. I. 4: 99-106. 1949.

Only one species of *Chenopodium* has been recorded in Fiji, but three taxa known to be occasionally cultivated in Tonga and Niue are probably grown at times in Fiji, although they do not thrive in tropical areas. These, with the records from Tonga and Niue, are: (1) *Beta vulgaris* L. var. *vulgaris* (beetroot or beet) (as *B. vulgaris*: Yuncker in Bishop Mus. Bull. 178: 51. 1943, in op. cit. 220: 107. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 58. 1970); (2) *Beta vulgaris* var. *ciela* L. (chard or Swiss chard) (Yuncker in Bishop Mus. Bull. 220: 107. 1959); and (3) *Spinacia oleracea* L. (spinach) (Yuncker in Bishop Mus. Bull. 178: 51. 1943, in op. cit. 220: 107. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 58. 1970).

1. CHENOPODIUM L. Sp. Pl. 218. 1753.

Usually erect, annual or perennial herbs, the young parts often with vesicular hairs; leaves alternate, sessile or petiolate; inflorescences axillary and terminal, spicate or paniculate; flowers hermaphrodite or by abortion ♀, ebracteolate, without a disk; perianth usually deeply 3- or 5-lobed; stamens inserted on tepals near base; ovary superior, subglobose; fruit enclosed by perianth, the seed often horizontal.

LECTOTYPE SPECIES: *Chenopodium rubrum* L., one of Linnaeus's original 22 species (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 9. 1913).

DISTRIBUTION: Cosmopolitan, mostly temperate, with 100-150 species.

1. *Chenopodium ambrosioides* L. Sp. Pl. 219. 1753; Horne, A Year in Fiji, 259. 1881; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 17: 24. 1946; Backer in Fl. Males. I. 4: 101. 1949; Greenwood in J. Arnold Arb. 30: 81. 1949; J. W. Parham in Dept. Agr. Fiji Bull. 35: 46. 1959, Pl. Fiji Isl. 226. 1964, ed. 2. 315. 1972.

Chenopodium auricomum sensu B. E. V. Parham in Agr. J. Dept. Agr. Fiji 10: 114. 1939; non Lindl.

An annual or perennial, erect or straggling, aromatic, glandular-pubescent herb 0.6-1 m. high, occurring from near sea level to about 750 m. elevation as a naturalized

weed in waste places, gardens, etc. The minute flowers, in axillary clusters on slender spikes, have greenish tepals; the seed is reddish brown to black. Flowers and fruits are found in scattered months.

TYPIIFICATION AND NOMENCLATURE: Several earlier references are noted by Linnaeus. *Chenopodium auricomum* is an Australian endemic (cf. Benth. Fl. Austral. 5: 159. 1870) and is unlikely to have been introduced into Fiji; *C. ambrosioides* also occurs in Australia.

DISTRIBUTION: Indigenous in tropical and subtropical America but now widespread. It was probably introduced into Fiji by early European settlers and is said to be common in the vicinity of Nandi, although herbarium vouchers from that locality have not been seen.

LOCAL NAMES AND USES: *Mexican tea*, the usual name, *bluebush*, and *wai ni ukuwomu* have been recorded in Fiji; elsewhere the species is sometimes known as *wormseed*. The leaves can be used for edible greens, and tea is made from the dried leaves. A volatile oil distilled from the glandular hairs is used as a vermifuge elsewhere, but this use has not been recorded in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandarivatu, *Tothill 667*. NANDRONGA & NAVOSA: Mbale-nambelo, *H. B. R. Parham 498*; without further locality, *DA 2918, 2919*. FIJI without further locality, *Horne s. n.*

ORDER POLYGONALES

FAMILY 78. POLYGONACEAE

POLYGONACEAE Juss. Gen. Pl. 82, as *Polygoneae*. 1789.

Herbs, shrubs, or climbers, rarely trees, the stems often with swollen nodes; leaves alternate (rarely opposite or verticillate), simple, the petioles usually dilated at base into membranous sheaths (ocreae), these clasping the stem; inflorescences axillary and terminal, diverse but primarily racemose, the partial inflorescences usually cymose; flowers hermaphrodite, less often unisexual (then plants either monoecious or dioecious), actinomorphic, small, monochlamydeous; tepals 3-6, cyclic or acyclic, often enlarged and persistent in fruit; stamens usually 6-9, sometimes fewer or more numerous, the filaments free or united at base, the anthers dorsifixed, 2-locular, longitudinally dehiscent; disk annular or composed of glands; ovary superior, compressed or trigonous, unilocular, the ovule solitary, basal, sessile or stalked, orthotropous, the styles 2-4, free or proximally connate, the stigmas capitate, peltate, or penicillate; fruit a trigonous or lenticular nut or a winged achene, the seed with abundant endosperm, the embryo often excentric.

DISTRIBUTION: Cosmopolitan, principally north temperate, with 32-40 genera. Although four genera are recorded from Fiji, none are indigenous there.

USEFUL TREATMENTS OF FAMILY: Backer, C. A., & R. C. Bakhuizen van den Brink, Jr. Polygonaceae. Fl. Java 1: 219-226. 1963. Eckardt, T. Polygonaceae. In: Melchior, H. Engl. Syll. Pflanzenfam. ed. 12. 2: 75-79. 1964.

KEY TO GENERA

Perennial herbs, climbing by means of axillary tendrils; rachis of racemes often terminated by a tendril; tepals white or pink at anthesis, becoming greenish; leaves without ocreae. 1. *Antigonon*
Plants without tendrils; leaves with ocreae.

Branchlets not phyllocladous or flattened; leaves persistent.

Tepals 6, in 2 whorls of 3 each, the inner ones conspicuously enlarged after anthesis, exceeding the sharply trigonous fruit in length. 2. *Rumex*

Tepals 5, subequal after anthesis, the fruit (in our species) lenticular. 3. *Polygonum*

Branchlets phyllocladous, strongly flattened, green, jointed; leaves fugacious, the blades lanceolate-linear, up to 6 × 1.5 cm.; flower clusters small, compact, alternating on edges of branchlets at nodes.

4. *Homalocladium*



FIGURE 77. *Degeneria vitiensis*. (Upper left) Foliage of a young tree on Taveuni (DA 16937). (Upper right) Mature fruits, one longitudinally opened to show seeds, from Mba Province, Viti Levu (tagged fruit from Smith 5923, others from Smith 5880), \times about 1.3. (Lower) Branchlets with foliage and advanced flower buds, from Serua Province, Viti Levu (Smith 9189), \times about 1/2.



FIGURE 78. (Upper) A flowering branchlet of *Piper methysticum*, from Mba Province, Viti Levu (Smith 4008), \times about 1/5.

(Lower) Branchlets with foliage and σ inflorescences of *Macropiper vitiense*, from Mba Province, Viti Levu (Smith 4812), \times about 1/10.



FIGURE 79. *Trimenia weinmanniifolia*. (Upper) Branchlets from a ♂ plant, showing foliage and the spreading white stamens, from the Rairaimatuku Plateau, Viti Levu (Smith 5639), × about 1.3. (Lower) Branchlets showing foliage and nearly mature fruits, from Taveuni (Smith 8355), × about 1.3.



FIGURE 80. (Upper left) Foliage and mature fruits of *Hernandia nymphaeifolia*, from coastal vegetation on Taveuni (no voucher), \times about 1/6.

(Upper right) Foliage and inflorescences of *Hernandia olivacea*, from Mba Province, Viti Levu (Smith 5678), \times about 1/5.

(Lower) Foliage and inflorescences of the stinging nettle *Dendrocnide harveyi* (Urticaceae), from coastal hills of Serua Province, Viti Levu (no voucher), \times about 1/4.



FIGURE 81. (Upper) A stand of the widespread *Casuarina equisetifolia*, characteristic of dry coastal hills, from Mathuata Province, Vanua Levu (vouchered by Smith 6430).

(Lower) Trees of *Gymnostoma vitiense* (also Casuarinaceae) often dominate patches of forest on the Seangangga Plateau, Vanua Levu (no voucher).



FIGURE 82. (Upper) Foliage and inflorescences of *Elaeocarpus storckii*, from Tholo-i-suva, Naitasiri Province, Viti Levu (DA 13195), \times about 1/2; photograph by R. R. Wright.

(Lower) Foliage and infructescences of *Macaranga caesariata* (Euphorbiaceae), from Serua Province, Viti Levu (Smith 9657), \times about 1/5.



FIGURE 83. (Upper) Foliage and flowers of *Paphia vitensis* (Ericaceae), from the summit of Mt. Tomanivi, Viti Levu (Smith 5144), \times about 1.3.

(Lower) Flowers of *Symplocos leptophylla*, from the forest of Rewa Province near Suva, Viti Levu (no voucher), \times about 3.

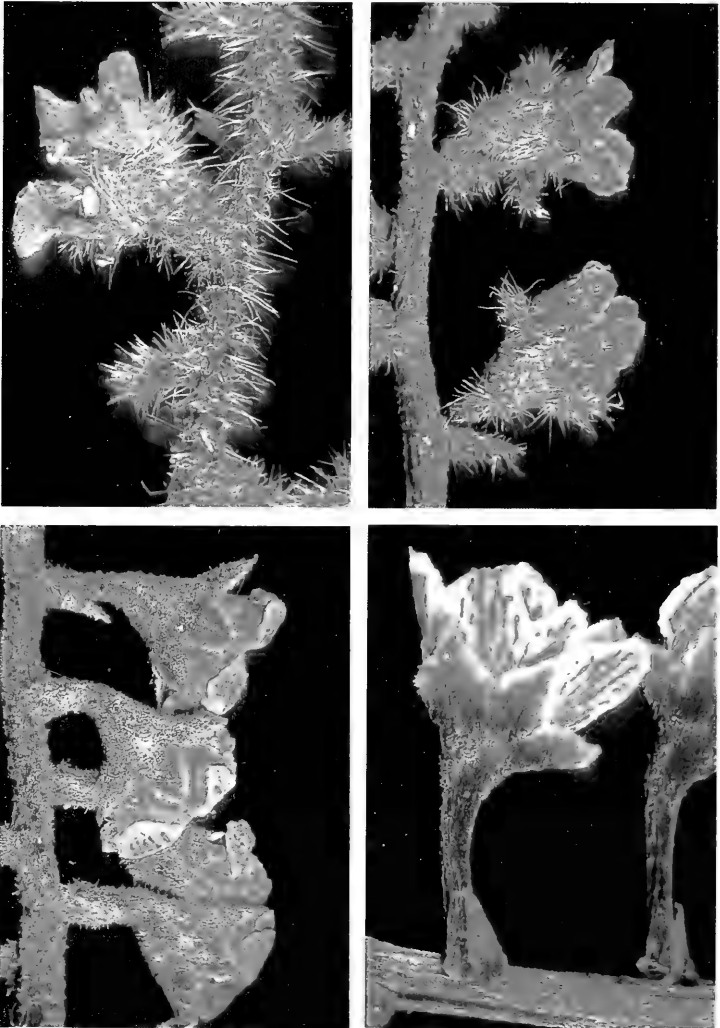


FIGURE 84. Flowers of *Maesa* spp. (Myrsinaceae), showing a portion of a rachis or inflorescence branch and flower-subtending bracts, all \times about 15. (Upper left) *M. corylifolia*, from Smith 5219. (Upper right) *M. pickeringii*, from DA 14763. (Lower left) *M. tabacifolia*, from Smith 8773. (Lower right) *M. vitiensis*, from Webster & Hildreth 14093. The colors shown here are somewhat darker than in living flowers, which have corollas white to pale yellow.

1. *ANTIGONON* Endl. Gen. Pl. 310. 1837.

Perennial herbs, climbing by means of axillary tendrils, the stems slender, angular; leaves petiolate, without ocreae, the blades ovate-deltoid, shallowly cordate at base; inflorescences racemose, the upper racemes forming a panicle, the rachis often terminated by a branched tendril; flowers hermaphrodite, in small clusters; tepals 5 (rarely 6), the 3 outer ones ovate-cordate, the inner ones narrower, all enlarged after anthesis and enclosing fruit; stamens 7-9, the filaments proximally connate; ovary trigonous, the styles 3, the stigmas capitate; fruit ovoid-conical, the seed longitudinally grooved.

TYPE SPECIES: *Antigonon leptopus* Hook. & Arn.

DISTRIBUTION: Tropical America, with about eight species. One species is cultivated and naturalized in Fiji.

1. *Antigonon leptopus* Hook. & Arn. Bot. Beechey Voy. 308. t. 69. 1838; Yuncker in Bishop Mus. Bull. 178: 50. 1943; Greenwood in J. Arnold Arb. 25: 402. 1944; Yuncker in Bishop Mus. Bull. 220: 106. 1959; J. W. Parham, Pl. Fiji Isl. 226. 1964, ed. 2. 314. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 170. 1970.

A scrambling vine of sunny places, cultivated in gardens and hedges near sea level and also naturalized along roadsides and in waste places. The tepals are pink to white, becoming membranous, greenish, reticulate-veined, and up to 1.5 cm. long in fruit.

TYPIIFICATION: The holotype (K or GL) was collected in Mexico, by Lay and Collie or perhaps by another member of H. M. S. Blossom's company.

DISTRIBUTION: Tropical America, but now widely cultivated and often naturalized in tropical areas. It is probably a comparatively recent introduction into Fiji, first recorded by Greenwood in 1944 (cited above), who indicated its occurrence in the vicinity of Lautoka, Mba Province, Viti Levu; no Greenwood specimen was cited nor has any been found in herbaria.

LOCAL NAMES AND USE: Only English names have been recorded in Fiji: *Mexican creeper*, *coral vine*, and *bride's tears*. The vine is an attractive ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Kotonivia, DA 12127. REWA: Suva, DA 14431. The frequency of the plant, both in cultivation and as an escape, is not adequately demonstrated by these vouchers.

2. *RUMEX* L. Sp. Pl. 333. 1753.

Annual or perennial herbs; leaves alternate or the lower ones clustered, the petioles with amplexicaul ocreae; inflorescences racemose or paniculate; flowers hermaphrodite or unisexual, subverticillate; tepals 6, in 2 whorls of 3 each, the outer ones slightly and the inner ones conspicuously enlarged after anthesis, enclosing the fruit and exceeding it in length, often reticulate-veined and with a basal protuberance; stamens 6; ovary trigonous, the styles outwardly deflexed, the stigmas large, penicillate, usually purple; fruit sharply trigonous.

LECTOTYPE SPECIES: *Rumex patientia* L., one of Linnaeus's original 22 species (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 1: 653. 1913).

DISTRIBUTION: Cosmopolitan, mostly in north temperate areas of both hemispheres, with about 200 species. One weedy species has been recorded in Fiji, but its occurrence there may be evanescent.

1. *Rumex crispus* L. Sp. Pl. 335. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 314. 1972.

An occasional weedy herb in gardens and along roadsides near sea level. The lowermost leaf blades are lanceolate, crispate at margin; the inner tepals at maturity

are suborbicular and up to 5 mm. long; and the fruit is about 3 mm. long.

TYPIIFICATION: Linnaeus gives several prior references, including one from *Hortus Cliffortianus*.

DISTRIBUTION: Indigenous in Old World temperate regions; not locally established in Fiji and perhaps not persistent.

LOCAL NAME: *Dock*.

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Korotongo, east of Singatoka, DA L. 16742.

3. **POLYGONUM** L. Sp. Pl. 359. 1753; Seem. Fl. Vit. 200. 1867; Danser in Bull. Jard. Bot. Buitenzorg III. 8: 136. 1927.

Upright, sprawling, or scandent herbs or shrubs; leaves with an amplexicaul ocrea, this often with longitudinal nerves extending into bristles on its upper margin; inflorescences usually spicate, the spikes sometimes aggregated into compound inflorescences; flowers hermaphrodite or sometimes polygamous, usually cymose-fascicled in axils of bracts or sometimes in leaf axils; tepals 5, acyclic, sometimes colored, subequal after anthesis; stamens 4–9; ovary compressed and with 2 styles (in our species) or trigonous and with 3 styles, the stigmas capitate; fruit lenticular (in our species) or trigonous-subglobose.

LECTOTYPE SPECIES: *Polygonum lapathifolium* L., one of the 26 species originally listed by Linnaeus (vide Börner in Abh. Naturwiss. Vereine Bremen 21: 276. 1912).

DISTRIBUTION: Cosmopolitan, mostly temperate, with 200–300 species. One species is occasional in Fiji and presumably is a naturalized adventive.

1. **Polygonum dichotomum** Bl. Bijdr. Fl. Ned. Ind. 529. 1826; Danser in Bull. Jard. Bot. Buitenzorg III. 8: 222. 1927.

Polygonum imberbe Solander ex Forst. f. Fl. Ins. Austr. Prodr. 90, nom. nud. 1786; Seem. in Bonplandia 9: 258, nom. nud. 1861, Viti, 440, nom. nud. 1862, Fl. Vit. 200, nom. nud. 1867.

Polygonum glabrum sensu Seem. Fl. Vit. 201. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 273. 1892; Yuncker in Bishop Mus. Bull. 220: 106. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 45. 1959, Pl. Fiji Isl. 226. 1964; non Willd.

Polygonum pedunculare sensu J. W. Parham, Pl. Fiji Isl. 226. 1964, ed. 2. 314. 1972; non Wall.

As seen in Fiji *Polygonum dichotomum* is a perennial, sprawling herb, with branches ascending to 1.2 m. when support is available, occurring from near sea level to an elevation of 825 m. in swampy areas, on the shores and in the shallow water of lakes and ponds, and in moist areas in the forest-grassland transition. Its leaf blades are ovate-lanceolate and up to 20 × 5 cm. but often smaller, usually abruptly obtuse at base, and its tepals are white. In the material at hand flowers and fruits occur between April and October.

TYPIIFICATION: The holotype, presumably collected by Blume and deposited at L, was obtained in humid places around Batavia, Java. *Polygonum imberbe* was merely listed and accredited to Solander by G. Forster and seems not to have been formally described. According to Seemann (1867, cited above), *P. imberbe* is a native of Tahiti, collected by Banks and Solander. The specimens of *Polygonum* that I have examined from the Societies seem similar to those from Fiji and Tonga.

DISTRIBUTION: Indigenous (according to Danser, 1927, cited above) in India, China, and Formosa and into Malesia and Queensland. It is probable that the species occurs east of Malesia only as an adventive, perhaps inadvertently carried by aboriginal voyagers. Merrill (in Chron. Bot. 14: 219. 1954) lists *Polygonum* among the

Indo-Malesian weeds found in Tahiti in 1769. The earliest specimen I have noted from Fiji is Harvey's, obtained in 1855.

LOCAL NAME: *Kokandra* (indicated for *DA 1501* only).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5390*. NAMOSI: Along Wainandoi River, *Vaughan 3335*. TAILEVU: Visama, *DA 1501*; between Mburetu and Ndaku, *DA 894, 2726*. TAVEUNI: Crater lake east of Somosomo, *DA 12401, 14366*; "Vuna, June 1860," *Seemann 370* (so indicated on κ specimen, but cited as from Viti Levu in *Flora Vitiensis*). FIJI without further locality, *Harvey*, November, 1855.

4. HOMALOCADIUM L. H. Bailey in *Gentes Herb.* 2: 56. 1929.

Polygonum sect. *Homalocladium* F. v. Muell. in *Trans. & Proc. Philos. Inst. Victoria* 2: 73. 1858.
Muehlenbeckia sect. *Homalocladium* Meisn. in *Bot. Zeitung* 23: 313. 1865.

Dioecious or polygamodioecious shrubs, the branchlets phyllocladous, strongly flattened, green, jointed, with slightly contracted nodes, the adult internodes up to 2.5 × 1.5 cm.; leaves sessile, fugacious, with ciliolate, evanescent ocreae, the blades lanceolate-linear, cuneate or subhastate at base, acute, up to 6 × 1.5 cm.; inflorescences small, compact, 1-7-flowered, in sessile, bracteate clusters alternating on edges of branchlets at nodes; tepals 4 or 5, proximally connate, persistent; stamens or staminodes 8 or 9; ovary trigonous, small and sterile in ♂ flowers, the styles 3, the stigmas erose; fruit berrylike, about 3 mm. long, enclosed by the enlarged perianth.

TYPE SPECIES: *Homalocladium platycladum* (F. v. Muell.) L. H. Bailey.

DISTRIBUTION: Indigenous in New Guinea and the Solomon Islands, with a single species.

USEFUL TREATMENT OF GENUS: Bailey, L. H. The case of *Muehlenbeckia*: a discussion of the wire-plants and ribbon-bush. *Gentes Herb.* 2: 55-58. 1929.

1. *Homalocladium platycladum* (F. v. Muell.) L. H. Bailey in *Gentes Herb.* 2: 58. *fig.* 27, *e-g.* 1929; J. W. Parham, *Pl. Fiji Isl.* 226. 1964, ed. 2. 314. 1972.

Polygonum platycladum F. v. Muell. in *Trans. & Proc. Philos. Inst. Victoria* 2: 73. 1858.
Coccoloba platyclada F. v. Muell. ex Hook. in *Bot. Mag.* 89: t. 5382. 1863.
Muehlenbeckia platyclados Meisn. in *Bot. Zeitung* 23: 313. 1865.

As seen in Fiji, *Homalocladium platycladum* is a shrub 2-4 m. high, cultivated in gardens and villages at low elevation. Its tepals are white or greenish and its fruits red or purple. The only available flowering specimen was collected in June.

TYPIFICATION: Mueller mentions his original material as having been collected in New Caledonia by Shepard; presumably this was from a cultivated plant.

DISTRIBUTION: New Guinea and the Solomon Islands; now widely cultivated elsewhere in the Pacific and in other tropical countries.

LOCAL NAMES AND USE: *Vono ni vavalangi* (noted for *DA 3014*); in other areas it has been called *ribbon bush* or *centipede plant*. It is infrequently grown in Fiji as an ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Navutu, *DA 3014*. TAILEVU: Wainimbokasi, *DA 738*.

ORDER PLUMBAGINALES

FAMILY 79. PLUMBAGINACEAE

PLUMBAGINACEAE Juss. *Gen. Pl.* 92, as *Plumbagines*. 1789.

Perennial herbs or shrubs, sometimes scandent, without stipules; leaves alternate, sometimes rosulate, simple; inflorescences usually spicate or racemose to paniculate, often composed of cymules or cincinni; flowers hermaphrodite, actinomorphic, sessile or subsessile, 5-merous; calyx gamosepalous, tubular or infundibuliform, often per-

sistent, with 2 bracteoles at base, sometimes ribbed, angled, or winged, the limb often membranous or scarious; corolla sympetalous, often deeply lobed, the lobes contorted in bud; stamens 5, hypogynous or perigynous, opposite corolla lobes, the filaments sometimes borne on corolla tube, the anthers introrse, 2-loculed, longitudinally dehiscent; ovary superior, mostly sessile, often 5-lobed or 5-ribbed, unilocular, the ovule solitary, anatropous, pendulous from a basal funicle, the styles 1 or 5, the stigmas 5, filiform or subcapitate; fruit usually an indehiscent nut or at length circumscissile, often enclosed within the persistent calyx, the seed with or without endosperm, the embryo straight.

DISTRIBUTION: Cosmopolitan, often near sea coasts or in semiarid regions, with 10-12 genera. One genus occurs in Fiji.

USEFUL TREATMENT OF FAMILY: Steenis, C. G. G. J. van. Plumbaginaceae. Fl. Males. I. 4: 107-112. 1949.

1. *PLUMBAGO* L. Sp. Pl. 151. 1753; Seem. Fl. Vit. 194. 1866; van Steenis in Fl. Males. I. 4: 109. 1949.

Herbs or shrubs; leaves with sessile blades or petiolate, often with 2 basal amplexicaul auricles; inflorescences terminal or axillary, spicate or racemose; calyx highly gamosepalous, 5-lobed, often with external, sessile or stalked glands; corolla hypocrateriform, the tube long, the limb spreading; stamens hypogynous, the filaments broadened at base, the anthers linear; style 1, with 5 short, stigmatose branches; fruit basally circumscissile, the upper part with 5 upwardly dehiscent valves.

LECTOTYPE SPECIES: *Plumbago europaea* L., one of Linnaeus's two original species (vide Hitchcock, Prop. Brit. Bot. 129. 1929).

DISTRIBUTION: Pantropical and subtropical, with 10-20 species. Three species are recorded from Fiji, two only in cultivation and one apparently indigenous.

KEY TO SPECIES

- Inflorescence rachis copiously glandular between flowers; calyx green, glabrous but glandular; corolla white, the tube 18-22 mm. long, the limb 12-15 mm. in diameter, the lobes 6-7 mm. long, apiculate; apparently indigenous. 1. *P. zeylanica*
- Inflorescence rachis not glandular between flowers; corolla red or blue (sometimes nearly white), the tube 25-40 mm. long, the limb 20-30 mm. in diameter; cultivated species.
- Corolla blue, sometimes nearly white, the lobes not apiculate; calyx green, eglandular, 10-14 mm. long, the lower part short-pilose; inflorescences composed of corymbose spikes 1-6 cm. long, the rachis of spikes copiously short-pilose; petiole base with stipulelike auricles. 2. *P. auriculata*
- Corolla red to scarlet, the lobes apiculate; calyx red, 8-9 mm. long, glabrous but glandular; inflorescences composed of lax spikes 10-30 cm. long, the rachis of spikes glabrous; petiole base without auricles. 3. *P. indica*

1. *Plumbago zeylanica* L. Sp. Pl. 151. 1753; Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862, Fl. Vit. 194. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 225. 1892; Christophersen in Bishop Mus. Bull. 128: 168. 1935; Greenwood in Proc. Linn. Soc. 154: 100. 1943; Yuncker in Bishop Mus. Bull. 184: 56. 1945; van Steenis in Fl. Males. I. 4: 109. 1949; J. W. Parham, Pl. Fiji Isl. 230. 1964, ed. 2. 319. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 63. 1972.

In Fiji *Plumbago zeylanica* is noted as a subscandent or erect shrub 1-5 m. high, occurring from near sea level to an elevation of about 400 m. in exposed thickets or on cliff faces and talus slopes along beaches. Its calyx is green, its corolla white but sometimes faintly blue-tinged, its anthers blue, and its fruits green and sticky. As far as dated specimens indicate, flowers occur between July and November, fruits in July and August.

TYPIIFICATION: Among the five references given by Linnaeus, that to his Fl. Zeyl. 73. 1747 would perhaps suggest the best lectotype.

DISTRIBUTION: Tropical Africa and Asia and eastward, apparently indigenous in the Pacific as far east as the Society and Marquesas Islands and Hawaii.

LOCAL NAMES: The names *keniken* and *tutunu* have been recorded.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Vicinity of Lautoka, *Greenwood* 828. NAMOSI: "Valley of Namosi," *Seemann* 361, p. p. MOTURIKI: *Seeman* 361, p. p. WAKAYA: *Milne* 376, *Tothill* 663. VANUA LEVU: MBUA: Navakasinga, Rukuruku Bay, *H. B. R. Parham* 3, *DA* 2575. MATHUATA: Mt. Uluimbau, south of Lambasa, *Smith* 6603. MOALA: *Milne* 108. TOTOYA: *Bryan* 354. MOTHE: On summit peak, *Bryan* 475.

2. ***Plumbago auriculata*** Lam. Encycl. Méth. Bot. **2**: 270. 1786; Yuncker in Bishop Mus. Bull. **178**: 93. 1943; van Steenis in Fl. Males. I. **4**: 111. 1949; C. E. Wood in Bailey **16**: 137. 1968.

Plumbago capensis Thunb. Prodr. Pl. Cap. 33. 1794; Yuncker in Bishop Mus. Bull. **220**: 210. 1959; J. W. Parham, Pl. Fiji Isl. **230**. 1964, ed. 2. 319. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 169. 1970.

Reported as cultivated in Fiji, *Plumbago auriculata* is an erect or clambering shrub with long, slender branches; its corolla is blue, sometimes pale blue or nearly white.

TIPIFICATION AND NOMENCLATURE: The holotype of *Plumbago auriculata* is a Sonnerat specimen (P) from the "East Indies," presumably from a cultivated plant; that of *P. capensis* is represented by two sheets, *Thunberg* 4363 and 4364 (UPS), from South Africa. A full discussion of the two names is given by C. E. Wood in Bailey **16**: 137-139. 1968.

DISTRIBUTION: Indigenous in South Africa, but early spread in cultivation to many tropical and subtropical areas.

LOCAL NAMES AND USE: No local name is recorded from Fiji, but the species is usually called *Cape plumbago*; Yuncker records the name *blue plumbago* from Niue. The species is well known as an ornamental.

No herbarium vouchers are available from Fiji, but the species was included in J. B. Thurston's 1886 *Catalogue* (cf. Vol. 1 of this *Flora*, pp. 47, 87) and was doubtless grown by him (as *Plumbago capensis*). It is unlikely that this species would be confused with any other, and of course it may still occur in Fiji in private European gardens.

3. ***Plumbago indica*** L. Herb. Amb. 24. 1754, Amoen. Acad. **4**: 133. 1759; Merr. Interpret. Rumph. Herb. Amb. 414. 1917; van Steenis in Fl. Males. I. **4**: 111. *fig. 2*. 1949; J. W. Parham, Pl. Fiji Isl. ed. 2. 319. 1972.

Plumbago rosea L. Sp. Pl. ed. 2. 215. 1762.

In Fiji *Plumbago indica* is a cultivated, suffrutescent herb, usually much-branched from base, with long, clambering stems, grown infrequently near sea level. Its calyx is red and its corolla red to scarlet. The only available collection was flowering in July.

TIPIFICATION: *Plumbago indica* is typified by *Radix vesicatoria* Rumph. Herb. Amb. **5**: 453. *t. 168*. 1747.

DISTRIBUTION: Indigenous in continental southern Asia, now widely cultivated in tropical countries. Apparently it is not often used in gardens in Fiji.

USE: Ornamental.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Cocoa Station, Nanduruloulou, *DA* 12176.

SUBCLASS DILLENIIDAE

As circumscribed by Cronquist (1968) and Takhtajan (1969), the subclasses Dilleniidae and Rosidae are difficult to separate on the basis of a reasonable number of criteria, since many exceptions must be acknowledged. The two subclasses are phylogenetically more advanced than the Magnoliidae, at least in most respects, but less advanced than the Asteridae. They presumably were separately derived from a magnoliidean ancestry and seem to constitute natural large groups, despite a lack of definitive distinguishing characters. These points are well analyzed by Cronquist (1968: 186, 224). In the present treatment two groups that are often referred to the order Myrtales (subclass Rosidae) are placed in the subclass Dilleniidae as the orders Lecythidales and Rhizophorales.

KEY TO ORDERS OCCURRING IN FIJI

Flowers usually polypetalous or apetalous (infrequently sympetalous, as in Cucurbitales); stamens usually numerous, sometimes few (or rarely 1 in some Euphorbiales); ovules chiefly bitegmic and crassinucellate, but sometimes unitegmic or tenuinucellate (infrequently both).

Gynoecium apocarpous (or sometimes basally syncarpous); stamens usually numerous; pollen binucleate when shed; sepals imbricate, persistent; seeds arillate, with well-developed endosperm.

DILLENALES (FAMILY 80)

Gynoecium syncarpous (or carpels, if free, united apically by styles); seeds with or without an aril, the endosperm well developed or lacking.

Placentation axile (seldom parietal).

Ovary superior (in our genera).

Flowers dichlamydeous, the petals free or basally connate in our genera (exceptions: petals sometimes lacking in Family 84, Clusiaceae, but then the ovary unilocular with a solitary, erect ovule and the leaf blades with numerous, closely approximate, parallel secondary nerves; petals sometimes lacking in Family 88, Sterculiaceae, but then the ovules ascending or horizontal and the fruit composed of free follicles or free, indehiscent carpels); flowers usually ♂ (but with several exceptions among our genera); ovules 1—many per ovary locule, erect or horizontal, less frequently pendulous.

Sepals imbricate; filaments free or connate in groups; mucilage cells or sacs mostly lacking.

THEALES (FAMILIES 81-84)

Sepals valvate; filaments often connate into a tube or column; mucilage cells or sacs often present. MALVALES (FAMILIES 85-90)

Flowers monochlamydeous, the petals absent or represented by often scalelike petaloid appendages inserted within a calycine floral tube (exception: petals present in some Euphorbiales but then the flowers unisexual); ovules 1 or 2 per ovary locule, pendulous; fruit capsular, drupaceous, or baccate, never composed of free follicles or free carpels.

Plants often with special laticiferous vessels, mostly stipulate (stipules often modified); flowers unisexual, the petals usually absent; fruit frequently a 3-locular septicidal capsule, often schizocarpic, rarely loculicidal or drupaceous or baccate. EUPHORBIALES (FAMILY 91)

Plants without milky latex, exstipulate; flowers ♂ (in our genera), the corolla absent or represented by often scalelike petaloid appendages inserted within a calycine floral tube; fruit drupaceous or baccate or a loculicidal, tardily dehiscent capsule.

THYMELAEALES (FAMILIES 92, 93)

Ovary inferior or semi-inferior (in our genera).

Stamens numerous and in several series or whorls; stipules absent (or, if present, minute and caducous); leaves alternate. LECYTHIDALES (FAMILIES 94, 95)

Stamens 8—many, usually 2-5 times as many as petals and uniseriate, often in pairs opposite petals or on outer edge of disk; stipules (in our genera) interpetiolar, obvious, when caducous leaving apparent scars; leaves opposite (in our genera). RHIZOPHORALES (FAMILY 96)

Placentation parietal (seldom axile).

Flowers with an obvious perianth, ♂ or less often unisexual, not borne in catkins.

Pistils composed of 3 or more (rarely of only 2) carpels; perianth rarely 4-merous; flowers hypogynous to perigynous or epigynous; leaves usually simple; plants often woody, usually without myrosin cells.

Ovary usually superior; plants of various habits, those of most included families with seeds having a well-developed endosperm. VIOLALES (FAMILIES 97-103)

Ovary usually inferior; herbs or vines, rarely suffrutescent, the seeds without or with scanty endosperm; flowers usually unisexual.

Stamens 1-5, often 3 and then with 1 anther unilocular and the others bilocular; style usually simple, the stigmas mostly 3; corolla usually sympetalous; plants mostly with tendrils.

CUCURBITALES (FAMILY 104)

Stamens 4-many, all with bilocular anthers; styles 2 or 3(-6), free or basally connate; perianth segments usually free, scarcely separable into sepals and petals; plants without tendrils.

BEGONIALES (FAMILY 105)

Pistils usually composed of 2 carpels; perianth often 4-merous; flowers hypogynous; leaves simple or compound or variously dissected; plants herbaceous or sometimes woody, with myrosin cells; (but flowers perigynous, carpels 3, and perianth 5-merous in Family 109, Moringaceae).

CAPPAELES (FAMILIES 106-109)

Flowers much reduced, without an obvious perianth, unisexual, borne in catkins; dioecious, woody plants. SALICALES (FAMILY 110)

Flowers sympetalous (in our representatives); stamens comparatively few, seldom more than 2-4 times as many as corolla lobes (but up to 10 or more times as many in Symplocaceae (Ebenales)).

Placentation axile, the ovary with 2-10 (-18) locules; stamens often more numerous than corolla lobes (but sometimes the same number).

Stamens usually twice as many as corolla lobes (or the same number as and alternating with corolla lobes), hypogynous or inserted on corolla tube, the anthers often dehiscent by terminal or oblique pores (but sometimes by longitudinal slits); pollen in our families in tetrads (but sometimes only one grain of the tetrad maturing); ovules usually numerous (but sometimes solitary) in each ovary locule, unitegmic, tenuinucellate. ERICALES (FAMILIES 111, 112)

Stamens often 2-4 times as many as corolla lobes, usually borne on corolla, the anthers dehiscent by longitudinal slits; pollen in monads; ovules usually few (1-4 per ovary locule), bitegmic or unitegmic, crassinucellate or tenuinucellate. EBENALES (FAMILIES 113-115)

Placentation free-central in a superior or semisuperior ovary; stamens as many as corolla lobes and opposite them, the filaments usually adnate to corolla; plants woody, the leaf blades often glandular-punctate or with secretory canals. PRIMULALES (FAMILY 116)

ORDER DILLENIALES

The Dilleniales are presumably derived from ancestral Magnoliidae, differing primarily in having the stamens initiated in centrifugal sequence, and considered suggestive of the ancestry of the larger order Theales. The Paeoniaceae (not in Fiji) are sometimes included in the order (Cronquist, 1968), although Takhtajan (1969) separates them as a related order Paeoniales.

FAMILY 80. DILLENACEAE

DILLENACEAE Salisb. Parad. Lond. 2: sub t. 73, as *Dilleneae*. 1807.

Trees, shrubs, or lianas, infrequently perennial herbs, the stipules lacking; leaves alternate or rarely opposite, simple, the petioles sometimes with stipulelike and wholly or partly caducous wings, the blades entire or dentate, rarely pinnatifid or trilobed, usually with numerous, prominent lateral nerves; inflorescences terminal or axillary, cymose, racemose, or reduced to a single flower; flowers hermaphrodite or unisexual (plants then usually dioecious), actinomorphic to androecially zygomorphic; sepals usually 4 or 5 (3-20), free or proximally connate, imbricate, persistent; petals usually 3-5 (2-7), imbricate, often crumpled in bud, fugacious; stamens usually numerous (rarely as few as 3), hypogynous, sometimes partly staminodial, the filaments free or united proximally into fascicles, the anthers basifixed, with lateral or introrse locules dehiscent longitudinally or by apical or subapical pores; gynoecium composed of several free or slightly united carpels (these rarely solitary), the ovules 1-many, anatropous, ascending from base or on an axile placenta, the raphe ventral, the styles free; fruit a follicle or berrylike (then enclosed by the sepals), the seeds usually with a crested or lacinate aril, the endosperm copious, fleshy, the embryo minute, straight.

Distribution: Pantropical and subtropical, mostly Australasian and American, with ten or eleven genera. Two genera are represented in Fiji by indigenous species.

USEFUL TREATMENTS OF FAMILY: Gilg, E., & E. Werdermann. Dilleniaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 7-36. 1925. Hoogland, R. D. Dilleniaceae. Fl. Males. I. **4**: 141-174. 1951. Dickison, W. C. Comparative morphological studies in Dilleniaceae, I-VI. J. Arnold Arb. **48**: 1-23, 231-240. 1967; **49**: 317-329. 1968; **50**: 384-400. 1969; **51**: 89-101, 403-418. 1970.

KEY TO GENERA

- Carpels 4-20 (5-10 in our species), in a whorl around the conical, protruding portion of the receptacle, coherent along their adaxial side; ovules 4-80 (12-15 in our species) per carpel; stamens 60-900 (200-500 in our species); fruit a pseudocarp, the maturing gynoecium enclosed by the enlarged sepals; inflorescences (in our species) 2(-6)-flowered racemes; petioles (in our species) with amplexicaul wings; leaf blades (in our species) usually ovate to elliptic and 18-45 × 9-23 cm. 1. *Dillenia*
- Carpels 1-10 (2 in our species), free (or basally loosely coherent) on the flat receptacle; ovules 1-25 (usually 3-7 in our species) per carpel; stamens 1-150 (60-90 in our species); fruit a follicetum of usually 1-seeded follicles; inflorescences (in our species) few-flowered spikes; leaves sessile or with unwinged petioles; leaf blades (in our species) oblong-lanceolate and usually 3.5-17 × 0.7-2.2 cm. 2. *Hibbertia*

1. *DILLENIA* L. Sp. Pl. 535. 1753; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 35. 1925; Hoogland in Fl. Males. I. **4**: 154. 1951, in *Blumea* **7**: 3. 1952; A. C. Sm. in J. Arnold Arb. **36**: 284. 1955.

Wormia Rottb. in Nye Saml. Kongel. Danske Vidensk. Selsk. Skr. **2**: 531. 1783; Seem. Fl. Vit. **3**. 1865; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 33. 1925.
Capellia Bl. Bijdr. Fl. Ned. Ind. **5**. 1825.

Trees or shrubs; leaves alternate, simple, the petiole often winged (wings caducous or partly or wholly persistent, often broad, at first amplexicaul and enclosing terminal bud); inflorescences usually terminal and racemose (sometimes becoming lateral and leaf-opposed, or ramiflorous and fasciculate) or reduced to a solitary flower (flowers usually 2 in our species), the bracts and bracteoles sometimes caducous or obsolete; flowers usually with 5 (4-6 or rarely more) sepals, these concave, enlarged and thickened in fruit; petals usually 5 (rarely 4, 6, or absent), usually obovate and rounded at apex; stamens numerous (60-900) (200-500 in our species), the outer and/or inner ones sometimes staminodial, the filaments free (or those of staminodes sometimes coherent), sometimes of different lengths, the anthers usually dehiscent by apical pores (our species) or less often by longitudinal slits; gynoecium composed of 4-20 carpels (5-10 in our species), these coherent with one another along conical part of receptacle, the ovules numerous (4-80) (12-15 in our species) but only 1-few maturing; pseudocarps consisting of gynoecium and calyx, the maturing gynoecium enclosed by the enlarged sepals, the adult pseudocarps dehiscent, with spreading carpels, or indehiscent, the seeds arillate or not.

TYPE SPECIES: The type species of *Dillenia* is *D. indica* L., the only original species; that of *Wormia* is *W. triquetra* Rottb. (= *D. triquetra* (Rottb.) Gilg); and that of *Capellia* is *C. multiflora* Bl. (= *D. excelsa* (Jack) Gilg). The genus *Wormia* is still sometimes maintained as distinct, but Hoogland's (1952, cited above, p. 6) reasons for combining it with *Dillenia* seem justified.

DISTRIBUTION: Madagascar to southern China and Hainan and eastward through Malasia to northern Queensland, the New Hebrides, and Fiji (absent from New Caledonia), with about 55 species. The single species from the New Hebrides and Fiji terminates the range of the genus on the east.

USEFUL TREATMENTS OF GENUS: Hoogland, R. D. A revision of the genus *Dillenia*. *Blumea* **7**: 1-145. 1952. Corner, E. J. H. The inflorescence of *Dillenia*. Notes Roy. Bot. Gard. Edinburgh **36**: 341-353. 1978.

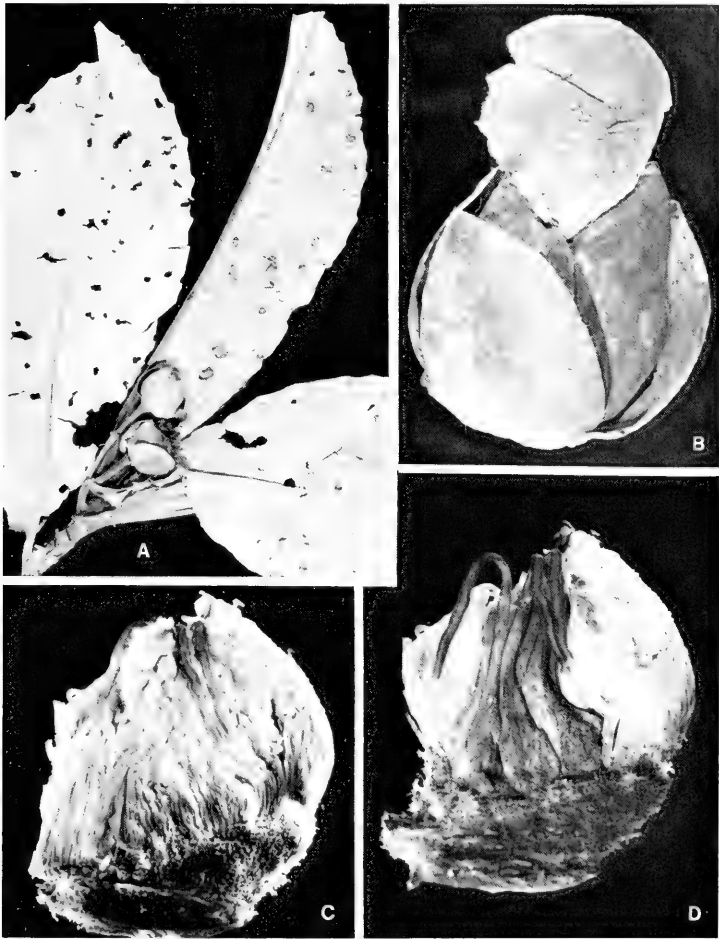


FIGURE 85. *Dillenia biflora*; A, distal portion of branchlet, with foliage and an inflorescence, $\times 1/3$; B, mature calyx, with protruding petals, $\times 2$; C, androecium of young flower (sepals and petals removed), showing staminodes, stamens, and 3 reflexed styles, $\times 4$; D, gynoecium of young flower (sepals and petals removed), with some stamens and staminodes removed, $\times 4$. A from *Smith 6911*, B-D from *Smith 1696*.

1. *Dillenia biflora* (A. Gray) Martelli ex Dur. & Jacks. Ind. Kew. Suppl. 1: 136, pro syn. 1902; Martelli ex Guillaumin in J. Arnold Arb. 12: 222. 1931; Hoogland in Blumea 7: 45. 1952; A. C. Sm. in J. Arnold Arb. 36: 284. 1955; J. W. Parham, Pl. Fiji Isl. 60. 1964, ed. 2. 93. 1972.

FIGURE 85.

Capellia biflora A. Gray, Bot. U. S. Expl. Exped. 1: 15. 1854, Atlas, pl. 1. 1856; Seem. in Bonplandia 9: 253. 1861, Viti, 432. 1862.

Capellia membranifolia A. Gray, Bot. U. S. Expl. Exped. 1: 17. 1854; Seem. Viti, 432. 1862.

Wormia biflora Seem. Fl. Vit. 3. 1865; Martelli in Becc. Malesia 3: 163. 1887; Drake, Ill. Fl. Ins. Mar. Pac. 103. 1889; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 35. 1925.

Wormia membranifolia Seem. Fl. Vit. 4. 1865; Martelli in Becc. Malesia 3: 164. 1887; Drake, Ill. Fl. Ins. Mar. Pac. 103. 1889; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 35. 1925.

Dillenia membranifolia Martelli ex Dur. & Jacks. Ind. Kew. Suppl. 1: 136, pro syn. 1902.

Dillenia neo-ebudica Guillaumin in J. Arnold Arb. 12: 222. 1931.

A tree 3-15 m. high, often locally common in Fiji from near sea level to 1,075 m. altitude, in dense or secondary forest or on its edges, in patches of forest in open country, in thickets, and sometimes on the edges of mangrove swamps. Its petals are white or cream-white, rarely yellowish, and sometimes faintly pink-tinged; and its filaments are white or cream-white. Flowers and fruits may be found throughout the year.

TYPIFICATION AND NOMENCLATURE: *Capellia biflora* is typified by U. S. Expl. Exped. (US 2305 HOLOTYPE; ISOTYPES at GH, P), collected in 1840 on Ovalau; *C. membranifolia* by U. S. Expl. Exped. (US 2306 HOLOTYPE; ISOTYPES at GH, NY), also obtained in 1840 on Ovalau. The type of *Dillenia neo-ebudica* is Kajewski 323 (A HOLOTYPE; ISOTYPES at BISH, BRI, K, NY, P, US), collected May 29, 1928, at Dillon Bay, Eromanga, New Hebrides; the first set of Kajewski's New Hebridean collection is at A, and no statement in Guillaumin's publications on them implies that the P duplicates are holotypes. In the light of abundant collections now at hand, I believe that Hoogland (1952, cited above) is justified in combining these three taxa. However, it should be noted that the combination *Dillenia biflora*, often accredited to Durand and Jackson (1902), was listed by them only as a synonym. Apparently the first valid combination (ICBN, Art. 33.1) was made by Guillaumin in 1931.

DISTRIBUTION: Fiji (thus far known with certainty from Viti Levu, Ovalau, Vanua Levu, and Taveuni) and the southern New Hebrides (Eromanga, Tanna, and Anietyum); more than 65 Fijian collections are available.

LOCAL NAMES AND USE: Reported Fijian names are *kuluva*, *kulava*, *kululova*, *kulukulu*, *kukulava*, *kukuluvu*, *kokonova*, and *tavoli*; the species is considered a useful timber tree, especially as providing a casewood.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Koromba, *Smith 4667*; vicinity of Nandarivatu, *Tohill 2*; Mt. Tomanivi, *DA 12734 (Melville et al. 7124)*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith 5430*. SERUA: Nathengathenga Creek, *DF 1199*; inland from Namboutini, *DF 1131*; north of Korovou, *St. John 18932*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8762*; Wainandoi River, *DA 12992*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15523*. NAITASIRI: Waimanu River, *DA L.13249 (Berry 58)*; Tholo-i-suva, *DA 4030*; Tamavua, *Yeoward 89*. TAILEVU: Hills east of Wainimbuka River, in vicinity of Ndakuivuna, *Smith 7209*; Naivithula, *Valentine 13*. REWA: West of Veisari, *Vaughan 3304*; vicinity of Lami, *Meebold 17070*. VITI LEVU without further locality, *Seemann 2*. OVALAU: Hills east of Lovoni Valley, *Smith 7344*; vicinity of Levuka, *Parks 20497*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1696*. MATHUATA: Seanganga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6911*; Wainikoro River, *Greenwood 695*. THAKAUNDROVE: Near Valethi, Savusavu Bay region, *Degener & Ordenez 13839*. TAVEUNI: Above Somosomo, *Gillespie 4818.5*.

2. HIBBERTIA Andrews, Bot. Repos. 2: pl. 126. 1800; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 21. 1925; A. C. Sm. in J. Arnold Arb. 36: 283. 1955.

Shrubs or small trees, rarely lianas, often freely branching; leaves alternate (rarely opposite), simple, petiolate or with the blades narrowed proximally into a clasping pseudostipule; inflorescences few-flowered pseudoracemes or one-sided spikes, sometimes reduced to a single flower, often with bracts and bracteoles; flowers usually ♂, sessile or short-pedicellate; sepals 5; petals 5 (or sometimes fewer), usually obovate and retuse to bilobed at apex; stamens (sometimes with additional staminodes) numerous, as many as 150, rarely as few as 3 or even 1 (60–90 in our species), distributed uniformly around the gynoeceum in one series (as in our species) or declinate (attached on one side of the gynoeceum), the filaments free or proximally slightly connate (in our species filiform, 2.5–3.5 mm. long at anthesis), the anthers dehiscent by introrse-lateral clefts (as in our species) or rarely by subapical pores; gynoeceum apocarpous or sometimes basally syncarpous, the carpels 1–10 (2 in our species), the ovules 1–25 (usually 3–7 in our species but only 1 maturing), the styles filiform, the stigmas minutely punctate; follicles usually 1-seeded, the aril in our species irregularly fimbriate at margin.

TYPE SPECIES: *Hibbertia volubilis* Andrews.

DISTRIBUTION: A genus of 120–150 species occurring mostly in Australia (with two species also extending into eastern Malesia), with a secondary center in New Caledonia (with one species also extending to Fiji), and one species in Madagascar. The generic range terminates in Fiji on the east.

USEFUL TREATMENTS OF GENUS: Wilson, C. L. The floral anatomy of the Dilleniaceae. I. *Hibbertia* Andr. Phytomorphology 15: 248–274. 1965. Rury, P. M., & W. C. Dickison. Leaf venation patterns of the genus *Hibbertia* (Dilleniaceae). J. Arnold Arb. 58: 209–241. 1977. Dickison, W. C., P. M. Rury, & G. L. Stebbins. Xylem anatomy of *Hibbertia* (Dilleniaceae) in relation to ecology and evolution. J. Arnold Arb. 59: 32–49. 1978.

As recently as 1978 (cited below), discussing the single species in Fiji, I indicated that the binomial *Hibbertia lucens* had been published only in synonymy and should be replaced by *H. brongniartii* Gilg ex Gilg & Werdermann. R. D. Hoogland (in litt.) has now kindly pointed out to me two oversights in my 1978 discussion, which are herewith remedied. It is now evident that the binomial *H. lucens* is to be restored for the species in question, as the binomial was validated by Sébert and Pancher in 1874, by means of a morphological description and notes on the wood, in a publication that I had overlooked (Notice sur les bois de la Nouvelle-Calédonie, published in *Revue Maritime et Coloniale*, in a series beginning in 1873, pp. 910–931, continued in 1874, and subsequently published in part as a book; Sébert, H., & J. A. I. Pancher. Résumé des caractères botanique. . . des principaux bois de la Nouvelle-Calédonie). Also, I had overlooked the valid publication of the substitute name *H. brongniartii* by Schlechter in 1906. The revised synonymy of the species is indicated below.

1. *Hibbertia lucens* Brongn. & Gris ex Sébert & Pancher in Rev. Marit. Colon. 41: 210. 1874; A. C. Sm. in Bishop Mus. Bull. 141: 97. 1936, in J. Arnold Arb. 36: 283. 1955; J. W. Parham, Pl. Fiji Isl. 60. 1964, ed. 2. 93. 1972. FIGURE 86.

Hibbertia salicifolia Turcz. in Bull. Soc. Nat. Moscou 36 (1): 549. 1863; non F. v. Muell. (1859).

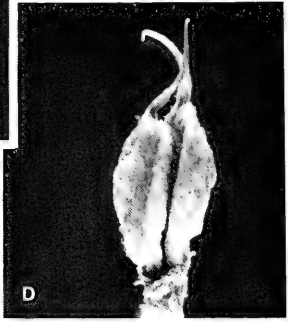
Hibbertia lucens Brongn. & Gris in Bull. Soc. Bot. France 11: 191, pro syn. 1864, in Ann. Sci. Nat. Bot. V. 2: 149, pro syn. 1864.

Hibbertia brongniartii Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. 6: 115, nom. illeg. sine basionymo valido. 1893; Gilg ex Schlechter in Bot. Jahrb. 39: 190. 1906; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 24. 1925; A. C. Sm. in Allertonia 1: 358. 1978.

Trisema salicifolia Brongn. & Gris ex Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. 6: 115, pro syn. 1893; Brongn. & Gris ex Schlechter in Bot. Jahrb. 39: 190, pro syn. 1906.

Hibbertia salicifolia Brongn. & Gris ex Schlechter in Bot. Jahrb. 39: 190, pro syn. 1906; non F. v. Muell.

As it occurs in Fiji, *Hibbertia lucens* is a shrub or an often slender, sometimes gnarled tree 2–6 m. high, occurring at elevations from near sea level to 1,155 m. in dense or usually dry forest, in secondary forest, on exposed slopes or in open rolling



country, in *talasinga* forests and thickets, and in the dense thickets on ridges and crests. Its sepals are greenish, its petals at first greenish but becoming bright yellow, its filaments and anthers bright yellow, and its styles pale yellow. Its flowers and transitional stages leading into fruits have been collected in months scattered throughout the year.

TYPEIFICATION AND NOMENCLATURE: Probably the type of *Hibbertia salicifolia* Turcz. should be considered the ultimate basionym of all the listed binomials; it is *Vieillard 63* (ISOTYPE at K), from Balade, New Caledonia. The binomial *H. lucens* was first published by Brongniart and Gris as a synonym of *H. salicifolia* Turcz. (non F. v. Muell.) in 1864. In validating the binomial *H. lucens* in 1874 Sébert and Pancher cited only *Fournier et Sébert 11*, but they attributed the binomial to Brongniart and Gris and therefore I take the type of their concept also to be *Vieillard 63*. The first valid publication of the binomial *H. lucens* is thus earlier than that of the other substitute name, *H. brongniartii*, by Schlechter in 1906. The latter binomial may be considered valid because Schlechter listed both *Trisema salicifolia* and *Hibbertia salicifolia* "Brongn. & Gris" in its synonymy; the latter may be taken as an indirect reference to *H. salicifolia* Turcz.

DISTRIBUTION: New Caledonia and Fiji (but absent from the New Hebrides). I have examined 30 Fijian collections from the two largest islands; the species is a frequent component of the *talasinga* of northern Vanua Levu, but elsewhere it seems to occur on exposed ridges and crests, usually in fairly dry places, or in dry forest patches in southern Viti Levu nearer the sea. It seems to be absent from northern and western Viti Levu as well as from the smaller islands.

LOCAL NAME: The only recorded name is *vesaukaka* (*Smith 6664*, Vanua Levu).

REPRESENTATIVE COLLECTIONS: VITI LEVU: SERUA: Coastal hills in vicinity of Taunovo River, east of Wainiyambia, *Smith 9595*. NAMOSI-NAITASIRI boundary: Summit of Mt. Naitarandamu, *Gillespie 3239*. NAMOSI: Mt. Voma, *Gillespie 2799*, *DA 616*. NAITASIRI: Tholo-i-suva, *DA 10985*. REWA: Mt. Korombamba, *DA 3864*. VANUA LEVU: "Interior," *Horne 651* (March, 1878, earliest known Fijian collection). MBUA: Between Mbua and Nambouwalu, *DA 1120*. MBUA OF MATHUATA: Between Nasarawangga and Ndreketi, *DA 1091*. MATHUATA: Near Ndreketi, *DA 1708*; Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6664*; District Farm Northern, *DA 15384*; Mt. Numbuiloa, east of Lambasa, *Smith 6494*; Wainikoro River, *Greenwood 516B*. THAKAUNDOVE: Summit of Mt. Mbatini, *Smith 687*; eastern buttress of Mt. Ndikeya, *Smith 1877*.

ORDER THEALES

KEY TO FAMILIES OCCURRING IN FIJI

Leaves alternate; seeds with or without endosperm.

Stipules present; ovary (in our genus) apocarpous, the carpels united apically by the style, each with 1 erect ovule; receptacle (in our genus) enlarging in fruit and bearing drupelets, the style terminal on receptacle, the filaments persistent at base of receptacle; seeds (in our genus) without endosperm.

81. OCHNACEAE

Stipules lacking; ovary syncarpous, usually 3-5-locular, the ovules 2 or more (rarely 1) per locule, axile.

Ovules bitegmic, crassinucellate; seeds without endosperm or with scanty endosperm; our indigenous species with unisexual flowers, 10-13 stamens, basifixed anthers, and a baccate fruit.

82. THEACEAE

FIGURE 86. *Hibbertia lucens*; A, distal portions of branchlets, with foliage and inflorescences, $\times 1$; B, lower surface of leaf blade, showing sericeous indument, $\times 10$; C, flower (petals fallen, many stamens removed), $\times 6$; D, gynoecium, $\times 6$; E, maturing seed with enveloping aril, $\times 10$. A from *Smith 687*, B & C from *Gillespie 3239*, D from *Smith 9595*, E from *DA 15384*.

Ovules unitegmic, tenuinucellate; seeds with copious endosperm; our species with hermaphrodite flowers, numerous stamens, dorsifixed, versatile anthers, and a loculicidally dehiscent capsule.

83. SAURAUACEAE

Leaves opposite or verticillate; seeds without endosperm.

Trees or shrubs, with resinous latex and oil glands, lacking stipules; flowers often unisexual, sometimes hermaphrodite; stamens usually numerous, the filaments sometimes variously connate; styles free, united, or lacking; fruit a loculicidal capsule or berry or drupe. 84. CLUSIACEAE

Aquatic herbs (our species), with paired, interpetiolar stipules; flowers hermaphrodite; stamens 10 (12) or fewer, the filaments free; styles free; fruit a septicidal capsule. 85. ELATINACEAE

FAMILY 81. OCHNACEAE

OCHNACEAE DC. in Ann. Mus. Hist. Nat. (Paris) 17: 410. 1811.

Trees or shrubs, rarely herbs, stipulate, the stipules often intrapetiolar, sometimes lacinate; leaves alternate, simple or very rarely pinnate, the blades often with numerous, pinnate nerves, glabrous; inflorescences axillary or terminal, racemose, cymose, or thyrsoid, sometimes compound, rarely composed of solitary or fasciculate flowers; flowers ♂, actinomorphic (rarely zygomorphic); sepals usually 5, less often 3-10, free or basally connate, imbricate, often quincuncial, persistent or less often caducous; petals 5-10, rarely 3-12, free, imbricate, contorted in bud, caducous; stamens hypogynous, 5-many, free, the filaments persistent, the anthers linear, basifixed, dehiscent lengthwise or by 1 or 2 terminal pores; staminodes sometimes present, subulate or petaloid; ovary superior, 2-15-carpellate, usually syncarpous, sometimes essentially apocarpous and then the carpels united apically by the style, the ovules 1-many, apotropous (anatropous with the raphe ventral), erect or rarely pendulous, axile or rarely parietal, the style simple, sometimes gynobasic, the stigmas free or fused; fruits sometimes composed of separate drupelets on an enlarged receptacle, sometimes a berry or a septicidal capsule, the seeds 1-many, sometimes winged, with or without endosperm, the embryo large, usually straight, sometimes curved.

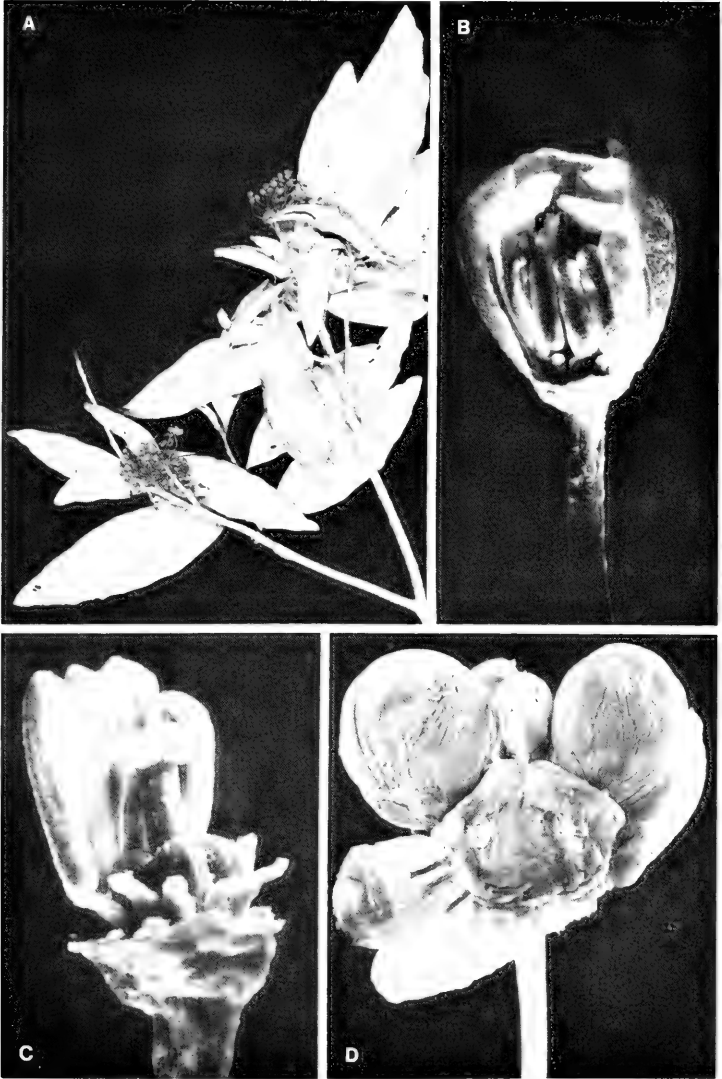
DISTRIBUTION: Pantropical and sometimes subtropical, with 30-40 genera and 400-600 species. Only one genus occurs in Fiji.

USEFUL TREATMENTS OF FAMILY: Gilg, E. Ochnaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 53-87. 1925. Kanis, A. A revision of the Ochnaceae of the Indo-Pacific area. Blumea 16: 1-82. 1968. Kanis, A. Ochnaceae. Fl. Males. I. 7: 97-119. 1971.

I. BRACKENRIDGEA A. Gray in Proc. Amer. Acad. Arts 3: 51. 1853, Bot. U. S. Expl. Exped. 1: 361. 1854; Seem. Fl. Vit. 34. 1865; Gilg in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 74. 1925; A. C. Sm. in J. Arnold Arb. 36: 284. 1955; Kanis in Blumea 16: 41. 1968, in Fl. Males. I. 7: 101. 1971.

Trees or shrubs; leaves simple, the blades chartaceous, with strongly curved secondary nerves and often with fine, ultimate, closely approximate veins (those of our species comparatively inconspicuous and 2-4 per millimeter); inflorescences axillary and terminal, thyrsoid, composed of simple or compound cymes, the bracts small, caducous, the pedicels slender, elongating in fruit; flowers with the receptacle rounded and enlarging in fruit; sepals 5, ovate to obovate; petals usually 5 (as in our species, but as many as 10 in others); stamens usually 10 (as in our species, but as many as 45 in

FIGURE 87. *Brackenridgea nitida*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$; B, young flower, with 2 sepals and 2 petals removed, $\times 10$; C, gynoecium and 4 stamens (sepals, petals, and 6 anthers removed), $\times 20$; D, young fruit, showing the swollen receptacle with 3 maturing carpels and 2 carpillary scars, the persistent style, persistent filaments attached to base of receptacle, and sepals (petals caducous, 1 sepal removed), $\times 6$. A-C from DA 16684, D from Smith 9373.



others), the filaments subterete, the anthers as long as or longer than filaments, dehiscent by longitudinal slits; ovary usually 5-carpellate (as in our species, but carpels as many as 10 in others), the carpels essentially free, the ovule solitary, erect, the style 5(-10)-costate, the stigma small, 5-lobed; fruit composed of 1-5 drupelets, the seed curved, without endosperm.

TYPE SPECIES: *Brackenridgea nitida* A. Gray (ING). Kanis (1968, cited above) accepts the genus and species as validly published by Gray in 1853 in a descriptio generico-specifica, even though a second binomial, *B. hookeri* (Planch.) A. Gray, was proposed at the same time, albeit with a question mark, this presumably implying that the generic description was based solely on *B. nitida*. It may be, however, that mention of a second species negates the application of Art. 42.1, ICBN, in which case Gray's 1854 publication would become the first valid publication of the genus; in that case *B. nitida* would also be the type species. In the 1854 publication the generic and specific descriptions were separated, but the combination *B. hookeri* was not validly proposed.

DISTRIBUTION: A genus of about ten species occurring in southeastern Asia and through Malesia to New Guinea and Queensland, with a disjunct endemic species terminating the range in Fiji.

One of the species with more than ten petals, stamens, and carpels (indicated by the parenthetical allusions in the above description) is *Brackenridgea fascicularis* (Blanco) Fern.-Vill.; Gilg and Werdermann (1925, p. 70) refer this to *Ochnafascicularis* Blanco (another disposition is *Notochnella fascicularis* (Blanco) v. Tiegh.), restricting *Brackenridgea* to species with five sepals, ten stamens, and five carpels.

1. ***Brackenridgea nitida*** A. Gray in Proc. Amer. Acad. Arts 3: 51. 1853, Bot. U. S. Expl. Exped. 1: 362. 1854, Atlas, pl. 42. 1856; Seem. in Bonplandia 9: 255. 1861, Viti, 435. 1862, Fl. Vit. 34. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 135. 1890; A. C. Sm. in J. Arnold Arb. 36: 284. 1955; J. W. Parham, Pl. Fiji Isl. 132. 1964, ed. 2. 190. 1972; Kanis in Blumea 16: 49. 1968; A. C. Sm. in Allertonia 1: 359. fig. 7, A, B. 1978.

FIGURE 87.

Brackenridgea nitida subsp. *nitida*; Kanis in Blumea 16: 50. 1968.

A shrub or tree 2-15 m. high, occurring at elevations from near sea level to 450 m. in dense, dry, or open forest, in patches of forest in open country, and in hillside thickets. Its pedicels and sepals are pale to deep pink; its petals white and faintly pink-tinged (or white within and pinkish without); and its mature carpels black on a red receptacle. Flowers and fruits have been obtained in most months.

TIPIFICATION: The type is *U. S. Expl. Exped.* (US 15456 & 15457 HOLOTYPE; ISOTYPES at GH, K, P), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, Vanua Levu, and Rambi. I have examined 41 collections; the species is locally abundant in Mathuata Province (from which 23 or 24 collections are known) but is less common elsewhere.

LOCAL NAMES AND USE: The names *mbele* and *mbelebele* have been noted on Vanua Levu, and the young leaves (*Smith 6331*) were used for wrapping cigarettes.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vuniyasi, near Nandi, *DA 2371*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 483C*; vicinity of Korotongo, *DA 11704*. SERUA: Hills between Wainigere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9373*. RA: Vicinity of Penang and Rakiraki, *Greenwood 483B*, *Degener & Ordenez 13695*. VANUA LEVU: MBUA: Nasau, Rukuruku Bay, *H. B. R. Parham 35*; Koromba Forest, Wairiki, *DA 15153*; lower Wainunu River Valley, *Smith 1834*. MBUA or MATHUATA: Between Nasarowangga and Ndreketi, *DA 1101*. MATHUATA: "Mathuata Coast," *Seemann 93*; near Mbasakalave, Ndreketi District, *Stauffer &*

Kuruvoli 5843; vicinity of Nanduri, *Tohill 446*; near Tambia Village, *Howard 126*; Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6647*; Seanggangga Station, *DA 16684*; Naketei, Lambasa District, *DA 13750 (DF 244, Bola 92)*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6331*; Mt. Ndelaikoro, *DA 13428*. THAKAUNDROVE: Eastern drainage of Yanawai River, *Degener & Ordenez 14113*; Mt. Valili, *DA 17539*; hills west of Mbutha Bay, Natewa Peninsula, *Smith 813*. RAMBI: *Horne 513*. FIJI without further locality, *Horne 596, 897* ("plains near Wai Wai Nasova").

The Fijian species seems most closely related to *Brackenridgea australiana* F. v. Muell., of Queensland, but it differs in its slightly smaller floral parts and very pronouncedly in the ultimate venation of its leaf blades, as illustrated in my 1978 discussion.

FAMILY 82. THEACEAE

THEACEAE D. Don, Prodr. Fl. Nepal. 224. 1825.

Trees or shrubs, without stipules; leaves alternate, simple, the blades pinnate-nerved, often serrate; inflorescences axillary (rarely terminal), composed of solitary or fasciculate flowers or less often racemose or paniculate; flowers usually hermaphrodite, less often unisexual (plants then dioecious or monoecious), actinomorphic, often with 2 or more bracteoles below calyx; sepals 5 (4-7), free or basally connate, imbricate; petals 5 (sometimes 4-9), hypogynous, imbricate, free or proximally connate; stamens usually numerous in several series, sometimes as few as 5-15, hypogynous, the filaments free or in fascicles or proximally connate, usually adnate to base of petals, the anthers basifixed or dorsifixed, 2-locular, dehiscing lengthwise (very rarely by terminal pores); ovary superior (rarely inferior), 3-5-locular (rarely 1-10-locular), the ovules 2 or more (rarely 1) per locule, anatropous, axile, the styles free or connate, as many as locules; fruit usually a loculicidal or septicidal capsule with a persistent columella, less often drupaceous or baccate, the seeds usually few-many and with scanty endosperm, winged or not, the embryo large, straight or curved.

DISTRIBUTION: Pantropical and subtropical, sometimes extending northward into temperate areas, with 16-35 genera and 500-600 species. Two genera occur in Fiji, one only in cultivation and the other with indigenous species.

USEFUL TREATMENT OF FAMILY: Melchior, H. Theaceae. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 109-154. 1925.

The Theaceae are economically important for the commercial tea plant and for many significant ornamentals.

KEY TO GENERA

- Plants with hermaphrodite flowers, these often large and showy (in our species 2.5-4 cm. across), the pedicels with 4-8 bracteoles; stamens numerous, many-seriate, the anthers dorsifixed; fruit a loculicidal capsule, the seeds 1 or 2 per locule. 1. *Camellia*
- Plants dioecious or rarely monoecious, the flowers comparatively small, less than 1 cm. across, the pedicels usually with 2 bracteoles; stamens 5-30 (10-13 in our species), uniseriate, the anthers basifixed; fruit a berry, the seeds usually numerous. 2. *Eurya*

1. CAMELLIA L. Sp. Pl. 698. 1753; Melchior in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 128. 1925.

Trees or shrubs; leaves spirally arranged or distichous, the blades coriaceous; flowers axillary, solitary or fasciculate, ♂, subsessile or short-pedicellate, often large and showy, the pedicels with 4-8 bracteoles; sepals usually 5-7, unequal; petals usually 5-7; stamens numerous, many-seriate, the outer filaments connate at base or nearly to apex and coherent to petals, the inner ones often free, the anthers dorsifixed; ovary 3-5-locular, the ovules 4-6 per locule, the styles 3-5 or proximally united; fruit a woody, loculicidal capsule with a persistent columella, the seeds 1 or 2 per locule, unwinged, without endosperm, the embryo straight.

TYPE SPECIES: *Camellia japonica* L., the only original species.

DISTRIBUTION: Tropical and subtropical southeastern Asia (northward to China, Japan, and Formosa) and into Malesia to Java, Celebes, and the Philippines, with 40-80 species. The commercial tea is sparingly cultivated in Fiji.

1. *Camellia sinensis* (L.) Kuntze in Acta Horti Petrop. **10**: 195. 1887; Melchior in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 131. fig. 61. 1925; J. W. Parham, Pl. Fiji Isl. **132**. 1964, ed. 2. 189. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 127. 1972.

Thea sinensis L. Sp. Pl. 515. 1753.

The commercial tea plant, as cultivated in Fiji, is grown from near sea level to an elevation of 850 m. as a shrub or small tree 0.5-3 m. high. Its leaves are elliptic-oblong and sometimes up to 30 cm. long, finely pubescent when young. It bears fragrant flowers 2.5-4 cm. broad, with white or pink-tinged petals, white filaments, and yellow anthers. The few available collections were flowering in May and November and fruiting in November.

TYPIFICATION: Linnaeus gave several prior references, including one to *Hortus Cliffortianus*.

DISTRIBUTION: A native of southeastern Asia, now widely cultivated as a commercial crop.

LOCAL NAMES AND USES: The usual name, *tea*, is utilized in Fiji, as well as *chah*. The species has been sporadically cultivated in Fiji since about 1890, and at present trials with different cultivars are being conducted in several localities by the Department of Agriculture. The species is also sometimes grown as an ornamental. Extensive discussions of the history, uses, etc. of tea are given by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 421-425. 1966) and Pursglove (Trop. Crops, Dicot. 599-612. 1968).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: An experimental plantation is maintained by the Department of Agriculture near Navai, south of Nandarivatu, but no vouchers are at hand. NAITASIRE: Nanduruloulou, DA 5596, 12257; Toninaiwau, Tholo-i-suva, DA 16952. VANUA LEVU: MBUA: Thongea, Wainunu River, DA L. 14240. TAVEUNI: A plantation is still in existence on the "Alpha tea estate" (J. W. Parham, 1972, cited above), but no vouchers are available.

2. *Eurya* Thunb. Nova Gen. Pl. 67. 1783; Seem. Fl. Vit. 14. 1865; Melchior in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 146. 1925.

Dioecious or rarely monoecious trees or shrubs; leaves short-petiolate, the blades crenate-serrate; flowers axillary, solitary or fasciculate, unisexual, usually with vestigial gynoecia or androecia, the pedicels with 2 (or 3) persistent bracteoles; sepals 5, somewhat unequal; petals 5 (-7), free or basally connate; stamens 5-30, uniseriate, the filaments coherent at base and adnate to petals or free, the anthers basifixed; ovary 2-6-locular, the ovules 4-60 per locule, the styles 2-6, proximally connate or nearly free; fruit a fleshy or dry berry, the seeds usually numerous, unwinged, with endosperm, the embryo usually curved.

TYPE SPECIES: *Eurya japonica* Thunb. (ING).

DISTRIBUTION: Eastern Asia through Malesia and into the Pacific to Samoa and Hawaii, with about 70 species.

USEFUL TREATMENT OF GENUS: Kobuski, C. E. Studies in Theaceae, III. *Eurya* subgenera *Euryodes* and *Penteurya*. Ann. Missour. Bot. Gard. **25**: 299-359. 1938.

The species occurring in the Fijian Region have often been referred to *Eurya japonica* Thunb., *E. acuminata* DC., or *E. angustifolia* Bl., none of which occur east of Malesia. The two species known from Samoa, *E. pickeringii* A. Gray and *E. richii* A.

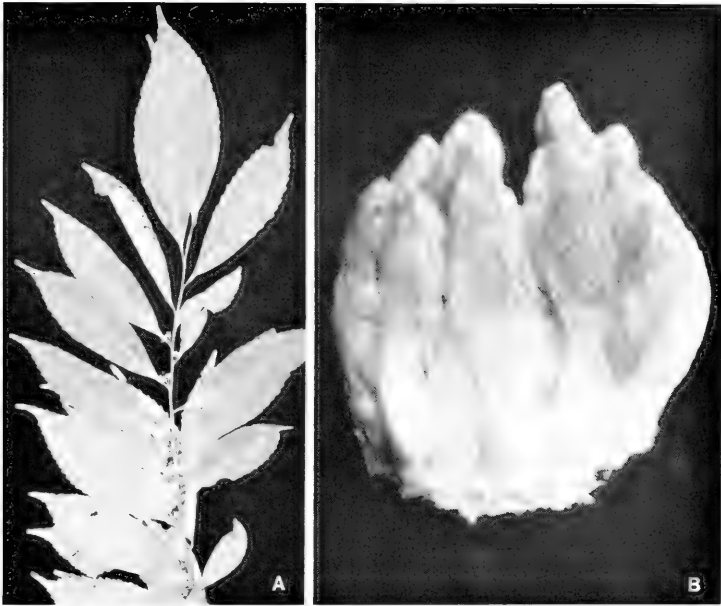


FIGURE 88. *Eurya vitiensis*; A, distal portion of branchlet, with foliage and ♀ inflorescences, $\times 1/2$; B, stamens from young ♂ flower, $\times 40$. A from Smith 7806, B from Smith 781.

Gray, have ♂ flowers with 5–8 stamens, while the two known from Fiji have 10–13 stamens; in both archipelagoes the ♀ flowers seem to lack staminodes and the ♂ flowers have very minute pistillodes or entirely lack them. *Eurya* has been erroneously recorded from the New Hebrides as *E. japonica* (Guillaumin in J. Arnold Arb. 14: 54. 1933) and sometimes identified as *E. vitiensis*, which in my observation does not occur there. For instance, R. S. N. H. 16343 (Espiritu Santo) has ♂ flowers with 5 stamens and a conspicuous, conical pistillode, the sepals and petals being minutely glandular within; R. S. N. H. 16197 (Tanna) has ♂ flowers with 10 stamens, but the sepals are conspicuously glandular-margined. It seems that there are at least two species of *Eurya* in the New Hebrides, but they are not conspecific with any of those known from Fiji or Samoa.

KEY TO SPECIES

Leaf blades prevailing lanceolate, usually about 3 times longer than broad, (2.5–)3.5–9 \times (1–)1.2–2.3 cm., gradually attenuate to an acumen 4–10 mm. long, the actual apex inconspicuously retuse; petals 2.5–3 mm. long at anthesis, connate in the proximal 1 mm. or free nearly to base; stamens 10, the filaments at anthesis 0.5–0.8 mm. long, the anthers obtuse at apex; terminal bud copiously sericeous; young branchlets and petioles appressed-pilose, eventually glabrate; mature leaf blades beneath often sparsely appressed-pilose, at least on costa, but eventually glabrate. 1. *E. vitiensis*

Leaf blades prevailingly elliptic, usually about twice as long as broad, 2-5.5 (-6.5) × 1.3-2.6 cm., obtuse or obtusely short-cuspidate, conspicuously retuse at apex, the acumen 0-3 mm. long; petals 3.5-4.5 mm. long at anthesis, connate in the proximal 1.5-2 mm.; stamens 10-13, the filaments at anthesis 1-1.5 mm. long, the anthers mucronate at apex; terminal bud often glabrous at least distally (but sometimes uniformly sericeous); young branchlets and petioles sparsely appressed-pilose, soon glabrate; mature leaf blades glabrous beneath. 2. *E. greenwoodii*

1. *Eurya vitiensis* A. Gray, Bot. U. S. Expl. Exped. 1: 210. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 14. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 117. 1890; Kobuski in Ann. Missouri Bot. Gard. 25: 341. 1938; J. W. Parham, Pl. Fiji Isl. 132. 1964, ed. 2. 189. 1972. FIGURE 88.

Eurya acuminata sensu Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862; Gibbs in J. Linn. Soc. Bot. 39: 141. 1909; non DC.

Eurya angustifolia sensu Seem. Fl. Vit. 14. 1865, op. cit. 425. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 117. 1890; J. W. Parham, Pl. Fiji Isl. 132. 1964, ed. 2. 189. 1972; non Bl.

Eurya vitiensis is an often slender tree or shrub 2-10 m. high, occurring at elevations of about 150-830 m. in dense forest or on its edges or sometimes along streams among reeds and in thickets. Its petals are white, greenish proximally, and its filaments are also white; fruits are recorded as green. Flowering material has been obtained between December and June and fruiting material slightly later.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 11575 & 11576 HOLOTYPE; ISOTYPE at K), collected in 1840 on Ovalau on the "summit of a mountain, 2,000 ft." The specimens probably came from the ridge west of Levuka leading to Mt. Ndelaiovalau, the highest point of the island (626 m.).

DISTRIBUTION: Endemic to Fiji and known from several high islands.

LOCAL NAME: The only name reported is *salu ki mbati* (Smith 4255).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nalotawa, eastern base of Mt. Evans Range, Greenwood 236, Smith 4255. NAMOSI: Vicinity of Namosi, Gillespie 2626. NAITASIRE: Vatavula, Nambathara hill, Gibbs 532. VITI LEVU without further locality, Milne 70, Graeffe 1542. KANDAVU: Seemann 43. OVALAU: Seemann 43-bis, 44; hills east of Lovoni Valley, Smith 7678. NGAU: Milne 232; hills east of Herald Bay, inland from Sawaieke, Smith 7806. TAVEUNI: Mt. Manuka, east of Wairiki, Smith 781. MOALA: Ndelaiovalau, Smith 1362. TOTOYA: Milne 85. FIJI without further locality, Harvey, Nov., 1855, Horne 610.

2. *Eurya greenwoodii* Kobuski in J. Arnold Arb. 33: 97. 1952; J. W. Parham, Pl. Fiji Isl. 132. 1964, ed. 2. 189. 1972. FIGURE 89.

Eurya greenwoodii is known as a compact, spreading, or freely branched shrub 1-3 m. high or a tree with a dense crown and 4-7 m. high, found at elevations of 500-1,195 m. in dry or scrubby forest or in the dense forest and thickets of ridges. Its petals and filaments are white and its fruits green, flowering and fruiting material having been obtained between February and July.

TYPIFICATION: The type is *Smith 4898* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected June 26, 1947, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from northern and northwestern Viti Levu.

LOCAL NAMES: Reported names are *samu ni mbati* (Smith 4898) and *kutumirase* (Degener 14799); the latter usually refers to the genus *Maesa* (Myrsinaceae).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, Greenwood 458; summit of Mt. Koroyanitu, Mt. Evans Range, Smith 4235; upper slopes of Mt. Koromba, Smith 4647; vicinity of Nandarivatu, Greenwood 236A, Degener 14799. NANDRONGA & NAVOSA: Nausori Highlands, DA 13383, DF 403 (Vetava 19).



FIGURE 89. *Eurya greenwoodii*; A, distal portions of branchlets, with foliage and ♀ inflorescences, $\times 1$; B, ♀ flower, with 1 sepal and 2 petals removed, $\times 15$; C, young stamen, adaxial surface, $\times 50$; D, 2 petals and associated stamens, $\times 20$. A & B from Smith 4898, C from Smith 4235, D from Smith 4647.

FAMILY 83. SAURAUACEAE

SAURAUACEAE J. Agardh, *Theoria Syst. Pl.* 110, as *Saurajae*. 1858.

Trees or shrubs, not scandent, without stipules; leaves alternate, simple, the blades with strong parallel secondary nerves, often coarsely pubescent or scaly, usually serrate; inflorescences axillary or lateral on older branches, usually a thyse composed of scorioid cymes; flowers actinomorphic, hypogynous, usually hermaphrodite (rarely functionally unisexual), pedicellate, subtended by a bract and 2 bracteoles; sepals (4 or) 5, broadly quincuncial, persistent, often accrescent; petals (4 or) 5, imbricate, free or basally connate, caducous (together with associated stamens); stamens (13-) 15-numerous, the filaments usually adnate to petal bases, the anthers dorsifixed, versatile, 2-celled, dehiscing by apical pores or short subapical slits; ovary 3-5-locular, the ovules numerous, anatropous, unitegmic, tenuinucellate, axile, the styles as many as locules, usually free, sometimes variously united, the stigmas simple or capitate; fruit 3-5-locular, a disintegrating berry or an apically and loculicidally dehiscent capsule, the seeds small, numerous, immersed in pulp, not winged, not arillate, the endosperm copious, the embryo straight or slightly curved.

DISTRIBUTION: A family composed of a single genus of 250-300 species in tropical America and Asia, eastward through Malesia to the Solomon Islands and northeastern Australia, the range terminating in Fiji with a single endemic species.

USEFUL TREATMENTS OF FAMILY: Gilg, E., & E. Werdermann. *Actinidiaceae*. Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2. 21: 36-47. 1925. Dickison, W. C. Observations on the floral morphology of some species of *Saurauia*, *Actinidia*, and *Clematoclethra*. *J. Elisha Mitchell Sci. Soc.* 88: 43-54. 1972.

The genus *Saurauia* has been variously assigned to a dilleniacean, thealean, or ericalean alliance, but it is now universally excluded from the Dilleniales (sensu str.). There remain different opinions whether to place *Saurauia* in its own family or to combine it with the Actinidiaceae, and whether this alliance of one or two families is better placed in the Theales or the Ericales. Dickison (1972, cited above) concludes that the genera concerned are readily accommodated in a single family best placed in the Ericales. The family Saurauaceae is maintained as distinct by van Steenis (in *Fl. Males. I.* 4: 37. 1948), Backer and Bakhuizen van den Brink, Jr. (*Fl. Java* 1: 324-326. 1963), Takhtajan (1969), and Hutchinson (1973). Takhtajan (1969) places the family in the Ericales; the other mentioned authors (and Cronquist, 1968, as Actinidiaceae) place it in the Theales. The placement is of little consequence, since the derivation of ericalean plants from ancestral thealean ones is generally accepted. But because of the large number of stamens and the sometimes separate styles of *Saurauia* and its allies, a position in the Theales seems justified, as pointed out by Cronquist (1968), in spite of their unitegmic, tenuinucellate ovules. I here follow Takhtajan and other mentioned authors in separating *Saurauia* into its own family.

The generic name has been spelled both as *Saurauia* and *Saurauja*; the latter spelling is correct according to Art. 73.5, ICBN. Both spellings were used by Willdenow in the original publication, but Hoogland (in *Taxon* 26: 147. 1977) indicated that *Saurauia* was used by Willdenow in his herbarium and proposed the conservation of that orthography. This proposal was accepted by the Committee for Spermatophyta (in *Taxon* 27: 545. 1978), an action taken too late to be incorporated into the Leningrad edition of the ICBN. The conservation will doubtless be reflected in the next edition, being in line with the conserved family orthography Saurauaceae. In the following citations I use the spelling *Saurauia* throughout, although many mentioned writers actually used *Saurauja*.

1. SAURAUIA Willd. in Ges. Naturf. Freunde Berlin Neue Schriften 3:407. 1801; Seem. Fl. Vit. 14. 1865; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 42. 1925; A. C. Sm. in J. Arnold Arb. 36: 284. 1955. Orth. cons. prop.

Draytonia A. Gray in Proc. Amer. Acad. Arts 3: 49. 1853, Bot. U. S. Expl. Exped. 1: 206. 1854.

Characters and distribution of the family.

TYPE SPECIES AND NOMENCLATURE: The type species of *Saurauia* is *S. excelsa* Willd., published in the original descriptio generico-specifica. *Draytonia* is typified by *D. rubicunda* A. Gray, which also was part of Gray's 1853 descriptio generico-specifica; in 1854 Gray provided separate descriptions of his genus and species.

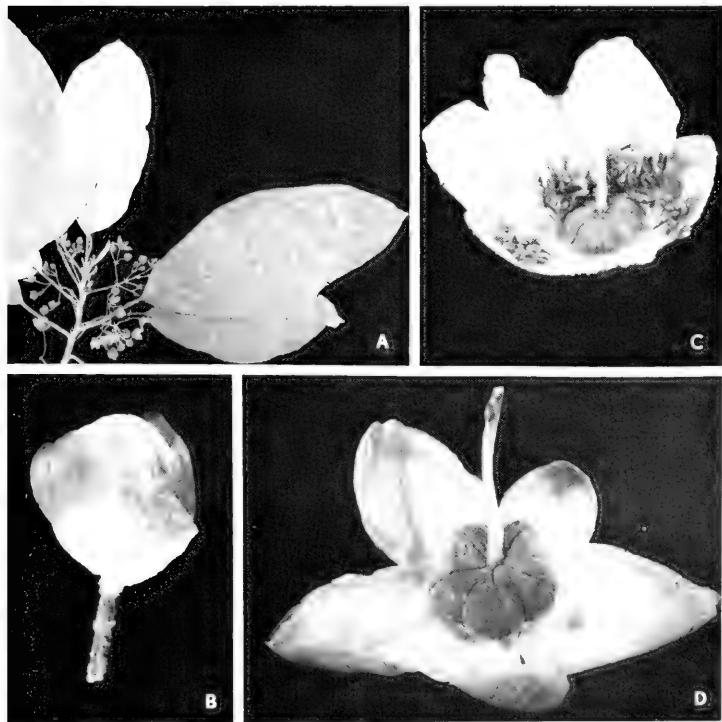


FIGURE 90. *Saurauia rubicunda*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$; B, young flower, $\times 3$; C, flower, with 2 sepals, 3 petals, and some stamens removed, $\times 3$; D, fruit (petals and stamens fallen), $\times 3$. A from *Smith 362*, B & C from *St. John 18237*, D from *Degener & Ordóñez 13544*.

1. *Saurauia rubicunda* (A. Gray) Seem. in *Bonplandia* 10: 296. 1862, Fl. Vit. 14. 1865, op. cit. 425. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 117. 1890; Gibbs in J. Linn. Soc. Bot. 39: 141. 1909; Turrill in op. cit. 43: 17. 1915; Gilg & Werdermann in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 45. 1925; A. C. Sm. in J. Arnold Arb. 31: 313. 1950, in op. cit. 36: 284. 1955; J. W. Parham, Pl. Fiji Isl. 132. 1964, ed. 2. 190. 1972.

FIGURE 90.

Draytonia rubicunda A. Gray in Proc. Amer. Acad. Arts 3: 49. 1853, Bot. U. S. Expl. Exped. 1: 207. 1854, Atlas, pl. 15. 1856; Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862.

A tree (2-) 4-15 m. high, with a trunk to 20 cm. or more in diameter, sometimes spreading and sometimes with a compact crown, found from near sea level to an elevation of about 1,200 m. in dense or open forest or on its edges or in patches of forest in open country. The pedicels are often rich pink, the sepals pale green to white or pale pink, the petals pale to deep pink or rose-purple and occasionally white, the filaments white or pale yellow, the anthers often bright yellow, the styles white, and the fruit deep red. Flowers and fruits occur abundantly throughout the year.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 11599 HOLOTYPE; ISOTYPES at GH, K), collected in 1840 on the island of Ovalau.

DISTRIBUTION: Endemic to Fiji and known from several high islands. As one of the most common small trees in Fiji, *Saurauia rubicunda* is represented by about 150 collections. A form with white petals, noted in 1950 (Smith, cited above), is now seen to occur sporadically throughout the range and is represented by about ten collections.

LOCAL NAMES AND USES: The most commonly used names for this distinctive and well-known species are *susu* and *mimila*; other reported names, arranged by provinces, are: *mimila ndina*, *milamila*, *kaindrandra* (Mba); *thothova* (Nandronga & Navosa); *mamakandora* (Serua); *mbulei* (Ra); *nambo*, *mindra*, *kau yalewa* or *kau ni yalewa* (Naitasiri); and *timbu ni susu* (Thakaundrove). Many uses are also ascribed to the species: the wood is hard and is sometimes used as a drill for making fire, and sticks from branchlets are used to shape pottery. Medicinally, a decoction from the leaves is said to be used to soothe eyes, to relieve tongue sores, and to cure constipation, while the bark has been noted as part of a remedy used in treating dysentery.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood* 39; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith* 4556; vicinity of Nandarivatu, *Gibbs* 520, *im Thurn* 256, *Degener & Ordonez* 13544; Mt. Tomanivi, *DA* 12703 (*Melville et al.* 7091). NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, *Smith* 5482; Nausori Highlands, *DA* 13389; north of Komave, *St. John* 18949. SERUA: Upper Navua River, *DA* 14488; vicinity of Namboutini, *DA* 13837 (*DF* 415, *Damanu* 87). NAMOSI: Mt. Naitarandamu, *Gillespie* 3114; vicinity of Namosi, *Horne* 847; Nambukavesi Creek, *DA* 13741 (*DF* 198, *Bola* 60). RA: Vicinity of Nasukamai, *Gillespie* 4400; vicinity of Rewasa, near Vaileka, *Degener* 15383. NAITASIRI: Wainimala Valley south of Matawailevu, *St. John* 18237; Nambukaluka, Waindina River, *DA* 276; Tholo-i-suva, *Vaughan* 3172. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith* 7137; Wainivesi River, *DA* 3289. REWA: Mt. Korombamba, *Parks* 20110. "VITI LEVU and OVALAU:": (Near Port Kinnaird on Ovalau) *Seemann* 42. OVALAU: *Milne* 53; Mt. Korotolotolu, west of Thawathi, *Smith* 8032. KORO: Eastern slope of main ridge, *Smith* 988. NGAU: *Milne* 235; hills east of Herald Bay, inland from Sawaieke, *Smith* 7789. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith* 1583; vicinity of Nandi, *MacGillivray* 212. MATHUATA: Seanggangga Plateau, vicinity of Natua, *Smith* 6909. THAKAUNDROVE: Southern slope of Valanga Range, *Smith* 362; Mt. Mariko, *Bierhorst* F138. TAVEUNI: Above Somosomo, *Gillespie* 4825.

Gilg and Werdermann (1925, cited above) place *Saurauia rubicunda* in sect. *Ramiflorae* Diels, composed of eight species from southeastern Asia and Malesia and the Fijian endemic.

FAMILY 84. CLUSIACEAE

CLUSIACEAE Lindl. Nat. Syst. Bot. ed. 2. 74. 1836.

Guttiferae Juss. Gen. Pl. 255. 1789. Nom. alt.

Trees or shrubs, dioecious or monoecious or polygamous or with hermaphrodite flowers, with resinous latex and oil glands, lacking stipules; leaves opposite or verticillate, simple, the blades often gland-dotted or with resin canals; inflorescences axillary or terminal, fasciculate, cymose, racemose, umbellate, or composed of solitary flowers; flowers hermaphrodite or unisexual, actinomorphic, hypogynous, the pedicels often bracteolate; perianth dichlamydeous (in some genera sometimes interpreted as monochlamydeous and composed of tepals); sepals 2-10, rarely more, imbricate or decussate, fused in bud in *Mammea*; petals 0-12, imbricate, rarely valvate; stamens (5-) usually numerous, free or with filaments variously connate and sometimes in phalanges opposite petals, the anthers 2-locular, basifixed or dorsifixed, usually dehiscent longitudinally, the ♀ flowers often with staminodes; ovary sessile, superior, completely or incompletely 1-many-locular, the ovules 1-many per locule, anatropous, axile or erect from base or rarely parietal, the styles free, united, or lacking, the stigmas diverse, sometimes radiating, the ♂ flowers sometimes with an ovarial vestige; fruit a loculicidal capsule or sometimes a berry or drupe, the seeds without endosperm, often arillate, the embryo large, often with minute cotyledons.

DISTRIBUTION: Pantropical and rarely subtropical. As now usually interpreted, the Clusiaceae (excluding Hypericaceae) are composed of 25-35 genera and 800-1,000 or more species. The family includes many timber trees, as well as species with edible fruits and useful resins and oils. Four genera occur in Fiji, three of them with indigenous species.

USEFUL TREATMENTS OF FAMILY: Engler, A. *Guttiferae*. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 154-237. 1925. Smith, A. C., & S. P. Darwin. Studies of Pacific Island plants. XXVIII. The *Guttiferae* of the Fijian Region. J. Arnold Arb. 55: 215-263. 1974.

KEY TO GENERA

- Plants polygamo-dioecious or with consistently hermaphrodite flowers, the petals if present (and often the sepals as well) white; stamens free or essentially so, with filiform filaments; ovary unilocular or incompletely 2-locular or 4-locular (in our indigenous species becoming unilocular by abortion); leaf blades with regular venation of numerous lateral nerves.
- Sepals 4, free, decussate or imbricate; style obvious; flowers hermaphrodite; leaf blades with numerous lateral nerves, the ultimate areoles not obvious nor with a central gland.
- Petals (in our species) 0-10, if present decussate or imbricate; ovary unilocular; fruit drupaceous, indehiscent, 1-seeded; inflorescences basically cymose, pseudoracemose or pseudopaniculate, few-many-flowered; leaf blades with usually conspicuous, closely approximate, parallel secondary nerves. 1. *Calophyllum*
- Petals 4, contorted; ovary incompletely 2-locular; fruit at length 2-valved, 1-4-seeded; inflorescences composed of solitary flowers at apices of branchlets or in distal leaf axis; leaf blades with thin, obscure secondary nerves; cultivated only. 2. *Mesua*
- Sepals 2, completely fused in bud, separating at anthesis; petals 4-6, imbricate; style short or essentially none; inflorescences fasciculate, the flowers ♂ and ♀ on different trees; leaf blades with veinlets forming a conspicuous reticulum, the ultimate areoles each with a raised gland in its center. 3. *Mammea*
- Plants dioecious (our indigenous species, but sometimes monoecious or polygamous elsewhere), the sepals (in our indigenous species) 4, rarely 2, decussate, the petals 2 or 4, imbricate or less often valvate, white to variously colored; stamens aggregated into 1 or more phalanges; ovary with 2 or more developing ovules; fruits with 2 or more seeds (or sometimes only 1 developing); leaf blades with comparatively spaced secondary nerves or these not regularly paralleled by conspicuous tertiaries. . . . 4. *Garcinia*

1. *CALOPHYLLUM* L. Sp. Pl. 513. 1753; Seem. Fl. Vit. 11. 1865; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 216. 1974; Stevens in op. cit. 61: 167. 1980.

Trees, often large and with hard wood, usually with abundant white or pale yellow latex, the apical bud composed of a reduced pair of leaves (these later developing), the

young branchlets terete to angular or slightly flattened; leaves decussate, petiolate, the petioles distally broadened, the blades thick in texture, entire, with numerous, closely approximate, parallel secondary nerves; inflorescences axillary or arising from defoliate branchlets, solitary, basically cymose, pseudoracemose or pseudopaniculate, few-many-flowered; flowers hermaphrodite (infrequently functionally unisexual), the perianth segments free, imbricate (sometimes interpreted as tepals, but perianth basically dichlamydeous); sepals (or outer tepals) 4 in 2 decussate series, usually broader and thicker than petals; petals 0-10 (in our species), if present decussate or imbricate, white, often more membranous than sepals; stamens numerous, 2-several-seriate, the filaments free or basally subcoherent, filiform, the anthers basifixed, oblong, rounded at both ends, dehiscent longitudinally; ovary subglobose or ovoid, unilocular, the ovule solitary, erect, the style terete, often filiform, curved in bud, the stigma peltate or shallowly infundibular; fruit drupaceous, the exocarp thin and usually brittle, the mesocarp fibrous, the endocarp bony or crustaceous, sometimes with a basal plug (this becoming detached during germination), the seed without an aril, the testa thin or with the outer layer thick and corky, the embryo subglobose, the cotyledons large.

LECTOTYPE SPECIES: *Calophyllum inophyllum* L. (vide Stevens, 1980, cited above), one of Linnaeus's two original species.

DISTRIBUTION: Pantropical, probably with 150-200 species, and with a major center of diversity in Indo-Malesia.

USEFUL TREATMENTS OF GENUS: Stevens, P. F. A review of *Calophyllum* L. (Guttiferae) in Papuaia. Austral. J. Bot. 22: 349-411. 1974. Stevens, P. F. A revision of the Old World species of *Calophyllum* (Guttiferae). J. Arnold Arb. 61: 117-699. 1980.

Prior to publication of his comprehensive and scholarly monograph of 1980, P. F. Stevens had kindly sent me a copy of the portions of his manuscript that pertain to the species occurring in Fiji, together with a key to those species, which is here used with a few modifications. In some points his findings pertinent to the Fijian species are in disagreement with those of Smith and Darwin (1974, cited above under the family); because his studies are vastly the more comprehensive, most of his suggestions are here accepted. In general, these refer to a broader concept of *Calophyllum cerasiferum*, a narrower concept of *C. amblyphyllum* (which he treats as a Fijian endemic only variably distinct from *C. vitiense*), reduction of *C. tenuicrustosum* to *C. vitiense*, and a broader concept of *C. neo-ebudicum*, which is taken to include *C. samoense*. Stevens considers the perianth parts not separable into sepals and petals and refers to them collectively as tepals. Most authors have considered the Clusiaceae to have dichlamydeous perianths and have treated the four outer "tepals" of *Calophyllum* flowers as sepals; they usually differ somewhat in size and texture from the inner perianth segments. In order to treat the genera of the family uniformly in this respect, I here use the terms sepals and petals. The Fijian species with 4-10 petals are (except for *C. inophyllum*) difficult to separate by using flower and fruit characters, and I follow Stevens in placing more reliance on vegetative characters. I have not attempted to modify the present treatment to agree with Stevens's terminology in all respects, e. g. I continue to use the term "endocarp" for the fruit layer that Stevens terms the "stone," which apparently develops from the outer part of the seed.

As here treated, *Calophyllum* is represented in Fiji by seven indigenous species, of which five are endemic.

KEY TO SPECIES

Petals none; flowers less than 10 mm. in diameter at anthesis; sepals not more than 4 mm. long; inflorescence axis less than 2 cm. long; fruits less than 2 cm. long, the endocarp less than 0.8 mm. thick in mature

fruits, lacking a basal plug; branchlets toward apex less than 1.8 mm. thick.

Indument of buds, young branchlets, young petioles, and peduncles conspicuous, the hairs spreading, 0.3-0.5 mm. long; terminal buds 4.5-5 mm. long; branchlets toward apex drying brown; fruiting pedicels up to 5 mm. long; mature fruits up to 12 mm. long, the endocarp 0.2-0.3 mm. thick.

1. *C. leucocarpum*

Indument of buds and young parts inconspicuously and evanescently sericeous-puberulent; terminal buds 2-3.7 mm. long; branchlets toward apex drying brown to yellowish; pedicels 2-13 mm. long; mature fruits up to 17 mm. long, the endocarp 0.4-0.8 mm. thick. 2. *C. leptocladum*

Petals at least 4; flowers more than 10 mm. in diameter at anthesis; sepals at least 4 mm. long; inflorescence axis usually considerably more than 2 cm. long; fruits at least 1.8 cm. long, the endocarp at least 1 mm. thick in mature fruits, with a basal plug; branchlets toward apex often more than 1.7 mm. thick.

Internodes 0.5-2.5 (-3.5) cm. long; branchlets toward apex drying pale brown to brown and yellowish white; leaf blades drying dull sepia on upper surface, the venation obscure, the secondary nerves (6-) 11-18 per 5 millimeters; petals 4-10, 6-11 mm. long; fruits 18-40 × 17-35 mm.

3. *C. cerasiferum*

Internodes (0.5-) 1-4 cm. long; branchlets toward apex usually drying brown; leaf blades drying grayish sepia to olivaceous on upper surface, the venation usually obvious, the secondary nerves fewer than 14 per 5 millimeters.

Petioles less than 2 mm. in diameter; leaf blades ovate to elliptic, acuminate at apex (at least in Fijian specimens), the secondary nerves 8-14 per 5 millimeters; pedicels 0.7-2 cm. long; petals 4 (rarely to 8), 5-11 mm. long; fruits 17-37 (-43) × 13-35 mm. 4. *C. neo-ebudicum*

Petioles at least 2 mm. in diameter; leaf blades usually elliptic to obovate, rarely ovate, retuse to acuminate at apex, the secondary nerves (3-) 4-9 (-11) per 5 millimeters; pedicels (0.4-) 1-5 cm. long.

Terminal buds 4-9 mm. long; leaf blades less than 2(-2.5) times longer than broad, drying other than sepia on upper surface and smooth even under strong magnification, the costa on upper surface often abruptly narrowed at base; petals 4 (perhaps rarely to 8), usually 8-14 mm. long; fruits usually 32-50 × 27-40 mm., the testa of seed with a spongy outer layer 1-12 mm. thick.

5. *C. inophyllum*

Terminal buds (4.5-) 7-12 mm. long; leaf blades usually about 3 times longer than broad, drying sepia on upper surface and minutely bullate under strong magnification, the costa on upper surface narrowing gradually from base; petals 4 (rarely to 8), 7.5-16 mm. long; fruits 22-33 × 15-26 mm.

Leaf blades acute to acuminate at apex; terminal buds (6-) 8-12 mm. long, usually with subcrustaceous indument. 6. *C. vitiense*

Leaf blades shallowly retuse to rounded or sometimes acute at apex; terminal buds 4.5-7 mm. long, usually with short-tomentose indument. 7. *C. amblyphyllum*

1. ***Calophyllum leucocarpum*** A. C. Sm. in J. Arnold Arb. **31**: 314. 1950; J. W. Parham, Pl. Fiji Isl. 134. 1964; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 219. *fig. 1-3*. 1974; Stevens in op. cit. **61**: 548. *fig. 34, m, q*. 1980.

An apparently rare slender tree 4 m. high, occurring at an elevation of 100-200 m. in patches of forest in open, rolling country; the sepals and filaments are white, the anthers yellow, and the fruit white. The only known collection bore flowers and fruits in December.

TYPEFICTION: The type is *Smith 6820* (A HOLOTYPE; many ISOTYPES), collected Dec. 4, 1947, on the Seangganga Plateau, in drainage of Korovuli River, vicinity of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and still known only from the type collection.

2. ***Calophyllum leptocladum*** A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 221. *fig. 4, 5*. 1974; Stevens in op. cit. **61**: 628. *fig. 43, e-h*. 1980.

A sometimes slender tree 9-22 m. high, with a trunk up to 50 cm. in diameter, found at elevations of about 50 to 670 m. in dense forest or in the demarcation zone between forest and grassland; the fruit is pale green, becoming nearly white at maturity. Flowers have been observed between December and March and fruits between May and July.

TYPEFICTION: The type is *Smith 7874* (US 2190685 HOLOTYPE; many ISOTYPES),

obtained June 22, 1953, on the slopes of Mt. Ndelaito on its northern spur, toward Navukailangi, Ngau.

DISTRIBUTION: Endemic to Fiji; infrequent, but now known from five of the high islands.

LOCAL NAMES AND USE: Recorded names are *ndamanu*, *ndamanu ndrau lailai*, and *ndamanu ndilondilo*; it is considered a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, O. & I. Degener 32165. SERUA: Inland from Ngaloa, Berry 111; Kandawa Hill (east of Navua River), DF 622 (S1404/7). NAMOSI: Mt. Vakarongasiu, DA 16127; Nambukavesi Creek, DF 489. NAITASIRE: Vatuvula Village, Waimanu River, DA 18694; Prince's Road, DA 142; Tholo-i-suva, DA 12460 (DF 109, Bola 11). RA: Vicinity of Naivotho Village (Nakorotumbu Tikina), Damanu K273. KANDAVU: Without further locality, DF 618 (S1404/3). OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, Smith 7538. VANUA LEVU: THAKAUNDROVE: Mt. Kasi, DA 15733; Navonu Creek, Natewa Peninsula, Berry 4. FIJI without further locality, Cottle, Dec., 1950.

This species and the preceding are readily distinguished from other *Calophylla* in Fiji by having flowers without petals (i. e. with only four perianth segments) and comparatively small fruits, which become white at maturity and have thin endocarp lacking a basal plug.

3. *Calophyllum cerasiferum* Vesque, Epharמושis 2: 10. pl. 32. 1889, in DC. Monogr. Phan. 8: 540, 585. 1893; J. W. Parham, Pl. Fiji Isl. ed. 2. 192. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 235. fig. 20, 21. 1974; Stevens in op. cit. 61: 562. 1980.

FIGURE 91.

Calophyllum burmanni sensu Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862; Horne, A Year in Fiji, 285. 1881; non Wight.

Calophyllum burmanni var. *parvifolium* sensu Seem. Fl. Vit. 11. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 116. 1890; non Wight.

Calophyllum amblyphyllum A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 232, p. p. 1974.

A tree 12–25 m. high and with a trunk to 60 cm. in diameter (or sometimes on exposed ridges stunted and only 2 m. high), with white or yellow latex, occurring at elevations of 150–1,250 m. in montane or hill forest, secondary forest, or in forest on ridges. The petals and filaments are white or cream-colored and the fruits are red-tinted, at maturity becoming darker. Flowers have been noted in March, June, and November, fruits in June and also between August and November.

TYPIFICATION: The type is *Seemann 49*, a fruiting specimen collected Aug. 24, 1860, on Mt. Voma, Namosi Province, Viti Levu, represented at BM, G, GH, and K. The locality is taken from the K sheet, although Seemann in 1865 indicated the number as from Kandavu. Since Vesque did not state which specimen he used in his original circumscription, Smith and Darwin indicated the K specimen as the holotype, as Vesque may well have seen it. Stevens believes that Vesque's original illustration was based on the specimen at G and takes that to be the lectotype.

DISTRIBUTION: Endemic to Fiji and now known from four of the high islands. Because the present interpretation of the species is considerably broader than that of Smith and Darwin in 1974, I cite below all the specimens now available.

LOCAL NAMES AND USE: *Ndamanu*, *ndamanu ndrau lailai*, *ndamanu ndilondilo*; sometimes noted as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Ndelainathovu, on escarpment west of Nandarivatu, Smith 4944; vicinity of Nandarivatu, Tothill 24, Vaughan 3431; Sovutawambu, near Nandarivatu, Degener 14664; Waimonge Creek and vicinity, south of Nandarivatu, Berry 82, 85, 88, DF 1075, Damanu K88. NANDRONGA & NAVOSA: South of Mt. Tomanivi, DA 14292; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, Smith 5461; track to Vanualevu Village, Berry 79. SERUA: Nambukelevu, upper Navua River, DA 15654; inland from Namboutini, DF 573 or 797 (S1404/9, Damanu R-22); inland

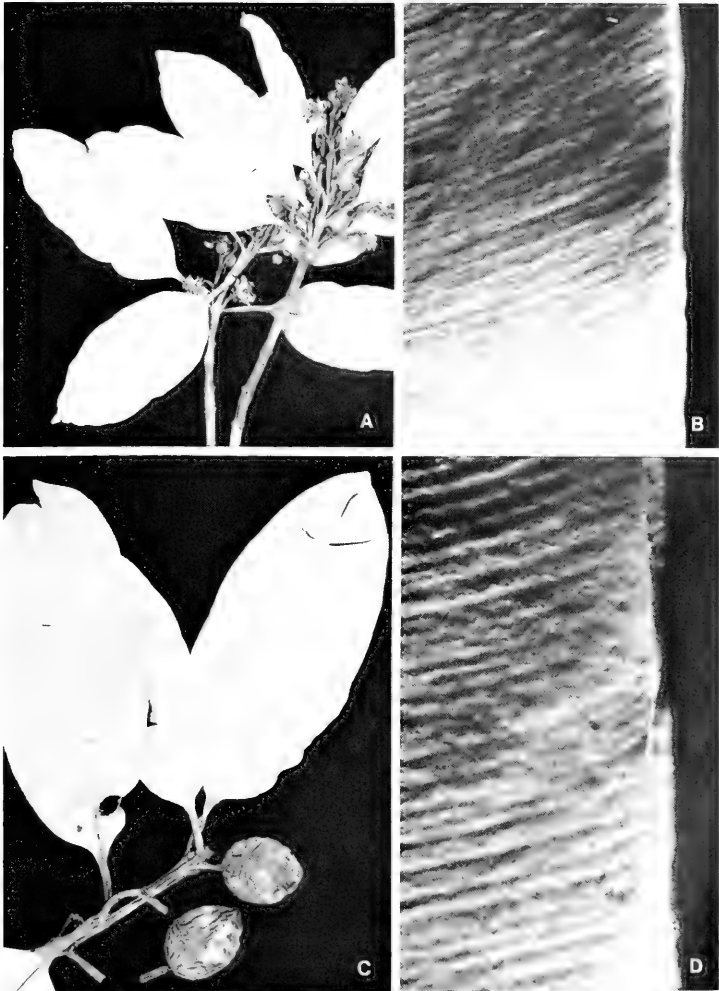


FIGURE 91. *Calophyllum cerasiferum*; A & B, small-leaved form, from *Berry 88*; A, distal portions of branchlets and inflorescences, $\times 1/2$; B, lower surface of leaf blade, $\times 10$; C & D, large-leaved form; C, distal portion of branchlet and fruits, $\times 1/2$, from *Smith 8378*; D, lower surface of leaf blade, $\times 10$, from *Smith 8525*.

from Ngaloa, *DF 574* or *798 (S1404)8, Damanu G-22*). NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8525, 8553*; Mt. Voma track, *DA 604*; Mt. Vakarongasiu, *Gillespie 3267*; hills near Navua River, *Greenwood 1036*. NAMOSI-NAITASIRI boundary: Summit of Mt. Naitarandamu, *Gillespie 3232*. NAITASIRI: Vicinity of Rewasau, *Howard 308*; Mendrausuthu Range, summit of higher peak, *DA 15463, 15471*; Vatuvula Village, Waimanu River, *DA 15695*. TAILEVU: Vicinity of Wailotua, Wainimbuka River, *Howard 336*. VITI LEVU without further locality, *MacGillivray & Milne 67*. OVALAU: Summit of Mt. Ndelaivalau and adjacent ridge, *Smith 7617*; vicinity of Levuka, *Gillespie 4480*. VANUA LEVU: MATHUATA: Sasa Tikina, without further locality, *Howard 195*. THAKAUNDOVE: Mt. Kasi, Yanawai River region, *Smith 1789, DA 15741*. VANUA LEVU without further locality, *Milne 244*. TAVEUNI: Hills east of Somosomo, west of old crater occupied by small swamp and lake, *Smith 8378*; valley between Mt. Manuka and main ridge of island, east of Wairiki, *Smith 8286*. FIJI without further locality, *Horne s. n.*

In the narrower sense adopted by Smith and Darwin in 1974, *Calophyllum cerasiferum* has comparatively small leaf blades (only slightly recurved at margin and more or less rounded at apex) and small, smooth fruits. The concept here adopted is that of Stevens; it includes specimens with larger leaf blades (sometimes strongly recurved at margin and acuminate at apex) and larger, wrinkled fruits. Most of these latter specimens were included in *C. amblyphyllum* by Smith and Darwin. In the present concept the petals vary in number between four and ten, and there is substantial variation in anther size. However, the variation among the specimens here cited is nearly continuous in one or another character, and I defer to Stevens's broader familiarity with the genus in defining *C. cerasiferum* primarily on the basis of the vegetative characters mentioned in the key to species.

4. *Calophyllum neo-ebudicum* Guillaumin in J. Arnold Arb. **12**: 227. 1931; St. John & A. C. Sm. in Pacific Sci. **25**: 326. 1971; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 230. fig. 14-16. 1974; Stevens in op. cit. **61**: 557. fig. 35, h-j, m-o. 1980.

FIGURE 92.

Calophyllum sp. n. Horne, A Year in Fiji, 258. 1881.

Calophyllum vitiense sensu Setchell in Carnegie Inst. Wash. Publ. **341**: 69. 1924; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 227, p. p., quoad fig. 10. 1974; non Turrill.

Calophyllum samoense Christophersen in Bishop Mus. Bull. **128**: 147. fig. 20. 1935; Yuncker in op. cit. **184**: 52. 1945; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 121. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 229. fig. 12, 13. 1974.

Calophyllum amblyphyllum sensu A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 232, p. p., quoad fig. 19. 1974.

A tree 5-30 m. high (to 58 m. farther west), with yellowish latex and with a trunk to 1 m. in diameter (trunk to 1.84 m. in diameter farther west), occurring at elevations from near sea level to 650 m. (up to 825 m. elsewhere) in dense, dry, or secondary forest or on its edges, often on limestone soils. Its perianth segments are white and its anthers yellow; its fruits turn from bluish to purple or black and are deeply wrinkled to smooth when dried. Flowers have been noted between September and February, but fruits are seen throughout the year.

TIPIFICATION: The lectotype is *Kajewski 705* (vide Smith and Darwin, 1974), collected Feb. 4, 1929, at Anelgauhat Bay, Aneityum, New Hebrides. This number is available at A, BISH, BRI, K, NY, P, and US. No place of deposit is indicated in the original publication and, since *Kajewski's* first set of New Hebrides plants is at A, Smith and Darwin indicated the A sheet as the lectotype. Stevens believes that the P sheet should be taken as the lectotype. The type of *Calophyllum samoense* is *Christophersen 720* (BISH HOLOTYPE; ISOTYPES at A, BISH, K, UC), collected Sept. 21, 1929, between Vaipouli and Manase, Savaii, Samoa.

DISTRIBUTION: New Britain and the Solomon Islands eastward to Samoa, Tonga, and Niue.

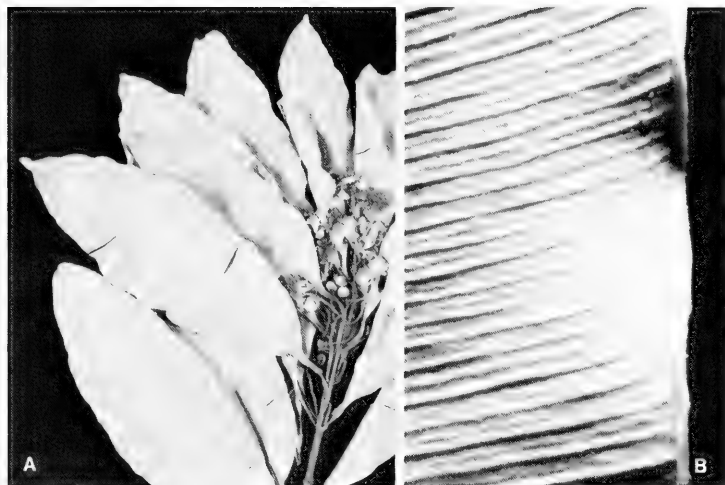


FIGURE 92. *Calophyllum neo-ebudicum*, from FD L.12384; A, distal portion of branchlet and inflorescences, $\times 1/2$; B, lower surface of leaf blade, $\times 10$.

LOCAL NAMES AND USES: The only name recorded in Fiji is *ndamanu kula* (on Moala), but many other names are used elsewhere. The plant has not been recorded as useful in Fiji, but in Samoa and the New Hebrides it is used for canoe-building, house-building, etc., and in the latter archipelago it is considered a valuable timber and is extensively exported.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 907*; Mt. Evans Range, *Greenwood 1232*. OVALAU: *Horne 43*. KORO: Main ridge, *Smith 1047*. VANUA LEVU: MATHUATA: Mt. Numbuloa, east of Lambasa, *Smith 6449*. THAKAUNDROVE: Vicinity of Valeni, Wailevu Tikina, *DA 15722*; Navonu Creek, Natewa Peninsula, *Howard 104*. MOALA: *Bryan*, July 11, 1924; near Maloku, *Smith 1334*. NAITAMBA: *DF L.12384*. MANGO: *Bryan 569*. FIJI without further locality, *Graeffe s. n.*

As here accepted, *Calophyllum neo-ebudicum* is taken in the broad sense adopted by Stevens (1980) to include *C. samoense* Christophersen, *C. pseudovitiense* Stevens, and various misinterpretations of other species. In 1974 Smith and Darwin separated *C. neo-ebudicum* and *C. samoense*, but I am here deferring to Stevens's opinion that a complex population ranging from New Britain and the Solomons to Samoa, Tonga, and Niue is best interpreted as *C. neo-ebudicum*. In this sense, it includes the specimens from Tonga and Niue cited by Smith and Darwin in 1974 as *C. amblyphyllum*. *Calophyllum neo-ebudicum* appears to be the only species of the genus (except for the widespread *C. inophyllum*) to occur in Samoa, the Horne Islands, Tonga, and Niue.

5. *Calophyllum inophyllum* L. Sp. Pl. 513. 1753; A. Gray, Bot. U. S. Expl. Exped. 1: 218. 1854; Seem. in Bonplandia 9: 254. 1861, in op. cit. 10: 296. 1862, Viti, 433. 1862, in J. Bot. 2: 71. 1864, Fl. Vit. 12. 1865; Horne, A Year in Fiji, 258. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 116. 1890; Vesque in DC. Monogr. Phan. 8: 544. 1893; Guillaumin in J. Arnold Arb. 12: 227. 1931; Christophersen in Bishop Mus. Bull. 128: 147. 1935; Yuncker in op. cit. 178: 85. 1943, in op. cit. 184: 52. 1945; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 98. 1948, in op. cit. 29: 32. 1959; Yuncker in Bishop Mus. Bull. 220: 187. 1959; J. W. Parham, Pl. Fiji Isl. 134. fig. 52. 1964, ed. 2. 192. fig. 57. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 100. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 326. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 32. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 223. fig. 6-8. 1974; Stevens in op. cit. 61: 324. fig. 16, f-m. 1980.

An often large and spreading tree 6-25 m. high, with white latex and a massive trunk to 1.5 m. in diameter, occurring at or near sea level (sometimes planted and naturalized inland up to 400 m. elevation), on beaches, in coastal thickets, and along streams near coast. The fragrant flowers have white perianth segments and yellow anthers, and the fruit is green to yellow, eventually becoming purplish or blackish. Flowers and fruits may be found throughout the year.

LECTOTYPIFICATION: As lectotype Stevens (1980, cited above) indicates *Hermanns* n. (BM, herb. Hermann 2.82), from Ceylon.

DISTRIBUTION: Eastern Africa and India throughout Malesia and eastward into the Tuamotus; it was presumably an aboriginal introduction into Hawaii. Approximately 50 Fijian collections are available.

LOCAL NAMES AND USES: In Fiji the name *ndilo* is uniformly used, but sometimes Europeans use the names *Alexandrian laurel* or *beach mahogany*. Oil from the fragrant fruits is used to scent coconut oil and for medicinal purposes, and an infusion of the leaves is also used medicinally. The wood is valued for many purposes, but in Fiji it is probably less prized than some of the forest species of *Calophyllum*. Seemann's 1865 discussion of the uses of *ndilo* is very comprehensive.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Yalombi, *St. John 18903*. MAMANUTHAS: NGGALITO Island, Malolo Group, O. & I. *Degener 32219*. VITI LEVU: MBA: Lautoka, *Greenwood 351*. NANDRONGA & NAVOSA: Vatukarasa, *DA 9287 (McKee 2857)*. SERUA: Korovisilou, *DF 281 (Damau 9)*. NAMOSI: Near Namosi Village (presumably planted), *Gillespie 2811*. RA: Waindawa, near Vaileka, *Degener 15420*. TAILEVU: Matavatathou, *DA 9231*. NATASIRE: Vunindawa Station (presumably planted), *DA 10011*. REWA: Suva, *Meebold 16426*. KANDAVU: Namalata Isthmus region, *Smith 177*. OVALAU: Vicinity of Thawathi, *Smith 8101*. KORO: Nambasovi, *DA 1033*. NAIRAI: Milne, Nov., 1855. NGAU: Shore of Herald Bay, *Smith 7944*. VANUA LEVU: MATHUATA: Nakuthi Island, *DA 15279*. THAKAUNDROVE: Vicinity of Valethi, *Bierhorst F114*. "TAVEUNI and LAKEMBA:" *Seemann 48*. TAVEUNI: Waiyevo, *Gillespie 4633*. YATHATA: Navakathuru, *DA 16197*. VANUA MBALAVU: Near Sawana Village, *Garnock-Jones 1064*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 763*. NAVUTU-I-LOMA: *Bryan 463*. FIJI without further locality, U. S. Expl. Exped., *Storck 873*.

Calophyllum inophyllum is so abundant in the southern Pacific that it may be expected along every strand. Its broad and usually rounded leaf blades and its large fruits readily distinguish it. The outer layer of the testa is characteristically thick and spongy, giving the fruits buoyancy.

6. *Calophyllum vitiense* Turrill in J. Linn. Soc. Bot. 43: 17. 1915; Watkins in Agr. J. Dept. Agr. Fiji 31: 15. fig. 1961; J. W. Parham, Pl. Fiji Isl. 134. 1964, ed. 2. 192. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 227. fig. 9, 11. 1974; Stevens in op. cit. 61: 554. 1980.

FIGURE 93A & B.

- Calophyllum spectabile* sensu A. Gray, Bot. U. S. Expl. Exped. 1: 218, p. 1854, in Proc. Amer. Acad. Arts 5: 315. 1862, in Bonplandia 10: 34. 1862; Seem. Fl. Vit. 11. 1865; Horne, A Year in Fiji, 258. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 116. 1890; non Willd.
Calophyllum polyanthum sensu Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862; non Wall. ex Choisy.
Calophyllum lanceolatum sensu Seem. Viti, 433. 1862; non Bl.
Calophyllum tenuicrustosum A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 236. fig. 22. 1974.
Calophyllum vitiense var. *vitiense*; Stevens in J. Arnold Arb. 61: 555. fig. 35, k, l. 1980.

A tree 5–30 m. high, with a trunk to 50 cm. or more in diameter, occurring at elevations of 90–1,050 m. in dense or open forest or rarely in grassland. The perianth parts, filaments, and style are white, the anthers yellow, and the mature fruit becomes purple or blackish. Flowers have been obtained between August and January, and fruit may be seen in most months.

LECTOTYPIFICATION AND NOMENCLATURE: The lectotype of *Calophyllum vitiense* is *im Thurn 297* (κ 3 sheets; ISOLECTOTYPE at BM) (cf. Smith and Darwin, 1974), collected Dec. 2, 1906, in the vicinity of Nandarivatu, Mba Province, Viti Levu. *Calophyllum tenuicrustosum* is typified by *Smith 4058* (A HOLOTYPE; many ISOTYPES), obtained April 28, 1947, on the slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, Mba Province, Viti Levu. The latter taxon, in Stevens's opinion, was a mixture, the type being a narrow-leaved, small-fruited individual of *C. vitiense*.

DISTRIBUTION: Endemic to Fiji and thus far known from several of the high islands. About 40 collections have been studied.

LOCAL NAMES AND USE: Recorded names are *ndamanu*, *ndamanu ndilo*, and *ndamanu ndilondilo*; the species is considered to produce very durable timber.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Natua Levu, Mt. Evans Range, *DA 14053*; vicinity of Nandarivatu, *Mead 1972*, *Gillespie 4229*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 469* (*Damanu 118*); Nasama Creek, Singatoka Valley, *DF 621* (*SI404/6*). SERUA: Inland from Namboutini, *DF 620* (*SI404/5*). NAMOSI: Nambukavesti Creek, *DF 619* (*SI404/4*). NAITASIRI: Wainiveimbalambala Creek, *DA 5833*; vicinity of Kalambo, *DA 16410*; vicinity of Tamavua, *Gillespie 2407*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7201*. VITI-LEVU without further locality, *Seemann 47*. OVALAU: Slopes of Mt. Korotolotolu, west of Thawathi, *Smith 8021*; hills east of Lovoni Valley, *Smith 7269*. NAIRAI: *Milne 297*. VANUA LEVU: MATHUATA: Motuyanga, Ndreketi River Valley, *DF 617* (*SI404/2*); Seangangga region, *DA 13935*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6362*. FIJI without further locality, *U. S. Expl. Exped., Horne 192*.

Calophyllum vitiense is readily recognized, among Fijian species, by its usually large, relatively narrow, acute to acuminate leaf blades with comparatively distant, clear secondary nerves, the upper surface appearing minutely bullate under magnification.

7. *Calophyllum amblyphyllum* A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 232. fig. 17, 18. 1974.

FIGURE 93C & D.

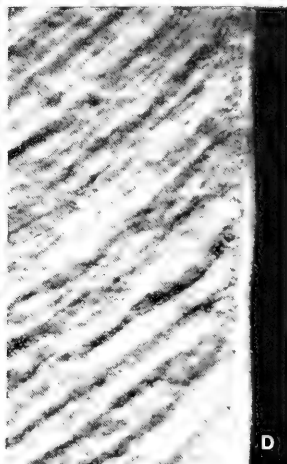
Calophyllum vitiense var. *amblyphyllum* Stevens in J. Arnold Arb. 61: 556. fig. 35, f, g. 1980.

A tree 9–15 m. high, occurring from near sea level to an elevation of about 150 m. in dense, dry, or littoral forest. The perianth segments and filaments are white and the anthers yellow. Flowering material has been obtained only in November and young fruits in December. The only collection with mature fruits (*DA 7036*) is not dated as to month.

TYPIIFICATION: The type is *Smith 9243* (US 2191735 HOLOTYPE; many ISOTYPES), collected Nov. 23, 1953, in hills west of Waivunu Creek, between Ngaloa and Korovou, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the southern coastal area of Viti Levu.

LOCAL NAME AND USE: *Ndamanu*; a useful timber tree.



AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Coastal hills in vicinity of Taunovo River, east of Wainiyambia, *Smith 9576*; along Queen's Road, *DA 7036*. REWA: Nggoya Forest Reserve, *DA 13764* (*DF 472*, *Damanu 124*).

As originally circumscribed, *Calophyllum amblyphyllum* included some 23 collections from four high Fijian islands, as well as material from Tonga and Niue. Stevens has referred most of the Fijian specimens to *C. cerasiferum* or *C. neo-ebudicum* and all of the collections from Tonga and Niue to the latter species. There remain in *C. amblyphyllum* only the type and three other known collections, all from coastal areas of southern Viti Levu. In this sense the taxon is a coherent one, most closely related to *C. vitiense* but differing in having its leaf blades usually rounded at apex and its terminal buds smaller and with a short-tomentose indument. It occurs in low elevation forest near the sea, whereas *C. vitiense* usually grows in interior, colline forest.

2. MESUA L. Sp. Pl. 515. 1753.

Trees or shrubs; leaves opposite, the blades coriaceous, with numerous, thin, obscure lateral nerves; inflorescences composed of solitary flowers at apices of branchlets or in distal leaf axils; flowers ♂; sepals 4, contorted, the inner ones the largest; petals 4, contorted; stamens numerous, the filaments free or basally coherent, the anthers basifixed, longitudinally dehiscent; ovary ovoid, incompletely 2-locular by means of basal septa, the ovules 2 in each locule, basal, the style elongate, the stigma peltate or shallowly infundibular; fruit (in our species) ellipsoid, subacute, with a carnos exocarp and woody endocarp, ultimately dehiscent into 2 valves, the seeds 1-4.

TYPE SPECIES: *Mesua ferrea* L., the only original species.

DISTRIBUTION: Southeastern Asia, with three species, one of which has been cultivated in Fiji.

1. *Mesua ferrea* L. Sp. Pl. 515. 1753; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 262. 1974.

As it occurs in Fiji, *Mesua ferrea* is sparsely cultivated near sea level as a small tree. Where native it attains a height of 30 m. and has fragrant flowers; the sepals are green, the 2 inner ones being white-margined; the petals are white, and the filaments are white to pale yellow.

TIPIFICATION: Of the references in the protologue, that to L. Fl. Zeyl. 206 (1747) is marked by an asterisk and probably provides the best lectotype.

DISTRIBUTION: Southeastern Asia, now cultivated elsewhere.

USES: This ornamental tree was doubtless introduced into Fiji for experimental purposes, but it may not have persisted. Where indigenous it is considered to produce a valuable timber, oil from the seeds has been used commercially, and various parts of the plants, including the flowers, are used medicinally.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Nanduruloulou, *DA 5523*.

FIGURE 93. A & B, *Calophyllum vitiense*, from *DA 5833*; A, distal portion of branchlet and inflorescences, $\times 1/2$; B, lower surface of leaf blade, $\times 10$. C & D, *Calophyllum amblyphyllum*, from *DA 13764*; C, distal portion of branchlet and inflorescence, $\times 1/2$; D, lower surface of leaf blade, $\times 10$.

3. *MAMMEA* L. Sp. Pl. 512. 1753; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 237. 1974.

Calysaccion Wight, Ill. Ind. Bot. 130. 1831; Seem. Fl. Vit. 13. 1865.

Polygamo-dioecious trees, glabrous throughout, the branchlets with interpetiolar, pseudostipular, transverse lines; leaves opposite, the petioles short-excavate, the excavations at first enclosing the terminal bud, the blades coriaceous, entire, with spreading secondary and tertiary nerves, the veinlets forming a conspicuous reticulum, the ultimate areoles each with a dark, raised gland in its center; inflorescences axillary, solitary, sometimes on old branchlets, fasciculate, often 2-5-flowered (but usually only 1 flower maturing); flowers subtended by closely imbricate bracts; calyx composed of 2 sepals, these completely fused in bud, separating at anthesis, at length caducous; petals 4-6; androecium composed of numerous stamens, the filaments filiform, free or weakly connate proximally, the anthers basifixed, longitudinally dehiscent; gynoecium lacking in ♂ flowers, in ♀ flowers consisting of a 4-locular ovary (this in our indigenous species becoming unilocular by abortion), the ovules 1-4 (1 in our indigenous species), basal, the style short or none, the stigma peltate, often lobed; fruit carnosous when fresh, drupaceous, oblique or curved or subglobose, the (style and) stigma persistent, the exocarp thin, the mesocarp drying dense and hard, the endocarp fibrous, the seed(s) often embedded in pulp when fresh.

TYPE SPECIES AND NOMENCLATURE: The lectotype species of *Mammea* is *M. americana* L. (vide Britton & Wilson, Sci. Surv. Porto Rico 5: 583. 1924), one of Linnaeus's two original species. The type species of *Calysaccion* is *C. longifolium* Wight. Some of the Old World species have been referred to *Ochrocarpos* Thou., which Kostermans (in the treatments cited below) limits to certain Madagascan taxa.

DISTRIBUTION: As interpreted by Kostermans (1956, 1961, cited below), *Mammea* includes 26 species extending from Asia through Malesia into the Pacific, also having a secondary center in Madagascar, a few species in tropical Africa, and only *M. americana* in tropical America. The American species is sparsely cultivated in Fiji and one indigenous species is also present.

USEFUL TREATMENTS OF GENUS: Kostermans, A. J. G. H. The genera *Mammea* L. and *Ochrocarpos* Thou. For. Serv. Indones., Div. Plann. (Djawatan Kehutanan Indonesia, Bagian Planologi Kehutanan), 9-15. 1956. Kostermans, A. J. G. H. A monograph of the Asiatic and Pacific species of *Mammea* L. (Guttiferae). Commun. For. Res. Inst. Indones. (Pengumuman Lembaga Pusat Penyelidikan Kehutanan, Indonesia) 72: 1-63. 1961.

KEY TO SPECIES

- Indigenous, littoral species; sepals usually 7-9 mm. long; petals 6, obovate, 10-17 mm. long; filaments at anthesis usually 4-8 mm. long; fruit obliquely ellipsoid to ovoid, obtuse at base and narrowed distally, up to 10 × 5 cm. at maturity, the seed solitary, with minute cotyledons. 1. *M. odorata*
 Cultivated species; sepals usually 11-17 mm. long; petals 4-6, obovate to orbicular, 17-25 mm. long; filaments at anthesis usually 10-12 mm. long; fruit subglobose or ovoid, usually 10-15 cm. in diameter at maturity, the seeds usually 2-4, with large cotyledons. 2. *M. americana*

1. *Mammea odorata* (Raf.) Kostermans, *Mammea* and *Ochrocarpos*, For. Serv. Indones., Div. Plann. 13. 1956, in Commun. For. Res. Inst. Indones. 72: 15. fig. 9, 10. 1961; J. W. Parham, Pl. Fiji Isl. ed. 2. 195. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 239. fig. 23-28. 1974.

Lolanara odorata Raf. Fl. Tellur. 1: 16, nom. nud. 1837, op. cit. 2: 34. 1837.

Calophyllum excelsum Zoll. & Moritzi in Natuur Geneesk. Arch. Ned.-Indië 2: 582. 1845.

Calysaccion obovale Miq. Fl. Ned. Ind. Suppl. 500. 1861; Seem. in Bonplandia 9: 254. 1861, Viti, 433.

1862; A. Gray in Proc. Amer. Acad. Arts 5: 315. 1862.

Calysaccion tinctorium Seem. Fl. Vit. 13. t. 9. 1865; Horne, A Year in Fiji, 258, as *Calysaccion tinctorum*. 1881.

Ochrocarpus tinctorius Drake, Ill. Fl. Ins. Mar. Pac. 116. 1890.

Ochrocarpus excelsus Vesque in DC. Monogr. Phan. 8: 525. 1893; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 192. fig. 80, A-H. 1925.

Ochrocarpos odoratus Merr. in J. Arnold Arb. 26: 94. 1945; J. W. Parham, Pl. Fiji Isl. 136, as *Ochrocarpus* o. 1964.

As it occurs in Fiji, *Mammea odorata* is a spreading tree 4–12 m. high, found near sea level in beach thickets, often on limestone, or on the inner edges of mangrove swamps. The petals, filaments, and ovary are white, the anthers yellow, and the essentially mature fruit green. Flowers have been obtained only in February and April, and fruits between February and August.

TYPIFICATION AND NOMENCLATURE: *Lolanara odorata* is based entirely on *Lignum clavorum* Rumph. Herb. Amb. 3: 97. t. 64. 1743; the Rumphian description and plate may therefore be taken as the type, the locality presumably being Amboina. Of the various synonymous basionyms, *Calysaccion tinctorium* is typified by *Seemann* 46 (κ HOLOTYPE; ISOTYPES at BM, GH), collected in May, 1860, in the vicinity of Somosomo, Taveuni. Seemann also noted on one of the two specimens at κ: "In Mbau there was only one tree." This note presumably indicates that Seemann saw the species on Mbau, but both sheets at κ probably came from Taveuni. The complicated synonymy of the species is fully discussed by Merrill (in J. Arnold Arb. 26: 93–96. 1945) and Kostermans (1956, 1961, cited above).

DISTRIBUTION: Coastal areas throughout Malesia from Java and the Philippines, thence eastward to Micronesia and Fiji. In Samoa the species is replaced by *Mammea glauca* (Merr.) Kostermans, as discussed by Smith and Darwin in 1974.

LOCAL NAMES AND USES: The usual names are *vetao* or *vetau*, but also recorded is *uvitao*. The close-grained wood is considered useful, and Seemann mentions that the sap was used by Fijians to dye their hair orange-brown.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Namaka, DA 11734. TAILEVU: Mokani, DA 656; between Mokani and Ndravo, DA 629, 15458. MBENGGI: Ndakuni, DA 2075. KORO: Uthu ni Vanua, DA 15831. VANUA LEVU: THAKAUNDROVE: Ndromoninuku, DA 16818. KATAFANGA: DA, May 5, 1947. NAYAU: Tohill 22. KAMBARA: On limestone formation, Smith 1263. FULANGA: On limestone formation, Smith 1190. FIJI without further locality, Howard 133.

2. *Mammea americana* L. Sp. Pl. 512. 1753; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 102. 1948, Pl. Fiji Isl. ed. 2. 195. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 262. 1974.

A tree attaining a height of 15–18 m., sparsely cultivated near sea level. The fragrant flowers are up to 5 cm. in diameter and the mature fruit is reddish green or becoming brown, subglobose or ovoid, and 7–15 (–25) cm. in diameter.

TYPIFICATION: Linnaeus gave several prior references and indicated the species as being from Hispaniola and Jamaica.

DISTRIBUTION: Presumably a native of the West Indies, *Mammea americana* was probably an early introduction throughout tropical and subtropical America, and it is now also widely cultivated in the Old World tropics.

LOCAL NAMES AND USES: *Mamey*, *mammee apple*, and *mammey apple*. The fruit has an orange-colored, sweetish pulp that can be eaten raw or cooked but is most often made into preserves. The tree is also used as an ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Nathotholevu, DA 17431. NAITASIRI or REWA: "Tamavua, Suva," DA 3126. Parham's 1948 reference indicates that the species was at that time growing in the Suva Botanical Gardens, but no voucher is available.

4. *GARCINIA* L. Sp. Pl. 443. 1753; Seem. Fl. Vit. 10. 1865; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 243. 1974.

Discostigma Hassk. in Flora 25: Beibl. 33. 1842.

Dioecious trees or shrubs (sometimes monoecious or polygamous elsewhere), often with copious, yellow, pale, or brownish latex, with secretory canals in foliage and flowers, glabrous throughout, the branchlets subterete or quadrangular or costate; leaves opposite, the petioles excavate basally and enclosing terminal bud, soon diverging and leaving an interpetiolar, pseudostipular, transverse line or scar, the excavation sometimes distally produced into a ligule, the blades coriaceous to submembranaceous, with spreading or subsending secondary nerves; inflorescences axillary or borne on defoliate branchlets, rarely terminal, in our indigenous species cymose, fasciculate, or glomerulate, elsewhere sometimes paniculate or with solitary flowers; flowers pedicellate or sessile, the perianth segments imbricate, usually decussate; sepals (in our indigenous species) 4 or rarely 2 (sometimes 5 elsewhere); petals (in our indigenous species) 2 or 4 (sometimes 5 elsewhere); ♂ flowers with a diverse androecium composed of 7—many stamens aggregated into 1 or more phalanges, sometimes with an ovarial rudiment, the anthers with or without free filaments; ♀ flowers with or without an androecial rudiment, the ovary 2—many-locular, the ovules solitary in each locule, axile or subsending, the stigma (in our indigenous species) sessile or subsessile, peltate, rounded, or pulvinate-discoid; fruit baccate or drupaceous, 2—many-celled, carnose when fresh, drying smooth or costate.

TYPE SPECIES AND NOMENCLATURE: The type species of *Garcinia* is *G. mangostana* L., the only original species; that of *Discostigma* is *D. rostratum* Hassk. The latter generic name is mentioned because one Fijian species was first referred to *Discostigma*, which, with many other genera, is now taken as a section of the large genus *Garcinia*. The most useful division of *Garcinia* into sections is probably that of Engler (1925, cited above under the family). Of the many sections recognized by Engler, only three extend eastward indigenously into the Fijian Region.

DISTRIBUTION: Paleotropical and subtropical, with 250—400 species, represented in Fiji by five indigenous species, of which one is endemic, and by three cultivated species.

KEY TO SPECIES

Indigenous species.

Petioles with excavation distally produced into a ligule 1.5—4 mm. long; leaf blades with 6—16 secondary nerves per centimeter; inflorescences terminal at inception, cymose, with paired bracts at nodes; sepals and petals each 4; ♂ flowers with androecium composed of 60—100 stamens aggregated into 4 phalanges opposite petals, with a sterile central gynoeceum; ovary of ♀ flowers (4-or) 5- or 6-locular; fruits ovoid to obovoid, often with a persistent short style and accrescent stigma, the seeds (4 or) 5 or 6, the dissepiments thin, the sepals persistent (sect. *Mangostana*). 1. *G. pseudoguttifera*

Petioles with excavation not produced into a ligule; leaf blades with 1—3 (—8) secondary nerves per centimeter; inflorescences axillary or on branchlets below leaves, fasciculate or glomerulate; sepals and petals each 4 or sometimes fewer; fruits ellipsoid, the stigma strictly sessile, persistent, pulvinate-discoid.

Pedicels obvious, 3—12 (—15) mm. long; androecium of ♂ flowers composed of numerous (up to 700) stamens aggregated into 4 phalanges opposite petals, with a sterile central gynoeceum; ovary of ♀ flowers 2-locular; fruits drying smooth, the seeds 2, the dissepiment thin, the sepals caducous, the stigma conspicuously accrescent (sect. *Discostigma*).

Flowers comparatively small, the sepals 1.5—3.5 × 1.5—4 mm., the petals 3—4.5 × 2.5—3.5 mm.; androecium in ♀ flowers lacking or forming an obscure annulus not more than 0.1 mm. high; mature fruits 13—16 × 12—14 mm.; petioles 2—10 mm. long; leaf blades 4—11 × 1.2—5 cm., attenuate at base and long-decurrent on petiole. 2. *G. vitiensis*

Flowers larger, the sepals 3—5 × 4—7 mm., the petals 3—6 × 3—7 mm.; androecium in ♀ flowers composed of short-oblong phalanges 0.5—0.7 mm. high; mature fruits 20—45 × 15—30 mm.; petioles 4—20 (—25) mm. long; leaf blades usually 7—17 × 4—11 cm., obtuse at base and short-decurrent on petiole. 3. *G. myrtifolia*

Pedicels lacking or minute, rarely to 2.5 mm. long; androecium of ♂ flowers central, composed of 7-30 stamens fused into a carnosé stalk, the anthers sessile or essentially so, the gynoecium lacking; ovary of ♀ flowers 5-13-locular; fruits drying costate, the seeds 5-13, enclosed in pyrenes separated by air-chambers or pulp, the endocarp of each pyrene bony or horny, the sepals persistent, the stigmas only slightly accrescent (sect. *Mungotia*).

Petals 4, very early marginally imbricate and soon conspicuously so; inflorescences composed of 3-9 flowers, each flower usually subtended by 2 bracts; fruits with a mesocarp 0.5-1.5 mm. thick, sharply (6-) 10-13-costate when dried, the pyrenes (6-) 10-13, with bony endocarps 0.2-1 mm. thick, obtuse to narrowly rounded on dorsal face; leaf blades usually chartaceous to membranaceous, obtuse to acute at base. 4. *G. sessilis*

Petals 2, valvate, thick-margined; ♂ inflorescences usually composed of 15-40 flowers (in distal inflorescences flowers rarely only 3-7), each flower often subtended by more than 2 bracts; fruits with a mesocarp 2-3 mm. thick, obtusely 5-8-costate when dried, the pyrenes 5-8, with horny endocarps 1-4 mm. thick, broadly rounded on dorsal face; leaf blades subcoriaceous to chartaceous, acute to attenuate at base. 5. *G. adinantha*

Cultivated species.

Leaf blades lanceolate-ovate to ovate-oblong; sepals and petals each 5; stamens aggregated into 5 phalanges opposite petals; fruit elliptic to globose or pyriform, usually longer than broad and often obtuse at apex (sect. *Xanthochymus*).

Branchlets drying sharply 6-8-costate; petioles stout, 6-9 mm. in diameter; leaf blades lanceolate-ovate, 25-30 × 6-10 cm., rounded at base, acuminate at apex, with 35-45 obvious secondary nerves, these strongly prominulous beneath. 6. *G. xanthochymus*

Branchlets drying irregularly angular; petioles 2-5 mm. in diameter; leaf blades lanceolate- or ovate-oblong, 10-30 × 3-15 cm., obtuse to acute or attenuate at base, bluntly cuspidate at apex, with 15-25 subimmersed or slightly raised secondary nerves. 7. *G. dulcis*

Leaf blades elliptic, 11-25 × 4-11 cm., attenuate at base, bluntly short-cuspidate at apex, with 40-50 fine, parallel secondary nerves, these obvious but not sharply elevated; petioles slender, 3-4 mm. in diameter; branchlets drying bluntly 6-10-costate; sepals and petals each 4; stamens aggregated into 4 phalanges opposite petals; fruit depressed-globose, 3.5-8 cm. in diameter (sect. *Mangostana*).

8. *G. mangostana*

1. *Garcinia pseudoguttifera* Seem. Fl. Vit. 11. 1865; Horne, A Year in Fiji, 262. 1881; Pierre, Fl. For. Cochinch. 1: XL. 1883; Drake, Ill. Fl. Ins. Mar. Pac. 115. 1890; Vesque in DC. Monogr. Phan. 8: 483. 1893; Yuncker in Bishop Mus. Bull. 220: 188. 1959; J. W. Parham, Pl. Fiji Isl. 134. 1964, ed. 2. 194. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 245. fig. 32-39. 1974.

Garcinia echinocarpa sensu Seem. in Bonplandia 9: 254. 1861, A. Gray in Proc. Amer. Acad. Arts 5: 315. 1862; non Thw.

Garcinia pedicellata Seem. Viti, 433, quoad spec. vit., non sensu typi. 1862.

Garcinia sp. n. Horne, A Year in Fiji, 262. 1881.

Garcinia pancheri sensu Guillaumin in J. Arnold Arb. 12: 226. 1931; non Pierre.

A compact, spreading, or slender tree (2-) 4-25 m. high with abundant yellow or pale latex and a trunk up to 30 cm. (or probably more) in diameter, occurring at elevations from near sea level to 1,150 m. in dense or thin forest or in forest patches and sometimes in beach thickets. Its petals are yellowish white, becoming pale pink to red, and its fruits are green, at length becoming red or darker. Flowers and fruits have been observed at all seasons.

TIPIFICATION AND NOMENCLATURE: The type of *Garcinia pseudoguttifera* is *Seeman 50* (K HOLOTYPE; ISOTYPES at BM, GH), collected in July or August, 1860, near the lower Navua River, Serua Province, Viti Levu. (These data are taken from the holotype, although in his protologue Seeman mentioned "Kandavu, in mountainous woods." Although other collections from Kandavu are available, it seems likely that Seemann's notes on his specimens are more apt to be correct than his printed data.) The other binomials listed above refer to misidentifications, although it should be noted that *G. pedicellata* (Forst. f.) Seem. (1862) is the first correct combination for *Clusia pedicellata* Forst. f. In making the combination Seemann cited his no. 50, but in

1865 he corrected this and indicated *G. pedicellata* as a New Caledonian endemic.

DISTRIBUTION: Abundant in Fiji (I have studied 56 collections from many islands) and also known from the New Hebrides (several islands) and Tonga (Vava'u only).

LOCAL NAMES AND USES: Generally used local names are *kau yalewa*, *mbulu*, *mbuluwai*, and *mbuliwai*, and to a lesser extent *sueri*, *suere*, *sarosaro*, and *mbulumangayalewa*. The names *mali* and *nambulinomati* have been recorded from the Yasawas and *mbulumanga* from Vanua Levu. There are a few records of the species being used as a timber tree. The fruit is sometimes considered edible, an oil from the fruit is used as a perfume, and an extract of the leaves has been used to relieve pain.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Along Wailevu Creek, *St. John 18072*. VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 507A*; Naloto Range, *DA 14761*; vicinity of Nandarivatu, *Gillespie 4194*; slopes of Mt. Tomanivi, *Smith 5216*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Berry 70*; northern portion of Rairaimatuku Plateau, *Smith 5552*. SERUA: Shores of Rovondrau Bay, *DA 7203*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8753*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15392*. NAITASIRI: Between Viria and Namuamua, *DA 68*; vicinity of Tamavua, *Gillespie 2196*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7143*. KANDAVU: Mt. Mbuke Levu, *Smith 217*; Lutumatavoro, *DA 14925*. OVALAU: Hills west of Lovoni Valley, *Smith 7637*; main range west of Levuka, *Gillespie 4438*. MAKONGAI: *Tohill 23*. KORO: Eastern slope of main ridge, *Smith 997*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1557*; above Thongea, Wainunu River, *DA 15794*. MATHUATA: Vicinity of Nanduri, *Tohill F435*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6552*. THAKAUNDRUVE: Mt. Kasi, Yanawai River region, *Smith 1801*; Tuvamila, Natewa Peninsula, *Howard 73*. RAMBI: Mountain forests, *Horne 450*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8319*. MOALA: Near Maloku, *Smith 1335*. VANUA MBALAVU: Northern limestone section, *Smith 1471*. FIJI without further locality, *U. S. Expl. Exped.*

2. *Garcinia vitiensis* (A. Gray) Seem. Fl. Vit. 10. 1865; Horne, A Year in Fiji, 262. 1881; Pierre, Fl. For. Cochinch. 1: XXXVI. 1883; Drake, Ill. Fl. Ins. Mar. Pac. 115. 1890; Vesque in DC. Monogr. Phan. 8: 365. 1893; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 223. 1925; Guillaumin in J. Arnold Arb. 12: 227. 1931; J. W. Parham, Pl. Fiji Isl. 136. 1964, ed. 2. 195. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 249. fig. 40-43. 1974.

Discostigma vitiense A. Gray, Bot. U. S. Expl. Exped. 1: 216. 1854, Atlas, pl. 16, A. 1856; Seem. Viti, 433. 1862.

Garcinia sp. n. Horne, A Year in Fiji, 262. 1881.

A sometimes slender or compact tree 3-25 m. high (rarely noted as a shrub about 2 m. high), with pale latex, found from near sea level to about 1,050 m. elevation in dense or rocky forest or in patches of forest in open country or on forested ridges. The sepals are pale green, the petals cream-colored, the stigma yellow, and the fruit turning to reddish purple or black at maturity. Flowers (♀ only thus far known) have been obtained in March and April and fruits between April and December.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 11515 HOLOTYPE; ISOTYPE at GH), collected in 1840 on Ovalau, without further data.

DISTRIBUTION: New Hebrides and Fiji; in the former archipelago the species is known only from Eromanga and Aneityum, one collection from each island being available. In Fiji it is thus far known from four of the high islands.

LOCAL NAME: There is only one record of a Fijian name, *asivula* (*Smith 5066*).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Ndelaioo, on escarpment west of Nandarivatu, *Smith 5066*; vicinity of Nandarivatu, *Tohill 150*. SERUA: Inland from Yarawa, *DF 1048*. NAMOSI: Mt. Vakarongasiu, *DA 16130*. NAITASIRI: Mendrausuthu Range, *DA 15482*; Prince's Road, *DA 1621*; Tholo-i-suva, *DA 117*. REWA: Mt. Korombamba, *DA 16504*, *Webster & Hildreth 14085*. NGAU: Hills east of Herald Bay, inland from Sawaeke, *Smith 7760*, *7761*. VANUA LEVU: MBUA: Vicinity of Ndama, *DA 17530*. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6690*, *6818*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6440*, *6577*; Wainikoro River, *Greenwood 700*.

MATHUATA OF THAKAUNDROVE: Between Waiwai and Lomaloma, *Horne 630*. FIJI without further locality, *Horne 1095*.

3. *Garcinia myrtifolia* A. C. Sm. in J. Arnold Arb. **31**: 315. 1950; Yuncker in Bishop Mus. Bull. **220**: 188. 1959; J. W. Parham, Pl. Fiji Isl. 134. 1964, ed. 2. 194. *fig. 58*. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 252. *fig. 44-48*. 1974.

A tree 6-28 m. high (sometimes only 3 m. high in Tonga), sometimes spreading or slender, with a trunk to 41 cm. (or probably more) in diameter and with pale yellow to brownish latex, occurring at elevations of 45-915 m. in forest and often near creeks. The petals are white or greenish white and the fruit at maturity turns to dull red or purple. Flowers and fruits may be expected throughout the year.

TYPIFICATION: The type is *Smith 4573* (A HOLOTYPE; many ISOTYPES), collected May 29, 1947, on the southern slopes of the Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Fiji, Tonga, and Samoa; from Fiji about 55 collections are at hand from the two largest islands and Kandavu. In Tonga the species is known only from Kao and 'Eua, seeming plentiful on the latter island; in Samoa it is known to occur on Upolu, Tutuila, Olosenga, and Tau.

LOCAL NAME AND USE: The name *laumbu* seems uniformly used for this species, which is valued as a timber tree, widely used to supply uprights for houses and other buildings.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1152*; vicinity of Nandarivatu, *Mead 1990*, *Gillespie 3397*; Sovutawambu, south of Nandarivatu, *Degener 14651*; slopes of Mt. Tomanivi, *Smith 5128*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 1140 (S1408/13)*; track to Vanualevu Village, *Berry 81*. SERUA: Nathengathenga Creek, *DF 1127 (S1408/9)*; inland from Namboutini, *DF R-40*; inland from Ngaloa, *DF 817* or *593 (S1408/6)*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8459*; Nambukavesi Creek, *DF 488*. NAITASIRE: Vicinity of Vatuvula, Waimanu River, *DA 15680*; Tholo-i-suva, *DA 12196 (DF 46, Watkins 715)*. KANDAVU: Naikorokoro, *DF 651 (S1408/1)*. VANUA LEVU: MATHUATA: Ndongotuki Tikina, *Howard 149*; Vunivia River region (Ndongotuki Tikina), *Howard 401*.

In spite of the abundance of *Garcinia myrtifolia* on Viti Levu, as evidenced by recent collections of foresters, the earliest known specimens seem to be those of Mead and Gillespie from Nandarivatu, dating from 1927 and 1928.

4. *Garcinia sessilis* (Forst. f.) Seem. Viti, 433. 1862, Fl. Vit. 10. 1865; Horne, A Year in Fiji, 262. 1881; Pierre, Fl. For. Cochinch. **1**: XXVII. 1883; Drake, Ill. Fl. Ins. Mar. Pac. 115. 1890; Hemsl. in J. Linn. Soc. Bot. **30**: 169. 1894; Engl. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 226. 1925; Christophersen in Bishop Mus. Bull. **128**: 149. 1935; Yuncker in op. cit. **220**: 189. 1959; J. W. Parham, Pl. Fiji Isl. 135. 1964, ed. 2. 195. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 111. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. **55**: 254. *fig. 49-56*. 1974.

Clusia sessilis Forst. f. Fl. Ins. Austr. Prodr. 74. 1786.

Garcinia roxburghii sensu Seem. in Bonplandia **9**: 254. 1861; non Wight.

Garcinia sp. n. Horne, A Year in Fiji, 262. 1881.

A tree 6-20 m. high (in Fiji), with a trunk to at least 30 cm. in diameter and with abundant yellowish latex, occurring at elevations from near sea level to 1,150 m. in dense or dry forest or on its edges. The flower buds are salmon-pink to dull red, the mature petals yellow to rich pink, the ovary and stigma green, and the mature fruits yellowish to red at maturity, the pyrenes being embedded in white pulp. Flowers and fruits have been obtained throughout the year.

TYPIIFICATION: The type is *J. R. & G. Forster* (BM LECTOTYPE), collected on Tongatapu, Tonga, during Cook's second voyage.

DISTRIBUTION: Santa Cruz Islands (Vanikoro) and Fiji (abundant, known from about 40 collections from many islands). The species is also common in Tonga and infrequent in Samoa. It is very probably an introduction into the two latter archipelagoes. W. R. Sykes (personal communication) states that he has found the species in Tonga only near villages or old habitation sites; it was presumably introduced by Tongans from Lau, which was well known to them in pre-European times. Tongans use the fruit extensively to perfume coconut oil. The Samoan introduction apparently came from Tonga.

LOCAL NAMES AND USE: Names in common use are *laumbu* and *mbuluwai*; locally recorded names are *mbulumangayalewa* (Mba, Thakaundrove), *kau yalewa* (Naitasiri), and *elala* (Kambara). The species provides a useful timber for house construction.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 936*; slopes of escarpment north of Nandarivatu, *Smith 6268*; vicinity of Nandarivatu, *Parks 20661*; Waimongge Creek, south of Mt. Tomanivi, *Berry 86*. NANDRONGA & NAVOSA: North of Komave, *St. John 18951*. SERUA: Hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith 9020*; hills north of Ngaloa, in drainage of Wainngere Creek, *Smith 9411*. NAMOSI: Vicinity of Namosi, *Seemann 51*; vicinity of Namuamua, *Gillespie 3021*. NAMOSI-NAITASIRI boundary: Near summit of Mt. Naitarandamu, *Gillespie 3245*. RA: Vicinity of Nasukamai, *Gillespie 4692.3*. NAITASIRI: Central Road, *Tothill 401*; vicinity of Nasinu, *Gillespie 3665*. OVALAU: Lovoni Valley, *Horne 185*, *DA 13297*. VANUA LEVU: MATHUATA: Vicinity of Mt. Ndrandramea, *DA 15387*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4757*. VANUA MBALAVU: Northern limestone section, *Smith 1482*. KAMBARA: On limestone formation, *Smith 1274*.

5. *Garcinia adinantha* A. C. Sm. & S. Darwin in *J. Arnold Arb.* **55**: 258. *fig. 57-61*. 1974.

Garcinia sp. n. Horne, *A Year in Fiji*, 262. 1881.

A tree 3-20 m. high, with yellow latex, occurring at elevations of 50-1,050 m. in dense or dry forest. The young petals vary in color from salmon-pink to dull red. Specimens with flower buds have been obtained in scattered months between March and December, fruiting specimens only in April and May.

TYPIIFICATION: The type is *Smith 1827* (BISH HOLOTYPE; many ISOTYPES), collected May 11, 1934, on Mt. Kasi, Yanawai River region, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the two largest islands.

LOCAL NAMES AND USE: Names recorded on Vanua Levu are *raumba*, *mbulumanga*, *mbulumangayalewa*, and *mbulu*. The species is considered a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandende Levu, Mt. Evans Range, *DA 14835*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4379*. SERUA: Hills between Wainngere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9372*. NAMOSI: Mt. Vakarongasiu, *Gillespie 3256*, *DA 14704*, *16129*. NAITASIRI: Vicinity of Navuso, *DA 12595*; vicinity of Tamavua, *Gillespie 2042*. REWA: Vicinity of Na Vasi, *Horne 734*. VANUA LEVU: MBUA: Navotuvotu, summit of Mt. Seatura, *Smith 1644*; Tambulotu, Wainunu River Valley, *DA 15754*; vicinity of Thongea, Wainunu River, *DA 15768*, *15771*. MATHUATA: Vicinity of Nasingasinga, *Berry 53*, *54*. FIJI without further locality, *Berry 30*.

6. *Garcinia xanthochymus* Hook. f. *Fl. Brit. Ind.* **1**: 269. 1874; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 195. 1972; A. C. Sm. & S. Darwin in *J. Arnold Arb.* **55**: 262. 1974; Kostermans in *Ceylon J. Sci., Biol. Sci.* **12**: 67. 1976.

Xanthochymus pictorius Roxb. Pl. Coromandel 2: 51. t. 196. 1805; non *Garcinia pictoria* Roxb.

Xanthochymus tinctorius DC. Prodr. 1: 562, sphalm. 1824.

Garcinia tinctoria W. F. Wight in U. S. Dept. Agr. Pl. Indust. Bull. 137: 50, nom. superfl. 1909; Alston in Trimen, Fl. Ceylon 6: 20. 1931.

A tree, sparsely cultivated near sea level, or perhaps moderately common, characterized by its sharply costate dried branchlets, proportionately narrow, lanceolate leaf blades with numerous, obvious secondary nerves, and pleasantly acid fruits.

TIPIFICATION AND NOMENCLATURE: The type of *Xanthochymus pictorius*, presumably collected by Roxburgh, was said to be "a native of moist valleys among the Circar mountains." The original description and plate are excellent and may be taken as the type. The epithet *pictorius* not being available in *Garcinia*, Hooker utilized the generic name. As pointed out by Kostermans (1976, cited above), the binomial *Xanthochymus tinctorius* seems to be a misprint for *X. pictorius*, the same original reference of Roxburgh being cited; the binomial *G. tinctoria*, often used for this species, is therefore superfluous.

DISTRIBUTION: Southeastern Asia, now often cultivated elsewhere.

LOCAL NAME AND USE: *Sour mangosteen*; the pulp (aril) surrounding the seeds is pleasantly acid and is used for making drinks and sherbets.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Lambasa, DA L.11589.

7. *Garcinia dulcis* (Roxb.) Kurz in J. Asiat. Soc. Bengal 43 (2): 88. 1874; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 261. 1974.

Xanthochymus dulcis Roxb. Pl. Coromandel 3: 66. t. 270. 1820.

A medium-sized tree sparingly cultivated near sea level, with pale yellow or whitish latex. The flowers are about 1 cm. in diameter at anthesis and have greenish white petals; the fruit is yellow, with pale orange or yellow pulp around the seeds.

TIPIFICATION: Roxburgh's description and plate may serve as the type.

DISTRIBUTION: Southeastern Asia and perhaps also parts of Malesia, now frequently cultivated elsewhere.

LOCAL NAME AND USE: No name has been noted in Fiji, but the species is often called simply *mangosteen*; the pulp (aril) surrounding the seeds is sour and is edible raw or cooked, often being made into jam.

The occurrence of this species in Fiji is not supported by a voucher, but it was observed growing in the Suva Botanical Gardens in 1969, and local residents indicate that it occurs in a few gardens and that its fruit is utilized on a small scale.

8. *Garcinia mangostana* L. Sp. Pl. 443. 1753; J. W. Parham, Pl. Fiji Isl. 134. 1964, ed. 2. 192. 1972; A. C. Sm. & S. Darwin in J. Arnold Arb. 55: 261. 1974.

A tree to 15 m. high, with yellow latex, occasionally grown near sea level. The flowers are large, 4-6 cm. in diameter at anthesis, terminal on branchlets, and with the petals yellowish and red-margined; the dark purple fruits have 4-8 translucent-white segments.

TIPIFICATION: I have not noted a lectotypification, but among Linnaeus's several references perhaps the one to *Hortus Cliffortianus* suggests a suitable lectotype.

DISTRIBUTION: The species is presumably of Indo-Malesian origin, but the precise area of indigenosity is apparently not known; it has long been in cultivation and may now be found in most tropical countries, although it is not easy to establish. It was introduced into Fiji in the 1880's and a few trees are still to be found.

LOCAL NAME AND USE: *Mangosteen*; this is sometimes considered the most delicious tropical fruit for its edible, fresh pulp (aril) surrounding the seeds.

AVAILABLE COLLECTION: VANUA MBALAVU: Site of Lomaloma Botanical Gardens, DA 10212.

FAMILY 85. ELATINACEAE

ELATINACEAE Dumort. Anal. Fam. Pl. 44, as *Elatinideae*. 1829.

Annual or perennial herbs, often aquatic, or suffrutescent perennials, with paired, interpetiolar stipules; leaves opposite or verticillate, simple (or much divided in submerged forms); inflorescences axillary, cymose or composed of solitary flowers; flowers small, ♂, actinomorphic or rarely zygomorphic, hypogynous, the perianth biseriate, persistent; sepals 2-5 (-6), free or proximally connate, imbricate; petals as many as sepals, free, imbricate; stamens twice as many as petals or as many (inner whorl aborted), the filaments free, the anthers 2-locular, dehiscent longitudinally; ovary superior, 2-5-locular, the ovules numerous, anatropous, axile, the styles 2-5, free, short, the stigmas clavate or subglobose; fruit a septicidal capsule, the seeds numerous, minute, without endosperm, the testa usually strongly sculptured, the embryo straight or curved, the cotyledons short.

DISTRIBUTION: Pantropical, subtropical, and temperate, with two genera and 40-45 species. One apparently indigenous species occurs rarely in Fiji.

USEFUL TREATMENTS OF FAMILY: Niedenzu, F. *Elatinaceae*. Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 270-276. 1925. Backer, C. A. *Elatinaceae*. Fl. Males. I. 4: 203-206. 1951.

The family has been assigned to various alliances, including the Violales and even the Caryophyllales, but it seems properly placed in the thealean complex, as indicated by Takhtajan (1967, 1969), Cronquist (1968), and Thorne (1976).

1. *ELATINE* L. Sp. Pl. 367. 1753; Seem. Fl. Vit. 10. 1865; A. C. Sm. in J. Arnold Arb. 36: 284. 1955.

Small, glabrous annuals, aquatic or in swampy places; leaves short-petiolate; flowers minute, solitary; sepals 2-4, thin, proximally connate, obtuse, without a midrib; petals 2-4; ovary depressed-globose, 2-4-locular, the stigmas clavate; capsule subglobose, membranous, the seeds straight or curved, with scalariform ribs.

LECTOTYPE SPECIES: *Elatine hydropiper* L., one of Linnaeus's two original species (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 538. 1913).

DISTRIBUTION: Pantropical, subtropical, and temperate, with 12-20 species.

1. *Elatine gratioloides* A. Cunn. in Ann. Nat. Hist. 4: 26. 1840; Niedenzu in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 276. 1925; Greenwood in J. Arnold Arb. 25: 398. 1944; A. C. Sm. in op. cit. 26: 101. 1945, in op. cit. 36: 284. 1955; J. W. Parham, Pl. Fiji Isl. 225. 1964, ed. 2. 312. 1972.

Elatine americana sensu Hook. f. Fl. Novae-Zel. 1: 27. 1852; Seem. in Bonplandia 9: 256. 1861; A. Gray in op. cit. 10: 36. 1862; non auct.

Elatine americana var. *australiensis* Benth. Fl. Austral. 1: 178. 1863.

Elatine ambigua sensu Seem. Fl. Vit. 10. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 115. 1890; non Wight.

A small aquatic herb, infrequent in Fiji at elevations from near sea level to about 600 m. in swamps or creeping on mud and forming small mats under shallow, slowly flowing water, sometimes in taro plantations. The entire plant is pale green.

TIPIFICATION AND NOMENCLATURE: The type of *Elatine gratioloides* is R. Cunningham s. n. (K HOLOTYPE), collected in 1833 in a bog at Tauraki, Hokianga River, North Island, New Zealand. For *E. americana* var. *australiensis* there are several specimens in the type cover at K, among which I have not noted a lectotypification.

DISTRIBUTION: Australia and New Zealand, and otherwise known only from Fiji. The Fijian collections appear to be the only ones known of the genus in the Pacific, but perhaps the species is readily overlooked. In attributing the available material to *Elatine gratioloides* rather than to *E. ambigua*, as discussed in 1945 (cited above), I follow the characterizations suggested by Niedenzu in 1925.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 952*. TAVEUNI: In swamps near Somosomo, *Seemann 183*.

ORDER MALVALES

KEY TO FAMILIES OCCURRING IN FIJI

- Petals valvate (rarely imbricate, never contorted), usually separate to base; epicalyx lacking; leaves stipulate; indument when present not composed of stellate or lepidote hairs; plants without mucilage sacs or canals and usually without mucilage cells. 86. ELAEocarpaceae
- Petals imbricate or contorted (rarely valvate); indument when present composed mostly of stellate or lepidote hairs; plants usually with mucilage cells or often with mucilage sacs or canals.
- Filaments free or connate, the anthers bilocular; trees or shrubs, rarely herbs.
- Stamens numerous (rarely 5-10), usually free or shortly connate at base and in a single whorl, sometimes in 5-10 fascicles, if only 5 then alternate with petals. 87. TILIACEAE
- Stamens (including staminodes if present) usually 10-numerous, the filaments often connate into a narrow tube (androphore), or stamens sometimes only 5 but then with connate filaments or (in *Pimia*) free and opposite petals. 88. STERCULIACEAE
- Filaments usually connate, the anthers usually unilocular.
- Trees; stamens free or often shortly connate, the anthers 1-several-locular, the pollen smooth, triporate; fruits loculicidally dehiscent or indehiscent; seeds often embedded in hairs arising from inner walls of capsule. 89. BOMBACACEAE
- Herbs or shrubs or comparatively small, soft-wooded trees; stamens monadelphous, firmly united into a staminal column, the anthers always unilocular, the pollen minutely spiny, usually multiporate; fruits septicidally dehiscent or schizocarpic, rarely loculicidally dehiscent or baccate.
90. MALVACEAE

FAMILY 86. ELAEocarpaceae

ELAEocarpaceae DC. Prodr. I: 519, as *Elaeocarpeae*. 1824.

Trees or shrubs, rarely epiphytic (not our genus), often with indument but the hairs not stellate, with free stipules or less often exstipulate; leaves alternate (spirally arranged or distichous) or sometimes opposite, simple (at least when mature), the blades palmate- or pinnate-nerved, frequently with domatia in axils of secondary nerves; inflorescences usually axillary or borne on defoliate branchlets (rarely terminal), racemose, dichasial, thyrsoid-paniculate, or rarely with clustered or solitary flowers; flowers hermaphrodite (rarely unisexual), actinomorphic, hypogynous, lacking an epicalyx, usually 4- or 5-merous, the receptacle elevated into a gynandrophore or not; sepals 4 or 5, rarely more, valvate, free or proximally connate; petals 4 or 5, valvate (rarely imbricate), never contorted, free or less often connate, often lacinate or lobed, sometimes lacking (present in our genus); disk present, annular-pulvinate, cupuliform, or lobed; stamens 4 or 5 to numerous, inserted within disk or on its surface, the filaments free, the anthers bilocular, basifixed, longitudinally or transversely dehiscent or with apical pores; staminodes rarely present (absent in our genus); ovary sessile or stipitate, (1-) 2-many-locular, the ovules 2-many per locule, anatropous (anatropous with the raphe ventral), pendulous, borne on axile placentas, the style 1, the stigma entire or lobed; fruit a loculicidally or septicidally dehiscent capsule or a drupe or berry, the locules 1-several, each locule with (0-) 1-many seeds, the seeds with or without an aril, sometimes strophiolate, the endosperm copious, the embryo straight or recurved.

DISTRIBUTION: Pantropical and subtropical, rarely warm temperate, with eight to twelve genera and probably about 400 species. Only the genus *Elaeocarpus* occurs in

Fiji. Although the family is still sometimes combined with the Tiliaceae (e. g. Hutchinson, 1973, p. 308), most recent students consider it a well-demarcated entity (e. g. Schultze-Motel in Melchior, Engl. Syll. Pflanzenfam. ed. 12. 2: 306. 1964).

USEFUL TREATMENTS OF FAMILY: Smith, A. C. Studies of Papuanian plants, VI. J. Arnold Arb. 25: 104-121, 222-298. 1944. Hutchinson, J. Tiliaceae, tribes Sloaneaee and Elaeocarpeae. Gen. Fl. Pl. 2: 494-497. 1967. Coode, M. J. E. A conspectus of Elaeocarpaceae in Papuasias. Brunonia 1: 131-302. 1978.

I. ELAEOCARPUS L. Sp. Pl. 515. 1753; Seem. Fl. Vit. 27. 1865; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 523. 1953.

Trees or shrubs, the stipules soon caducous; leaves spirally arranged, sometimes crowded toward apices of branchlets, the blades often coriaceous, usually shallowly crenate or serrate; inflorescences axillary or borne on defoliate branchlets, racemose; flowers ♂, 4- or 5-merous, the receptacle raised; sepals free or basally short-connate; petals valvate, fimbriate or otherwise lobed or dentate distally; disk 4- or 5-lobed; stamens 10-numerous, inserted within disk, the anthers basifixed, linear, usually aristate or pilose, dehiscing by terminal pores or short, transverse slits; ovary sessile, (1-) 2-7-locular, the ovules 2-many per locule, the style filiform to subulate, the stigma punctiform; fruit a drupe composed of 1 pyrene, the mesocarp carnosous or fibrous, the endocarp bony or woody or sometimes fibrous, often variously ornamented, the locules 1-7, each locule 1-seeded (or some seeds aborted), the seeds without an aril, the cotyledons straight or recurved.

TYPE SPECIES: *Elaeocarpus serratus* ("serrata") L., the only original species.

DISTRIBUTION: Madagascar and Mauritius to eastern Asia, Malesia, Australia, and New Zealand, and eastward into the Pacific as far as Hawaii, with at least 250 species.

USEFUL TREATMENT OF GENUS: Smith, A. C. Studies of Pacific Island plants, XV. The genus *Elaeocarpus* in the New Hebrides, Fiji, Samoa, and Tonga. Contr. U. S. Nat. Herb. 30: 523-573. 1953.

In reviewing the genus *Elaeocarpus* in the Fijian Region (1953, cited above), I recognized nine sections in the genus, following my treatment of some of the Papuanian species (1944, cited above under the family, pp. 222-270), which had been slightly modified from the revision by Schlechter (in Bot. Jahrb. 54: 107-146. 1916). Of the nine sections believed to be represented in Papuasias, seven extend eastward into the Fijian Region, where they are attenuated in an interesting pattern, only three being found indigenously in Fiji itself. In his valuable 1978 discussion, Coode (cited above under the family, pp. 160-246) does not accept Schlechter's sections in their entirety but replaces them by eleven unnamed groups (often divided into subgroups), some of which partially conform to Schlechter's concepts. Coode is no doubt correct in believing that the earlier circumscribed sections require redefinition, utilizing more precise criteria, but his 1978 system is not sufficiently developed to permit the definite application of sectional names to the eleven groups. In Fiji three clusters of species seem quite well defined, but in the following key I refrain from utilizing sectional names or group numbers for them. There are now known 21 indigenous Fijian species (20 of them endemic) in these three groups (whether called sections or not), and an additional species of a different group occurs in cultivation in Fiji. Clarification of interspecific relationships in *Elaeocarpus* must await completion of monographic studies initiated by R. Weibel (Morphologie de l'embryon et de la graine des *Elaeocarpus*. Candollea 23: 101-108. 1968). Some of the species of *Elaeocarpus* must be considered among the most beautiful trees of the Fijian forests.

KEY TO SPECIES

- Ovary (4- or) 5-locular, each locule with 4 or 6 ovules; inflorescences borne on defoliate branchlets, the petals white, usually 16-17 mm. long and deeply laciniate; fruits globose, blue, 1.5-3 cm. in diameter, the endocarp rugulose, copiously ornamented with irregular, rounded processes; leaf blades lanceolate-oblong, 8-20 cm. long; cultivated species. 1. *E. grandis*
- Ovary 2-locular; indigenous species.
- Flowers small, the petals not more than 6 mm. in length, with few (up to 10) laciniae; stamens 10-27, the anthers erostrate; ovules 2 or 4 per ovary locule; fruits small, round in cross-section, the mesocarp thin, the endocarp inconspicuously rugulose.
- Petals 4.5-6 mm. long, with 3-6 apical laciniae; stamens 18-27, the anthers 1.3-2.5 mm. long; ovary glabrous.
- Petioles 1-2 cm. long; leaf blades subcoriaceous or chartaceous, obovate-elliptic, 6.5-10 × 2.5-4.5 cm., attenuate at base, obtusely cuspidate at apex; racemes lax, up to 6 cm. long, 2-4-flowered, the pedicels at anthesis 20-25 mm. long; petals obovate, 2.5-3 mm. broad; anthers 2-2.5 mm. long; ovary locules with 4 ovules. 2. *E. pittosporoides*
- Petioles 2-3.5 cm. long; leaf blades chartaceous, ovate-lanceolate, 6.5-8.5 × 2.5-3.3 cm., obtuse or cuneate at base, slenderly acuminate at apex; racemes straight, 1.5-3.5 cm. long, 4-9-flowered, the pedicels at anthesis 4-7 mm. long; petals oblong, 1.5-1.8 mm. broad; anthers 1.3-1.8 mm. long; ovary locules with 2 ovules. 3. *E. praeclarus*
- Petals 1.3-3 mm. long, with 5-10 apical laciniae; stamens 9-16, the anthers not more than 1.3 mm. long; ovary pilose, the locules with 2 ovules; racemes straight, 2-4.5 cm. long, 6-18-flowered, the pedicels at anthesis 2-6 mm. long.
- Flowers very small, the petals 1.3-1.9 mm. long; stamens 9-16, the anthers 0.3-0.7 mm. long.
- Branchlets and petioles at first pale-puberulent or strigose, usually soon glabrate; leaf blades subacute and attenuate at base, predominantly obovate-elliptic, 2-5.5 cm. broad, soon glabrate on both sides; flower-subtending bracts (soon caducous) 2-3 mm. long; stamens 1.2-1.3 mm. long, the anthers 0.6-0.7 mm. long. 4. *E. cassinoides*
- Branchlets and petioles copiously hispidulous-puberulent, the indument often subsistent; leaf blades rounded or broadly obtuse at base, rarely acute, oblong-elliptic, 3-6.7 cm. broad, often persistently puberulent beneath at least on costa and secondaries; flower-subtending bracts (soon caducous) about 1 mm. long; stamens 0.6-0.7 mm. long, the anthers 0.3-0.4 mm. long. 5. *E. pyriformis*
- Flowers larger, the petals 2.5-3 mm. long; stamens 10-12, the anthers 1-1.3 mm. long; leaf blades obovate-oblong, often reddish beneath, attenuate at base. 6. *E. kasiensis*
- Flowers large, the petals at least 9.5 mm. long, often copiously laciniate (laciniae 6-35); stamens often numerous, rarely as few as 15, the anthers rostrate; ovules 4-8 per ovary locule; fruits comparatively large, the endocarp forming a somewhat flattened putamen with obvious and sometimes lobed lateral angles.
- Fruits large, 3.5-6.5 cm. or more long, the endocarp hard and bony; flowers large, the petals at anthesis 18-55 mm. long; stamens 40-125; ovules 6 or 8 per locule.
- Ovary glabrous or very sparsely pilose and soon glabrate; sepals essentially glabrous without or, if sparsely strigose in bud, soon glabrate; anthers with a comparatively conspicuous dorsal awn (0.8-4 mm. long) and sometimes also with a ventral awn.
- Leaf blades thick-coriaceous, 9-28 × 4-12 cm., rounded or bluntly cuspidate at apex, acute or obtuse at base, the petioles 3-12 mm. long; branchlets very stout (7-20 mm. in diameter toward apices) and copiously cicatricose; sepals thick-coriaceous, 30-40 mm. long; petals yellow toward base, pink distally, carnose, 30-47 mm. long, crenulate-lobed at rounded apex (lobes subequal, obtuse, 1-2 mm. long); stamens 100-125, the filaments short-hispidulous (hairs 0.1-0.2 mm. long), the anthers 13-16 mm. long. 7. *E. storckii*
- Leaf blades chartaceous to coriaceous, gradually narrowed to an acute or obtuse apex; branchlets usually not exceeding 5 mm. in diameter toward apices; petals white or yellowish, submembranaceous, the apical laciniae oblong or lanceolate, often irregular, acute or subacute, 2-10 mm. long; stamens 40-100, the filaments conspicuously hispidulous (hairs 0.2-1 mm. long).
- Flowers comparatively large, the sepals usually exceeding 20 mm. in length, the petals 23-55 mm. long, the apical laciniae 9-20, the anthers 1-aristate; fruits (known only for no. 9) comparatively large, at least 5 cm. long at maturity.
- Sepals lanceolate, rigid, 43-49 × 6-7 mm., minutely puberulent within; petals 45-55 × 10-12 mm., the apical laciniae 9-11 in number and 7-10 mm. long; stamens 60-90, 30-35 mm. long, the filaments 12-15 mm. long, with hairs 0.2-0.3 mm. long, the anthers 15-20 mm. long and with a dorsal awn to 3 mm. long; style 25-30 mm. long; leaf blades ovate, 10-16 × 5.5-9 cm., rounded at base; inflorescence axis 4-5 cm. long, glabrous. 8. *E. ampliflorus*

- Sepals lanceolate or oblong-lanceolate, carnose, 18-36 × 3.5-9 mm., sericeous or tomentellous within; petals 23-40 × 7-18 mm., the apical laciniae 9-20 in number and 3-8 mm. long; stamens 48-100, 15-27 mm. long, the filaments 6-10 mm. long, with hairs 0.5-1 mm. long, the anthers 7-14 mm. long; style 10-20 mm. long.
- Leaf blades elliptic to lanceolate, usually 13-23 × 5-9 cm., acute to attenuate at base and decurrent on petiole; inflorescence axis usually 1-4 cm. long and pale-puberulent at anthesis; sepals copiously sericeous-tomentellous within (hairs golden, 0.2-0.5 mm. long); stamens 48-90, the anthers 9-14 mm. long including dorsal awn (0.8-1.5 mm. long). 9. *E. chelonimorphus*
- Leaf blades ovate-elliptic, 7-13 × 3-5 cm., rounded or faintly cordate at base; inflorescence axis 4-6 cm. long, glabrous; sepals densely sericeous within (hairs whitish, 1-2 mm. long); stamens 90-100, the anthers 7-9 mm. long including dorsal awn (3-3.5 mm. long). 10. *E. gillespieanus*
- Flowers smaller, the sepals up to 22 mm. long, the petals 22-25 mm. long, the apical laciniae 6-16, the anthers sometimes biaristate; fruits 3.5-5 cm. long at apparent maturity.
- Leaf blades ovate-elliptic, 7-16 × 3-6.5 cm., rounded to broadly obtuse at base, the petioles 1-4 cm. long; sepals 3-4 mm. broad, the petals with 6-9 apical lobes. 11. *E. vitiensis*
- Leaf blades lanceolate or lanceolate-ovate, 7-11 × 2-4 cm., acute to obtuse at base, the petioles (1-) 1.5-3 cm. long; sepals 2-3 mm. broad, the petals with 11-16 apical lobes. 12. *E. lepidus*
- Ovary sericeous with long-persistent hairs; sepals puberulent without, perhaps at length subglabrate; anthers with a comparatively short awn (0.5-0.8 mm. long).
- Leaf blades acute or narrowly obtuse at base and decurrent on petiole; young vegetative parts and inflorescence axis closely pilose with hairs less than 0.4 mm. long; petals lacinate along margins nearly to base or at least on lateral margins above middle, as well as apically, the lobes 11-35.
- Leaf margins coarsely crenate, the veinlet-reticulation comparatively conspicuous, prominulous on both surfaces; axis of inflorescence and pedicels sparsely strigose-puberulent; sepals 11-15 mm. long; petals probably not much exceeding sepals in length at anthesis, lacinate along margins nearly to base with 11-17 lobes; ovary minutely sericeous with pale hairs about 0.2 mm. long. 13. *E. laurifolius*
- Leaf margins inconspicuously crenulate, the veinlet-reticulation inconspicuous, subimmersed or plane above; axis of inflorescence and pedicels copiously sericeous-puberulent; sepals 17-22 mm. long; petals 18-25 mm. long, lacinate in distal half with 16-35 lobes; ovary conspicuously sericeous with golden hairs 0.4-0.5 mm. long. 14. *E. subcapitatus*
- Leaf blades rounded or subcordate at base; young vegetative parts and inflorescence axis with hairs 0.4-0.6 mm. long; petals lacinate only at apex, the lobes 11-13. 15. *E. melochioides*
- Fruits often smaller, 2.5-4.5 cm. long, the endocarp sometimes fibrous; flowers smaller, the petals at anthesis 9.5-15 mm. long; stamens 15-41; ovules 4-8 per locule.
- Flowers comparatively large, the sepals 11-13.5 mm. long, the petals 13-15 mm. long, white, with 8-12 apical laciniae; stamens 20-30, the filaments copiously sericeous with pale hairs 0.7-1 mm. long, the anthers 5-7 mm. long; style 8-12 mm. long; inflorescences short, the axis not more than 2.5 cm. long; leaf blades comparatively small, not exceeding 7 × 3.5 cm., acute or obtuse at base, the petioles not more than 1.5 cm. long. 16. *E. kambi*
- Flowers smaller, the sepals not more than 11.5 mm. long; stamens (15-41) with glabrous or minutely hispidulous-puberulent filaments (hairs not more than 0.1 mm. long), the anthers not more than 4.6 mm. long; style not exceeding 6 mm. in length; inflorescence often elongate, the axis at least 3 cm. long; leaf blades only rarely less than 7 cm. in length, the petioles usually much longer than 1.5 cm.
- Leaf blades large, usually 14-38 × 7-17 cm., the secondary nerves 9-15 per side; branchlets greatly thickened, 6-17 mm. in diameter toward apices; anthers with an apical awn 0.2-0.8 mm. long. Racemes 12-16 cm. long, the pedicels 3.2-7 mm. long at anthesis; petals with 7-12 apical laciniae.
- Indument comparatively sparse and short (hairs of various parts usually less than 0.2 mm. long, the leaf blades essentially glabrous beneath); leaf blades obovate, gradually narrowed toward base; petals rich pink, with pale yellow laciniae; anthers with dorsal awns 0.5-0.8 mm. long. 17. *E. milnei*
- Indument comparatively copious and long (hairs of various parts 0.2-0.6 mm. long, the leaf blades densely and persistently pilose beneath); leaf blades oblong-elliptic, usually rounded at base; petals pure white at anthesis; anthers with dorsal awns 0.2-0.3 mm. long. 18. *E. chionanthus*
- Racemes 22-40 cm. long, the rachis and pedicels tomentellous with hairs 0.3-0.7 mm. long, the pedicels 15-55 mm. long at anthesis; petals pink, whitish distally, with 13-17 apical laciniae;

- leaf blades elliptic or obovate-elliptic, rounded at base; young parts copiously sericeous with hairs 0.6–1 mm. long. 19. *E. roseiflorus*
- Leaf blades comparatively small, usually 5–20 × 3–11 cm., the secondary nerves 5–11 per side; branchlets comparatively slender, 2–8 (–10) mm. in diameter toward apices; anthers with an apical awn 0.6–1.2 mm. long.
- Stamens 28–41; style 3.5–4 mm. long; petals white (color not known for no. 21), the apical laciniae 12–19; leaf blades shallowly cordate to rounded or broadly obtuse at base; indument of branchlets and petioles often long-persistent.
- Leaf blades elliptic to elliptic- or lanceolate-ovate, usually 12–20 × 4.5–11 cm., inconspicuously crenulate at margin; pedicels 8–13 mm. long at anthesis; sepals 7–8 mm. long; petals 9.5–10 mm. long, with 12–16 apical laciniae; anthers with an apical awn 1–1.2 mm. long. 20. *E. graeffei*
- Leaf blades ovate, 5–9 × 3–6.5 cm., essentially entire at margin; pedicels 3–5 mm. long at anthesis; sepals 9–10 mm. long; petals 12–12.5 mm. long, with 16–19 apical laciniae; anthers with an apical awn 0.6–0.8 mm. long. 21. *E. degenerianus*
- Stamens about 15, the anthers with an apical awn 0.8–1 mm. long; style 5–6 mm. long; sepals 7.5–9 mm. long; petals 9.5–10.5 mm. long, pink, with 7 or 8 yellowish apical laciniae; pedicels 7–10 mm. long at anthesis, to 20 mm. long in fruit; leaf blades narrowly elliptic or obovate-lanceolate, usually 7–12 × 3–5.5 cm., obtuse to acute at base, entire or obscurely crenulate at margin; indument of branchlets and petioles evanescent. 22. *E. xanthodactylus*

1. *Elaeocarpus grandis* F. v. Muell. *Fragm. Phyt. Austral.* 2: 81. 1860; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* 10: 114. 1939; J. W. Parham in *op. cit.* 19: 98. 1948, in *op. cit.* 29: 32. 1959, *Pl. Fiji Isl. ed. 2.* 162. 1972.

An occasionally cultivated tree found at elevations from near sea level to about 250 m. Where native it is a tall tree (to 36 m. or more high), with a trunk to 1.25 m. in diameter and with large buttresses, and with horizontally spreading branches. The petals are white, usually about 16–17 mm. long, and copiously and deeply laciniate. The fruits are blue, globose, and up to 3 cm. in diameter.

TIPIFICATION: Queensland: "Ad ripas nemorosas fluvii Pine River. Hill et Mueller." The holotype is probably at MEL.

DISTRIBUTION: A native of Queensland, now occasionally grown in other tropical areas. The species is well described and illustrated by W. D. Francis, *Austr. Rain-For. Trees*, ed. 2. 273. *fig. 164, 165.* 1951.

LOCAL NAMES AND USES: The most commonly used Australian name is *quandong* (variously modified by *blue*, *silver*, *white*, or *brush*); also used are *blue fig* and *blue marble tree*. The wood is considered useful for various purposes and is easy to work. The tree is also highly ornamental, and the pulp surrounding the endocarp is said to be edible. In Australia (as in Hawaii) the putamens are used for necklaces. The species was doubtless introduced into Fiji experimentally and is now sparingly grown as an ornamental tree.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Tholo-i-suva, *Howard 49*; old Agricultural Station at Approved School, Nasinu, *DA L.22233 (DF 74)*. TAILEVU: Wainimbokasi, *DA 490*. REWA: Government House grounds, Suva, *DA L.11442*; also grown in Suva Botanical Gardens (J. W. Parham, 1948, cited above) but no available vouchers. FIJI without further locality, *DA s. n.* (5 sheets at SUVA; these may possibly represent material from Tovu Island, Ra Province, mentioned by B. E. V. Parham, 1939, cited above).

2. *Elaeocarpus pittosporoides* A. C. Sm. in *J. Arnold Arb.* 26: 100. 1945, in *Contr. U. S. Nat. Herb.* 30: 534. 1953; J. W. Parham, *Pl. Fiji Isl.* 114. 1964, ed. 2. 163. 1972.

An apparently infrequent tree 5–6 m. high, found in forest at elevations of 200–300 m.; the inflorescences, borne in leaf axils near apices of branchlets, bear flowers with yellow petals.

TIPIFICATION: The type is *Greenwood 1010* (A HOLOTYPE; ISOTYPES at BISH, K, US),

collected in May, 1943, in hills east of the Navua River, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and still known only from the type collection.

3. *Elaeocarpus praeclarus* A. C. Sm. in Pacific Sci. 25: 491. 1971. FIGURES 94D, 95A.

A tree about 4.5 m. high, apparently infrequent on a forested slope at an elevation of about 600 m.; the trunk is about 7 cm. in diameter. No color notes are available.

TIPIFICATION: The type is *W. J. Howard 301* (BISH HOLOTYPE; ISOTYPES at MASS, SUVA), collected Oct. 10, 1968, on the northern slope of Mt. Korombasonga, in the drainage of Vuindavuani Creek, south of Nakoroutari, Thakaundrove Province, Vanua Levu (17 or 18 km. south of Lambasa). In 1971 I erroneously cited the locality as in Mathuata Province.

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection; the region has been very inadequately collected by botanists.

4. *Elaeocarpus cassinoides* A. Gray, Bot. U. S. Expl. Exped. 1: 204. 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 331. 1857; Seem. Viti, 433. 1862, Fl. Vit. 29. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126, as *E. cassinoides*. 1890; Hemsl. in J. Linn. Soc. Bot. 30: 171. 1894; A. C. Sm. in J. Arnold Arb. 26: 99. 1945, in Contr. U. S. Nat. Herb. 30: 535. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972. FIGURE 94A-C.

A sometimes spreading tree 6-23 m. high, with a trunk to 1 m. in diameter, occurring in dense or open forest or in thickets from near sea level to an elevation of 500 m.; the petals are pink to cream-white and the fruits are blue or purplish. Flowers have been collected between December and February and fruits between March and August.

TIPIFICATION: The type is *U. S. Expl. Exped.* (US 13596 HOLOTYPE; ISOTYPES at GH, K), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu. Although Gray recorded that apparently identical material had been noted as from Tonga, it is now apparent that part of the material was mislabelled and that the species does not occur in Tonga.

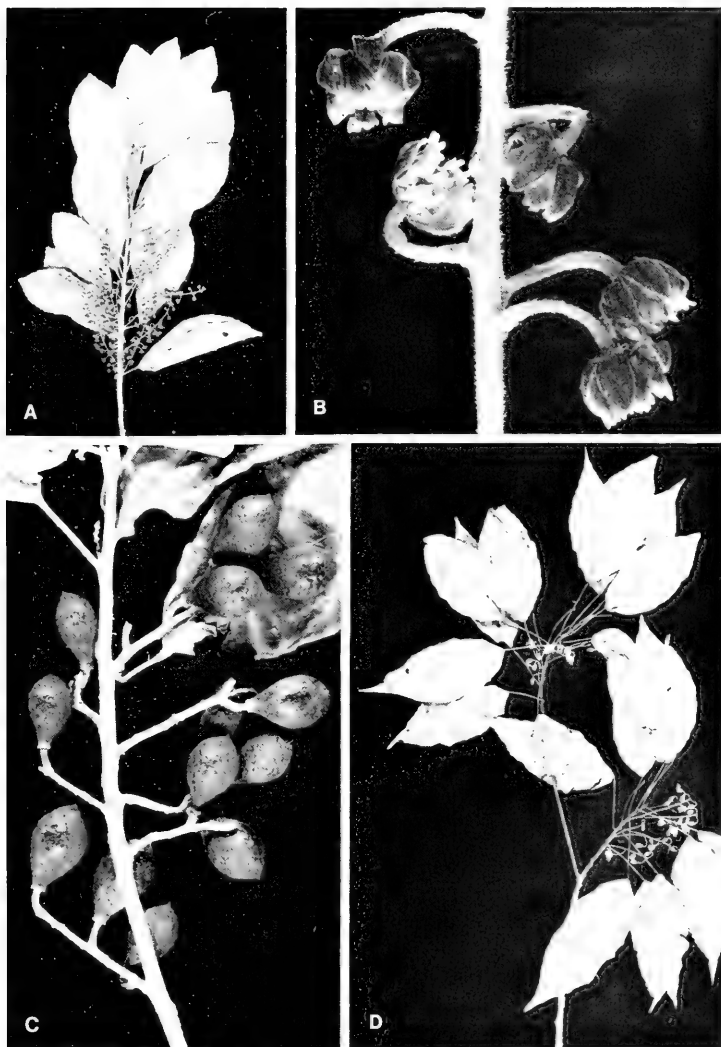
DISTRIBUTION: Endemic to Fiji and known to occur sparingly on five of the islands. A specimen from Guadalcanal, Solomon Islands, identified as *E. cassinoides*, obviously does not belong with the Fijian material (cf. Coode, 1978, cited above under the family, p. 183).

LOCAL NAME: *Wailoaloa* (from *Smith 1735* only).

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Slopes of Mt. Korombamba, *Gillespie 2307*. KORO: Western slope, *Smith 1086*; eastern slope of main ridge, *Smith 1007*. NGAU: Slopes of Mt. Ndelaitho, on northern spur, toward Navukailangi, *Smith 7869*. VANUA LEVU: MBUA: Lower Wainunu River Valley, *Smith 1735*. MATHUATA: Seanggangga District Farm, *DA 14105*. MOALA: Above Maloku, *Smith 1353*.

5. *Elaeocarpus pyriformis* A. Gray, Bot. U. S. Expl. Exped. 1: 205. 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 332. 1857; Seem. Viti, 433. 1862, Fl. Vit. 29. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 537. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 163. 1972.

FIGURE 94. A-C, *Elaeocarpus cassinoides*; A, distal portion of branchlet and inflorescences, $\times 1/3$; B, portion of inflorescence, one flower with 1 sepal, 1 petal, and 3 stamens removed, $\times 6$; C, infructescences, $\times 1$. D, *Elaeocarpus praeclarus*, distal portion of branchlet and inflorescences, $\times 1/3$. A & B from *Smith 1086*, C from *Smith 1735*, D from *Howard 301*.



A tree 8–15 m. high, obtained at elevations from near sea level to 750 m. in dense forest or on wooded ridges. No color notes or dates are available with flowering collections; the fruits are shining, metallic green-blue, becoming brighter blue, and obtained in scattered months between March and December.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 13616 HOLOTYPE; ISOTYPES at GH, K), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty from three of the high islands.

LOCAL NAME: *Kesa* (from *MacDaniels 1041* only).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nambuyasa, south of Navai, *Gillespie 4086*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 1187*. NAMOSI: Vicinity of Namosi, *Gillespie 2835*. NAITASIRI: Waindina River basin, *MacDaniels 1041*. NGAU: Hills east of Herald Bay, inland from Sawaike, *Smith 7756*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6831*. FIJI without further locality, *Horne 222, 981, Tothill 375*.

Although closely related to *Elaeocarpus cassinoides*, Gray's second species of this relationship is readily distinguished by its copious indument, differently shaped leaf blades, small flower-subtending bracts, and stamens only about half as large. The fact that the two type collections were recorded from "Mbua Bay" is not unusual, since everything the U. S. Exploring Expedition obtained while there anchored is so recorded, although the area covered by its collectors was probably quite extensive.

6. *Elaeocarpus kasiensis* A. C. Sm. in Bishop Mus. Bull. **141**: 92. *fig. 48*. 1936, in Contr.

U. S. Nat. Herb. **30**: 538. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972.

A shrub 3 m. high, with the leaf blades often reddish beneath, collected in dense, low forest at elevations of 300–430 m. The sepals are yellow and the petals pink with yellow margins.

TYPIFICATION: The type is *Smith 1761* (BISH HOLOTYPE; many ISOTYPES), collected May 10, 1934, on Mt. Kasi, Yanawai River region, Thakaundrove Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection. This very distinctive species, like some others from the Mt. Kasi area, has not been subsequently collected. The region is characterized by bauxite soils that support an unusual and stunted vegetation, now largely destroyed.

7. *Elaeocarpus storckii* Seem. in Bonplandia **10**: 295. 1862, Viti, 433. 1862, Fl. Vit. 28. *t.*

7. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890; A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 540. 1953; J. W. Parham, Pl. Fiji Isl. 115. *fig. 48*. 1964, ed. 2. 163. *fig. 49*. 1972. FIGURE 82 (upper).

An often slender tree 9–25 m. high, with a trunk up to 60 cm. (or more?) in diameter, occurring in dry or open forest at elevations of 50–550 m. The inflorescences are borne on branchlets below leaves; the sepals are rich pink or reddish purple or yellowish with red spots; the petals are yellow proximally and pink toward apices; and the fruits are deep purple at maturity and up to 6.5 × 4.5 cm. Flowers and fruits have been collected between November and January and fruits also in April.

TYPIFICATION: The type is *Storck 871* (K HOLOTYPE; ISOTYPES at BM, GH), collected (probably between November, 1860, and January, 1861) on Ovalau near Port Kinnaid.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Ovalau, and Vanua Levu.

LOCAL NAMES AND USE: Recorded names are *ngaingai* (Storck 871) and *nggainggai* (DA 13195). The species is noted as a timber tree (Howard 93).

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills between Waininggere and Waises Creeks, between Ngaloa and Wainiyambia, *Smith* 9555. NAITASIRI: Tholo-i-suva, DA 13195, L.23197 (DF 133); vicinity of Kalambo, *Tothill*, in 1929. REWA: Near summit of Mt. Korombamba, *Gillespie* 2325. VANUA LEVU: THAKAUNDROVE: Navonu Creek, Natewa Peninsula, *Howard* 93. FIJI without further locality, *Horne* 479.

Readily distinguished from its congeners by a host of characters, this striking tree in flower is one of the most beautiful in Fiji.

8. *Elaeocarpus ampliflorus* A. C. Sm. in Pacific Sci. **25**: 492. 1971. FIGURE 95B & C.

A rare small tree (said to be 1-2 m. high), found in lowland forest (probably not higher than 100-200 m.); the petals are yellowish.

TYPEFICTION: The type is DA 15576 (coll. S. *Vodonaivalu*) (BISH HOLOTYPE; ISOTYPE at SUVA), obtained Aug. 22, 1968, in flower, near Waimbue Creek, upper Waimanu River Basin, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

This striking plant has larger flowers than any other known Fijian species of *Elaeocarpus*, being of the general relationship of *E. chelonimorphus* and *E. gillespieanus* but differing from both in the obvious characters mentioned in the above key. Its sepals and petals are sometimes four.

9. *Elaeocarpus chelonimorphus* Gillespie in Bishop Mus. Bull. **83**: 18. fig. 22. 1931; A.

C. Sm. in op. cit. **141**: 95. 1936, in Contr. U. S. Nat. Herb. **30**: 541. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972. FIGURES 95D, 96A.

An abundant, often spreading or slender tree 5-20 m. high, with a trunk to 30 cm. (and doubtless more) in diameter, occurring at elevations of 30-1,323 m. in dense or secondary forest, in patches of forest in open country, or in the mossy forest of high ridges. The sepals are green to pale yellow or cream-colored; the petals white to pale or greenish yellow; the filaments pale to greenish yellow and the anthers yellow; the disk lobes pale yellow; the gynoecium green to pale yellow; and the fruits, often borne on branches or on the trunk, green to yellowish and turning bluish or dull purple. Flowers and fruits have been obtained throughout the year.

TYPEFICTION: The type is *Gillespie* 2293 (BISH HOLOTYPE; ISOTYPES at GH, K, NY, US), collected Aug. 15, 1927, on the southeastern slope of Mt. Korombamba, Rewa Province, Viti Levu.

DISTRIBUTION: The most common Fijian species of the genus, *Elaeocarpus chelonimorphus* is endemic and is thus far known from the four largest islands. It occurs abundantly in middle elevation forest as well as on the highest ridges; 75 collections have been studied.

LOCAL NAMES AND USES: Recorded names are *kambi*, *tambadamu*, *sivia*, *ma*, and *wathiwathi*. It has been noted as a timber tree, and collectors have observed that the flowers and seeds are considered edible by children, as well as by birds and bats.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood* 877A; vicinity of Nandarivatu, DA L.13472 (DF 552); summit of Mt. Tomanivi, *Smith* 5195. NANDRONGA & NAVOSA: Nausori Highlands, DF 1142; northern portion of Rairaimatuku Plateau, *Smith* 5646; ridge between Naloka and Naraiyawa, DA 2473. SERUA: Inland from Namboutini, DA L.22313; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith* 9322; Taunovo River, *Nasoqiri* 14. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith* 8575; summit of Mt. Vakarongasiu, DA 16123; Mau, Wairoro Creek, DA 13734 (DF 219). NAMOSI-NAITASIRI boundary: Summit ridge of Mt. Naitarandamu, *Gillespie* 3141. NAITASIRI: Vicinity of Matawailevu, Wainimala Valley, *St. John* 18209; Waimanu River, DA L.13354 (*Berry* 53); vicinity of Tamavua, *Yeoward* 61. TAILEVU: Copper Mine, Waimaro River, DA 13630;

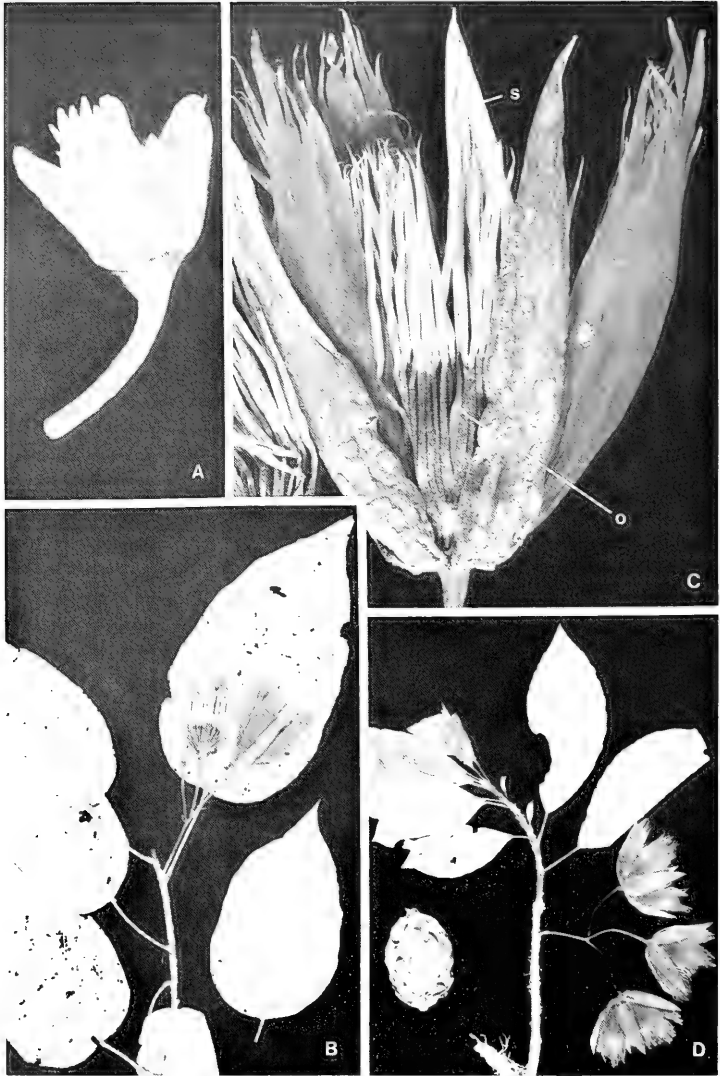




FIGURE 96. A, *Elaeocarpus chelonimorphus*, flower with 1 sepal, 1 petal, and several stamens removed, showing ovary (o) and style (s), $\times 2$, from Smith 2001. B, *Elaeocarpus lepidus*, flower with 1 sepal, 2 petals, and a few stamens removed, $\times 2$, from Smith 948.

Wainivesi River, DA 2629. REWA: Mt. Korombamba, DA 3848. KANDAVU: Summit of Mt. Mbuke Levu, DA 14930. VANUA LEVU: MATHUATA: Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, Smith 6659. MATHUATA-THAKAUNDROVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, Smith 550. THAKAUNDROVE: Mt. Kasi, Yanawai River region, Smith 1798; Mt. Uluingala, Natewa Peninsula, Smith 2001. TAVEUNI: Mountains inland from Somosomo, Gillespie 4834; slopes of Mt. Manuka, east of Wairiki, Smith 8246.

The variation in the leaves and flowers that I mentioned in my 1953 discussion, in the light of more abundant material now available, is seen to be of little consequence in this striking but abundant species.

FIGURE 95. A, *Elaeocarpus praeclarus*, flower with 2 sepals, 1 petal, and several stamens removed, $\times 6$. B & C, *Elaeocarpus ampliflorus*; B, distal portion of branchlet and an inflorescence, $\times 1/3$; C, flower with 1 petal and a few stamens removed, showing ovary (o) and style (s), $\times 2$. D, *Elaeocarpus chelonimorphus*, distal portion of branchlet and an inflorescence, with a detached dried fruit, $\times 1/3$. A from Howard 301, B & C from DA 15576, D from Smith 2001.

10. *Elaeocarpus gillespieanus* A. C. Sm. in Bishop Mus. Bull. **141**: 94. *fig. 49*. 1936, in Contr. U. S. Nat. Herb. **30**: 544. 1953; J. W. Parham, Pl. Fiji Isl. **114**. 1964, ed. 2. 162. 1972.

A tree about 20 m. high, apparently rare in dense forest, obtained at an elevation of about 400 m. The petals are white.

TIPIFICATION: The type is *Smith 1613* (BISH HOLOTYPE; many ISOTYPES), collected April 27, 1934, on the southern slopes of Mt. Seatura, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

LOCAL NAME: *Mamakara*.

A species of the relationship of *Elaeocarpus chelonimorphus* but readily distinguished as noted in the above key.

11. *Elaeocarpus vitiensis* Gillespie in Bishop Mus. Bull. **83**: 20. *fig. 24*. 1931; A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 545. 1953; J. W. Parham, Pl. Fiji Isl. **116**. 1964, ed. 2. 163. 1972.

A tree 3–15 m. high, with a trunk up to 50 cm. in diameter, occurring at elevations of 250–900 m. in dense forest or in wooded ravines. The slightly fragrant flowers have green sepals and white or yellowish white petals; the fruits at maturity are brownish or dark olive-green. Flowers have been obtained in September and November and fruits between July and December.

TIPIFICATION: The holotype is *Gillespie 3973* (BISH), collected Nov. 22, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAME AND USE: *Tambandamu*; considered a useful timber tree (*Berry 316*).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Vicinity of Nandarivatu, at head of escarpment, *Gillespie 4169*; Nauwanga, south of Nandarivatu, *Degener 14544*. SERUA: Vunamaravu, upper Navua River, *DA 15505*. NAITASIRI: Sovi River, Waindina Valley, *Berry 316*.

12. *Elaeocarpus lepidus* A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 547. 1953; J. W. Parham, Pl. Fiji Isl. **114**. 1964, ed. 2. 163. 1972. FIGURE 96B.

A tree 16–27 m. high, with a trunk 50–70 cm. (and probably more) in diameter, found in dense forest or on its edges and sometimes along streams at elevations of 100–800 m. The flowers have green sepals, white petals and filaments, and brown anthers; the fruits, borne on defoliate branches, are bluish green or brown and up to 5 × 3.5 cm. Flowers have been obtained only in January, fruits between June and October.

TIPIFICATION: The type is *Smith 948* (US 1676699 HOLOTYPE; many ISOTYPES), collected Jan. 29, 1934, on the eastern slope of the main ridge above Sinuvatha, Koro.

DISTRIBUTION: Endemic to Fiji and thus far known definitely from four of the high islands.

LOCAL NAME: *Kambi*.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Slopes of the escarpment north of Nandarivatu, *Smith 6280*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7757*. VANUA LEVU: MBUA: Above Namuavoivoi, Sarowangga River basin, *Berry 56*. THAKAUNDROVE: Vicinity of Vaturova, Natewa Peninsula, *Howard 179*. FIJI without further locality, *Horne 437*, *DA 3918*.

This species and the preceding are a closely allied pair related to *Elaeocarpus chelonimorphus* and its immediate allies, but readily distinguished by their substantially smaller flowers.

13. *Elaeocarpus laurifolius* A. Gray, Bot. U. S. Expl. Exped. 1: 203. 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 331. 1857; Seem. Viti, 433. 1862, Fl. Vit. 28. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 549. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 163. 1972.

This inadequately known species is presumably a tree from low elevation forest; of the three known collections two are without locality and all are without precise dates.

TIPIFICATION: The holotype is *U. S. Expl. Exped.* (us 13612), collected in 1840 from Fiji but without definite locality.

DISTRIBUTION: Endemic to Fiji, and known with certainty only from Vanua Levu.

LOCAL NAME: *Ndongo rua* (reported from *DA 321*; "second mangrove", a very unlikely name).

AVAILABLE COLLECTIONS: VANUA LEVU: THAKAUNDRIVE: Vicinity of Ndawara, Yanawai River, *DA 321*. FIJI without further locality, *Horne 772*.

This species and the two following form a group differing from *Elaeocarpus chelonimorphus* and its allies in their persistently sericeous ovaries, puberulent sepals, and short-awned anthers; in spite of the paucity of material the three species seem readily separable among themselves.

14. *Elaeocarpus subcapitatus* Gillespie in Bishop Mus. Bull. 83: 19. fig. 23. 1931; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 550. 1953; J. W. Parham, Pl. Fiji Isl. 115. 1964, ed. 2. 163. 1972.

A tree to 18 m. (or more?) high, found in dense forest at elevations of 150–1,153 m. The petals are indicated as white and the fruit, probably not fully mature, as green. Flowers have been obtained only in September and fruits between October and January.

TIPIFICATION: The type is *Gillespie 3235* (BISH HOLOTYPE; ISOTYPE at GH), collected Sept. 28, 1927, on the summit of Mt. Naitarandamu, Namosi–Naitasiri boundary, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES AND USE: *Kambi*, *ndovula* (both from *DF 1121*); considered a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *DF 1142, 1143*. SERUA: Vunamaoli Creek, inland from Namboutini, *DF 1121*. NAMOSI: Between Nanggarawai and Wainimakutu, *Gillespie 3205*; between Namuamua and Nanggarawai, Wainikoroiuva River, *Gillespie 3229*; summit of Mt. Voma, *Gillespie 2723*. NAMOSI–NAITASIRI boundary: Summit of Mt. Naitarandamu, *Gillespie 5117*. VITI LEVU without further locality, *Graeffe 49*.

15. *Elaeocarpus melochioides* A. C. Sm. in Contr. U. S. Nat. Herb. 30: 552. 1953.

A tree about 7 m. high, known from dense forest at 870–970 m. elevation.

TIPIFICATION: The type is *Smith 6092* (A HOLOTYPE; many ISOTYPES), collected Sept. 18, 1947, on the northern portion of the Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

16. *Elaeocarpus kambi* Gibbs in J. Linn. Soc. Bot. 39: 142. pl. 13, fig. 11–13. 1909; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 555. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972. FIGURE 97A.

A stately tree 26–30 m. high, with a spreading, rounded crown and a trunk at least 60 cm. in diameter, found in dense forest at elevations of 800–970 m. The flowers have

sepals greenish proximally and white distally, pure white petals and anthers, and greenish filaments. Flowers have been obtained in September and October and fruits in November.

TIPIFICATION: The type is *Gibbs 808* (BM HOLOTYPE; ISOTYPE at K), collected in October, 1907, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the vicinity of Nandarivatu, Viti Levu.

LOCAL NAME AND USE: *Kambi*; the fruit was noted as edible by Gibbs, but her collection bears only flowers.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Vicinity of Nandarivatu, *Gillespie 3863*; hills east of Nandala Creek, south of Nandarivatu, *Smith 5954*.

This beautiful and apparently rare tree may be more abundant in its limited area than it seems, as its crown is lost in the forest canopy; the species is morphologically isolated and without close relatives.

17. *Elaeocarpus milnei* Seem. Fl. Vit. 28. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890; A. C. Sm. in Contr. U. S. Nat. Herb. 30: 556. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 163. 1972; A. C. Sm. in Contr. U. S. Nat. Herb. 37: 79. 1967.

A tree 5-15 m. high, found in dense forest at elevations from near sea level to 600 m. The sepals are dull pink, the petals rich pink, with pale yellow apical laciniae. From the few available collections, flowers have been noted in September (and perhaps August) and fruits in January.

TIPIFICATION: The holotype is *Milne 81* (K), noted on the specimen as from "Nisana, by the margin of stream in the forest."

DISTRIBUTION: Endemic to Fiji and probably limited to Viti Levu. My speculation in 1953 as to "Nisana" being in the present Province of Nandronga & Navosa was certainly inaccurate; at that time I had seen only the type specimen, but now two other collections are available, both from Namosi Province. In view of this, it seems probable that the type also was obtained in the forested southeastern portion of Viti Levu. Milne and Macdonald (1857; cf. Vol. 1 of this *Flora*, pp. 43, 86), during their trip into the interior of Viti Levu, ascended the Waindina River as far as Namosi, which was their base from August 28 to September 3, 1856. I do not find "Nisana" mentioned by either Milne or Macdonald, but it seems likely that the locality was in the Waindina Valley.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8731*; Wainandoi River, *DA 13809*.

The final six species of *Elaeocarpus* in the present treatment are characterized by having comparatively small flowers and elongate racemes, large leaf blades, and a fruit with a somewhat fibrous endocarp (as contrasted with the bony endocarp of *E. chelonimorphus* and its close allies).

FIGURE 97. A, *Elaeocarpus kambi*, flower with 2 sepals, 2 petals, and 4 stamens removed, $\times 6$. B-D, *Elaeocarpus chionanthus*; B, lower surface of basal part of leaf blade, $\times 2$; C, distal portion of raceme and detached flowers, $\times 1$; D, flower with 1 sepal, 2 petals, and 5 stamens removed, $\times 6$. E, *Elaeocarpus xanthodactylus*, distal portion of branchlet and inflorescences, $\times 1/3$. A from *Smith 5954*, B-D from *Smith 9495*, E from *Smith 6471*.



18. *Elaeocarpus chionanthus* A. C. Sm. in Contr. U. S. Nat. Herb. **37**: 79. 1967; J. W. Parham, Pl. Fiji Isl. ed. 2. 162. 1972. FIGURE 97B-D.

A slender tree to 8 m. high, known from dense forest at an elevation of 50–150 m. The flowers have the petals and filaments pale green, becoming pure white, the anthers yellow, and the gynoecium pale green.

TYPIFICATION: The type is *Smith 9495* (US 2191946 and 2191947 HOLOTYPE; many ISOTYPES), collected Dec. 7, 1953, in hills west of Waivunu Creek, between Ngaloa and Korovou, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

19. *Elaeocarpus roseiflorus* A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 559. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 163. 1972.

Elaeocarpus milnei sensu A. C. Sm. in Bishop Mus. Bull. **141**: 95. 1936; non Seem.

A spreading tree about 10 m. high, found in dense forest along a stream at an elevation of about 700 m. The petals are rich pink, whitish distally.

TYPIFICATION: The type is *Smith 670* (NY HOLOTYPE; many ISOTYPES), collected Nov. 29, 1933, on the southwestern slope of Mt. Mbatini, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

The species is very distinct from *Elaeocarpus milnei*, with which I at first confused it, in having its racemes and pedicels conspicuously elongate and with a tomentellous indument, its petal laciniae more numerous, and its leaf blades rounded rather than gradually narrowed proximally.

20. *Elaeocarpus graeffei* Seem. in J. Bot. **2**: 76. 1864, Fl. Vit. **28**. t. 8. 1865; Drake, Ill. Fl. Ins. Pac. 126. 1890; A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 561. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972.

A sometimes spreading tree 7–25 m. high, occurring at elevations from near sea level to 610 m. in dense forest, sometimes along creeks, or on forested forehills. The petals are noted as white; the fruit is borne on branchlets below the leaves. Flowers have been obtained between January and April, fruits between March and June.

TYPIFICATION: The type is *Graeffe 59* or *s. n.* (BM HOLOTYPE; ISOTYPE at K), collected on Viti Levu without further data. There are two specimens at BM, one without number and the other indicated as 59, which seem to be parts of the same collection and may be taken together as the holotype.

DISTRIBUTION: Fiji and Tonga; in Fiji the species is thus far known definitely only from Viti Levu and Kambara. The Tongan records are recent, the species now having been collected on 'Eua by both W. R. Sykes and G. P. Buelow.

LOCAL NAMES AND USES: On Viti Levu the names *tambandamu*, *mindri*, and *ndrivi* have been recorded; on Kambara *vathea*. The species is considered a useful timber tree, and one informant noted that an extract from leaves boiled in water is used for stomach ailments.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1096*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4447*; vicinity of Rararua, Nanggalitala Creek, drainage of Singatoka River, *DA 14722*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15603, 15634*; Agricultural Station, Singatoka River, *DA 15102*; vicinity of Singatoka, *DA 3206, 3210, 3211*. RA: Hills near Penang, *Greenwood 751*; Tuvaluatu, between Rewasa and Nokonoko, *Degener 15369a*. NAITASIRI: Waivau Creek, between Viria and Muamua, *DA 490*. TAILEVU: Without further locality, *DA 11824*. KAMBARA: On limestone formation, *Smith 1266*. FIJI without further locality, *Horne 15, s. n., DA s. n.*

Elaeocarpus graeffei and the two following taxa form a group of three species, readily distinguished from one another, differing from *E. milnei* and its more immediate relatives in their slender branchlets, smaller and fewer-nerved leaf blades, and longer-awned anthers.

21. *Elaeocarpus degenerianus* A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 564. 1953; J. W. Parham, Pl. Fiji Isl. 114. 1964, ed. 2. 162. 1972.

A presumably large forest tree, found at elevations of 750–1,000 m.

TIPIFICATION: The type is *Gillespie 4285* (BISH HOLOTYPE; ISOTYPES at GH, US), collected Dec. 13, 1927, in flower and fruit, on the slopes of Mt. Nanggarambuluta, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and apparently rare, known only from the vicinity of Nandarivatu, Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: Mba: Vicinity of Nauwanga, south of Nandarivatu, *Degener 14527*.

22. *Elaeocarpus xanthodactylus* A. C. Sm. in Contr. U. S. Nat. Herb. **30**: 566. 1953; J. W. Parham, Pl. Fiji Isl. 116. 1964, ed. 2. 163. 1972. FIGURE 97E.

A tree 4–12 m. high, occurring in dense forest on ridges at elevations of 300–590 m. The petals are at first greenish yellow, becoming rich pink with yellowish lobes, and the stamens are pale yellow; the fruits are reddish green, probably becoming brown at full maturity. Flowers have been obtained in November, fruits in July and November.

TIPIFICATION: The type is *Smith 6471* (A HOLOTYPE; many ISOTYPES), collected Nov. 3, 1947, on the summit ridge of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Vanua Levu and Moala. In 1953 I expressed hesitation in referring *Smith 6555*, a fruiting collection from essentially the type locality, to this species. With further study, however, my doubts are removed; the Moala specimen, not cited in 1953, has essentially similar fruits and leaves even more closely resembling those of the type.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Summit of southwestern ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6555*. MOALA: Summit ridge, *Bryan 345*.

FAMILY 87. TILIACEAE

TILIACEAE Juss. Gen. Pl. 289. 1789.

Trees or shrubs, rarely herbs, with paired stipules, the indument, when present, of branched or stellate hairs; leaves alternate (spirally arranged or distichous), rarely opposite, simple, the blades often asymmetrical; inflorescences axillary, leaf-opposed, or terminal, basically cymose, usually racemiform, paniculiform, or umbelliform, rarely composed of few or solitary flowers; flowers hermaphrodite (rarely unisexual, the plants then monoecious), actinomorphic, usually 5-merous, occasionally with an epicalyx; receptacle sometimes raised into an androgynophore; sepals (3–) 5, free or proximally connate, usually valvate, the calyx sometimes accre.cent; petals usually 5 (3–6), imbricate or contorted, infrequently valvate, often glandular at base, rarely absent; stamens (5–) 10–numerous, usually free, sometimes basally connate or in 5–10 fascicles, sometimes partly staminodial, the anthers dorsifixed (rarely basifixed), 2-celled, longitudinally dehiscent or with apical pores; ovary superior (very rarely inferior but not in our genera), 2–10-locular (rarely incompletely so), the ovules 1–many per locule, anatropous, usually ascending, the placentation axile, rarely

parietal, the style 1, the stigma punctiform, capitate, or lobed, rarely sessile; fruit a berry or a drupe (with 1-several pyrenes) or a loculicidally or septicidally dehiscent capsule or a schizocarp with indehiscent mericarps, the seeds 1-many, winged or not, sometimes pilose, the endosperm copious to scanty, the embryo usually straight.

DISTRIBUTION: Pantropical and subtropical, to a lesser extent temperate, with 45-55 genera. Estimates of the number of species vary between about 500 and 1,000. Seven genera of Tiliaceae are known to occur in Fiji, six of them with indigenous species.

USEFUL TREATMENTS OF FAMILY: Burret, M. Beiträge zur Kenntnis der Tiliaceen. Notizbl. Bot. Gart. Berlin 9: 592-880. 1926. Hutchinson, J. Tiliaceae. Gen. Fl. Pl. 2: 473-497. 1967.

KEY TO GENERA

- Sepals free to base or nearly so; anthers with the locules not apically contiguous, each dehiscing by a separate cleft; fruit not winged.
- Stamens inserted on receptacle adjacent to petals; androgynophore none or inconspicuous; petals not pitted or glandular within the base.
- Fruit a capsule with numerous seeds; style short.
- Capsule dehiscing by lateral slits, loculicidally valved, unarmed, siliquiform to ellipsoid (rarely globose and slightly muricate); ovules numerous in 2 series affixed at central angle; stipules lanceolate-filiform. 1. *Corchorus*
- Capsule much compressed contrary to septum, loculicidally dehiscent apically, the seeds ciliate at margin with densely radiating hairs; ovules 25-50 per locule, several often juxtaposed on each side of placenta; stipules often oblique and connate. 2. *Trichospermum*
- Fruit a berry, the seeds immersed in pulp; stigma sessile; stipules unequal, one filiform-subulate, the other reduced; leaf blades unequal-sided. 3. *Muntingia*
- Stamens inserted on a somewhat elevated androgynophore; petals pitted or glandular within the base; fruit indehiscent or at length breaking into mericarps.
- Fruit a drupe, indehiscent, lobed or not; ovules 2-8 per locule, affixed in 2 series.
- Style dilated at apex, the stigma broadened, peltate-lobed or penicillate; gynoeceum (1-)2-4-locular; fruits somewhat lobed. 4. *Grewia*
- Style narrowed distally, the stigma punctiform or with small, inconspicuous lobes; gynoeceum 3- or 4- or incompletely 2-locular; fruits not lobed. 5. *Microcos*
- Fruit subglobose to broadly ellipsoid, sometimes breaking into mericarps, aculeate, echinate, or setose with often hooked bristles; locules of gynoeceum with 2 juxtaposed ovules; sepals usually corniculate distally. 6. *Triumfetta*
- Sepals united into a 3-5-lobed, campanulate calyx; anthers short, the locules apically contiguous and divergent proximally, dehiscing by a contiguous cleft; gynoeceum 3-5-locular, the ovules 2-6 per locule; fruit a loculicidally dehiscent capsule, the valves bialate. 7. *Berrya*

1. **CORCHORUS** L. Sp. Pl. 529. 1753; Burret in Notizbl. Bot. Gart. Berlin 9: 864. 1926.

Herbs or shrubs, often annuals, the stipules lanceolate-filiform; leaves alternate, the blades herbaceous, crenate-serrate; inflorescences axillary or leaf-opposed, cymose or fasciculate, with 1-6 flowers; flowers ♂, 4- or 5-merous; sepals free, oblong-lanceolate, mucronate, subcucullate, essentially glabrous; petals about as long as sepals, spatulate, short-clawed, yellow; stamens (5-) numerous, glabrous, the filaments filiform, the anthers dorsifixed, laterally dehiscent; ovary (2-) 3-6-locular, pilose, the ovules numerous in each locule, the style short, terete, glabrous, the stigma lobed, fimbriate; fruit a loculicidally dehiscent 3-6-valved capsule, erect, linear to subglobose, sometimes with transverse partitions, the seeds numerous, exalate, angular.

LECTOTYPE SPECIES: *Corchorus olitorius* L. (vide M. L. Green, Prop. Brit. Bot. 162. 1929), one of Linnaeus's original four species.

DISTRIBUTION: Pantropical and subtropical, probably with 60-100 species, two of which yield commercially important fibers. Two species occur in Fiji, one indigenous and the other cultivated and naturalized.

KEY TO SPECIES

- Leaf blades ovate-lanceolate, 3-16 (-20) × 1.5-6 (-7) cm., glabrate, the lowest marginal teeth produced into subulate lobes, the petioles usually 1-5 cm. long; fruit a beaked, 10-costate, 5-locular, linear capsule 3-10 cm. long and 0.4-0.8 cm. broad, with smooth surfaces, the seeds separated by transverse septa; cultivated and naturalized. 1. *C. olitorius*
- Leaf blades obovate, 1-4.5 × 0.7-3 cm., crenate-serrate distally, narrowly obtuse and without subulate lobes at base, copiously stellate-pubescent beneath, the petioles 0.3-1 cm. long; fruit a cylindrical-ellipsoid, 4- or 5-locular capsule up to 2.5 × 1 cm., copiously stellate-pubescent and tuberculate, without transverse septa; indigenous. 2. *C. torresianus*

1. *Corchorus olitorius* L. Sp. Pl. 529. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 161. 1972.

Corchorus trilocularis sensu A. C. Sm. in Bishop Mus. Bull. 141: 96. 1936; Greenwood in Proc. Linn. Soc. 154: 95. 1943; J. W. Parham in Dept. Agr. Fiji Bull. 35: 62. 1959; J. W. Parham, Pl. Fiji Isl. 113. 1964, ed. 2. 162. 1972; non L.

A sparsely cultivated subliguous herb 0.3-2 m. high, also found near sea level as a naturalized weed along roadsides, in waste places, and in cultivated fields. Flowering specimens are not available, but the yellow petals are 6-8 mm. long; fruiting specimens have been obtained between February and May.

TYPIFICATION: Linnaeus cites several prior references and indicates: "*Habitat in Asia, Africa, America.*"

DISTRIBUTION: Indigenous in Asia and Africa, but now pantropical in cultivation and as a weed.

LOCAL NAMES AND USES: One of the species that yields *jute*, *Corchorus olitorius* is also known in various areas as *tossa jute*, *Jew's mallow*, and *melokhia*. The soft bast fibers, retted from the stems, provide a textile fiber widely used for twine, coarse cloth, burlap bags, paper-making, etc. In some areas the young growth is eaten as a green vegetable. A useful account of *Corchorus* as a fiber plant is provided by Purseglove, Trop. Crops, Dicot. 613-619. 1968.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 251*; Saweni Beach, Lautoka, *DA 11763, 17353*; Tavakumbu, Lautoka, *DA 10715*.

The species is reported as common in the vicinity of Lautoka and Nandi but has not been observed elsewhere in Fiji. Greenwood first noted it in 1921 or 1922; whether it was introduced as a potential fiber plant or as a vegetable is not indicated. The record of *Corchorus trilocularis* is based on a misidentification; that species, typified by a Forsskål collection from Arabia, has a more slender, 3-valved capsule, and small flowers in comparison with *C. olitorius*.

2. *Corchorus torresianus* Gaud. Voy. Uranie et Physicienne, Freycinet, Bot. 477. 1830;

A. C. Sm. in Bishop Mus. Bull. 141: 95. 1936; Yuncker in op. cit. 220: 179. 1959; J. W. Parham, Pl. Fiji Isl. 113. 1964, ed. 2. 162. 1972; Fosberg in Micronesica 2: 147. 1966.

Corchorus torresianus var. *yunckeri* Fosberg in Micronesica 2: 147. 1966.

A compact shrub 0.3-2 m. high, occurring near sea level on beaches, rocky islets, and limestone cliffs, and sometimes in coconut plantations. Its petals are yellow and its fruits grayish brown. Flowers have been noted in July and fruits between July and February.

TYPIFICATION: The type was obtained on Rota, Mariana Islands, presumably by Gaudichaud (P) during the voyage of *l'Uranie* and *la Physicienne* (1817-1820). Variety *yunckeri* is typified by *Yuncker 15985* (BISH HOLOTYPE), from Lifuka, Tonga.

DISTRIBUTION: The species has a scattered distribution from the Mariana and Caroline Islands to New Caledonia and eastward through Fiji and Tonga to the Tuamotus. It is frequently associated with limestone and in Fiji is known only from the Lau Group.

AVAILABLE COLLECTIONS: YATHATA: Naveranavula, *DA 15541*; without further locality, *DA 13621*. NAYAU: On beach, *Tothill 48*. FULANGA: On limestone formation, *Smith 1227*. ONGEA NDRIKI: On an isolated rocky islet, *Bryan 393*.

2. *TRICHOSPERMUM* Bl. Bijdr. Fl. Ned. Ind. 56. 1825; Seem. Fl. Vit. 27. 1865; Burret in Notizbl. Bot. Gart. Berlin 9: 846. 1926.

Diclidocarpus A. Gray in Proc. Amer. Acad. Arts 3: 48. 1853, Bot. U. S. Expl. Exped. 1: 200. 1854. *Graeffea* Seem. in J. Bot. 2: 71, nom. nud. 1864, Fl. Vit. 27. 1865.

Trees with stellate indument, the stipules obvious and persistent, often oblique and connate, or inconspicuous and caducous; leaves distichous, the blades coriaceous to chartaceous, finely serrate or crenulate, 3- or 5-nerved at base, with a glandular thickening on each side of base at apex of petiole; inflorescences axillary and terminal, umbellately cymose, often long-pedunculate, the ultimate cymules subtended by a whorl of bracts, the pedicels sometimes bracteolate below calyx; sepals 5, free; petals 5, imbricate, sometimes nectariferous at base, often smaller than sepals; stamens numerous, free, borne on a crenate disk or on a subconical receptacle, glabrous, the anthers dorsifixed, suborbicular or oblong; ovary 1-3-locular, densely pilose, the ovules numerous in each locule, biseriate, the style 2- or 3-branched; fruit a capsule compressed contrary to septum, 2-celled and loculicidally dehiscent apically (rarely 3-celled, but not in our species), the valves persistently united proximally, the seeds numerous in each locule, compressed, densely ciliate at margin, convex and glabrous on one surface, flattened and sometimes comate on the other.

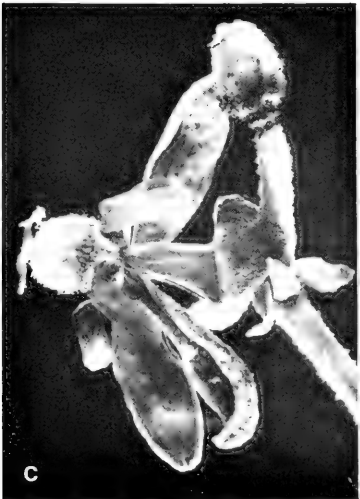
TYPE SPECIES AND NOMENCLATURE: The type species of *Trichospermum* is *T. javanicum* Bl. *Diclidocarpus* is typified by *D. richii* A. Gray, first published as part of a descriptio generico-specifica; *Graeffea* is based on *G. calyculata* Seem., the only species. It was early recognized that no significant characters distinguish the three concepts.

DISTRIBUTION: Indo-Malesia and into the Pacific as far as Samoa, and tropical America, with 20-25 species. Two indigenous species occur in Fiji, one being endemic.

KEY TO SPECIES

Branchlets often conspicuously flattened distally (but sometimes subterete), often 6-15 mm. broad, usually flexuose; stipules obvious, broader than long, often long-persistent, conspicuously oblique, subcupuliform, connate at least on one margin, 10-25 mm. broad, the scars usually confluent opposite petiole; petioles 2-7 cm. long; leaf blades comparatively large, 15-45 × 8-25 cm.; inflorescence in full anthesis and fruit (12-) 15-25 cm. long; cymule-subtending bracts 2-3 mm. long; petals 1-1.5 mm. broad; style branches about 2 mm. long; fruits slightly broader than long, 10-17 × 12-20 (-25) mm., the seeds 1.5-2 mm. long, copiously ciliate at margin but glabrous on both surfaces. 1. *T. calyculatum*

FIGURE 98. *Trichospermum calyculatum*; A, distal portion of branchlet, with foliage and infructescences, × 1/3; B, branchlet, showing stipules, × 2; C, cymule of 2 flowers, showing subtending bracts and 1 complete flower, the other flower with the perianth caducous, × 4; D, seeds, with marginal cilia, both surfaces glabrous, × 10. A & D from *Parks 20368*, B & C from *Smith 7021*.



Branchlets subterete, 2-5 mm. in diameter, straight or inconspicuously flexuose; stipules comparatively inconspicuous and often early caducous, usually longer than broad, slightly oblique, free, 5-12 mm. broad, the scars not or scarcely confluent opposite petiole; petioles 1-4.5 cm. long; leaf blades smaller, 7-21 × 3.5-13 cm.; inflorescence in full anthesis and fruit 4-12 cm. long; cymule-subtending bracts 3-9 mm. long; petals 1.5-3 mm. broad; style branches about 1 mm. long; fruits obviously broader than long, 15-35 × 20-40 mm., the seeds 2-2.5 mm. long, copiously ciliate at margin and comate on the flattened surface. 2. *T. richii*

1. ***Trichospermum calyculatum*** (Seem.) Burret in Notizbl. Bot. Gart. Berlin 9: 848. 1926; Gillespie in Bishop Mus. Bull. 91: 19, fig. 21. 1932; J. W. Parham, Pl. Fiji Isl. 116, fig. 49. 1964, ed. 2. 165. 1972. FIGURE 98.

Graeffea calyculata Seem. in J. Bot. 2: 71, nom. nud. 1864, Fl. Vit. 27. t. 6. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890.

Macaranga maudsleyi Horne, A Year in Fiji, 264, nom. nud. 1881.

Macaranga maudsleyi Horne ex Baker in J. Linn. Soc. Bot. 20: 371, nom. nud. 1883; Pax in Pflanzenr. 63 (IV. 147. VII): 394, nom. nud. 1914; A. C. Sm. in J. Arnold Arb. 33: 390, nom. nud. 1952.

Trichospermum microcarpum Burret in Notizbl. Bot. Gart. Berlin 15: 94. 1940; J. W. Parham, Pl. Fiji Isl. 116. 1964, ed. 2. 165. 1972.

A tree 2-16 m. high, with a trunk up to 60 cm. in diameter, found from near sea level to an elevation of 520 m. in dense forest or on its edges, sometimes being locally frequent. Its sepals are dull purplish without and whitish within, its petals pale purple to nearly white, and its ovary is yellowish. Flowers and fruits may be expected throughout the year.

TYPEFIICATION AND NOMENCLATURE: The holotype of *Graeffea calyculata* is *Graeffea s. n.* (MEL), collected on Viti Levu without further locality or date. Although the large stipules are characteristic of the species, Gillespie (1932, cited above) correctly indicates that Seemann's artist exaggerated them; the inflorescence bracts are also shown as too conspicuous. The source of the name *Macaranga maudsleyi* (*maudsleyi*) is *Horne 679* (κ), collected between Suva and Kalambo, Naitasiri or Rewa Province, Viti Levu. In 1952 (cited above) I had not located this specimen at κ, but it is now available and clearly represents *Trichospermum calyculatum*. *Trichospermum microcarpum* was based on *St. John 18193*, collected in fruit on Aug. 3, 1937, near Matawailevu, Wainamo Creek, Wainimala River Valley, Naitasiri Province, Viti Levu. Unfortunately all the material of this number was sent by the Bishop Museum to Berlin for study by Burret, who doubtless intended to return the holotype and duplicates to BISH; however, it seems that all the material was destroyed. Consequently Burret's description may serve as the type; fortunately the description is adequate to tie the name to the "large" Fijian species of the genus, with obvious, oblique stipules and a comparatively small fruit. It should be noted that Burret did not see any collections of *T. calyculatum*, although he made the correct combination; therefore he may have been misled by Seemann's illustration, which at any rate does not show the fruit.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu; I have studied 27 collections of the species.

LOCAL NAMES AND USES: *Mako* (a generic name), *makou*, *makaloo*, *makuiloi*. The species is considered a useful timber tree, providing a good case timber; its bark is sometimes used to tie rafters in house construction.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: North of Komave, *St. John 18956*. SERUA: Vicinity of Nambukelevu, upper Navua River, *Berry 93*; Waimbale, near Namboutini, *Degener 15482*; inland from Korovisilou, *DF 735*; Tumburua, inland from Ngaloa, *DF 907*; hills east of Navua River, near Nukusere, *Smith 9081*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8811*; vicinity of Nakavu, Navua River, *Parks 20368*; hills near Navua River, *Greenwood 1035*. RA OR NAITASIRI: Between Nukulau and Nasonggo, *Howard 312*. NAITASIRI: Waindrandra Creek, *DA 652*; Waimanu River,

DA L. 13277 (Berry 42); vicinity of Nasinu, *Gillespie 3514*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7021*; Wainivesi River, *DA 13649*. REWA: "Vicinity of Suva," *Tothill 498a*, *Meebold 16429*.

2. *Trichospermum richii* (A. Gray) Seem. in *Bonplandia* 9: 254, as *T. ritchei*. 1861, in op. cit. 10: 295. 1862, Viti, 433. 1862, Fl. Vit. 27. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890; Gibbs in J. Linn. Soc. Bot. 39: 142. 1909; Burret in *Notizbl. Bot. Gart. Berlin* 9: 849. 1926; Christophersen in *Bishop Mus. Bull.* 128: 140. 1935; Yuncker in op. cit. 184: 49. 1945; J. W. Parham, *Pl. Fiji Isl.* 116. 1964, ed. 2. 165. *fig. 50*. 1972. FIGURES 99, 100A.

Diclidocarpus richii A. Gray in *Proc. Amer. Acad. Arts* 3: 49. 1853, *Bot. U. S. Expl. Exped.* 1: 200. 1854, *Atlas, pl. 14*. 1856, in *Proc. Amer. Acad. Arts* 5: 315. 1862.

Trichospermum sp. A. C. Sm. in *Bishop Mus. Bull.* 141: 96. 1936.

Trichospermum cf. *richii* Burret in *Notizbl. Bot. Gart. Berlin* 15: 94. 1940.

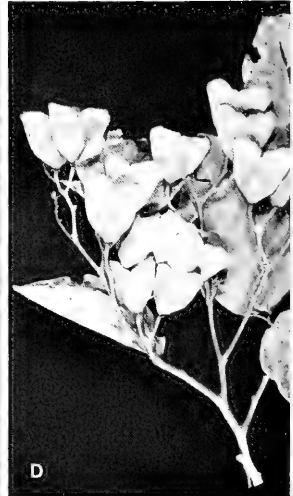
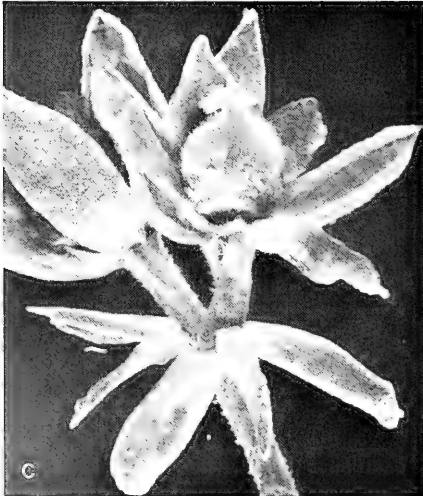
A slender or spreading tree 4–25 m. high, with a trunk to 60 cm. (or more?) in diameter, occurring from near sea level to an elevation of 900 m. in dense or open forest or on its edges, in crest forest, or in thickets in grassland, often locally common. Its sepals are pale green without and white or greenish white within, its petals and filaments greenish white to white or yellowish, and its anthers yellow. Flowers and fruits occur abundantly throughout the year.

TYPIFICATION AND NOMENCLATURE: The holotype is *U. S. Expl. Exped.* (us 13492), collected in 1840 and presumably a mixture from two localities, the island of Ovalau and Mbua Bay, Mbua Province, Vanua Levu; it is not now possible to separate the two parts. My 1936 reference was to *Smith 406*, and Burret's 1940 reference was to *St. John 18182*; the first of these is clearly referable to *Trichospermum richii*. All the material of *St. John 18182* seems to have been destroyed, but from Burret's remarks I have no doubt that *T. richii* is the correct place for it.

DISTRIBUTION: Fiji and Samoa. Burret also attributed the species to Yap, Caroline Islands, but I find no reason for such an identification. The genus seems to be lacking from Tonga and Niue. The abundance of this species in Fiji is suggested by the availability of more than 100 collections from several of the high islands.

LOCAL NAMES AND USE: Recorded names are *mako*, *maku*, *mata*, and *ndravindravi*; one record of the use of *masimasi* I consider very questionable. The species is usually considered a useful timber tree, especially as a case wood, but other foresters have indicated that the wood is light and brittle.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 237*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4272*; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4515*; Vovono Creek, *DA 14719*; vicinity of Nandarivatu, *Gibbs 643*. NANDRONGA & NAVOSA: Nausori Highlands, *DA L.13476* (*DF 1163*); northern portion of Rairaimatuku Plateau, *Smith 5663*. SERUA: Inland from Namboutini, *Damanu R.13*; inland from Ngaloa, *DF 844* (*S1423/4*); Taunovo River, *DA L.13474* (*DF 987*). NAMOSE: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8764*; vicinity of Namosi, *Milne 71*; Nambukavesi Creek, *DA L.13673* (*Howard 2*). NAITASIRI: Between Viria and Muamua, *DA 205*; Prince's Road, *Vaughan 3331*; Suva Pumping Station, *Degener & Ordonez 13743*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7178*; Mburetu, Navuloa River, *Storck 870*. REWA: West of Veisari River, *Vaughan 3303*; Mt. Korombamba, *Gillespie 2227*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 72*; vicinity of Naikorokoro, *DF 845* (*S1423/1*). OVALAU: Valley of Mbureta and Lovoni Rivers, *Smith 7509*; Port Kinnaird, *Seemann 41*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7766*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1526*; Thongea, Wainunu River, *DA 15763*. MATHUATA: Naravuka, Ndreketi River, *DF 996* (*S1423/5*); Sarava, near Lambasa, *DF 843* (*S1423/3*). THAKAUNDROVE: Above Naingganggi, Nasavu Creek, *DA 15707*; hills west of Korotasere, Natewa Bay, *Smith 1924*. TAVEUNI: Nggeleni Creek, *DA L.24152*; Mt. Manuka, east of Wairiki, *Smith 782*.



3. *Muntingia* L. Sp. Pl. 509. 1753.

Trees or shrubs, with unequal, paired stipules, one of these filiform-subulate, the other reduced; indument composed of stellate hairs; leaves distichous, the blades unequal-sided, serrate; inflorescences supra-axillary, composed of 1-few clustered flowers; flowers ♀, 5-merous; sepals connate at base, acuminate; petals crumpled in bud, obovate, short-clawed, caducous; disk cupuliform, pilose; stamens numerous, inserted on disk, the anthers rounded, dorsifixed, dehiscent by longitudinal clefts; ovary surrounded by glandular hairs, short-stipitate, 5-7-locular, the ovules many in each locule, the stigma sessile, thick, sulcate-lobed; fruit a 5-7-locular berry, the seeds many, immersed in pulp.

TYPE SPECIES: *Muntingia calabura* L., the only original species.

DISTRIBUTION: Tropical America, with two or three species.

Muntingia is sometimes referred to the Elaeocarpaceae (cf. Burret, 1926, cited above under the family, p. 868; Schultze-Motel in Melchior, Engl. Syll. Pflanzenfam. ed. 12. 2: 306. 1964), but Coode (in *Brunonia* 1: 134. 1978) mentions characters indicating that it is correctly placed in the Tiliaceae. Its stellate indument also supports this placement. Hutchinson (1967, cited above under the family, p. 485) places it in the tribe Tiliaeae.

1. *Muntingia calabura* L. Sp. Pl. 509. 1753; St. John & A. C. Sm. in *Pacific Sci.* 25: 333. 1971; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 165. 1972.

An infrequently cultivated tree or shrub 3-12 m. high, grown near sea level. Where native its trunk attains a diameter of about 15 cm. It is readily recognized by its soft-pilose branchlets and leaves, the blades of which are strongly unequal-sided, 5-10 × 2-3.5 cm., and acuminate; the petals are white or pink-tinged, the stamens yellow, and the fruit is a globose red or yellowish berry 8-12 mm. in diameter.

TYPIFICATION: Linnaeus cites several prior references, indicating: "*Habitat in Jamaica.*" An asterisk suggests that the specimen described in Hort. Cliffort. 203. 1738 may provide the best lectotype.

DISTRIBUTION: Tropical America, widely cultivated and sometimes naturalized elsewhere, as on Uvea (St. John and Smith, 1971, cited above). In Fiji it is known from a single, presumably cultivated collection, but it is doubtless more frequent than this suggests.

NATIVE NAMES AND USES: Although none have been recorded in Fiji, the usual names are *capulin*, *Panama berry*, and *Japanese cherry*. The berry is sweet and edible, the bark fiber may be used to make rope and twine, and sometimes the species is regarded as an ornamental shade tree.

AVAILABLE COLLECTION: FIJI without further locality, DA 3921.

FIGURE 99. *Trichospermum richii*: A, distal portion of branchlet, with foliage and inflorescences, × 1/3; B, branchlet, showing stipules, glandular thickenings at base of leaf blade, and portion of inflorescence, × 2; C, cymule of 2 flowers (with pedicel scar of third), 1 flower with 2 sepals and 1 petal removed, × 4; D, distal portion of branchlet, with foliage and infructescences, × 1/3. A-C from Smith 1924, D from DF 1163.

4. *Grewia* L. Sp. Pl. 964. 1753; Seem. Fl. Vit. 26. 1865; Burret in Notizbl. Bot. Gart. Berlin 9: 632. 1926.

Malloccoca J. R. & G. Forst. Char. Gen. Pl. 39. 1775, ed. 2. 77. 1776.

Trees or shrubs (infrequently climbers, but not our species), with stellate indument, the stipules entire or divided; leaves alternate, the blades usually serrate-dentate, 3-7-nerved from base; inflorescences axillary, leaf-opposed, or terminal, cymose, often paniculiform; flowers ♂ (rarely unisexual); sepals 5, free; petals 5, often shorter than sepals, foveolate or glandular within at base with numerous small papillae; receptacle elevated into an androgynophore, this frequently glandular; stamens numerous, borne at apex of androgynophore, the anthers dorsifixed, curved, longitudinally dehiscent; ovary (1-) 2-4-locular, the ovules 2-6 (-8) per locule, biseriate, the style subulate, the stigma broadened, peltate-lobed or penicillate; fruit drupaceous, 2-4-lobed, the pyrenes 2-4, each with 1-several exalate seeds and spuriously septate between seeds.

LECTOTYPE SPECIES AND NOMENCLATURE: The lectotype species of *Grewia* is *G. occidentalis* L. (vide M. L. Green, Prop. Brit. Bot. 186. 1929), one of Linnaeus's two original species. The type species of *Malloccoca* is *M. crenata* J. R. & G. Forst., the only original species (= *Grewia crenata* (J. R. & G. Forst.) Schinz & Guillaumin). The identity of the two generic concepts was early recognized.

DISTRIBUTION: Africa to Indo-Malesia and into the Pacific as far as the Society Islands, with about 150 species. Two species occur in Fiji, one of them being endemic.

KEY TO SPECIES

Leaf blades persistently soft-pilose on both surfaces but especially so beneath (hairs stellate, with obvious spreading rays 0.3-0.5 mm. long), ovate- or elliptic-oblong, 7-22 × 4-12.5 cm., broadly obtuse to cordate at base. 1. *G. vitiensis*
 Leaf blades soon glabrate, or sometimes subpersistently but sparsely pilose on nerves beneath with minute stellate hairs or a few subappressed simple hairs, lanceolate to ovate, 4-18 × 2-9 cm., obtuse to rounded or subcordate at base. 2. *G. crenata*

1. *Grewia vitiensis* Turrill in J. Linn. Soc. Bot. 43: 18. 1915; Burret in Notizbl. Bot. Gart. Berlin 9: 724. 1926; J. W. Parham, Pl. Fiji Isl. 116. 1964, ed. 2. 165. 1972.

A tree 4-11 m. high, occurring in dense or open forest at elevations of 100-900 m.; its flowers have yellowish or greenish sepals. Flowers and fruits have been obtained between November and May.

TYPIFICATION: The type is *im Thurn 279* (K HOLOTYPE; ISOTYPE at BM), collected Nov. 24, 1906, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known with certainty only from the western half of Viti Levu.

LOCAL NAMES AND USE: *Siti* (a generic name), *nithi*, and *risisa* have been reported; the bark and leaves are said to be used medicinally.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Northern portion of Mt. Evans Range, between Mt. Vatuyani and Mt. Natondra, *Smith 4274*; vicinity of Nandarivatu, *Degener 14305*; vicinity of Rararua, Nanggalitala Creek, Singatoka River basin, *DA 14723*. NANDRONGA & NAVOSA: Singatoka River Valley, about 53 km. northeast of Singatoka, *Webster & Hildreth 14378*; vicinity of Tonuve (Ruwailevu Tikina), *H. B. R. Parham 160, 161*; Nokonoko district (Singatoka Tikina), *H. B. R. Parham 219*; vicinity of Mbalo, near Vatukarasa, *Degener 15221, 15242*. SERUA: Vicinity of Navutulevu, *DA 13754 (DF 237)*, *Bola 85, DA L.13608 (DF 296, Damanu 24)*. RA: Vicinity of Nasukamai, *Gillespie 4691.2*. FIJI without further locality, *Horne s. n.*

2. *Grewia crenata* (J. R. & G. Forst.) Schinz & Guillaumin in Sarasin & Roux, Nova Caledonia Bot. 179. 1921; Setchell in Carnegie Inst. Wash. Publ. 341: 72. 1924; Burret in Notizbl. Bot. Gart. Berlin 9: 668, 870. 1926; Christophersen in Bishop

Mus. Bull. **128**: 141. 1935; Yuncker in op. cit. **178**: 80. 1943, in op. cit. **184**: 50. 1945, in op. cit. **220**: 179. 1959; J. W. Parham, Pl. Fiji Isl. **116**. 1964, ed. 2. 163. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 206. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 31, 70. 1972; St. John in Phytologia **36**: 369. 1977.

Mallocalocca crenata J. R. & G. Forst. Char. Gen. Pl. 39. t. 39. 1775, ed. 2. 78. t. 39. 1776.

Grewia mallocalocca L. f. Suppl. Pl. 409, as *G. mallocalocca*, nom. illeg. 1781; Forst. f. Fl. Ins. Austr. Prodr. 62. 1786; A. Gray, Bot. U. S. Expl. Exped. **1**: 197. 1854; Seem. in Bonplandia **9**: 254. 1861; A. Gray in op. cit. **10**: 34. 1862, in Proc. Amer. Acad. Arts **5**: 315. 1862; Seem. Viti, 433. 1862, Fl. Vit. 26. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 125. 1890; Guillaumin in J. Arnold Arb. **12**: 231. 1931.

Grewia persicaefolia A. Gray, Bot. U. S. Expl. Exped. **1**: 198. 1854; Seem. Viti, 433. 1862, Fl. Vit. 26. 1865; Drake Ill. Fl. Ins. Mar. Pac. 125. 1890; J. W. Parham, Pl. Fiji Isl. **116**. 1964, ed. 2. 164. 1972.

Grewia prunifolia A. Gray, Bot. U. S. Expl. Exped. **1**: 199. 1854; Seem. in Bonplandia **9**: 254. 1861, Viti, 433. 1862, Fl. Vit. 26. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 125. 1890; Burret in Notizbl. Bot. Gart. Berlin **9**: 727. 1926; Yuncker in Bishop Mus. Bull. **220**: 180. 1959; J. W. Parham, Pl. Fiji Isl. **116**. 1964, ed. 2. 165. 1972.

Grewia persicifolia A. Gray ex Burret in Notizbl. Bot. Gart. Berlin **9**: 686. 1926.

A tree or shrub 2–12 m. high, often slender or with dense foliage, occurring from near sea level to an elevation of 1,120 m. in dense, dry, open, or secondary forest, or in patches of forest in open country, or on open hillsides. This frequently common species has its sepals green without and white to greenish white within, its petals and filaments white to pale greenish yellow, its anthers yellow, its gynoecium green, and its fruits black at maturity. It may be seen in flower and fruit throughout the year.

TYPIFICATION AND NOMENCLATURE: There are several specimens at BM from Tahiti collected by Banks and Solander or by "Forster," but only one is indicated as collected by J. R. and G. Forster. This specimen, herewith designated as the lectotype, is pencilled: "*Grewia mallocalocca* Lin. fil. Suppl. p. 409!" The younger Linnaeus's binomial is illegitimate, since it is based on *Mallocalocca crenata*. Although the correct combination was made in 1921, both Setchell (in 1924) and Burret (in 1926) overlooked this and indicated their combinations as new. *Grewia persicaefolia* is typified by *U. S. Expl. Exped.*, collected on Ovalau in 1840; I have not found a specimen so labelled at US (although one may later be found there), but isotypes are at GH and K. The type of *Grewia prunifolia* is *U. S. Expl. Exped.* (US 13263 HOLOTYPE; ISOTYPES at GH, K), obtained in 1840 and indicated by Gray as from "Ovalau and Mathuata." The first of Gray's two taxa has lanceolate, comparatively narrow leaf blades, in form matched here and there throughout the range of *G. crenata*. The type collection of *G. prunifolia* has smaller leaf blades, rounded or subcordate at base and proportionately broad; this collection is very similar to material from the Society Islands. It is evident that no isolating mechanisms have yet been effective in segregating populations of *G. crenata*, in which flower and fruit characters are reasonably consistent.

DISTRIBUTION: New Hebrides and New Caledonia eastward to the Society Islands; the species is sometimes also accredited to the Mariana and Caroline Islands, but such material requires reconsideration by a specialist. In Fiji *Grewia crenata* is an abundant species, to be anticipated on most islands; although certainly indigenous, it sometimes gives the impression of being a pioneer "weed tree." I have examined more than 100 collections from Fiji.

LOCAL NAMES AND USES: *Siti* is the commonly used name (*siji* in parts of Lau); other reported names are *sitisiti*, *nithe*, *vauvau*, and *mboko ni ngata*, the last probably a jocose name. The crushed leaves are said to have medicinal properties, reported as used to control yaws and also as an internal remedy for sprains.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Nakawa Gulch, west of Mbatinaremba, *St. John 18150*. MAMANUTHAS: NGGALITO Island, Malolo Group, *O. & I. Degener 32209*. VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 369*; west of Tavua, *O. & I. Degener 32090*; vicinity of Nandarivatu, *Parks 20677*; Mt. Tomanivi, *DA 12768 (Melville et al. 7160)*. NANDRONGA & NAVOSA: Nausori Highlands, *O. & I. Degener 32174*; Thuvu, west of Singatoka, *Greenwood 926*. SERUA: Flat coastal strip near Ngaloa, *Smith 9689*. NAITASIRE: Waindina Valley, *Tohill 36* (coll. *MacDaniels*). TAILEVU: Naingani Island, *DA 3344*; vicinity of Londoni, *DA 14421*. REWA: Hills near Lami, *Gillespie 4578*; between Nukui and Mataisuva Point, *DA 2578*. OVALAU: Hills east of Lovoni Valley, *Smith 7338*; vicinity of Levuka, *Parks 20484*. WAKAYA: *Tohill 37a*. KORO: Eastern slope of main ridge, *Smith 935*. NGAU: Shore of Herald Bay, near Sawaieke, *Smith 7910*. VANUA LEVU: MBUA: Vicinity of Nasau, Rukuruku Bay, *H. B. R. Parham 9*. MATHUATA: *Seemann 40*; Nambekavu Island, Ndreketi River, *DA 16954*; Seanggangga Plateau, vicinity of Natua, *Smith 6706*; Undu Point, *Tohill 39a*. THAKAUNDOVE: Between Mbalanga and Valethi, *Degener & Ordonez 14053*; Navonu Creek, Natewa Peninsula, *DA 15063*. TAVEUNI: Somosomo, *Seemann 39* (on K label but indicated as Ovalau in Fl. Vit.); western slope between Somosomo and Wairiki, *Smith 722*. MOALA: Near Naro, *Smith 1305*. YATHATA: Naveranavula, *DA 15545*. VANUA MBALAVU: Near Limestone formation, *Garnock-Jones 1047*. LAKEMBA: Tumbou Valley, *Garnock-Jones 860*. KAMBARA: On limestone formation, *Smith 1236*. FULANGA: *Tohill 39*.

5. *MICROCOS* L. Sp. Pl. 514. 1753; Burret in Notizbl. Bot. Gart. Berlin 9: 756. 1926; A.

C. Sm. in J. Arnold Arb. 36: 283. 1955.

Trees or shrubs, with stellate indument; leaves alternate, the blades entire or shallowly crenate, often 3-nerved at base; inflorescences axillary and terminal or borne on defoliate branchlets, cymose, paniculiform; flowers ♂, short-pedicellate, sometimes with involucre bracteoles; sepals and petals 5 (petals sometimes lacking, but present in our species); receptacle elevated into an androgynophore; stamens 5-many; ovary usually 3-locular, sometimes 4-locular or incompletely 2-locular, the ovules 2-8 per locule, biseriate, the style narrowed distally, the stigma punctiform or inconspicuously lobed; fruit drupaceous, globose to pyriform, not lobed, the mesocarp fibrous, the endocarp hard, the seeds exalate.

LECTOTYPE SPECIES: *Microcos paniculata* L. (vide M. L. Green, Prop. Brit. Bot. 161. 1929), one of Linnaeus's two original species.

DISTRIBUTION: Africa to southeastern Asia and Malesia, with 50-75 species, and with an endemic Fijian species terminating the generic range.

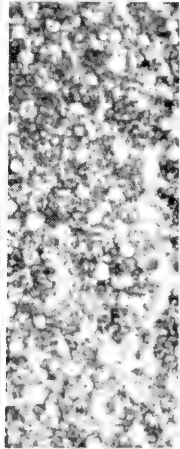
To combine *Microcos* with *Grewia*, as suggested by Hutchinson (1967, cited above under the family, p. 487) seems unjustified; other authors find the stigmatic and fruit characters adequately differentiating.

1. *Microcos vitiensis* A. C. Sm. in Bishop Mus. Bull. 141: 96. fig. 50. 1936, in J. Arnold Arb. 31: 304. 1950, in op. cit. 36: 283. 1955; J. W. Parham, Pl. Fiji Isl. 116. 1964, ed. 2. 165. 1972.

FIGURE 100B & C.

A sometimes slender tree 3-18 m. high, occurring in dense forest at elevations of 150-900 m. Its sepals, petals, and filaments are greenish white, its anthers yellow, and its fruits at length bright orange or orange-yellow, globose or ovoid and up to 4 cm. in diameter. Flowers have been obtained between September and February, fruits between July and December.

FIGURE 100. A, *Trichospermum richii*, seeds, with marginal cilia and the flattened surface (above) comate, $\times 10$. B & C, *Microcos vitiensis*; B, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$; C, flower with 1 sepal and 2 petals removed, showing androgynophore (a) with 2 filaments bent back from its apex, a petal (p), and the inconspicuously 3-lobed stigma (s), $\times 10$. D, *Berrya pacifica*, portion of lower surface of leaf blade, showing copious glands, $\times 30$. A from *DF 1163*, B from *DA 14004*, C from *Smith 6166*, D from *DA 13897*.



TYPEIFICATION: The type is *Smith 759* (BISH HOLOTYPE; many ISOTYPES), collected Dec. 14, 1933, on the western slope of Taveuni between Somosomo and Wairiki.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Taveuni.

LOCAL NAME: *Sama* (noted for *Smith 8129* and probably erroneous, as the name is in widespread use for *Commersonia bartramia*, Sterculiaceae).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu to Lewa, *Smith 6166*. SERUA: Nathengathenga Creek, upper Navua River, *DF 978*; inland from Namboutini, *DA 14004*; inland from Ngaloa, *DA 14103*, *DF 869*. TAVEUNI: Vicinity of Nggeleni, *DA 14399*, *15867*; track to lake east of Somosomo, *DA 14067*; vicinity of Waiyevo, *Gillespie 4700*; vicinity of Wairiki, *Gillespie 4619*; slopes of Mt. Manuka, east of Wairiki, *Smith 8129*.

Except for the Fijian endemic, *Microcos* appears to be unrecorded east of New Guinea and the Bismarck Archipelago. Our species is apparently most closely related to the New Guinean *M. ledermannii* Burret and *M. schlechteri* Burret.

6. TRIUMFETTA L. Sp. Pl. 444. 1753; Seem. Fl. Vit. 26. 1865; Burret in Notizbl. Bot. Gart. Berlin 9: 861. 1926.

Herbs or shrubs, with stellate indument; leaves alternate, the blades entire or 3-7-lobed, serrate-crenate or dentate; inflorescences extra-axillary or leaf-opposed, spiciform or fasciculate-cymulose; flowers ♂; sepals 5, free, cucullate and usually corniculate distally; petals 5 (sometimes lacking), yellow, pitted or glandular-thickened within at base; receptacle elevated into a 5-glandular androgynophore; stamens free, usually numerous, sometimes as few as 10, the filaments filiform, the anthers dorsifixed, longitudinally dehiscent; ovary tuberculate or setose, 2-5-locular, each locule with 2 juxtaposed ovules, the stigma filiform, glabrous, the stigma dentate or short-branched; fruit a dehiscent or indehiscent, dry, 2-5-valved capsule, subglobose to broadly ellipsoid, sometimes breaking into mericarps, aculeate, echinate, or setose with often hooked bristles, the seeds exalate.

TYPE SPECIES: *Triumfetta lappula* L., the only original species.

DISTRIBUTION: Pantropical and subtropical, with about 150 species. Two species occur in Fiji, one indigenous and the other a troublesome weed.

KEY TO SPECIES

- Shrubby, suberect plant to 2 m. high; petioles to 10 cm. long; leaf blades variable in size and shape, often broadly ovate or rhomboid, 2-10 × 1.5-7 cm., rounded to broadly obtuse at base, sometimes 3- or 5-lobed, the apex and lobes acute to acuminate; flowers about 5 mm. long; fruits 4-6 mm. in diameter, densely tomentose and also covered with nearly glabrous, hooked bristles. 1. *T. rhomboidea*
- Prostrate plant, with long, trailing branches to 3 m. long; petioles to 6 cm. long; leaf blades subsorbicular to broadly ovate, 1.5-6 cm. long and nearly as broad, rounded to cordate at base, sometimes inconspicuously 3-lobed, the apex and lobes rounded to obtuse; flowers about 10 mm. long; fruits 6-12 mm. in diameter, soft-spiny with pubescent bristles. 2. *T. procumbens*

1. *Triumfetta rhomboidea* Jacq. Enum. Syst. Pl. Carib. 22. 1760; J. W. Parham in Dept. Agr. Fiji Bull. 35: 62. fig. 24. 1959, Pl. Fiji Isl. 116. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 206. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 74, 80. 1972.

Bartramia indica L. Sp. Pl. 389. 1753; non *Triumfetta indica* Lam. (1792).

Triumfetta bartramia L. Syst. Nat. ed. 10. 1044, nom. illeg. 1759; Merr. Interpret. Rumph. Herb. Amb. 354. 1917; Christophersen in Bishop Mus. Bull. 128: 141. 1935; Yuncker in op. cit. 178: 80. 1943; Greenwood in Proc. Linn. Soc. 154: 95. 1943; Yuncker in Bishop Mus. Bull. 184: 50. 1945, in op. cit. 220: 180. 1959; J. W. Parham, Pl. Fiji Isl. ed. 2. 165. 1972.

A shrub or subligneous herb 0.3-2 m. high, found from near sea level to an elevation of 600 m. as an abundant weed along roads and trails, in clearings, waste

places, thickets, and canefields, and on open hillsides. Its sepals are yellow or becoming reddish, its petals are yellow or orange-tinged, its stamens are yellow, and its fruits are brown, with hooked bristles that readily become attached to animals and clothing. Flowers and fruits are found throughout the year.

TYPIIFICATION AND NOMENCLATURE: The earliest binomial, *Bartramia indica*, is probably best lectotypified by the plant described in Fl. Zeyl. 174. 1747. However, the epithet cannot be used in *Triumfetta* because *T. indica* Lam. (1792) is a different taxon and precludes the use of *indica* in *Triumfetta* for the Linnaean concept. *Triumfetta bartramia* is illegitimate because the epithet *indica* should have been utilized by Linnaeus at that time. The earliest available binomial seems to be *T. rhomboidea*, for which Jacquin gave no type information; presumably the type was a West Indian plant, the species having early spread throughout the tropics.

DISTRIBUTION: Now a pantropical weed, the species was presumably indigenous in the Old World tropics. How far to the east it was indigenous remains problematical; in Fiji no collectors earlier than Greenwood seem to have obtained it, and therefore one may assume that it was a fairly recent rather than an aboriginal introduction. About 55 Fijian collections are at hand.

LOCAL NAMES: *Nggatima* or *nggatima ni valalangi* (the latter indicating nonindigeness); also used are the names *Chinese burr* and *Hibiscus burr*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Lautoka, *Greenwood 136*; Nandi, *DA 10289*; Nalotawa, eastern base of Mt. Evans Range, *Smith 4111*; Tonge, Mba River, *DA 10432*; Vatia Point, *DA 2815*. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Webster & Hildreth 14308*; Keiyasi, Singatoka River, *DA 10166*; Korolevu Bay, *DA 2878*. SERUA: Coastal strip near Ngaloa, *Smith 9614*. RA: Ellington, *DA 7911*; Ndombulevu, *DA 9530*. TAILEVU: Queen Victoria School Farm, *DA 7746*. REWA: Suva, *H. B. R. Parham 117*. KANDAVU: Between Taulaula and Ndavinggele, *DA 2947*; Namalata isthmus region, *Smith 189*. YANUTHA LEVU (south of Ovalau): *DA 8984*. VANUA LEVU: MBUA: Ndama, *DA 1098*. MATHUATA: Raranimbumbulu, *DA 10506*. THAKAUNDROVE: Savusavu, *DA 9111*. TOTOYA: Waroka, *DA 13242*. VANUA MBALAVU: Lomaloma Botanical Gardens, *DA 10205*; southern limestone section, *Smith 1427*. KATAFANGA: *Bryan 542*. THITHIA: Nasolo, *DA 13254*. LAKEMBA: Near Tumbou Village, *Garnock-Jones 918*.

2. ***Triumfetta procumbens*** Forst. f. Fl. Ins. Austr. Prodr. 35. 1786; A. Gray, Bot. U. S. Expl. Exped. 1: 197. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, in J. Bot. 2: 71. 1864, Fl. Vit. 26. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 124. 1890; Christophersen in Bishop Mus. Bull. 128: 141. 1935; Greenwood in Proc. Linn. Soc. 154: 95. 1943; Yuncker in Bishop Mus. Bull. 178: 81. 1943, in op. cit. 184: 50. 1945, in op. cit. 220: 180. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 63. fig. 25. 1959, Pl. Fiji Isl. 116. 1964, ed. 2. 165. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 206. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 333. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 37, 65, 75, 80. 1972.

A low shrub, spreading or sprawling, with prostrate stems 2–3 m. long, occurring near sea level on beaches and in coastal forest on sandy soil. Its sepals, petals, and stamens are yellow, or the petals may be orange-yellow. Flowers have been collected between March and June, fruits between May and October.

TYPIIFICATION: The lectotype may be taken as *G. Forster* (BM), from the Society Islands, indicated (on reverse) as "G. Forster's Herbarium" and (on front) as "204. *Triumfetta procumbens*."

DISTRIBUTION: Micronesia and eastern Malesia eastward to the Tuamotu Islands, sometimes considered to extend westward to the Seychelles, western Malesia, and the

Ryukyus (but the western plant may be *T. repens* (Bl.) Merr. & Rolfe).

LOCAL NAME: *Wa loa* (recorded only for *Smith 310*).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 272*. SERUA: Ndeumba Beach, *DA 13196*; Navua Beach, *Vaughan 3440*; Waimate Beach, Navua, *DA 10119*. KANDAVU: Western end of island, near Cape Washington, *Smith 310*; without further locality, *Tothill 47, 47a*. OVALAU: *U. S. Expl. Exped. TAVEUNI: Somosomo, Seemann 38*. THITHIA: Silia Yalewa, *DA 13258*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 785*.

7. BERRYA Roxb. Hort. Beng. 42, as *Berria*, nom. nud. 1814, Pl. Coromandel 3: 60, as *Berria*. 1820; corr. DC. Prodr. 1: 517. 1824; Burret in Notizbl. Bot. Gart. Berlin 9: 605. 1926; A. C. Sm. in J. Arnold Arb. 36: 283. 1955. Nom. et orth. cons.

Trees, with small, caducous stipules, the indument stellate; leaves alternate, the blades entire or palmately 3-7-lobed, often cordate at base, minutely glandular at least beneath, obscurely stellate-pilose in nerve axils; inflorescences axillary and terminal, copiously paniculate; flowers ♂, the perianth and stamens persistent, marcescent; calyx campanulate to cupuliform, 3-5-lobed or irregularly splitting, glabrous within; petals usually 4 or 5, white to pink; receptacle usually elevated into an androgynophore; stamens numerous, glabrous, the filaments filiform, free or short-connate proximally, the anthers dorsifixed, subglobose, with locules apically contiguous and dehiscent by a lengthwise, continuous cleft; ovary copiously pubescent, 3-5-locular, the ovules 2-6 per locule, the style subulate; fruit a loculicidally dehiscent, 3-5-valved capsule, the valves longitudinally winged along each edge, the wings vertical, divergent, the locules with 1-4 seeds, these exalate, setose, the style caducous.

TYPE SPECIES: *Berrya ammonilla* Roxb. (= *B. cordifolia* (Willd.) Burret).

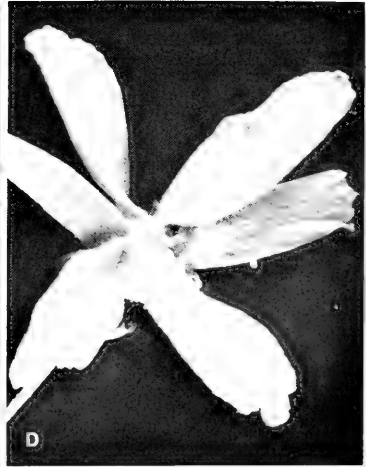
DISTRIBUTION: Southeastern Asia and Malesia to New Caledonia, with five or six species and with an outlying Fijian endemic terminating the range. In indicating *Berrya* to occur in the Society Islands, van Balgooy (in *Blumea Suppl.* 6: 199. 1971) was doubtless alluding to *Tahitia vescoana* (Baill.) Burret, originally referred to *Berrya* by Baillon.

Although combination of *Berrya* and the Afro-American genus *Carpodiptera* Griseb. has been suggested, this seems entirely unwarranted (cf. Burret, 1926, cited above, and Hutchinson, 1967, cited above under the family, p. 492).

KEY TO SPECIES

- Gynoecium 3-locular (rarely 4-locular); fruits with 3 carpidia and 6-alate (rarely with 4 carpidia and 8-alate), the wings 10-15 mm. broad; petioles usually 5-13 cm. long; leaf blades usually (15-) 18-26 × (11-) 15-20 cm. and deeply cordate at base, short-acuminate or cuspidate at apex, evanescently glandular on both surfaces, the glands beneath pale, peltate; style about 3 mm. long; cultivated species. 1. *B. cordifolia*
- Gynoecium usually 4- or 5-locular (rarely 3-locular); fruits usually with 4 or 5 carpidia and 8- or 10-alate (rarely with 3 carpidia and 6-alate), the wings 5-12 mm. broad; petioles 2.5-(-7.5) cm. long; leaf blades usually 10-15 (-23) × 6-9 (-15) cm., rounded to subcordate at base, slenderly and sharply acuminate at apex, glandular on both surfaces, the glands beneath profuse, castaneous, subglobose or flattened; style 4-5 mm. long; indigenous species. 2. *B. pacifica*

FIGURE 101. *Berrya pacifica*; A, distal portion of branchlet, with foliage and infructescence, × 1/3; B, stamen with dehiscent anther, × 50; C, proximal surface of fruit, showing persistent calyx and petals and a few stamens, × 2; D, distal surface of fruit, the style caducous, × 2. A from *Howard 121* (detached leaf from *DA 13897*), B-D from *Smith 4590*.



1. *Berrya cordifolia* (Willd.) Burret in Notizbl. Bot. Gart. Berlin **9**: 606. 1926; Hill in Bot. Mus. Leaflet **7**: 109. 1939; J. W. Parham, Pl. Fiji Isl. ed. 2. 161. 1972.

Espera cordifolia Willd. in Ges. Naturf. Freunde Berlin Neue Schriften **3**: 450. 1801.

Berrya ammonilla Roxb. Hort. Beng. **42**, as *Berrya a.*, nom. nud. 1814, Pl. Coromandel **3**: 60. *t.* 264, as *Berrya a.* 1820; Merr. Enum. Philipp. Fl. Pl. **3**: 22. 1923.

A sparsely cultivated tree, very large where indigenous, experimentally grown near sea level. One of the available Fijian collections was fruiting in March.

TYPEFICTION AND NOMENCLATURE: *Espera cordifolia* was based on a specimen from the vicinity of Jaffna, Ceylon; *Berrya ammonilla* on material from India. As indicated above, Burret first combined the two concepts.

DISTRIBUTION: Ceylon and Burma to Java, Borneo, Celebes, the Philippines, and islands off the Queensland coast. The species is grown elsewhere as an ornamental or timber tree but usually it does not flourish.

LOCAL NAMES AND USES: Known in the trade as *trincomali* or *trincomalee*, the tree produces a timber with dark red heartwood that is considered superior for its toughness, durability, and flexibility. It is used extensively for house- and boat-building and for tools.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Plant Introduction and Quarantine Station, Nanduloulou, DA 7402; Nasinu Experiment Station, DA 1568.

2. *Berrya pacifica* A. C. Sm. in J. Arnold Arb. **31**: 303. 1950, in op. cit. **36**: 283. 1955; J. W. Parham, Pl. Fiji Isl. **113**. 1964, ed. 2. 161. 1972. FIGURES 100D & 101.

A tree 12–25 m. high, with a trunk up to 50 cm. (or more?) in diameter, occurring in dense or open forest at elevations of 300–600 m. Its fruits are dull red or greenish and red-tinged. Flowers have been obtained in May and fruits in May and July.

TYPEFICTION: The type is *Smith 4590* (A HOLOTYPE; many ISOTYPES), collected May 29, 1947, on the southern slopes of the Nausori Highlands, in the drainage of Namosi Creek, above Tumbenasolo, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu and Vanua Levu, apparently being rare or at least infrequently collected.

LOCAL NAMES: *Tovau* (Nandronga & Navosa), *tivi vula* (Thakaundrove).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, DA 13897 (coll. I. T. Kuruvoli), 17106 (coll. T. Bulai). VANUA LEVU: THAKAUNDOVE: North of Ndakunimba, in drainage of Wailoaloa Creek, southeastern portion of Natewa Peninsula, Howard 121.

Berrya pacifica represents an interesting eastward discontinuity of the generic range. It is readily distinguished from the infrequently cultivated *B. cordifolia* by a combination of foliage, floral, and fruiting characters.

FAMILY 88. STERCULIACEAE

STERCULIACEAE Bartling, Ord. Nat. Pl. 255, 340. 1830.

Trees or shrubs (often soft-wooded) or suffrutescent, perennial (very rarely annual) herbs, the stipules free, often early caducous, the indument when present usually composed of stellate hairs; leaves alternate (spirally arranged or distichous), rarely subopposite, the petiole often pulvinate at apex, the blades simple or digitately lobed or foliolate; inflorescences usually axillary, sometimes borne on stems or branches, rarely terminal, basically cymose, the cymes variously aggregated, sometimes reduced to a single flower; flowers hermaphrodite or unisexual, actinomorphic (very rarely zygomorphic), sometimes showy, infrequently with an epicalyx of subtending bracteoles; receptacle sometimes forming an androgynophore; sepals usually

3-5, valvate, usually partially connate, less often free; petals 5 (sometimes lacking), imbricate or contorted, free or adnate to base of androecium, often persistent; androecium various, the stamens usually in 2 whorls, free or with filaments connate into a tube (androphore), sometimes partially staminodial, the anthers 2-locular, dehiscent longitudinally or rarely by terminal pores; ovary free, composed of 2-5 (rarely 10-12) united or free carpels or rarely reduced to 1 carpel, the ovules 2 or more (rarely 1) per carpel or ovary locule, anatropous, ascending or horizontal, the placentation axile, the style simple or lobed (styles rarely free to base); fruit usually dry, rarely fleshy, indehiscent or variously dehiscent, often a schizocarp, the carpels sometimes free in fruit and spreading, the seeds sometimes enveloped by pulp or with a short strophiole, sometimes winged, the endosperm copious to scanty, sometimes lacking, the embryo straight or curved, the cotyledons usually foliaceous.

DISTRIBUTION: Pantropical and subtropical, rarely extending into temperate regions, with 65-70 genera and probably more than 1,000 species. Fourteen genera are recorded from Fiji, eight of them represented by indigenous species, five known only in cultivation, and one (*Waltheria*) presumably adventive.

USEFUL TREATMENTS OF FAMILY: Royen, P. van. Sterculiaceae. Manual For. Trees Papua New Guinea 3: 1-39. 1964. Hutchinson, J. Sterculiaceae. Gen. Fl. Pl. 2: 497-522. 1967.

Hutchinson's 1967 treatment offers a sequence of tribes and genera that is here utilized. He recognizes eleven tribes, eight of which are represented in Fiji by either indigenous or introduced genera. In the following key the tribal names are indicated parenthetically, but of course the key statements refer only to the genera of our concern and hence do not adequately circumscribe the tribes.

KEY TO GENERA

Flowers hermaphrodite; petals present; carpels united (solitary in *Waltheria*); fruit a capsule (except in *Theobroma*).

Ovary sessile or subsessile on receptacle, an androgynophore not developed or very short; staminal tube very short or stamens free; flowers actinomorphic.

Petals flat, not cucullate or channelled.

Flowers with large and comparatively conspicuous petals.

Stamens 10-25, forming an androphore bearing at apex free filaments in 5 fascicles alternating with 5 ligulate staminodes; fruit a loculicidally dehiscent capsule (tribe Dombeyaeae).

Trees or shrubs; flowers aggregated into cymose or umbelliform inflorescences; petals persistent and more or less marcescent; ovules 2-4 per ovary locule; styles free or shortly united basally; seeds 1 or 2 per capsule locule. 1. *Dombeya*

Coarse herbs of swampy places; flowers solitary; petals falling off with androphore; ovules numerous; style filiform, the stigma subentire; seeds numerous. 2. *Pentapetes*

Stamens 5, opposite petals, the filaments connate proximally into a tube; ovules 1 or 2 per ovary locule (or carpel) (tribe Hermanniaeae).

Ovary 5-locular, the styles free or basally united; fruit a loculicidally or septicidally 5-valved capsule, each locule usually 1-seeded, the seeds sometimes alate. 3. *Melochia*

Ovary composed of a single carpel, the style excentric, clavate or penicillate; fruit a small, 2-valved, 1-seeded capsule, the seeds exalate. 4. *Waltheria*

Flowers with minute, scalelike petals; stamens 5, opposite and slightly shorter than petals, the filaments free from one another, the anthers with short, spreading locules; staminodes absent; ovary 5-locular, each locule with 1 ovule, the style short, entire; fruit copiously echinate with flaccid bristles (tribe Lasiopetalae). 5. *Pimia*

Petals cucullate or channelled; ovary 5-locular.

Fertile anthers 5, opposite petals, alternating with deltoid-lanceolate or 3-lobed staminodial lobes; petals broadly concave proximally, ligulate and channelled distally; ovules 2-6 per ovary locule; fruit a loculicidally 5-valved capsule, copiously echinate with soft, stellate-pilose bristles; inflorescences and infructescences associated with foliage (tribe Byttneriaeae). 6. *Commersonia*

Fertile anthers in fascicles of 2 or 3 opposite petals, alternating with 5 filiform to lanceolate staminodes; petals contracted proximally into a concave-cucullate claw (hood) concealing the anthers, produced distally into a spatulate blade; ovules many in each ovary locule; fruit essentially drupaceous, not echinate; inflorescences and infructescences mostly on main stem and branches (tribe Theobromaeae). 7. *Theobroma*

- Ovary borne on apex of a long, narrow androgynophore, 5-lobed, 5-locular; fertile stamens 1-3 borne on staminal tube between each 2 staminodial segments, the anther locules divergent; flowers slightly zygomorphic (tribe Helictereteae).
- Inflorescences axillary, usually composed of solitary or fasciculate-cymose flowers; calyx tubular or hypocrateriform, becoming circumscissile and marcescent around androgynophore, this in our species 3 cm. or more long; fertile stamens 1 or 2 in each sinus of staminal tube; ovules and seeds many; styles free or partially connate; fruit composed of separating mature carpels, these dehiscing along ventral suture, straight or spirally twisted (as in our species). 8. *Helicteres*
- Inflorescences terminal, large, paniculate; calyx deeply 5-partite, the lobes caducous; androgynophore less than 1 cm. long; fertile stamens 3 in each sinus of staminal tube; ovules 3 or 4 in each ovary locule, the seeds solitary in each locule or as few as 1 per capsule; style inconspicuously 5-lobed; fruit an inflated, 5-lobed, loculicidally 5-valved capsule. 9. *Kleinhovia*
- Flowers unisexual or hermaphrodite (and then often not functionally so); petals none; androgynophore often present, sometimes short or lacking; carpels free or coherent (sometimes with connate or coherent styles); fruit composed of free follicles or indehiscent carpels.
- Fruit composed of dehiscent follicles (tribe Sterculieae).
- Follicles of fruit woody or coriaceous, not dispersing with the seeds attached; leaf blades sometimes digitately foliolate.
- Seeds borne along margins of open follicles, free from the endocarp; radicle opposite the hilum; calyx lobes without scales. 10. *Sterculia*
- Seeds each half-enveloped by the honeycomblike compartments of the endocarp; radicle next to the hilum; calyx lobes each with a pilose scale near base. 11. *Brachychiton*
- Follicles of fruit membranous, papyraceous, or chartaceous, often with obvious veins, dehiscent long before maturity, dispersing with the seeds attached; leaf blades sometimes palmately lobed but not compound.
- Ovules 2 or more per carpel; calyx not persistent in fruit; follicles open at base, rounded dorsally and becoming flattened; seeds 2 or more per follicle, adhering to margins, not basal in follicles. 12. *Firmiana*
- Ovules 2 per carpel, collateral; calyx persistent in fruit; follicles pouch-shaped at base, with a dorsal, rudderlike keel; seed 1 per follicle, basal. 13. *Pterocymbium*
- Fruit composed of indehiscent carpels, these usually expanded into an oblique, flattened wing; leaf blades digitately foliolate or (as in our species) 1-foliolate and appearing simple but with the petiole pulvinate at apex; lower surface of leaflet blades often fimbriate-lepidote (tribe Tarriteae). 14. *Hertiera*

1. *DOMBEYA* Cav. *Monad. Classis Diss. 2: App. 1. 1786, 3: 121. 1787. Nom. cons.*

Trees or shrubs, with obvious stipules; leaves alternate, often crowded toward apices of branchlets, the blades entire or lobed, palmately nerved; inflorescences axillary or terminal, cymose or umbelliform, the bracteoles 3, caducous before anthesis; flowers ♂; calyx deeply 5-parted, the lobes becoming reflexed; petals 5, persistent, sometimes becoming subscariose; stamens forming an androphore bearing at apex 15-25 filaments in 5 fascicles alternating with 5 ligulate staminodes; ovary sessile, pilose, (2-) 5-locular, the ovules 2-4 per locule, the styles (2-) 5, free or shortly united basally; fruit a loculicidally dehiscent capsule with 1 or 2 seeds per locule.

TYPE SPECIES: *Dombeya palmata* Cav.

DISTRIBUTION: Africa, Madagascar, and Mascarene Islands, with more than 200 species, some of which are cultivated as ornamentals. One species is known to be cultivated in Fiji.

1. *Dombeya burgessiae* Gerr. ex Harvey & Sonder, *Fl. Cap. 2: 590. 1862; J. W. Parham, Pl. Fiji Isl. ed. 2. 166. 1972.*

An infrequently cultivated shrub 2-4 m. high, found near sea level. It bears attractive flowers, the large, rounded petals being white, pink toward their bases. The only available collection was flowering in July.

TIPIFICATION: The type was collected by W. T. Gerrard along the Klip River, South Africa; the species has also been cultivated in the Botanical Gardens in Durban.

DISTRIBUTION: South Africa.

USE: Like several other species of *Dombeya*, *D. burgessiae* is an ornamental garden plant. It may be a recent introduction into Fiji, the only collection at hand having been obtained in 1960.

AVAILABLE COLLECTION: VITI LEVU: REWA: Botanical Gardens, Suva, DA 12094.

2. **PENTAPETES** L. Sp. Pl. 698. 1753.

Coarse herbs of swampy places, often suffruticose, the stipules linear; leaves alternate, the blades of lower leaves ovate-oblong, those of distal leaves lanceolate-linear, crenate-dentate, often lobed; inflorescences composed of axillary, solitary (rarely paired) flowers, these ♂, the articulate pedicels bearing 2 or 3 soon caducous bracteoles; calyx deeply 5-partite, persistent, the lobes ovate-lanceolate; petals 5, obovate, adnate to androphore and falling off with it; androphore bearing 10–15 stamens in 5 fascicles alternating with 5 ligulate staminodes, the free parts of filaments short, the anthers extrorse; ovary sessile, 5-locular, the ovules numerous, the style filiform, the stigma subentire; fruit an ovoid-globose, loculicidally dehiscent capsule, the placentas plumose, often separating, the seeds many.

LECTOTYPE SPECIES: *Pentapetes phoenicea* L. (vide M. L. Green, Prop. Brit. Bot. 173. 1929), one of the three species originally referred to the genus by Linnaeus; the other two are now placed in *Pterospermum* Schreber.

DISTRIBUTION: Southeastern Asia and into Malesia, with a single species, this reported to have been in cultivation in Fiji.

1. **Pentapetes phoenicea** L. Sp. Pl. 698. 1753; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972.

A coarse, suffruticose herb 0.3–1.2 m. high, known in Fiji only from a reported introduction. Elsewhere, where indigenous or naturalized, it sometimes occurs in wet places such as the edge of rice fields. It has red petals, whitish at base, red staminodes, and yellow anthers; the seeds are black and covered with white protuberances.

TYPIFICATION: Several prior references are indicated by Linnaeus, with the statement: "*Habitat in India.*"

DISTRIBUTION: India, southeastern Asia, and into Malesia, now cultivated and naturalized elsewhere.

This species is here included because of its listing by Parham; it seems to have been introduced into Fiji by J. B. Thurston (cf. Vol. 1 of this *Flora*, p. 47). No Fijian collections are available and it is probable that the species has not persisted, although it may still occur in private gardens. It is perhaps an ornamental curiosity around garden pools, as the stems when submerged bear many thin roots.

3. **MELOCHIA** L. Sp. Pl. 674. 1753; Seem. Fl. Vit. 24. 1865; A. C. Sm. in J. Arnold Arb. 31: 305. 1950; Goldberg in Contr. U. S. Nat. Herb. 34: 207. 1967.

Trees, shrubs, or coarse herbs, the indument usually stellate and often copious on various parts, the stipules lanceolate to linear, acuminate or acute, usually not exceeding 10×4 mm., less frequently suborbicular; leaves alternate, the blades simple, crenate to serrate; inflorescences axillary, leaf-opposed, or terminal, glomerulate or cymose, the cymes often combined into corymbs, spikes, or panicles; flowers ♂, 5-merous, often dimorphic; calyx 5-dentate or 5-partite, the lobes valvate in aestivation, often red to yellow or brown, persistent, sometimes accrescent; petals 5, variously colored, usually obovate to oblanceolate, marcescent; stamens 5, opposite petals, the filaments connate proximally into a tube cohering to petal bases (filaments usually long in short-styled flowers, short in long-styled flowers), the anthers broad; staminodes absent or minute; ovary sessile or subsessile, 5-locular, rarely 6–8-locular, the ovules 2

per ovary locule, the styles filiform, free or basally united; fruit a loculicidally or septically 5(6-8)-valved capsule, each locule usually 1-seeded, the seeds brown to black, sometimes alate.

LECTOTYPE SPECIES: *Melochia pyramidata* L. (vide M. L. Green, Prop. Brit. Bot. 172. 1929) is indicated as the lectotype species by ING. However, Goldberg (1967, cited below, p. 211) takes *M. corchorifolia* L. as the lectotype species, since it was the only species referred to by Linnaeus in *Genera Plantarum*, ed. 5. 1754. Both species are among the five described by Linnaeus in 1753, but it would seem that Goldberg's lectotypification may be the better (cf. ICBN, Art. 13.4).

DISTRIBUTION: Pantropical and subtropical; Goldberg (1967, cited below) recognizes 54 species, and probably several have been more recently described. Eight species are known to occur in Fiji, seven of them indigenous (and endemic) and one a naturalized weed.

USEFUL TREATMENTS OF GENUS: Smith, A. C. *Melochia* L. J. Arnold Arb. 31: 305-313. 1950. Goldberg, A. The genus *Melochia* L. (Sterculiaceae). Contr. U. S. Nat. Herb. 34: 191-363. 1967.

The weedy species in Fiji belongs in sect. *Melochia* (cf. Goldberg, 1967, cited above, p. 279); all the indigenous Fijian species are members of sect. *Visenia* K. Schum. (cf. Goldberg, 1967, p. 218).

KEY TO SPECIES

Fruits first loculicidally dehiscent along dorsal suture, then along ventral suture, eventually also septical, falling apart at full maturity; sinuses between calyx lobes obtuse; seeds trigonal, not winged (sect. *Melochia*); our species a naturalized weed, to 2.5 m. high, the leaf blades ovate to lanceolate, usually 2-6 × 1-2.5 cm., the inflorescences subcapitate, congested, the petals usually white to pink.

1. *M. corchorifolia*

Fruits (in our species) loculicidally dehiscent along ventral suture and also along dorsal suture distally, not falling apart at full maturity; sinuses between calyx lobes acute; seeds (in our species) winged (sect. *Visenia*); indigenous species; trees or shrubs, with comparatively lax, corymbiform inflorescences.

Stipules suborbicular, 3-8 mm. long and broad; indument copious, with mixed small stellate hairs and larger, simple, often gland-tipped hairs; petioles 5-12 cm. long; leaf blades broadly ovate, 11-23 × 7-20 cm., cordate at base; petals yellow; capsules 7.5-8.5 × 6-7 mm.; seed 4-4.5 mm. long, the wing (2-2.2 mm. long) subequal in length to the nucellus. 2. *M. parhamii*

Stipules lanceolate or deltoid, longer than broad, not more than 2 mm. broad.

Petals yellow; indument of stellate hairs only, lacking glandular hairs.

Petioles of mature leaves 6-15 cm. long, the blades broadly ovate, 10-21 × 8-17 cm., cordate at base, often deeply so, essentially glabrous except for costa and secondaries beneath; capsules 7-9 × 7-7.5 mm.; seed 3-4 mm. long, the wing (0.5-2 mm. long) not exceeding the nucellus in length.

3. *M. vitiensis*

Petioles of mature leaves usually less than 5 cm. (rarely to 7 cm.) long; seed (not known for no. 6) at least 5 mm. long, the wing equalling or exceeding the nucellus in length.

Mature leaf blades ovate or oblong-ovate, 7-18 × 3-12 cm., obtuse to subcordate (rarely cordate) at base, the petioles 1-5 (-7) cm. long; calyx lobes 2-3 mm. long, acute.

Young branchlets and petioles sparsely stellate-pilose or puberulent; mature leaf blades subglabrate, usually obtuse to truncate-rounded (less often shallowly cordate) at base; pedicels at anthesis 3-7 mm. long; capsules 8-10 × 6-8 mm.; seed with a wing 2.5-3.5 mm. long.

4. *M. degeneriana*

Young branchlets and petioles copiously tomentellous; mature leaf blades persistently soft-stellate-pilose beneath, usually subcordate at base; pedicels at anthesis 1-4 mm. long; capsules 5-10 × 5.3-9.4 mm.; seed with a wing 3-3.5 mm. long. 5. *M. mollipila*

Mature leaf blades oblong- or elliptic-lanceolate, 5-8 × 1.1-2.5 cm., acute or obtuse at base, the petioles 0.3-2 cm. long; calyx lobes 3-3.5 mm. long, acuminate; capsules to 7 × 6 mm.

6. *M. grayana*

Petals pink.

Petioles of mature leaves 9-20 cm. long, the blades 17-25 × 14-22 cm., deeply cordate; inflorescences 17.5-26 cm. long, the peduncle 7-15 cm. long; calyx large, the lobes 5-7 mm. long; capsules about 8 × 8 mm.; seed with a wing about 2.5 mm. long; indument of stellate hairs only, lacking glandular hairs. 7. *M. longepetiolata*

Petioles of mature leaves 0.5–2 cm. long, the blades 7–9 × 5–7 cm., rounded or subcordate at base; inflorescences 3.5–7 cm. long, the peduncle 2–4 cm. long; calyx comparatively small, the lobes 2–3 mm. long; capsules 5–7.7 mm. long and broad; seed with a wing 1.2–1.7 mm. long; indument of pedicels and calyces composed of stellate hairs mixed with simple, several-celled, gland-tipped hairs. 8. *M. roseiflora*

1. **Melochia corchorifolia** L. Sp. Pl. 675. 1753; J. W. Parham in Dept. Agr. Fiji Bull. 35: 64. fig. 26. 1959, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. 34: 304. 1967.

A coarse herb or subshrub 0.3–2.5 m. high, sparingly naturalized on waste land and in cultivated areas near sea level. Its calyx is pale green, its petals usually white to pink (rarely yellow, purple, or violet), its filaments and styles white to yellow or green, and its anthers yellow. Its capsules at length become purplish or black and its seeds blackish brown. Flowers and fruits may be expected throughout the year.

TYPIFICATION: Linnaeus listed several prior references; Goldberg (1967, cited above) has indicated the type to be a Dillenius specimen (OXF).

DISTRIBUTION: Widespread in the Old World tropics and subtropics, now pantropical. Except for the Fijian occurrence, I have not noted any references to the species in the Pacific east of the Caroline Islands, Solomon Islands, and Queensland. As to the date of its introduction into Fiji, Parham (1959, cited above) indicates *DA 8678* (coll. J. T. Hall in Lambasa in 1954) as the earliest collection known to him, but there are two earlier *DA* numbers, cited below.

LOCAL NAMES: Recorded Hindi names are *bundaya*, *bundahia*, and *bundava*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Adi Cakobau School, Sawani, *DA 7237*. TAILEVU: Veisama, *DA 14442*. REWA: Department of Agriculture, Suva, grown from seeds derived from *DA 8678*. VANUA LEVU: MATHUATA: Lambasa and immediate vicinity, *DA 3129, 8678, 10511, 11482*.

2. **Melochia parhamii** A. C. Sm. in Pacific Sci. 23: 384. 1969; J. W. Parham, Pl. Fiji Isl. ed. 2. 168. 1972. FIGURE 102.

A shrub or small tree 1.5–3 m. high, known only from a forested ridge at 600–925 m. elevation. Flowers, with yellow petals, and fruits have been obtained only in August.

TYPIFICATION: The type is *DA 12790* (BISH HOLOTYPE; ISOTYPE AT SUVA), collected Aug. 21, 1962, on Mt. Ndelaikoro, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type locality; a second collection was obtained on the same date at the same locality.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 12833* (BISH, K, SUVA).

Both known collections were obtained by J. W. Parham. *Melochia parhamii* is very distinct from the other indigenous Fijian species, being sharply characterized by its suborbicular stipules and its copious indument of mixed stellate and simple, several-celled, glandular hairs. Its closest relative seems to be *M. umbellata* (Houtt.) Stapf (India to New Guinea), from which it is readily distinguished by its glandular indument, its yellow (rather than red or pink) petals, and its very different capsules and seeds, as noted in my first discussion.

3. **Melochia vitiensis** A. Gray, Bot. U. S. Expl. Exped. 1: 193. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 24. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 124. 1890; A. C. Sm. in J. Arnold Arb. 31: 306. 1950; J. W. Parham, Pl. Fiji

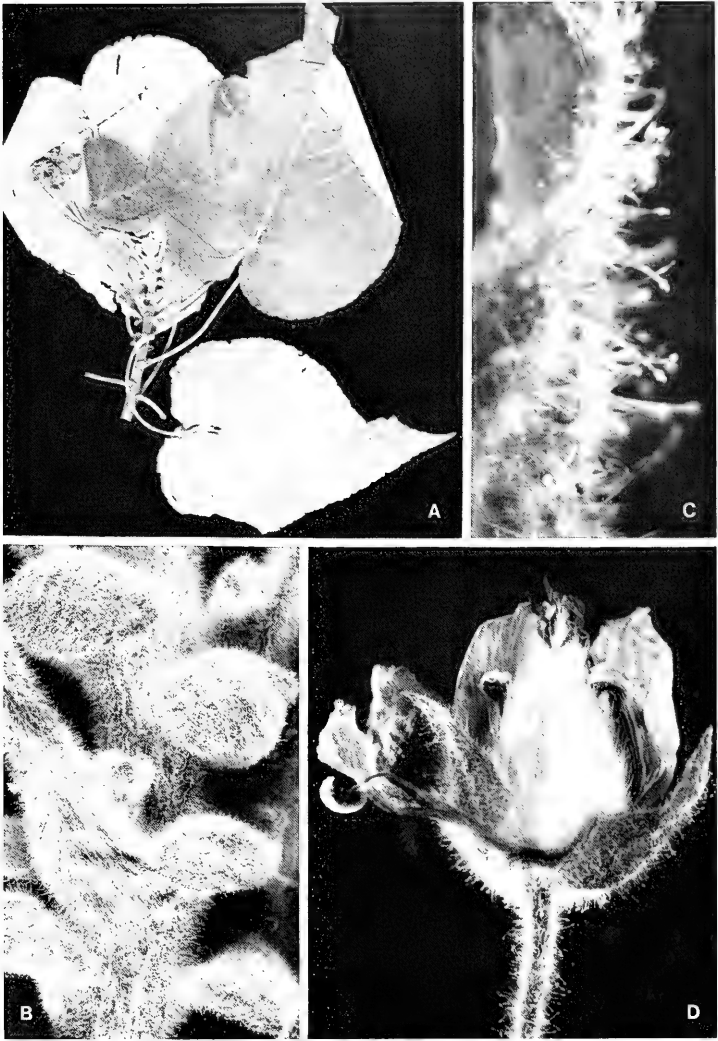


FIGURE 102. *Melochia parhamii*, from DA 12790; A, distal portion of branchlet, with foliage and inflorescence, $\times 1/4$; B, portion of branchlet with stipules, $\times 4$; C, indument of calyx, $\times 30$; D, flower, with 1 calyx lobe removed and 1 petal with attached stamen bent to left, $\times 6$.

Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. **34**:226. 1967.

FIGURE 103F.

A shrub or often spreading tree 1.5–12 m. high, occurring from near sea level to an elevation of 600 m. in thin forest or thickets or on grass-covered forehills. The sometimes fragrant flowers have a pinkish calyx; the petals are yellow, sometimes pale and nearly white and rarely with a faint pink tinge distally; the filaments and styles are pale yellow or greenish white; the anthers are bright yellow; and the capsules are brown. Flowers have been obtained in months from March to November, fruits between June and November.

TIPIFICATION: Gray described the species from U. S. Exploring Expedition material said to have been collected on Vanua Levu, Taveuni, Ovalau, and Oneata. At us there are three Exploring Expedition collections so identified by Gray, all without locality; in 1950 I indicated *U. S. Expl. Exped.* (US 13128), apparently the principal basis for the description, as the holotype, but it would better be considered the lectotype. Other *U. S. Expl. Exped.* specimens so identified at GH and K may not strictly be isolectotypes.

DISTRIBUTION: Endemic to Fiji and known from several islands (but not including Viti Levu); I have studied 30 collections in addition to the material seen by Gray. St. John (in *Phytologia* **36**: 369. 1977) has recorded *Melochia vitiensis* from Futuna, Horne Islands, on the basis of *Kirch 24* (BISH). This collection appears to me to represent *M. aristata* A. Gray, previously known from Samoa, Tonga, and the Society Islands. The two species (cf. Smith, 1950, pp. 305–307) are superficially very similar, but *M. aristata* has pink or red petals and an unwinged seed. In *M. vitiensis* the seed wing is apparent but small, usually narrowly deltoid and 0.5–2 mm. long. No flower color is noted for *Kirch 24*, but the seed is unwinged.

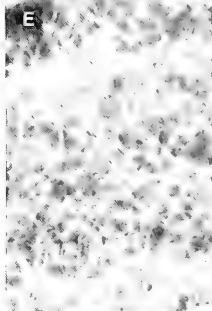
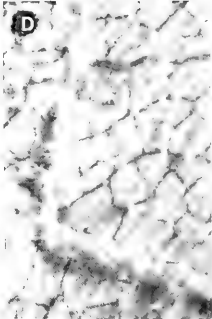
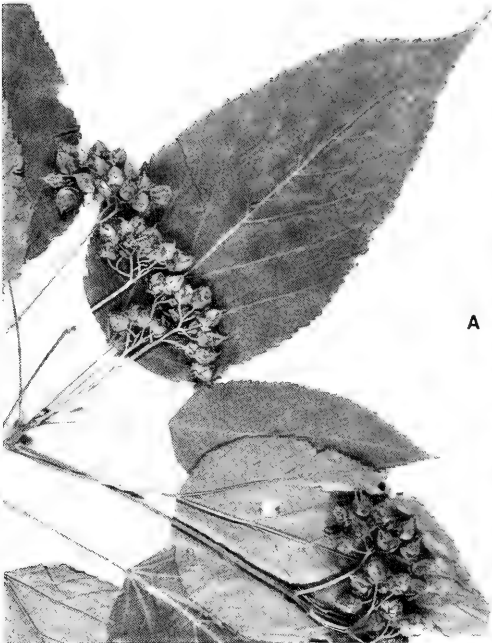
LOCAL NAMES AND USE: Recorded names are *iviloa*, *iviiviloa*, *evuevuloa*, *kuruloa*, *tanggalito*, *mbangalita*, and *sama*. On Ngamea the stem is part of an internal remedy for treating ulcers.

REPRESENTATIVE COLLECTIONS: WAKAYA: *Milne 385*. NGAU: *Milne 162*. VANUA LEVU: MBUA: Lower Wainunu River valley, *Smith 1727*. MATHUATA: Natua, Seanggangga Plateau, *DA 15339*; Mt. Numbuiloa, east of Lambasa, *Smith 6549*. THAKAUNDROVE: Nakoroutari, *DA 15230*; Wainigata Station, near Savusavu, *DA 12027*; Nakawanga, Nukumbolu Creek, *Gressitt 2487*. VANUA LEVU without further locality, *Seemann 37*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4701*; Mt. Manuka, east of Wairiki, *Smith 8178*. NGGAMEA: Naiiviivi Village, *Weiner 71-7-21B*. MATUKU: *Bryan 259*. TOTOYA: *Milne 91*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 988*. THIKOMBIA-I-LAU: *Tohill 32*. LAKE-MBA: Tumbou River valley, *Garnock-Jones 862*. KAMBARA: On limestone formation, *Smith 1301*. FULANGA: *Bryan 445*.

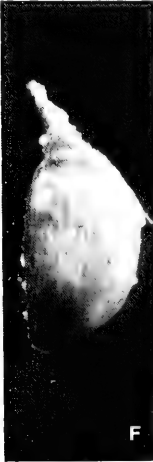
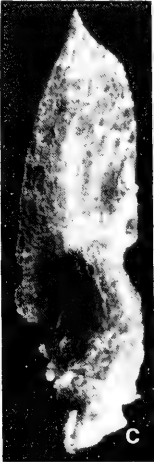
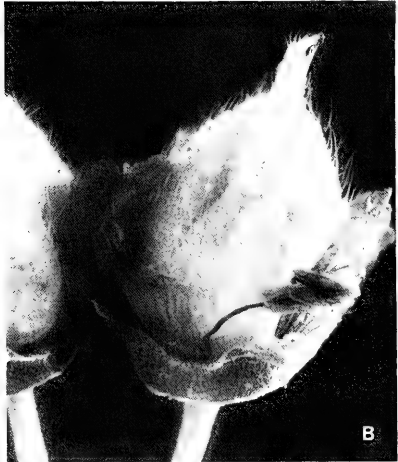
It may be noted that *Melochia vitiensis* occurs on Vanua Levu and many of the smaller islands to the south and east, whereas *M. degeneriana*, the only Fijian species with which it can be confused, is abundant on Viti Levu (also occurring infrequently in Loma-i-Viti and western Vanua Levu).

4. *Melochia degeneriana* A. C. Sm. in J. Arnold Arb. **31**: 307. 1950; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. **34**: 231. 1967. FIGURE 103A–D.

A sometimes slender tree 2–15 m. high, with a trunk up to 30 cm. in diameter, occurring at elevations from near sea level to 1,000 m. in dense, dry, or open forest or on its edges, in crest forest, and on reed-covered slopes. The calyx is pinkish, the petals and filaments pale yellow, fading to nearly white or cream-colored, and the anthers yellow. Flowers and fruits occur in most months.



A



TYPEFICTION: The type is *Smith 5095* (A HOLOTYPE; many ISOTYPES), collected July 7, 1947, on the western slopes of Mt. Tomanivi, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji, fairly frequent on Viti Levu and nearby islands but apparently rare on Vanua Levu. About 45 collections are at hand.

LOCAL NAMES AND USE: Names recorded from Viti Levu are *semalo*, *semelo*, *samala*, *samaloa*, *seti*, and *makou*, from the Yasawas *pupuinti*. An extract of the leaves is said to be used medicinally.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Vicinity of Yalombi, *St. John 18009*. MAMANU-THAS: NGGALITO Island, Malolo Group, *O. & I. Degener 32215*. VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez 13643*; slopes of Mt. Evans Range, *Greenwood 122*; Vatia Point, *DA 13571*; Nauwanga, south of Nandarivatu, *Degener 14558*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4585*. SERUA: Inland from Namboutini, *DF 205 (Bola 64)*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9456*; vicinity of Wainiyambia, *DF 438 (Damanu 102)*. NAMOSI: Hills near Namosi Village, *Gillespie 2825*. RA: Vatundamu, vicinity of Rewasa, near Vaileka, *Degener 15399*. NAITASIRE: Upper Waindina River, *MacDaniels 1026*; Prince's Road, *DA 28*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7023*; Naingani Island, *DA 3334*. REWA: Vicinity of Suva, *Tothill 33*. OVALAU: Hills southeast of valley of Mbureta River, *Smith 7422*; mountains near Levuka, *Horne 378*. NAIRAI: *Milne 170*. VANUA LEVU: MBUA: Nawaka, *H. B. R. Parham 417* or *s. n.*

Closely related only to *Melochia vitiensis*, *M. degeneriana* is distinguishable by its consistently shorter petioles, smaller and proportionately narrower leaf blades usually obtuse or rounded (only occasionally cordate and then shallowly so) at base, proportionately slightly narrower capsules, and seeds with a distinctly larger wing.

5. *Melochia mollipila* A. C. Sm. in J. Arnold Arb. 31: 308. 1950; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. 34: 232. 1967.

FIGURE 103E.

Melochia odorata sensu Gibbs in J. Linn. Soc. Bot. 39: 141. 1909; non L. f.

A tree or tall shrub 3–7 m. high, known from elevations between 450 and 825 m. in forest and in thickets on hillsides or in grassland. The calyx is pink and the petals and filaments are yellow to pale yellow. Flowers have been collected between August and December, fruits only in September and October.

TYPEFICTION: The type is *Smith 6040* (A HOLOTYPE; many ISOTYPES), collected Sept. 15, 1947, on slopes of the escarpment north of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from northwestern Viti Levu.

LOCAL NAMES: *Samalo*, *samaloa*, *vuvundi*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1239*. NANDRONGA & NAVOSA: Nausori Highlands, *DA L. 13478 (DF 427)*, *Vetawa 20*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5588*. RA: Vicinity of Nasukamai, *Gillespie 4692.3*; vicinity of Numbumakita, *Gibbs 521*.

FIGURE 103. A–D, *Melochia degeneriana*; A, distal portion of branchlet, with foliage and infructescences, $\times 1/2$; B, immature capsule, with calyx, petals, and stamens, $\times 6$; C, seed, $\times 15$; D, portion of lower surface of leaf blade, $\times 30$. E, *Melochia mollipila*, portion of lower surface of leaf blade, $\times 30$. F, *Melochia vitiensis*, seed, $\times 15$. A & B from *Smith 7422*, C from *O. & I. Degener 32215*, D from *Smith 5095*, E from *Smith 5588*, F from *Bryan 445*.

6. *Melochia grayana* A. C. Sm. in J. Arnold Arb. **31**: 309. 1950; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. **34**: 235. 1967.

Melochia vitiensis var. β A. Gray, Bot. U. S. Expl. Exped. **1**: 193. 1854; Seem. Fl. Vit. **24**. 1865.

As far as field notes indicate, *Melochia grayana* is a shrub about 2 m. high, occurring in dense crest forest at probable altitudes of 400–590 m. Its calyx is orange-tinged and its petals and stamens are yellow. The only dated specimens have flowers collected in October and November and fruits in October.

TIPIFICATION: The type is *Smith 6525* (A HOLOTYPE; many ISOTYPES), collected Nov. 6, 1947, on the summit ridge of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu. Gray's unnamed variety was based on *U. S. Expl. Exped.* (US 13126), collected in 1840 from Mathuata but without further data.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Mathuata Province, Vanua Levu.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Mountains near Lambasa, *Greenwood 620, 620A*.

7. *Melochia longepetiolata* A. C. Sm. in J. Arnold Arb. **31**: 310. 1950; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. **34**: 228. 1967. FIGURE 104A–D.

A small tree 4–8 m. high, occurring at elevations of 200–500 m. in dense forest and among reeds. Its petals are pink or salmon-pink. Flowers and fruits have been obtained only in October.

TIPIFICATION: The type is *Smith 218* (US 1676559 HOLOTYPE; many ISOTYPES), collected Oct. 23, 1933, on the southwestern slopes of Mt. Mbuke Levu, Kandavu.

DISTRIBUTION: Endemic to Fiji and, as far as known, to the island of Kandavu, on which it is the only species of *Melochia* yet recorded.

LOCAL NAME: *Tundrou*.

AVAILABLE COLLECTIONS: KANDAVU: Mt. Mbuke Levu, *DA 14913*; hills above Namalata and Ngaloa Bays, *Smith 110*.

In the Pacific material of *Melochia*, petal color seems a dependable character. The petals are either definitely pink to red, as in *M. odorata* L. f., *M. aristata* A. Gray, and the last two Fijian species here discussed, or yellow (sometimes at length fading to white and even with a faint pinkish distal tinge which does not obscure the bright yellow of fresh material), as in the remaining Fijian species. Although I have used this color distinction in the above key, it is not useful for herbarium specimens without adequate collectors' notes. Without reference to the petal character, *M. longepetiolata* sharply differs from other Pacific taxa of the genus in its long-petiolate leaves with large, deeply cordate, essentially glabrous blades, its very large, long-pedunculate inflorescences, and its relatively large calyces.

8. *Melochia roseiflora* A. C. Sm. in J. Arnold Arb. **31**: 311. 1950; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; Goldberg in Contr. U. S. Nat. Herb. **34**: 234. 1967.

FIGURE 104E.

A shrub or small tree 1–8 m. high, found at elevations of 700–1,195 m. in dense ridge forest and thickets or in the grassland-forest transitional zone. Its pedicels and calyces are deep pink, its petals and styles rich or bright pink, its filaments nearly white, and its anthers yellow. Flowers and fruits have been collected between March and June.

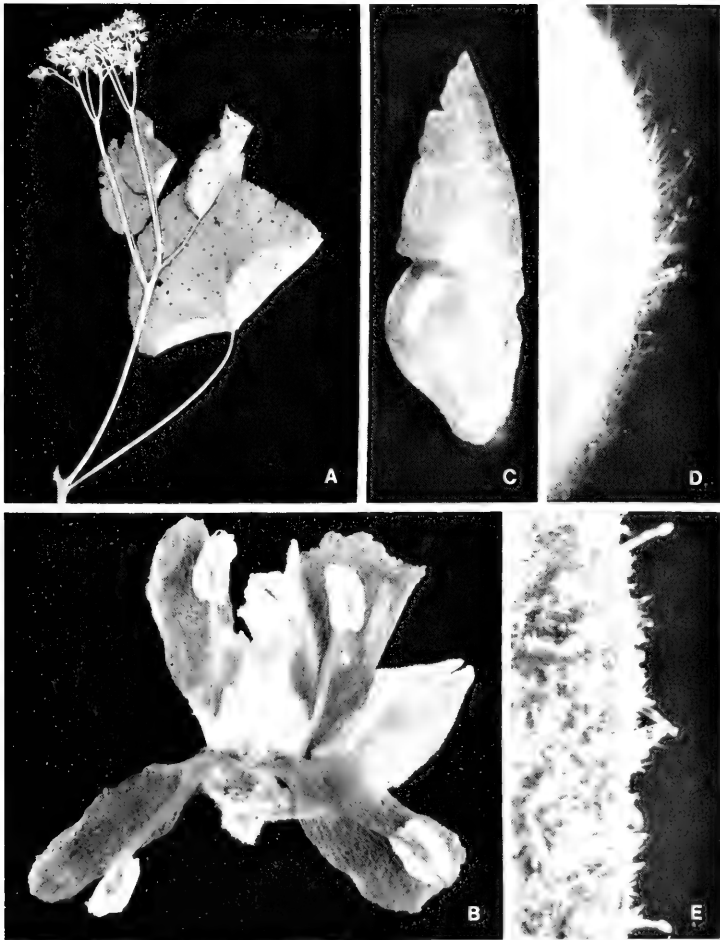


FIGURE 104. A-D, *Melochia longepetiolata*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$; B, flower, with 2 calyx lobes removed and 2 petals with attached stamens bent forward, $\times 6$; C, seed, $\times 15$; D, indument of calyx, $\times 30$. E, *Melochia roseiflora*, indument of calyx, $\times 30$. A & C from DA 14913, B & D from Smith 218, E from Smith 4236.

TYPIFICATION: The type is *Smith 4361* (A HOLOTYPE; many ISOTYPES), collected May 12, 1947, in the northern portion of the Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the Mt. Evans Range in northwestern Viti Levu.

LOCAL NAME: *Vuvundi* (recorded only for the type collection).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 316* (collected June 26, 1921, and also Apr. 23, 1922); Nandendeleva, *DA 14844*; summit of Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4236*.

Although its petals are similarly pink, *Melochia roseiflora* is not closely related to the preceding species, *M. longepetiolata*, or to any other Fijian species. It may be of the general relationship of *M. odorata* L. f. (New Guinea to New Caledonia and the New Hebrides), from which it differs most obviously in its distinctly winged seeds, but also in its shorter petioles, smaller leaf blades, compact inflorescences, and the comparatively harsh indument of its young parts, with simple, gland-tipped hairs mixed among the stellate hairs characteristic of the genus.

4. *WALThERIA* L. Sp. Pl. 673. 1753; Seem. Fl. Vit. 24. 1865.

Shrubs or erect herbs, the indument composed of stellate hairs (sometimes with a mixture of simple hairs), the stipules narrow; leaves alternate, simple, the blades serrate-dentate; inflorescences axillary or terminal, glomerulate or cymose, sometimes racemiform or paniculiform; flowers ♂, 5-merous; calyx 5-partite; petals 5, oblong-spathulate, marcescent; stamens 5, opposite petals, the filaments connate proximally into a tube, the anthers with parallel cells; staminodes absent; ovary composed of a single, sessile carpel, the ovules 2, the style excentric, clavate or penicillate; fruit a small, 2-valved, 1-seeded capsule, the seeds exalate.

LECTOTYPE SPECIES: *Waltheria americana* L. (vide M. L. Green, Prop. Brit. Bot. 172. 1929), one of Linnaeus's two original species.

DISTRIBUTION: Tropical America, with a few species scattered in other tropical areas, and probably with 30-40 species. One ubiquitous weed is naturalized in Fiji.

1. *Waltheria indica* L. Sp. Pl. 673. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 169. 1972; St. John in *Phytologia* 33: 89. 1976.

Waltheria americana L. Sp. Pl. 673. 1753; A. Gray, Bot. U. S. Expl. Exped. 1: 189. 1854; Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 25. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 123. 1890; Greenwood in Proc. Linn. Soc. 154: 95. 1943; Yuncker in Bishop Mus. Bull. 220: 186. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 65. fig. 27. 1959, Pl. Fiji Isl. 119. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 204. 1970.

In Fiji this widespread weed is a shrub 0.3-1 m. high, commonly found from near sea level to an elevation of about 900 m. along roadsides, in waste places, plantations, and canefields, and on grass- and reed-covered slopes. It has orange-yellow to yellow petals and may be seen in flower and fruit throughout the year.

TYPIFICATION AND NOMENCLATURE: *Waltheria americana* and *W. indica* were simultaneously proposed by Linnaeus, who cited several prior references for each. St. John (1976, cited above) indicates that each is represented by material in Linnaeus's herbarium, but I have not noted a firm lectotypification of the two binomials. The two Linnaean taxa have long been considered conspecific; each has sometimes been treated as a variety of the other, and many other names have been reduced to the species, which is usually considered too variable to be divided into logical varieties. The Linnaean

taxa were first united in 1818 by R. Brown, whose choice of *W. indica* must be retained; this case is cited as an example in ICBN, Art. 57.2.

DISTRIBUTION: A now ubiquitous pantropical weed, presumably American in origin but very early spreading to the Old World. It was probably carried into southern Pacific archipelagoes by early European voyagers, although possibly it was an inadvertent aboriginal introduction. Interesting comments on its distribution are offered by Merrill (in Chron. Bot. **14**: 245–246. 1954), Fosberg and Sachet (in Smithsonian Contr. Bot. **21**: 19. 1975), and St. John (in Phytologia **33**: 89–92. 1976). I have noted about 20 Fijian collections, but the species is more frequent than this would suggest.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 232*; Sambeto River valley, *DA 10296*; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4558*; Vatia Point, *DA 2816*. KANDAVU: *Seemann 36*. VANUA LEVU: MBUA?: "Ramasa Hill," *H. B. R. Parham 2*. MATHUATA: Seanggangga region, *DA 11781*; vicinity of Lambasa, *DA 10469*. VANUA LEVU without further locality, *U. S. Expl. Exped.* VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 1015*. ONEATA: *U. S. Expl. Exped.*

5. *PIMIA* Seem. in *Bonplandia* **10**: 366. 1862, Fl. Vit. 25. 1865; A. C. Sm. in *J. Arnold Arb.* **36**: 283. 1955.

Büttneriacearum gen. nov. aff. *Commersoniae* Seem. Viti, 433. 1862.

Trees, presumably small, with an abundant tomentum of ferrugineous stellate hairs, the stipules caducous (not seen); leaves alternate, the petioles short, the blades subcoriaceous, entire, pinnate-nerved (in the sole species ovate- or obovate-oblong, up to 5 × 2 cm., obtuse at apex, at length glabrate above); inflorescences cymose, few-flowered; flowers ♂, small, 5-merous; calyx deeply 5-partite, the lobes obovate, obtuse; petals 5, minute, scalelike, subdeltoid; stamens 5, opposite and slightly shorter than petals, the filaments free from one another, adnate to petal bases, the anthers subglobose, the locules short and spreading, longitudinally dehiscent; staminodes absent; ovary 5-locular, each locule with a single ascending ovule, the style short, entire; fruit a 5-locular, 5-seeded capsule (probably loculicidally dehiscent but not dehisced in the available material), copiously echinate with flaccid, stellate-tomentose bristles, 6–10 of these conspicuously longer than the others.

TYPE SPECIES: *Pimia rhamnoides*, the only known species.

DISTRIBUTION: Endemic to Fiji and monotypic.

This remarkable endemic genus, presently known from only a single collection, has been referred to the Sterculiaceae by Seemann and the few later botanists who have discussed it. Although the single species is very inadequately known, this would seem the correct familial assignment, but (as pointed out by Hutchinson, 1967, cited above under the family, pp. 471–476) the Sterculiaceae and Tiliaceae are not very readily separated. Hutchinson places *Pimia* in his tribe Lasiopetalae, which is probably its logical position; more ample collections, if made, may permit reconsideration of the genus.

1. *Pimia rhamnoides* Seem. in *Bonplandia* **10**: 366. 1862, Fl. Vit. 25. t. 5. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 124. 1890; A. C. Sm. in *J. Arnold Arb.* **36**: 283. 1955; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 169. 1972.

Rhamnea Seem. in *Bonplandia* **9**: 255. 1861.

Seemann's description indicates this rare plant to be a tree 12–15 m. high, occurring on the margin of forests along the coast. Although no color notes are given except the indication that the copious indument is ferrugineous-tomentose, Seemann's plate permits a reasonable understanding of the genus and species.

TYPIIFICATION: The type is *Seemann 83*, collected in October, 1860, along the northern coast (Mathuata indicated on κ sheet) of Vanua Levu. The κ sheet seems to be sterile, as implied by Seemann. It has a few short stubs that must have borne fruits; these stubs are axillary, 4–6 mm. long, with 1–3 lateral scars, slightly swollen at the apex from which presumably a fruit was dehiscent. The κ sheet also includes Seemann's notes for his descriptions and sketches for his plate. He states that flowers were from the βM sheet. The latter now lacks flowers but it has a few-branched inflorescence in a pocket. In the present case I herewith indicate the βM specimen as the lectotype and the κ specimen as an isolectotype. The date (October, 1860) is taken from the κ sheet; during that month Seemann called at several localities along the northern coast of Vanua Levu (cf. Viti, 225–230, 260–268. 1862), and no detailed locality for *Pimia rhamnoides* can be suggested.

DISTRIBUTION: Endemic to Fiji and known only from the type collection. Many parts of the "Mathuata coast" have not been carefully botanized, and therefore one must hope that Seemann's remarkable genus will be found again. Fortunately his description and excellent plate will permit ready recognition of his very distinctive genus.

6. COMMERSONIA J. R. & G. Forst. Char. Gen. Pl. 22. 1775, ed. 2. 43. 1776; Seem. Fl. Vit. 25. 1865.

Trees or shrubs, often copiously stellate-pubescent, the stipules caducous; leaves alternate, simple, the blades often unequal-sided, serrate-dentate, sometimes lobed, herbaceous in texture; inflorescences axillary or leaf-opposed, rarely terminal, cymose-corymbose; flowers \char"26 , 5-merous; calyx 5-lobed; petals 5, broadly concave proximally, ligulate and channelled distally; androphore a short tube not adnate to petals, the fertile stamens 5, opposite petals, alternating with deltoid-lanceolate or 3-lobed staminodial lobes, these at first concealing ovary, becoming recurved, the anthers subglobose, with divaricate locules; ovary sessile, 5-locular, the ovules 2–6 per locule, the styles short, free or proximally united; fruit a loculicidally 5-valved capsule, copiously echinate with soft, stellate-pilose bristles, the seeds 1 or 2 per locule, exalate.

TYPE SPECIES: *Commersonia echinata* J. R. & G. Forst. (= *C. bartramia* (L.) Merr.).

DISTRIBUTION: Southeastern Asia through Malesia to Micronesia, Australia, New Caledonia, and eastward to the Society and Marquesas Islands, with nine or ten species, mostly Australian. One widespread species is indigenous in Fiji.

1. *Commersonia bartramia* (L.) Merr. Interpret. Rumph. Herb. Amb. 362. 1917; Christophersen in Bishop Mus. Bull. 128: 145. 1935; J. W. Parham, Pl. Fiji Isl. 117. 1964, ed. 2. 166. 1972; St. John & A. C. Sm. in Pacific Sci. 25: 333. 1971.

Muntingia bartramia L. Amoen. Acad. 4: 124. 1759.

Commersonia echinata J. R. & G. Forst. Char. Gen. Pl. 22. t. 22. 1775, ed. 2. 44, t. 22. 1776; Andrews, Bot. Repos. 8: pl. 519. 1808; Drake, Ill. Fl. Ins. Mar. Pac. 124. 1890; Guillaumin in J. Arnold Arb. 12: 230. 1931.

Commersonia platyphylla Andrews, Bot. Repos. 9: sub pl. 603. 1810; A. Gray, Bot. U. S. Expl. Exped. 1: 188. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 25. 1865.

A shrub or small tree 0.5–18 m. high, with a trunk sometimes up to 40 cm. in diameter, occurring from near sea level to 500 m. elevation and often locally abundant in dry forest, secondary forest, and patches of forest and thickets in grassland. At times *Commersonia bartramia* almost gives the appearance of being a "weed tree," but it is doubtless indigenous and vagile, thriving in dry and fairly open situations. Its flowers, cream-colored to green in bud, have white or cream-white petals, white filaments, and

yellow or nearly white anthers; its seeds are dark brown. Flowers and fruits are seen throughout the year.

TYPIFICATION: The whole basis of *Muntingia bartramia* L. is *Restiaria alba* Rumph. Herb. Amb. 3: 187. t. 119. 1743, the type being from Amboina. *Commersonia echinata* is based on the same Rumphian plate. Andrews published the binomial *C. platyphylla* (1810) as a new name for his prior plate (1808) of *C. echinata*, which was prepared from a cultivated plant; from the illustration this is scarcely separable from the Rumphian concept.

DISTRIBUTION: Southeastern Asia through Malesia to Micronesia, eastern Australia, and into the Pacific as far as the Society and Marquesas Islands. However, no records have been noted from Tonga, Niue, or the Cook Islands. About 75 Fijian collections are available.

LOCAL NAMES AND USES: The Fijian name *sama* is so well established for this species that one must suspect misinformation if it is applied to other species; other names are *sama ndina*, *samaloa*, and *lekesama*. It is widely used for firewood, and in Thakau-drove its roots have been noted as part of an internal remedy for "pains in bones."

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Near Vakambuli, inland from Lautoka, *DA 10872*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4583*; Mbaravi, east of Tumbukula, *Webster & Hildreth 14384*. SERUA: Upper Navua River, *Howard 5*; Taunovo River, *Vaughan 3158*. NAMOSI: Trail up Mt. Voma, *Gillespie 2492*; Nambukavesi Creek, *DF 426*. RA: Near Nasukamai, *Gillespie 3394.2*; vicinity of Rakiraki, *Degener & Ordonez 13696*. NAITASIRI: Matawailevu, Wainimala River, *St. John 18282*; Waindina River, *MacDaniels 1042*; Nanduru-loulou, *DA 12517*. NAITASIRI-REWA boundary: Mt. Kombalevu, *Parks 20283*. TAILEVU: Tonia, *DA 9993*. REWA: Mt. Korombamba, *H. B. R. Parham 93*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 129*. OVALAU: Hills east of Lovoni Valley, *Smith 7272*. "OVALAU and LAKEMBA." *Seemann 34* (Port Kinnaird on Ovalau). NAIRAI: *Milne 173*. VANUA LEVU: MBUA: Liuka Creek, Rukuru Bay, *H. B. R. Parham 23*. MATHUATA: Seanggangga region, *DA 11484*; vicinity of Nggelemumu, east of Lambasa, *Gressitt 2475*. THAKAUNDROVE: East of Savusavu, *Bierhorst F163*; hills west of Korotasere, Natewa Bay region, *Smith 1923*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4745*. MOALA: Ndelaimoala, *Smith 1375*. VANUA MBALAVU: *Graeffe 1516*. LAKEMBA: Ridge east of Levuka Valley, *Garnock-Jones 827*. FIJI without further locality, *U. S. Expl. Exped.*

7. *THEOBROMA* L. Sp. Pl. 782. 1753; Cuatr. in Contr. U. S. Nat. Herb. 35: 449. 1964.

Trees or large shrubs, the indument usually of stellate hairs, the stipules lanceolate, caducous; leaves alternate, simple, the blades undivided, pinnately nerved; inflorescences mostly borne on main stems and branches, dichasial or monochasial, (1-) few-many-flowered; flowers ♂, 5-merous; calyx deeply 5-partite, the sepals valvate in aestivation, nearly free or proximally united; petals 5, dextrorsely contorted in aestivation, contracted proximally into a concave-cucullate claw (hood), produced distally into a flat, spatulate blade; androecium in 2 verticils united into a tube at base, the outer whorl with 5 sterile, petaloid or linear staminodes opposite sepals, the inner whorl with 5 fertile stamens opposite petals, the free filaments short, minutely 2- or 3-branched, each branch with an anther, these concealed by the petal hoods, the locules 2, dehiscing by longitudinal clefts; ovary sessile, 5-locular, the ovules many in each locule, the styles filiform-subulate, connate at base; fruit subbaccate or subdrupaceous, often large, indehiscent, ovoid-ellipsoid, smooth or costate, 5-locular, the endocarp becoming pulpy, the seeds many, exalate.

LECTOTYPE SPECIES: *Theobroma cacao* L. (vide M. L. Green, Prop. Brit. Bot. 177. 1929), one of the two species originally referred to the genus by Linnaeus.

DISTRIBUTION: Tropical continental America, with about 22 species. *Theobroma cacao* is widely cultivated throughout the tropics.

USEFUL TREATMENT OF GENUS: Cuatrecasas, J. Cacao and its allies: a taxonomic revision of the genus *Theobroma*. Contr. U. S. Nat. Herb. 35: 379-614. 1964.

1. *Theobroma cacao* L. Sp. Pl. 782. 1753; Yuncker in Bishop Mus. Bull. **178**: 84. 1943, in op. cit. **184**: 52. 1945; J. W. Parham in Agr. J. Dept. Agr. Fiji **19**: 102. 1948; B. E. V. Parham in op. cit. **23** (2): 14. 1952; Cuatr. in Contr. U. S. Nat. Herb. **35**: 495. 1964; J. W. Parham, Pl. Fiji Isl. 119. 1964, ed. 2. 169. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 204. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 334. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 45. 1972.

A tree 4-8 (rarely to 20 where indigenous) m. high, cultivated near sea level in Fiji. Its flowers have white to pale violaceous or reddish sepals, petals with the claw (hood) white with purplish or red nerves and the blade pale yellow, and red or purplish staminodes. The fruits become reddish or yellowish, ovoid, and up to 30 × 10 cm.

LECTOTYPIFICATION: Cuatrecasas (1964, cited above, pp. 496, 508-509) indicates as the lectotype the specimen (BM) in the Sloane Herbarium, vol. 5, p. 59.

DISTRIBUTION: Mexico and Central America to the Guianas and middle Amazonia, and westward to the Andes. Two subspecies are recognized by Cuatrecasas; subsp. *cacao*, of Mexico and Central America, is widely cultivated and includes several forms and cultivars.

LOCAL NAMES AND USE: *Cacao*, *cocoa*. The commercial *cacao* was first introduced into Fiji by J. B. Thurston from Java in 1878, and it has since been introduced several times without becoming commercially productive. However, in recent years selected clonal material has been grown more successfully, and in 1969 about 70 tons were produced (J. W. Parham, 1972, cited above). An excellent review of the cocoa industry in Fiji was published by L. W. Harwood et al. in Agr. J. Dept. Agr. Fiji **29**: 49-111. 1959. Extended discussions are provided by Cuatrecasas (1964, cited above, pp. 495-517) and Purseglove (Trop. Crops, Dicot. 571-598. 1968).

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, Government House grounds, DA, Oct. 1949. Although extensive plantations occur in Fiji, other herbarium vouchers are not available.

8. *HELICTERES* L. Sp. Pl. 963. 1753.

Shrubs or small trees, the indument composed of stellate or branched hairs, the stipules narrow or filiform; leaves alternate, simple, the blades palmately nerved, entire or serrate (in our species obovate, serrate, often lobed on the somewhat truncate distal margin); inflorescences axillary, composed of solitary or fasciculate-cymose flowers (as in our species) or umbelliform, spiciform, or racemiform; flowers ♂, large (in our species long-pedicellate); calyx tubular or hypocrateriform, 3-5-lobed at apex, at length circumscissile at base and marcescent around gynophore; petals 5, equal or 2 broader than the others, the claws elongate, sometimes auriculate near apex; staminal tube elongated, adnate to gynophore, truncate or 5-dentate at apex or with 5 staminal segments, the fertile stamens 1 or 2 borne in each sinus of staminal tube, the anthers with short free filaments, the locules divaricate or confluent; ovary borne on apex of a long, narrow gynophore, 5-lobed, 5-locular, the ovules many in each locule, the styles short, free or partially connate, slightly thickened at apex; fruit composed of separating mature carpels, these dehiscing along ventral suture, straight or becoming conspicuously and spirally twisted (in our species), often stellate-tomentose or setose, the seeds many, exalate, sometimes tuberculate.

LECTOTYPE SPECIES: *Helicteres isora* L. (vide M. L. Green, Prop. Brit. Bot. 186. 1929), one of Linnaeus's two original species.

DISTRIBUTION: Tropical Asia and America, and in some warm temperate regions, probably with 50-60 species. One species is sparingly cultivated in Fiji.

1. *Helicteres isora* L. Sp. Pl. 963. 1753; J. W. Parham, Pl. Fiji Isl. ed. 2. 167. 1972.

A large shrub, infrequently cultivated in Fiji near sea level. An interesting and curious plant, *Helicteres isora* has a yellow calyx, large (3-4 cm. long) petals turning from green and blue to scarlet and red-glandular within, a slender androgynophore 3 cm. long or more, a red-glandular ovary, and mature carpels 3-8 cm. long and closely, spirally twisted. The only available collection was fruiting in November.

TYPIFICATION: Several prior references are listed by Linnaeus.

DISTRIBUTION: India to Java, occasionally cultivated elsewhere.

LOCAL NAME AND USES: Sometimes called *red isora* elsewhere, this plant is reputed to have medicinal uses and also to produce a useful fiber (cf. Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 1153-1154, 1966).

AVAILABLE COLLECTION: VITI LEVU: MBA: Nandi, DA 9798.

9. *KLEINHOVIA* L. Sp. Pl. ed. 2. 1365. 1763; Seem. Fl. Vit. 24. 1865.

Trees, with fibrous bark, the stipules subulate-linear; leaves alternate, the petioles long, the blades suborbicular-ovate, herbaceous, entire, cordate, acuminate, 3-7-nerved at base; inflorescence a large, freely branched, terminal panicle; flowers ♂, 5-merous, slightly zygomorphic; calyx deeply 5-partite, the lobes unequal, caducous; petals 5, unequal, 4 linear-spathulate and subsaccate at base, the posterior 1 shorter, with connate-induplicate margins; staminal tube elongated, adnate to gynophore, campanulate and 5-parted at apex, the fertile stamens 3 (2 longer than the other) borne between each 2 small, dentate, staminodial segments, the anthers with short free filaments, the locules divergent; ovary borne on apex of a long, narrow gynophore within dilated apex of staminal tube, 5-lobed, 5-locular, each locule with 3 or 4 ovules, the style slender, inconspicuously 5-lobed; fruit a membranous, inflated, reticulate-veined, turbinate, 5-lobed, loculicidally 5-valved capsule, the seeds solitary in each locule or often aborted and only 1 per capsule developing, globose, verruculose.

TYPE SPECIES: *Kleinhovia hospita* L.

DISTRIBUTION: Old World tropics and subtropics, extending eastward in the Pacific to the Society Islands, and monotypic.

1. *Kleinhovia hospita* L. Sp. Pl. ed. 2. 1365. 1763; A. Gray, Bot. U. S. Expl. Exped. 1: 189. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 24. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 123. 1890; Merr. Interpret. Rumph. Herb. Amb. 363. 1917; Guillaumin in J. Arnold Arb. 14: 54. 1933; Christophersen in Bishop Mus. Bull. 128: 145. 1935; Yuncker in op. cit. 184: 52. 1945, in op. cit. 220: 186. 1959; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 168. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 35. 1972.

A sometimes locally common tree 10-20 m. high, with an often gnarled trunk to 1 m. in diameter, occurring from near sea level to an elevation of not more than 100 m., in coastal thickets, in swamps near beaches, along streams in low elevation forest, or sometimes in dry forest, and often forming groves. Its flowers have red, pink, or purplish sepals and slightly unequal petals, 4 of these being colored like the sepals and the posterior one being yellow-tinged. The capsules are pink, with white seeds. Flowers have been obtained in months between December and July, and fruits between February and July.

TYPIFICATION: The type is a Kleinhof specimen that was cultivated in Java. Merrill (1917, cited above) notes that the species is represented by *Catti-marus* Rumph. Herb. Amb. 3: 177. t. 113. 1743, but that is not to be taken as Linnaeus's type.

DISTRIBUTION: India to tropical Africa; eastward in the Pacific through Malesia to the Caroline Islands and Queensland to the Society Islands. About 25 Fijian collec-

tions have been examined, but the species is more abundant in favorable localities than this would indicate.

LOCAL NAMES AND USES: The usual Fijian name is *mamakara*, but *makara* has also been recorded. The timber is useful, perhaps especially for tools and implements; in Malesia the leaves are said to be used medicinally.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Between Natalau and Lautoka, *Degener 15014*; Mba River at Rarawai Mill, *Greenwood 182*. NANDRONGA & NAVOSA: Near Thotho Levu, *H. B. R. Parham 288*; vicinity of Nandrala, *H. B. R. Parham 241*. RA: Namuimanda, *DA 7209*. OVALAU: *U. S. Expl. Exped.*; vicinity of Levuka, *Gillespie 4417*. KORO: East coast, *Smith 1060*. VANUA LEVU: MATHUATA: Undu Point, *Tothill 31*. THAKAUNDROVE: Savsavu, *DA 5751*; Nasinu, Natewa Bay, *DA 16835*. VANUA LEVU without further locality, *U. S. Expl. Exped. TAVEUNI*: Somosomo, *Seemann 35* (on K sheet, but Vanua Levu in Fl. Vit.); vicinity of Waiyevo, *Gillespie 4811*. VANUA MBALAVU: Near Narothivo Village, *Garnock-Jones 1092*.

10. STERCVLIA L. Sp. Pl. 1007. 1753; Seem. Fl. Vit. 23, p. p. 1865.

Monoecious or polygamous trees or erect shrubs, the stipules caducous, the indument when present composed of stellate hairs sometimes mixed with simple hairs; leaves alternate, often crowded at apices of branchlets, the blades simple, lobed, or (as in our species) digitately foliolate (adjacent leaflets sometimes proximally united), herbaceous to coriaceous; inflorescences axillary, subterminal, or borne on stems and branches, paniculate or racemose; flowers unisexual or hermaphrodite, the terminal ones mostly ♀ or ♂ and more precocious; calyx (4- or 5-lobed, often somewhat petaloid and colored, the tube often campanulate, the lobes sometimes apically coherent; petals none; ♂ flowers with a slender androphore bearing at apex 5-15 subsessile anthers, these with 2 parallel locules; androgynophore in ♀ or ♂ flowers shorter than androphore in ♂ flowers, with 5-15 sterile or fertile anthers just below apex; carpels 2-6, free or somewhat coherent, the ovules 2-many per carpel, the styles free, connate, or coherent, peltate or lobed at apex; fruit composed of stellately spreading, sessile or short-stalked, coriaceous, ovoid-oblong, beaked follicles, these soon dehiscent, the seeds 1-many, borne along margins of open follicles, exalate, with a fleshy outer testa.

LECTOTYPE SPECIES: *Sterculia foetida* L. (vide M. L. Green, Prop. Brit. Bot. 190. 1929), one of Linnaeus's two original species.

DISTRIBUTION: Pantropical and warm temperate, probably with about 200 species, extending eastward in the Pacific as far as Samoa, Tonga, and Niue. Two endemic species are known to occur in Fiji.

The genus *Sterculia* seems to have been known in Fiji only from the type material of *S. vitiensis* until it was discussed by H. B. Guppy (Obs. Nat. Pac. 2: 391-392. 1906), who observed many large, woody, empty follicles on the forest floor in Vanua Levu. He apparently did not preserve herbarium material of the genus, and therefore it cannot be said which of the two Fijian species he observed. Most extant herbarium collections of the genus from Fiji are due to the systematic forest study stimulated by the Directorate of Overseas Surveys and initiated in 1966 (cf. Vol. 1 of this *Flora*, p. 82). *Sterculia vitiensis* is now known from the additional collections cited below, and a second species of the genus has also been discovered. Although fruiting material of the latter is not yet known, striking indument characteristics permit its ready recognition.

KEY TO SPECIES

Indument of branchlets, stipules, petioles, petiolules, and peduncles sparse (rays of hairs scarcely 0.2 mm. long) and evanescent; petiolules 7-15 mm. long, comparatively slender, 2-2.5 mm. in diameter; leaflet blades beneath stellate-puberulent (rays of hairs scarcely 0.2 mm. long) and soon glabrate; carpels in ♂ flowers (at least sometimes) 5; fruiting follicles sometimes 5, at apparent maturity 9-18 cm. long,

persistently but minutely stellate-tomentulose (rays of hairs scarcely 0.2 mm. long), the seeds (at least sometimes) as many as 14. 1. *S. vitiensis*
 Indument of branchlets, stipules, petioles, petiolules, and peduncles copious and persistent, composed of (simple or) 2-5-rayed stellate hairs with the rays 0.3-1 mm. long; petiolules 3-5 mm. long, robust, 2.5-3.5 mm. in diameter; leaflet blades beneath persistently pilose with simple hairs 0.8-1.5 mm. long and also minutely stellate-puberulent; carpels in ♂ flowers 2, copiously stellate-hirtellous, the rays of hairs 0.4-0.6 mm. long, the ovules about 10 per carpel. 2. *S. dasyphylla*

1. *Sterculia vitiensis* Seem. Fl. Vit. 23. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 122. 1890; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 13: 47. 1942; J. W. Parham, Pl. Fiji Isl. 119. 1964, ed. 2. 169. 1972. FIGURE 105A.

A tree 8-25 m. high, with a trunk up to 1.2 m. in diameter, occurring in lowland forest at elevations up to 300 m. Flowering material has been obtained in April and December, fruits in February, March, and July.

TIPIFICATION: The type is an unnumbered collection by Storck, obtained on Viti Levu without further data, and presumably the holotype is at κ. However, I have been unable to locate such Storck material at either κ or BM, it perhaps having been on loan during my visits. Seemann's description leaves no doubt of the identity of the specimens cited below.

DISTRIBUTION: Endemic to Fiji, and thus far known only from Viti Levu and Vanua Levu.

LOCAL NAMES AND USES: The usual Fijian name is *wathiwathi*, but the name *ma* has also been applied to several collections. Some recent foresters have indicated the plant as a useful timber tree, although it is not common enough to be frequently used. B. E. V. Parham (1942, cited above) stated that the seeds are edible and of excellent flavor; the only specimen at Suva that might have been available to him at that time is *DA 671*.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Nathengathenga Creek, upper Navua River, *DA L.11634*, *DF 1132* (*S1562/3*); inland from Ngaloa, *DA 15668*, *DA L.13480* (*DF 922*), *DF 1133*, *1134* (*S1562/1*), *Howard 203*, *DA L.21205* (*DF 52*), *L.21206* (*DF 53*), *L.21207* (*DF 54*). NAITASIRI: Vasila, Waidina River, *DA 671*; Waimanu River, *DA 15653*. VANUA LEVU: MATHUATA: Without further locality, *DA L.21199* (*DF 50*), *L.21200* (*DF 51*). Credit for obtaining these valuable specimens is due to M. J. Berry, W. J. Howard, E. Damanu, and A. Nasoqiri. No. *DA 671* was probably collected by B. E. V. Parham. It should be noted that the species is concentrated in southern Viti Levu except for the two numbers mentioned from Mathuata Province; since these lack locality data, it is conceivable that the labels are erroneous.

2. *Sterculia dasyphylla* A. C. Sm. in Pacific Sci. 23: 385. 1969; J. W. Parham, Pl. Fiji Isl. ed. 2. 169. 1972.

A tree about 13 m. high, collected in forest at an unspecified elevation (but from the locality probably not more than 300 m.). The flowers have a cream-colored calyx and were available in November.

TIPIFICATION: The type is *DA 14092* (coll. *I. Qoro*) (BISH HOLOTYPE; ISOTYPES at K, SUVA), collected in November, 1964, in the Navonu Creek area, Natewa Peninsula, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from the locality associated with the type collection.

AVAILABLE COLLECTION: FIJI without further locality, *Howard 224* (SUVA). As W. J. Howard worked extensively in eastern Vanua Levu, it is possible that his specimen came from the Natewa Peninsula.

11. *BRACHYCHITON* Schott & Endl. Melet. Bot. 34. 1832.

Monoecious or polygamous trees, often with seasonally deciduous foliage; leaves alternate, the blades usually 3- or 5-palmatilobed, sometimes entire or digitately



FIGURE 105. A, *Sterculia vitiensis*, distal portion of branchlet with foliage, and a detached fruiting follicle, $\times 1/4$. B, *Firmiana diversifolia*, distal portion of branchlet, with foliage and infructescence, $\times 1/4$. A from DA 15668 (detached follicle from DA L.21199), B from Smith 7307.

compound; inflorescences fasciculate, short-racemose, or short-paniculate in axils of leaves or their scars; flowers unisexual or hermaphrodite; calyx campanulate, 4- or 5-lobed, the lobes valvate in bud, each with a pilose scale near base; petals none; androgynophore short or none, the stamens with filaments connate in a tube bearing at apex 5 groups of 2 or 3 anthers, each group with a lanceolate lobe exceeding the anthers in length; stamens perhaps sterile in ♀ or ♂ flowers; ovary 5-locular, the ovules 2 or more per locule, the styles 5, united; fruit composed of free follicles, these spreading, short-stipitate, tardily dehiscent, the seeds 1-several, each half-enveloped by the honeycomblike compartments of the endocarp.

TYPE SPECIES: *Brachychiton paradoxum* Schott & Endl.

DISTRIBUTION: Australia, with about eleven species (one extending into southern New Guinea), some of them cultivated elsewhere in the tropics. One species is recorded as having been cultivated in Fiji.

1. *Brachychiton* sp.

The genus is here included because B. E. V. Parham (in Agr. J. Dept. Agr. Fiji 10: 113. 1939) reported two taxa now referable to *Brachychiton* as having been introduced

in 1918 and 1920 for planting on the property of W. L. Wallace on Tovu Island, Ra Province, Viti Levu. The names used by Parham were *Brachychiton populneum* and *Sterculia trichosiphon*. It is unlikely that two species of *Brachychiton* were introduced. The species concerned was probably one of those often grown as ornamentals, perhaps *B. populneum* (Schott & Endl.) R. Br. (in J. Benn. & R. Br. Pl. Jav. Rar. 234. 1844, based on *Poecilodermis populnea* Schott & Endl. Melet. Bot. 33. 1832), usually considered a synonym of *B. diversifolium* (G. Don) R. Br. (in loc. cit., based on *Sterculia diversifolia* G. Don, Gen. Hist. Dichlam. Pl. 1: 516. 1831). *Sterculia trichosiphon* Benth. (Fl. Austral. 1: 229. 1863) is based on *Trichosiphon australe* Schott & Endl. (Melet. Bot. 34, as *Trichosiphum a.* 1832) (*Sterculia australis* Druce in Bot. Soc. Exch. Club Brit. Isles 1916: 648. 1917), often referred to *Brachychiton platanoides* R. Br. (in loc. cit.); apparently the oldest epithet for this species is *australe*, but I find no such epithet combined with the correct generic name *Brachychiton*. No voucher seems available for the species grown in Fiji, which may not have persisted in cultivation there.

12. FIRMIANA Marsili in Saggi Sci. Lett. Accad. Padova 1: 114, 116. 1786; Ridley in Kew Bull. 1934: 214. 1934; A. C. Sm. in J. Arnold Arb. 36: 283. 1955; Kostermans in Pengumuman Bal. Bes. Penjel. Kehut. Indonesia 54: 3. 1956, in Reinwardtia 4: 281. 1957.

Sterculia sensu Seem. Fl. Vit. 23, p. p. 1865.

Monoecious or seemingly (but presumably not functionally) polygamous trees or erect shrubs, the indument, when present, of stellate hairs, the stipules small; leaves alternate, long-petiolate, the blades simple, entire or palmately 3- or 5-lobed, palmately nerved, often cordate at base; inflorescences axillary or borne on leafless branchlets, large, paniculate; flowers unisexual (bisexual in appearance but apparently not functionally so), often with copious stellate hairs, often brightly colored; calyx tubular, with a nectarial disk at base within, the lobes 5, valvate in bud, shorter than tube; petals none; ♂ flowers with a short androgynophore developing after anthesis and bearing at apex 10-15 anthers, these sessile or short-stipitate, 2-locular, longitudinally dehiscent, the pistillodes 5, concealed by anthers; ♀ flowers with a longer androgynophore bearing at apex a ring of 10-15 (sterile) anthers and 5 conglutinate carpels, the ovules 2 or 4 (or 6?) per carpel, the styles short, somewhat excentric, the carpels soon separating and expanding; fruits composed of stipitate follicles, these papyraceous or chartaceous in texture and often conspicuously veined, entirely dehiscent long before maturity and dispersing with the seeds adhering to margins, the seeds 2 or more per follicle, globose, exalate.

TYPE SPECIES: *Firmiana platanifolia* (L. f.) Schott & Endl. This species was discussed and illustrated by Marsili, but he did not actually make the combination (ICBN, Art. 33.1).

DISTRIBUTION: West tropical Africa to southeastern Asia and China, eastward into Malaysia to New Guinea, with about ten species including an outlying endemic in Fiji terminating the range. Van Balgooy (in Blumea Suppl. 6: 197. 1971) indicates the genus as erroneously recorded from Fiji, but there can be no doubt that the Fijian species is correctly placed.

USEFUL TREATMENTS OF GENUS: Kostermans, A. J. G. H. The genus *Firmiana* Marsili (Sterculiaceae). Pengumuman Bal. Bes. Penjel. Kehut. Indonesia 54: 3-33. 1956. This was reprinted in Reinwardtia 4: 281-310. 1957, and Kostermans recorded additional notes in Reinwardtia 5: 383-390. 1961.

1. *Firmiana diversifolia* A. Gray, Bot. U. S. Expl. Exped. 1: 185. 1854, Atlas, pl. 13.

1856; Seem. Viti, 433. 1862; Ridley in Kew Bull. 1934: 214. 1934; A. C. Sm. in J. Arnold Arb. 36: 283. 1955; Kostermans in Pengumuman Bal. Bes. Penjel. Kehut. Indonesia 54: 21. fig. 6. 1956, in Reinwardtia 4: 300. fig. 8. 1957, in op. cit. 5: 245. 1960; J. W. Parham, Pl. Fiji Isl. ed. 2. 166. 1972. FIGURES 105B, 106A & B.

Sterculia diversifolia Seem. Fl. Vit. 23. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 122. 1890; non G. Don (1831). *Sterculia guppyi* Greenwood in Kew Bull. 1929: 240. 1929; J. W. Parham, Pl. Fiji Isl. 119. 1964.

A tree 10–20 m. high, occurring at elevations of 100–850 m. in dense, dry, or open forest or in forest on ridges. The infructescence forms a large, open panicle as much as 50 cm. in diameter. Flowers have been obtained only in January, fruits between April and August.

TYPEFICTION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (us 12990 HOLOTYPE; ISOTYPES at GH, K, P), collected in 1840 on Ovalau and Vanua Levu as noted by Gray. The holotype does not bear a definite locality, but the K sheet is indicated as from Ovalau. Probably the Exploring Expedition material, in fruit, came from more than one plant, and therefore the duplicates may not strictly be isotypes. Greenwood's new name, which would be correct if *Firmiana* should be combined with *Sterculia* (a clearly unacceptable course), presumably acknowledges H. B. Guppy's interest in the dispersal of *Sterculia* and other genera that do not extend much farther east than Fiji. However, Guppy, in his discussion of *Sterculia* (cited above under that genus), was referring to the genus in its correct sense and not in the sense of *Firmiana*, which appears not to have come to his attention.

DISTRIBUTION: Endemic to Fiji and now known from several high islands.

LOCAL NAMES AND USES: Recorded Fijian names are *vau theva* (*pautheva*, *pauthepa*), *vau langgiwa*, *tatavi*, and *valongia*. The seeds are said to be edible, and bast from the bark is bleached in the sun and used for ceremonial dress.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Matomba, near Nandala, south of Nandarivatu, *Degener 15023*; valley of Nandala Creek, near Nauwanga, *Smith 5855*. NAMOSI: Vicinity of Namosi Village?, *Graeffe 1365*. RA: Tuvavatu, vicinity of Rewasa, near Vaileka, *Degener 15365*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7059*. REWA: Mt. Korombamba, *Meebold 16476*. OVALAU: *Tothill 29* (coll. H. Simmond); hills east of Lovoni Valley, *Smith 7307*; hills above Levuka, *Gillespie 4417*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7825*. VANUA LEVU: THAKAUNDOVE: Vicinity of Tuvamila, Natewa Peninsula, *Howard 80*; Navonu Creek, Natewa Peninsula, *Howard 206*. FIJI without further locality, *Horne 357*, s. n.

13. *PTEROCYMBIUM* R. Br. in J. Benn. & R. Br. Pl. Jav. Rar. 219. 1844; Kostermans in Reinwardtia 1: 41. 1950; A. C. Sm. in J. Arnold Arb. 36: 283. 1955.

Monoecious (or polygamo-monoecious?) trees, seasonally deciduous before flowering, the indument, when present, of stellate hairs, the stipules lateral, subulate, caducous; leaves alternate, simple, the blades entire or palmately 3- or 5-lobed, cordate or rounded at base, with 3 or more basal nerves; inflorescences axillary but crowded toward apices of branchlets, large, broadly paniculate; flowers unisexual or seemingly ♀ (but probably not functionally so); calyx turbinate-campanulate, 5-lobed nearly to middle, colored, the lobes valvate in bud, persistent in fruit; petals none; ♂ flowers with a slender androphore bearing at apex 8–15 short-stipitate anthers in a single whorl, the anthers somewhat coherent, with 2 parallel locules; ♀ flowers with a shorter androgynophore bearing anthers (presumably sterile) as in ♂ flowers and also 3–6 free, sessile carpels, these concealed by the anthers, dorsally gibbous, the ovules 2 per carpel, collateral, the styles slightly coherent distally, the stigmas free, recurved; fruits with 1–6 free, stipitate, boat-shaped follicles, these membranous, pouch-shaped at base, with a rudderlike keel, dehiscent long before maturity, the seed 1, basal in follicle, obovate, exalate.

TYPE SPECIES: *Pterocymbium javanicum* R. Br.

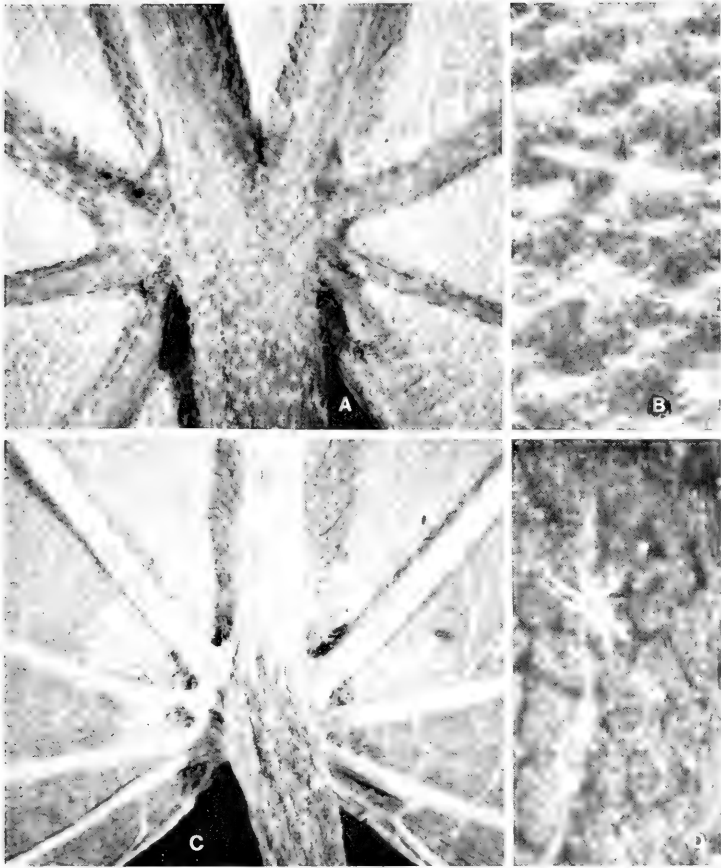


FIGURE 106. A & B, *Firmiana diversifolia*; A, lower surface of base of leaf blade, $\times 10$; B, indument of lower surface of leaf blade, $\times 70$. C & D, *Pterocymbium oceanicum*; C, lower surface of base of leaf blade, $\times 10$; D, indument of lower surface of leaf blade, $\times 70$. A & B from *Smith 7059*, C & D from *Greenwood 1092*.

DISTRIBUTION: Southeastern Asia through Malesia to New Guinea and the Bismarck Archipelago, with five or six species including an outlying endemic in Fiji terminating the range.

USEFUL TREATMENT OF GENUS: Kostermans, A. J. G. H. Notes on *Pterocymbium* R. Br. (Sterculiaceae). *Reinwardtia* 1: 41-49. 1950.

1. *Pterocymbium oceanicum* A. C. Sm. in J. Arnold Arb. 27: 320. 1946, in op. cit. 36: 283. 1955; J. W. Parham, Pl. Fiji Isl. 119. 1964, ed. 2. 169. 1972.

FIGURE 106C & D.

A tree 15-30 m. high, occurring at elevations of approximately 400-600 m. in dry forest or on its edges or in ridge forest. The calyx is yellow-green without and red-brown within. As far as now known, the species bears flowers briefly in September and then presumably develops fruits (not yet available). Foliage-bearing, sterile trees have been observed in November (*Berry 100*), February (*DA 15602, 15630*), and August (type tree). Specimens with only a few lingering leaves and young buds have been observed in August and September (*DF 1196, 1197, 1251*).

TYPIFICATION: The type is *Greenwood 1082* (A HOLOTYPE; ISOTYPES AT BISH, K, US), collected in mountains near Lautoka (doubtless in western foothills of Mt. Evans Range), Mba Province, Viti Levu. Greenwood obtained the type material on two occasions from the same tree; on Sept. 24, 1944, he procured fallen flowers and leaves, and on Aug. 18, 1945, he collected foliage-bearing branchlets.

DISTRIBUTION: Endemic to Fiji and known only from northwestern Viti Levu and a single collection from east-central Vanua Levu.

LOCAL NAMES AND USE: Recorded Fijian names are *yanitu*, *yanita*, *anita*, *amanita*, and *ma*. In the Nausori Highlands the species is known as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Mountains near Lautoka, *Greenwood 341*; forest near Mbukuya (Mangondro Tikina), *DF 1196, 1197, 1251* (all coll. J. *Vetawa*). NANDRONGA & NAVOSA: Nausori Highlands, *DA 15602, 15630* (both coll. M. J. *Berry*). VANUA LEVU: THAKAUNDRUVE: Nakoroutari (Vaturova Tikina), south of Lambasa, *Berry 100*.

Pterocymbium oceanicum is most frequently collected in sterile condition, flowering very briefly after most leaves have fallen. Its leaves appear very similar to the unlobed leaves of *Firmiana diversifolia*. However, with careful examination the two species can be distinguished from foliage alone. The basal nerves of the lower surfaces of leaf blades of *F. diversifolia* have a chartaceous "webbing" between them (FIGURE 106A), forming "pockets" from which a few minute simple hairs (0.1-0.3 mm. long) project. The stellate hairs (FIGURE 106B) of the lower leaf blade surface are often fairly abundant, 0.15-0.2 mm. in diameter, with the rays spreading in one plane. The basal nerves of the lower surfaces of leaf blades of *P. oceanicum* lack obvious "webbing" (FIGURE 106C), and the associated simple hairs are 0.2-0.7 mm. long. The stellate hairs (FIGURE 106D) of the lower leaf blade surface are sparse, 0.15-0.3 mm. in diameter, with rays that may spread in more than one plane.

14. *HERITIERA* Ait. Hort. Kew. 3: 546. 1789; Seem. Fl. Vit. 23. 1865; Kostermans in Council Sci. Indonesia Publ. 1: 3. 1959, in *Reinwardtia* 4: 465. 1959, in op. cit. 5: 377. 1961.

Monoecious trees, often with well-developed buttresses, the indument lepidote or stellate, the stipules subulate, small; leaves alternate, digitately foliolate or 1-foliolate (then appearing simple, as in our species, but with the petiole pinnulate at apex), the blades chartaceous to coriaceous, entire, usually finely fimbriate-lepidote beneath, palmately or pinnately nerved; inflorescences axillary or subterminal, freely panicu-

late, the pedicels articulate; flowers unisexual, small; calyx campanulate or urceolate, shortly 4- or 5-lobed (rarely 6- or 7-lobed); petals none; receptacle convex, glandular-papillate, flatter in ♀ flowers than in ♂ flowers; ♂ flowers with an androgynophore bearing at apex 4 or 5 (or 6) anthers in a regular ring or an irregular clump, each anther with 2 longitudinally dehiscent locules, the carpels minute and sterile or abortive; ♀ flowers less numerous, slightly larger than ♂ flowers, the short androgynophore bearing sterile anthers just below apex and at apex 4 or 5 (or 6) loosely confluent carpels, these laterally compressed, the ovules 2, the styles short, free or connate, the stigmas minute, recurved; fruits composed of 2-5 (-6) free, often samaroid, indehiscent carpels, these consisting of an ellipsoid to globose nut, with a woody epicarp usually expanded subapically into a flattened wing, the seed 1.

TYPE SPECIES: *Heritiera littoralis* Ait.

DISTRIBUTION: Eastern Africa to tropical Asia, eastward through Malasia to tropical Australia, and into the Pacific as far as Tonga and Niue, with 35-40 species, one of which is apparently introduced farther east in Polynesia and in Hawaii. Two species are indigenous in Fiji.

USEFUL TREATMENT OF GENUS: Kostermans, A. J. G. H. A monograph of the genus *Heritiera* Aiton (Stercul.). *Reinwardtia* 4: 465-583. (June) 1959 (issued originally as Publication 1 of the Council for Sciences of Indonesia, Djakarta, April 24, 1959).

KEY TO SPECIES

Leaflet blades (of unifoliolate leaf) lanceolate- to oblong- or ovate-elliptic, (8-) 10-24 × (3-) 5-15 cm., rounded to subcordate and often oblique at base, rounded to obtuse or mucronate at apex, the lower surface with a dense layer of appressed, radially striate scales (these 0.25-0.4 mm. in diameter, silvery, with a similarly colored center about 0.05 mm. in diameter), the lateral nerves 8-10 (-15) pairs; petiole 5-20 mm. long; calyx of ♀ flowers 4-6 (-7) mm. long; fruiting carpels obliquely ellipsoid, up to 9 × 5 cm., with a scarcely raised (1-2 mm. high) ventral ridge, the dorsal ridge obvious (5-8 mm. high), extending into a similar, inconspicuous apical wing; plant of coastal forest and mangrove swamps.

1. *H. littoralis*

Leaflet blades (of unifoliolate leaf) oblong- or ovate-elliptic, those of mature plants 6-15 × 3-7 cm. (of juvenile plants up to 30 × 17 cm.), obtuse or rounded at base, obtuse to obtusely acuminate at apex, the lower surface with a dense layer of appressed, radially striate hairs (these 0.15-0.25 mm. in diameter, pale ferruginous to aureous, with a dark ferruginous center about 0.1 mm. in diameter), the lateral nerves 6-13 pairs; petiole 16-80 mm. long; calyx of ♀ flowers 3-4 mm. long; fruiting carpels obliquely ellipsoid, up to 5 × 2.5 cm., inconspicuously ridged ventrally and dorsally but with an apical, beaklike, flattened, obtuse wing about 10 mm. long; plant of inland forest. 2. *H. ornithocephala*

1. *Heritiera littoralis* Ait. Hort. Kew. 3: 546. 1789; Benth. in London J. Bot. 2: 211. 1843; A. Gray, Bot. U. S. Expl. Exped. 1: 184. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 23. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 122. 1890; Guillaumin in J. Arnold Arb. 12: 230. 1931; Yuncker in Bishop Mus. Bull. 220: 187. 1959; Kostermans in Council Sci. Indonesia Publ. 1: 11. fig. 1, 2. 1959, in *Reinwardtia* 4: 473. fig. 1, 2. 1959, in op. cit. 5: 242. 1960; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 167. fig. 51. 1972. FIGURE 107A & B.

A locally abundant, often spreading tree 2-8 m. high and with a trunk to 25 cm. in diameter as seen in Fiji (but to 25 m. high and with a trunk to 60 cm. in diameter elsewhere), with thin buttresses, occurring near sea level in coastal thickets and mangrove swamps and on the edge of forest along rocky shores. The calyx is pale green and brownish-pubescent without, white proximally within and pink to red distally; the short androgynophore is white; and the fruiting carpels are pale brown. Flowering material has been obtained between January and July and fruits essentially throughout the year.

TYPIFICATION: Aiton mentioned specimens obtained by Koenig (in Ceylon) and by David Nelson. An appropriate lectotype is the specimen from Tonga collected by

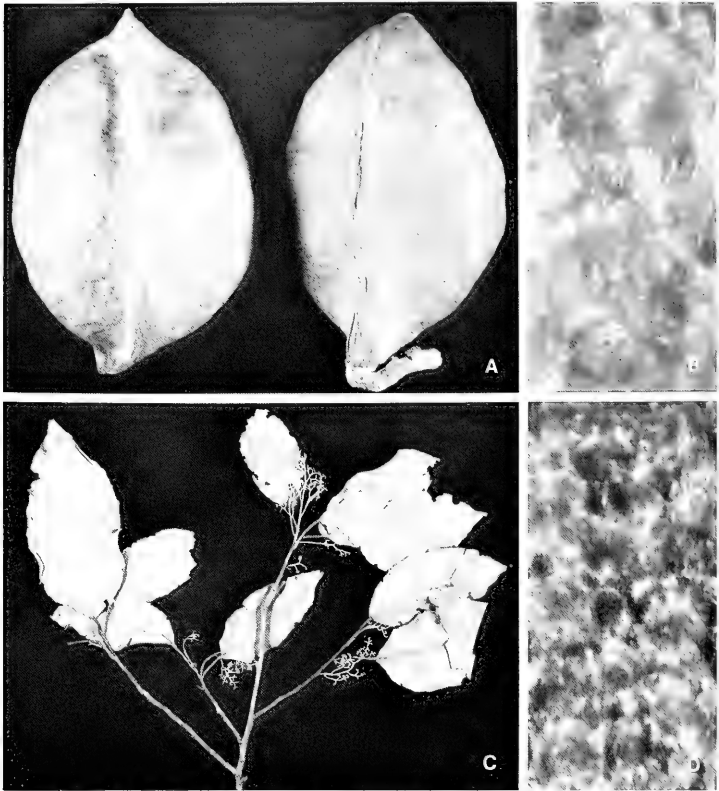


FIGURE 107. A & B, *Heritiera littoralis*; A, mature fruiting carpels (dorsal surface left, ventral surface right), $\times 1$; B, scales of lower surface of leaf blade, $\times 70$. C & D, *Heritiera ornithocephala*; C, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$; D, scales of lower surface of leaf blade, $\times 70$. A from Smith 187, B from Smith 7903, C from DA 15609, D from DF 519.

Nelson (BM) on Cook's third voyage. Aiton indicated that the species was introduced into cultivation by Banks in 1780; this introduction probably came from Nelson's material.

DISTRIBUTION: Coastal situations from eastern Africa to India and north to Formosa, eastward through Malesia to tropical Australia and into the Pacific at least as far as Tonga. I have found no records of its occurrence in Samoa or Niue, but specimens are available from the Cook and Society Islands, possibly introduced as is the case in Hawaii. Although only about 30 Fijian collections are at hand, the species may be anticipated on the coasts of most islands in the group.

LOCAL NAMES AND USES: Fijian names are *kendra ivi na yalewa kalou*, *kendra ivi, kaena ivi na kaka, rayalewakalou*, and *savara mbulu ndamu*. A common English name is *looking glass plant*. Although I find no Fijian records of its use, the tough wood is very durable and is widely used for boat-building. On Mbengga the branches have been reported as part of an internal remedy for thrush.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Yalombi, *St. John 18095*. VITI LEVU: SERUA: Ndeumba Beach, *DA 13209*. NAMOSI: Lombau, *DA 13849 (DF 353)*; Wainandoi River, *Mead 1961*. NAITASIRI: Koronivia, *DA 12866*. TAILEVU: Natovi, *DA 12495*. REWA: Near Lami, *Gillespie 2062*; Suva Bay, *MacDaniels 1016*; Nukulau Island, *Barclay 3450* or *s. n.*, *Hinds*. MBENGGGA: Savusavukalou, *Weiner 194*. KANDAVU: Namalata isthmus region, *Smith 187*; Ndaku, *DA 2959*. OVALAU: North of Levuka, *Gillespie 4493*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7903*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 589*. THAKAUNDROVE: Nukulekaleka, *DA 13171*; Maravu, near Salt Lake, *Degener & Ordenez 14256*. LAKEMBA: Between Yandrana and Vakano, *Garnock-Jones 957*. FIJI without further locality, *U. S. Expl. Exped., Seemann 33*.

2. *Heritiera ornithocephala* Kostermans in Reinwardtia 5: 241. fig. 6. 1960; J. W. Parham, Pl. Fiji Isl. 118. 1964, ed. 2. 167. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 202. fig. 20. 1970. FIGURES 107C & D, 108.

Brownlowia sp. Yuncker in Bishop Mus. Bull. 178: 80. 1943; A. C. Sm. in J. Arnold Arb. 26: 101. 1945.

A tree 10–35 m. high, with a trunk up to 1 m. in diameter and often with a large, spreading crown, occurring in usually dense forest at elevations of 60–970 m. The paniculate inflorescence is large and diffuse, up to 15 cm. in length and with a copious brown indument; the calyx is greenish yellow without and purplish within; and the fruiting carpels are brown. Flowering specimens have now been obtained between December and July, fruits in March and May.

TIPIFICATION: The type is *Horne 905* (GH HOLOTYPE; ISOTYPE at K), collected in 1877 or 1878 in Fiji without further locality.

DISTRIBUTION: Fiji, Tonga (Kao only), and Niue. This frequent and very distinctive tree, well known to Fijians as *rosarosa*, had been noted by Greenwood, Gillespie, and myself many times prior to 1954, but all individuals found were sterile. Yuncker had also noted it sterile on Niue, and we had both unwarily taken it for a species of *Brownlowia* (Tiliaceae). The Horne fruiting collection seems to have been the earliest, but it remained for Kostermans to place the taxon and to describe it. In recent years it has been frequently collected in Fiji, and several specimens with flowers or fruits are available. In order to indicate its abundance I cite below all Fijian specimens examined by me. In Fiji it appears not to grow near the sea, differing sharply in habitat from *Heritiera littoralis*, but Sykes (1970, cited above) discusses and illustrates it as a component of the coastal forests of Niue.

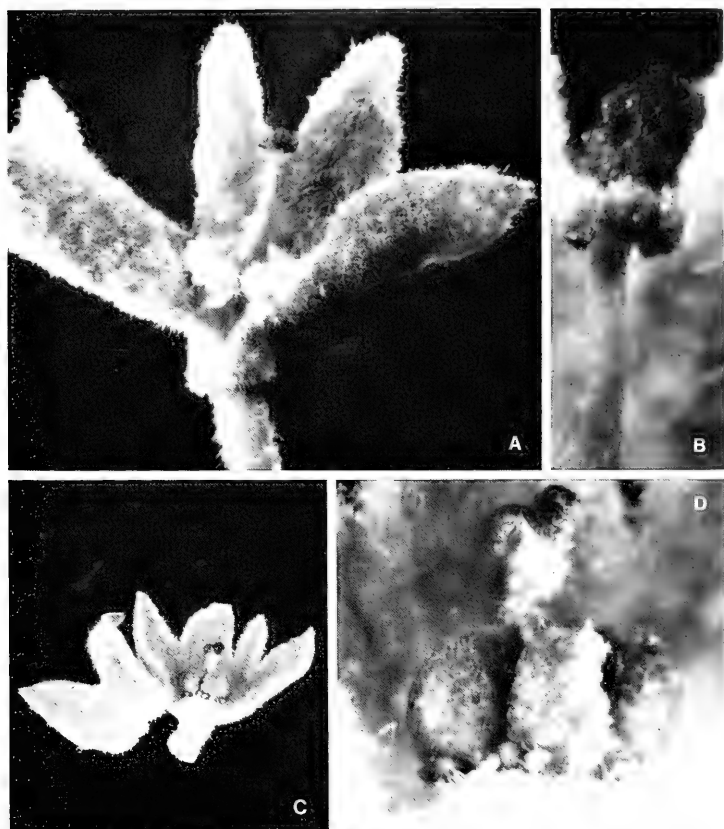


FIGURE 108. *Heritiera ornithocephala*, from DF 519; A, ♂ flower with calyx spread open, $\times 20$; B, distal portion of androgynophore, with dark anthers above abortive carpels, $\times 60$; C, ♀ flower with calyx spread open, $\times 6$; D, gynoeceium, with staminodes at apex of short androgynophore, $\times 30$.

LOCAL NAMES AND USES: The best known Fijian name is *rosarosa*; also recorded are *savai rosarosa*, *rongi*, *thau ndamu*, and *vau ndamu*. The name *tofaki* listed by Kostermans (more accurately *tafaki*) is the Niuean name. It is a well-known timber tree in Fiji, producing a hard wood that is useful for knife handles and gun stocks.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 957*; vicinity of Nandarivatu, *Mead 1975*, *Gillespie 3726*, *4401.5*; hills between Tumbeindreketi and Nggaliwana Creeks, *Smith 6019*; lower slopes of Mt. Tomanivi, *Greenwood 1177*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15609*, *DF 717 (S1416/3)*, *Damanu 158*, p. p., *NH.22*; southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4580*. SERUA: Inland from Navutulevu, *Damanu NL.12*; inland from Namboutini, *DF 526 (Damanu 158*, p. p.), *585* or *809 (S1416/6)*, *722 (S1416/4)*, *R-23*, *Damanu R.7*, *Howard 37*; inland from Korovisilou, *DF 700 (S1416/5)*, *Damanu KL.2*; inland from Ngaloa, *DF 519 (Damanu 153)*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8546*; vicinity of Namuamua, *Gillespie 3000*; hills east of Navua River, *Greenwood 957A*; Nambukavesi Creek, *DF 511*, *Vaisewa 20*. NAITASIRI: Waindina River, *DA 183*; Waimanu River, *DA L.13356 (Berry 22)*; Tholo-i-suva, *Vukicea*, Aug. 24, 1950. TAILEVU: Vicinity of Naimasimasi, *DF 993 (Damanu 179)*, *DA L.13477 (DF 1122)*. REWA: Slopes of Mt. Korombamba, *Gillespie 2372*. KANDAVU: Vicinity of Naikorokoro, *DF 701 (S1416/2)*, *Damanu KU.12*, *KU.14*; Kandavu without further locality, *Bola 129*. OVALAU: Hills southeast of valley of Mbureta River, *Smith 7452*. VANUA LEVU: MATHUATA: Ndreketi River Valley, *DA 317*; vicinity of Lambasa, inland, *DF 718 (S1416/1)*, *Damanu L.17*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8244*.

FAMILY 89. BOMBACACEAE

BOMBACACEAE Kunth, *Malvac.*, Büttner., *Tiliac.* 5, as *Bombaceae*. (April) 1822.

Trees, often buttressed, sometimes with swollen trunks, the stipules soon caducous; leaves spirally arranged or distichous, simple or digitately compound, usually with peltate scales or stellate hairs; inflorescences axillary, extra-axillary, or borne on stems and branchlets, cymose or composed of solitary or fascicled flowers; flowers hermaphrodite, large, usually actinomorphic; calyx valvate in bud, truncate or irregularly fissile or 5-lobed, often subtended by an epicalyx; petals usually 5, contorted in bud, often elongate, free or proximally connate, rarely absent; stamens 3-many (staminodes sometimes present), free or with filaments united into a tube, the anthers usually unilocular, straight to flexuose or twisted, usually dehiscent longitudinally, the pollen smooth; ovary superior, 2-5-locular, the ovules 2 or more per locule, anatropous, the placentation axile, the style simple, capitate or lobed; fruit usually a loculicidally dehiscent or indehiscent capsule, the seeds smooth, embedded in hairs arising from inner walls of capsule, the endosperm scanty or none, the cotyledons flat, contorted, or plicate.

DISTRIBUTION: Pantropical, with about 30 genera and 200 species. Two species are infrequently cultivated in Fiji.

USEFUL TREATMENT OF FAMILY: Hutchinson, *J. Bombacaceae*. Gen. Fl. Pl. 2: 522-535. 1967.

KEY TO GENERA

- Leaves simple, sometimes lobed; filaments united into a tube distally bearing many sessile, long, flexuose anther locules; style stout, the stigma cylindrical, spirally grooved; capsule 5-valved, the septa persistently attached to the valves. 1. *Ochroma*
- Leaves digitately foliolate; filaments united into a tube proximally, free distally or in 5 groups, each filament bearing 1-3 twisted anther locules; style filiform, clavate at apex, the stigma subentire; capsule 5-valved, the valves separating from the septa, these persistently attached to the columella. 2. *Ceiba*

1. OCHROMA Sw. Nov. Gen. & Sp. Prodr. 6, 97. 1788.

Trees, not seasonally deciduous, the stipules large, caducous; leaves alternate, simple, sometimes angular-lobed, palmately nerved, stellate-pubescent beneath; inflorescences composed of solitary, axillary flowers, these large, slightly zygomorphic, the pedicel with caducous bracteoles proximally; calyx tubular or infundibular, 5-lobed,

thick-walled, the lobes ovate-deltoid, 3 often marginally colored and rounded, the other 2 subacute; petals spatulate, erect, at length recurved and recoiled; stamens with filaments forming a shortly 5-lobed tube bearing in its distal portion many sessile, long, flexuose anther locules; ovary 5-locular, the ovules many in each locule, the style stout, the stigma cylindrical, spirally 5-grooved; fruit a loculicidally 5-valved capsule, this long, narrow, densely brown-tomentose within, the seeds numerous, embedded in tomentum, exarillate, the endosperm fleshy, the cotyledons broad, involute-margined.

TYPE SPECIES: *Ochroma lagopus* Sw. (= *O. pyramidale* (Cav.) Urb.).

DISTRIBUTION: Tropical America (southern Mexico and West Indies to Bolivia), often considered monotypic but sometimes divided into about nine species (cf. W. W. Rowlee in J. Wash. Acad. Sci. 9: 157-167. 1919). A. Robyns (in Ann. Missouri Bot. Gard. 51: 64-67. fig. 9. 1964) considers the genus to consist of a single species, and that viewpoint is here adopted.

1. *Ochroma pyramidale* (Cav.) Urb. in Repert. Sp. Nov. Beih. 5: 123. 1920; J. W. Parham, Pl. Fiji Isl. ed. 2. 170. 1972.

Bombax pyramidale Cav. in Lam. Encycl. Méth. Bot. 2: 552. (Apr. 14) 1788, Monad. Classis Diss. 5: 294. (July 23-26) 1788.

Ochroma lagopus Sw. Nov. Gen. & Sp. Prodr. 98 (June 20-July 31) 1788; J. W. Parham in Agr. J. Dept. Agr. Fiji 29: 33. 1959.

An infrequently cultivated tree, found near sea level and attaining a height of about 12 m. (but becoming much taller where indigenous). The petals are noted as yellowish or brownish white; the only available collection was flowering in June.

TYPIIFICATION: Cavanilles stated that he examined a specimen in the Vaillant herbarium; this, presumably at P, may be taken as the holotype, although the author indicated that the species had been discovered by Plumier and is very common in the Antilles. Swartz's material also came from the West Indies, but his name was proposed slightly later in 1788 than Cavanilles's.

DISTRIBUTION: West Indies and perhaps elsewhere in tropical America.

LOCAL NAME AND USE: The well-known *balsa* is valued for its lightweight wood, which is used commercially for many purposes. It is also an ornamental tree and in some parts of the tropics is used for reforestation; perhaps it was brought into Fiji for such a purpose.

AVAILABLE COLLECTION: VANUA LEVU: THAKAUNDOVE: Savusavu, near Department of Agriculture office, Howard 110. Parham (1959, cited above) lists the species as then growing in the Suva Botanical Gardens, but no voucher is available.

2. *CEIBA* Mill. Gard. Dict. Abridg. ed. 4. 1754.

Trees, often seasonally deciduous, the stipules small, caducous; leaves alternate, digitately compound, the leaflets 3-11, short-petiolulate, glabrous, glaucous beneath, entire at maturity; inflorescences axillary or borne at defoliate nodes, composed of fasciculate or solitary flowers, these actinomorphic (rarely slightly zygomorphic); calyx campanulate to urceolate, subtruncate to irregularly 3-12-lobed, persistent; petals connate at base, adnate to staminal tube, falling off together with stamens and style; stamens 3-15, the filaments joined into a tube proximally, free distally or in 5 groups, each filament bearing 1-3 twisted anthers locules; ovary 5-locular, the ovules many in each locule, the style filiform, clavate at apex, the stigma subentire; fruit a loculicidally 5-valved, woody to coriaceous, oblong to subobovoid capsule, the valves within densely tomentose, separating from the base upwardly from the persistent septa, the septa and columella glabrous, the seeds numerous, embedded in tomentum, exarillate, the endosperm scanty, the cotyledons contorted-plicate.

LECTOTYPE SPECIES: *Ceiba pentandra* (L.) Gaertn. (*Bombax pentandrum* L.). The informative discussion by Nicolson (in *Taxon* **28**: 369. 1979) points out that Miller established the genus *Ceiba* with two polynomic species, both based on Plumier, Nov. Gen. 42. 1703. Plumier's *pl.* 32 must represent the type of one or both of Miller's taxa, and this plate is taxonomically the same as *Bombax pentandrum*, although it was not among Linnaeus's references pertaining to that species.

DISTRIBUTION: Tropical and subtropical America, with about ten species, one of which is widely cultivated and occasionally naturalized in the Pacific. One species, as noted below, has a natural distribution extending to West Africa.

1. ***Ceiba pentandra*** (L.) Gaertn. *Fruct. Sem. Pl.* **2**: 244. *t.* 133. 1791; Christophersen in *Bishop Mus. Bull.* **128**: 145. 1935; Yuncker in op. cit. **178**: 84. 1943, in op. cit. **184**: 51. 1945, in op. cit. **220**: 185. 1959; J. W. Parham in *Agr. J. Dept. Agr. Fiji* **29**: 32. 1959, *Pl. Fiji Isl.* 119. 1964, ed. 2. 170. 1972; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 51. 1970.

Bombax pentandrum L. *Sp. Pl.* 511. 1753.

As it occurs in Fiji, *Ceiba pentandra* is sparingly cultivated and rarely naturalized near sea level; where indigenous it becomes a large tree to 30 m. high or more, with a stout, buttressed trunk. Its petals are white to pale rose, and its mature fruits become brown, with white or grayish internal indument. Flowers and fruits have not yet been observed on Fijian specimens.

LECTOTYPIFICATION: Nicolson (1979, discussed above under the genus) suggests that, since no specimens were preserved by Linnaeus, the best lectotypifying reference among the six originally cited is Rheede, *Hort. Ind. Malabar.* **3**: *t.* 49-51 (presumably *t.* 50, which shows flowers). 1682.

DISTRIBUTION: A valuable discussion of the distribution and many other aspects of *Ceiba pentandra* has been provided by H. G. Baker (The evolution of the cultivated kapok tree: a probable West African product. *In*: Brokesha, D. (ed.). *Ecology and Economic Development in Tropical Africa.* *Inst. Internat. Stud. Univ. Calif. Berk. Res. Ser.* **9**: 185-216. 1965). Like other species of *Ceiba*, *C. pentandra* was doubtless tropical American in origin (var. *caribaea*), spreading to West Africa by pre-human dispersal in sea drift. Variety *caribaea* occurs in West Africa, and a var. *guineensis* has also evolved there. The commonly cultivated form (var. *pentandra*) apparently arose as a hybrid between the other two varieties and reached Asia as a trade item as early as the tenth century.

LOCAL NAMES AND USES: *Kapok*, *vauvau ni vavalangi*, *semar*. Kapok is the floss derived from the inner wall of the capsule; it is widely used for filling cushions, etc., and for insulating purposes. Although the species was probably brought into Pacific areas as an ornamental or for experimental purposes, it has many other uses; it provides a useful lightweight timber, fibers are obtained from the bark, the leaves and bark are used medicinally, the pods and seeds are edible, and oil from the seeds is utilized for many purposes. Interesting discussions have been provided by Burkill (*Dict. Econ. Prod. Malay Penins.* ed. 2. 507-511. 1966) and Purseglove (*Trop. Crops, Dicot.* 34-39. 1968).

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Nanduruloulou, *DA 751*. REWA: Botanical Gardens, Suva, *DA 12108*.

Specimens of *Ceiba pentandra*, either cultivated or naturalized, are now available

from Micronesia, Tonga, Niue, Samoa, and the Cook, Austral, Society, and Marquesas Islands, as well as Hawaii.

FAMILY 90. MALVACEAE

MALVACEAE Juss. Gen. Pl. 271. 1789.

Shrubs or annual or perennial herbs, sometimes small trees, with mucilage canals, stipulate, the stems and bark usually fibrous, the indument composed of stellate hairs or scales but usually also with some simple hairs; leaves alternate (spirally arranged), simple, entire to lobed or toothed, usually palmate-nerved; inflorescences axillary or terminal, racemose- or panicle-like-cymose or fasciculate or composed of solitary flowers; flowers hermaphrodite, rarely unisexual, usually actinomorphic and 5-merous; calyx composed of (3-) 5 usually connate, valvate sepals, sometimes subentire, often persistent; epicalyx often present and persistent, formed by 3-many segments, these free or connate; petals 5, contorted, usually asymmetrical, adnate proximally to staminal column and falling off with it, sometimes marcescent; stamens numerous, monadelphous, forming a staminal column, this 5-dentate at apex with filaments projecting from its outer surface or not dentate at apex but there bearing numerous free filaments, the anthers dorsifixed, unilocular, often reniform, longitudinally dehiscent, the pollen minutely spiny; ovary superior, (3-) 5-many-locular, the ovules 1-many per locule, anatropous, the placentation axile, the styles as many as ovary locules or rarely twice as many, usually highly united, the stigmas on style arms or nearly united; fruit a schizocarp or capsule, infrequently indehiscent (rarely baccate), 3-many-seeded, the mericarps 1-many-seeded, the seeds often pubescent or comose, usually with scanty endosperm, the embryo usually curved, the cotyledons often plicate.

DISTRIBUTION: Pantropical and subtropical, sometimes in temperate regions. The number of genera to be accepted varies in different treatments from about 50 to 88, and the number of species from about 1,000 to 2,300. Ten genera are known to occur in Fiji, but only four species (in the genera *Hibiscus*, *Thespesia*, *Gossypium*, and *Sida*) are believed to be indigenous, the other species being cultivated or adventive.

USEFUL TREATMENTS OF FAMILY: Borssum Waalkes, J. van. Malesian Malvaceae revised. *Blumea* 14: 1-213. 1966. Hutchinson, J. Malvaceae. Gen. Fl. Pl. 2: 536-567. 1967. Fryxell, P. A. A redefinition of the tribe Gossypieae. *Bot. Gaz.* 129: 296-308. 1968.

Some of the difficulties of sharply separating the Malvaceae and Bombacaceae are interestingly discussed by Borssum Waalkes (1966, cited above, pp. 7-8) and Fryxell (1968, cited above, pp. 304-307). In general, the Malvaceae always have an obvious staminal column, the anthers are consistently unilocular, and the pollen is spiny. Karyological distinctions are fairly dependable (Fryxell, 1968). The tribe Gossypieae may eventually best be treated as a distinct family. These problems are not pertinent to the flora of Fiji, since the Bombacaceae are present only as sparingly cultivated large trees. The 1966 treatment of Borssum Waalkes, which is somewhat conservative in its treatment of species, includes all the taxa known to occur in Fiji; his keys have been abstracted for our purposes. However, the tribe Gossypieae should probably be removed from the Hibisceae, as discussed by Fryxell.

The family is economically important for cotton (*Gossypium* spp.). Several other genera yield useful fibers, at least one (*Abelmoschus*) has edible portions, the wood of a few species is useful, and some genera (notably *Hibiscus*) are well known as ornamentals.

KEY TO GENERA

- Staminal column 5-dentate at apex; filaments projecting from outer surface of column or a considerable part of it; epicalyx present (in our species).
- Style 1, branched at apex or with a lobed or ribbed stigma, the branches, lobes, or ribs as many as ovary locules, usually 5; fruit a capsule.
- Foliage non-punctate; nectaries lacking at summit of peduncle; style distally divided into 5 spreading branches; seeds more or less reniform (tribe Hibisceae).
- Calyx 5-lobed or 5-partite, not (or rarely) splitting on one side during anthesis, not adnate to corolla, persistent after flowering. 1. *Hibiscus*
- Calyx minutely 5-dentate at apex, splitting on one side during anthesis, adnate to corolla and falling off with it after anthesis. 2. *Abelmoschus*
- Foliage more or less punctate; trimerous nectaries often borne at summit of peduncle; calyx entire or minutely 5-dentate; style undivided, bearing a lobed or ribbed stigma at apex; seeds turbinate, often comose (tribe Gossypieae).
- Epicalyx with 3-8 small, narrow, mostly caducous segments; ovary 5-locular or 10-locular due to false dissepiments; fruit woody, 5-locular, with ridges alternating with dissepiments; seeds glabrous or short-pilose, rarely lanate; black oil-glands lacking. 3. *Thespesia*
- Epicalyx with 3 large, leaflike, cordate, persistent segments; ovary and capsule 3-5-locular, the capsule papery or leathery; seeds densely long-lanate; nearly all parts punctate with black oil-glands. 4. *Gossypium*
- Styles 10, twice as many as ovary locules or mericarps; fruit a schizocarp, at maturity breaking into mericarps (tribe Ureneae).
- Mericarps glochidiate with hooked spines; corolla rotate, the petals not auriculate; herbs or undershrubs, the leaf blades glanduliferous on costa beneath. 5. *Urena*
- Schizocarps smooth and fleshy, ultimately breaking into mericarps; corolla long-campanulate or fusiform, the petals auriculate at base; shrubs, often with scrambling branches, the leaf blades not glanduliferous on costa beneath. 6. *Malvastrum*
- Staminal column not dentate at apex but there bearing numerous free filaments; epicalyx present or absent; styles or style branches as many as ovary locules; fruit a schizocarp, at maturity breaking into mericarps (tribe Malveae).
- Flowers (and fruits) with an epicalyx of 3 small segments, these slightly adnate to calyx; ovules 1 per ovary locule; mericarps 1-seeded, without a transverse, false dissepiment; style branches with capitate stigmas. 7. *Malvastrum*
- Flowers (and fruits) without an epicalyx (at least in our species).
- Ovules 1 per ovary locule; mericarps 1-seeded, closely enveloping the seed.
- Leaf blades hastate; flowers medium-sized, with bluish or purple petals; mericarp with lateral walls obliterated before maturity. 8. *Anoda*
- Leaf blades orbicular to lanceolate or linear, not hastate; flowers small, with yellow petals; mericarps with lateral walls persistent or decaying after maturity. 9. *Sida*
- Ovules 2 or more per ovary locule; mericarps follicular, with 2 or more seeds, dehiscent and dropping the seeds at maturity; flowers medium-sized, our species with yellow to orange petals.
10. *Abutilon*

1. *HIBISCUS* L. Sp. Pl. 693. 1753; Seem. Fl. Vit. 16, p. p. 1865; Borss. in Blumea 14: 25. 1966. Nom. cons.

Herbs, shrubs, or trees, the indument rarely lepidote; leaf blades entire to palmately-lobed, often glanduliferous on one or more of the principal nerves; inflorescences axillary, composed of solitary flowers or these in terminal racemes or panicles by reduction of distal leaves; pedicels usually articulate, thickened at apex; segments of epicalyx 3-many, free or shortly connate, usually persistent; calyx usually campanulate, 5-partite; corolla often large and showy, sometimes small; staminal column usually shorter than or as long as petals, antheriferous throughout or only in distal half; ovary 5-locular or 10-locular due to false dissepiments, the ovules 3-many per locule, the style 1, distally 5-branched, the stigmas discoid, capitate, or spatulate; fruit a loculicidally dehiscent capsule, this 5- or (by false dissepiments) 10-locular, the seeds 3-many per locule, subglobose or reniform, glabrous or pilose.

TYPE SPECIES: *Hibiscus syriacus* L., one of Linnaeus's 20 original species. Typ. cons.

DISTRIBUTION: Pantropical and subtropical, sometimes in temperate areas, with 250-300 species. Borssum Waalkes places the Malesian species in nine sections, five of

which are represented by species occurring in Fiji. Eight species are here noted in Fiji, one indigenous and the others cultivated (sometimes naturalizing) or adventive.

KEY TO SPECIES

- Trees, with large, ovate to oblong, broadly attached stipules, these ultimately leaving annular scars; epicalyx usually shorter than calyx, with 8-11 deltoid, acute segments; staminal column shorter than petals, antheriferous throughout; ovary and capsule 10-locular, with 5 true and 5 false dissepiments (sect. *Azanza*). 1. *H. tiliaceus*
- Herbs or shrubs, the stipules small, filiform, linear to lanceolate, occasionally spatulate or cochleariform; ovary and capsule 5-locular.
- Calyx becoming enlarged and inflated after anthesis and sometimes enveloping fruit, with 10 strongly prominent nerves, 5 of them bifurcating at sinuses into intramarginal nerves of lobes that unite with each midnerve at apex; staminal tube shorter than petals, antheriferous throughout; leaf blades glanduliferous on costa beneath, the larger ones palmately lobed; annual herbs, often woody at base (sect. *Furcaria*).
- Stems unarmed or with caducous bristles, smooth or verrucose; leaf blades variable, undivided to deeply 3- or 5-lobed, up to 15 cm. long and broad; pedicels becoming 10-17 mm. long in fruit; calyx after anthesis becoming fleshy and 25-55 mm. long, sparsely pilose to densely hispid; seeds stellate-pilose. 2. *H. sabdariffa*
- Stems with conical prickles and also velutinous to tomentose with minute stellate hairs; leaf blades undivided to shallowly 3- or 5-lobed, up to 11 x 9 cm.; pedicels 2-5 mm. long, not much elongating in fruit; calyx after anthesis pergamentaceous and about 20 mm. long, stellate-pilose and setose without, stellate-velutinous within; seeds glabrous. 3. *H. diversifolius*
- Calyx not much enlarged after anthesis and without prominent nerves.
- Staminal column longer than petals, antheriferous in distal half; shrubs, with ovate, entire or serrate-dentate but seldom lobed leaf blades; corolla large and showy, the petals usually 5-10 cm. long (sect. *Lilibiscus*).
- Pedicels 1.5-7.5 cm. long; segments of epicalyx linear-lanceolate, 5-18 mm. long; calyx 5-parted for about half its length; corolla with entire petals, variable in color (red to orange or yellow), often double; staminal column slightly longer than petals, firm. 4. *H. rosa-sinensis*
- Pedicels 8-16 cm. long; segments of epicalyx 1-2 mm. long; calyx irregularly 2-4-lobed and sometimes spathaceous; corolla with deeply incised, flabellately bipinnatifid petals, these red, sometimes with yellow or white margins; staminal column about twice as long as petals, slender, flaccid. 5. *H. schizopetalus*
- Staminal column shorter than petals, antheriferous throughout; corolla smaller, the petals 1-7 cm. long; segments of epicalyx well developed and persistent.
- Seeds with an aureole of long, silky, ferruginous hairs; calyx not more than 22 mm. long, divided to middle or slightly deeper; leaf blades somewhat ovate, often 3-lobed, up to 12.5 x 6 cm. (sect. *Hibiscus*).
- Large shrubs, to 4 m. or more high; leaf blades essentially glabrous, not glanduliferous on costa beneath; pedicel 5-15 mm. long, stout, inarticulate; calyx 14-22 mm. long; corolla 3-6 cm. long, purple to red or white and sometimes variegated; fruit much longer than calyx. 6. *H. syriacus*
- Herbs or undershrubs to 1.5 m. high; leaf blades stellate-pilose beneath or on both surfaces, usually glanduliferous on costa beneath; pedicel 10-25 mm. long, accrescent to 45 mm. long, slender, articulate; calyx 6-10 mm. long; corolla 1-3 cm. long, pink to white; fruit subglobose, about as long as calyx. 7. *H. hirtus*
- Seeds dorsally tomentose, the hairs 2-4 mm. long, spreading to subspreading; pedicel accrescent to 40 mm. or more long, articulate; calyx 20-33 mm. long, abruptly widened above base, deeply divided; corolla 5-7 cm. long, white, becoming pink to red; leaf blades orbicular, 10-25 cm. long and broad, 3-7-lobed, cordate at base, stellate-pilose and also with long glandular hairs beneath, not glanduliferous on costa beneath (sect. *Trionum*). 8. *H. mutabilis*

1. *Hibiscus tiliaceus* L. Sp. Pl. 694. 1753; Borss. in *Blumea* 14: 29. 1966.

In this widespread species Borssum Waalkes recognizes five subspecies that occur in Malesia; two of them are known from Fiji.

KEY TO SUBSPECIES

- Leaf blades orbicular or suborbicular, about as broad as long, deeply cordate at base, rarely inconspicuously 3-lobed. 1a. subsp. *tiliaceus*
 Leaf blades ovate to elliptic, longer than broad, usually acute to rounded at base, deeply or shallowly 3-lobed. 1b. subsp. *hastatus*

1a. ***Hibiscus tiliaceus* subsp. *tiliaceus***; Borss. in *Blumea* **14**: 30. 1966.

Hibiscus tiliaceus L. Sp. Pl. 694. 1753; Seem. Fl. Vit. 18. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 121. 1890; Guillaumin in J. Arnold Arb. **12**: 228. 1931; Christophersen in Bishop Mus. Bull. **128**: 143. 1935; Yuncker in op. cit. **178**: 83. 1943, in op. cit. **184**: 51. 1945, in op. cit. **220**: 184. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 115. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 333. 1971; St. John in Phytologia **36**: 369. 1977.

Paritium tiliaceum Juss. ex St. Hil. Fl. Bras. Merid. **1**: 256. 1828; A. Gray, Bot. U. S. Expl. Exped. **1**: 178. 1854; Seem. in Bonplandia **9**: 254. 1861, Viti, 433. 1862.

Paritium purpurascens Seem. in Bonplandia **9**: 254, nom. nud. 1861, Viti, 433, nom. nud. 1862; A. Gray in Bonplandia **10**: 34, nom. nud. 1862, in Proc. Amer. Acad. Arts **5**: 315, nom. nud. 1862.

Hibiscus tiliaceus var. *purpurascens* Seem. Fl. Vit. 18. 1865; J. W. Parham, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972.

Pariti tiliaceum Britton, Fl. Bermuda, 239. 1918.

Hibiscus tiliaceus var. *tiliaceus*; J. W. Parham, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972.

Pariti tiliaceus (sic) var. *tiliaceus*; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 31. 1972.

A spreading tree 3–10 m. high (as seen in Fiji, but elsewhere sometimes to 15 m. or more high) occurring near sea level in coastal thickets and lowland thickets, often along river banks; it is often found inland up to 800 m. elevation, but then it is planted or an escape from cultivation. Its petals are yellow, rich purple at base on both surfaces, and turning pinkish or red; its staminal column is yellow, its style rich purple distally, and its fruit brown. Flowers and fruits occur throughout the year.

TYPIFICATION AND NOMENCLATURE: Among Linnaeus's references, that to Fl. Zeyl. 259. 1747 bears an asterisk, and therefore Borssum Waalkes indicates the holotype as Herb. Hermann, Vol. III, fol. 51, *Linn. n. 258* (BM). The holotype of *Hibiscus tiliaceus* var. *purpurascens* is *Seemann 24* (K), collected in 1860 at or near Somosomo, Taveuni. This specimen and a few others from Fiji have the branchlets and leaves turning purplish, but the color variation occurs in company with the usual green-leaved form and seems inconsequential.

DISTRIBUTION: Pantropical and subtropical, especially along coasts. Its seeds are viable after floating in seawater for several months, this doubtless accounting for its wide dispersal. Because of its many uses *Hibiscus tiliaceus* has been planted near inland villages and readily becomes naturalized away from the sea. About 35 Fijian collections are at hand, but the species is more abundant than this would indicate.

LOCAL NAMES AND USES: The usual Fijian names are *vau* and *vau ndina*; also noted are *vaundra* and *vauleka*; the purple-tinged variant is known as *vau ndamu* or *vau ndamundamu*. The inner bark has many uses for its fiber, such as cordage (for tying house timbers, canoe outriggers, etc.), making skirts worn on ceremonial occasions, and straining the coarse particles from *yanggona*. Medicinal uses are also ascribed to the species: its leaves are wrapped on bone fractures, and its stem is part of an internal remedy for treating ulcers.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Lautoka, *Greenwood 399*; shores of Mba River near its mouth, *Smith 4741*; vicinity of Nandarivatu, *Gillespie 4251*. NANDRONGA & NAVOSA: Near Thotho Levu, *H. B. R. Parham 257*. SERUA: Vicinity of Ngaloa, *Smith 9683*. NAMOSI: Melimeli, *DF 354* (*Damanu 43*). NAITASIRE: Vunindawa, *DA 10007*; Koronivia, *DA 6022*. TAILEVU: Matavatathou, *DA 11280*; Wainimbokasi, *DA 816*. REWA: Suva Bay, *Bryan 189*. KANDAVU: Namalata isthmus region, *Smith 16*. KORO: West coast, *Smith 1081*. NGAU: Shore of Herald Bay, vicinity of Sawaike, *Smith 7947*. TAVEUNI: Navakawau,

Weiner 71-7-27b. VANUA MBALAVU: Near Lomaloma, Garnock-Jones 986. LAKEMBA: Seemann 25. FULANGA: On limestone formation, Smith 1223.

1b. *Hibiscus tiliaceus* subsp. *hastatus* (L. f.) Borss. in *Blumea* 14: 36. fig. 6a. 1966.

Hibiscus hastatus L. f. Suppl. Pl. 310. 1781; Forst. f. Fl. Ins. Austr. Prodr. 49. 1786.

Hibiscus tricuspis Banks ex Cav. Monad. Classis Diss. 3: 152. t. 55, fig. 2. 1787; Seem. Fl. Vit. 18. 1865;

Drake, Ill. Fl. Ins. Mar. Pac. 122. 1890; J. W. Parham, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972.

Paritium tricuspis G. Don, Gen. Hist. Dichlam. Pl. 1: 485. 1831; Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862.

A small tree growing with subsp. *tiliaceus* or slightly inland in forested ravines to an elevation of 150 m. It has the same basic characters as the typical subspecies.

TYPIFICATION AND NOMENCLATURE: The type of *Hibiscus hastatus* is *J. R. & G. Forster* (LINN HOLOTYPE; ISOTYPES at BM, K, P), collected in Tahiti, Society Islands, during Cook's second voyage. As the holotype of *H. tricuspis*, Borssum Waalkes cites *Forster ?142* (P). However, the fact that Cavanilles assigned the binomial to Banks suggests that the holotype may be erroneously marked and may be a duplicate of the BM specimen indicated as "Tahiti—Banks & Solander. Cook's 1st Voyage." At any rate, only one taxon is concerned.

DISTRIBUTION: Pacific islands from the Bismarck Archipelago eastward to the Societies; probably cultivated elsewhere. In Fiji it seems comparatively infrequent. The leaf blades may be very inconspicuously 3-lobed, but the general shape and the base of the blade readily separate the taxon from subsp. *tiliaceus*.

LOCAL NAMES AND USES: The names *vau* and *vaundra* have been used, and apparently the two subspecies in Fiji are similarly utilized.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Korovou, east of Tavua, *Degener 14967*. FIJI without further locality, *Seemann 26*.

2. *Hibiscus sabdariffa* L. Sp. Pl. 695. 1753; Christophersen in *Bishop Mus. Bull.* 128: 144. 1935; Yuncker in op. cit. 178: 83. 1943, in op. cit. 184: 51. 1945; Borss. in *Blumea* 14: 64. 1966; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 114. 1970; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 171. 1972.

A sparingly cultivated and sometimes naturalized subliguous annual herb 1-3 m. high, often with reddish stems, found near sea level. The calyx is green or whitish, at length becoming pale yellow or red; the petals are pale yellow with a bright yellow or maroon spot at base, and the fruit is an ovoid capsule 2-3 cm. long. The few available specimens do not indicate seasonality of flowering and fruiting in Fiji.

TYPIFICATION: Borssum Waalkes (1966) could not reach a satisfactory conclusion as to the typification of this species; he believes that a special study would be required to fix on an appropriate lectotype and therefore indicates that his concept of the species is "the usual one."

DISTRIBUTION: Cultivated in all tropical regions either for edible purposes or as a fiber-producing plant. The original area of the species is not indicated by Borssum Waalkes (1966), but Purselove (*Trop. Crops, Dicot.* 370-374. fig. 59. 1968) considers the species indigenous to West Africa, spreading to Asia at least three centuries ago and taken to the New World by the slave trade in the seventeenth century. In the Pacific only var. *sabdariffa*, with edible calyces, seems to occur; a second variety is grown elsewhere for its fiber.

LOCAL NAMES AND USES: *Roselle*, the usual name, has been used in Fiji; other frequently used names are *Jamaican sorrel* and *red sorrel*. The succulent calyces are

boiled with sugar to produce the sorrel drink; jellies, preserves, and chutneys may also be made from the calyces. The young leaves and young stalks may be used as a potherb or in salads.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Between Nanduna and Navuakethe, *DA 2609*. TAILEVU: Nakaile, *DA 5657*. VANUA LEVU: MATHUATA: Lambasa, *DA 11797*.

3. *Hibiscus diversifolius* Jacq. *Collect.* **2**: 307. 1789, *Icon. Pl. Rar.* **3**: *t. 551*. 1792; A. Gray, *Bot. U. S. Expl. Exped.* **1**: 174. 1854; Seem. in *Bonplandia* **9**: 254. 1861, Viti, 433. 1862, *Fl. Vit.* **17**. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* **121**. 1890; Guillaumin in *J. Arnold Arb.* **12**: 228. 1931; Greenwood in *Proc. Linn. Soc.* **154**: 95. 1943; J. W. Parham, *Pl. Fiji Isl.* **120**. 1964, ed. 2. 171. 1972; Borss. in *Blumea* **14**: 65. 1966.

Hibiscus camabinius sensu Yuncker in *Bishop Mus. Bull.* **178**: 82. 1943; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 112. 1970; non L.

An annual herb 1–2.5 m. high, suffruticose at base and with thorny stems, abundantly naturalized as a weed along roadsides and in open fields, ricefields, and thickets, at elevations from near sea level to about 200 m. As noted in Fiji the petals are usually pale yellow and maroon within proximally, but they are sometimes indicated as purple elsewhere. Flowers and fruits occur throughout the year.

TYPIFICATION: Jacquin's 1792 illustration may be taken as the holotype (cf. *Borsum Waalkes*, 1966).

DISTRIBUTION: Old World tropics, including Malesia, Australia, and Pacific islands. I doubt its indigenesness much to the east of New Guinea, although it is found eastward to Fiji and Niue and also in Hawaii. Probably it was an aboriginal introduction into Fiji, but whether inadvertently or for use as a fiber plant is questionable.

LOCAL NAMES AND USES: Fijian names are *kalauaisoni*, *kalakalauaisoni*, *kalakala visoni*, *lewa ni sanggalu*, and *lewa ni nasanggalau*. To a limited extent the stem fibers are used for cordage, and juice from the leaves is reportedly used to procure abortion.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 158*; north of Natalau, *Degener 15001*. NANDRONGA & NAVOSA: Korolevu, *DA 2879*. NAITASIRI: Nangali, *DA 14340*; Mbatiki, *DA 2604*. TAILEVU: Wainimbuka River Valley, *DA 10958*; Matavatathou, *DA 7755*; Natovi, *DA 10849*, *12489*; Sawakasa, *DA 14341*; Navoloo, *DA 2712*. VANUA LEVU: MBUA: Mbua Bay, *U. S. Expl. Exped.* MATHUATA: Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6748*; Malau Road, *DA 10503*. THAKAUNDROVE: Near Navakaka Village, *DA 16833*. LAKEMBA: *Tothill 27*, *DA 2525*; near Tumbou, *Garnock-Jones 920*. FIJI without further locality, *Seemann 21*.

4. *Hibiscus rosa-sinensis* L. *Sp. Pl.* **694**. 1753; A. Gray, *Bot. U. S. Expl. Exped.* **1**: 173. 1854; Seem. in *Bonplandia* **9**: 254. 1861, Viti, 433. 1862, *Fl. Vit.* **16**. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* **121**. 1890; Christophersen in *Bishop Mus. Bull.* **128**: 143. 1935; Yuncker in *op. cit.* **178**: 83. 1943, in *op. cit.* **184**: 51. 1945; J. W. Parham in *Agr. J. Dept. Agr. Fiji Isl.* **19**: 99. 1948; Yuncker in *Bishop Mus. Bull.* **220**: 183. 1959; J. W. Parham, *Pl. Fiji Isl.* **120**. 1964, ed. 2. 171. 1972; Borss. in *Blumea* **14**: 72. 1966; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 114. 1970; St. John & A. C. Sm. in *Pacific Sci.* **25**: 333. 1971; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 19, 31. 1972.

Hibiscus storckii Seem. in *Bonplandia* **9**: 254, nom. nud. 1861, Viti, 433, nom. nud. 1862; A. Gray in *Bonplandia* **10**: 34, nom. nud. 1862, in *Proc. Amer. Acad. Arts* **5**: 315, nom. nud. 1862; Seem. *Fl. Vit.* **17**. *t. 4*. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* **121**. 1890; J. W. Parham, *Pl. Fiji Isl.* **121**. 1964, ed. 2. 171. 1972. *Hibiscus rosa-sinensis* var. *flore pleno* Seem. *Fl. Vit.* **17**, nom. nud. 1865.

The most common garden hibiscus is cultivated widely in Fiji, usually as a shrub 1-3 m. high and between sea level and 500 m. elevation; it is also freely naturalized along trails and in thickets and forest. As elsewhere, there is a beautiful range of flower color from crimson to red, rich pink, orange, and yellow. Double-flowered forms are frequent, as are many cultivars and putative hybrids between this species and *H. schizopetalus*. Flowering does not seem to be seasonal.

TYPIFICATION AND NOMENCLATURE: The obvious lectotype is Herb. Hermann, Vol. III, fol. 4, *Linn. n. 260* (BM) (vide Borssum Waalkes, 1966). The type of *Hibiscus storckii* is *Seemann 23* (K HOLOTYPE; ISOTYPE at BM), collected in May, 1860, near Somosomo, Taveuni. Asa Gray, studying some of Seemann's material, expressed his opinion that *H. storckii* was not sufficiently distinct from *H. rosa-sinensis*, but Seemann (in *Bonplandia 10*) used his editorial prerogative parenthetically to question that conclusion, subsequently proceeding with his description. Examination of the type shows conclusively that Gray was correct. If the species is further divided, our material may all be placed in var. *rosa-sinensis*.

DISTRIBUTION: Cultivated throughout the world in the tropics and subtropics, often for hedges, and in temperate greenhouses. Although the origin of the species is uncertain, it was probably indigenous in eastern Africa, with its relative, *H. schizopetalus*. It was either an aboriginal or a very early European introduction into Pacific areas.

LOCAL NAMES AND USE: *Hibiscus* is widely used, but Fijian names are *senitoo*, *sengguelu*, *senithikombia*, *kauti*, and *lororu*. The species, of course, is a favorite ornamental and may be seen in practically every town and village, often in hedges.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Nanggara Island, *H. B. R. Parham s. n.* REWA: Suva, Botanical Gardens, *DA 12295, 12332*. MBENGGGA: Raviravi, *Weiner 164*. KANDAVU: Western end of island, near Cape Washington, *Smith 323*. OVALAU: *U. S. Expl. Exped., Milne 241, MacGillivray, Oct., 1854, Bryan 606*; near summit of main ridge west of Levuka, *Gillespie 4453*. MOTURIKI: *Seemann 22*. WAKAYA: *Milne 36*. VANUA LEVU: MATHUATA: Mountains along coast, *Greenwood 637*. NAYAU: *Bryan, Sept. 12, 1924*.

5. *Hibiscus schizopetalus* (Mast.) Hook. f. in *Bot. Mag.* **106**: t. 6524. 1880; Yuncker in *Bishop Mus. Bull.* **178**: 83. 1943, in op. cit. **220**: 183. 1959; J. W. Parham, *Pl. Fiji Isl.* 121. 1964, ed. 2. 171. 1972; Borss. in *Blumea* **14**: 73. 1966; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 114. 1970; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 19. 1972.

Hibiscus rosa-sinensis var. *schizopetalus* Mast. in *Gard. Chron.* n. s. 12: 272. fig. 45. 1879.

As seen in Fiji, *Hibiscus schizopetalus* is a cultivated shrub 2-4 m. high, growing near sea level and also in villages at higher elevation. Its deeply incised petals are red, sometimes with yellow or white margins, and its conspicuous staminal column is also red. It flowers and fruits throughout the year.

TYPIFICATION: As no specimen seems to have been preserved as the basis of Masters's description, his 1879 illustration may be taken as the holotype.

DISTRIBUTION: Eastern Africa, but now cultivated throughout the tropics. It hybridizes readily with *Hibiscus rosa-sinensis* and is apparently one of the parents of many cultivated forms.

LOCAL NAME AND USE: *Coral hibiscus*; like *Hibiscus rosa-sinensis*, this species is a garden favorite and is often used as a hedge plant, being more common in Fiji than indicated below.

AVAILABLE COLLECTION: VITI LEVU: REWA: Botanical Gardens, Suva, *DA 12180*.

6. *Hibiscus syriacus* L. Sp. Pl. 695. 1753; Yuncker in Bishop Mus. Bull. **178**: 83. 1943, in op. cit. **220**: 184. 1959; Borss. in Blumea **14**: 75. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 115. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 19. 1972; J. W. Parham, Pl. Fiji Isl. ed. 2. 171. 1972.

An occasionally cultivated shrub 1.5–4 m. high, to be expected in gardens near sea level; its petals are variable in color from purple to red, pink, or white and sometimes variegated, and double-flowered forms are frequent. The specimens seen in Fiji were flowering in January and March.

TYPEFICTION: No lectotype was indicated by Borssum Waalkes, but a suitable specimen may exist in one of the Linnaean herbaria or in Clifford's herbarium.

DISTRIBUTION: Indigenous in warm temperate China, but early introduced into Mediterranean areas including Syria, and now widely cultivated elsewhere.

LOCAL NAMES AND USE: *Rose of Sharon*; *hibiscus*; *white*, *pink*, or *purple hibiscus*. It is an ornamental species but may not be well suited to a strictly tropical climate.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Botanical Gardens, Suva, DA 12287, 12330, 12331.

7. *Hibiscus hirtus* L. Sp. Pl. 694. 1753; Borss. in Blumea **14**: 75. 1966; J. W. Parham, Pl. Fiji Isl. ed. 2. 171. 1972.

An infrequently cultivated herb or undershrub to 1.5 m. high, to be anticipated in gardens at sea level. *Hibiscus hirtus*, comparatively small-flowered for the genus, has attractive flowers with the petals pink or orange-pink and rarely white, a pink staminal column and style arms, and dark red stigmas. The only available Fijian material was flowering in March.

TYPEFICTION: The holotype is no. 875.18 in the Linnaean Herbarium (cf. Borssum Waalkes, 1966).

DISTRIBUTION: India and Malesia, and occasionally cultivated elsewhere.

USE: An attractive ornamental, but apparently infrequent; no specimens from Pacific islands have been noted except the following.

AVAILABLE COLLECTION: VITI LEVU: REWA: Lami, in private garden, DA 16440.

8. *Hibiscus mutabilis* L. Sp. Pl. 694. 1753; Christophersen in Bishop Mus. Bull. **128**: 144. 1935; Yuncker in op. cit. **178**: 82. 1943; J. W. Parham, Pl. Fiji Isl. 120. 1964, ed. 2. 171. 1972; Borss. in Blumea **14**: 66. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 114. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 333. 1971.

A large shrub, to 5 m. high, sometimes cultivated in gardens near sea level; its flowers have white petals that become pink to red and are often double.

LECTOTYPEFICTION: As lectotype Borssum Waalkes (1966) indicates no. 875.20 (LINN), from a plant in Hortus Upsaliensis.

DISTRIBUTION: Southern China and Formosa, now widely cultivated elsewhere and grown in several Pacific archipelagoes. No herbarium vouchers are available from Fiji, but Parham (1972) indicates that the species is moderately common. It was apparently introduced into Fiji by J. B. Thurston (cf. Vol. 1 of this *Flora*, p. 47).

LOCAL NAME AND USE: Usually known as *rose mallow*, the species is an attractive ornamental.

9. *Hibiscus* sp.

A species of sect. *Azanza* that I have not been able to identify is represented by the following collection.

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, DA 11720 (tree 3-5 m. high, planted in a Department of Forestry trial plot, collected in flower March 4, 1959; corolla yellow; *vau*).

2. ABELMOSCHUS Medik. Malv. 45. 1787; Borss. in *Blumea* 14: 89. 1966.

Hibiscus sect. *Abelmoschus* DC. Prodr. 1: 449. 1824.

Hibiscus L. sensu Seem. Fl. Vit. 16, p. 1865.

Herbs or low shrubs, often with sharp prickles, the stipules linear to filiform, caducous; leaf blades palmately lobed to subentire, often hastate or sagittate, without glands on nerves, the lobes dentate; inflorescences axillary, composed of solitary flowers or these in terminal racemes by reduction of distal leaves, the pedicels not articulate; segments of epicalyx 4-16, free or sometimes shortly connate, usually persistent; calyx spathaceous, 5-dentate at apex, splitting on one side, adnate to corolla and falling off with it and staminal column; corolla large to medium-sized; staminal column much shorter than petals, antheriferous throughout; ovary 5-locular (rarely 6-9-locular), the ovules numerous in each locule, the style 1, distally 5(-9)-branched, the stigmas discoid; fruit a loculicidally dehiscent, oblong to cylindrical, beaked or mucronate capsule, the seeds numerous, subreniform, glabrous or pilose.

LECTOTYPE SPECIES: *Abelmoschus moschatus* Medik. (vide Borssum Waalkes, 1966).

DISTRIBUTION: Southern and southeastern Asia throughout Malesia to northern Australia, adventive or cultivated and often naturalized elsewhere. Three species have been noted in Fiji.

The three species of *Abelmoschus* known to occur in Fiji are all doubtless introductions, although *A. moschatus* seems to be of little use and therefore may have been aboriginally introduced either inadvertently or in error for *A. manihot*. Of the two species useful for food, *A. manihot* must certainly have been an aboriginal introduction, since its use as a potherb is well documented throughout its range. It seems likely that the third species, *A. esculentus*, which provides the edible *okra*, was not known to early Fijians and was a comparatively recent European or Indian introduction.

As represented in herbaria, the three species are often inadequate and difficult to distinguish through available leaves, indument, or flowers. However, their fruits are very distinct. Local names in Fiji are quite standardized, and the species are readily distinguished on the basis of their uses. Nevertheless, there has been a degree of confusion in the Fijian botanical literature. *Seemann 18* represents the species commonly used as a potherb and not for its fruit. In 1861 and 1862 Seemann cited this number correctly as *Abelmoschus manihot*, but in 1865 he altered his identification to *Hibiscus esculentus*, the *okra*, which was probably a recent introduction.

KEY TO SPECIES

Segments of epicalyx 7-10 (-12), linear to lanceolate, 5-18 mm. long, 1-2.5 mm. broad; capsules ovoid to fusiform, 5 cm. or longer at maturity, terete or faintly angular or sulcate.

Mature capsules ovoid to oblong, 5-8 cm. long, terete or faintly angular; stems usually hispid, rarely prickly; pedicels 15-75 mm. long or more; a weed, not considered edible. 1. *A. moschatus*

Mature capsules long-fusiform, 10-25 cm. long, usually sulcate; stems glabrous or sparsely short-pilose and rough; pedicels 5-15 mm. long; fruit edible as a vegetable. 2. *A. esculentus*

Segments of epicalyx 4-6 (-8), ovate to oblong, 10-30 mm. long, 5-10 mm. broad; capsules oblong-ovoid, 3.5-6 cm. long, 2-2.5 cm. broad, pentagonous, with 5 prominent costas, concave between costas; young leaves and branch tips eaten as greens. 3. *A. manihot*

1. *Abelmoschus moschatus* Medik. Malv. 46. 1787; A. Gray, Bot. U. S. Expl. Exped. 1: 172. 1854; Seem. in Bonplandia 9: 254. 1861, in op. cit. 10: 295. 1862, Viti, 433. 1862; Christophersen in Bishop Mus. Bull. 128: 144. 1935; Borss. in Blumea 14: 90. 1966.

Hibiscus abelmoschus L. Sp. Pl. 696. 1753; Seem. Fl. Vit. 17. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 120. 1890; Greenwood in Proc. Linn. Soc. 154: 95. 1943; Yuncker in Bishop Mus. Bull. 178: 82. 1943, in op. cit. 184: 50. 1945, in op. cit. 220: 183. 1959; J. W. Parham, Pl. Fiji Isl. 120. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 112. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 19, 31, 37. 1972.

As seen in Fiji, *Abelmoschus moschatus* is a coarse, sometimes suffruticose herb 0.7–3 m. high, found from near sea level to an elevation of about 450 m. as a weed naturalized in gardens, plantations, ricefields, and clearings, and also occurring along trails and on the edges of forest. Its petals are yellow, deep reddish purple within at base; its staminal column is yellow, dark purple at base, and its green fruits become dark brown to black at maturity. Flowers have been noted between February and August and fruits at the same time or a few months later. As the species is treated by Borssum Waalkes, our material seems to fall into subsp. *moschatus* var. *moschatus* (Borss. in Blumea 14: 91. 1966; J. W. Parham, Pl. Fiji Isl. ed. 2. 170. 1972).

LECTOTYPIFICATION: The lectotype of *Hibiscus abelmoschus* is a specimen in the Clifford Herbarium (BM); vide Borssum Waalkes, 1966.

DISTRIBUTION: India and southern China through Malesia and into the Pacific; the precise limit of its indigenoussness is problematical, but, as noted above, I doubt if it is native in Fiji; more likely it was an inadvertent aboriginal introduction.

LOCAL NAMES AND USE: Fijian names are *wakiwaki*, *wakewake*, *wakeke*, *vakeke*, *aukiki*, *okeoke*, and *o'e'e*. Seemann reports that juice from the leaves was used to procure abortions.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Garden near Mt. Nggamu, vicinity of Ngaloa, *Degener 15061*. NAMOSI: Gardens near Namosi Village, *Gillespie 2933*. RA: Vicinity of Nasukamai, *Gillespie 4385.2*. NAITASIRE: Vunindawa, *DA 10028*; Nanduna, *DA 2086*. TAILEVU: Vicinity of Korovou, *DA 10941*; near Verata, *DA 5614*, p. p. OVALAU: Port Kinnaird, *Storck 869*. VANUA LEVU: MATHUATA: Inland from Lambasa, *Greenwood 571*. THAKAUNDROVE: Mbalanga, *DA 10755*; Wainigata Station, *DA 12039, 13115*; Unisalusalu, *DA, Apr. 8, 1948*. TAVEUNI: *Seemann 19*; vicinity of Somosomo, *Gillespie 4773*. VANUA MBALAVU: Narothisivo Village, *Garnock-Jones 1111*. KAMBARA: Above Lomati Village, *Bryan 499*. FIJI without further locality, *U. S. Expl. Exped., Gillespie 4419*.

2. *Abelmoschus esculentus* (L.) Moench, Meth. Pl. 617. 1794; Borss. in Blumea 14: 100. 1966.

Hibiscus esculentus L. Sp. Pl. 696. 1753; Yuncker in Bishop Mus. Bull. 178: 82. 1943; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 113. 1970.

Abelmoschus moschatus sensu J. W. Parham, Pl. Fiji Isl. ed. 2. 170. 1972; non Medik.

A coarse, sometimes suffruticose herb 1–5 m. high, frequently cultivated in vegetable gardens near sea level. Its petals are pale yellow with a dark red or purple base, and its long-fusiform fruits are unmistakable. Apparently fruits are available at all seasons.

TYPIFICATION: The holotype is no. 875.31 (LINN); vide Borssum Waalkes, 1966.

DISTRIBUTION: Now cultivated in most tropical and warm countries, probably of Asiatic origin, and doubtless a cultivar.

LOCAL NAMES AND USE: *Okra*; *bindi* (Hindi). The species is much more frequent in small gardens than indicated by the single collection cited.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, *DA 12397*.

3. *Abelmoschus manihot* (L.) Medik. Malv. 46. 1787; A. Gray, Bot. U. S. Expl. Exped. 1: 172. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862; B. E. V. Parham in

New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 99. 1972.

Hibiscus manihot L. Sp. Pl. 696. 1753; B. E. V. Parham in Agr. J. Dept. Agr. Fiji **13**: 43. 1942; Yuncker in Bishop Mus. Bull. **220**: 185. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 113. 1970. *Abelmoschus esculentus* sensu A. Gray, Bot. U. S. Expl. Exped. **1**: 172. 1854; Seem. Viti, 433. 1862; non Moench.

Hibiscus esculentus sensu Seem. Fl. Vit. 17. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 121. 1890; J. W. Parham, Pl. Fiji Isl. 120. 1964; non L.

In Fiji *Abelmoschus manihot* is seen as a coarse, perennial, often suffruticose herb 1-3 m. high, commonly cultivated at elevations between sea level and about 900 m. Its petals are white to yellow, dark purple at base. Since the apical portions of the plant are soon harvested, flowers and fruits are infrequently noted but both have been collected in August. Our material falls into subsp. *manihot* (Borss. in Blumea **14**: 96. 1966; J. W. Parham, Pl. Fiji Isl. ed. 2. 170. 1972).

LECTOTYPIFICATION: Borssum Waalkes (1966) indicates the lectotype of *Hibiscus manihot* as a specimen in the Clifford Herbarium (BM).

DISTRIBUTION: Probably indigenous in southeastern Asia, subsp. *manihot* is doubtless a cultigen with glabrous stems derived from wild, more pilose and prickly plants; it has been widely cultivated in Malesia and presumably carried into Pacific islands by early voyagers.

LOCAL NAMES AND USE: *Mbele*, *vauvau*, *vauvau ni Viti*; the young leaves and branch tips are cooked and eaten as greens. At least four different forms, presumably cultivars, are recognized by Fijians.

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Nandala, south of Nandarivatu, *Degener 14881, 14882*. NAITASIRI: Matawailevu, Wainimala River, *St. John 18295*; Mbatiki, *DA 5660*. TAILEVU: Near Verata, *DA 5614*, p. p. FIJI without further locality, *Seemann 18, C. H. Wright*, in 1925, in 1928.

3. *THESPESIA* Solander ex Correa in Ann. Mus. Hist. Nat. (Paris) **9**: 290. 1807; Seem. Fl. Vit. 18. 1865; Borss. in Blumea **14**: 105. 1966; Fosberg & Sacht in Smithsonian Contr. Bot. **7**: 7. 1972. Nom. cons.

Trees or shrubs, the indument composed of scales or stellate hairs, the stipules small, subulate or lanceolate; leaf blades entire to palmate-lobed, often glanduliferous on one or more of the principal nerves; inflorescences axillary, composed of solitary flowers or these in terminal racemes by reduction of distal leaves; pedicels usually inarticulate, thickened at apex; segments of epicalyx 3-8, free, caducous; calyx usually somewhat ligneous, cupuliform, entire or minutely 5-dentate, persistent; corolla large and showy; staminal column usually much shorter than petals, antheriferous throughout; ovary 5-locular or 10-locular due to false dissepiments, the ovules 3-many per locule, the style short, clavate, with a 5-sulcate or rarely 5-lobed stigma; fruit a capsule with a woody-coriaceous pericarp, loculicidally tardily dehiscent or indehiscent, 5- or seemingly 10-locular due to alternating ridges, the seeds 3-many per locule, obovoid, glabrous or short-pilose.

TYPE SPECIES: *Thespesia populnea* (L.) Solander ex Correa (*Hibiscus populneus* L.).

DISTRIBUTION: Pantropical and subtropical, with about 15 species; one widespread species is indigenous in Fiji and another is sparingly cultivated.

KEY TO SPECIES

Fruit indehiscent, irregularly crumbling in age, 2-4.5 cm. in diameter, the seeds 4 per locule, usually 7-8 mm. long; young parts brown-lepidote; leaf blades not lobed, not glanduliferous on costa beneath; segments of epicalyx 3, oblong to lanceolate, 4-17 mm. long; calyx about 18 mm. in diameter; indigenous and frequent at or near sea level (sect. *Thespesia*). 1. *T. populnea*
 Fruit a (sometimes tardily) dehiscent capsule 1.8-3 cm. in diameter, the seeds 8-14 per locule, about 4 mm. long; young parts tomentose with minute stellate hairs; leaf blades 3- or 5-lobed, glanduliferous on base

of costa beneath; segments of epicalyx 4-6, usually subulate, 4-10 mm. long; calyx 7-9 mm. in diameter; cultivated species (sect. *Lampas*). 2. *T. lampas*

1. ***Thespesia populnea*** (L.) Solander ex Correa in Ann. Mus. Hist. Nat. (Paris) **9**: 290. *t. 8, fig. 1*. 1807; Benth in London J. Bot. **2**: 211. 1843; A. Gray, Bot. U. S. Expl. Exped. **1**: 179. 1854; Seem. in Bonplandia **9**: 254. 1861, Viti, 433. 1862, Fl. Vit. **18**. 1865; Drake, Ill. Fl. Ins. Mar. Pac. **119**. 1890; Guillaumin in J. Arnold Arb. **12**: 229. 1931; Christophersen in Bishop Mus. Bull. **128**: 144. 1935; Yuncker in op. cit. **178**: 83. 1943, in op. cit. **184**: 51. 1945; A. C. Sm. in Smithsonian Rep. **1954**: opp. 310. *pl. 3, fig. 2*. 1955; Yuncker in Bishop Mus. Bull. **220**: 184. 1959; J. W. Parham, Pl. Fiji Isl. **121**. 1964, ed. 2. **173**. 1972; Borss. in Blumea **14**: 106. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 117. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 333. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 82. 1972; Fosberg & Sachet in Smithsonian Contr. Bot. **7**: 8. *fig. 1, 2, 5*. 1972. FIGURE 109.

Hibiscus populneus L. Sp. Pl. 694. 1753.

An often abundant tree 2-15 m. high, occurring at or near sea level along beaches and river banks, in coastal thickets, and on edges of mangrove swamps and of forest along rocky shores. The corollas are yellow with a maroon center, becoming salmon-pink to red; the green fruits become purplish to brown as they mature. Flowers and fruits occur throughout the year.



FIGURE 109. Foliage and fruits of *Thespesia populnea*, from Ngau (Smith 7899), \times about 1/2.

LECTOTYPIFICATION: The lectotype, from Ceylon, is Herb. Hermann, Vol. IV, fol. 34, *Linn. n. 258* (BM); vide Borssum Waalkes, 1966.

DISTRIBUTION: Pantropical and subtropical; cf. Fosberg and Sachet, 1972, for a list of many collections. About 30 Fijian collections are at hand, but the species is more abundant than this would suggest.

LOCAL NAMES AND USES: The well known Fijian name is *mulomulo*; I consider records of the use of *wiriwiri* dubious, since this name is the standard one for *Gyocarpus americanus*. The indigenous *Thespesia* provides a very durable wood that is used for outriggers, boat-knees, spears, knife-handles, etc. The bark is reported to be used medicinally, sometimes to prepare a liquid that is drunk to treat thrush.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Shores of Mba River near its mouth, *Smith 4742*. NANDRONGA & NAVOSA: Vatukarasa, *DA 9286 (McKee 2856)*. SERUA: Vicinity of Ngaloa, *Degener 15106*. NAMOSI: Mouth of Nambukavesi Creek, *DA 13751 (DF 193, Bola 55)*. RA: Ellington, *Parks 20854*. TAILEVU: Londoni, *Valentine 10*. REWA: Nukulau Island, *Barclay 3431*. MBENGGGA: Raviravi, *DA 6072*. KANDAVU: Namalata isthmus region, *Smith 180*. OVALAU: Vicinity of Levuka, *Gillespie 4504*. KORO: East coast, *Smith 1092*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7899*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 526*. THAKAUNDOVE: Nasinu, Natewa Bay, *DA 16834*. TAVEUNI: *Seemann 27*. MOALA: *Bryan 310*. MATUKU: *Bryan 238*. VANUA MBALAVU: Near Namalata Village, *Garnock-Jones 1119*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 798*. FULANGA: *Bryan 446*.

2. *Thespesia lampas* (Cav.) Dalzell & Gibson, *Bombay Fl.* 19. 1861; Borss. in *Blumea* 14: 116. 1966; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 173. 1972.

Hibiscus lampas Cav. *Monad. Classis Diss.* 3: 154. t. 56, fig. 2. 1787.

An infrequently cultivated shrub 1-5 m. high, grown near sea level; the corolla is light yellow with a dark purple center. Our material has been noted in flower in July and in fruit in July and September.

TYPIIFICATION: The holotype is *Sonnerat s. n.* (P), from the Philippines.

DISTRIBUTION: Eastern Africa to southern and southeastern Asia and throughout many parts of Malesia, occasionally cultivated elsewhere (as in the Singapore Botanic Gardens, cf. Burkill, *Econ. Prod. Malay Penins.* ed. 2. 2191. 1966, whence perhaps the Fijian material). Our specimens represent var. *lampas*; a second variety extends into Australia.

USE: Ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, Botanical Gardens, *DA 12102*. TAVEUNI: Waitavala Estate, Waiyevo, *DA 11510*.

4. *Gossypium* L. Sp. Pl. 693. 1753; Seem. *Fl. Vit.* 19. 1865; Borss. in *Blumea* 14: 119. 1966.

Annual herbs or perennial shrubs, rarely small trees, nearly all parts punctate with black oil-glands; leaf blades usually palmately 3-9-lobed, occasionally entire, usually glanduliferous on the central principal nerves beneath; inflorescences composed of axillary, solitary flowers, these usually on sympodial branches; pedicels inarticulate, usually with a distal nectary below epicalyx; segments of epicalyx 3, free or shortly connate, usually foliaceous, longer than calyx, entire to dentate or deeply lacinate; calyx cupuliform, truncate to 5-dentate or 5-lobed, usually with 3 nectaries at base without, these alternating with segments of epicalyx; corolla medium-sized to large; staminal column much shorter than petals, antheriferous throughout; ovary 3-5-locular, the ovules 2-many in each locule, the style short, clavate, with a 5-sulcate stigma; fruit a subglobose to ovoid or rarely fusiform, acute or acuminate, loculicidally dehiscent, 3-5-lobed, papery or leathery capsule, the seeds often ovoid, densely long-lanate and sometimes also with a fine, shorter tomentum.

LECTOTYPE SPECIES: *Gossypium arboreum* L. (vide Britton & Millsp. *Bahama Fl.*

273. 1920; Brizicky in J. Arnold Arb. **48**: 152. 1967), one of Linnaeus's three original species. The ING indication of *G. herbaceum* refers to a later lectotypification.

DISTRIBUTION: Pantropical and subtropical and often cultivated in warm temperate areas; indigenous in Hawaii and in the southern Pacific. The number of *Gossypium* species is a subject of disagreement among specialists. Some of the earlier students of the genus recognized as many as 70 species, Fryxell (1969, cited below) accepts 35 species, while J. B. Hutchinson (1947, cited below) restricts the number of species to 20. Borssum Waalkes (1966) accepts the species delimitations of Hutchinson, treating three species, each further divided, in Malesia. These same three species have been recorded from Fiji.

USEFUL TREATMENTS OF GENUS: Hutchinson, J. B. The classification of the genus *Gossypium*. In: Hutchinson, J. B., R. A. Silow, & S. G. Stephens. The Evolution of *Gossypium* and the Differentiation of the Cultivated Cottons, 1-53. 1947. Burkill, I. H. *Gossypium*. Dict. Econ. Prod. Malay Penins. ed. 2. 1119-1126. 1966. Fryxell, P. A. The typification and application of the Linnaean binomials in *Gossypium*. Brittonia **20**: 378-386. 1968. Pursglove, J. W. *Gossypium* L. Trop. Crops, Dicot. 333-364. 1968. Fryxell, P. A. A classification of *Gossypium* L. (Malvaceae). Taxon **18**: 585-591. 1969. Fryxell, P. A. A Nomenclator of *Gossypium*: the Botanical Names of Cotton. Techn. Bull. U. S. Dept. Agr. **1491**: 1-114. 1976.

Cotton culture in Fiji had a brief but exciting heyday, well detailed by R. A. Derrick (A History of Fiji. Suva, 1946). Prior to contact with Europeans, Fijians had no knowledge of the possible uses of cotton, even though a variety of *Gossypium hirsutum* seems to be indigenous. European settlers in the early nineteenth century showed a mild interest in establishing cotton, but it was not until the British Government Mission of 1860, led by Col. W. J. Smythe (cf. Vol. I of this *Flora*, p. 45), that serious consideration was given to the feasibility of cotton as a major crop. By 1866 a real "cotton boom" was in full swing, aided by shortages caused by the Civil War in the United States. But in 1870 the market for "Sea Island cotton" crashed, and soon after that Fijian plantations abandoned cotton in favor of sugar.

Seemann in 1860 was very attentive to the possibilities of Fiji as a cotton-producing area, and his accounts (Viti, 48-57. 1862; Fl. Vit. 19-23. 1865) are especially interesting. He points out that cotton is not indigenous in Fiji, having been introduced in the early nineteenth century and soon becoming naturalized. In fact, however, naturalization of cotton in Fiji was transitory. Of the three species here discussed, *Gossypium arboreum* has apparently not been collected since Seemann's visit, and *G. barbadense* has become scarce. Only *G. hirsutum* seems really established today, and, as pointed out below, one element of this species is probably indigenous and may be expected to persist in a few outlying areas.

In spite of his remark to the effect that all cotton in Fiji had been introduced, Seemann nevertheless described a new species, *Gossypium tomentosum*, assigning the binomial to Nuttall and citing three Fijian collections as well as four from Hawaii. This name has caused a degree of confusion, since the Fijian and Hawaiian specimens are not conspecific. The three Fijian specimens were collected by Smythe, Pritchard, and Seemann (no. 28). These are mounted on one herbarium sheet at k and are all very incomplete; the first comes from Navatu (now known as Narewa), on the northern coast of Viti Levu in Ra Province, and consists of three or four leaves, one flower, and some loose seeds; the second is from Kandavu and consists only of one flower and two leaves; the third, also from Kandavu, is made up of two leaves and one good flower. These three specimens, all referable to *G. hirsutum*, are so inadequate that none, in my opinion, is a suitable lectotype. Therefore I believe that Fryxell (in Sida **5**: 1-2. 1972,

and in 1976, cited above, p. 73) should be followed in designating *Nuttall s. n.* (BM) as the lectotype and in treating *G. tomentosum* as a Hawaiian endemic, although a contrary opinion has been expressed (Wilbur in Pacific Sci. **18**: 101-103. 1964; St. John, List Fl. Pl. Haw. Isl. 228. 1973; Wilbur in Taxon **30**: 478-481. 1981).

Distributional problems in *Gossypium* have fascinated phytogeographers; some of the treatments mentioned above elaborate or refer to controversial opinions, which are briefly summarized by Purseglove (1968, pp. 341-345). The genus appears to have acquired a tropical-tricentric, somewhat southerly distribution in Tertiary times. The New World amphidiploid species (subgen. *Karpas* Raf.; cf. Fryxell, 1969, cited above, p. 590) are believed by many specialists to have evolved without the aid of man. This position receives support from observations that some cotton seeds maintain the ability to germinate after as many as three years in seawater, and that the species in question often have littoral habitats. Such evidence also supports an American ancestry for *G. tomentosum* in Hawaii and *G. hirsutum* var. *taitense* in the southern Pacific.

KEY TO SPECIES

- Segments of epicalyx entire or remotely dentate (with 3-5 teeth near apex and less than 3 times as long as broad), united for 1 cm. or more; corolla usually campanulate, the petals 3-4 cm. long, usually pale yellow, often with a basal reddish spot; staminal column 1.5-2 cm. long. 1. *G. arboreum*
- Segments of epicalyx deeply lacinate (with 7-15 long-deltoid to almost linear teeth more than 3 times as long as broad), free or united for no more than 5 mm. at base; corolla infundibular.
- Leaf blades palmate-lobed to no more than half their length into 3 (rarely 5) deltoid to ovate segments; petals 2.5-5 cm. long, usually pale yellow and without a basal reddish spot; staminal column 1-2 cm. long, with loosely arranged anthers. 2. *G. hirsutum*
- Leaf blades deeply palmate-divided to about 2/3 their length into 3 or 5 ovate to oblong segments; petals 5-8 cm. long, usually bright yellow and with a basal reddish spot; staminal column 3.5-4 cm. long, with compactly arranged anthers. 3. *G. barbadense*

1. *Gossypium arboreum* L. Sp. Pl. 693. 1753; Seem. in Bonplandia **9**: 254. 1861, Viti, 433. 1862, Fl. Vit. 21. 1865; Greenwood in J. Arnold Arb. **36**: 398. 1955; J. W. Parham, Pl. Fiji Isl. 120. 1964, ed. 2. 170. 1972; Borss. in Blumea **14**: 121. 1966; Fryxell in Brittonia **20**: 382. 1968.

Gossypium herbaceum sensu A. Gray, Bot. U. S. Expl. Exped. **1**: 179, as *G. herraceum*. 1854; non L. *Gossypium arboreum* var. Seem. in Bonplandia **9**: 254. 1861.

Gossypium arboreum, at one time cultivated in Fiji near sea level, is a shrub 1-3 m. high, usually with pale yellow petals with a basal reddish spot.

TIPIFICATION AND NOMENCLATURE: The lectotype of *Gossypium arboreum* is no. 874.3 (LINN); vide Borssum Waalkes, 1966. Of the two broad varieties into which Borssum Waalkes divides the Malesian material, the type-including variety has leaf blades with linear to lanceolate segments and is used only for experimental or ornamental purposes. The second variety, var. *obtusifolium* (Roxb. ex G. Don) Mast., may be typified by Roxburgh's unpublished plate (no. 1495) of *G. obtusifolium* in the library of the Calcutta Botanic Garden (cf. Fryxell, 1976, cited above under the genus, p. 55, for references to typification and nomenclature). This variety has leaf blades with obovate, ovate, or oblong segments and is regularly cultivated for commercial purposes.

DISTRIBUTION: *Gossypium arboreum* is one of the diploid Old World cottons that is widely cultivated and in which several races are recognized. It was probably introduced into Fiji about 1835 and again by Seemann in 1860, although it appears not to have persisted in cultivation or to have become naturalized, no modern collections

being assignable to it. Probably the collections referred to by Gray and Seemann (who understood it to include "New Orleans cotton") would have been referable to var. *obtusifolium*.

LOCAL NAMES AND USE: *Cotton*; *vauvau ni vavalangi*. Although it is an important commercial species, apparently *Gossypium arboreum* was less successfully grown in Fiji than *G. barbadense*, if one is to judge from Pritchard's remarks quoted by Seemann in Viti, 56. 1862. More recent experiments may have been undertaken (Parham, 1972) but have been unsuccessful.

AVAILABLE COLLECTIONS: VANUA LEVU without further locality, *U. S. Expl. Exped.* TAVEUNI: Somosomo, *Seemann 32*. FIJI without further locality, *Seemann 31*.

2. *Gossypium hirsutum* L. Sp. Pl. ed. 2. 975. 1763; Borss. in *Blumea* 14: 123. 1966; Fryxell in *Brittonia* 20: 382. 1968; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 148. 1972; sensu var. *taitense* et var. *religiosum*.

Gossypium religiosum sensu Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862.

Gossypium tomentosum Nutt. ex Seem. Fl. Vit. 22, p. p. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 120, p. p. 1890; J. W. Parham, Pl. Fiji Isl. 120. 1964, ed. 2. 171. 1972; quoad spec. vit., non sensu lectotypi.

Gossypium taitense Parl. Sp. Cot. 39. t. 6, fig. A. 1866.

Gossypium purpurascens var. *religiosoides* Roberty in *Candollea* 7: 333, sine descr. lat. 1938.

Gossypium hirsutum var. *taitense* Roberty in *Candollea* 13: 66. 1950; Borss. in *Blumea* 14: 126. 1966.

Gossypium hirsutum var. *punctatum* sensu J. W. Parham, Pl. Fiji Isl. 120. 1964; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 148. 1972; non sensu typi.

Gossypium hirsutum var. *hirsutum* sensu J. W. Parham, Pl. Fiji Isl. ed. 2. 171. 1972; non sensu typi.

Gossypium hirsutum occurs sparingly in Fiji (or perhaps frequently in a few isolated localities) at elevations from near sea level to about 30 m. as a shrub 1-3 m. high, on cleared forehills, on steep grassy talus, and among reeds. Its petals are usually pale yellow, eventually turning pinkish, and its capsules are brown. Insofar as our collections are dated, flowers have been obtained in August and fruits in August and February.

TYPOIFICATION AND NOMENCLATURE: As indicated below in my discussion of its distribution, *Gossypium hirsutum* is a complex species, the Pacific elements of which should eventually be properly evaluated by a specialist on the genus. Here I merely indicate typification of those names that may prove to have relevance. Linnaeus based his description of *G. hirsutum* on an earlier description (as *Gossypium* sp. no. 4) published by Miller (*Gard. Dict.* ed. 6. 1752); Fryxell (1968, cited above) considers Miller's description to be the holotype, taking as a "corroborative reference specimen" the sheet in the Sloane Herbarium, Vol. 294, fol. 45 (BM) that Borssum Waalkes (1966) had indicated as the lectotype. The typical variety of *G. hirsutum* is probably not strictly pertinent to our problem, since it appears not to occur on Pacific islands east of Malesia. The controversial binomial *G. religiosum* is discussed by Fryxell (1968, pp. 385-386, and 1976, p. 63, both cited above under the genus), who takes as the holotype no. 874.6 (LINN), perhaps from the West Indies. *Gossypium taitense* (according to Fryxell, 1976, cited above under the genus, p. 72) is typified by *Moerenhout s. n.* (FI), from Tahiti. *Gossypium purpurascens* var. *religiosoides* Roberty, an invalid name, is based on *Seemann 28* (G; also at K), from Kandavu, Fiji.

DISTRIBUTION: *Gossypium hirsutum* is one of the New World tetraploid cottons, presumably indigenous in the West Indies and Central America and introduced into Africa and thence into most tropical Old World areas in post-Columbian times. However, var. *taitense* is believed to be indigenous in eastern Polynesia and apparently westward as far as Fiji.

Borssum Waalkes divides the Malesian material of *Gossypium hirsutum* into two varieties, var. *hirsutum* and var. *taitense* (Parl.) Roberty. None of the available collections from Fiji eastward in the Pacific seem referable to var. *hirsutum*, having mature capsules 1.5–2.5 cm. long, whereas the capsules of var. *hirsutum* are 3–5 cm. long. Some of our material cited below (e. g. *O. & I. Degener 32354, DA 12284, Bryan 488*) is vegetatively subglabrate and agrees well with material from the Tuamotus, Marquesas, Societies, and Samoa that would appear typical of var. *taitense*. One may assume that this element of *G. hirsutum* is indigenous in Fiji. Other Fijian specimens (e. g. *DA 4027, 4028*) have the dense indument characteristic of var. *hirsutum* but capsules like those of var. *taitense*. It seems likely that this element represents an introduced population, perhaps of *G. hirsutum* var. *religiosum* (L.) Watt (Wild Cult. Cotton Pl. 201. 1907; based on *G. religiosum* L. Syst. Nat. ed. 12. 2: 462. 1767). Possibly the three Fijian specimens included by Seemann in his (Hawaiian) *G. tomentosum* also belong in var. *religiosum* (this is presumably what Roberty intended by *G. purpurascens* var. *religiosoides*, nom. invalid.), although none of the three specimens are accompanied by capsules.

In view of the complications inherent in the origins of different Pacific populations of *Gossypium hirsutum*, I refer the Fijian material of this relationship to the species in the broad sense, although inclined to believe that some of its elements are indigenous (var. *taitense*) and others (perhaps var. *religiosum*) introduced (probably early in the nineteenth century).

LOCAL NAMES AND USE: *Cotton; vauvau; vauvau ni vavalangi*. Elements of *Gossypium hirsutum* are widely cultivated in tropical areas, often in regions too rigorous for *G. barbadense*. However, *G. hirsutum* var. *taitense*, although known to Tahitians before Cook's first voyage, was not utilized by them, and apparently neither this nor any introduced cotton has been of any lasting interest to Fijians.

AVAILABLE COLLECTIONS: MAMANUTHAS: NNGALITO Island, Malolo Group, *O. & I. Degener 32354*. VITI LEVU: RA: Navatu (Narewa), on coast west of Penang River, *Smythe s. n. KANDAVU*: Without further locality, *Seemann 28, Pritchard s. n. VANUA LEVU*: MBUA: Thukuvou Bay, Yandua Island, *DA 12284*; Ngaloa Island, *DA 4008, 4029*. VANUA LEVU without further locality (but probably from the islands off the Mbua coast listed above), *DA 4027, 4028, 13691*. ONEATA: *Bryan 488*.

3. *Gossypium barbadense* L. Sp. Pl. 693. 1753; A. Gray, Bot. U. S. Expl. Exped. 1: 179. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 21. 1865; Christophersen in Bishop Mus. Bull. 128: 144. 1935; Greenwood in J. Arnold Arb. 36: 398. 1955; J. W. Parham, Pl. Fiji Isl. 120. 1964; Fryxell in Brittonia 20: 378. 1968; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 148. 1972; sensu var. *barbadense*.

Gossypium peruvianum Cav. Monad. Classis Diss. 6: 313. t. 168. 1788; Seem. in Bonplandia 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 21. 1865; Greenwood in J. Arnold Arb. 36: 398. 1955.

Gossypium brasiliense sensu Yuncker in Bishop Mus. Bull. 178: 84. 1943, in op. cit. 184: 51. 1945, in op. cit. 220: 185. 1959.

Gossypium barbadense var. *brasiliense* sensu Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 111. 1970.

Gossypium barbadense, although no longer cultivated in Fiji, still persists infrequently as a shrub or small tree 1–6 m. high near sea level, in open places and on the edges of cultivated areas. Its petals are usually bright yellow with a basal reddish spot. Our few collections show flowers in March, May, and November, fruits in March and November.

LECTOTYPIFICATION AND NOMENCLATURE: There have been involved discussions of

a suitable lectotypification of *Gossypium barbadense*, summarized by Fryxell (1968, cited above). Fryxell argues that the appropriate lectotype is the illustration cited by Linnaeus (Plukenet, *Phytographia*, t. 188, fig. 1. 1692) rather than the specimen upon which the original plate was based (Vol. 100, fol. 105, in the Sloane Herbarium, BM). The holotype of *G. peruvianum* is a specimen in the Cavanilles Herbarium (MA). Practically all students of the genus now synonymize these two taxa.

DISTRIBUTION: Widely cultivated and often naturalized throughout the tropics and subtropics, but American in origin. *Gossypium barbadense* is now generally understood to be the tetraploid South American cotton often called "Sea Island cotton," although this agricultural form was developed comparatively recently and has no relevance to the Linnaean species. Two broad varieties are recognized by Borssum Waalkes as occurring in Malasia: var. *barbadense* and var. *acuminatum* (Roxb.) Triana & Planch. *Gossypium brasiliense* Macf. (i. e. *G. barbadense* var. *brasiliense* (Macf.) Mauer) falls into the broad concept of var. *acuminatum*. All modern southern Pacific collections of *G. barbadense* that I have examined, from Micronesia and Fiji eastward to the Societies, have mature capsules about 3–4 cm. long and are referable to var. *barbadense* (Borss. in *Blumea* 14: 128. 1966; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 171. 1972).

LOCAL NAMES AND USE: *Cotton*; *vauvau*; *vauvau ni vavalangi*. "Sea Island cotton," introduced by early European settlers and again by Seemann in 1860, was probably grown more successfully in Fiji than other cottons, but even so its cultivation had practically ceased by the early 1870's.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Banks of lower Lambasa River, *Smith 6626*. VANUA MBALAVU: Sawana Village, *DA 13259*. ONGEA LEVU: *Bryan 421*. FIJI without further locality, *U. S. Expl. Exped., Seemann 29, 30*.

5. *URENA* L. Sp. Pl. 692. 1753; Seem. Fl. Vit. 16. 1865; Borss. in *Blumea* 14: 137. 1966.

Annual or perennial, erect, rigid herbs or undershrubs, the indument composed of stellate hairs; leaf blades palmate-lobed or angular, glanduliferous on costa beneath; inflorescences axillary, composed of solitary or fasciculate flowers, the pedicels short, inarticulate; segments of epicalyx 5, short-connate proximally; calyx campanulate, 5-partite, usually with nectaries on midnerves of sepals; corolla small, the petals 5, rotate or recurved, connate proximally and united to staminal column, this about as long as petals and antheriferous in the distal half; ovary 5-locular, the ovules 1 per locule, the style divided nearly from base into 10 arms, the stigmas capitate, papillose; fruit a subglobose schizocarp, breaking into 5 indehiscent mericarps, these trigonous, dorsally convex and covered with glochidia, each of these with 4 or 5 short, sharp, retrorse hooks, the seeds ascending.

LECTOTYPE SPECIES: *Urena lobata* L. (vide M. L. Green, *Prop. Brit. Bot.* 173. 1929), one of Linnaeus's three original taxa.

DISTRIBUTION: A monotypic genus (as treated by Borssum Waalkes, but sometimes divided into as many as six species by others), the single species now pantropical but presumably Asiatic in origin.

1. *Urena lobata* L. Sp. Pl. 692. 1753; Seem. in *Bonplandia* 9: 254. 1861, Viti, 433. 1862, Fl. Vit. 16. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 119. 1890; Christophersen in *Bishop Mus. Bull.* 128: 142. 1935; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* 11: 83. 1940; Greenwood in *Proc. Linn. Soc.* 154: 95. 1943; Yuncker in *Bishop Mus. Bull.* 178: 82. 1943, in op. cit. 184: 50. 1945; Mune & J. W. Parham in *Dept. Agr.*

Fiji Bull. **31**: 26. fig. 5. 1957; J. W. Parham in op. cit. **35**: 70. fig. 30. 1959; Yuncker in Bishop Mus. Bull. **220**: 182. 1959; J. W. Parham, Pl. Fiji Isl. 122. 1964, ed. 2. 173. 1972; Borss. in *Blumea* **14**: 138. 1966; Mune & J. W. Parham in Dept. Agr. Fiji Bull. **48**: 28. fig. 8. 1967; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 118. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 333. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 74, 80. 1972.

Urena lobata var. *rhombifolia* A. Gray, Bot. U. S. Expl. Exped. **1**: 169. 1854.

Urena morifolia sensu A. Gray, Bot. U. S. Expl. Exped. **1**: 170. 1854; Seem. Viti, 433, as *U. morifolia*. 1862, Fl. Vit. 16. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 119. 1890.

In Fiji *Urena lobata* is a shrub or subligneous herb 0.5–3 m. high, found at elevations from near sea level to the summit of Mt. Tomanivi, 1,323 m. It is a pernicious weed abundantly naturalized in gardens, canefields, pastures, clearings, and grassland, and also found along forest trails and on open hillsides. Its petals are pink, purplish at base; its anthers and stigmas are purple; and its fruits turn from green to brown. Flowers and fruits are found throughout the year.

TYPIFICATION AND NOMENCLATURE: The lectotype is no. 873.1 (LINN), perhaps from Hortus Upsaliensis (vide Borssum Waalkes, 1966). *Urena lobata* var. *rhombifolia* is typified by U. S. Expl. Exped. (US 12643 HOLOTYPE), collected on Ovalau in 1840. *Urena morifolia* DC. falls into subsp. *sinuata* var. *sinuata* in the sense of Borssum Waalkes and does not strictly pertain to Fijian material. Specimens from the Fijian Region seem best referred to subsp. *lobata* var. *lobata* (Borss., 1966, p. 140, fig. 7e).

DISTRIBUTION: Pantropical, but probably originally of Asiatic origin and spread into many parts of the world by aboriginal voyagers; it was doubtless brought into many Pacific areas in this manner. About 55 Fijian collections have been examined; the plant is a troublesome weed in Fiji and is difficult to eradicate.

LOCAL NAMES AND USE: *Nggatima* is the best known Fijian name, but also recorded are *nggatima ni Viti*, *ngguatema*, *gataya* (Hindi), and *hibiscus burr*. The species is grown as a fiber crop in some tropical areas, the fiber providing a good substitute for jute, but in Fiji it is a declared noxious weed.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 75A*; Tavua, *DA 9485*; summit of Mt. Tomanivi, *DA 7141*. NANDRONGA & NAVOSA: Keiyasi, Singatoka River, *DA 10167*; Singatoka, *Greenwood 75B*. SERUA: Tokotoko road, *DA 10553*. RA: Vicinity of Nasukamai, *Gillespie 4390*; Ndombui-levu, *DA 9530*. NAITASIRE: Nanduna, *DA 9592*; vicinity of Nasinu, *Gillespie 3414*. TAILEVU: Korovou, *DA 10940*; Wainimbokasi, *DA 10580*. REWA: Mt. Korombamba, *DA 1243*; vicinity of Rewa Village, U. S. Expl. Exped. KANDAVU: Western end of island, near Cape Washington, *Smith 321*. OVALAU: *Graeffe 1591*. WAKAYA: *Milne 38*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 469*. THAKAUNDROVE: Between Nikawa Bay and Valetthi, *Bierhorst F68*. RAMBI: *DA 3696*. TAVEUNI: Vicinity of Somosomo, *Gillespie 4767*. MOALA: *Milne 116*. VANUA MBALAVU: Lomaloma, *DA 10231*. LAKEMBA: *Seemann 17*.

6. MALVAVISCUS Fabric. Enum. Meth. Pl. 155. 1759; Schery in Ann. Missouri Bot. Gard. **29**: 203. 1942; Borss. in *Blumea* **14**: 131. 1966.

Shrubs, often scrambling or trailing, the stipules linear-lanceolate; leaf blades entire or palmate-lobed, without glands on nerves of lower surface; flowers axillary and solitary or forming a few-flowered terminal or subterminal cyme, the pedicels inarticulate; segments of epicalyx 5–10, lanceolate to spatulate, short-connate proximally; calyx 5-lobed, at first campanulate, at length splitting and spreading, without nectaries; corolla medium-sized to large and showy, the petals 5, erect, never spreading, unilaterally uncinat-auriculate at base; staminal column longer than petals, antheriferous only in distal portion; ovary 5-locular, the ovules 1 per locule, the styles 10, connate at base, the stigmas capitate; fruit a smooth, subglobose, berrylike schizocarp, initially with a fleshy layer, ultimately drying and breaking into 1-seeded indehiscent mericarps, the seeds ascending.

TYPE SPECIES: *Hibiscus malvaviscus* L. (= *Malvaviscus arboreus* Cav.). A proposal to conserve the generic name *Malvaviscus* with the authorship of Cavanilles (Monad. Classis Diss. 3: 131. 1787) was made by Bakhuizen van den Brink, Jr., Borssum Waalkes, and van Steenis (in Taxon 15: 43. 1966). However, Dandy (in op. cit. 15: 163. 1966) pointed out that conservation is not required, as Fabricius in 1759 had adequately distinguished and defined the genus, with a reference to *Hibiscus malvaviscus* L.

DISTRIBUTION: Tropical America, with three species (Schery, 1942, cited below; other botanists recognize as many as 20 or even 50 species); some taxa are now widely cultivated as ornamentals. One species occurs in cultivation in Fiji.

USEFUL TREATMENT OF GENUS: Schery, R. W. Monograph of *Malvaviscus*. Ann. Missouri Bot. Gard. 29: 183-243. 1942.

1. ***Malvaviscus arboreus*** Cav. Monad. Classis Diss. 3: 131. t. 48, fig. 1. 1787; Schery in Ann. Missouri Bot. Gard. 29: 209. 1942; Borss. in Blumea 14: 132. 1966.

Hibiscus malvaviscus L. Sp. Pl. 694. 1753.

KEY TO VARIETIES

Petals 2-3 cm. long; leaf blades 5-11 cm. long, usually 3-5-lobed. 1a. var. *arboreus*
 Petals 6-7 cm. long; leaf blades 10-20 cm. long, entire or less often 3-lobed. 1b. var. *penduliflorus*

1a. ***Malvaviscus arboreus*** var. ***arboreus***; Borss. in Blumea 14: 132. 1966; J. W. Parham, Pl. Fiji Isl. ed. 2. 172. 1972.

A shrub 0.6-2 m. high, cultivated from near sea level to about 250 m. Its erect flowers have red or scarlet petals and have been obtained in January and March, but they may be seen at other times of the year as well.

TYPIFICATION: The lectotype is a specimen in the Clifford Herbarium (BM); vide Borssum Waalkes, 1966.

DISTRIBUTION: Mexico to Peru and Brazil, now widely cultivated in tropical areas and in temperate greenhouses. Both varieties occurring in Fiji are apparently comparatively recent introductions.

LOCAL NAMES AND USE: Known in Fiji as *Chinese hat*; elsewhere it is sometimes called *Turks cap*. An attractive ornamental, but seen only in and near Suva.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Toninaiwau, Tholo-i-suva, DA 16740. REWA: Suva, in private garden, DA 16224.

1b. ***Malvaviscus arboreus*** var. ***penduliflorus*** (Moc. & Sessé ex DC.) Schery in Ann. Missouri Bot. Gard. 29: 223. 1942; Borss. in Blumea 14: 133. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 115. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 172. 1972.

Malvaviscus penduliflorus Moc. & Sessé ex DC. Prodr. 1: 445. 1824.

A shrub 1.5-4 m. high, cultivated between sea level and about 250 m. Its drooping flowers have orange-red to pale pink petals, dull purple anthers, and a reddish or pale pink staminal column. Flowers are seen during much of the year but our collections are dated in February and March.

TYPIFICATION: The holotype may be considered the tracing (in G-DC) of one of the colored plates drawn for Sessé and Mociño from living specimens in Mexico.

DISTRIBUTION: Mexico to Ecuador and Venezuela, now widely cultivated.

LOCAL NAMES AND USE: Known in Fiji as *sleeping hibiscus* or simply as *malvaviscus*;

elsewhere it is sometimes known as *firecracker hibiscus*. Like the typical variety it is an attractive ornamental, somewhat more commonly seen in and near Suva; the form with red petals is somewhat more common than that with pink petals.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Toninaiwau, Tholo-i-suva, DA 16721, 16726. REWA: Lami, in private garden, DA 16448; Suva, in private garden, DA 16729.

7. *MALVASTRUM* A. Gray in Mem. Amer. Acad. Arts II. 4: 21. 1849; Borss. in Blumea 14: 151. 1966. Nom. cons.

Annual, erect or prostrate herbs or undershrubs; leaf blades simple or rarely shallowly lobed, penninerved, coarsely serrate-dentate proximally, without glands on nerves; inflorescences axillary, composed of solitary or fasciculate flowers or these in terminal and axillary spikes; flowers small, sessile or on short, inarticulate pedicels; segments of epicalyx 3, small, narrow, slightly adnate to calyx at base, distally free; calyx broadly campanulate, 5-partite; corolla rotate; staminal column shorter than petals, divided at apex into numerous filaments; ovary 10–15-locular, the ovules 1 per locule, the styles as many as ovary locules, connate proximally, filiform or clavate, the stigmas capitate; fruit a discoid schizocarp, breaking into flattened, 1-seeded mericarps, these reniform, awned or not, laterally radially veined, indehiscent or 2-valved, bearing a short columella after falling, the seeds reniform.

LECTOTYPE SPECIES: *Malvastrum wrightii* A. Gray (= *M. aurantiacum* (Scheele) Walp.: *Malva aurantiaca* Scheele). This lectotypification has been changed from that indicated in earlier editions of the ICBN, being discussed by Brizicky (in Taxon 15: 311–315. 1966) and Bates (in op. cit. 27: 495. 1978).

DISTRIBUTION: Tropical and subtropical or warm temperate America, with three species (as interpreted by Borssum Waalkes), of which two are widely naturalized as weeds. One species occurs in Fiji. Other botanists recognize 75 or even 100 species in the genus.

1. *Malvastrum coromandelianum* (L.) Garcke in Bonplandia 5: 295. 1857; Yuncker in Bishop Mus. Bull. 178: 81. 1943; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 17: 24. 1946; Yuncker in Bishop Mus. Bull. 220: 181. 1959; J. W. Parham, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972; Borss. in Blumea 14: 152. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 115. 1970.

Malva coromandeliana L. Sp. Pl. 687. 1753.

Malva tricuspidata R. Br. in Ait. f. Hort. Kew. ed. 2. 4: 210, nom. superfl. 1812.

Malvastrum tricuspidatum A. Gray, Pl. Wright. 1: 16, nom. superfl. 1852; Greenwood in Proc. Linn. Soc. 154: 95. 1943; J. W. Parham in Dept. Agr. Fiji Bull. 35: 71. fig. 31. 1959.

A suffrutescent herb or shrub 0.5–1 m. high, locally abundant near sea level as a naturalized weed in waste places, gardens, canefields, and open fields and along roadsides. The flowers have yellow or orange, sometimes pale or nearly white petals; flowers and fruits occur throughout the year in sunny places.

LECTOTYPIFICATION: The lectotype is no. 870.3 (LINN), from Hortus Upsaliensis (vide Borssum Waalkes, 1966). *Malva tricuspidata* is a superfluous name, since Brown mentioned *Malva coromandeliana* as a synonym.

DISTRIBUTION: Tropical and subtropical America, but now a widespread weed, established in most Pacific archipelagoes. It seems to be a comparatively recent arrival in Fiji, the earliest available collection being that of Greenwood in Lautoka; about 35 Fijian collections are at hand, but the species is more abundant than this would indicate, especially in western Viti Levu.

LOCAL NAMES: *Broom weed; clock plant.*

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 100*; Nandi airport, *DA 9744*; Vatia Point, west of Tavua, *DA 2806*. NANDRONGA & NAVOSA: Volivoli, near Singatoka, *DA 10667*; Lawangga, near Singatoka, *DA 9764*. RA: Rakiraki, *DA 1682*; Ellington, *DA 2819*. REWA: Suva, *DA 10793*. OVALAU: Levuka, *DA 1358*. VANUA LEVU: MBUA: Lekutu River, *DA 1129*. MATHUATA: Nasea, Lambasa, *DA 2896*. THAKAUNDROVE: Thavanandi, *DA 10770*. VANUA MBALAVU: Lomaloma, *DA 10244*.

8. *ANODA* Cav. *Monad. Classis Diss.* 1: 38. 1785; Borss. in *Blumea* 14: 148. 1966.

Annual, hispid or glabrescent herbs, the stipules filiform or linear; leaf blades entire or 3-lobed or divided, usually hastate; inflorescences axillary, composed of solitary, medium-sized flowers or these in terminal racemes or panicles; epicalyx lacking; calyx 5-lobed; petals long-ciliate proximally; staminal column divided at apex into numerous filaments; ovary 10-many-locular, the ovules 1 per locule, the style branches as many as ovary locules, filiform, connate proximally, the stigmas capitate or truncate; fruit a flattened, stellate-verticillate schizocarp, breaking into 1-seeded mericarps, these separating from a short columella, the dorsal surfaces sometimes distally mucronate, the lateral partitions becoming obliterated before maturity, the seeds pendulous or horizontal.

LECTOTYPE SPECIES: *Anoda hastata* Cav. (vide Britton & Wilson, *Sci. Surv. Porto Rico* 5: 555. 1924).

DISTRIBUTION: Tropical and subtropical America, with 10-20 species, of which two or three have been introduced elsewhere as ornamentals or adventives. One species is a sparingly naturalized weed in Fiji, perhaps originally an escape from cultivation.

1. *Anoda cristata* (L.) Schlechtendal in *Linnaea* 11: 210. 1837; Borss. in *Blumea* 14: 149. 1966; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 170. 1972.

Sida cristata L. *Sp. Pl.* 685. 1753.

A coarse herb nearly 1 m. high, sparingly naturalized as a weed in villages and along beaches, but apparently still very local in Fiji. The flowers have bluish petals and have been obtained in February; fruiting material was noted in October.

TYPIFICATION: Linnaeus cited several prior references and noted: "*Habitat in Mexico.*"

DISTRIBUTION: Tropical and subtropical America, sometimes cultivated and naturalized elsewhere. In Fiji it may be an escape from cultivation in extreme southern Lau; no other Pacific records have been noted.

AVAILABLE COLLECTIONS: ONO-I-LAU: Nukuni Village, *DA L13752* (coll. *O. Kaloumaira*, Feb. 14, 1967), *DA 15897*.

9. *SIDA* L. *Sp. Pl.* 683. 1753; Seem. *Fl. Vit.* 15. 1865; Borss. in *Blumea* 14: 177. 1966.

Annual or perennial herbs or undershrubs, sometimes prostrate or creeping, usually stellate-pilose; leaf blades simple and orbicular to linear (our species), rarely lobed, penninerved or palmate-nerved, not hastate, without glands on nerves; inflorescences axillary, composed of solitary flowers or these fasciculate or short-racemose or in larger, terminal racemes of panicles by reduction of distal leaves; flowers small, the pedicels articulate; epicalyx lacking (in our species) or sometimes present and ephemeral; calyx broadly campanulate, 5-lobed, the sepals with prominent midribs and marginal nerves; corolla rotate; staminal column usually shorter than petals, divided at apex into numerous filaments; ovary 4-14-locular, the ovules 1 per locule, the style branches as many as ovary locules, connate proximally, the stigmas capitate or truncate; fruit a subglobose to oblate schizocarp, breaking into 1-seeded mericarps, these subtrigonal, aristate or not at apex, smooth or prominently reticulate dorsally, sometimes apically dehiscent, separating from a slender columella, the lateral partitions persistent or decaying after maturity, the seeds pendulous or horizontal.

LECTOTYPE SPECIES: *Sida rhombifolia* L. (vide M. L. Green, Prop. Brit. Bot. 172. 1929), one of ten species originally included in the genus by Linnaeus.

DISTRIBUTION: Pantropical and subtropical, sometimes in warm temperate areas, largely American, with 150–250 species. Three species (all of sect. *Sida*) are known from Fiji, one indigenous and the other two abundantly naturalized weeds. Two other species recorded from Tonga, *Sida cordifolia* L. and *S. spinosa* L. (cf. Yuncker in Bishop Mus. Bull. 220: 181, 182. 1959), have not been noted in Fiji.

KEY TO SPECIES

Stipules of each pair different, the larger one linear to lanceolate, obviously flattened, 4–11 × 1–1.5 mm., 3–6-nerved; indument of young parts, petioles, lower surfaces of leaf blades, etc., laxly stellate (rays to 0.3 mm. long) or sometimes simple (hairs 0.5–1 mm. long), the mature plants subglabrate; pedicels 2–5 mm. long, usually articulate near middle; styles and mericarps usually 7 or 8 (6–10), glabrous.

1. *S. acuta*

Stipules of each pair similar, filiform, 1-nerved or without obvious nerves; indument of young parts, petioles, lower surfaces of leaf blades, etc., comparatively copious, composed of minute, subsistent, stellate hairs (rays about 0.1 mm. long); pedicels longer than subtending petioles.

Leaf blades orbicular to broadly ovate, comparatively small, 0.5–2.5 × 0.5–2 cm.; stipules 1–3 mm. long; pedicels usually 1–2 cm. long, inconspicuously articulate toward apex; styles and mericarps 5.

2. *S. parvifolia*

Leaf blades ovate to oblong or lanceolate, usually 2–7 × 0.5–3 cm.; stipules 3–10 mm. long; pedicels often to 3 or 4 cm. long, obviously articulate somewhat above middle; styles and mericarps 9–12.

3. *S. rhombifolia*

1. *Sida acuta* Burm. f. Fl. Ind. 147. 1768; Christophersen in Bishop Mus. Bull. 128: 141. 1935; Yuncker in op. cit. 178: 81. 1943; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 17: 22. 1946; Greenwood in J. Arnold Arb. 30: 76. 1949, in op. cit. 36: 398. 1955; Mune & J. W. Parham in Dept. Agr. Fiji Bull. 31: 24. 1957; Yuncker in Bishop Mus. Bull. 220: 181. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 68. fig. 29. 1959, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972; Borss. in Blumea 14: 186. 1966; Mune & J. W. Parham in Dept. Agr. Fiji Bull. 48: 26. fig. 7. 1967; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 116. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 80. 1972.

Sida carpinifolia sensu Greenwood in Proc. Linn. Soc. 154: 95. 1943; non sensu str.

Sida linifolia sensu A. Gray, Bot. U. S. Expl. Exped. 1: 157. 1854; Seem. Viti, 433. 1862, Fl. Vit. 15. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 118. 1890; J. W. Parham in Dept. Agr. Fiji Bull. 35: 66. 1959, Pl. Fiji Isl. 121. 1964, ed. 2. 172. 1972; non Juss. ex Cav.

A low shrub 0.3–1.5 m. high, with a strong taproot, occurring from near sea level to about 300 m. as a weed, naturalized in waste places, plantations, canefields, and pastures and along roadsides. Its petals are pale yellow or rarely white; flowers and fruits occur throughout the year.

TYPIFICATION AND NOMENCLATURE: A specimen from Java (G), lacking collector's name and number, is indicated as the lectotype (cf. Borssum Waalkes, 1966). *Sida carpinifolia* is the basis of *S. acuta* subsp. *carpinifolia* (L. f.) Borss. and does not enter into our synonymy in the sense of the type. All the above references to *S. linifolia* refer only to the Exploring Expedition specimen from Ovalau cited below; I believe this to fall into *S. acuta*, although it is an aberrant form with very narrow leaves and a heavy indument of simple hairs.

DISTRIBUTION: A species of pantropical occurrence, but perhaps indigenous in Central America. Our material seems to represent subsp. *acuta*, which is established in most Pacific archipelagoes. Greenwood (1955, cited above), believed his Lautoka specimen, obtained in 1919, to be the earliest record for Fiji, but if the Exploring

Expedition specimen mentioned above is correctly placed here the species was in Fiji as early as 1840. About 40 Fijian collections are now at hand; the species is very abundant locally, especially in western and northern Viti Levu, and is a declared noxious weed.

LOCAL NAMES: *Broom weed*; *Paddy's lucerne*; recorded Fijian names are *ndeni vuaka* and *ndeniosa*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 99*; Suanaka, Nandi River, *DA 2914*; vicinity of Tonge, Mba River, *DA 10435*; Vatia Point, west of Tavua, *DA 2810*. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *DA 2908*; Singatoka Valley road, *DA 9145*. RA: Yanggara, *DA 10739*; between Penang and Ellington, *DA 3030*. TAILEVU: Matavatathou, *DA 9940*. OVALAU: *U. S. Expl. Exped. (us 12252)*; Levuka, *DA 1135*. VANUA LEVU: MATHUATA: Lambasa, *Greenwood 674*. TAVEUNI: *Gillespie 4795.5*; Vuna, *DA 5744*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 990*.

1. *Sida parvifolia* DC. Prodr. 1: 461. 1824; Borss. in *Blumea* 14: 192. 1966; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 172. 1972.

Sida microphylla sensu Benth. in *London J. Bot.* 2: 211. 1843; Seem. *Fl. Vit.* 15. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 118. 1890; Greenwood in *J. Arnold Arb.* 25: 1944; non Cav.

Sida retusa sensu A. Gray, *Bot. U. S. Expl. Exped.* 1: 158. 1854; Seem. *Viti*, 433. 1862; non L.

Sida samoensis Rechinger in *Repert. Sp. Nov.* 4: 228. 1907; Christophersen in *Bishop Mus. Bull.* 128: 142. 1935; Yuncker in *op. cit.* 178: 82. 1943, in *op. cit.* 184: 50. 1945, in *op. cit.* 220: 182. 1959; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 117. 1970.

A prostrate herb, subliguous toward base, with trailing or ascending branches to 60 cm. long, occurring near sea level on beaches and on headlands and rocky places near the sea, usually on limestone, apparently indigenous but sometimes found in villages. The petals are yellow; flowers and fruits have been obtained in January, April, and May.

TYPIFICATION AND NOMENCLATURE: The holotype of *Sida parvifolia* is *Bory s. n.* (G-DC), collected on La Réunion (Bourbon), Mascarene Islands. For *S. samoensis* three syntypes from Samoa were cited by Rechinger, his nos. 219, 1640, and 1719; the last of these, from Savaii, is duplicated at K. Specimens from the Fijian Region that have been identified as *S. samoensis* appear to me indistinguishable from Indian Ocean collections.

DISTRIBUTIONS: Mascarene and Seychelles Islands eastward, sparingly in Malesia and into the Pacific from Micronesia to Fiji, Samoa, Tonga, and Niue. The species is nowhere abundant and seems to prefer coralline seashores and a seasonally dry climate. Although it sometimes appears weedlike in villages, I believe that it is indigenous in the Fijian Region. In Fiji the first collections date from 1840.

LOCAL NAME AND USE: *Nggavi ni laweyalewa*; entire plant mixed with water and taken internally to promote menstruation (information from *Weiner 243*).

AVAILABLE COLLECTIONS: YASAWAS: YASAWA: Tamusua, *DA 13665*. NATHULA: Nathula Village, *DA 11833*. *Weiner 243*. VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 920*. REWA: Nukulau Island, *Barclay s. n.* KANDAVU: Between Talaulia and Ndavinggele (presumably by a coastal route around western end of island), *DA 2943*. FIJI without further locality, *U. S. Expl. Exped. (us 12312)*, *Horne 1024*.

3. *Sida rhombifolia* L. Sp. Pl. 684. 1753; A. Gray, *Bot. U. S. Expl. Exped.* 1: 158. 1854; Seem. in *Bonplandia* 9: 254. 1861; Viti, 433. 1862; *Fl. Vit.* 15. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 118. 1890; Christophersen in *Bishop Mus. Bull.* 128: 142. 1935; Greenwood in *Proc. Linn. Soc.* 154: 95. 1943; Yuncker in *Bishop Mus. Bull.* 178: 81. 1943, in *op. cit.* 184: 50. 1945; J. W. Parham in *Agr. J. Dept. Agr. Fiji* 19: 104. 1948, in *Dept. Agr. Fiji Bull.* 35: 66. *fig. 28*. 1959; Yuncker in *Bishop Mus. Bull.* 220: 182. 1959; J. W. Parham, *Pl. Fiji Isl.* 121. 1964, ed. 2. 173. 1972; Borss. in

Blumea **14**: 193. 1966; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 117. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 333. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 80, 127. 1972.

A coarse, subligneous herb or a shrub 0.5–2 m. high, with a long taproot, occurring from near sea level to an elevation of 900 m. as an abundantly naturalized weed in waste places, gardens, pastures, coconut plantations, thickets, and clearings, along roadsides, and on open hillsides among reeds and ferns. Its flowers have bright yellow to pale orange petals and bright yellow anthers; the fruits turn from green to brown. Flowers and fruits are found throughout the year.

LECTOTYPIFICATION: The lectotype (cf. Borssum Waalkes, 1966) is a specimen in the Clifford Herbarium (BM).

DISTRIBUTION: Pantropical and subtropical; this broad distribution was apparently very early, and I have not noted an opinion as to the original area of the species. It is established in practically all Pacific archipelagoes and probably was an inadvertent aboriginal introduction. About 90 Fijian collections have been examined; these appear to belong to subsp. *rhombifolia*, one of the two subspecies recognized by Borssum Waalkes.

LOCAL NAMES AND USES: *Broom weed*; *Paddy's lucerne*; recorded Fijian names are *thavuthindra*, *nggavi ni lawa*, *nggavi ni lathoi*, *ndenime*, *ndeniosa*, *ndeni vuaka*, *ndeni puaka*, and *mbariara*. The branches are frayed and used as toothbrushes, and the leaves are reported to be part of a remedy to cure diarrhoea. More importantly, the species is a serious weed and is difficult to eradicate, although it has not been declared a noxious weed like *S. acuta*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 98*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4112*; Mt. Nanggaranambuluta, east of Nandarivatu, *DA 10377*. NADRONGA & NAVOSA: Keiyasi, Singatoka River, *DA 10173*; Lawangga, Singatoka, *DA 9777*. SERUA: Vicinity of Ngaloa, *Smith 9446*; vicinity of Navua, *DA 11447*. RA: Yanggara, *DA 2830*; vicinity of Penang, *DA 7043*. NAITASIRI: Vunindawa, *DA 10021*; Nanduruloulou, *DA 2638*. TAILEVU: Naingani Island, *DA 3368*; Wainimbokasi, *DA 10571*. REWA: Suva, *Meebold 16535*. KANDAVU: Western end of island, near Cape Washington, *Smith 297*. VANUA LEVU: MATHUATA: Vicinity of Lambasa, *DA 10471*. THAKAUNDROVE: Vicinity of Savusavu, *Bierhorst F215*. TAVEUNI: Waiyevo, *DA 5715*. MOALA: *Bryan 316c*. VANUA MBALAVU: Lomaloma, *DA 10234*. LAKEMBA: *Seemann 16*.

10. ABUTILON Mill. Gard. Dict. Abridg. ed. 4. 1754; Borss. in *Blumea* **14**: 159. 1966.

Annual herbs or perennial undershrubs or shrubs, less often trees, often with soft, stellate indument; leaf blades simple, angular, or lobed, palmate-nerved, usually cordate at base, without glands on nerves; inflorescences axillary, composed of solitary flowers or these in loose, terminal racemes or panicles by reduction of distal leaves; flowers medium-sized, the pedicels usually articulate near apex; epicalyx lacking; calyx campanulate or cupuliform, 5-lobed; corolla rotate to campanulate; staminal column usually much shorter than petals, widened at base, divided at apex into numerous filaments; ovary 5–40-locular, the ovules 2–9 (rarely 1 by abortion) per locule, the style branches as many as ovary locules, filiform or clavate, connate proximally, the stigmas capitate; fruit a subglobose to cylindrical, campanulate, or discoid schizocarp, breaking into (1–) 2–9-seeded mericarps, these follicular, mostly flat and reniform, rounded to acuminate or aristate at apex, tardily separating from a slender columella, the seeds subreniform, ascending to pendulous, loosely held within the mericarp and falling out of it.

LECTOTYPE SPECIES: *Abutilon avicennae* Gaertn. (*Sida abutilon* L.) (vide Britton & Millsp. Bahama Fl. 264. 1920).

DISTRIBUTION: Pantropical and subtropical, with 150–400 species. One species occurs in Fiji as a sparingly naturalized weed.

1. **Abutilon indicum** (L.) Sweet, Hort. Brit. 54. 1826; Borss. in *Blumea* **14**: 170. 1966; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 111. 1970; J. W. Parham, *Pl. Fiji Isl. ed. 2.* 170. 1972.

Sida indica L. Cent. II. Pl. 26. 1756.

A coarse, suffruticose herb 0.5–2 m. high, sparingly naturalized as a weed on plantations near sea level. The flowers have yellow to orange petals and have been noted, together with ripe fruits, in April and September.

TYPIFICATION: The lectotype (cf. Borssum Waalkes, 1966) is no. 866.29 (LINN), from Hortus Upsaliensis.

DISTRIBUTION: Tropics and subtropics of both hemispheres, but probably of Indo-Australian origin. Of the three subspecies recognized by Borssum Waalkes, our material seems to represent subsp. *indicum*. Other than for the recent Fijian collections, obtained only in 1968, the species seems to be recorded in the Pacific only from Hawaii and Niue. It is possibly a garden escape, although not noted in cultivation in Fiji.

AVAILABLE COLLECTIONS: VANUA MBALAVU: Yanuyanu Island, *DA L.13846, L.14391* (both coll. Mrs. E. Hennings).

ORDER EUPHORBIALES

None of the comparatively small families that seem closely related to the Euphorbiaceae have representatives in Fiji. The Euphorbiaceae themselves have been variously placed in the Dilleniidae and Rosidae or in superorders allied to one or to the other subclass. Takhtajan's placement seems supported by many characters suggesting a relationship to the order Malvales (cf. Hutchinson, 1973, p. 331). As outlined by Takhtajan (1967) and Thorne (1976) the Euphorbiales include the family Dichapetalaceae, which both Cronquist (1968) and Hutchinson (1973) place in a rosalean alliance. Although the Dichapetalaceae seem a fairly isolated family, no obvious characteristics ally them closely to the Euphorbiaceae or even to the Dilleniidae. In the present treatment I defer the Dichapetalaceae (with only one species in Fiji) to the subclass Rosidae.

FAMILY 91. EUPHORBIACEAE

EUPHORBIACEAE Juss. Gen. Pl. 384, as *Euphorbieae*. 1789.

Monoecious or dioecious herbs, shrubs, or trees, infrequently scandent plants, often with special laticiferous vessels, mostly stipulate, the stipules sometimes represented by branched hairlike bodies, glands, or thorns; leaves alternate (usually spirally arranged, sometimes distichous), infrequently opposite or verticillate, simple or digitately lobed, less often digitately compound, sometimes reduced; inflorescences mostly axillary, usually complex but basically cymose; flowers unisexual, actinomorphic, hypogynous; sepals valvate or imbricate, or in very specialized inflorescences sometimes much reduced or absent; petals absent or rarely present and sometimes united; stamens very diverse in number (mostly 3–20 but sometimes 1–1,000), free or variously united, the anthers 2(3- or 4-)locular, erect or inflexed in bud, dehiscing lengthwise or rarely by pores, staminodes sometimes present in ♀ flowers; ovary superior, usually 3-locular (sometimes 1–14-locular), the ovules solitary or paired (often collateral) in each locule, anatropous or hemitropous, pendulous, epitropous, the funicle often thickened, the placentation axile, the styles as many as ovary locules, free or variously united, often bilobed, a vestige of an ovary often present in ♂ flowers; disk often present in both ♂ and ♀ flowers, annular, cupuliform, or of separate

glands; fruit mostly a 3-locular capsule, often schizocarpic, usually septical and with a persistent columella, rarely loculicidal or a berry or drupe, the pericarp double, the mericarps as many as ovary locules, 2-valved, the seeds often with a conspicuous caruncle, the endosperm mostly copious and fleshy, the embryo straight.

DISTRIBUTION: Tropical, subtropical, and temperate regions of the world, with about 300 genera and at least 7,500 species. Twenty-nine genera are known to be represented in Fiji, 21 of them including indigenous species. Many cultivated or adventive species are also present.

USEFUL TREATMENTS OF FAMILY: Pax, F., & K. Hoffman. Euphorbiaceae. *In*: Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 11-233. 1931. Webster, G. L. The genera of Euphorbiaceae in the southeastern United States. *J. Arnold Arb.* 48: 303-430. 1967. Hutchinson, J. Tribalism in the family Euphorbiaceae. *Amer. J. Bot.* 56: 738-758. 1969. Airy Shaw, H. K. The Euphorbiaceae of Borneo. *Kew Bull. Add. Ser.* 4: 1-245. 1975. Webster, G. L. Conspectus of a new classification of the Euphorbiaceae. *Taxon* 24: 593-601. 1975.

The Euphorbiaceae, essentially cosmopolitan in range except for arctic regions, are known for many useful products, including para rubber, tung oil, castor oil, physic nut, waxes, and cassava. Among well-known ornamentals in the family may be mentioned the crotons and poinsettia.

The family has attracted the attention of many competent specialists, among them H. K. Airy Shaw and G. L. Webster, who have devoted many years of study to development of phylogenetic classifications as well as to detailed regional studies. Webster's recent conspectus of a new classification (1975, cited above) is currently being elaborated by its author, who has kindly offered me much valuable advice and who has at my request contributed to the present work the key to genera known to be present in Fiji. (I have taken some liberties with this key to account for a few unusual situations found in our species.) The parenthetically indicated names of subfamilies and tribes are those currently used by Webster; subtribal names are not here indicated.

KEY TO GENERA

BY GRADY L. WEBSTER

(University of California, Davis)

- Locules of ovary each with 2 ovules (rarely 1, but not in our species); milky latex absent; indument of simple hairs; leaves simple, with entire blades (except leaves compound, with serrulate blades, in no. 9, *Bischofia*).
- Stipules present; leaves alternate (rarely opposite); plants monoecious or dioecious (subfam. Phyllanthoideae).
- Leaves simple; flowers in axillary clusters or spikes or racemes.
- Petals present; sepals valvate (tribe Brideliaceae). 1. *Cleistanthus*
- Petals absent; sepals imbricate.
- Flowers in racemes or spikes.
- Ovary 1-locular; ♂ flowers solitary in axil of each bract (tribe Antidesmeae). 2. *Antidesma*
- Ovary 2- or 3-locular; ♂ flowers usually 2 or more per bract (tribe Aporuseae). 3. *Baccaurea*
- Flowers in axillary clusters (in no. 6, *Phyllanthus*, and no. 8, *Glochidion*, inflorescences sometimes short-amentiform).
- Disk of ♂ flowers central (intrastaminal); ovary 1-locular, the style unlobed and dilated (tribe Drypetaceae). 4. *Drypetes*
- Disk of ♂ flowers extrastaminal or absent; ovary of 2 or more locules (tribe Phyllanthae).
- Pistillode present in ♂ flowers; leaves on main axes not reduced to scales; fruit fleshy.
5. *Flueggea*
- Pistillode absent; leaves on main axes often reduced to scales subtending deciduous branchlets; fruit capsular.
- Floral disk present; seeds with a dry testa, not ventrally invaginated. . . 6. *Phyllanthus*
- Floral disk absent; seeds with a somewhat fleshy testa, ventrally invaginated.
- Styles emarginate or bifid; anthers not apiculate. 7. *Breynia*
- Styles entire or sometimes emarginate; anthers apiculate (in our species 3, dorsally adnate to a column, the connective produced into 3 connivent lobes). . . 8. *Glochidion*

- Leaves trifoliate, the leaflet blades serrulate; flowers in panicles (tribe Bischofiaee). 9. *Bischofia*
- Stipules absent (or minute and evanescent); leaves opposite (rarely alternate); plants dioecious (rarely monoecious); flowers apetalous; seeds with a smooth, dry, shining testa (subfam. Oldfieldioideae).
- Stamens fewer than 25, free, the anthers not apiculate; floral disk present in ♀ flowers; fruit dry, capsular (tribe Hyenancheae). 10. *Austrobuxus*
- Stamens usually 20-30, the filaments connate, the anthers apiculate; floral disk absent; fruit fleshy, tardily dehiscent (tribe Petalostigmataee). 11. *Petalostigma*
- Locules of ovary each with 1 ovule.
- Milky latex absent; flowers apetalous; calyx not petaloid; sepals (at least of ♂ flowers) valvate in bud (subfam. Acalyphoideae; tribe Acalypheae).
- Inflorescences terminal, with ♀ flowers distal; stamens with branched filaments and many anthers; seeds carunculate; leaf blades palmately lobed. 12. *Ricinus*
- Inflorescences, if terminal, not with ♀ flowers distal to ♂; stamens not branched with many anthers. Indument of simple hairs; leaves alternate, the blades not granulose-glandular beneath; inflorescences axillary.
- Anther-sacs not vermiform-pendulous; styles unlobed to bifid; bracts subtending ♀ flowers not greatly enlarged in fruit; seeds ecarunculate.
- Disk absent in ♂ flowers; anther-sacs not parted to connective.
- Styles unlobed; anthers 3- or 4-locular; leaf blades with embedded laminar glands; seed coat fleshy. 13. *Macaranga*
- Styles bifid; anthers 2-locular; leaf blades without laminar glands; seed coat dry. 14. *Cleidion*
- Disk present in ♂ flowers, intrastaminal; anther-sacs parted to connective; styles unlobed; leaf blades without embedded laminar glands; seed coat fleshy. 15. *Claoxylon*
- Anther-sacs vermiform-pendulous; styles laciniate; bracts subtending ♀ flowers accrescent in fruit; seeds more or less carunculate. 16. *Acalypha*
- Indument of stellate hairs; leaves (in our species) opposite, the blades granulose-glandular beneath; inflorescences terminal at inception; capsules muricate or echinate, the seed coat fleshy. 17. *Mallotus*
- Latex present, usually milky or colored (in some taxa nearly clear); calyx aestivation not valvate (except in no. 18, *Hevea*, with apetalous flowers and induplicate-valvate calyx aestivation).
- Sepals imbricate (except in no. 18, *Hevea*, valvately or irregularly rupturing in no. 22, *Aleurites*) and covering anthers before anthesis; petals present (at least in ♂ flowers) or if not then leaves compound or with sometimes (at least when juvenile) peltate blades; bracts not biglandular at base (subfam. Crotonoideae).
- Petals absent; pollen grains tricolporate; seeds ecarunculate.
- Leaves compound; plants monoecious; anthers 2-locular; stigmas bilobed; fruit capsular (tribe Micrandreae). 18. *Hevea*
- Leaves simple, the blades sometimes peltate; plants dioecious; anthers 3- or 4-locular; stigmas disciform; fruit drupaceous (tribe Adenolineae). 19. *Endospermum*
- Petals present (at least in ♂ flowers) or calyx petaloid; pollen grains porate or inaperturate, the exine verrucate; seeds carunculate (except in no. 22, *Aleurites*).
- Flowers apetalous, the calyx petaloid; disk of ♂ flowers intrastaminal, annular or lobed (tribe Manihoteae). 20. *Manihot*
- Flowers (at least ♂ ones) with petals; disk of ♂ flowers extrastaminal.
- Stamens connate; flowers in dichasia or panicles (tribe Jatropheae).
- Sepals of ♂ flowers free or nearly so; indument of simple hairs; fruit capsular. 21. *Jatropha*
- Sepals of ♂ flowers fused in bud, irregularly rupturing at anthesis; indument of stellate, bifurcate, or simple hairs; fruit drupaceous. 22. *Aleurites*
- Stamens free; flowers in racemes or spikes.
- Indument of simple hairs; styles unlobed; stamens not inflexed in bud (tribe Codiaeae). 23. *Codiaeum*
- Indument of stellate hairs or scales; styles bifid to multifid; stamens inflexed in bud (tribe Crotonaeae). 24. *Croton*
- Sepals not entirely covering anthers before anthesis; petals absent; leaves simple; bracts usually biglandular at base (subfam. Euphorbioideae).
- Flowers in racemes or spikes (not condensed into pseudanthia); perianth present; stamens 2 or more; styles usually unlobed; leaves alternate; stipules present (tribe Hippomaneae).
- Stamens 6-20 or more; petioles elongated (3 cm. long or more on mature leaves); seeds carunculate. 25. *Omalanthus*
- Stamens 2 or 3; petioles shorter (3 cm. long or less on mature leaves).
- Plants dioecious or sometimes monoecious; spikes axillary (sometimes terminal at inception); columella not 3-horned at base; seeds ecarunculate. 26. *Excoecaria*

- Plants monoecious; spikes terminal; columella 3-horned or indurated-angled at base; seeds carunculate. 27. *Stillingia*
 Flowers with perianth obsolete or absent; aggregated in pseudanthia (cyathia); ♂ flowers with a single stamen; styles bifid (tribe Euphorbiae).
 Leaves alternate (at least the lower ones in our species); stipules lacking (in our species); seeds usually carunculate. 28. *Euphorbia*
 Leaves opposite; stipules present; seeds ecarunculate. 29. *Chamaesyce*

1. *CLEISTANTHUS* Hook. f. ex Planch. in Hook. Icon. Pl. 8: pl. 779. 1848; Jablonsky in Pflanzenz. 65 (IV. 147. VIII): 8. 1915; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 80. 1931; A. C. Sm. in J. Arnold Arb. 36: 280. 1955.

Monoecious shrubs or trees, without milky latex, with often minute stipules, the indument of simple hairs or plants essentially glabrous; leaves alternate, distichous, short-petiolate, the blades entire; inflorescences axillary, pulvinate; flowers clustered, essentially sessile; calyx 5-lobed, the lobes valvate; petals 5, minute; stamens 5 in ♂ flowers, borne on an annular, pulvinate disk, the anthers erect in bud, 2-locular, introrse, a rudimentary pistil present; ♀ flowers with the calyx persistent, the ovary 3 (rarely 4-)lobed, the ovules 2 per locule; the disk annular, its inner margin cupuliform and appressed to ovary, the styles subcoherent at base, 2-lobed or 2-partite; fruit a schizocarp, the endocarp separating from exocarp, the columella persistent.

TYPE SPECIES: *Cleistanthus polystachyus* Hook. f.

DISTRIBUTION: Eastern Africa to Malesia, Micronesia, Australia, and New Caledonia, with a single endemic Fijian species terminating the range to the east, and with 100-140 species.

1. *Cleistanthus micranthus* Croizat in J. Arnold Arb. 26: 98. 1945; A. C. Sm. in op. cit. 36: 280. 1955; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 179. 1972. FIGURE 110.

A sometimes spreading tree 5-6 m. high, occurring in dry forest at elevations between 50 and 200 m. The calyx is rich pink, the petals and anthers nearly white. Flowers and fruits have been obtained in April, July, and December.

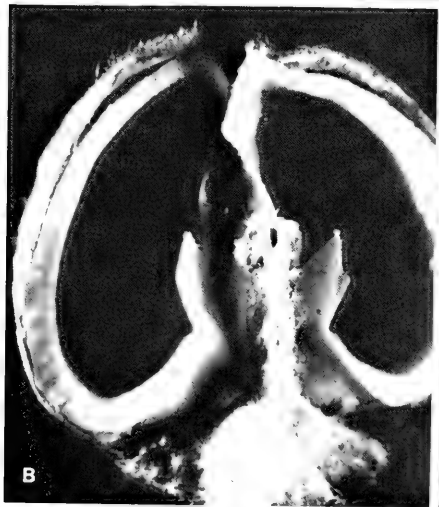
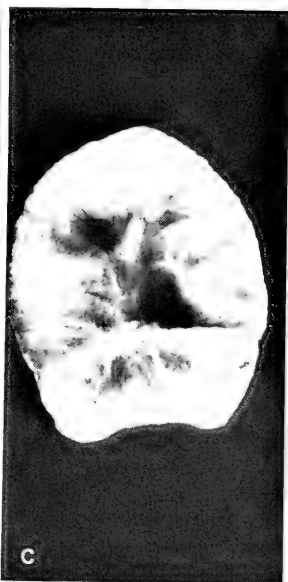
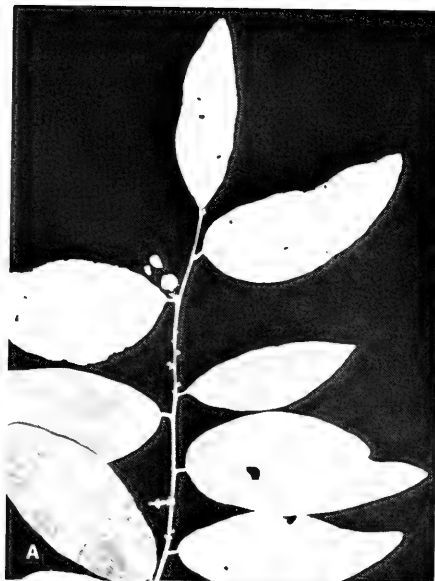
TYPIFICATION: The type is *Greenwood 1018* (A HOLOTYPE; ISOTYPES at BISH, K), collected in May, 1943, in hills at about 200 m. (without further locality), Serua Province, Viti Levu.

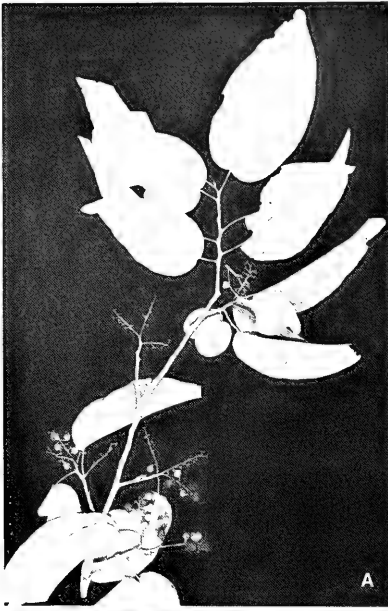
DISTRIBUTION: Endemic to Fiji and apparently rare, known from only three collections made on Viti Levu and Vanua Levu.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills between Wainiggere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9531*. VANUA LEVU: MATHUATA: Hills near Lambasa, *Greenwood 615* (July 8, 1923).

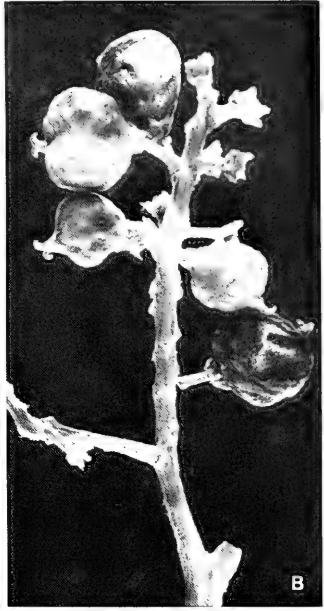
Croizat placed his species in sect. *Australes*, occurring in Australia, New Caledonia, and Fiji, as a relative of *Cleistanthus stipitatus* (Baill.) Muell. Arg. and *C. dallachyanus* (Baill.) Benth.

FIGURE 110. *Cleistanthus micranthus*, from *Smith 9531*; A, distal portion of branchlet, showing a dehisced fruit and a seed, × 1/3; B, dehisced fruit, with 2 mericarps and persistent columella, × 10; C, seed, ventral surface, × 10; D, seed, dorsal surface, × 10.

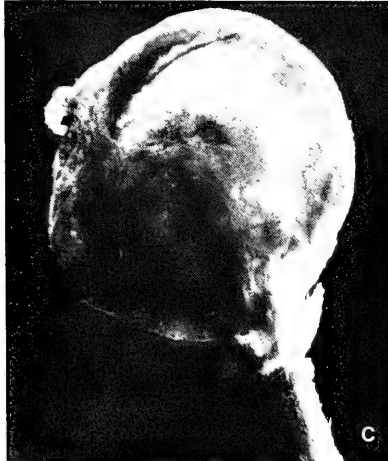




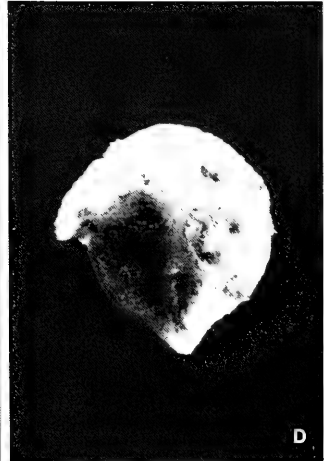
A



B



C



D

2. *ANTIDESMA* L. Sp. Pl. 1027. 1753; Seem. Fl. Vit. 217. 1867; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 107. 1922, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 54. 1931; A. C. Sm. in J. Arnold Arb. 33: 367. 1952.

Diocious trees or shrubs, without milky latex, stipulate, the indument when present of simple hairs; leaves alternate, distichous, simple, the blades pinnate-nerved, entire; inflorescences usually axillary spikes or racemes or panicles, the flowers small; calyx 3-7-lobed to subtire or denticulate, the lobes imbricate if developed; petals absent; ♂ flowers solitary in axils of bracts, with 2-7 stamens opposite calyx lobes, borne within disk or in disk cavities or between disk lobes, often incurved in bud, the anthers 2-locular, longitudinally dehiscent, with short, thick connectives, a rudimentary pistil absent or small, the disk cupuliform, pulvinate, or lobed; ♀ flowers with an annular or cupuliform disk, the ovary 1-locular, the ovules 2, the stigmas 2-4, terminal, excentric, or lateral, often recurved, entire to 2-partite; fruit drupaceous, symmetrical or asymmetrical, the putamen reticulate or marked by conspicuous ridges and depressions, the pyrene usually 1-seeded.

TYPE SPECIES: *Antidesma alexiteria* L., the only original species.

DISTRIBUTION: Paleotropical and subtropical, with about 170 species, extending eastward in the Pacific to Samoa and Hawaii. It is represented in Fiji by five endemic species and is not uncommon in the interiors of the two large islands, although nineteenth century botanists obtained only two collections of the genus. It is sometimes placed as the sole genus of the family Stilaginaceae C. Agardh (*Stilago* L. = *Antidesma*). The small, drupaceous fruits with reticulate or irregularly pitted putamens are unlike those of other Euphorbiaceae, and Airy Shaw (in Willis, Dict. Fl. Pl. Ferns, ed. 7. 1076. 1966) suggests an alliance to the family Icacinaceae (subclass Rosidae in the present *Flora*). However, Webster, Hutchinson (1973), and most other concerned botanists seem satisfied to leave *Antidesma* in the Euphorbiaceae.

USEFUL TREATMENT OF GENUS: Smith, A. C. *Antidesma* L. J. Arnold Arb. 33: 367-373. 1952.

KEY TO SPECIES

Calyx of ♀ flowers cupuliform or rotate, deeply 4- or 5-lobed, the lobes ovate-deltoid, puberulent on both surfaces; ovary and fruit usually asymmetrical, the stigmas usually excentric or lateral, the mature fruit subglobose, 5-6 mm. in diameter, the pyrene coarsely reticulate, shallowly pitted, 3.5-4.5 mm. in diameter; inflorescence branches and pedicels persistently puberulent; leaf blades papyraceous, rounded or subcordate at base, often faintly pilose on costa or in nerve axils beneath (sect. *Tetrandra*).

1. *A. pacificum*

Calyx cupuliform, truncate or inconspicuously lobed, usually glabrous except at margin; ovary and fruit symmetrical, the stigmas terminal, the mature fruit (insofar as known in our species) comparatively large, ellipsoid to obovoid, 12-22 × 7-12 mm., the pyrene deeply pitted, with conspicuous ridges, 10-17 × 5-9 mm.; inflorescence branches and pedicels usually glabrous at anthesis; leaf blades chartaceous to subcoriaceous, attenuate to obtuse at base (sect. *Montana*).

Leaf blades glabrous; ♂ flowers with the rudimentary pistil copiously puberulent at least distally.

Petioles 4-15 mm. long; leaf blades usually 14-21 × 5-11 cm., narrowly revolute at margin; calyx of ♀ flowers at anthesis 1-1.2 mm. long and about 1.7 mm. in diameter, the margin truncate or minutely denticulate, the limb equalled or exceeded by disk, this glabrous on both sides, ciliolate at apex; ovary narrowed into a short style 0.2-0.3 mm. long, the stigmas slender, acute, sharply recurved.

2. *A. insulare*

Petioles 1-5 mm. long; leaf blades usually 5-15 × 2-7 cm., plane or slightly recurved at margin; calyx of ♀ flowers at anthesis 1.5-1.7 mm. long and usually more than 2 mm. in diameter, the margin 4- or 5-lobed or dentate, the limb exceeding disk; stigmas stout, obtuse, spreading but not recurved.

FIGURE 111. *Antidesma pacificum*, from Smith 1332; A, distal portion of branchlet with infructescences, × 1/3; B, portion of infructescence, × 3; C, fruit, × 10; D, pyrene, × 10.

Leaf blades usually 8-15 × 3.5-7 cm., the costa stout (0.7-1.5 mm. broad near base of blade); disk of ♀ flowers pilose on both sides at least distally, as well as ciliolate; ovary narrowed into a short style about 0.2 mm. long; rudimentary pistil in ♂ flowers oblong-ovoid, about 0.8 mm. broad; mature fruit 15-22 mm. long. 3. *A. gillespieanum*

Leaf blades 4-9 × 1.8-4 cm., the costa comparatively slender (0.5-0.8 mm. broad near base of blade); disk of ♀ flowers essentially glabrous except at ciliolate margin; ovary narrowed into an obvious style about 1 mm. long; rudimentary pistil in ♂ flowers oblong-cylindric, 0.3-0.4 mm. broad; mature fruit 12-16 mm. long. 4. *A. elassophyllum*

Leaf blades uniformly and persistently soft-pilose beneath, oblong- or ovate-elliptic, 8-13 × 4.5-7 cm.; young ♂ flowers with the disk very short, much exceeded by the calyx limb, the rudimentary pistil essentially glabrous. 5. *A. trichophyllum*

1. ***Antidesma pacificum*** Muell. Arg. in DC. Prodr. 15 (2): 254. 1866; Seem. Fl. Vit. 217. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 289. 1892; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 150. 1922; A. C. Sm. in J. Arnold Arb. 33: 368. 1952; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 177. 1972. FIGURE 111.

A tree about 5 m. high, known with certainty to occur at elevations between sea level and 100 m. in thickets, and with deep purple fruits obtained in March.

TYPIFICATION: The type is *U. S. Expl. Exped.* (? HOLOTYPE at G; ISOTYPES at GH, US 1944460), collected in 1840 in Fiji without further locality. The depository of the holotype was not stated by Mueller.

DISTRIBUTION: Endemic to Fiji and known definitely only from Vanua Levu and Moala.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA or THAKAUNDROVE: Undu Point, *Tothill 44*. MOALA: Near Maloku, *Smith 1332*. FIJI without further locality, *Horne 491*, *DA 3910*.

More closely related to the Samoan *Antidesma sphaerocarpum* Muell. Arg. than to the following Fijian species, *A. pacificum* is probably the only member of the genus to be anticipated in coastal areas in Fiji.

2. ***Antidesma insulare*** Gillespie in Bishop Mus. Bull. 91: 12. fig. 13 (excl. e-g). 1932; A. C. Sm. in J. Arnold Arb. 33: 368. 1952; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972.

A small tree or shrub, occurring in forest at elevations of about 100-250 m. Notes on the available collections are very inadequate; flowering specimens are dated August and September.

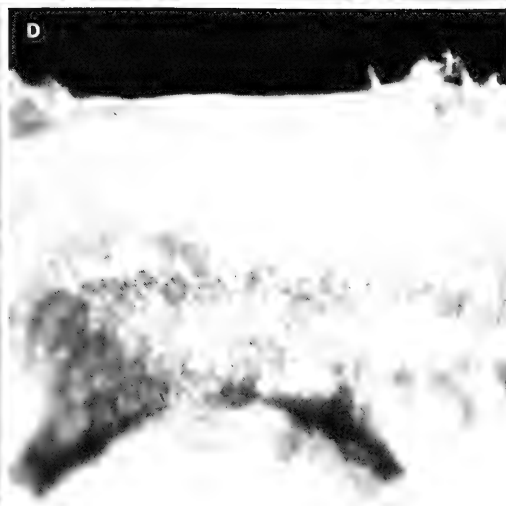
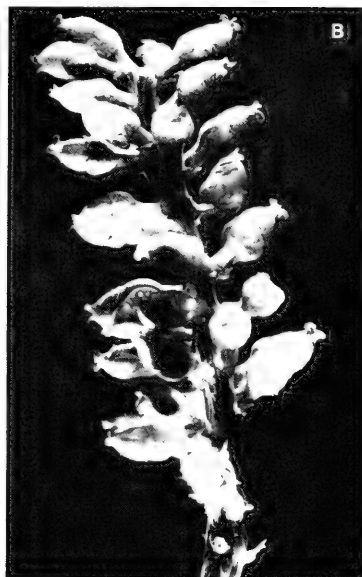
TYPIFICATION: The type is *Gillespie 2292* (BISH HOLOTYPE; ISOTYPES at A, BISH, GH, K, NY), collected Aug. 15, 1927, on the southeastern slopes of Mt. Korombamba, Rewa Province, Viti Levu.

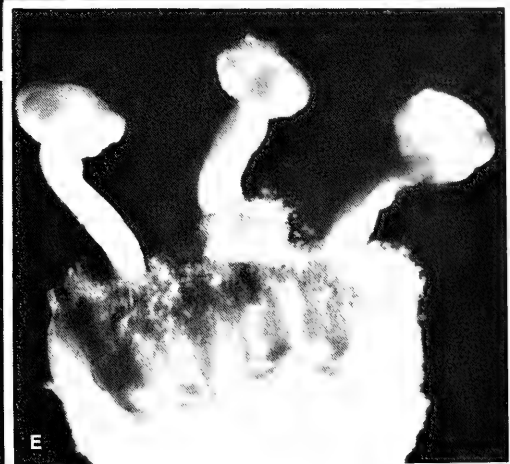
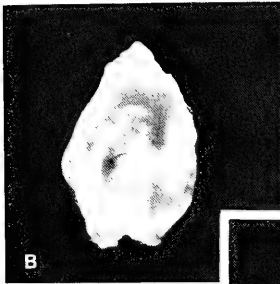
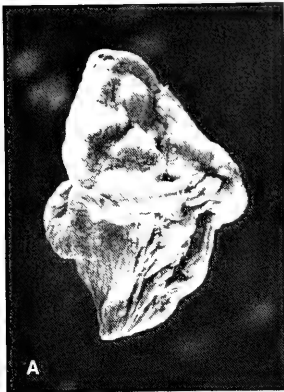
DISTRIBUTION: Endemic to Fiji and known from a very limited area in southeastern Viti Levu.

LOCAL NAME: *Milamila* (from *DA 12221*). The name *natha*, mentioned by J. W. Parham (1964, 1972, cited above), seems to refer only to *Smith 656*, *Antidesma elassophyllum*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Savura Creek, *DA 12221* (*DF 71*, *Bola 4*); vicinity of Tamavua, *Gillespie 2030*.

FIGURE 112. *Antidesma gillespieanum*; A, distal portion of branchlet with ♀ inflorescences, × 1/3; B, ♀ inflorescence, × 3; C, ♀ flower and subtending bract, × 15; D, inner surface of portions of calyx limb and disk of ♀ flower, showing indument of disk, × 60. A from *DA 13098*, B-D from *Smith 5990*.





As noted in my 1952 treatment, *Antidesma insulare* seems restricted in distribution; most of the collections originally cited by Gillespie are referable to the following two species, which are not known to occur in southeastern Viti Levu.

3. *Antidesma gillespieanum* A. C. Sm. in J. Arnold Arb. 33: 370. 1952; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972. FIGURES 112, 113.

An often slender tree 2–15 m. high, found at elevations of 100–1,220 m. in dense forest; infrequent below 400 m. Its flowers have the calyx greenish or greenish yellow and sometimes faintly pink-tinged, the filaments white to pale yellow, the anthers yellow and pink-tinged, and the stigmas greenish white; the mature fruits are deep red to purple. Flowers have been obtained between September and December, fruits between February and October.

TIPIFICATION: The type is *Smith 5990* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected Sept. 12, 1947, in hills between Ngaliwana and Tumbendreketi Creeks, east of the sawmill at Navai, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and apparently the most widespread species in Fiji, now being known from the four largest islands.

LOCAL NAMES: *Poroporo* (Mba Province); *saukalambuthi* (Mbuva Province). Each of these names has been recorded only once.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gillespie 4330*, *Smith 5050*, *DA 13098*; ridges of Mt. Nanggaranambuluta, *Gillespie 4071*; vicinity of Nandala, south of Nandarivatu, *Degener 15019*; hills east of Nandala Creek, *Smith 6214*; vicinity of Navai, *DA 14984*; hills between Ngaliwana and Tumbendreketi Creeks, east of the sawmill at Navai, *Smith 5878*; slopes of Mt. Tomanivi, *DA 13097*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4719*; between Singatoka and Navua Rivers, *DA 2475*. SERUA: Track to Mt. Tikituru, *DA 14475*. NAMOSI: Mt. Naitarandamu, *Gillespie 3316*; hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8503*; summit of Mt. Vakarongasiu, *Gillespie 3255*. KANDAVU: Mt. Mbuke Levu, *Smith 230*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1572*. TAVEUNI: Nanggalendamundamu, near Nggeleli, *DA 15864*.

4. *Antidesma elassophyllum* A. C. Sm. in J. Arnold Arb. 33: 371. 1952; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972. FIGURE 114A.

A shrub or small tree 3–10 m. high, occurring at elevations of 500–1,120 m. in dense forest or mossy forest or in dense crest thickets of high or exposed ridges. Its calyx and filaments are reported as white and its fruit as red to purplish. Flowers have been obtained in October and November, fruits between July and January.

TIPIFICATION: The type is *Smith 656* (NY HOLOTYPE; ISOTYPES at BISH, GH, K, US), collected Nov. 28, 1933, on the crest of the Mt. Mbatini Range, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from the two largest islands.

LOCAL NAMES: *Molau*, *naiha*, each recorded once from Vanua Levu.

FIGURE 113. *Antidesma gillespieanum*; A, mature fruit, × 3; B, pyrene, × 3; C, ♂ inflorescence, × 3; D, ♂ flower, × 10; E, ♂ flower with part of calyx limb and 1 stamen removed to show disk, tip of rudimentary pistil, and 3 stamens, × 30. A & B from *Smith 1572*, C–E from *Smith 6214*.

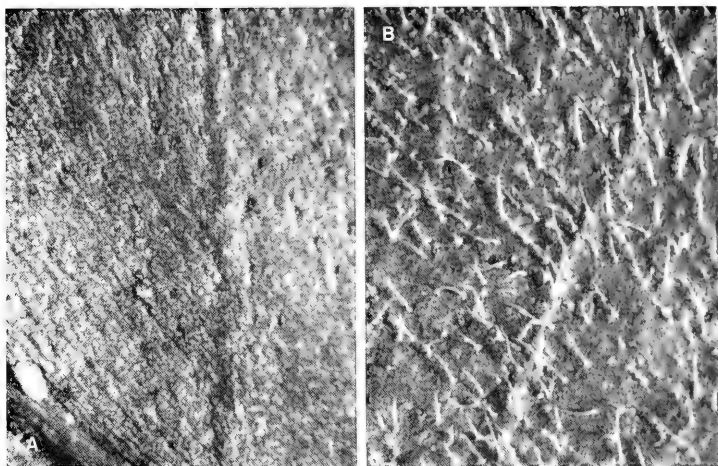


FIGURE 114. A, *Antidesma elassophyllum*, portion of lower surface of leaf blade, $\times 20$, from *Smith 557*. B, *Antidesma trichophyllum*, portion of lower surface of leaf blade, $\times 20$, from *Smith 5573*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 951, 1073, 1263*; Natua Levu, Mt. Evans Range, *DA 14054*; Mt. Mbatilamu, *DA 14124*; vicinity of Nandarivatu, *Tothill 376, Parks 20538*; near summit of Mt. Nanggaranambuluta, *Gillespie 3784*; hills east of Nandala Creek, *Smith 5941*. VANUA LEVU: MATHUATA: Summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6465*. MATHUATA-THAKAUNDROVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 557*. FIJI without further locality, *Gillespie 4051*.

5. *Antidesma trichophyllum* A. C. Sm. in *J. Arnold Arb.* **33**: 373. 1952; J. W. Parham, *Pl. Fiji Isl.* 124. 1964, ed. 2. 177. 1972. FIGURE 114B.

A slender tree about 8 m. high, apparently rare in dense forest at an elevation of 725–825 m. The σ buds are yellowish and are known only from the type collection.

TYPEIFICATION: The type is *Smith 5573* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected Aug. 7, 1947, on the northern portion of the Rairaimatuku Plateau, between Nandrau and Nanga, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

LOCAL NAME: *Molatha*.

3. *BACCAUREA* Lour. *Fl. Cochinch.* 641, 661. 1790; Seem. *Fl. Vit.* 220. 1867; Pax & Hoffm. in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **19c**: 50. 1931; Merr. in *Trans. Amer. Philos. Soc. n. s.* **24** (2): 232. 1935.

Diocious trees, without milky latex, stipulate, the stipules usually small and soon caducous but sometimes accrescent and subsistent, the indument when present of simple hairs; leaves alternate, spirally arranged, the petioles sometimes leaving con-

spicuous scars after falling, often swollen at apex, the blades papyraceous to coriaceous, pinnate-nerved, entire to crenate; inflorescences axillary or borne on defoliate branchlets, sometimes several together, racemose or paniculate or narrowly thyriform, the flowers small; calyx 3-7-lobed, the sepals free or shortly connate at base, imbricate, often somewhat unequal; petals lacking; ♂ flowers usually 2 or more in axil of each bract, the disk absent (in our species) or obscure, the stamens (3-) 4-10, free, the filaments filiform, the anthers 2-locular, a rudimentary pistil present; ♀ flowers sometimes solitary in bract axils, sometimes larger than ♂, lacking disk glands or these present and inconspicuous, the ovary 2- or 3-locular, the ovules 2 per ovary locule, the styles short and connate or lacking, the stigmas small, 2-lobed, sometimes forming a persistent, lobulate stigmatic shield; fruit a dehiscent or indehiscent capsule, often subglobose, the pericarp brittle to coriaceous, the locules each with 1 or 2 seeds or the seeds (in our species) reduced to 1 or 2 per capsule.

LECTOTYPE SPECIES: Merrill (1935, cited above) indicated *Baccaurea ramiflora* Lour. as the "type of the genus," among the three species originally included by Loureiro.

DISTRIBUTION: Southeastern Asia, throughout Malesia, and eastward into the Pacific as far as Niue and Samoa, with about 80 species. Although one species is typified by a putative Tahitian collection, this would appear due to an erroneous label, *Baccaurea taitensis* Muell. Arg. seeming to be a Samoan endemic (cf. Smith, 1978, cited below, pp. 380-383). Three species are indigenous in Fiji, one of them also occurring in Niue; however, the genus seems lacking from Tonga.

USEFUL TREATMENT OF GENUS: Smith, A. C. *Baccaurea* Lour. *Allertonia* 1: 377-389. 1978.

KEY TO SPECIES

- Fruits comparatively large, subglobose, 13-20 mm. in diameter at maturity, rounded at base and apex, without a style, the stigmatic shield sessile, the pericarp coriaceous, 1-2 mm. thick; indument of young parts subsistent on terminal branchlets, petioles, and principal nerves of lower leaf blade surfaces; stipules caducous except at distal node, 2-4 mm. long, not accrescent; leaf blades 6-16 × 3-7 cm.; inflorescence parts (rachis, pedicels, sepals, and pistil) copiously puberulent; flowers lacking disk glands. 1. *B. seemannii*
- Fruits comparatively small, ovoid to ellipsoid or subglobose, 6-10 mm. long and broad at maturity, obtusely short-stipitate to broadly obtuse at base, often narrowed to a conical style but sometimes rounded at apex, the style usually obvious but sometimes lacking, the pericarp subcoriaceous or brittle, less than 0.8 mm. thick; indument of young parts evanescent, the rachis and pedicels soon glabrate, the sepals glabrous; ♀ flowers with obscure, glabrous disk glands.
- Stipules not accrescent, not exceeding 3 × 1 mm., caducous except at distal node; scars of fallen leaves comparatively inconspicuous, 1.5-3 mm. broad, surmounting a pulvinus usually 0.2-0.5 mm. high; leaf blades usually 4-13 × 2.5-7.5 cm.; inflorescences narrowly paniculate in lower part and racemose distally; pericarp of mature fruit brittle, 0.3-0.5 mm. thick. 2. *B. stylaris*
- Stipules accrescent and usually persistent at several distal nodes, becoming foliaceous in texture and 5-20 × 2-15 mm.; scars of fallen leaves conspicuous, 2-5 mm. broad, surmounting a pulvinus 0.5-2 mm. high; leaf blades 7-27 × 4-10.5 cm.; inflorescences racemose; pericarp of mature fruit subcoriaceous, 0.5-0.8 mm. thick. 3. *B. pulvinata*

1. *Baccaurea seemannii* (Muell. Arg.) Muell. Arg. in DC. Prodr. 15 (2): 462, as *B. seemanni*. 1866; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 85, fig. 6. 1970; A. C. Sm. in *Allertonia* 1: 378, fig. 12. 1978. FIGURE 115.

Acalypha sp. Seem. in *Bonplandia* 9: 258. 1861, Viti, 441. 1862.

Pierardia seemanni Muell. Arg. in *Flora* 47: 469. 1864.

Baccaurea wilkesiana Muell. Arg. in DC. Prodr. 15 (2): 461. 1866; Seem. Fl. Vit. 220. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 289. 1892; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 177. 1972.

Baccaurea seemanni Muell. Arg. ex Seem. Fl. Vit. 221. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 288. 1892; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 177. 1972.

Baccaurea aff. *tahitensis* sensu Yuncker in Bishop Mus. Bull. 178: 72. 1943; non *B. taitensis* Muell. Arg.

A tree 3–15 m. high, occurring from sea level to an elevation of 300 m. in dense or dry forest or on its edges or in coastal thickets; the sepals and stamens are pale yellow. Insofar as specimens are dated, flowers have been obtained between May and November, fruits only in May.

TYPIFICATION AND NOMENCLATURE: The type of *Pierardia seemanni* is *Seemann 390* (K HOLOTYPE; ISOTYPE at BM), collected in October, 1860, on Ovalau. *Baccaurea wilkesiana* is typified by *U. S. Expl. Exped.* (G HOLOTYPE; ISOTYPES at GH, US 75125), collected in 1840, also on Ovalau. The two concepts were considered distinct species by Mueller, Seemann, and others until recently. The Seemann collection bears only ♂ inflorescences, while the Exploring Expedition material apparently came from two different plants, one with fruits and one with skimpy ♂ inflorescences. In herbaria most large-fruited Fijian *Baccaureae* have been identified as *B. wilkesiana*, while *B. seemannii* has been confused with the recently described *B. pulvinata*.

DISTRIBUTION: Fiji (known only from Viti Levu and Ovalau) and Niue. Of the three Fijian species of the genus, this is the least abundant, but on Niue it is one of the most common understorey trees. Its absence from Tonga is surprising.

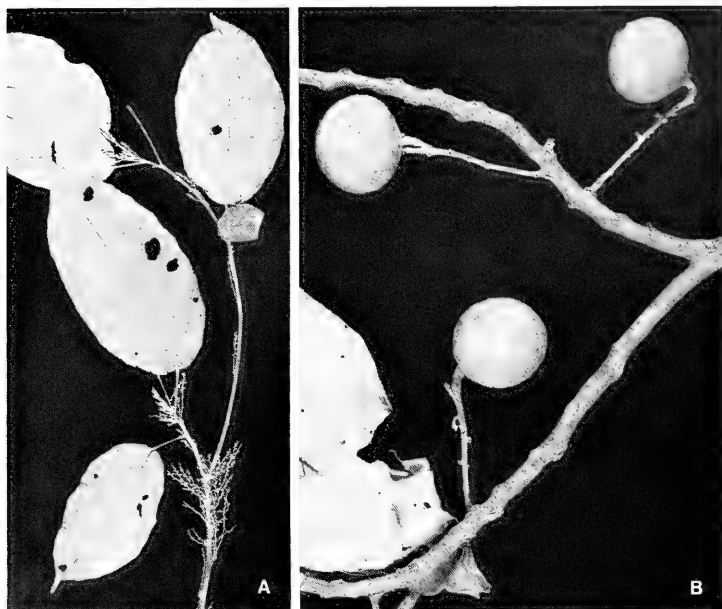


FIGURE 115. *Baccaurea seemanni*; A, distal portion of branchlet, with ♂ inflorescences, $\times 1/3$, from DA 550; B, infructescences, $\times 1$, from Smith 7413.

LOCAL NAMES AND USES: The names *kutu* and *mono* have each been noted once on Viti Levu; the species is well known on Niue as *koka*, and there it is used in house construction and as a dye plant. The only use noted in Fiji is an unspecified medicinal one.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Uluvatu, vicinity of Mbalo, near Vatukarasa, *Degener* 15252; Naruku, in same area, *Degener* 15320. SERUA: Flat coastal strip in vicinity of Ngaloa, *Smith* 9692; Vunindilo Beach, *DA* 16618. NAMOSI: Lower slopes of Mt. Voma, *DA* 550. NAITASIRI: Waindrandra Creek, *DA* 691, 3379, 3380, 3381; Tholo-i-suva, *DF* 483 (*P. Seruvatu* 2). VITI LEVU without further locality, *Graeffe* 62. OVALAU: Levuka River, *Milne* 259; hills southeast of valley of Mbureta River, *Smith* 7413. FIJI without further locality, *Horne* 168, 219.

Baccaurea seemannii is more closely related to *B. taitensis* Muell. Arg. (apparently endemic to Samoa) than to the other two Fijian species. It is well distinguished from *B. taitensis* in its smaller flowers, fewer stamens, and other obvious characters discussed in my 1978 treatment.

2. *Baccaurea stylaris* Muell. Arg. in DC. Prodr. 15 (2): 465. 1866; Seem. Fl. Vit. 221. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 289. 1892; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 177. 1972; A. C. Sm. in Allertonia 1: 383. fig. 14. 1978. FIGURE 116A & B.

Olacinae? Seem. in Bonplandia 10: 296. 1862, Viti, 434. 1862.

Baccaurea obtusa A. C. Sm. in Bishop Mus. Bull. 141: 84. fig. 43. 1936; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 177. 1972.

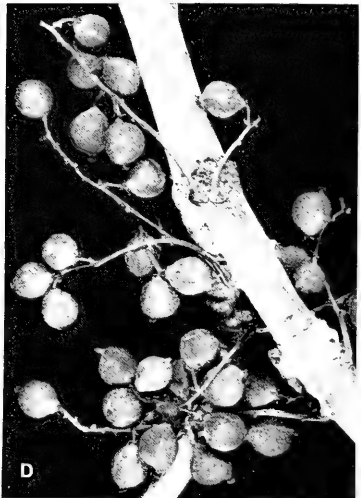
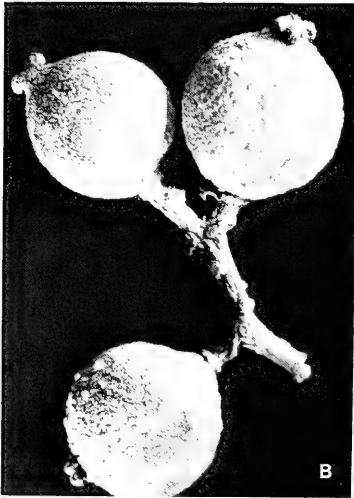
A tree (sometimes recorded as a large shrub) 2–10 m. high, sometimes freely branched or slender, with a trunk up to 20 cm. in diameter, occurring from near sea level to an elevation of 970 m. in dense or secondary forest. The inflorescence rachis is purple to deep red or rich pink, the sepals and filaments dull or deep red to rich pink, the anthers rich purple or deep red, and the young gynoeceum purple; the capsules, at first pale yellow, become purple to black at maturity. Flowers and fruits are found throughout the year.

TIPIFICATION AND NOMENCLATURE: The type of *Baccaurea stylaris* is *U. S. Expl. Exped.* (G HOLOTYPE; ISOTYPES at GH, K, US 75126), collected in 1840 in Fiji without further locality. *Baccaurea obtusa* is typified by *Smith* 420 (BISH HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, on Mt. Mariko, Thakaundrove Province, Vanua Levu. The latter was considered distinct because of its comparatively thick and rounded or obtuse leaf blades, its mature fruits being obtuse or rounded at both ends and with a very short style. The present abundance of material indicates that this form predominates on exposed ridges, but transitional collections connect it with the more typical form of *B. stylaris*, with often short-acuminate leaf blades and tapering fruits with an obvious style.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands; this is the most abundant Fijian *Baccaurea*. Approximately 80 collections have now been studied.

LOCAL NAMES: The Fijian name *mindra* has been recorded several times, the following only once each: *mono*, *mbatindrili*, *sinu mbuta*, *kailoa*, *kusanithovu*, and *vurevure*. The species is not considered useful, although its fruits are appreciated by pigeons.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Degener* 14337; hills between Nggaliwana and Tumbendreketi Creeks, *Smith* 5870. NANDRONGA & NAVOSA: Nausori Highlands, *DA* 13795 (*DF* 399); Uluvatu, vicinity of Mbalo, near Vatukarasa, *Tabualewa* 15632; north of Komave, *St. John* 18955. SERUA: Mbuoyombuyo, near Namboutini, *Tabualewa* 15572; Vatutavathe, vicinity of Ngaloa, *Degener* 15189. NAMOSI: Korombasambasanga Range, *DA* 2216; near Namuamua, *Gillespie* 2989; Mt. Vakarongasiu, *DA* 16133. RA: Mountains near Penang, *Greenwood* 770; Mataimeravula, vicinity of



Rewasa, near Vaileka, *Degener 15406*. NAITASIRE: Track to Mendrausuthu Range, *DA 15022*; Waimanu River, *DA 980*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7111*. REWA: Mt. Korombamba, *DA 16516*. KANDAVU: Naikorokoro, *DA 13760 (DF 322, Bola 130)*; Kiombo, *DA 12433 (DF 78)*. OVALAU: Slopes of Mt. Korotolutolu, west of Thawathi, *Smith 8060*; Port Kinnaird, *Storck 878*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7853*. VANUA LEVU: MBUA: Mt. Seatura, *DA 15168*. MATHUATA: Seangangga region, *DA 13924*. THAKAUNDROVE: Mt. Kasi, Yanawai River region, *Smith 1780*; Wailevu, Savusavu Bay, *DA 14284*. TAVEUNI: Mountains inland from Somosomo, *Gillespie 4844*.

The type collection of *Baccaurea stylaris* bears ♀ inflorescences in young fruiting condition; the GH sheet also includes a few detached ♂ flowers and sketches of them apparently by Mueller. In the many other available ♂ inflorescences, disk glands are lacking and the filaments are glabrous. In describing the species Mueller must have mixed with the Exploring Expedition material some very different ♂ inflorescences, apparently from another species and another area; this situation is discussed in my 1978 treatment.

3. *Baccaurea pulvinata* A. C. Sm. in *Allertonia* 1: 386. fig. 15, 16. 1978.

FIGURE 116C & D.

A tree 2–12 m. high, with a trunk up to 15 cm. in diameter, occurring between sea level and an elevation of 1,100 m. in dense or open forest. Its inflorescence rachis, pedicels, sepals, and anthers are dark red, its fruits pinkish when young but becoming brown to purplish. Flowers have been obtained between November and March, fruits between April and January.

TYPEFICTION: The type is *Degener 14905* (A HOLOTYPE; ISOTYPES at BISH, K, NY), collected March 26, 1941, in the vicinity of Nandrau, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and, as now known, to Viti Levu, from which 30 collections have been examined.

LOCAL NAMES: The names *mindra* and *mendra* have been recorded.

REPRESENTATIVE COLLECTIONS: VITI LEVU: SERUA: Inland from Ngaloa, *DA 16558*. NAMOSI: Near summit of Mt. Naitarandamu, *Gillespie 3301*; Mt. Voma, *DA 11667*; hills east of Navua River, *Greenwood 998A*; Wainandoi River, *DF 203 (Bola 62)*. NAITASIRE: Nasonggo, *DA 15314*; Waimanu River, *DA 15826*; Tholo-i-suva, *DA 11574*; vicinity of Tamavua, *Setchell & Parks 15064*, *Gillespie 2085*. TAILEVU: Waimaro River, Copper Mine, *DA 13632*. REWA: Veisari River, *Horne 692*; Mt. Korombamba, *Meebold 17026*; Nggoya Forest Reserve, *DA 13759 (DF 477, Damanu 126)*.

In herbaria this species had frequently been misconstrued as *Baccaurea seemanii*, due to failure to equate that species with *B. wilkesiana*. Actually *B. pulvinata* is a very distinct taxon, readily distinguished from *B. stylosa* by its remarkable stipules, conspicuously pulvinate branchlets, and several less obvious characters.

4. DRYPETES Vahl, *Ecol. Amer.* 3: 49. 1807; Pax & Hoffm. in *Pflanzenr.* 81 (IV. 147. XV): 229. 1922, in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. 19c: 72. 1931; A. C. Sm. in *J. Arnold Arb.* 36: 280. 1955.

Calypsosepalum S. Moore in *J. Bot.* 63: Suppl. 91. 1925; I. W. Bailey & A. C. Sm. in *J. Arnold Arb.* 34: 52. 1953; A. C. Sm. in *op. cit.* 36: 277. 1955.

FIGURE 116. A & B, *Baccaurea stylaris*, showing variability in fruits, × 4. C & D, *Baccaurea pulvinata*; C, persistent stipules, × 6; D, infructescences, × 1. A from *Degener 15406*, B from *Smith 1780*, C from *Gillespie 2085*, D from *Setchell & Parks 15064*.

Dioecious trees and shrubs, stipulate; leaves alternate, distichous, short-petiolate, the blades often coriaceous, entire to dentate; inflorescences axillary, fasciculate, the flowers often subsessile; calyx with 4 or 5 (-7) sepals, these imbricate, deciduous; petals absent; ♂ flowers with the disk intrastaminal, with lobes sometimes projecting between stamens; stamens 3-12 (rarely -50), the filaments free, the anthers basifixed, 2-locular, extrorse to introrse, a rudimentary pistil present or absent; ♀ flowers with a cupuliform disk, the ovary 1-locular (rarely 2-4-locular), the ovules 2 per ovary locule, the styles nearly obsolete, the stigmas subsessile, somewhat dilated, unlobed; fruit drupaceous, indehiscent, the exocarp carnose, the endocarp crustaceous or bony, the seeds usually solitary, ecarunculate.

TYPE SPECIES: The type species of *Drypetes* is *D. glauca* Vahl, the only original species; that of *Calyptosepalum* is *C. sumatranum* S. Moore, his sole species.

DISTRIBUTION: Pantropical, with 150-200 species, mostly paleotropical. Previously believed to have a Pacific range terminating in Fiji (Smith, 1955, cited above), *Drypetes* is now known to be present in Tonga (Vava'u and 'Eua), Niue, and Samoa (Tutuila, Apolima). The species occurring in these archipelagoes is probably *D. vitiensis*.

USEFUL TREATMENTS OF GENUS: Bailey, I. W., & A. C. Smith. A new Fijian species of *Calyptosepalum*. J. Arnold. Arb. 24: 52-64. 1953. Steenis, C. G. G. J. van. The identity of the genus *Calyptosepalum* S. Moore (Santalaceae) with *Drypetes* (Euphorbiaceae). Blumea 10: 140-141. 1960. Smith, A. C., & E. S. Ayensu. The identity of the genus *Calyptosepalum* S. Moore. Brittonia 16: 220-227. 1964.

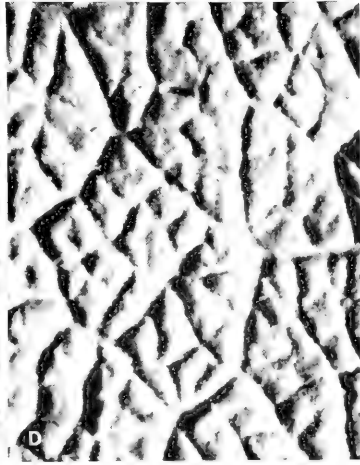
In assigning a Fijian species to the previously monotypic *Calyptosepalum*, Bailey and Smith were dissatisfied with Moore's placement of his genus in the Santalaceae, from which family it had already been removed by Swamy (in Amer. J. Bot. 36: 671. 1949), who suggested a possible affinity with the Olacaceae, a position considered unlikely by Bailey and Smith (1953, p. 63). However, van Steenis's broad knowledge of Malesian genera led him correctly to synonymize *Calyptosepalum* with *Drypetes* (1960, cited above). This assignment was confirmed by Smith and Ayensu (1964, cited above), who also concluded that two species of *Drypetes* were recognizable in Fiji; these are accepted below, but one must admit that the differences are cryptic and perhaps subject to future reconsideration, should ample material of *Drypetes* from the Fijian Region become available.

Drypetes is sometimes considered anomalous in the Euphorbiaceae, among other reasons for the presence of mustard oils (M. Ettlinger, in litt.), a characteristic of many members of the order Capparales. A lucid discussion of the taxonomic isolation of *Drypetes* is provided by Webster (1967, cited above under the family, pp. 329-332), who, like most other specialists in the Euphorbiaceae, retains it in that family.

KEY TO SPECIES

Leaf blades firmly chartaceous to thin-coriaceous, ovate-elliptic, 3-8.5 cm. long, 1.8-5 cm. broad, the stomatal organization predominantly paracytic, the venation comparatively less massive, the veins with an inconspicuous sclerenchymatous sheath and only infrequent free endings; fruit narrowly ovoid at apparent maturity, 15-20 mm. long, 7-12 mm. broad, obtuse to rounded at base, narrowed toward apex, the stigmatic shield persistent, 1-3 mm. broad. 1. *D. vitiensis*

FIGURE 117. *Drypetes vitiensis*, from DA 14448; A, distal portion of branchlet with infructescences, × 1/3; B, fruit, × 3; C, portion of upper surface of leaf blade, × 20; D, portion of lower surface of leaf blade, × 20.



Leaf blades thick-coriaceous, oblong or elliptic, 5–12 cm. long, 3–7 cm. broad, the stomatal organization predominantly anomocytic, the venation comparatively massive, the veins with a heavy sclerenchymatous sheath and free endings; fruit ellipsoid, 18–30 mm. long, 10–18 mm. broad, rounded at base and apex, the stigmatic shield deciduous, leaving an inconspicuous scar 0.5–1 mm. in diameter.

2. *D. pacifica*

1. *Drypetes vitiensis* Croizat in *Sargentia* 1: 49. 1942; A. C. Sm. in *J. Arnold Arb.* 36: 280. 1955; A. C. Sm. & Ayensu in *Brittonia* 16: 226. *fig. 2, 4.* 1964; J. W. Parham, *Pl. Fiji Isl.* 126. 1964, ed. 2. 179. 1972. FIGURE 117.

An infrequent tree 4–6 m. high, known from elevations of 50–1,000 m. in dry forest or on the edges of dense forest. The fruit, at first green, becomes red at maturity. Fruits have been obtained in June, July, and September.

TIPIFICATION: The type is *Degener 15430* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected June 3, 1941, near Mataimeravula, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu.

DISTRIBUTION: Previously thought to be a Fijian endemic, *Drypetes vitiensis* is probably the species now known to occur in Tonga, Niue, and Samoa, as mentioned above under the genus.

LOCAL NAME: *Meme* (recorded from type collection).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Parks 20691*; Mt. Nanggaranbuluta, east of Nandarivatu, *DA 14448*.

2. *Drypetes pacifica* (I. W. Bailey & A. C. Sm.) A. C. Sm. in A. C. Sm. & Ayensu in *Brittonia* 16: 226. *fig. 1, 3.* 1964. FIGURE 118.

Calyposepalum pacificum I. W. Bailey & A. C. Sm. in *J. Arnold Arb.* 34: 52. *pl. 1, 2.* 1953; A. C. Sm. in *J. Arnold Arb.* 36: 277. 1955; v. Steenis in *Blumea* 10: 140. 1960; J. W. Parham, *Pl. Fiji Isl.* 149. 1964, ed. 2. 214. 1972.

A tree to 12 m. high, occurring at elevations of 550–850 m. in forest or on its edges. The calyx is dull yellow, and the fruit, green when young, becomes orange at maturity. Flowers (past maturity and persisting with fruit) have been obtained in July, fruits in January and July.

TIPIFICATION: The type is *Smith 5339* (A HOLOTYPE; many ISOTYPES), collected July 21, 1947, in the valley of Nggaliwana Creek, north of the sawmill at Navai, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji (but see comment under the genus) and apparently rare, known from only two collections made on Viti Levu and Ovalau.

LOCAL NAME: *Ndonggau* (recorded from type collection).

AVAILABLE COLLECTION: OVALAU: Wooded stream above Levuka reservoir, *Gillespie 4522*.

The fact that the two Fijian species of *Drypetes* here recognized are essentially sympatric in upland Viti Levu diminishes one's confidence in them. However, both are known with apparently mature fruits that are quite different, and the less obvious characters discussed by Smith and Ayensu in 1964 seem to be reflected in superficially discernible leaf blade distinctions. Obviously too few specimens are at hand to permit an adequate understanding of the genus in the Fijian Region.

5. *FLUEGGEE* Willd. *Sp. Pl.* 4: 637 (as *Flüggea*), 757 (as *Fluggea*). 1806; Willd. *Enum. Pl. Horti Berol.* 1013 (as *Flueggea*). 1809.

Dioecious or less often monoecious trees or shrubs, without milky latex, stipulate; leaves alternate (spirally arranged or distichous), simple, the blades entire, the leaves on main axes not reduced to scales; inflorescences axillary, fasciculate, many-flowered

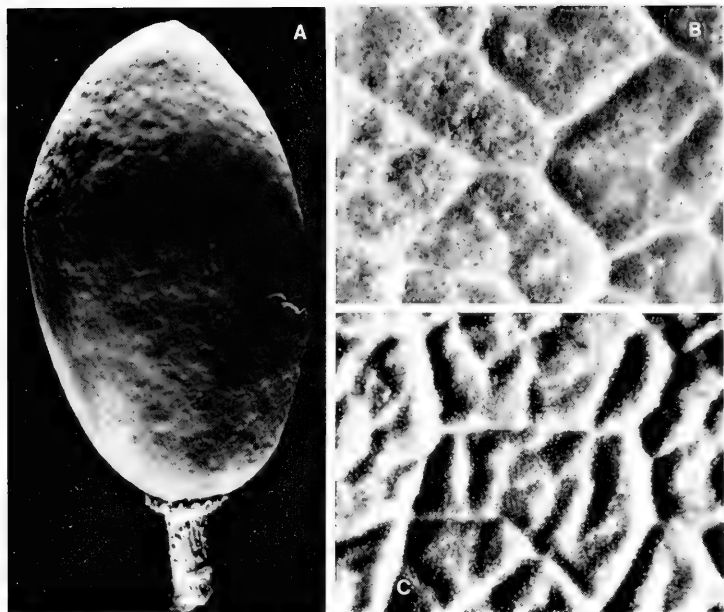


FIGURE 118. *Drypetes pacifica*, from Smith 5339; A, fruit, $\times 3$; B, portion of upper surface of leaf blade, $\times 20$; C, portion of lower surface of leaf blade, $\times 20$.

(occasionally bisexual), the flowers lacking petals, the calyx deeply 5-lobed, the lobes imbricate in bud, persistent in ♀ flowers; ♂ flowers with 5 free disk glands alternating with stamens, the stamens 5 or fewer, the filaments free, the anthers erect, with 2 extrorse locules, a rudimentary pistil present; ♀ flowers with an annular, crenate disk, the ovary 3-locular, each locule with 2 ovules, the styles short-connate basally, divaricate, once or twice bifid, the stigmas subulate; fruit fleshy, the endocarp hard, the seeds ecarunculate, the testa succulent.

TYPE SPECIES: *Flueggea leucopyrus* Willd.

DISTRIBUTION: Scattered in the tropics and subtropics, with species in the West Indies, South America, Spain and Portugal, tropical Africa, tropical Asia, and eastward in the Pacific to northern Australia, Tonga, and Samoa, with ten species. One species occurs in Fiji, but it seems most likely that this was an aboriginal introduction into the Fijian Region and that the indigenous occurrence of the genus terminates to the east in New Guinea, or possibly in the Solomon or Santa Cruz Islands.

USEFUL TREATMENT OF GENUS: G. L. Webster is preparing a discussion of the genus, which will probably be in print in 1981 prior to the present volume.

Although *Flueggea* is sometimes incorporated into the genus *Securinega* (Commerçon ex Juss. Gen. Pl. 388. 1789, nom. cons.), Webster (1975, cited under the family, pp. 594, 595) refers them to different subtribes of the tribe Phyllanthaceae. *Securinega* is taken to include only some Mascarene taxa.

1. *Flueggea flexuosa* Muell. Arg. in *Linnaea* 34: 76. 1865.

Securinega flexuosa Muell. Arg. in DC. Prodr. 15 (2): 450. 1866.

Securinega sp. Christophersen in Bishop Mus. Bull. 128: 120. 1935.

Securinega samoana Croizat in Bishop Mus. Bull. 184: 45. 1945; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 17: 25. 1946; Yuncker in Bishop Mus. Bull. 220: 170. 1959; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 189. 1972; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 103. 1972.

As known in Fiji, *Flueggea flexuosa* is a tree or large shrub 3–8 m. high, found in forest (but often near villages or agricultural stations) at elevations from near sea level to about 250 m. Flowers have been observed in June and November, fruits between September and February.

TYPEFICTION: The holotype of *Flueggea flexuosa* is *Cuming 1855* (G), collected in the Philippines. *Securinega samoana* is typified by *Christophersen 2765* (NY HOLOTYPE; ISOTYPES at BISH, US), collected Sept. 30, 1931, between Tufutafoe and Falelima, Savaii, Samoa. In describing the latter, Croizat pointed out the trifling nature of differences between his new species and *Securinega flexuosa*, preferring to indicate the Samoan plant as distinct because of its discrete range. The now available material indicates that *Flueggea flexuosa* is a fairly uniform species.

DISTRIBUTION: Philippines and Moluccas eastward to the Solomon Islands, Tonga, the Horne and Wallis Islands, and Samoa. B. E. V. Parham (1946, cited above) indicated *Securinega samoana* as indigenous in Samoa but introduced into Fiji, Rotuma, and Tonga by native peoples, who value the timber for house-building. Christophersen (1935, cited above) and W. A. Whistler (personal communication) are of the opinion that it was an introduction into Samoa. All the known Fijian collections are comparatively recent, but nevertheless one may suspect that the species was an aboriginal introduction into the entire Fijian Region. It seems unlikely that earlier collectors would have overlooked a species now fairly frequent in eastern Viti Levu; possibly its Fijian occurrence is indeed modern in contrast to that in one or more nearby archipelagoes.

LOCAL NAMES AND USES: The usual Fijian name is *mbaumuri*, but also recorded are *molau* (usually indicating *Glochidion*) and *watoro*. The timber is said to be durable and is used for house-building (for posts) and fences. The fruit is the source of a dye used on Uvea, but this has not been recorded from Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: RA: Ndombuilevu, DA 7314, *Vetawa 30*; Rakiraki, DF 510 (*Vetawa 31*). NAITASIRI: Waindrandra Creek, DA 467; Nawanggambena (on Waindrandra Creek), DA 1290; Nanduruloulou, DA 961; Tholo-i-suva (introduced), DA L.22421 (DF 122). TAILEVU: Thautata (Mbau Tikina), DA 1200, 1201. OVALAU: Tokou (on east coast south of Levuka), DA 13718.

6. *PHYLLANTHUS* L. Sp. Pl. 981. 1753; Seem. Fl. Vit. 217, p. p. 1867; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 60. 1931.

Monoecious or dioecious trees, shrubs, or herbs, without milky latex, sometimes entirely glabrous, with small stipules, the lateral axes sometimes deciduous, subtended by scalelike leaves; foliage leaves alternate (spirally arranged or distichous) or infrequently opposite, short-petiolate, simple, the blades entire, unlobed, pinnate-veined; inflorescences axillary, composed of condensed cymes or sometimes with solitary

flowers, the petals lacking, the calyx synsepalous, with 4-6 imbricate or decussate lobes, the disk usually apparent, cupular or segmented; ♂ flowers with the disk extrastaminal and usually segmented, the stamens 2-5 (-15), the filaments free or connate, the anthers extrorse, dehiscing longitudinally or horizontally, a rudimentary pistil usually absent; ♀ flowers usually lacking staminodes, the calyx persistent, the disk usually cupular to patelliform, sometimes segmented, rarely absent, the ovary usually 3-locular (rarely 2-12-locular), the ovules 2 in each locule, usually collateral, the styles free or basally connate, usually bifid (sometimes entire or multifid); fruit usually an explosive capsule, the columella more or less persistent, the seeds usually 2 per mericarp, the testa usually dry and thin, not ventrally invaginated.

LECTOTYPE SPECIES: *Phyllanthus niruri* L. (vide Small in Britton & Brown, Ill. Fl. N. U. S. ed. 2: 453. 1913), one of Linnaeus's six original species.

DISTRIBUTION: Tropical and subtropical, sometimes in temperate areas, with at least 750 species, most abundant in the Old World tropics. Nine species are here recorded from Fiji, four of them indigenous, four naturalized weeds, and one sparingly cultivated.

USEFUL TREATMENTS OF GENUS: Webster, G. L. Studies of the Euphorbiaceae, Phyllanthoideae. III. A monographic study of the West Indian species of *Phyllanthus*. J. Arnold Arb. 37: 91-122, 217-268, 340-359. 1956; 38: 51-80, 170-198, 295-373. 1957; 39: 49-100, 111-212. 1958. Webster, G. L. A revision of *Phyllanthus* (Euphorbiaceae) in the continental United States. Brittonia 22: 44-76. 1970. Webster, G. L., & H. K. Airy Shaw. A provisional synopsis of the New Guinea taxa of *Phyllanthus* (Euphorbiaceae). Kew Bull. 26: 85-109. 1971. G. L. Webster also has in press a treatment of the Melanesian species of *Phyllanthus*, which may be issued in 1981 prior to the present volume of this *Flora*.

Dr. Webster has kindly provided me with some of the data here recorded for *Phyllanthus*, taken from his current treatment of the Melanesian species. The following key to species was drafted by him, although I have added details to it and modified it in a few respects. The present treatment is obviously to be taken as tentative, pending Webster's more specialized treatment.

KEY TO SPECIES

Cultivated tree; leaves along main branches reduced, those along ultimate, minutely pilose twigs distichous, crowded, very numerous (often 80-100 or more per twig), the petioles about 0.5 mm. long, the blades linear-oblong, usually 10-15 × 2-3 mm.; ♂ flowers with 3 stamens, the filaments connate into a column, the anthers vertically dehiscent; ♀ flowers with the disk urceolate or cupuliform, entirely enclosing the ovary, narrowly segmented at apex, the styles deeply bifid. 1. *P. emblica*
Indigenous or adventive species.

Trees or shrubs 1-4 m. high; indigenous species; leaves on main branches spirally arranged, reduced to scales, the foliage leaves distichous on deciduous branchlets; seeds smooth.

Leaves alternate on mostly bipinnatifid deciduous branchlets; filaments connate.

Leaf blades ovate, narrowed to an acute or acuminate tip, (2-) 6-14 × (1.3-) 3-8 cm.; pedicels often long and capillary, those of ♂ flowers 2-15 mm. long at anthesis, those of ♀ flowers at anthesis and of capsules (12-) 15-30 mm. long; ♂ inflorescences often obviously amentiform, the anthers vertically dehiscent; capsules to 5 × 8 mm. 2. *P. pergracilis*

Leaf blades at apex obtuse, emarginate, or rounded, not more than 7 × 4 cm.; inflorescences fasciculate or inconspicuously amentiform.

Pedicels of ♂ flowers 3-18 mm. long at anthesis, those of ♀ flowers at anthesis and of capsules (5-) 8-27 mm. long; anthers vertically dehiscent, 0.4-0.7 mm. long; capsules to 4 × 7 mm.; petioles 3-7 mm. long; leaf blades ovate, 2.5-7 × 1.5-4 cm., obtuse or slightly emarginate at apex, slightly paler beneath. 3. *P. heterodoxus*

Pedicels of ♂ flowers 1-4 mm. long at anthesis, those of ♀ flowers at anthesis and of capsules 12-17 mm. long; anthers horizontally dehiscent, about 0.2 mm. long; capsules to 3 × 5 mm.; petioles 1-2 mm. long; leaf blades suborbicular to obovate, 1-2 cm. long and broad, rounded or subretuse at apex, conspicuously paler beneath. 4. *P. wilkesianus*

Leaves opposite on pinnatifid deciduous branchlets, subsessile (petioles 1-2 mm. long), the blades suborbicular-ovate, 1.3-3 × 1-2.5 cm., broadly truncate to subcordate at base, rounded or faintly emarginate at apex; pedicels 2-5 mm. long at anthesis, 5-7 mm. long in fruit; filaments free, the anthers 0.3-0.4 mm. long, vertically dehiscent; capsules 4-5 mm. long and broad. 5. *P. sp.*

Herbs, sometimes suffruticose but less than 1 m. high; adventive species.

Leaves on main stem distichous, not reduced to scales; ultimate branchlets not deciduous; petioles 0.5–1 mm. long; leaf blades narrowly elliptic-lanceolate, 5–33 × 2–8 mm.; pedicels of ♂ flowers 1–2 mm. long, those of ♀ flowers and capsules 2–10 mm. long; anthers horizontally dehiscent; capsules up to 2 × 3.5 mm., the seeds verruculose. 6. *P. virgatus*

Leaves on main stems spirally arranged, reduced to scales, the foliage leaves distichous and alternate on deciduous, pinnatifid branchlets; capsules usually not exceeding 2 mm. in breadth.

♀ flowers sessile or subsessile (pedicels not more than 0.5 mm. long in fruit), solitary at proximal nodes of branchlets; ♂ flowers in monochasia of 5–7 flowers at distal nodes of branchlets, the pedicels usually less than 0.5 mm. long, the anthers vertically dehiscent; seeds transversely ridged; leaf blades oblong-obovate to linear, 6–25 × 2–9 mm., minutely hispidulous marginally and submarginally beneath. 7. *P. urinaria*

♀ flowers pedicellate (pedicels 1–2 mm. long in fruit); ♂ flowers with pedicels 0.6–1.3 mm. long, the anthers obliquely or horizontally dehiscent; seeds longitudinally ribbed; leaf blades elliptic- or obovate-oblong, 5–10 × 2–5 mm., glabrous.

Cymules bisexual, each of 1 ♂ and 1 ♀ flower (proximal 1 or 2 axils of branchlets with unisexual cymules of 1 or 2 ♂ flowers), but fruits solitary; calyx lobes usually 5, acute; ♀ flowers with the disk deeply lobed; main stems not sharply angled; semiprostrate to erect herb 10–60 cm. high, somewhat woody toward base. 8. *P. amarus*

Cymules unisexual, the distal ones represented by solitary ♀ flowers; calyx lobes usually 6, obtuse; ♀ flowers with the disk subentire; main stems sharply angled; herb 5–10 cm. high, the stems subrepent. 9. *P. debilis*

1. ***Phyllanthus emblica*** L. Sp. Pl. 982. 1753; Muell. Arg. in DC. Prodr. 15 (2): 352. 1866.

Emblica officinalis Gaertn. Fruct. Sem. Pl. 2: 122. t. 108. 1791.

A tree 6–10 m. high, infrequently cultivated in Fiji near sea level. The calyx lobes are yellowish, the fruit pale yellow and up to 2.5 cm. in diameter. The only available collection was in fruit in April.

TYPEIFICATION: Five prior references are given by Linnaeus, including one to his Fl. Zeyl. 333. 1747.

DISTRIBUTION: Tropical southeastern Asia and into Malesia to Timor.

LOCAL NAMES AND USES: No name was recorded for the Fijian material, but the species is often known as *emblic* or *myrobalan*. The species is cultivated as an ornamental in tropical and subtropical areas, and the sour pulp of its fruit is used for preserves, being rich in vitamin C. Various uses of the species as a timber and dye and for medicinal purposes are discussed by Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 935–936, as *Emblica officinalis*. 1966.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Nathokaika, Rewa River, DA 5617.

2. ***Phyllanthus pergracilis*** Gillespie in Bishop Mus. Bull. 91: 18. fig. 20. 1932; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972.

A shrub or tree 1–3 m. high, often with purplish branchlets and leaves, occurring at elevations from near sea level to 1,127 m. in dense or dry forest or in forest on ridges. The calyx lobes are pale yellow, tinged with deep red; the gynoecium is yellow and purple-tinged; and the capsules are pale or dull yellow, turning red. Flowers have been collected in most months, fruits between June and October.

TYPEIFICATION: The type is *Gillespie 2122* (BISH HOLOTYPE), collected Aug. 9, 1927, near Tamavua, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu, where it is fairly frequent, 30 collections being at hand.

LOCAL NAME: The only recorded name is *masulele* (DA 1602), probably not to be taken seriously.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood* 902; Mt. Evans Range, *Greenwood* 1280; summit of Mt. Nangaranambuluta, east of Nandarivatu, *Gillespie* 4334. SERUA: Mbuyombuyo, near Namboutini, *Tabualewa* 15608; hills between Waininggere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith* 9547. NAMOSI: Mt. Naitarandamu, *Gillespie* 3307.5; hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith* 8466; Mt. Voma, *Gillespie* 2680. NAITASIRI: Tholo-i-suva, *DA* 1602, *Vaughan* 3360; Tamavua Falls, *Tohill* 712; Suva Pumping Station, *Degener & Ordonez* 13758. REWA: Mt. Korombamba, *Meebold*, July, 1932. FIJI without further locality, *Horne* 767.

3. *Phyllanthus heterodoxus* Muell. Arg. in DC. Prodr. **15** (2): 321. 1866; Seem. Fl. Vit. 220. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 287. 1892; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972.

A slender shrub or small tree 1–4 m. high, found in usually dense forest at elevations from near sea level to 866 m. The calyx lobes are pale yellow and the capsules pale or greenish yellow. Flowers have been obtained between May and November, fruits between February and November.

TYPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G), collected in 1840 in Fiji without further locality; apparently no specimen was retained at US.

DISTRIBUTION: This comparatively infrequent species is known only from Vanua Levu and Fulanga, in view of which distribution it is certainly to be expected on other islands.

AVAILABLE COLLECTIONS: VANUA LEVU: "Mountains of the interior," *Greenwood* 573. MATHUATA: Mt. Ndelaikoro, *DA* 12818; vicinity of Lambasa, *Greenwood* 573A; summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith* 6499. THAKAUNDROVE: Mt. Kasi, Yanawai River region, *Smith* 1830; Mt. Mariko, *Smith* 444. FULANGA: On limestone formation, *Smith* 1125.

4. *Phyllanthus wilkesianus* Muell. Arg. in DC. Prodr. **15** (2): 396. 1866; Seem. Fl. Vit. 220. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 288. 1892; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972.

A shrub or small tree 1–4 m. high, with a compact crown, or sometimes apparently subsucculent, found sparingly in dense or dry forest at elevations of 100–800 m. The calyx lobes are white, the outer ones faintly purple-tinged. Flowers have been obtained in September and December, fruits only in the latter month.

TYPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE at G; ISOTYPE at GH), collected in 1840 in Fiji without further locality, but at an elevation of 2,000 feet; no specimen was located at US. In view of the noted elevation and the very few localities known for the species, the type may well have been obtained in hills along the northern coast of Vanua Levu, but this is speculative. Mueller's descriptions of this and the prior species leave no doubt of their identity.

DISTRIBUTION: Endemic to Fiji and known with certainty from only two localities, one on each of the large islands.

LOCAL NAME: *Lele* (*Smith* 6294), a very uninformative name.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes of escarpment north of Nandarivatu, *Smith* 6294; vicinity of Nandarivatu, *Gillespie* 4159. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith* 6841.

5. *Phyllanthus* sp.

A shrub 1–2 m. high, sometimes with purplish young leaves, found in dry or light forest at elevations of 50–429 m. The calyx lobes are pale yellow and pink-tinged; the ovary and styles are pale pink, or pale yellow and pink-tinged; and the capsules are also pale yellow with a pink tinge. Flowers and fruits have been obtained in April, August, and December.

DISTRIBUTION: Known only from hills near the coast in southern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills between Wainingere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9630* (Dec. 21, 1953). REWA: Slopes and summit of Mt. Korombamba, *Gillespie 2326, DA 1276, 16532, 17369*.

This very distinct species will be described and typified by G. L. Webster in his review of *Phyllanthus* in Melanesia, perhaps available prior to the issue of this present volume.

6. *Phyllanthus virgatus* Forst. f. Fl. Ins. Austr. Prodr. 65, as *P. virgata*, 1786.

Phyllanthus simplex Retz. Obs. Bot. 5: 29. 1788; Muell. Arg. in DC. Prodr. 15 (2): 391. 1866; Seem. Fl. Vit. 220. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 287. 1892; Christophersen in Bishop Mus. Bull. 128: 121. 1935; Yuncker in op. cit. 178: 72. 1943; Greenwood in Proc. Linn. Soc. 154: 104. 1943; Yuncker in Bishop Mus. Bull. 184: 45. 1945, in op. cit. 220: 159. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 72. 1959, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 95. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 83. 1972.

Phyllanthus fruticosus Wall. sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Phyllanthus simplex var. *virgatus* Muell. Arg. in DC. Prodr. 15 (2): 392. 1866; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 21. 1972.

In Fiji *Phyllanthus virgatus* is seen as a suffruticose herb 20–60 cm. high, freely branching from near base, occurring at elevations from near sea level to about 200 m. as a weed of cultivated fields and waste places, sometimes sparingly naturalized in forest or on hillsides. Flowers and fruits may be found throughout the year.

TYPIFICATION AND NOMENCLATURE: G. Forster cited his original material as: "F. Societatis insulae." There is no Forster material (from Cook's second voyage) of the species at either BM or K, but at BM there are two sheets pencilled as "*Phyllanthus simplex* var. *virgatus*" collected in Tahiti by Banks and Solander on Cook's first voyage. Perhaps one of these should be designated by a specialist on the genus as the lectotype. I have not traced the typification of *Phyllanthus simplex*, but it is now generally recognized that only one species is here concerned.

DISTRIBUTION: Widely distributed in the Old World tropics and presumably indigenous in Asia or Malesia. Its introduction throughout the southern Pacific was doubtless aboriginal and inadvertent.

LOCAL NAME AND USE: The only report (from *Weiner 275*) indicates the name *tei ni niu* and use of the young leaves, with those of other plants, as a remedy for diarrhoea or dysentery.

AVAILABLE COLLECTIONS: YASAWAS: NAVITI: Kese, *DA 11765*. VITI LEVU: MBA: Ndrasa, Lautoka, *DA 11384*; inland from Lautoka, *Greenwood 58*. NANDRONGA & NAVOSA: Nathotholevu, *H. B. R. Parham 265*. NAMOSI: Namosi Village, *Weiner 275*. RA: Ndombuilevu, *DA 7824*. VITI LEVU without further locality, *Gillespie*, Dec. 25, 1927. KANDAVU: *DA 9642*. VANUA LEVU: THAKAUNDRUVE: Savusavu Bay region, *Degener & Ordonez 13881*. TAVEUNI: Somosomo, *Seemann 418*; vicinity of Wairiki, *Gillespie 4759*. KAMBARA: *Tothill 711*. FIJI without further locality, *Horne 120a, DA 3915*.

7. *Phyllanthus urinaria* L. Sp. Pl. 982. 1753; Muell. Arg. in DC. Prodr. 15 (2): 364.

1866; Croizat in *Sargentina* 1: 46. 1942; Greenwood in *J. Arnold Arb.* 25: 402. 1944, in op. cit. 30: 81. 1949; J. W. Parham in Dept. Agr. Fiji Bull. 35: 73. 1959, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972.

As seen in Fiji, *Phyllanthus urinaria* is a usually suberect herb 20–60 cm. high, found from near sea level to an elevation of 1,127 m. as a weed in villages, gardens, and waste places, and also naturalized along forest trails and on cleared ridges and summits. Its calyx lobes are greenish white and purple-tinged, and its capsules are dull red to deep purple. Flowers and fruits are found throughout the year.

LECTOTYPIFICATION: Among the four prior references mentioned by Linnaeus, that to Fl. Zeyl. 332. 1747 is best taken as indicating the lectotype: *Herb. Hermann* (BM), from Ceylon (cf. Webster in Brittonia 22: 65. 1970).

DISTRIBUTION: Indigenous in tropical eastern Asia and now a pantropical weed. Its introduction into Fiji seems to have been later than that of the preceding species and probably not aboriginal.

LOCAL NAMES AND USE: Recorded names are *kai moku*, *se mbulumbulu*, and *tho mokumoku*; one report indicates that the leaves and those of guava are pounded together, boiled in salt water, and used for toothache.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandarivatu, *Greenwood 789A*, *Tohill 734*; summit of Mt. Nanggaranambuluta, east of Nandarivatu, *Smith 4851*, *DA 2430*; south of Nauwangga, *Smith 5824*. NAITASIRE: Waindrandra Creek, *DA 467*; Waindina River, *Weiner 236*; Nanduruloulou, *DA 9582*; Koroni-via, *DA 3978*; N. T. C. Farm, *DA 9385*; Tamavua, *DA 11220*. TAILEVU: Londoni, *DA 9969*; Korovou, *DA*, May 28, 1945. Also observed in Serua and Ra Provinces by Greenwood, but no vouchers seen. OVALAU: Lovoni Village, *Smith 7471*. VANUA LEVU: MATHUATA: Wainikoro River, *Greenwood 705*. THAKAUNDROVE: Ndevo, Natewa Peninsula, *DA 9622*. FIJI without further locality, *DA 3198*.

8. *Phyllanthus amarus* Schumacher & Thonning in Kongel. Danske Vidensk.-Selsk. Skr. 4: 195. 1829; Brenan in Kew Bull. 5: 217. 1950; Webster in J. Arnold Arb. 37: 13. 1956; J. W. Parham, Pl. Fiji Isl. ed. 2. 188. 1972.

Phyllanthus niruri sensu Christophersen in Bishop Mus. Bull. 128: 121. 1935; Yuncker in op. cit. 178: 72. 1943; Greenwood in Proc. Linn. Soc. 154: 104. 1943; Yuncker in Bishop Mus. Bull. 184: 45. 1945; Greenwood in J. Arnold Arb. 30: 81. 1949; Yuncker in Bishop Mus. Bull. 220: 159. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 73. fig. 32. 1959, Pl. Fiji Isl. 131. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 95. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 57. 1972; non L.

As noted in Fiji, *Phyllanthus amarus* is a semiprostrate to erect herb 10–60 cm. high, somewhat woody toward base, occurring at low elevations (not collected above about 50 m.) as a weed in villages, gardens, and cultivated fields, often abundantly naturalized. Its calyx lobes are pale green to white and its young capsules are pale green. Flowers and fruits occur at any season.

TYPIFICATION: The type is *Schumacher & Thonning* (C HOLOTYPE), from Guinea, Africa. A full discussion of interpretations of *Phyllanthus niruri* and *P. amarus* is provided by Webster in J. Arnold Arb. 37: 5–9, 13. 1956.

DISTRIBUTION: Presumably indigenous to the American tropics (in spite of its African type collection), now a pantropical and ubiquitous weed.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka and vicinity, *Greenwood 208*, *DA 10330*; Nandi and vicinity, *DA 8562*, *9690*. NANDRONGA & NAVOSA: Loma, Singatoka, *DA 11320*. SERUA: Ngaloa, *Smith 9498*. RA: Ndombuilevu, *DA 11001*. NAITASIRE: Nathokaika, *DA 10045*; N. T. C. Farm, *DA 9883*; Ndavuilevu, *DA 409*. TAILEVU: "Tailevu North," *DA 1687*. REWA: Suva, *DA 12233*. OVALAU: Lovoni Village, *Smith 7470*. VANUA LEVU: MATHUATA: Moro, *DA 8727*. VANUA MBALAVU: Lomaloma, *DA 10233*. LAKEMBA: Near Tumbou, *Garnock-Jones 909*. FIJI without further locality, *DA 3996*.

9. *Phyllanthus debilis* Klein ex Willd. Sp. Pl. 4: 582. 1805; J. W. Parham, Pl. Fiji Isl. ed. 2. 188. 1972.

Phyllanthus simplex sensu Gibbs in J. Linn. Soc. Bot. 39: 168. 1909; non Retz.

As sparingly noted in Fiji, *Phyllanthus debilis* is an herb 5–10 cm. high with subrepent stems, occurring from near sea level to about 450 m. as a naturalized weed near habitations.

TYPIFICATION: Willdenow's original citation was: "Habitat in India orientali."

DISTRIBUTION: An Old World species, now a tropical weed but apparently less widely distributed than *Phyllanthus amarus*.

AVAILABLE COLLECTIONS: VITILEVU: MBA: North of Lomolomo, *Degener & Ordonez 13689*; road from Tavua to Waikumbukumbu, *Gibbs 689*. RA: Penang, *Greenwood 789*; Vaileka, P. W. D. yard, *DA 7165*. OVALAU: Near Levuka, *Horne 360*. MOALA: *Milne 124*, p. p.

Phyllanthus debilis seems less frequent in Fiji than *P. amarus*, but the two are readily confused, in spite of the apparently dependable characters utilized by Webster and Airy Shaw (in *Kew Bull.* **26**: 91–92, 1971). Identifications here noted should be considered tentative pending Webster's review of the Melanesian species, mentioned above.

7. BREYNIA J. R. & G. Forst. *Char. Gen. Pl.* 73. 1775, ed. 2. 145. 1776; Pax & Hoffm. in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **19c**: 59. 1931. *Nom. cons.*

Monococious shrubs or small trees, glabrous throughout, the stipules small; leaves along main branches spirally arranged and reduced, distichous along ultimate branchlets, short-petiolate, simple, the blades entire; inflorescences axillary, the lower axils bearing fascicles of 3–many ♂ flowers, the higher axils bearing solitary ♀ flowers, the flowers lacking petals and disk; ♂ flowers with the calyx fleshy, obovoid-turbinate, shortly 6-lobed, the stamens 3, the filaments connate into a column bearing 2-locular anthers apically, these not apiculate; ♀ flowers with the calyx campanulate to cupuliform, 6-lobed or -toothed, persistent and sometimes accrescent, the ovary 3-locular, the walls thickened distally, each locule with 2 ovules, the stigmas small, subulate-dentiform, incurved; fruit a capsule dehiscent into 2-seeded cocci, the seeds with a somewhat fleshy testa, ventrally invaginated.

TYPE SPECIES: *Breynia disticha* J. R. & G. Forst., the only original species.

DISTRIBUTION: China and southeastern Asia through Malesia to Australia, New Caledonia, and the New Hebrides, with about 25 species. A widely distributed cultivar of *Breynia disticha* is grown in Fiji.

Need for the conservation of *Breynia* J. R. & G. Forst. was pointed out by Croizat (in *Sargentina* **1**: 48. 1942), but conservation was not effected until the Edinburgh edition of ICBN, p. 307. 1966.

1. *Breynia disticha* J. R. & G. Forst. cv. 'Roseo-picta'

Phyllanthus nivosus W. G. Sm. in *Fl. Mag.* (London) n. s. **1874**: pl. 120. 1874; Regel in *Gartenfl.* **28**: 19. 1879; Sherff in *Field Mus. Nat. Hist., Bot. Ser.* **17**: 568. 1939.

Phyllanthus nivosus roseo-pictus Regel in *Gartenfl.* **28**: 21. fig. 1879.

Breynia nivosus Small in *Bull. Torrey Bot. Club* **37**: 516. 1910; Setchell in *Univ. Calif. Publ. Bot.* **12**: 187.

1926; Wilder in *Bishop Mus. Bull.* **86**: 66. 1931; Christophersen in *op. cit.* **128**: 120. 1935; F. Br. in *op. cit.* **130**: 137. 1935; Yuncker in *op. cit.* **178**: 72. 1943, in *op. cit.* **184**: 45. 1945, in *op. cit.* **220**: 169. 1959.

Breynia nivosus var. *roseo-picta* F. Br. in *Bishop Mus. Bull.* **130**: 137. 1935.

Breynia disticha var. *typica* f. *nivosa* Croizat in *Sargentina* **1**: 48. 1942.

Breynia disticha var. *disticha* f. *nivosa* Croizat ex J. W. Parham, *Pl. Fiji Isl.* **125**. 1964, ed. 2. 177. 1972.

Breynia nivosus cv. 'Roseo-picta'; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 86. 1970.

As seen in Fiji, this attractive cultivated plant is a shrub to 2 m. high, with the distal leaves mottled with green, white, pale pink, and purple, found in or near villages and towns near sea level. The ♂ calyx is greenish yellow, the ♀ calyx white with green markings, the filament column white, and the anthers pale yellow. Flowers have been noted in November and December, but doubtless flowers and fruits occur in most months.

TYPEIFICATION AND NOMENCLATURE: The type material of *Breynia disticha* was collected by the Forsters on Cook's second voyage; the locality is not stated in the original publication, but G. Forster (*Fl. Ins. Austr. Prodr.* **75**. 1786) indicates New Caledonia and the New Hebrides (Tanna). *Phyllanthus nivosus* is based on a specimen cultivated by J. Bull, of Chelsea, originally sent from the New Hebrides; Regel's

illustration may be taken as the type of his trinomial. A plethora of botanical names exists for the garden favorite *snowbush*, only some of those used in the Pacific being listed above. It seems best treated as a cultivar of *Breynia disticha*, as suggested by G. L. Webster (in litt.).

DISTRIBUTION: The cultivar is widely grown throughout the tropics, its abundance in Fiji being merely suggested by the few specimens here cited.

LOCAL NAMES AND USE: *Snowbush* and *snowbush breynia* are commonly used; the plant is an attractive ornamental, often used in hedges.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Saweni Beach, near Lautoka, *Greenwood 727B*. NADRONGA & NAVOSA: Singatoka, *Greenwood 727*. SERUA: Ngaloa, *Smith 9623*. REWA: Suva, *Degener & Ordonez 13667*, *Meebold 16893*.

8. GLOCHIDION J. R. & G. Forst. Char. Gen. Pl. 57. 1775, ed. 2. 113. 1776; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 56. 1931. Nom. cons.

Monoecious (or perhaps infrequently dioecious) trees or shrubs, without milky latex, the stipules often subsistent; leaves along main branches reduced to scales subtending deciduous branchlets, alternate on distal branchlets, short-petiolate, the blades entire; inflorescences axillary, fasciculate or racemiform, the flowers lacking petals and disk, the calyx lobes usually imbricate, the ♂ and ♀ flowers in different inflorescences or in the same inflorescence; ♂ flowers pedicellate, the calyx 5-9-lobed, the lobes imbricate, the stamens 3-8 (3 in all our species), the filaments connate into a column, the anthers 2-locular, dehiscent longitudinally, the connective prolonged, apiculate or conical, 3-dentate, a rudimentary pistil lacking; ♀ flowers sessile or short-pedicellate, the calyx (3-) 5- or 6-lobed nearly to base, rarely gamosepalous, persistent, not accrescent, the ovary 3-15-locular, each locule with 2 ovules, the styles often connate into a persistent column, less often free nearly to base, rarely elongating after anthesis, the stigmas essentially free, entire or inconspicuously 2-dentate; fruit a capsule, dehiscent into 2-seeded cocci, the seeds with a fleshy testa, ventrally invaginated.

TYPE SPECIES: *Glochidion ramiflorum* J. R. & G. Forst., the only original species.

DISTRIBUTION: Tropical Asia through Malesia and eastward in the southern Pacific to the Marquesas and Tuamotus, with 300 or more species including a few in Madagascar and tropical America. Eighteen species are here recognized as indigenous in Fiji, 17 of them apparently endemic, including five here first described.

LOCAL NAME: All species of *Glochidion* in Fiji are called *molau*, and therefore this name is omitted from discussions of individual species.

Glochidion has seemed a difficult genus to taxonomists, the vegetative characters sometimes proving variable within otherwise reasonable taxa, the flowers reduced to sometimes distracting similarity and simplicity, without petals or disk, and the capsules offering only limited variation. Nevertheless, in our area there are striking characters in the ♀ flowers, bearing mostly on the gynoeceum as to the development of a short or long stylar column, the number, shape, and degree of freedom of its styles, and the gynoeceal indument or lack of it. Staminate flowers offer less variation, in all our species having three anthers dorsally adnate to a column with little variation in its projecting, three-lobed connective. Characters bearing on vegetative indument and leaf shape and size are useful within limits, but in general a systematic arrangement seems best based on ♀ flowers. In the southern Pacific the identity and distribution of the type species, *G. ramiflorum*, have been differently interpreted. Although I believe this species not to occur east of the New Hebrides, it is included in the present discussion in an attempt to clarify its relationship with *G. concolor*.

KEY TO SPECIES

Stigmas, ovary locules, and cocci of capsules 5-8 (10 or 11 in no. 12).

Stylar column not exceeding 2 mm. in length at anthesis, not or slightly projecting from calyx (noticeably projecting in no. 7, but then not exceeding 1.5 mm. in length).

Petioles 1-2 mm. long; leaf blades ovate or oblong-ovate, (1.5-) 3-8 (-12) × (1.2-) 2-5 (-6) cm., deeply or shallowly cordate at base and sometimes amplexicaul; young branchlets, petioles, and leaf blades (at least beneath) copiously spreading-pilose with hairs 0.2-0.6 (-1) mm. long; inflorescences compact, few-flowered, the ♀ flowers usually solitary, on pedicels 1-2 mm. long, copiously spreading-white- or brownish-pilose throughout, the calyx lobes 6-9, the stylar column cylindrical, 0.5-1.2 mm. long, the 5 or 6 styles stout, erect, free about half their length; ovary locules and cocci 5 or 6; mature capsules 5-7 × 10-12 cm., persistently pilose. 1. *G. cordatum*

Petioles usually 2 mm. long or longer (sometimes shorter in nos. 7 and 8); leaf blades not cordate at base, not amplexicaul.

Leaf blades acuminate or acute or cuspidate at apex.

Stylar column cylindrical to truncate-conical, 1-1.5 mm. long at anthesis, the styles connate to apex or distally free and short-divergent; inflorescences short-amentiform to fasciculate, many-bracteate, the rachis if present up to 5 mm. long; petioles stout; leaf blades ovate or elliptic-ovate, comparatively large, 6-23 × 3.5-10.5 cm., sometimes glaucous beneath, rounded to obtuse at base, acute to gradually acuminate and callose-apiculate at apex; capsules comparatively large, at maturity 5-10 × 10-20 mm., with 6 (rarely 7) cocci.

Indument of distal portions of branchlets, petioles, and lower surfaces of leaf blades (at least on costa and nerves) copiously spreading-pilose with hairs 0.2-0.5 mm. long; petioles 4-10 mm. long; leaf blades 6-23 × 4-10 cm.; calyx lobes usually pilose without; gynoeceum copiously spreading-pilose at anthesis. 2. *G. amentuligerum*

Indument of distal portion of branchlets, petioles, and leaf blade surfaces comparatively sparse or these parts glabrous; petioles 3-5 mm. long; leaf blades 6-17 × 3.5-10.5 cm.; calyx lobes usually glabrous; gynoeceum very obscurely puberulent to glabrous at anthesis.

3. *G. anfractuosum*

Stylar column oblate-truncate or rounded-conical, not more than 1 mm. long; inflorescences usually fasciculate, sometimes short-amentiform with a many-bracteate rachis less than 1.5 mm. long; petioles slender; leaf blades glabrous, comparatively small, not exceeding 11 × 4.5 cm., usually concolorous, acute to attenuate at base, acute to acuminate at apex; capsules comparatively small, at maturity not exceeding 5 × 12 mm., with 5-8 cocci.

Leaf blades oblong- to ovate-elliptic, (4-) 5-11 × (1.5-) 2-4.5 cm., 2-2.5 (rarely 3 or 4) times as long as broad, acute at base, obtusely short-cuspidate or bluntly acuminate at apex; ♂ flowers with the pedicels 3-6 mm. long at anthesis, the outer calyx lobes 1.5-2 mm. long, the anthers usually 0.5-0.7 mm. long; ♀ flowers with the pedicels 2-6 mm. long at anthesis, the outer calyx lobes 0.8-1 mm. long, the stylar column (5-) 6-8-lobed.

Gynoeceum composed of a short ovary and rounded-conical stylar column, the ovary pilose with hairs about 0.15-0.2 mm. long, the column very shallowly divided at apex into 6 incurved, bilobed, stigmatiferous segments; not in Fiji but included for comparison.

G. ramiflorum

Gynoeceum completely glabrous, composed of a short ovary and oblate-truncate column deeply cleft into (5-) 6-8 conspicuous, unlobed, stigmatiferous segments, these much longer than ovary; capsules glabrous. 4. *G. concolor*

Leaf blades ovate-elliptic to lanceolate, (2.5-) 3-7 × (0.8-) 1-2.5 cm., about 3 times as long as broad, acute to attenuate at base, often slenderly acuminate and callose-apiculate at apex; ♂ flowers with the pedicels 1-4 mm. long at anthesis, the outer calyx lobes 1-1.2 mm. long, the anthers 0.3-0.6 mm. long; ♀ flowers with the pedicels 1-3 mm. long at anthesis, the outer calyx lobes 1-1.2 mm. long, the stylar column deeply cleft into (4-) 5-7 conspicuous, unlobed, stigmatiferous segments, these much longer than ovary, the ovary (and sometimes the stylar column at least basally) copiously pilose with hairs 0.1-0.2 mm. long; capsules often minutely puberulent. 5. *G. seemanii*

Leaf blades rounded or obtuse at apex, glabrous, 1.8-9 × 0.6-4.5 cm.; petioles 1-7 mm. long; gynoeceum glabrous, the ovary 5-8-locular, the stylar column cylindrical-conical, broadly truncate at apex, the styles distally free; inflorescences fasciculate or short-amentiform (rachis not more than 1 mm. long).

Mature capsules not exceeding 6 × 8 mm., 5-7-locular; calyx lobes strictly glabrous; petioles 1-4 mm. long; leaf blades not exceeding 6.5 × 3.5 cm.

♀ flowers subsessile, the pedicels less than 0.5 mm. long, the outer calyx lobes 1.3-2 mm. long, exceeding the gynoeceum in length at anthesis; ovary sharply contracted distally, the stylar column 1-1.5 mm. long at anthesis (soon elongating to 1.5-2 mm.), the styles 6, stout, free about half their length, erect, shortly bifid at apex; petioles 2-4 mm. long; leaf blades

- oblong-elliptic, 2-3 × 1-1.7 cm., obtuse at base, rounded and inconspicuously glandular-mucronulate at apex, essentially concolorous; plant glabrous throughout. 6. *G. euryoides*
- ♀ flowers on pedicels 1-2.5 mm. long at anthesis, the outer calyx lobes not more than 1 mm. long, exceeded by the gynoeceum at anthesis; ovary not contracted distally, the styler column 1-2 mm. long at anthesis, the styles stout, free about half or quarter their length, erect, obtuse or callose-acute and entire at apex; petioles 1-2 mm. long; leaf blades usually glaucous beneath; plants with at least a trace of indument on younger parts.
- Branchlets, petioles, and sometimes pedicels minutely puberulent (hairs 0.1-0.2 mm. long); leaf blades orbicular-elliptic to oblong-obovate, (2-) 2.5-6.5 × (1-) 1.5-3.5 cm., rounded or faintly retuse at apex; styles and ovary locules usually 6, rarely 5. . . . 7. *G. vitiense*
- Branchlets and young parts sparsely puberulent, the plant otherwise glabrous; leaf blades ovate, 1.8-3 × 0.6-1.2 cm., subacute at base, obtuse at apex; styles and ovary locules 6 or 7. 8. *G. podocarpum*
- Mature capsules 8-10 × 15-20 mm., 5-8-locular; pedicels of ♀ flowers 0.8-1 mm. long, the outer calyx lobes 1-1.3 mm. long, closely but densely pilose within, the ovary sharply contracted at apex, the styler column 0.7-1 mm. long, with 5-8 stout styles free nearly to base, erect, obtuse at apex; petioles 5-7 mm. long; leaf blades elliptic to oblong-elliptic, 4-9 × 2-4.5 cm., obtuse at base and apex. 9. *G. calciphilum*
- Styler column conspicuous, 1.8-3 mm. long at anthesis, long-projecting from calyx; plants essentially glabrous throughout.
- Stigmas, ovary locules, and cocci of capsules 5 or 6; styler column carnosic in texture, not obviously hollow (except in the stigmatic area), 2-3 mm. long at anthesis, obviously lobed at apex with stigmatiferous segments at least 0.2 mm. long; leaf blades thick-chartaceous to subcoriaceous, essentially concolorous.
- Petioles 6-12 mm. long; leaf blades (4-) 6-14 × (2-) 2.5-5 cm., cuneate-attenuate at base, obtusely cuspidate to acuminate at apex, drying dull green. 10. *G. atrovirens*
- Petioles 2-8 mm. long; leaf blades 2.5-6 × 1-3.3 cm., acute to obtuse at base, rounded to obtusely cuspidate at apex, drying brown. 11. *G. brunnescens*
- Stigmas, ovary locules, and cocci of capsules 10 or 11; styler column hollow, 1.8-2 mm. long at anthesis, composed of laterally joined styles that are flat and thin in texture, truncate at apex and shallowly 10- or 11-lobed, the lobes scarcely 0.1 mm. long, faintly emarginate; petioles slender, 2-5 mm. long; leaf blades thin-chartaceous, ovate or lanceolate, (3-) 5-8 × 1.5-3.5 cm., slenderly acuminate at apex, paler beneath than above. 12. *G. multilobum*
- Stigmas, ovary locules, and cocci of capsules 3 or 4 (rarely 5 in no. 18); styler column (including styles, these essentially free in no. 18) 1.5-5 mm. long at anthesis and sometimes protruding from calyx; leaf blades oblong-ovate, elliptic, or lanceolate, 3-14 × 1.5-6 cm.
- Calyx of ♀ flowers with 5 or 6 lobes free nearly to base (these sometimes only 3 by abortion of inner lobes); styler column composed of firmly connate styles, these free only toward apex or in distal half, 3 or 4 in number, not or slightly accrescent in fruit; ♂ flowers with pedicels 1-6 mm. long; capsules to 5-7 × 8-12 mm., with 3 or 4 cocci.
- Indument lacking (or sometimes young branchlets, petioles, and costas of young leaf blades pilose with spreading hairs rarely as long as 1 mm., or calyx lobes minutely puberulent in no. 16, or gynoeceum partially pubescent with hairs no more than 0.2 mm. long in nos. 14, 15, and 16); leaf blades 3-14 × 1.5-6 cm.; inflorescences fasciculate or amentiform, 1-many-flowered; ♀ flowers with the calyx lobes erect and 1-3 mm. long, glabrous or minutely pilose without.
- Styler column clavate, 3-5 mm. long at anthesis and long-protruding from calyx, the projecting portion exceeding the calyx by at least 2 mm.; inflorescences fasciculate or short-amentiform.
- Petioles 4-7 mm. long; leaf blades 4-11 × 2-5.5 cm., slenderly acuminate at apex, paler beneath; ♀ flowers with pedicels 1-3 mm. long at anthesis, the calyx 6-lobed nearly to base (or sometimes 3-lobed by abortion of inner lobes), the gynoeceum entirely glabrous, the styler column gradually tapering proximally. 13. *G. gillespiei*
- Petioles 3-5 mm. long; leaf blades 3-5 × 1.5-2.5 cm., obtusely short-cuspidate at apex, concolorous; ♀ flowers subsessile, the pedicels less than 0.5 mm. long, the calyx 6-lobed nearly to base or in some flowers gamosepalous and 3-lobed, the styler column contracted in the basal 1-1.2 mm. into a cylindrical portion, this closely puberulent with minute, pale, ascending hairs.
14. *G. inusitatum*
- Styler column cylindrical-conical, 1.5-2.5 mm. long at anthesis, subequal to calyx in length or slightly protruding, the projecting portion not exceeding the calyx by more than 1 mm.; inflorescences fasciculate or amentiform, the ♀ flowers sessile or on pedicels not exceeding 0.5 mm. in length.
- Petioles 2-5 mm. long; leaf blades elliptic, ovate-elliptic, or lanceolate, (4-) 6-14 × (1.5-) 2-6 cm., the apex often elongate-acuminate, slender, to 25 mm. long; inflorescences often amentiform, the rachis sometimes few-branched, 1-4 (-6) mm. long, many-bracteate; calyx lobes in ♂ flowers 5 or 6, in ♀ flowers apparently always 5, quincuncial, 1.5-3 mm. long; staminal

column 1.5-1.8 mm. long, the anthers 1-1.2 mm. long; gynoeceum (including ovary) fulvo-puberulent or the stylar column (2-2.5 mm. long) glabrous distally, the ovary locules and stigmas 3; capsules 3-locular, 5-7 × 11-12 mm. 15. *G. bracteatum*

Petioles 1-3 mm. long; leaf blades oblong-elliptic, (3-) 4-6.5 × (1.5-) 2-3 cm., the apex acute or cuspidate, not more than 5 mm. long; inflorescences fasciculate or short-amentiform, the rachis not more than 1.5 mm. long, few-bracteate; calyx lobes apparently always 6, 1.5-2 mm. long; staminal column about 0.8 mm. long, the anthers about 0.5 mm. long; gynoeceum glabrous or both ovary and stylar column (1.5-2.2 mm. long) appressed-puberulent, the ovary locules and stigmas 3 or 4; capsules 3- or 4-locular, those available not exceeding 5 × 8 mm.

16. *G. collinum*

Indument of young branchlets, petioles, calyx lobes, and gynoecea often long-persistent, composed of delicate, 5-8-septate hairs 0.5-1 mm. long; leaf blades 4-7.5 × 1.5-2.5 cm.; inflorescences fasciculate or short-amentiform, sometimes 2-flowered, the ♀ flowers usually solitary, with calyx lobes 0.8-1 mm. long, the inner ones often reduced, the stylar column very slender, subulate, about 2 mm. long, protruding from calyx at anthesis; capsules about 7 × 12 mm. 17. *G. atalotrichum*

Calyx of ♀ flowers gamosepalous, cupuliform-cylindric, with lobes connate except at tips or in distal half, spathaceous and splitting along one side as ovary matures; leaf blades 3-7.5 × 1.5-3.2 cm.; ♂ flowers with pedicels 1-3 mm. long.

Stylar column composed of the very shortly connate bases of styles, these essentially free, usually 4 (often 3, rarely 5), 1.5-2 mm. long at anthesis, accrescent to 4-5 mm. long in fruit; calyx of ♀ flowers with 4-6 lobes; capsules sessile, to 5 × 8 mm., with 4 (often 3, rarely 5) cocci; young parts copiously pilose with spreading, several-septate hairs 0.3-0.5 mm. long, but the plant sometimes becoming subglabrate throughout; petioles 1-2 mm. long. 18. *G. melvilliorum*

Stylar column clavate, 3.2-4.2 mm. long at anthesis, contracted into a slender, puberulent basal portion 1-1.2 mm. long, the column distally glabrous and minutely 3- or 4-lobed; calyx of ♀ flowers with 3 lobes; plant glabrous throughout (except for base of stylar column); petioles 3-5 mm. long.

14. *G. inusitatum*

1. *Glochidion cordatum* Seem. in *Bonplandia* 9: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862; Seem. ex Muell. Arg. in *Linnaea* 32: 64. 1863; Gibbs in *J. Linn. Soc. Bot.* 39: 168. 1909; J. W. Parham, *Pl. Fiji Isl.* 128. 1964, ed. 2. 183. 1972.

FIGURE 119A.

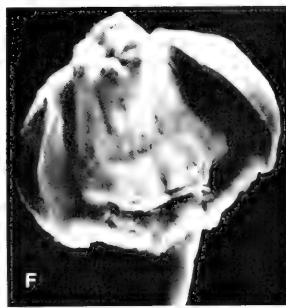
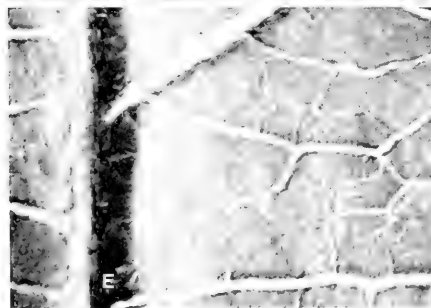
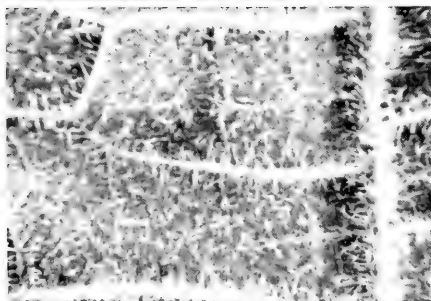
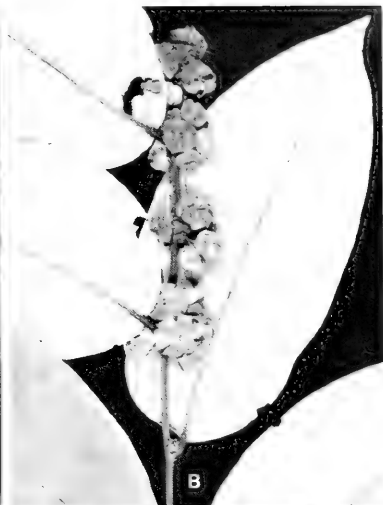
Phyllanthus cordatus Muell. Arg. in *Flora* 48: 376. 1865, in DC. *Prodr.* 15 (2): 294. 1866; Seem. *Fl. Vit.* 219. 1867.

A tree or shrub 3-7 m. high, freely branched or slender, often with spreading branches and dense foliage, occurring with some frequency at elevations of 50-900 m. in dry forest or on its edges, in ridge forest, in thickets, pastures, and along roadsides. The calyx lobes are pale yellowish green, the inner ones sometimes being a brighter yellow, the gynoeceum is pale yellowish green, and the seeds become bright red. Flowers and fruits are seen throughout the year.

TYPEFICTION: The type is *Seemann 416* (HOLOTYPE probably at G; ISOTYPES at K, BM); the K isotype bears two field labels: (1) Port Kinnaird, Ovalau, June, 1860, and (2) Viti Levu, July, 1860. It is not now possible to separate the two parts, and therefore the type locality must be taken as Ovalau and Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several islands; about 40 collections are at hand.

FIGURE 119. A, *Glochidion cordatum*, ♀ flower, with 3 calyx lobes removed, × 15. B-D, *Glochidion amentuligerum*; B, distal portion of branchlet, with foliage and mature capsules, × 1/2; C, portion of lower leaf blade surface, × 10; D, ♀ flower, with 2 calyx lobes removed, × 15. E & F, *Glochidion anfractuosum*; E, portion of lower leaf blade surface, × 10; F, ♀ flower, with 3 calyx lobes removed, × 15. A from *Smith 8624*, B & D from *Smith 1926*, C from *DA 13487*, E from *Smith 6033*, F from *Gillespie 3394*.



LOCAL NAMES AND USES: The conspicuous indument of this species makes applicable such names as *molau yalewa*, *molau vuhua*, *nggalo mbongi*, *nggalonggalo*, *nggalo-nggalo vosa*, and *kau yalewa*. The species is said to have medicinal attributes, the leaves and bark being used for stomach troubles, "pains in bones," and other ailments.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vakambuli, near Lautoka, *DA 10873*; Nalotawa, eastern base of Mt. Evans Range, *Greenwood 239*; Nandarivatu, *Gibbs 771*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 289 (Damanu 17, p. p.)*; Nathoholevu, *H. B. R. Parham 248*. SERUA: Navutulevu, *Damanu 17, p. p.*; Namata rapids, Navua River, *Gillespie 2944*. NAMOSI: Valley of Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8624*; west of Melimeli, *Webster & Hildreth 14324*. RA: Vicinity of Nasukamai, *Gillespie 4691.9*. NAITASIRI: Vicinity of Vunindawa, *DA 10035*; Viria, *Meebold 16514*. TAILEVU: Wainivesi, *DA 11272*. REWA: Vicinity of Suva, *Tohill 740*. OVALAU: Vicinity of Levuka, *Gillespie 4479*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6784*; Lambasa, *Greenwood 239A*. THAKAUNDRIVE: Wainigata, *Weiner 71-754*. FIJI without further locality, *Harvey*, November, 1855.

This sharply marked species differs from all others in our area in the dense, pale, persistent indument of its vegetative and floral parts, as well as in its cordate and often amplexicaul leaf blades.

2. *Glochidion amentuligerum* (Muell. Arg.) Croizat in *Sargentia* 1: 46. 1942; J. W. Parham, *Pl. Fiji Isl.* 127. 1964, ed. 2. 182. 1972. FIGURE 119B-D.

Phyllanthus amentuliger Muell. Arg. in *Flora* 48: 390. 1865, in DC. *Prodr.* 15(2): 313. 1866; Seem. *Fl. Vit.* 219. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 286. 1892.

An often slender tree or shrub 1.5-4 m. high, found at elevations of 100-400 m. in dense or open forest or on its edges, in patches of forest in open areas, and in thickets. The calyx is cream-colored or dull yellow, sometimes pink-tinged. Flowers and fruits have been obtained between March and December.

TIPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at US 1944712), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from Vanua Levu and eastern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Navolau, Rewa River, *DA 223*; Tholo-i-suva, *Parks 20901*; vicinity of Tamavua, *H. B. R. Parham 285, 292*. TAILEVU: "Tailevu North," *DA 1691*. REWA: Mt. Korombamba, *DA 16508*. VANUA LEVU: MATHUATA: Nasautha, *DA 13487*; Seanggangga Plateau, *Smith 6819, DA 13928*; Mt. Numbuiloa, east of Lambasa, *Smith 6456*. THAKAUNDRIVE: Eastern drainage of Yanawai River, *Degener & Ordenez 14115*; vicinity of Savusavu, *Bierhorst F212, F214*; Vunimoli, Vaturamulo, *DA 15394*; Namoliwawa, *DA 13156*; hills west of Korotasere, *Smith 1926*.

Glochidion amentuligerum and *G. anfractuosum* in their typical states are readily distinguished, the former having the vegetative parts and gynoecium copiously pilose and the latter having these parts glabrous or sparsely pilose. The type collections of both species are among the smaller-leaved specimens, the two species being usually characterized by having leaves larger than those of any other Fijian species. The presence of sometimes amentiform inflorescences is noted in both species. Of the two species, only *G. amentuligerum* is known with certainty from Vanua Levu, and on Viti Levu *G. anfractuosum* is the more abundant and usually occurs at higher elevations, but their ranges are perhaps not mutually exclusive.

3. *Glochidion anfractuosum* Gibbs in *J. Linn. Soc. Bot.* 39: 168. *pl. 15.* 1909; J. W. Parham, *Pl. Fiji Isl.* 127. 1964, ed. 2. 182. 1972. FIGURE 119E & F.

A tree or shrub 1.5-8 m. high, usually slender, sometimes spreading, known from elevations of 100-1,075 m. in dense or dry forest, in thickets, or in ridge forest. The branchlets and sometimes the venation of leaves may be noticeably purplish; the calyx is yellowish green or pale yellow, often rich pink or reddish-tinged on the lobes; and the

capsules may become dull pink or purplish, with orange-red seeds. Flowers and fruits occur throughout the year.

TYPIIFICATION: The type is *Gibbs 730* (BM HOLOTYPE), collected in September, 1907, near Nandarivatu ("Col-i-Nandarivatu"), Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known definitely only from Viti Levu and Ovalau; about 40 collections have been examined.

LOCAL NAMES: The names *ndathia* and *mokovatu* have been recorded.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka (probably hills inland), *Greenwood 83*; Mt. Evans Range, *DA 14177*; Mt. Ndelainathovu, on escarpment west of Nandarivatu, *Smith 4942*; Mt. Ndelaiyoo, west of Nandarivatu, *Webster & Hildreth 14145*; Nandarivatu, *Parks 20566*; Mt. Nanggaranambuluta, *DA 10370*; Mt. Tomanivi, *DA 14661*. NANDRONGA & NAVOSA: Nandrau, *Degener 14922*. NANDRONGA & NAVOSA-NAMOSI boundary area: Between Navua and Singatoka Rivers, *DA 2470*. SERUA: Hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith 8995*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8721*; Mt. Voma, *DA 13959*. NAITASIRE: Wainivakindau Creek (Waimanu River tributary), *DA 15414*. OVALAU: Summit and adjacent slopes of Mt. Korotolutolu, west of Thawathi, *Smith 8041*; summit of Mt. Ndelaiovalau and adjacent ridge, *Smith 7366*.

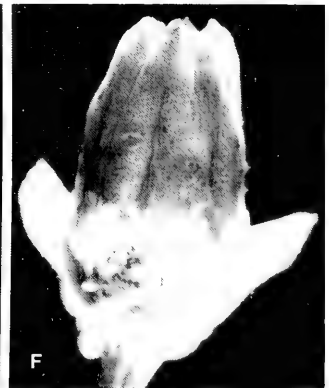
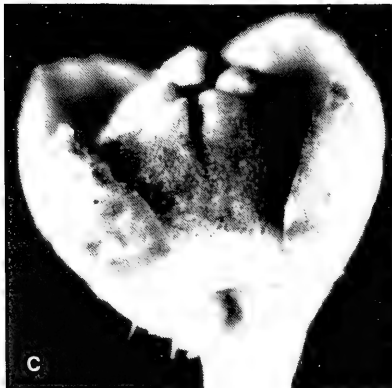
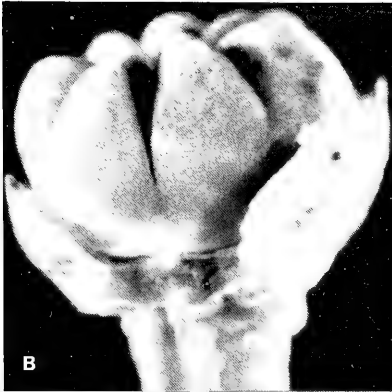
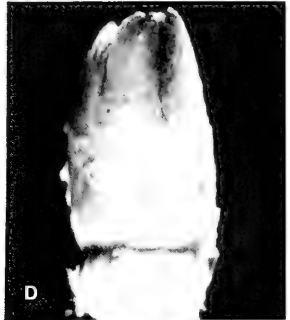
Glochidion ramiflorum J. R. & G. Forst. Char. Gen. Pl. 57. t. 57. 1775, ed. 2. 114. t. 57. 1776; Forst. f. Fl. Ins. Austr. Prodr. 68, p. p. 1786; Croizat in *Sargentia* 1:47, p. p. 1942, in *Occas. Pap. Bishop Mus.* 17:209, p. p. 1943; Airy Shaw in *Kew Bull.* 27:60. 1972. FIGURE 120A.

Glochidion tannaense Guillaumin in *J. Arnold Arb.* 13:90. 1932.

LECTOTYPIIFICATION AND NOMENCLATURE: Interpretations of *Glochidion ramiflorum* have been so diverse that most students of Pacific plants are willing to use the binomial as a catch-all for any Pacific species of *Glochidion* with medium-sized, oblong- to ovate-elliptic leaf blades and a comparatively short gynoeceum. Lectotypification is therefore urgently required. No locality was mentioned in the original publication, and G. Forster in 1786 (p. 68) did not clarify the situation by listing the species from "Societatis insulae et nouae Hebrides." (Croizat in 1942 erroneously referred to G. Forster's page 92, on which a different *Glochidion* is listed with the sole indication "Tanna." Therefore, Tanna has no claim to being the *locus classicus* on the basis of Croizat's explanation.) One might assume that Mueller (in DC. Prodr. 15 (2): 289. 1866) had clarified the matter by proposing a var. *genuinus* under *Phyllanthus ramiflorus*, basing it on a Forster collection in "hb. holm." but failing to mention a locality. (Croizat in 1942 implied that Mueller had referred to a plant from the Societies, but such is not the case.)

It seems advisable to choose a lectotype from among the Forster material in the Banks Herbarium (BM); cf. vol. 1 of this *Flora*, p. 36. Only one sheet of this relationship at BM is indicated as collected by J. R. & G. Forster; on the reverse this is marked as from "Tanna & Amsterdam Insula Oceani pacifici. J. R. & G. Forster," and on the front is pencilled "*Phyllanthus ramiflorus* α genuinus, Muell. Arg. in Dec. Prodr. 15, 2, p. 289." Three other specimens at BM from "G. Forster's Herbarium" are without locality, and they are not necessarily duplicates, although one of them, indicated as "361. *Glochidion ramiflorum*," is evidently the specimen referred to by G. Forster in 1786 (p. 68). From the facts at hand I do not understand the allusion of G. Forster and others to the Society Islands as a possible *locus classicus* for this species.

The potential type localities seem narrowed to Tanna (New Hebrides) and Amsterdam Island (i. e. Tongatapu, Tonga). The J. R. & G. Forster specimen mentioned



above agrees so well with type material of *G. tannaense* Guillaumin that one may assume it to have been obtained on Tanna (although this cannot be claimed with certainty). Nevertheless I believe that the situation may be clarified by accepting as the lectotype of *G. ramiflorum* the J. R. & G. Forster specimen at BM, and by assuming that it was obtained on Tanna. The conclusion stated by Croizat in 1942 is thus supported, although not for the reasons given by him.

Glochidion tannaense Guillaumin is typified by *Kajewski 91* (A HOLOTYPE; ISOTYPES at BISH, K, P, etc.), collected March 5, 1928, at Lenakel, Tanna, New Hebrides.

DISTRIBUTION: The above discussion of lectotypification takes on importance if one concludes that the many collections from east of the New Hebrides differ from New Hebridean material of *Glochidion ramiflorum* in gynoecial details. Much of the Fijian material currently passing as *G. ramiflorum* is in my opinion better referred to *G. concolor* (as suggested by my key and by FIGURES 120A and B). As here interpreted, *G. ramiflorum* has a distribution extending from New Guinea to the New Hebrides and perhaps elsewhere to the west, but not farther east than the New Hebrides. A future monographer of the genus, if in basic agreement with my suggestion, will be faced with reidentifying the many collections of "*G. ramiflorum*" sensu lato from Polynesia and the eastern parts of the Fijian Region, a task not to be undertaken lightly.

4. *Glochidion concolor* Muell. Arg. in *Linnaea* 32: 62. 1863; Croizat in *Sargentia* 1: 47. 1942; Yuncker in *Bishop Mus. Bull.* 220: 160, p. p. 1959; J. W. Parham, *Pl. Fiji Isl.* 127. 1964, ed. 2. 183. 1972. FIGURES 120B, 121A, 126A.

Glochidion ramiflorum sensu Seem. in *Bonplandia* 9: 259. 1861, Viti, 441. 1862; Yuncker in *Bishop Mus. Bull.* 220: 160, p. p. 1959; J. W. Parham, *Pl. Fiji Isl.* 128. 1964, ed. 2. 183. 1972; non J. R. & G. Forst.

Glochidion ramiflorum var. *lanceolatum* Muell. Arg. in *Linnaea* 32: 63. 1863.

Phyllanthus concolor Muell. Arg. in *Flora* 48: 374. 1865, in *DC. Prodr.* 15 (2): 290. 1866.

Phyllanthus ramiflorus var. *lanceolatus* Muell. Arg. in *Flora* 48: 374. 1865, in *DC. Prodr.* 15 (2): 289. 1866; Seem. *Fl. Vit.* 218. 1867; non sensu Croizat in *Occas. Pap. Bishop Mus.* 17: 210. 1943.

Phyllanthus concolor var. *ellipticus* Muell. Arg. in *DC. Prodr.* 15 (2): 290. 1866; Seem. *Fl. Vit.* 219. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 286. 1892. *

Phyllanthus ramiflorus sensu Seem. *Fl. Vit.* 432. 1873; Drake, *Ill. Fl. Ins. Mar. Pac.* 287, p. p. 1892; non Muell. Arg.

A tree (less often a shrub 1 m. high) to 13 m. high (rarely to 25 m., with a trunk to 50 cm. in diameter), often slender or spreading, occurring from near sea level to an elevation of 1,000 m. in dense or open forest or on its edges, in thickets, in the forest-grassland transition, and on open slopes. The calyx lobes are pale yellow to orange, and the young capsules are yellow, with red seeds. This most abundant *Glochidion* in Fiji may be found in flower or fruit in all months.

TIPIFICATION AND NOMENCLATURE: *Glochidion concolor* is based exclusively on *Harvey* (HOLOTYPE in Herb. Lenormand, CN, now transferred to P; ISOTYPES at BM, K), collected in November, 1855, in Fiji without further locality. In referring this taxon to *Phyllanthus*, Mueller in 1866 took it to include two varieties. The first of these was var.

FIGURE 120. A, *Glochidion ramiflorum*, ♀ flower, with 1 calyx lobe removed, × 30. B, *Glochidion concolor*, ♀ flower, with 1 calyx lobe removed, × 30. C, *Glochidion seemannii*, ♀ flower, with 1 calyx lobe removed, × 30. D & E, *Glochidion euryoides*; D, gynoecium slightly after anthesis, × 30; E, ♀ flower, with 2 calyx lobes removed, × 30. F, *Glochidion vitiense*, ♀ flower, with 2 calyx lobes removed, × 30. A from *Kajewski 91* (from Tanna, New Hebrides), B from *Smith 1304*, C from *Gillespie 3682*, D & E from *Smith 4659*, F from *Gillespie 4411*.

ellipticus, which he apparently considered his "alpha" variety, since it also is based on the same Harvey collection as the species. The varietal epithet was not utilized by Mueller under *Glochidion concolor* in 1863, but at that time he described a var. *obovatum* under *G. concolor* (transferring the trinomial to *Phyllanthus* in 1866); this second variety is referable to *Glochidion vitiense* (q. v.). *Glochidion ramiflorum* var. *lanceolatum* (a trinomial later transferred to *Phyllanthus ramiflorus*) was based by Mueller on two collections: *Jardin* (CN, doubtless now at P), from the Marquesas, and *Seemann 415*, from Fiji. (Croizat in *Occas. Pap. Bishop Mus.* 17: 210. 1943 indicated the type of the trinomial as from the Societies, but this can scarcely be considered an accurate lectotypification.) In discussing *Phyllanthus ramiflorus* var. *lanceolatus* in 1867, Seemann emphasized his own collection, which I here take as the lectotype; it consists of two parts not now separable, and may be cited as: *Seemann 415* (LECTOTYPE doubtless at G; ISOLECTOTYPES at BM, K), collected at Port Kinnaird, Ovalau, in June, 1860, and at Somosomo, Taveuni, in May, 1860. *Glochidion ramiflorum* var. *lanceolatum* as thus lectotypified may confidently be referred to the synonymy of *G. concolor*. In the above literature references I refrain from including many to *Glochidion ramiflorum* from eastern parts of the Fijian Region, since most of these seem not to refer to *G. concolor* and must eventually be considered by a specialist on the genus.

DISTRIBUTION: Fiji and Tonga; possibly elsewhere in the Fijian Region, but in material now at hand I believe that neither *Glochidion concolor* nor *G. ramiflorum* is to be found in Samoa; *Phyllanthus ramiflorus* var. *samoanus* seems worthy of specific rank. There appear to be more than one species of *Glochidion* in Tonga, but at least some of the material from that archipelago, in particular some of the collections from 'Eua, seem properly referred to *G. concolor*. I have examined about 90 Fijian collections of *G. concolor*, which may be expected on most of the islands.

LOCAL NAMES AND USES: In addition to the generally used *molau*, recorded names are *molau ndamu*, *molau yalewa*, *molau tangane*, *ngalo*, *nggalo*, and *nggalonggalo*. The leaves are said to be eaten to cure stomach trouble, and the wood is often utilized as firewood.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1300*; Korovou, east of Tavua, *Degener 14950*; Nandarivatu, *Gillespie 3168*; Mt. Tomanivi, *DA 12769* (*Melville et al. 7161*). NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, *Smith 4591*; Thuvu, west of Singatoka, *Webster & Hildreth 14310*. SERUA: Namboutini, *DA 12204* (*DF 54*); north of Korovou, *St. John 18946*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8758*; vicinity of Namuamua, *Gillespie 2954*. NAITASIRE: Matawailevu, Wainimala River, *St. John 18303*; Tamavua, *Gillespie 2154*. TAILEVU: Vicinity of Ndakuivuna, *Smith 7018*. REWA: Namboro, *DA 16972*; Suva, *Yeoward 69*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 73*. OVALAU: Vicinity of Levuka, *Degener & Ordenez 13798*. KORO: Eastern slope of main ridge, *Smith 1067*. NAIRAI: Tovu Lailai, *DA 17718*. NGAU: East of Herald Bay, on slopes of Mt. Vonda, *Smith 7983*. VANUA LEVU: MATHUATA: Mt. Numbuiloa, east of Lambasa, *Smith 6402*. THAKAUNDROVE: Vicinity of Savusavu, *Bierhorst F211*. TAVEUNI: Vicinity of Waiyeyo, *Gillespie 4663*. MOALA: Near Naroi, *Smith 1304*. LAKEMBA: Tumbou River, *Garnock-Jones 841*. FULANGA: On limestone formation, *Smith 1146*.

FIGURE 121. A, *Glochidion concolor*, distal portion of branchlet, with foliage and maturing fruits (some cocci aborted), $\times 1$. B, *Glochidion seemanii*, distal portion of branchlet, with foliage and mature capsules, $\times 1$. C, *Glochidion euryoides*, distal portion of branchlet, with foliage and inflorescences, $\times 1$. D, *Glochidion vitiense*, young branchlet, petiole, basal part of leaf blade, and inflorescence with a single \varnothing flower, $\times 10$. A from *St. John 18946*, B from *DA 13932*, C from *Smith 4659*, D from *Gillespie 4411*.



5. *Glochidion seemannii* Muell. Arg. in *Linnaea* 32: 63, as *G. seemanni*. 1863.

FIGURES 120C, 121B, 126B.

Melanthesa sp. Seem. in *Bonplandia* 9: 259. 1861, Viti, 441. 1862.

Phyllanthus seemannianus Muell. Arg. in *Flora* 48: 374. 1865, in DC. *Prodr.* 15 (2): 290. 1866; Seem. Fl. Vit. 219. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 287. 1892.

Glochidion seemannianum Muell. Arg. in *Flora* 48: 374, pro syn. 1865.

Phyllanthus venulosus Muell. Arg. in *Flora* 48: 374. 1865, in DC. *Prodr.* 15 (2): 291. 1866; Seem. Fl. Vit. 219. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 288. 1892.

Glochidion seemanni Muell. Arg. ex A. C. Sm. in *Bishop Mus. Bull.* 141: 84. 1936; J. W. Parham, Pl. Fiji Isl. 128. 1964, ed. 2. 183. 1972.

A shrub or tree 2–15 m. (rarely to 20 m.) high, often compact, slender, or freely branched, occurring from near sea level to 1,150 m. in dense, dry, or secondary forest, in thickets, or in open rolling areas or on open hillsides. The calyx lobes are pale yellow to greenish white, the androecium yellow, the gynoecium green, and the capsules reddish or pink-tinged. Flowers and fruits are found throughout the year.

TYPEIFICATION AND NOMENCLATURE: The type of *Glochidion seemannii* is *Seemann 413* (HOLOTYPE probably at G; ISOTYPES at BM, K), collected on Kandavu in 1860; Mueller's inadvertent change of the epithet to *seemannianus*, when he transferred it to *Phyllanthus*, has been widely followed. *Phyllanthus venulosus* is typified by *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944719), collected in 1840 in Fiji without further locality. No significant differences are found between the two entities.

DISTRIBUTION: Endemic to Fiji and thus far known from six of the islands, but probably considerably more widespread. About 40 collections have been examined.

LOCAL NAMES AND USE: In addition to *molau*, recorded names are *molau yalewa*, *nggalo*, *manawi*, and *mbavono*. The stem is reported on Taveuni as part of a remedy to treat weakness after childbirth.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 336B*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4254*; vicinity of Nandarivatu, *Degener 14405*; Mt. Nangaranambuluta, east of Nandarivatu, *Gillespie 3682*; slopes of Mt. Tomanivi, *Smith 5277*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5487*. SERUA: Namboutini, *DA L.22284 (DF 78)*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2496*. NAITASIRI: Sawani, *DA 3182*. OVALAU: Wainiloka, *DA 1347*. VANUA LEVU: MBUA: Koromba Forest, *DA 15119*. MATHUATA: Seanggangga Plateau, *DA 13932*. TAVEUNI: Trail above Somosomo, *Weiner 71-7-13a*. MOALA: Near Maloku, *Smith 1339*.

6. *Glochidion euryoides* A. C. Sm. in *J. Arnold Arb.* 33: 373. 1952; J. W. Parham, Pl. Fiji Isl. 128. 1964, ed. 2. 183. 1972.

FIGURES 120D & E, 121C.

A slender, freely branching tree about 4 m. high, apparently rare, known from forest on ridges and spurs at an elevation of 800–1,075 m. The calyx lobes are white.

TYPEIFICATION: The type is *Smith 4659* (A HOLOTYPE; ISOTYPES at BISH, K, US, etc.), collected June 3, 1947, on the upper slopes of Mt. Koromba, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and still known only from the type collection.

This little-known, small-leaved species is simulated only by *G. brunnescens* (no. 11 in this treatment), which also has comparatively small, apically rounded leaf blades, although they are less congested, usually larger, and with longer petioles. The two species are not closely related in respect to the essential characters of their gynoecia (cf. FIGURES 120D & E, and 123B & C).

7. *Glochidion vitiense* (Muell. Arg.) Gillespie in *Bishop Mus. Bull.* 91: 17, fig. 18. 1932;

Croizat in *Occas. Pap. Bishop Mus.* 17: 212. 1943; J. W. Parham, *Pl. Fiji Isl.* 128. *fig. 50, A.* 1964, ed. 2. 183. *fig. 54, A.* 1972. FIGURES 120F, 121D.

Melanthesa sp. Seem. in *Bonplandia* 9: 259. 1861, Viti, 441. 1862.

Glochidion concolor var. *obovatum* Muell. Arg. in *Linnaea* 32: 63. 1863.

Phyllanthus vitiensis Muell. Arg. in *Flora* 48: 374. 1865, in DC. *Prodr.* 15 (2): 290. 1866; Seem. *Fl. Vit.* 219. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 288. 1892.

Phyllanthus concolor var. *obovatus* Muell. Arg. in DC. *Prodr.* 15 (2): 290. 1866; Seem. *Fl. Vit.* 219. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 286. 1892.

An often compact shrub or tree 0.6–8 m. high, occurring from near sea level to an elevation of 590 m. in dense or dry forest, in open rolling country, or on grassy slopes. The calyx lobes are indicated as pale yellow, yellow, or yellowish green. Flowers have been obtained between June and February, fruits between December and February.

TIPIFICATION AND NOMENCLATURE: The type of *Phyllanthus vitiensis* is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944720), collected in 1840 in Fiji without further locality. Gillespie thought it likely that the type came from Ovalau because of its similarity to his no. 4411; this of course may have been the case. *Glochidion concolor* var. *obovatum* is typified by *Seemann 412* (HOLOTYPE probably at G; ISOTYPES at BM, K), collected in 1860 on Viti Levu without further locality. In 1943 Croizat suggested the reduction of the latter taxon to *G. vitiense*, certainly a correct interpretation.

DISTRIBUTION: Endemic to Fiji and known from several islands; below I cite all the collections known to me.

LOCAL NAME: *Molau tangane*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Teindamu River, *DA 11552*; "Mba closed area," near Lautoka, *DA 10858, 11131, 11132, 11375, 11709*. SERUA: Hills between Wainigere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9640*. TAILEVU: Navuloa River, *DA 2723*; Naingani Island, *DA 3332, 3348, 3357*. REWA: Mt. Korombamba, *DA 3837*. KANDAVU: Hills above Naikorokoro, *DA 11699*. OVALAU: Mountains above Levuka, *Gillespie 4411*. NAIRAI: *Milne 174*. VANUA LEVU: MATHUATA: Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6730*; Seangangga Plateau, Ndravoningatandamu to Nanenivunda River, *Harwood 92*. MOALA: *Tothill 720*. KANATHEA: *Graeffe 1547*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 1093*. FIJI without further locality, *Horne 38, 229*.

This very distinctive species is characterized by the close, uniform indument of its vegetative parts, by its small, rounded leaf blades, and by its projecting (but still comparatively small) stylar column in relation to its reduced calyx lobes.

8. *Glochidion podocarpum* (Muell. Arg.) C. B. Robinson in *Philipp. J. Sci. Bot.* 6: 330. 1911.

Phyllanthus podocarpus Muell. Arg. in DC. *Prodr.* 15 (2): 310. 1866; Seem. *Fl. Vit.* 219. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 287. 1892; J. W. Parham, *Pl. Fiji Isl.* 131. 1964, ed. 2. 188. 1972.

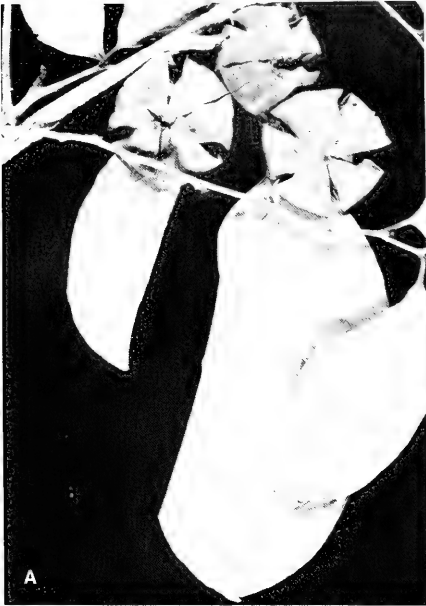
A slender, densely branched shrub, inadequately known but apparently most closely related to *G. vitiense*, differing in its more glabrous habit and its smaller, proportionately narrower leaf blades.

TIPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at US 62132), collected in 1840 in Fiji without further locality.

DISTRIBUTION: Endemic to Fiji and known only from the type collection. An adequate appraisal of the species must await further material.

9. *Glochidion calciphilum* Croizat in *Sargentia* 1: 46. 1942; J. W. Parham, *Pl. Fiji Isl.* 127. 1964, ed. 2. 182. 1972. FIGURE 122A & B.

A compact shrub or gnarled tree about 1 m. high, occurring near sea level on



limestone and on lagoon cliffs. The calyx lobes are yellow. Flowers have been obtained in February and fruits in February and March.

TIPIFICATION: The type is *Smith 1217* (GH HOLOTYPE; ISOTYPES at BISH, K, US, etc.), collected Feb. 26, 1934, on a limestone cliff in the lagoon of Fulanga.

DISTRIBUTION: Endemic to Fiji and thus far known only from two islands of southern Lau.

AVAILABLE COLLECTION: KAMBARA: On limestone formation, *Smith 1279*.

Although *Glochidion calciphilum* remains known only from the two collections first described by Croizat, it is a well-marked species among the Fijian *Glochidion*es with comparatively short gynoecea, five or more ovary locules, and rounded or obtuse leaf blades. It is well characterized by its large capsules, calyx lobes that are closely pilose within, and comparatively short styles free nearly to base.

10. *Glochidion atrovirens* A. C. Sm., sp. nov. (described at end of genus)

FIGURE 122C & D.

A shrub or tree 2–5 m. high, occurring in dry or dense forest at elevations of 50–100 m. The calyx is pale yellow, as is the gynoeceum, and the essentially mature capsules are noted as green. The three known collections, made in April, July, and December, all bear flowers; fruits have been obtained in April and July.

TIPIFICATION: The type is *Smith 9550* (BISH HOLOTYPE; many ISOTYPES), collected Dec. 10, 1953, in hills between Wainingere and Waisese Creeks, between Ngaloa and Wainiyambia, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from near-coastal areas of southern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Track to Mt. Korombamba, *DA L.26242* (coll. *S. Vodonaivalu*); 6 miles from Suva, *Meebold 16438*. Meebold's collection is noted as from "6 miles south of Suva." This of course is impossible, and he must have intended "west." A point six miles along the Queen's Road would be very close to the departure of the trail toward Mt. Korombamba, and therefore it is likely that the two Rewa collections came from essentially the same locality; they are so similar in appearance as to suggest that they may even have come from the same plant, although collected in 1932 (Meebold) and 1977 (Vodonaivalu) respectively.

Glochidion atrovirens and the two following species, all here described as new, are characterized by having five or more stigmas, ovary locules, and cocci, but they differ from the first nine species of this treatment in their conspicuous, protruding stylar columns. Although each of the three species also has its own foliar characteristics, they have been casually misidentified in herbaria without consideration of their distinctive gynoecea. Only ♀ flowers and fruits are seen on the available collections of *G. atrovirens*, but this does not necessarily indicate that the plants are dioecious.

FIGURE 122. A & B, *Glochidion calciphilum*; A, distal portion of branchlet, with foliage and mature capsules, × 1; B, ♀ flower, with 2 calyx lobes removed, × 30. C & D, *Glochidion atrovirens*; C, distal portion of branchlet, with foliage and a maturing capsule, × 1; D, ♀ flower, with 2 calyx lobes removed, × 20. A from *Smith 1217*, B from *Smith 1279*, C from *DA L.26242*, D from *Smith 9550*.

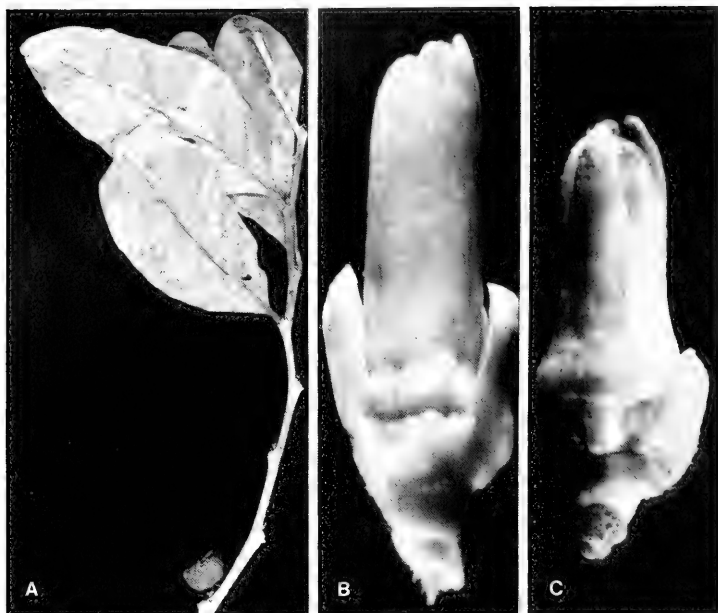


FIGURE 123. *Glochidion brunnescens*; A, distal portion of branchlet, with foliage, a single ♀ flower near apex, and a maturing fruit below with the stylar column persistent, $\times 1$; B, ♀ flower, with 2 calyx lobes removed, $\times 20$; C, ♀ flower, with some calyx lobes aborted, showing the glabrous ovary, $\times 20$. A from DA 16135, B from DA 14548, p. p., C from Smith 1770.

11. *Glochidion brunnescens* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 123, 126C.

A shrub or slender tree 1–4 m. high, known to occur at elevations of 300–960 m. in dense forest, ridge forest, and dense scrubby forest. The flower buds are dark red, the mature calyx lobes greenish or pale yellow. Flowers have been obtained in May and November, immature fruits only in November.

TYPIFICATION: The type is DA 14548, p. p. (coll. *D. Koroiveibau & I. Qoro*) (BISH HOLOTYPE; ISOTYPE at SUVA), obtained Nov. 12, 1965, on the summit of Mt. Nambui, third peak of Korombasambasanga Range, Namosi Province, Viti Levu. A second sheet assigned this number represents a species of *Casearia* (Flacourtiaceae).

DISTRIBUTION: Endemic to Fiji and known only sparingly from the interior parts of Viti Levu and Vanua Levu.

LOCAL NAME: *Molau ndamu* was noted for the Mt. Kasi collection.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Mt. Vakarongasiu, DA 16131, 16135. VANUA LEVU: THAKAUNDROVE: Mt. Kasi, Yanawai River region, Smith 1770; southern slope of Mt. Mariko, Smith 401.

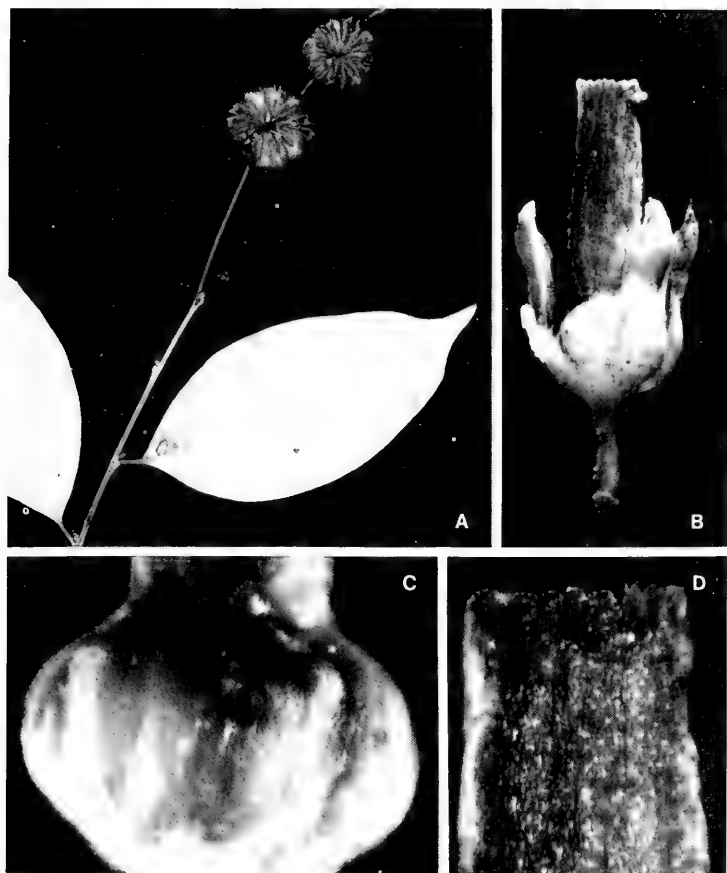


FIGURE 124. *Glochidion multilobum*, from Smith 606; A, branchlet with foliage, an inflorescence with a single ♂ flower, and 2 mature capsules, × 1; B, ♀ flower, with 3 calyx lobes removed, × 20; C, ovary and base of stylar column, × 70; D, tip of stylar column, × 70.

Glochidion brunnescens in its ♀ flowers seems closely related to the preceding species, *G. atrovirens*, although minor gynoecial differences are indicated in the descriptions. The two species are strikingly dissimilar in leaf size, shape, and color; they appear to be allopatric, *G. atrovirens* being a plant of coastal hills and *G. brunnescens* occurring in interior regions of higher elevation.

12. *Glochidion multilobum* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 124, 126D.

A shrub or slender tree 2-4 m. high, apparently rare in dense forest or crest forest at elevations of 300-800 m. The calyx is greenish white or cream white. Flowers were obtained in April and November, fruits only in November.

TIPIFICATION: The type is *Smith 606* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 28, 1933, on the southwestern slope of Mt. Mbatini, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from two montane areas of Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MBUA: Mt. Seatura, *DA 14894* (coll. *I. T. Kuruvoli*).

Glochidion multilobum is remarkable in having ten or eleven stigmas, ovary locules, and cocci, no other Fijian species having been noted with more than eight such parts. In its protruding gynoecium it seems related to the two preceding species, *G. atrovirens* and *G. brunnescens*, but these have the styler column carnosose in texture and hollow only distally where the styles are separate. The styler column of *G. multilobum* is hollow throughout, composed of laterally joined styles that are flat and thin in texture, with minute stigmatiferous lobes. Differences in leaf texture, color, and size also distinguish the three species of this relationship from one another.

13. *Glochidion gillespiei* Croizat in *Sargentia* 1: 46. 1942; J. W. Parham, *Pl. Fiji Isl.* 128. 1964, ed. 2. 183. 1972.

FIGURE 125A & B.

Glochidion manono sensu Gillespie in *Bishop Mus. Bull.* 91: 16. fig. 17. 1932; non Baill. (as *G. manoun*, sphalm., nom. nud.) 1858, nec Muell. Arg. 1863. Non *Phyllanthus manono* Muell. Arg. 1866, nec Seem. *Fl. Vit.* 219. 1867, nec Drake, *Ill. Fl. Ins. Mar. Pac.* 287. 1892.

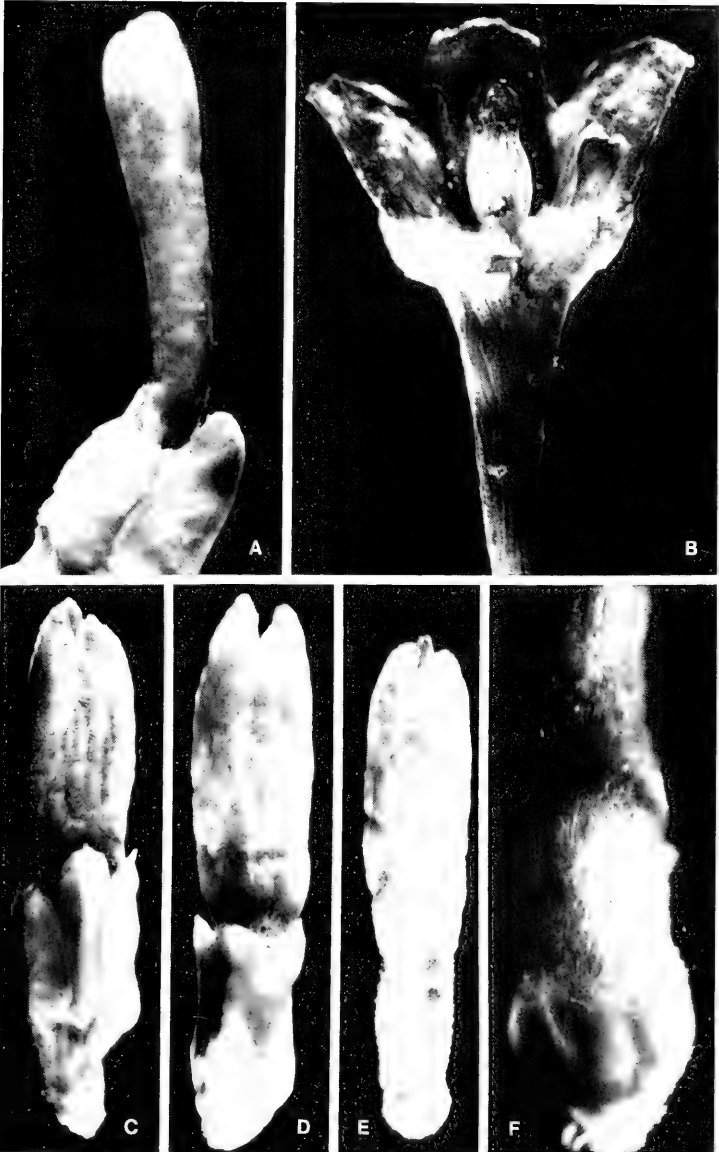
A shrub or small tree about 2 m. high, known with certainty only from elevations of 750-1,155 m. in dense forest or ridge forest. The calyx lobes are dull yellow. Flowers have been obtained in March, September, and October, but fruits are still unknown.

TIPIFICATION: The type is *Gillespie 3161* (GH HOLOTYPE; ISOTYPES at BISH), collected Sept. 28, 1927, near the summit of Mt. Naitarandamu, Namosi Province (near its boundary with Naitasiri Province), Viti Levu.

DISTRIBUTION: Endemic to Fiji and known sparingly from mountains in the interior of Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Summit of Mt. Naitarandamu, *Gillespie 3343*; summit of Mt. Vakarongasiu, *Gillespie 3265*. NAITASIRI: Mendrausuthu Range, *DA 15476*.

FIGURE 125. A & B, *Glochidion gillespiei*, from *Gillespie 3161*; A, ♀ flower, with 1 calyx lobe removed, × 20; B, ♂ flower, with 3 calyx lobes removed, × 20. C-F, *Glochidion inusitatum*, from *Smith 1851*; C, ♀ flower, with 6-lobed calyx, × 20; D, ♀ flower, with gamosepalous, 3-lobed calyx, × 20; E, gynoecium, × 20; F, ovary and basal portion of styler column, × 50.



14. *Glochidion inusitatum* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 125C-F, 126E.

A shrub about 2 m. high, apparently rare in thickets in scrubby forest at elevations of 200-300 m. The calyx is dull yellow, and flowers have been obtained only in May; fruits are not known.

TIPIFICATION: The type is *Smith 1851* (BISH HOLOTYPE; many ISOTYPES), collected May 17, 1934, on the divide between the Wainunu and Ndreketi Rivers, between the old village site of Nanduna (on Nanduna River, a headwater of the Wainunu River) and Mt. Ndelanathau, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

The new species is puzzling in that it bears ♀ flowers with two types of calyces, these diverse calyces clearly borne in adjacent inflorescences on the same specimen in approximately equal numbers. In some such ♀ flowers the calyx is gamosepalous and three-lobed, in shape suggestive of the calyx of *Glochidion melvilliorum*, an otherwise unrelated species. In other flowers the calyx is of the usual type for Fijian *Glochidion*es, six-lobed nearly to base. This curious situation might cause one to question the value of calyx characters in *Glochidion*, although in *G. melvilliorum* the gamosepalous condition seems entirely stable. In general, *G. inusitatum* appears related to *G. gillespiei*, from which it differs in having its stylar column basally contracted into a cylindrical, puberulent portion, as well as in its very different foliage.

15. *Glochidion bracteatum* Gillespie in Bishop Mus. Bull. 91: 15. fig. 16. 1932; J. W. Parham, Pl. Fiji Isl. 127. 1964, ed. 2. 182. 1972. FIGURE 127A & B.

A shrub or usually slender tree 1-5 m. high, known from elevations of 100-429 (perhaps to 1,075) m. in dense or light forest. The calyx lobes and anthers are pale yellow. Flowers have been obtained in months scattered throughout the year, but fruits are known with certainty to occur only in August.

TIPIFICATION: The type is *Gillespie 2169* (BISH HOLOTYPE; 2 ISOTYPES also at BISH), collected Aug. 7, 1927, on the southeastern slopes of Mt. Korombamba, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from southern and eastern Viti Levu. The first specimen cited below, from Mt. Koromba, Mba Province, is sterile and may be questioned, although it has the amentiform inflorescence and the leaf shape typical of the species. This specimen accounts for the high elevation mentioned above; otherwise no specimens are available from higher altitudes than the summit of Mt. Korombamba, 429 m., where the species is abundant. At present I refer 32 collections to this species.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Summit of Mt. Koromba, *DA 14743*. SERUA: Inland from Ngaloa, *DA 16805*. NAITASIRE: Vunindawa, *DA 10009*; Navuso, *DA 12601*; Central Road, *MacDaniels 1163a*; Tamavua Falls, *Tothill 713*; vicinity of Tamavua Village, *Gillespie 2443*; Nasinu, *DA 7290*. REWA: Slopes and summit of Mt. Korombamba, *Gillespie 2272, 2396*.

Of the eleven collections referred here by Gillespie in 1932, three must be removed: *Gillespie 2907* represents *Glochidion anfractuosum*, *Gillespie 3265* *G. gillespiei*, and *Parks 20593* a species of *Casearia* (Flacourtiaceae).

16. *Glochidion collinum* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 127C & D, 128A & B.

A sometimes spreading tree 8-10 m. high (or smaller?), occurring sparingly in dense

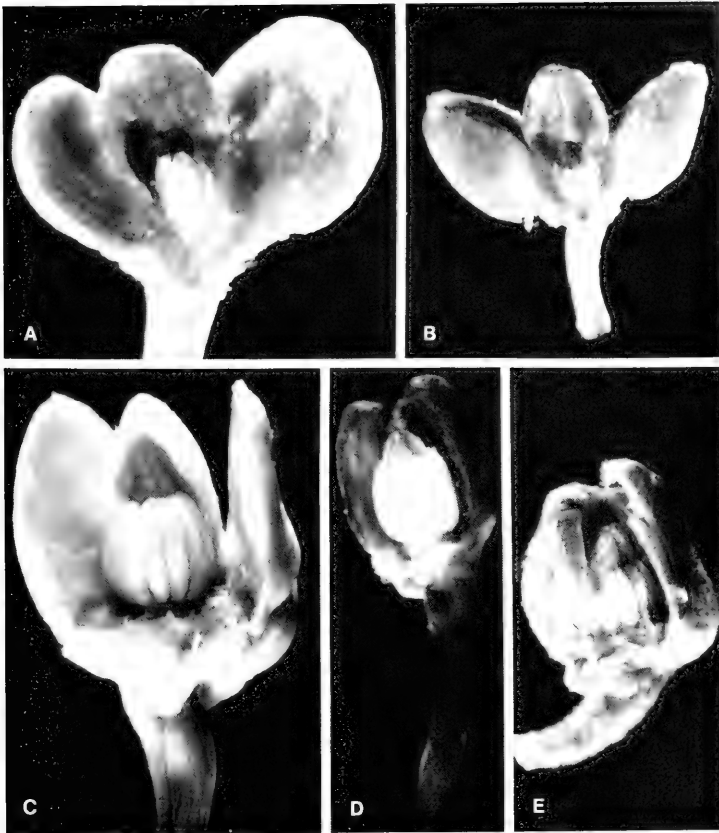
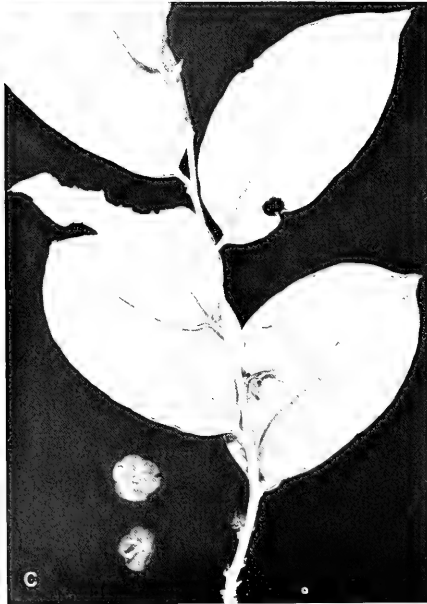


FIGURE 126. A, *Glochidion concolor*, ♂ flower, with 3 calyx lobes removed, × 20. B, *Glochidion seemannii*, ♂ flower, with 3 calyx lobes removed, × 20. C, *Glochidion brunnescens*, ♂ flower, with 3 calyx lobes removed, × 20. D, *Glochidion multilobum*, ♂ flower, with 3 calyx lobes removed, × 20. E, *Glochidion inusitatum*, immature ♂ flower, with 2 calyx lobes removed, × 30. A from Smith 1304, B from Gillespie 3682, C from DA 16131, D from Smith 606, E from Smith 1851.



forest at elevations of 850–1,150 m. Flowers and young capsules have been obtained in July, September, and November.

TYPIFICATION: The type is *Smith 6148* (BISH HOLOTYPE; many ISOTYPES), collected Sept. 18, 1947, on the northern portion of the Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the interior of Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu ("base of Tholo-i-Nandarivatu Mt."), *Gillespie 4022*; western and southern slopes of Mt. Tomanivi, *Smith 5285*. NAMOSI: Slopes of Mt. Voma, *Gillespie 2734*.

The available material of this upland species, which can be related only to *Glochidion bracteatum*, indicates that degree of indument is not reliable in the genus. Whereas the type of the new species is glabrous throughout except for its youngest parts, at the other extreme the Mt. Voma specimen has very obvious indument on the branchlets, petioles, and calyx and gynoeceum of the ♀ flowers. *Glochidion collinum* differs from *G. bracteatum* in its substantially smaller leaves that lack elongate apices, in its shorter inflorescences (the amentiform type being often conspicuous in *G. bracteatum*), in always having flowers with six calyx lobes (in *G. bracteatum* these appear to be uniformly five in ♀ flowers), in its smaller flowers, and in the less conspicuous or absent indument of its gynoeceum.

17. *Glochidion atalotrichum* A. C. Sm. in Contr. U. S. Nat. Herb. 37: 74. 1967; J. W. Parham, Pl. Fiji Isl. ed. 2. 182. 1972. FIGURE 128C & D.

A spreading, freely branched tree 4–8 m. high, found in dense forest at elevations of 250–800 m. The calyx lobes are yellowish green; all three known collections bore flowers and fruits in September.

TYPIFICATION: The type is *Smith 8747* (US 2191397 HOLOTYPE; many ISOTYPES), collected Sept. 28, 1953, on the northern slopes of the Korombasambasanga Range, in the drainage of Wainavindrau Creek, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from Namosi Province, Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Mt. Naitarandamu, *Gillespie 3103*; hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8463*.

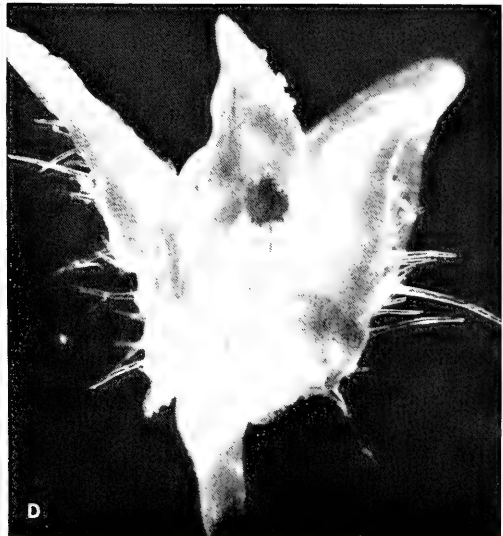
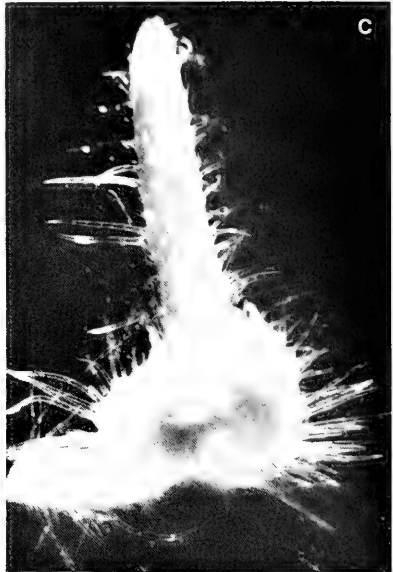
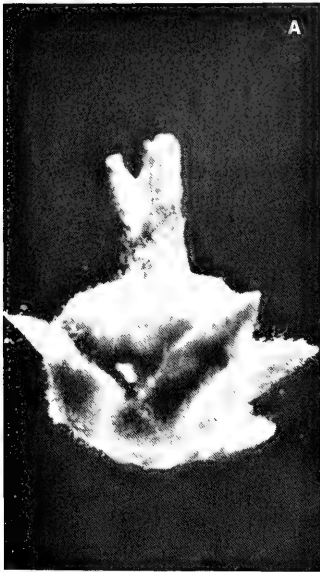
18. *Glochidion melvilliorum* Airy Shaw in Kew Bull. 25: 487. 1971. FIGURE 129.

A spreading tree to 4.5 m. high, occurring sparingly in dense or mixed forest at elevations of 600–670 m. Flowers and fruits were obtained in January and May.

TYPIFICATION: The type is *R. & E. F. Melville & J. W. Parham 7048* (DA 12672) (κ HOLOTYPE; ISOTYPES at BISH, SUVA), collected May 2, 1962, in the Nausori Highlands, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from essentially the type locality.

FIGURE 127. A & B, *Glochidion bracteatum*; A, ♀ flower, with 2 calyx lobes removed, × 20; B, ♂ flower, with 3 calyx lobes removed, × 20. C & D, *Glochidion collinum*; C, distal portion of branchlet, with foliage and a developing fruit attached below leaves, and with 2 detached mature capsules, × 1; D, ♀ flower, with 1 calyx lobe removed, × 20. A & B from *Gillespie 2169*, C from *Gillespie 4022* (detached fruits from *Smith 5285*), D from *Smith 6148*.



AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands (along road 23 miles from Nandi), O. & I. Degener 32166.

A second collection of the strikingly distinct *Glochidion melvilliorum* indicates that the nearly free styles become noticeably accrescent in fruit, and also that the vegetative and calycine indument decreases with maturity.

DESCRIPTIONS OF NEW SPECIES OF GLOCHIDION

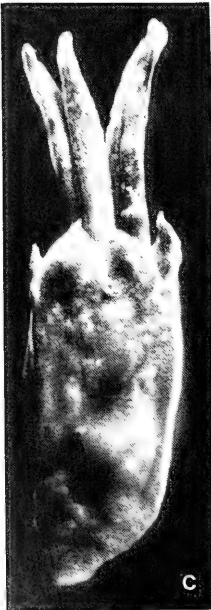
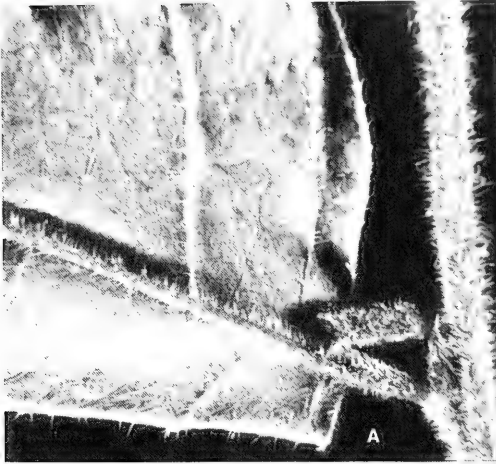
10. *Glochidion atrovirens* A. C. Sm., sp. nov.

Arbor 2-5 m. alta omnino glabra, stipulis ovato-lanceolatis 1.5-2 mm. longis acutis caducis, ramulis apicem versus inconspicue anfractuosus; petiolis crassis (ad 2 mm. diametro) 6-12 mm. longis superne angulatis; foliorum laminis crasso-coriaceis vel subcoriaceis in sicco atro-virentibus concoloribus ellipticis vel ovato- vel lanceolato-ellipticis, (4-) 6-14 cm. longis, (2-) 2.5-5 cm. latis, basi cuneato-attenuatis et in petiolum decurrentibus, apice obtuse cuspidatis vel in acuminem 5-10 mm. longum callosio-apiculatum terminatis, costa supra subelevata subtus prominenti, nervis secundariis utrinsecus 5-8 patentibus curvatis utrinque paulo elevatis, rete venularum inconspicuo subimmerso; inflorescentiis fasciculatis vel breviter amentiformibus, rhachidi interdum ad 4 mm. longa et semel ramulosa multibracteata, bracteis imbricatis deltoideis acutis 0.5-1 mm. longis; floribus ♂ non visis; floribus ♀ (1-) 3-5 per inflorescentiam sessilibus vel pedicellis ad 0.3 mm. longis, calyce cupuliformi ad 3 mm. longo, lobis 6 biseriatis erectis subaequalibus oblongis 1.5-2 mm. longis apice callosio-apiculatis; gynoeceo sub anthesi 3-3.8 mm. longo, ovario breviter cylindrico 6-loculari apice mox contracto, columna stylari crassa cylindrica 2.2-3 mm. longa 6-lobata, lobis oblongis sub anthesi 0.2-0.3 mm. longis truncatis demum ad 0.7 mm. longis profunde emarginatis; capsulis sessilibus solitariis oblatis 4-6 × 10-12 mm. 6-lobatis apice depressis, columna stylari persistenti non accrescenti sed profundius lobata. HOLOTYPE: FIJI: VITI LEVU: SERUA: *Smith 9550* (BISH).

11. *Glochidion brunescens* A. C. Sm., sp. nov.

Arbor vel frutex 1-4 m. altus omnino glaber, stipulis deltoideis callosio-acutis 1-2 mm. longis subpersistentibus, ramulis gracilibus apicem versus subangulatis 1-1.5 mm. diametro; petiolis 2-8 mm. longis fere ad basim anguste alatis; foliorum laminis subcoriaceis in sicco brunneis subconcoloribus oblongo-ellipticis, 2.5-6 cm. longis, 1-3.3 cm. latis, basi acutis vel obtusis et in petiolum decurrentibus, apice rotundatis vel obtuse cuspidatis et callosio-mucronulatis, costa supra plana vel subelevata subtus subprominenti, nervis secundariis utrinsecus 5-8 curvatis marginem versus anastomosantibus supra planis subtus elevatis vel utrinque immersis, rete venularum subimmerso vel subtus subprominulo; inflorescentiis fasciculatis vel breviter amentiformibus, rhachidi ad 1.5 mm. longa paucibracteata 1-5-flora, bracteis deltoideis acutis 0.5-0.8 mm. longis, floribus ♂ et ♀ eadem inflorescentia interdum enatis; florum ♂ pedicellis gracilibus 0.5-4 mm. longis, calyce oblongo-cupuliformi 2-3 mm. longo, lobis 6 carnosus biseriatis oblongo-ellipticis apice minute apiculatis exterioribus 1.5-2.2 mm. longis, columna staminali 1.2-1.6 mm. longa ellipsoideoconica basi contracta, antheris 3 dorso adnatis 0.7-1 mm. longis, connectivo in lobis acutis erectis 0.3-0.5 mm. longis producto; floribus ♀ interdum solitariis subsessilibus vel pedicellis crassis ad 1.5 mm. longis portatis, calyce ad 3 mm. longo, lobis 6 biseriatis erectis demum patentibus oblongis 1.2-2.2 mm. longis apice obtusis callosio-apiculatis, interioribus paulo minoribus interdum abortivis; gynoeceo calycem sub anthesi multum excedenti 2.5-4 mm. longo, ovario vadose 5- vel 6-sulcato apice haud constricto, loculis 5 vel 6, columna stylari cylindrica 2-3 mm. longa, lobis 5 vel 6 erectis 0.5-1.2 mm. longis obtusis vel leviter emarginatis; capsulis immaturis oblatis 5- vel 6-lobatis ad 4 × 7 mm., calycis lobis et columna stylari persistentibus non accrescentibus. HOLOTYPE: FIJI: VITI LEVU: NAMOSI: *DA 14548*, p. p. (BISH).

FIGURE 128. A & B, *Glochidion collinum*; A, maturing ♀ flower, with 1 calyx lobe removed, showing pilose phase, × 20; B, ♂ flower, with 2 calyx lobes removed, × 20. C & D, *Glochidion atalotrichum*; C, ♀ flower, geniculate on pedicel, the ovary partially concealed by a reduced inner calyx lobe, × 30; D, ♂ flower, with 2 calyx lobes removed, × 30. A from *Gillespie 2734*, B from *Smith 6148*, C & D from *Smith 8747*.



12. *Glochidion multilobum* A. C. Sm., sp. nov.

Frutex vel arbor gracilis 2-4 m. alta omnino subglabra, ramulis subangulatis apicem versus 0.7-1 mm. diametro mox teretibus, stipulis deltoideis subacutis 0.8-1.2 mm. longis caducis; petiolis gracilibus superne angulatis 2-5 mm. longis; foliorum laminis tenuiter chartaceis in sicco fuscis subtus pallidioribus ovatis vel lanceolatis, (3-) 5-8 cm. longis, 1.5-3.5 cm. latis, basi acutis et in petiolium breviter decurrentibus, apice graciliter acuminatis (acumine 5-15 mm. longo callosio-apiculato), pilis minutis paucis laminae pagina inferiore vulgo costa prope basim interdum dispersis, costa supra plana vel vadose sulcata subtus elevata, nervis secundariis utrinsecus 4-7 arcuato-adscedentibus supra planis subtus prominulis, rete venularum immerso subtus obscuro vel subprominulo; inflorescentiis fasciculatis vel breviter amentiformibus, rhachidi gracili ad 2 mm. longa, bracteis deltoideis haud 0.5 mm. longis, floribus 1-3, ♂ et ♀ eadem inflorescentia interdum enatis; florum ♂ pedicellis sub anthesi 2-4 mm. longis, calyce cupuliformi 1.3-2.2 mm. longo, lobis 6 biseriatis oblongo-ellipticis, exterioribus 1-2 mm. longis acutis, interioribus paulo minoribus, antheris 3 columnam dorso adnatis 0.6-0.8 mm. longis, connectivo in lobis 3 obtusis conniventibus producto; florum ♀ pedicellis gracilibus 0.5-1 mm. longis, calyce cupuliformi fere ad basim 6-lobato, lobis biseriatis anguste oblongis acutis, exterioribus 1.5-1.7 mm. longis, interioribus paulo minoribus interdum subabortivis; gynoeccio 2.5-2.8 mm. longo sub anthesi calycem excedenti, ovario oblato 10- vel 11-loculari glabro apice paulo contracto, columna stylari cylindrica tubulosa textura tenui sub anthesi 1.8-2 mm. longa glabra vel obscure puberula, lobis 10 vel 11 haud 0.1 mm. longis obscure emarginatis apicem truncatum columnae tubulosae cingentibus; capsulis oblatis videtur subsessilibus 4-6 × 11-16 mm., cocci 10 vel 11, columna stylari demum decidua sed partem basalem tubulosam relinquenti. HOLOTYPE: FIJI: VANUA LEVU: THAKAUNDOVE: *Smith 606* (BISH).

14. *Glochidion inusitatum* A. C. Sm., sp. nov.

Frutex ad 2 m. altus ubique praeter basim columnae stylaris glaber, ramulis apicem versus subquadrangulibus gracilibus (0.8-1 mm. diametro) mox teretibus, stipulis deltoideis acutis ad 1 mm. longis caducis; petiolis gracilibus leviter canaliculatis 3-5 mm. longis; foliorum laminis crasso-chartaceis in sicco fuscis concoloribus ovato-ellipticis, 3-5 cm. longis, 1.5-2.5 cm. latis, basi acutis et in petiolium decurrentibus, apice obtuse breviter cuspidatis, costa supra paulo impressa vel subplana subtus elevata, nervis secundariis utrinsecus 4-6 curvatis marginem versus anastomosantibus supra planis subtus prominulis, rete venularum immerso; inflorescentiis fasciculatis 1-3-floris paucibracteis, bracteis deltoideis haud 0.5 mm. longis, floribus ♂ et ♀ eadem inflorescentia interdum enatis; florum ♂ immaturorum pedicellis gracilibus ad 1 mm. longis, calyce cupuliformi ad 1.5 mm. longo, lobis 6 biseriatis deltoideo-oblongis obtusis vel subacutis exterioribus 1-1.2 mm. longis, antheris 3 columnam staminalem dorso adnatis 0.3-0.4 mm. longis, connectivo in lobis 3 conniventibus concis producto; florum ♀ sessilibus vel pedicellis ad 0.5 mm. longis portatis, calycibus nunc gamosepalis nunc profunde 6-lobatis, calyce gamosepalo cupuliformi-cylindrico sub anthesi 1.8-2.2 mm. longo et 0.7-0.9 mm. diametro, lobis 3 oblongis apice rotundatis, sinibus acutis, calyce altero cupuliformi 1.5-2 mm. longo fere ad basim 6-lobato, lobis biseriatis erectis subaequalibus anguste oblongis 1.5-1.8 mm. longis obtusis vel subacutis; gynoeccio sub anthesi 3.5-4.5 mm. longo, ovario breviter cylindrico 3- vel 4-loculari glabro apice subcontracto, columna stylari clavata e calyce protrusa basi in columnam cylindricam 1-1.2 mm. longam 0.3-0.5 mm. diametro pilis pallidis adscedentibus haud 0.1 mm. longis arcte puberulam contracta, columnae stylaris parte distali glabra cylindrica 0.7-1 mm. diametro 3- vel 4-lobata, lobis erectis deltoideis obtusis 0.2-0.4 mm. longis; capsulis non visis. HOLOTYPE: FIJI: VANUA LEVU: MATHUATA: *Smith 1851* (BISH).

FIGURE 129. *Glochidion melvilliorum*; A, young branchlet with stipule, petiole, lower surface of leaf blade, and inflorescence with a single immature ♀ flower, × 10; B, ♀ flower, with 2 calyx segments removed, × 20; C, maturing ♀ flower, showing glabrate calyx and 4 elongating, essentially free styles, × 20; D, capsule with 4 cocci and 4 styles (1 broken), the spatheaceous calyx persisting at base, and a maturing flower above the fruit with 5 styles, × 6; E, capsule with 3 cocci and 3 styles, × 6. A & B from *DA 12672*, C-E from *O. & I. Degener 32166*.

16. *Glochidion collinum* A. C. Sm., sp. nov.

Arbor ad 10 m. alta, partibus vegetativis glabris vel interdum pilis ad 1 mm. longis ornatis; petiolis 1-3 mm. longis superne anguste alatis; foliorum laminis chartaceis vel subcoriaceis in sicco fuscis concoloribus vel subtus paulo pallidioribus, oblongis vel oblongo-ellipticis, (3-) 4-6.5 cm. longis, (1.5-) 2-3 cm. latis, basi obtusis vel rotundatis vel obscure subcordatis, apice acutis vel acumine haud 5 mm. longo cuspidatis, glabris vel costa et nervis pilos paucos gerentibus, costa utrinque elevata, nervis secundariis utrinsecus 4-7 curvato-adscedentibus utrinque prominulis, rete venularum subtus interdum prominulo; inflorescentiis 2-5-floris fasciculatis vel breviter amentiformibus, rhachidi ad 1.5 mm. longa paucibracteata, bracteis deltoideis obtusis haud 0.5 mm. longis, floribus ♂ et ♀ eadem inflorescentia plerumque enatis; florum ♂ pedicellis 1.5-2 mm. longis, calyce cupuliformi ad 2 mm. longo, lobis 6 biseriatis exterioribus oblongis callosio-apiculatis ad 1.5 mm. longis, interioribus paulo minoribus, antheris 3 columnam staminalem dorso adnatis ad 0.5 mm. longis, connectivo in lobis 3 conniventibus producto; floribus ♀ sessilibus vel pedicellis ad 0.5 mm. longis, calyce cupuliformi 1.5-2.5 mm. longo fere ad basim 6-lobato, lobis biseriatis erectis ubique glabris vel minute puberulis, exterioribus oblongo-deltoideis callosio-mucronulatis 1.5-2 mm. longis, interioribus paulo minoribus; gynoecio glabro vel fere ad apicem pilis haud 0.05 mm. longis adpresso-puberulo sub anthesi calyce paulo excedenti, ovario oblato 3- vel 4-loculari apice constricto, columna stylari crassa cylindrico-conica stylorum partibus liberis inclusis 1.5-2.2 mm. longa fere ad medium in stylis 3 vel 4 erectis vel subcurvatis subacutis vel minute emarginatis divisa; capsulis juvenibus oblatis ad 5 × 8 mm. glabris vel parce adpresso-puberulis 3- vel 4-lobatis, columna stylari non accrescenti basim versus saepe pilosa. HOLOTYPE: FIJI: VITI LEVU: NAITASIRE: *Smith 6148* (BISH).

9. *Bischofia* Bl. *Bijdr. Fl. Ned. Ind.* 1168. 1826 or 1827; Airy Shaw in *Kew Bull.* 18: 253. 1965.

Bischofia Bl. ex Dec. in *Orbigny, Dict. Univ. Hist. Nat.* 2: 639. 1842; Seem. *Fl. Vit.* 221. 1867; Pax & Hoffm. in *Pflanzenr.* 81 (IV. 147. XV): 312. 1922, in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. 19c: 78. 1931.

Dioecious or rarely monoecious trees, without milky latex, the stipules membranaceous; leaves alternate, spirally arranged, long-petiolate, trifoliolate, the leaflets unequally petiolulate, with serrulate blades; inflorescences axillary toward apices of branchlets, many-flowered, paniculate, the ♂ copiously branched, the ♀ sometimes subracemose; flowers small, actinomorphic, without petals or disk; ♂ flowers with 5 sepals, these free, subvalvate, cucullate, at length reflexed, the stamens 5, opposite sepals, the filaments short, connate to base of a rudimentary pistil, the anthers large, introrse, 2-locular, at first enclosed by the hooded sepals, the pistillode short-stipitate, broad, peltate; ♀ flowers with 5 imbricate, caducous sepals, the staminodes lacking or minute, the ovary superior, usually 3-locular (rarely 2- or 4-locular), the ovules 2 per locule, collateral, the style short, the stigmas usually 3 (rarely 2 or 4), elongate, linear-subulate, entire, spreading or reflexed; fruit small, baccate, subglobose, the endocarp thin, crustaceous, the seeds 3-6 per fruit, the testa smooth, the endosperm copious.

TYPE SPECIES: *Bischofia javanica* Bl.

DISTRIBUTION: A monotypic genus occurring from India and central China throughout Malesia and eastward into the Pacific. Its precise eastern boundary as an indigenous genus is questionable, but presumably it occurs naturally as far east as Samoa, Tonga, and Niue. Since the sole species has many uses, it may have been an aboriginal introduction into such archipelagoes as the Cook and Society Islands (but here also it may be indigenous). In Hawaii it is considered an introduction.

USEFUL TREATMENT OF GENUS: Airy Shaw, *H. K. Bischofiaceae*. *Kew Bull.* 18: 252-254. 1965.

The placement of *Bischofia* in the Euphorbiaceae has often been questioned, most recently by Airy Shaw, who has proposed for it the family Bischofiaceae. He believes it related to the family Staphyleaceae (order Sapindales, subclass Rosidae). Webster (1967, cited above under the family, p. 312), while retaining *Bischofia* in the Euphorbiaceae, believes that it is somewhat anomalous and that Airy Shaw's proposal of a separate family may be justifiable.

Bischofia was named for G. W. Bischoff, and the generic name has been altered to *Bischoffia* by Decaisne and many subsequent botanists. However, Blume's spelling was doubtless an intentional latinization and should be preserved (ICBN, Art. 73.7).

1. ***Bischofia javanica*** Bl. Bijdr. Fl. Ned. Ind. 1168. 1826 or 1827; Drake, Ill. Fl. Ins. Mar. Pac. 288. 1892; Guillaumin in J. Arnold Arb. 13: 91. 1932; Christophersen in Bishop Mus. Bull. 128: 121. 1935; Yuncker in op. cit. 184: 46. 1945, in op. cit. 220: 161. 1959; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 177. fig. 52. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 86. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 329. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 92. 1972.

Bischoffia sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Bischoffia javanica Bl. ex Seem. Fl. Vit. 221. 1867; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 313. fig. 26. 1922, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 78. fig. 38. 1931.

As it occurs in Fiji, *Bischofia javanica* is an often spreading tree 5–30 m. high, with copious colorless latex and with a trunk up to 70 cm. in diameter, found from near sea level to an elevation of 900 m. in forest or on its edges, in thickets, or on grassy slopes. The sepals are cream-colored to pale green or pale yellow; the stamens have pale green filaments and yellow anthers, and the fruits when mature vary from pinkish to dull red and orange-brown. Flowers have been obtained between September and March, while fruits persist throughout the year.

TYPIFICATION: Presumably the holotype is a Blume (L) specimen from Java.

DISTRIBUTION: As stated for the genus; some 50 Fijian collections are at hand.

LOCAL NAMES AND USES: The usual Fijian names are *koka* or *tongotongo*, but also recorded are *koka ndamu*, *tongo*, *tongatonga*, and *tea*. The plant is well known to Fijians as a timber tree, providing hard and durable posts. The bark is said to have medicinal properties, and one collector notes the fruits as edible. In other areas, including Samoa, the Horne and Wallis Islands, and Tonga, a red-brown dye is prepared from the bark and is widely used on tapa, but this usage has not been reported in Fiji.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 345*; north of Natalau, *Degener 14990*; vicinity of Nandarivatu, *Gillespie 4266*; Mt. Nanggaranambuluta, *Tothill 750*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 1001 (S1551/3)*; vicinity of Mbelo, near Vatukarasa, *Degener 15218*. SERUA: Inland from Namboutini, *DF 984 (Damanu 175)*; inland from Ngaloa, *DF 1002 (S1551/4)*; Navua River, *Seemann 417*. NAMOSI: Wainivisoa Creek, near Navunikambi, *DA 14988*; vicinity of Namosi, *Parks 20260*. RA: Mountains near Penang, *Greenwood 345A*. NAITASIRI: Vicinity of Vunindawa, *DA 10038*; between Viria and Muamua, *DA 53*; Waindina River, *MacDaniels 1044*; Waimanu River, *DA L13265 (Berry 26)*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7223*. OVALAU: Mountains near Levuka, *Horne 395*. KORO: Eastern slope of main ridge, *Smith 1058*. VANUA LEVU: MATHUATA: Naravuka, Ndreketi River, *DF 994 (S1551/1)*. THAKAUNDROVE: Wainigata Station, *DA 12004*. RAMBI: *Horne s. n.* TAVEUNI: Vicinity of Wairiki, *Gillespie 4670*. LAKEMBA: Tumbou Valley, *Garnock-Jones 861*.

10. **AUSTROBUXUS** Miq. Fl. Ned. Ind. Suppl. 444. 1861; v. Steenis in Blumea 12: 362. 1964; Airy Shaw in Kew Bull. 29: 308. 1974.

Longetia Baill. in Adansonia 2: 228, nom. nud. 1862, in op. cit. 6: 352. 1866; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 75. 1931.

Buraevia Baill. in Adansonia 11: 83. 1873; A. C. Sm. in J. Arnold Arb. 36: 280. 1955. Nom. cons. non nisi vs. *Bureava* Baill. (1861).

Dioecious or rarely monoecious trees or shrubs, glabrous, without milky latex or stipules; leaves opposite or alternate, short-petiolate, the blades chartaceous to coriaceous, entire; inflorescences axillary or arising from defoliate nodes, bracteate, the

flowers short-pedicellate, the sepals 4-8, usually biseriate, the petals lacking; ♂ inflorescences compactly cymose, several-flowered, sometimes 2 or 3 superposed, the flowers with a minute, obscure, pulvinate disk, the stamens 2-25, the filaments short, the anthers subglobose-oblong, 2-locular, longitudinally and extrorsely dehiscent, a rudimentary pistil small or lacking; ♀ inflorescences congested (cymose, rarely racemose), the flowers several (rarely 1), fasciculate, with an inconspicuous, cupuliform disk surrounding base of ovary, this 2-4-locular, the ovules 2 (rarely 1) per locule, collateral, carunculate, the stigmas sessile or on a very short, thick style, distinct or discoid-pulvinate; pedicels in fruit slightly elongating and sepals persistent, the fruit a dry capsule (rarely drupaceous and 1-seeded), the exocarp thin, subcoriaceous, separating from endocarp, this breaking into 2-valved mericarps, the persistent columella dilated proximally, the seeds usually 2 per mericarp, usually carunculate or arillate, with a smooth, dry, nitid testa.

TYPE SPECIES AND NOMENCLATURE: Each of the three genera listed above was based on a single species: *Austrobuxus* on *A. nitidus* Miq., *Longetia* on *L. buxoides* Baill., and *Buraveavia* on *B. carunculata* (Baill.) Baill. (*Baloghia carunculata* Baill.). The genera *Longetia* and *Buraveavia* were maintained as distinct by Bentham and Hooker (Gen. Pl. 3: 280. 1880) and by Guillaumin (Fl. Nouv.-Caléd. 175, 181. 1948). However, Pax and Hoffman (in Pflanzenr. 81 (IV. 147. XV): 289. 1922, and again in 1931, cited above) combined the genera under the earlier name, *Longetia*. The differences, if both genera were to be retained, are not conspicuous; *Buraveavia* is said to have an inconspicuous disk in both ♂ and ♀ flowers, but the absence of such a disk from at least the ♀ flowers of *Longetia* was apparently due to an erroneous observation. *Longetia* was noted as a synonym of *Austrobuxus* by van Steenis (1964, cited above), who proposed conservation of the former name (in Regnum Veg. 34: 59. 1964). This suggestion was not acceptable to the Committee for Spermatophyta (in Taxon 16: 228. 1967), which considered the name *Longetia* not sufficiently significant for conservation. Van Steenis made a second proposal to conserve *Longetia* (in Taxon 18: 341-342. 1969), which was also rejected by the Committee for Spermatophyta (in Taxon 20: 385. 1971). Therefore *Austrobuxus* must be used for the present generic concept. The necessary new combinations have been made and several novelties described by Airy Shaw.

DISTRIBUTION: Malaya and Sumatra to eastern Australia, New Caledonia, and Fiji, where an endemic species terminates the range. Sixteen species are now assigned to the genus (Airy Shaw, 1974, cited below).

USEFUL TREATMENTS OF GENUS: Airy Shaw, H. K. New combinations and new taxa in *Austrobuxus* Miq. Kew Bull. 25: 506-510. 1971. Airy Shaw, H. K. New species of *Austrobuxus* Miq., with a key to the whole genus. op. cit. 29: 303-309. 1974.

1. *Austrobuxus horneanus* (A. C. Sm.) Airy Shaw in Kew Bull. 23: 342. 1969; J. W. Parham, Pl. Fiji Isl. ed. 2. 177. 1972. FIGURE 130.

Buraveavia sp. Benth. & Hook. f. Gen. Pl. 3: 280. 1880; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 291. 1922.

Buraveavia horneana A. C. Sm. in J. Arnold Arb. 33: 374. 1952, in op. cit. 36: 280. 1955; J. W. Parham, Pl. Fiji Isl. 125. 1964.

FIGURE 130. *Austrobuxus horneanus*; A, distal portion of branchlet, with ♂ inflorescences, × 1/3; B, young ♂ inflorescence, × 10; C, androecium of young ♂ flower, with 1 outer sepal remaining, × 30; D, infructescence, with 2 dehiscent fruits and the persistent columellas of others, × 2; E, arillate seeds dependent from apex of persistent columella, × 10. A-C from DA 12873, D from Smith 6669, E from DA 12849.



A tree or shrub 2-10 m. high, occurring at elevations of 100-600 m. in forest, in patches of forest in open country, or on hillside slopes. The young inflorescences are yellowish green, the sepals yellow, the mature fruit dull red or black, and the seeds bright red. Flowers have been obtained in October and December, fruits in March, July, August, November, and December.

TYPIFICATION: The type of *Buraeavia horneana* is *Smith 6872* (A HOLOTYPE; many ISOTYPES), collected Dec. 6, 1947, on the Seangangga Plateau in drainage of the Korovuli River, vicinity of Natua, Mathuata Province, Vanua Levu. The specific epithet refers to the Horne collection cited below, the first known collection of the species, discussed but not named by Bentham and Hooker (1880, cited above).

DISTRIBUTION: Endemic to Fiji and thus far known only from central Vanua Levu, probably limited to the area drained by the Ndreketi River. Horne's specimen indicates an altitude of about 600 m. and hence was probably collected near the divide between Mathuata and Thakaundrove Provinces, most likely in the Ndreketi River drainage, although no village of Lomaloma seems still to exist where shown on Horne's map (cf. Horne, *A Year in Fiji*, 19. 1881).

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Near Mbasakalave, Ndreketi District, *Stauffer & Kuruvoli 5848*; vicinity of Korovuli, *DA 12873, 13434*; vicinity of Natua, *Smith 6669, DA 12849*; Nasautha (?Nasuva, near Nasuva River, a tributary of Ndreketi River), *DA 13477*. MATHUATA or THAKAUNDROVE: Between Waiwai and Lomaloma, *Horne 600*.

The relationship of *Austrobuxus horneanus* (Airy Shaw, 1974, cited above under the genus) is with the Malesian *A. nitidus* Miq. and *A. montanus* (Ridley) Airy Shaw rather than with any New Caledonian species.

11. *Petalostigma* F. v. Muell. in Hook. J. Bot. Kew. Gard. Misc. 9: 16. 1857; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 281. 1922, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 74. 1931.

Dioecious trees or shrubs, the stipules minute, the indument often copious, of simple hairs; leaves alternate, short-petiolate, the blades entire, penninerved; inflorescences axillary, fasciculate (♀ flowers solitary or few), the flowers short-pedicellate, apetalous, without a disk; ♂ flowers with 4-6 imbricate sepals, the stamens 20-30, the filaments connate into a column, free distally, the anthers erect, elongate, 2-locular, longitudinally and extrorsely dehiscent, apiculate, a rudimentary pistil lacking; ♀ flowers subtended by 2-4 bracts, the sepals as in ♂ flowers but narrower and soon caducous, the ovary 4 (rarely 3-)locular, the ovules paired in each locule, the styles (3 or) 4, the stigmas broad, often petaloid, undulate or lacinate, spreading, revolute, carnose; capsule simulating a drupe, at length breaking into 2-valved cocci, the exocarp carnose, the endocarp hard, the seeds carunculate, nitid, the cotyledons broad, flat.

TYPE SPECIES: *Petalostigma quadriloculare* F. v. Muell.

DISTRIBUTION: Australia and southern New Guinea, with six or seven species, one of which has been cultivated in Fiji.

1. *Petalostigma quadriloculare* F. v. Muell. in Hook. J. Bot. Kew Gard. Misc. 9: 17. 1857; Pax & Hoffm. in Pflanzenr. 81 (IV. 147. XV): 282. fig. 22 (as var. *pubescens*). 1922; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 10: 116. 1939.

A small or medium-sized tree, said by Parham (cited above) to have been introduced in 1938 and to be growing in 1939 on the property of W. L. Wallace, Tovu Island, Ra Province, Viti Levu.

TYPIFICATION: The type is a Mueller collection from northern Australia. Pax and Hoffman (1922, cited above) cite Mueller specimens from Arnhem Land (Northern Territory) and Cooktown (northern Queensland).

DISTRIBUTION: Northern and eastern Australia. No voucher supports the record of cultivation in Fiji, but the species may persist there.

LOCAL NAMES: Parham lists the names *quinine berry*, *bitter bark*, *emu apple*, and *wild quince*.

12. *RICINUS* L. Sp. Pl. 1007. 1753; Seem. Fl. Vit. 229. 1867; Pax & Hoffm. in Pflanzenr. **68** (IV. 147. XI): 119. 1919, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c**: 149. 1931.

Monoecious shrubs or small trees (or annuals in temperate areas), with watery sap, the stipules forming a sheath, caducous, leaving an annular scar; leaves alternate, the petiole elongate, the blade peltate, palmately 7-11-lobed, serrate at margin; inflorescences terminal (but due to sympodial growth appearing axillary and leaf-opposed), narrowly paniculate, bearing cymules of ♂ flowers at proximal nodes and of ♀ (or both ♂ and ♀) flowers distally, the flowers lacking petals and disk, the calyx synsepalous in bud and valvately 3-5-partite at anthesis; ♂ flowers with numerous (up to 1,000) introrse anthers, the filaments partially connate at base and irregularly branched, a rudimentary pistil lacking; ♀ flowers without staminodes, the ovary 3-locular, usually spinose-muricate, the ovules 1 per locule, anatropous, the styles connate proximally, bifid, with usually conspicuously papillate branches; fruit a globose or ellipsoid schizocarp, usually echinate, the columella distally dilated, the seeds subcompressed, smooth, carunculate, usually mottled, explosively dispersed, the endosperm copious, the cotyledons foliaceous.

TYPE SPECIES: *Ricinus communis* L.

DISTRIBUTION: Indigenous in Africa but early introduced into the Middle East and Asia, with a single very variable species often divided into many varieties and now widely cultivated and naturalized.

USEFUL TREATMENTS OF GENUS: Webster, G. L. *Ricinus*. J. Arnold Arb. **48**: 379-385. 1967. Purseglove, J. W. *Ricinus* L. Trop. Crops, Dicot. 180-186. 1968.

1. *Ricinus communis* L. Sp. Pl. 1007. 1753; Seem. in Bonplandia **9**: 259. 1861, Viti, 441. 1862; Muell. Arg. in DC. Prodr. **15** (2): 1017. 1866; Seem. Fl. Vit. 229. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 293. 1892; Pax & Hoffm. in Pflanzenr. **68** (IV. 147. XI): 119. fig. 29. 1919; Greenwood in Proc. Linn. Soc. **154**: 104. 1943; Yuncker in Bishop Mus. Bull. **178**: 74. 1943; B. E. V. Parham & Charlton in Agr. J. Dept. Agr. Fiji **18**: 18. 1947; Yuncker in Bishop Mus. Bull. **220**: 164. 1959; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 74. fig. 34. 1959, Pl. Fiji Isl. 131. 1964, ed. 2. 188. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 95. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 54. 1972.

As seen in Fiji *Ricinus communis* is a shrub 1-4 m. high (sometimes becoming a tree to 10 m. high), found at elevations from near sea level to 200 m. or probably higher, cultivated in villages and gardens and also naturalized in thickets and waste places and along roadsides. The calyx is pale green, the stamens are white or yellow, and the stigmatic surfaces are red. Flowers and fruits occur throughout the year.

TYPIFICATION: Linnaeus cited several prior references, including his own *Hortus Cliffortianus*, *Flora Zeylanica*, and *Hortus Upsaliensis*.

DISTRIBUTION: As of the genus. It was probably an aboriginal introduction into Fiji, having been observed in many areas, including interior Viti Levu, by Seemann.

LOCAL NAMES AND USES: *Mbele ni vavalangi*, *toto ni vavalangi*, and *utouto* are recorded Fijian names for the *castor oil plant* or *castor bean plant*. Although at present *Ricinus communis* seems to be grown in Fijian gardens as an ornamental, its seeds are of economic importance for their high content of castor oil, which has well-known medicinal uses as a purgative. Castor oil also has many industrial applications, being used in the manufacture of lubricants, soaps, inks, textile dyes, paints, waxes, etc. The seed coats are extremely poisonous and may be fatal to humans if eaten.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Upper Singatoka Valley, DA 11358; near Thuvu, west of Singatoka, DA 10269. SERUA: Hills east of Navua River, near Nukusere, Smith 9152. REWA: Samambula, Suva, DA 5866. VANUA LEVU: MATHUATA: Lambasa, Greenwood 643. TAVEUNI: Waimanggere Estate, DA 11518. FIJI without further locality, Seemann 401, DA 4000.

13. MACARANGA Thou. Gen. Nova Madagasc. 26. 1806; Seem. Fl. Vit. 227. 1867; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 298. 1914, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 128. 1931; A. C. Sm. in J. Arnold Arb. 33: 376. 1952.

Monoecious or dioecious trees or shrubs, the stipules often conspicuous, the indument composed of simple hairs; leaves alternate (spirally arranged), sometimes long-petiolate, the blades often peltate (in our species only rarely epeltate), entire (in all our species) or palmately divided, often copiously glandular at least on lower surfaces; inflorescences axillary or borne on defoliate branchlets, spiciform, racemiform, or paniculiform, bracteate, some of the bracts often patelliform-glandular, the flowers apetalous and lacking a disk, the sepals valvate in bud; ♂ flowers clustered, minute, the calyx subglobose to clavate in bud, 3- or 4-lobed or -partite, the stamens 1-30 (in our species 3-15), the anthers 3- or 4-locular, the connectives not prolonged apically, a rudimentary pistil lacking; ♀ flowers sometimes solitary along axis of inflorescence, the calyx cupuliform to urceolate, subentire, dentate-lobed, or deeply divided, persistent, the staminodes none, the ovary 1-6-locular (2- or 3-locular in our species), the ovules 1 per locule, the styles (2 or 3 in our species) linear-subulate, unlobed; fruit a loculicidally dehiscent capsule or a schizocarp, often muricate or tuberculate, the seeds with a fleshy testa, ecarunculate.

LECTOTYPE SPECIES: L. C. Wheeler (in Taxon 24: 537. 1975) indicated *Macaranga roxburghii* Wight (1853) as the lectotype species, considering it to be the earliest validly published binomial assigned to the genus. However, M. J. E. Coode (in Taxon 25: 184. 1976) pointed out that *M. roxburghii* is an Indian species and could not have been part of Du Petit-Thouars's "original material" (cf. ICBN, Art. 7.5). The species Thouars had in hand were Madagascan and Mauritian, and therefore Coode proposes as the lectotype species *M. mauritiana* Bojer ex Muell. Arg. in DC. (1866).

DISTRIBUTION: Tropical Africa and Madagascar throughout Indo-Malesia to Australia and into the Pacific at least to the Society Islands (but not to Hawaii), with 300 or more species. Nine species occur indigenously in Fiji, seven of them being endemic.

USEFUL TREATMENT OF GENUS: Smith, A. C. Macaranga Thou. J. Arnold Arb. 33: 376-390. 1952.

As noted in my 1952 discussion, Pax and Hoffmann (1931, cited above, pp. 128-134) utilized combinations of many characters to recognize 36 sections within *Macaranga*. In spite of the considerable choice thus proffered, two of our species, *M. graeffeana* and *M. vitiensis*, cannot be fitted into a section, while the remaining species fall into either sect. *Adenoceras* or sect. *Eumappa*. It is probable that an ultimate revision of the genus will provide more natural groupings. Some Malesian and Asian species of *Macaranga* are common elements of secondary forest, and a few have

hollow, ant-inhabited stems. In Fiji, however, the genus is clearly an element of the indigenous forest and of high ridges, and the species have solid stems.

KEY TO SPECIES

Fruits smooth or tuberculate with oblong-conical processes not more than 2 mm. long; inflorescence bracts (at least the larger ones) patelliform-glandular; styles 2, divaricate, not more than 3 mm. long.

Inflorescence branches, bracts, pedicels, and at least the ♀ calyces persistently tomentellous or spreading-puberulent; fruits smooth.

Leaf blades spreading-pilose on both surfaces with soft, persistent hairs 0.3–1 mm. long, the hairs of the inflorescence indument 0.5 mm. long or more, the ♂ calyx glabrous; stamens 12–15; stipules, branchlets, and petioles copiously pilose with hairs 0.4–1.3 mm. long. . . . 1. *M. membranacea*

Leaf blades glabrous or with the nerves beneath (and rarely above) puberulent or tomentellous, the hairs of the inflorescence indument minute, rarely more than 0.3 mm. long, the ♂ calyx with a similar but sparser indument, at length glabrate; stamens 6–11; stipules, branchlets, and petioles usually glabrous, sometimes short-pilose. . . . 2. *M. seemannii*

Inflorescence branches, bracts, pedicels, and calyces glabrous or soon glabrate (the few hairs, if present, scattered and not forming a uniform indument) (or in species no. 4 the inflorescences sometimes hispidulous or setulose-puberulent, but the ♀ calyces merely sparsely sericeous).

Leaf blades broadly ovate to deltoid, less than twice as long as broad; fruits smooth or with processes rarely exceeding 0.5 mm. in length.

Leaves very large, the petioles 12–45 cm. long, the blades 25–60 cm. long, 20–50 cm. broad, broadly peltate (petiole attached 5–10 cm. from basal margin), the veinlets strongly prominulous on lower surface; ♂ inflorescence often 15–30 cm. long, freely branching; developing ovary and fruit smooth.

Stipules oblong-lanceolate, 3–5 × 1.5–2.5 cm.; indument of branchlets, petioles, and lower surfaces of leaf blades comparatively sparse and fugacious, the hairs 0.2–0.6 mm. long; leaves with petioles 22–45 cm. long and blades 34–60 × 23–50 cm.; stamens 12–14. . . . 3. *M. magna*

Stipules elliptic-oblong, about 1.5 × 1 cm.; indument of branchlets, petioles, and lower surfaces of leaf blades copious and persistent, the hairs 1–2.5 mm. long; leaves with petioles 12–23 cm. long and blades 25–45 × 20–35 cm.; stamens 7–11. . . . 4. *M. caesariata*

Leaves smaller, the petioles 5–21 cm. long, the blades (7–) 8–30 cm. long, (4–) 5–23 cm. broad, less broadly peltate (petiole attached 1–6 cm. from basal margin), the veinlets on lower surface plane or merely slightly prominulous; ♂ inflorescence not exceeding 12 cm. in length; stamens 5–10.

Stipules 1–5 cm. long; leaf blades with 5–8 primary nerves; fruits comparatively small, 3.5–5 mm. long, 6–8 mm. broad, often tuberculate. . . . 5. *M. graeffeana*

Stipules 5–7 cm. long, 12–18 mm. broad, glabrous; branchlets and petioles glabrous, the petioles (13–) 15–19 cm. long; leaf blades broadly ovate, 13–17 × 12–16.5 cm., the petiole attached 3–4.5 cm. from basal margin, the primary nerves 8–10, the margin closely callose-crenulate; fruits comparatively large, the mature capsules 6–10 mm. long, 9–16 mm. broad, smooth or very rarely with a few scattered conical tubercles 0.1–0.4 mm. long. . . . 6. *M. marikoensis*

Leaf blades deltoid- or ovate-lanceolate, averaging 2.5–3 times as long as broad (13–55 × 4–20 cm.); fruits copiously tuberculate with oblong-conical processes 0.5–2 mm. long; stamens 3–6.

7. *M. vittensis*

Fruits ornamented with somewhat flattened processes 1.5–8 mm. long; inflorescence bracts not patelliform-glandular; inflorescence branches, bracts, pedicels, and calyces copiously puberulent or short-pilose.

Flower-subtending bracts of ♂ inflorescences 2–4 mm. long, entire; stamens (4–) 6–9; fruits with processes 3–8 mm. long and with 3 styles, these 4–10 mm. long, ascending to spreading, copiously papillose; lower surfaces of leaf blades with yellowish, golden, or pale brown glands, these sometimes few or lacking. . . . 8. *M. harveyana*

Flower-subtending bracts of ♂ inflorescences 4–10 mm. long, at least the larger ones fimbriate-dentate; stamens 3–5; fruits with processes 1.5–3 mm. long and with 2 styles, these 1.5–4 mm. long, divaricate and appressed to fruit apex, not or inconspicuously papillose; lower surfaces of leaf blades usually with copious dark reddish brown or blackish glands. . . . 9. *M. secunda*

1. *Macaranga membranacea* Muell. Arg. in DC. Prodr. 15 (2): 996. 1866; Seem. Fl. Vit. 228. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 293. 1892; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 393. 1914; A. C. Sm. in J. Arnold Arb. 33: 378. 1952; J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972. FIGURE 131.

Mappa sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Tanarius membranaceus Kuntze, Rev. Gen. Pl. 2: 620. 1891.

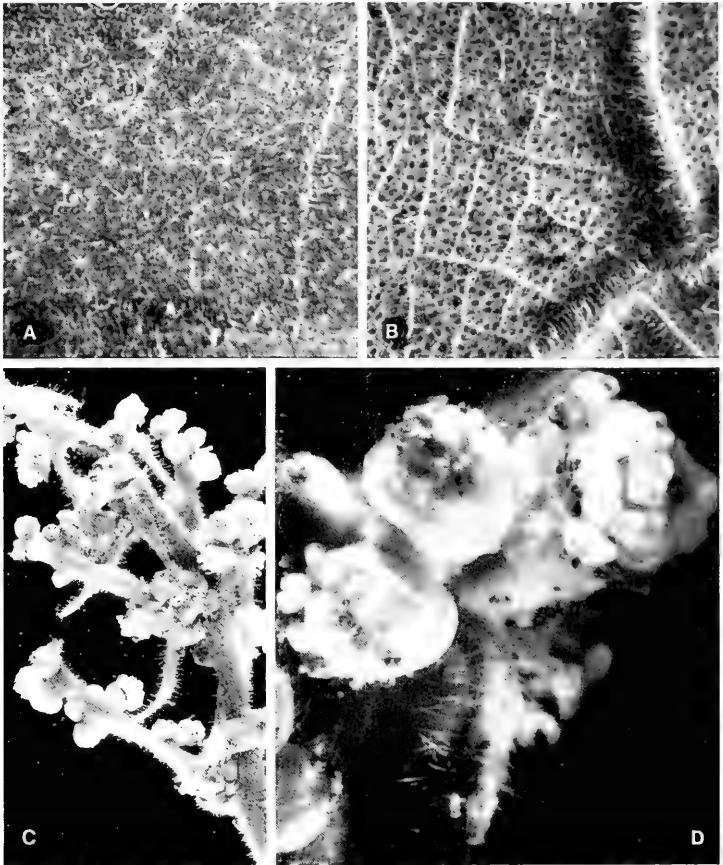


FIGURE 131. *Macaranga membranacea*; A, portion of upper surface of leaf blade, $\times 10$; B, portion of lower surface of leaf blade, $\times 10$; C, portion of σ inflorescence, $\times 4$; D, cluster of σ flowers in axil of a bract, each glandular calyx when open disclosing 12-15 stamens, $\times 20$. A & B from *DA 13453*, C & D from *Smith 6641*.

A tree 5–8 m. high, with pale yellow latex turning red on exposure, occurring from near sea level to an elevation of 200 m. in forest or on its edges or in patches of forest in open country. The calyx and filaments are pale greenish yellow and the fruits, as far as available, are green. Dated flowering specimens have been obtained in November and December, fruiting specimens in July.

TYPIFICATION: The type is a U. S. Exploring Expedition specimen, collected in Fiji in 1840 but without detailed locality, presumably deposited at G. An isotype is available at GH. No isotype has been located at US. The type material is from a sterile plant, but the specimens cited below unmistakably agree with it.

DISTRIBUTION: Endemic to Fiji and known with certainty only from western and northern Vanua Levu.

LOCAL NAMES: The name *mama* was referred to my collections from the Seangangga Plateau. Other recorded names are *lutulutu* and *ovutu*, noted by H. B. R. Parham, presumably used in western Vanua Levu.

AVAILABLE COLLECTIONS: VANUA LEVU: MBUA: Vicinity of Nasau, Rukuruku Bay, *H. B. R. Parham 19, 28*; woods above Nandi Bay, *Milne 233*. MATHUATA: Ndreketi River, *DA 13453*; Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6641, 6707*; Mt. Numbuloa, east of Lambasa, *DA 14644*; "Mathuata coast," *Greenwood 654*. VANUA LEVU without further locality, *H. B. R. Parham 342*. FIJI without further locality, *Seemann 420*.

2. **Macaranga seemannii** (Muell. Arg.) Muell. Arg. in DC. Prodr. **15** (2): 999, as *M. seemanni*. 1866; A. C. Sm. in J. Arnold Arb. **33**: 378. 1952.

Macaranga seemannii, in which I recognize three varieties, is a well-marked species closely related only to *M. membranacea*, from which it differs in having its leaf blades glabrous or essentially so, its inflorescence indument shorter, and its stamens fewer. The indument of the ♀ and fruiting pedicels and calyces is characteristically ferruginous, dense, and closely tomentellous, whereas the corresponding indument of *M. membranacea* is composed of longer, spreading hairs.

DISTRIBUTION: Fiji, Tonga, and Niue.

KEY TO VARIETIES

- Stipules oblong-lanceolate, 1.5–4 cm. long, 5–15 mm. broad; petioles 9–27 (–30) cm. long; leaf blades broadly ovate, usually 13–40 × 8.5–25 cm., rounded at base, broadly peltate (petiole attached 2.5–8 cm. from basal margin); infructescence 3–12 cm. long.
- Branchlets and petioles glabrous or with a few scattered hairs, not uniformly soft-pilose; stipules 5–10 mm. broad, glabrous or puberulent without when young; petioles 9–18 (–30) cm. long; primary nerves of leaf blades 6–8; hairs of inflorescence indument 0.1–0.2 mm. long. 2a. var. *seemannii*
- Branchlets and petioles copiously soft-pilose; stipules 8–15 mm. broad, puberulent on both surfaces or glabrate distally; petioles (10–) 16–27 (–30) cm. long; primary nerves of leaf blades 8 or 9; hairs of inflorescence indument 0.2–0.4 mm. long. 2b. var. *capillata*
- Stipules narrowly oblong-lanceolate, 1–2 cm. long, 3–4 mm. broad, copiously spreading-pilose on both surfaces; branchlets and petioles densely tomentellous-puberulent, the petioles 8–12 cm. long; leaf blades ovate-deltoid, 10–19 × 6–13 cm., rounded-truncate at base, less broadly peltate (petiole attached 1.5–2.5 cm. from basal margin); infructescence 2–3 cm. long. 2c. var. *deltoides*

2a. **Macaranga seemannii** var. *seemannii*; A. C. Sm. in J. Arnold Arb. **33**: 379. 1952; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 92. fig. 7. 1970.

FIGURE 132A.

Mappa sp. Seem. in Bonplandia **9**: 258, 259. 1861, Viti, 441. 1862.

Mappa seemanni Muell. Arg. in Flora **47**: 468. 1864.

Macaranga seemanni Muell. Arg. in DC. Prodr. **15** (2): 999. 1866; Seem. Fl. Vit. 228. 1867.

Tanarius seemannii Kuntze, Rev. Gen. Pl. **2**: 620. 1891.

Macaranga seemanii Muell. Arg. ex Drake, Ill. Fl. Ins. Mar. Pac. 293. 1892; Hemsl. in J. Linn. Soc. Bot. 30: 192. 1894; Pax & Hoffm. in Pflanzenz. 63 (IV. 147. VII): 336. 1914; Yuncker in Bishop Mus. Bull. 220: 162. 1959.

Macaranga seemanni var. *seemanni*; J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972.

The typical variety of *Macaranga seemanii* is a tree 4–20 m. high, with a straight trunk up to 1 m. in diameter, and with thin, colorless or yellowish latex, occurring at elevations from near sea level to 1,150 m. in dense forest or on its edges, in thin forest among reeds, or in thickets. Its calyx is pale yellow, dull yellowish green, or greenish white, its filaments and styles pale yellow, and its fruits greenish yellow. Flowers and fruits have been noted throughout the year.

LECTOTYPIFICATION: Mueller originally cited three Fijian specimens, all deposited at K: *Harvey s. n.*, *Seemann 397*, and *Seemann 419*. The Harvey specimen (BM, GH, K) is without detailed locality and is represented only by detached leaves and fruiting branchlets. *Seemann 397*, also without further locality, is represented by two good sheets at K. *Seemann 419* (BM, GH, K) is a good collection but with very immature flowers; the K sheet is noted as from Taveuni. I herewith designate as the lectotype the two complementary sheets of *Seemann 397* at K (ISOLECTOTYPES at BM, GH), collected in 1860 in Fiji without detailed locality.

DISTRIBUTION: Fiji, Tonga, and Niue. I have examined 45 collections from Fiji; Sykes notes that this variety is a very common tree in the inland Niue forests.

LOCAL NAMES AND USES: Recorded Fijian names are *ndavo*, *mama*, *velutu*, and *ngandoa*; on Niue this variety, var. *capillata*, and *M. harveyana* are all recognized by different local names (Sykes, 1970, cited above). The timber is used for construction and also for firewood, and in the Yasawas unspecified parts of the plant are used medicinally to procure abortions.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Wailevu Creek, *St. John 18074*. VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1197*; slopes of escarpment north of Nandarivatu, *Smith 6028*; valley of Nggaliwana Creek, near Navai, *Webster & Hildreth 14125*; western and southern slopes of Mt. Tomanivi, *Smith 5212*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5637*. SERUA: North of Korovou, *St. John 18923*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8404*; vicinity of Namuamua, *Gillespie 3049*; Wainandoi River, *DA 8360*. NAITASIRI: Nasonggo, *DA 15325*; vicinity of Matawailevu, Wainimala River, *St. John 18183*; Waimanu River, *DA L.13266 (Berry 60)*; vicinity of Nasinu, *Gillespie 3654*. TALEVU: Naivithula, Wainivesi River, *Valentine 18*. REWA: Near Lami, *Tothill 738*; near Suva Bay, *MacDaniels 1015*. OVALAU: Slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8083*. KORO: *Tothill 697*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7821*. VANUA LEVU: MATHUATA: Southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6546*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4716*. MOALA: Lowland forest, *Bryan 299*.

2b. *Macaranga seemanii* var. *capillata* A. C. Sm. in J. Arnold Arb. 33: 380. 1952; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 92. 1970.

Macaranga seemanni var. *capillata* A. C. Sm. ex J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972.

This variety has been noted as a tree 10–15 m. high, with a trunk up to 25 cm. in diameter and with red or pale latex, found from sea level to an elevation of 450 m. in dense forest or on its edges. The calyx is green or dull yellow and the fruits are green, at length becoming black. Flowers have been obtained in June and August, fruits between August and December.

TYPIFICATION: The type is *Bryan 500* (BISH HOLOTYPE; ISOTYPES at BISH, K, SUVA), collected Aug. 24, 1924, in the central basin of Kambara.

DISTRIBUTION: Known from scattered localities in Fiji and also from Niue; not yet recorded from Tonga but to be anticipated there.

LOCAL NAMES: *Ndavo*; *venua*.

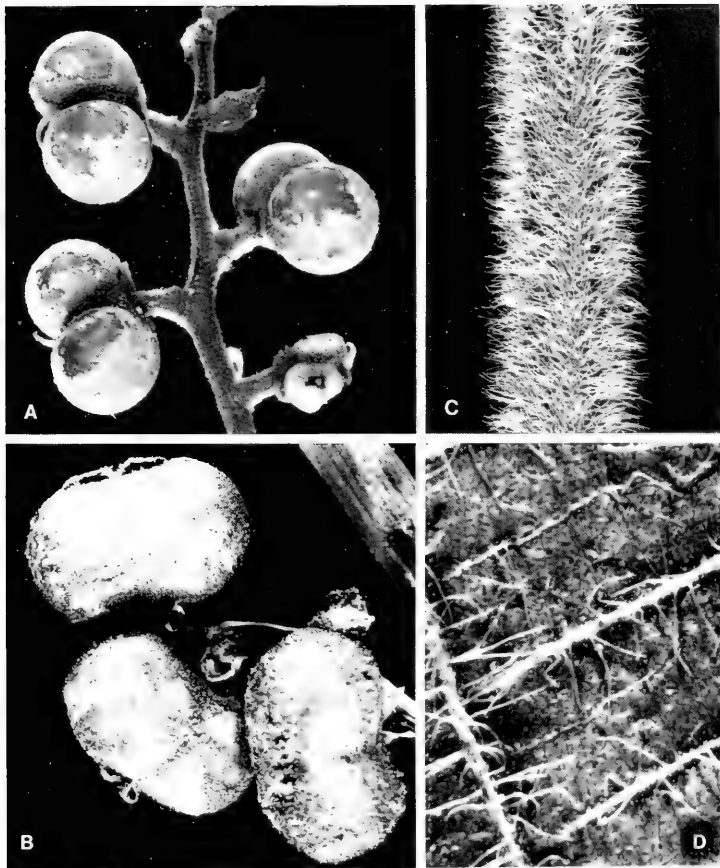


FIGURE 132. A, *Macaranga seemannii* var. *seemannii*, mature fruits, the copious glands of the surface partially shed, $\times 4$, from *St. John 18074*. B, *Macaranga marikoensis*, mature fruits, $\times 4$, from *Smith 447*. C & D, *Macaranga caesariata*, from *Smith 9218*; C, portion of petiole, $\times 4$; D, portion of lower surface of leaf blade, $\times 10$.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Flat coastal strip in vicinity of Ngaloa, *Smith 9488*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 46*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7788*.

Variety *capillata* is not sharply separable from the typical variety of *Macaranga seemannii*, with which it may be sympatric, as on Ngau, but the indument characters utilized in my key seem to warrant its recognition. Sykes (cited above) notes that the Niuean people distinguish the two taxa by different names, and that the leaf blades of var. *seemannii* are shining above and tend to dry a copper-brown color, characteristics not observed in var. *capillata*.

2c. **Macaranga seemannii** var. **deltoidea** A. C. Sm. in J. Arnold Arb. 33: 380. 1952.

Macaranga seemanni var. *deltoidea* A. C. Sm. ex J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972.

A tree about 5 m. high, occurring in dense forest on ridges and spurs at elevations of 670–1,075 m. Flowers have been obtained in January and fruits in June.

TYPIFICATION: The type is *Smith 4669* (A HOLOTYPE; many ISOTYPES), collected June 3, 1947, on the upper slopes of Mt. Koromba, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from only two collections made in upland western Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *O. & I. Degener 32169*.

Of the three varieties of *Macaranga seemannii* here recognized, var. *deltoidea* seems the most sharply marked; although it is inadequately known, it seems not to be sympatric with either of the other varieties.

3. **Macaranga magna** Turrill in Kew Bull. 1924: 393. 1924; A. C. Sm. in J. Arnold Arb. 33: 381. 1952; J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972.

Macaranga grandifolia Turrill in J. Linn. Soc. Bot. 43: 38. 1915; Pax & Hoffm. in Pflanzentr. 68 (IV. 147. XIV): 32. 1919; non Merr. (1913).

Macaranga magna, a striking species by virtue of its large leaves and stipules, is a usually slender tree 5–10 m. high, found at elevations of 150–970 m. in forest or on its edges or in dense ridge forest. Its inflorescence parts, including branches, bracts, calyx, and styles, are dark red or crimson, and its young fruit is yellow. Flowers and young fruits have been obtained in scattered months.

TYPIFICATION: The type of *Macaranga grandifolia* Turrill, for which *M. magna* was proposed as a new name, is *in Thurn 134* (K HOLOTYPE; ISOTYPE at BM), collected March 6, 1906, near Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES: *Ndavo*, *ndavolutu*, and *mavu* have been recorded.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Southern slopes of Mt. Ndelainathovu, on escarpment west of Nandarivatu, *Smith 4951*; vicinity of Nandarivatu, *Tohill 737*, *Gillespie 3986*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14911*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8745*. NAITASIRE: Nanduna, near Waindrandra Creek, *DA 1523*, *1524*; Tholo-i-suva, *DA 54*, *503*, *13804*; Prince's Road, *Meebold 21364*. REWA: Mt. Korombamba, *Gillespie 2379*. VITI LEVU without further locality, *Parks 20895*. FIJI without further locality, *Howard 29*.

4. **Macaranga caesariata** A. C. Sm. in Contr. U. S. Nat. Herb. 37: 73. 1967; J. W. Parham, Pl. Fiji Isl. ed. 2. 185. 1972. FIGURES 82 (lower), 132C & D.

A usually slender and freely branched tree 6–12 m. high, with copious thin red latex, found in dense or dry forest at elevations of 50–1,070 m. The calyx is brick-red

and the anthers are pale yellow. Flowers have been noted in March and November, fruits in November and December.

TYPIFICATION: The type is *Smith 9218* (US 2191715 and 2191716 HOLOTYPE; many ISOTYPES), collected Nov. 23, 1953, in hills west of Waivunu Creek, between Ngaloa and Korovou, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from only a few dispersed localities on Viti Levu.

LOCAL NAMES: *Ndavo*; *mavo*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandendelevu, Mt. Evans Range, *DA 14838*. SERUA: Hills between Wainingere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith 9657*. REWA: Mt. Korombamba, *Meebold 16473*.

In leaf size *Macaranga caesariata* approaches *M. magna* among Fijian species, but it is sharply distinguished by its smaller stipules, the copious, crowded, and very long indument of its branchlets and leaves, and its fewer stamens.

5. *Macaranga graeffeana* Pax & Hoffm. in Notizbl. Bot. Gart. Berlin **10**: 384. 1928; A. C. Sm. in J. Arnold Arb. **33**: 382. 1952.

Macaranga graeffeana has sometimes been confused with *M. seemannii*, but it is readily distinguished from that well-marked species in having its inflorescence parts glabrous or soon glabrate, this distinction being most obvious in respect to the ♀ pedicels and calyces, and in having its fruits usually sparsely tuberculate rather than smooth.

KEY TO VARIETIES

Leaf blades broadly ovate or deltoid-ovate, (8-) 12-30 × (6-) 8-23 cm., the petiole usually attached 2-4 cm. from lower margin, the margin entire to crenate-undulate; petioles (6-) 8-21 cm. long; fruits sparsely tuberculate, the processes 0.2-0.7 mm. long, rarely lacking; plants often with slight indument on vegetative parts and inflorescences.

Stipules 1-3.5 cm. long, 5-10 mm. broad, glabrous or sparsely puberulent (rarely long-pilose) and usually glabrate; branchlets and petioles glabrous or soon glabrate; mature leaf blades usually 12-24 × 8-15 cm. 5a. var. *graeffeana*

Stipules 2.5-5 cm. long, 12-20 mm. broad, copiously puberulent without; branchlets and petioles soft-pilose, eventually glabrate; mature leaf blades 15-30 × 13-23 cm. 5b. var. *major*

Leaf blades deltoid, (7-) 8-14 × (4-) 5-8 cm., narrowly peltate (petiole attached 1-1.5 cm. from lower margin), the margin conspicuously glandular-crenate-undulate; petioles (4-) 5-10 cm. long; fruits smooth, very rarely with a few minute, conical tubercles; plants glabrous throughout. 5c. var. *crenata*

5a. *Macaranga graeffeana* var. *graeffeana*; A. C. Sm. in J. Arnold Arb. **33**: 383. 1952; J. W. Parham, Pl. Fiji Isl. 128. 1964, ed. 2. 185. 1972.

Macaranga graeffeana Pax & Hoffm. in Notizbl. Bot. Gart. Berlin **10**: 384. 1928.

The typical variety of *Macaranga graeffeana* is a shrub 1-2 m. high or a tree to 18 m. high, often spreading or freely branched, with a trunk to 45 cm. in diameter, and with abundant pale latex, found from near sea level to an altitude of 1,150 m. in dense forest or on its edges, in patches of forest in open country, or on open hillsides. The young inflorescences are reddish, the calyx yellowish or pink-tinged, the styles dull red, and the fruits yellow-green, with dull red processes. Flowers have been noted between May and December, fruits between August and December.

TYPIFICATION: The holotype was *Graeffe 651* (B, probably destroyed), collected on Viti Levu without further locality. No isotypes have been located, but the species is well described and seems clearly represented by various specimens from southern Viti Levu, an area known to be the source of many Graeffe collections.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Ovalau, and Vanua Levu; I have examined about 40 collections of the variety.

LOCAL NAMES: *Ndavo*, *mavu*, *vouotu*, *vovotu*, *tavotavo*, *ngandoa*, and *ngandoa* have been recorded; at least the first two of these are applicable to most species of the genus in Fiji.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Southern slopes of Mt. Ndelainathovu, on escarpment west of Nandarivatu, *Smith 4928*; vicinity of Nandarivatu, *Gillespie 3988*. NANDRONGA & NAVOSA: Naloka, *DA 1449*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8515*; between Navunikambi and Korovou, *DA L.13267 (Berry 3)*; summit of Mt. Vakarongasiu, *Gillespie 3285*. NAMOSI-NAITASIRI boundary: Summit of Mt. Naitarandamu, *Gillespie 3234*. NAITASIRI: Near Viria, *DA 50*; Savura, Tholo-i-suva, *DA 12431 (DF 76, Watkins 740)*; Nanduruloulou, *DA 8388*. TAILEVU: Matavatathou, *DA 13612*; near Visa, Vungalei District, *DA 5664*. REWA: Mt. Korombamba, *Gillespie 2212*. OVALAU: Hills east of Lovoni Valley, *Smith 7259*. VANUA LEVU: MATHUATA: Seangga-gga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6812*; Nakawangga, Mali Island, *Gressitt 2485*; Wainikoro River, *Greenwood 706*. THAKAUNDRIVE: Mt. Mariko, *Smith 421*, p. p. (fr.); Wainigata Station, *DA 12008*.

5b. *Macaranga graeffeana* var. *major* A. C. Sm. in *J. Arnold Arb.* **33**: 384. 1952; J. W. Parham, *Pl. Fiji Isl.* **130**. 1964, ed. 2. 185. 1972.

A tree 3–12 m. high, often freely branched, with copious pale yellow latex, occurring at elevations of 300–900 m. in forest or in thickets among reeds. The inflorescences and flowers are sometimes reddish-tinged and the calyx is greenish white. Flowers and fruits have been noted in scattered months.

TYPEIFICATION: The type is *Degener 14874* (A HOLOTYPE; ISOTYPES at BISH, K, NY, US), collected March 21, 1941, near Vuninatambua, vicinity of Navai, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known from several high islands.

LOCAL NAMES: *Ndavo*, *ngandoa*, and *tavotavo* have been recorded; these names are more or less generic in nature.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nauwangga, south of Nandarivatu, *Degener 14809*. SERUA: Vunamaravu, upper Navua River, *DA 15504*. KANDAVU: Kiombo, *DA 12439 (DF 84)*. VANUA LEVU: THAKAUNDRIVE: Mt. Mariko, *Smith 421*, p. p. (♂), Vatorova Tikina, *Howard 169*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8165*.

Variety *major* is not well defined geographically from the typical variety of *Macaranga graeffeana*, but it is recognizable by its larger and copiously puberulent stipules, its soft-pilose branchlets and petioles, and its larger leaf blades.

5c. *Macaranga graeffeana* var. *crenata* (A. C. Sm.) A. C. Sm. in *J. Arnold Arb.* **33**: 384. 1952; J. W. Parham, *Pl. Fiji Isl.* **128**. 1964, ed. 2. 185. 1972. FIGURE 133A & B.

Macaranga crenata A. C. Sm. in *Bishop Mus. Bull.* **141**: 86. fig. 44. 1936.

This variety has been recorded as a tree 3–10 m. high, known from elevations of 650–1,195 m. in dry thickets and in the forests of crests and summits. The calyx is rich pink to red and the anthers are white. Flowers have been obtained in May and November, fruits in November and January.

TYPEIFICATION: The type is *Smith 530* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 21, 1933, on the crest of the Korotini Range between Navitho Pass and Mt. Ndelaikoro, Mathuata-Thakaundrove boundary, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the two largest islands.

LOCAL NAME: *Kitimoku*, from the type collection, is the only name recorded.

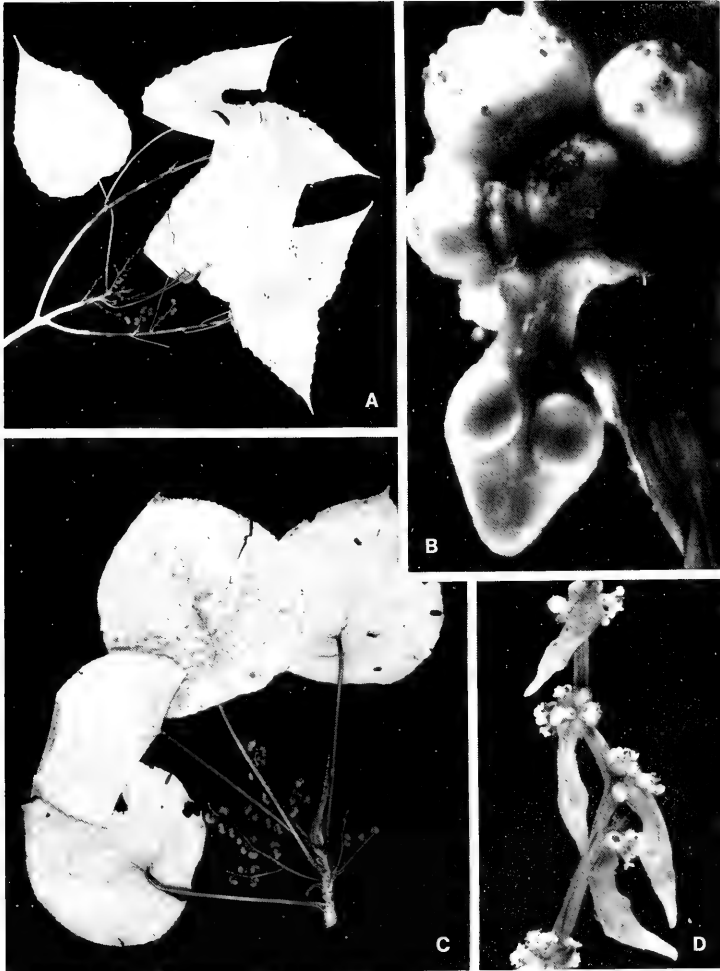
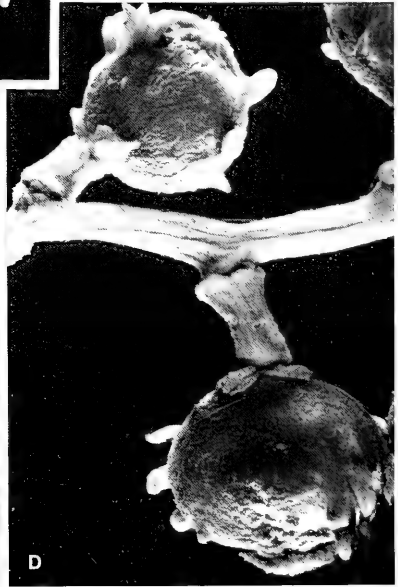


FIGURE 133. A & B, *Macaranga graeffeana* var. *crenata*; A, distal portion of branchlet, with foliage and mature infructescences, $\times 1/4$, from *Smith 530*; B, cluster of σ^7 flowers in axil of a bract, showing the glandular calyces, the upper one beginning to open to disclose 5-7 stamens, $\times 20$, from *Smith 4197*. C, *Macaranga marikoensis*, distal portion of branchlet, with foliage and mature infructescences, $\times 1/4$, from *Smith 447*. D, *Macaranga vitiensis*, portion of σ^7 inflorescence, $\times 4$, from *Smith 9285*



AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4197*, *DA 14152*; Nandendelevu, Mt. Evans Range, *DA 14061*. NAMOSI: Korombasambasanga Range, *DA 2198*; track to Mt. Nambui, Korombasambasanga Range, *DA 14555*. VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 12813*, *12835*.

Although var. *crenata* has the basic characters of *Macaranga graeffeana*, it seems restricted to exposed ridges and summits; from the two other varieties here recognized it differs in its short-petiolate, smaller, narrowly peltate, and obviously crenate leaf blades, in being completely glabrous, and in having fruits with only very infrequent, minute tubercles.

6. *Macaranga marikoensis* A. C. Sm. in *J. Arnold Arb.* 33: 385. 1952; J. W. Parham, *Pl. Fiji Isl.* 130. 1964, ed. 2. 186. 1972. FIGURES 132B, 133C.

A slender tree 7–10 m. high, infrequently noted in dense forest at elevations of 600–930 m. The calyx is white; flowers have been collected only in August, fruits in August and November.

TYPIFICATION: The type is *Smith 447* (US 1676109 HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, on Mt. Mariko, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from only four collections made on Viti Levu, Vanua Levu, and Taveuni.

LOCAL NAME: Only the name *rote*, from the type collection, has been noted.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Summit of Mt. Voma, *Gillespie 2727*. VANUA LEVU: MATHUATA: Mt. Ndelaikoro, *DA 12812*. TAVEUNI: Hills east of Somosomo, west of old crater occupied by small swamp and lake, *Smith 8396*.

Closely related only to *Macaranga graeffeana*, *M. marikoensis* is readily distinguished by its large stipules, proportionately broader leaf blades with more numerous primary nerves, and substantially larger fruits.

7. *Macaranga vitiensis* Pax & Hoffm. in *Pflanzenr.* 63 (IV. 147. VII): 337. 1914; A. C. Sm. in *J. Arnold Arb.* 33: 386. 1952; J. W. Parham, *Pl. Fiji Isl.* 130. *fig. 50, B.* 1964, ed. 2. 186. *fig. 54, B.* 1972. FIGURES 133D, 134A–C.

Macaranga sanguinea Gillespie in *Bishop Mus. Bull.* 91: 17. *fig. 19.* 1932.

A large shrub or slender, simple, few-branched tree 1–5 m. high, with abundant red latex, occurring in open or dry forest or in clearings at elevations from near sea level to 400 m. The inflorescence branches are red, with pale green bracts, the calyx is greenish or red-tinged, the stamens are greenish white, and the fruits are yellow-green with brown tubercles and reddish brown styles, at length becoming scarlet. Flowers have been obtained throughout the year, fruits only between October and December.

TYPIFICATION AND NOMENCLATURE: As type of *Macaranga vitiensis*, Pax and Hoffman cited a Fijian collection by "Leon." No collector of this name is known to have worked in Fiji, and in 1952 (cited above) I speculated that the authors had misinterpreted the second word of "Viti Levu" as written on the sheet by (or for) Graeffe. Having become increasingly familiar with Graeffe's specimens, I feel sure that this was the case, and that the type was a Graeffe collection from southern Viti Levu,

FIGURE 134. A–C, *Macaranga vitiensis*; A, distal portion of branchlet, with foliage and mature infructescences, $\times 1/4$; B, cluster of σ flowers in axil of a reflexed bract, each glandular calyx when open disclosing 3–6 stamens, $\times 20$; C, mature fruits, $\times 4$. D, *Macaranga secunda*, mature fruits, $\times 4$. A & C from *DA 15847*, B from *Smith 9285*, D from *Smith 9671*.

where he is known to have worked. The holotype was presumably deposited at B and has been destroyed; no other Graeffe collections of *M. vitiensis* have been discovered, but the description, from a ♂ plant, unmistakably points to *M. sanguinea* Gillespie. This latter name is based on *Gillespie 3625.4* (BISH HOLOTYPE; ISOTYPES AT BISH, GH, K, NY), collected Oct. 29, 1927, in the vicinity of Nasinu, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and, with the exception of a single collection from Vanua Levu, known only from southern and eastern Viti Levu, in which area it is locally abundant and conspicuous. I have studied more than 40 collections of the species.

LOCAL NAMES AND USE: Recorded names are *ndavo*, *mavu*, and *tavitilau*. Degener (no. 15182) notes that the leaves are used for unspecified medicinal purposes.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: North of Komave, *St. John 18963*. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9285*; Vatutavathe, vicinity of Ngaloa, *Degener 15182*. NAITASIRI: Tamavua-Sawani road, *Setchell & Parks 15111*; Tholo-i-suva, *DA 14522*; vicinity of Nasinu, *Greenwood 1123*. TAILEVU: Wainivesi forest near Copper Mine, Waimaro River, *DA 15847*. REWA: Navesi sawmill, *Horne 1044*; near Veisari, *DA 13207*; slopes of Mt. Korombamba, *Gillespie 2271*; vicinity of Lami, *Meebold 16902*. VANUA LEVU: MATHUATA: Mountains near coast, *Greenwood 725*.

Perhaps the most distinctive species of *Macaranga* in Fiji, *M. vitiensis* is at once recognized by its elongate leaf blades and its copiously tuberculate fruits; its ♂ flowers have comparatively few stamens. In southern Viti Levu it may be seen in some abundance from the Queen's Road, including the portion that crosses southern Namosi Province, from which no herbarium vouchers seem to be available.

8. *Macaranga harveyana* (Muell. Arg.) Muell. Arg. in DC. Prodr. 15 (2): 998. 1866; Seem. Fl. Vit. 228, p. p. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 292, p. p. 1892, Fl. Polynés. Franç. 186. 1893; Hemsl. in J. Linn. Soc. Bot. 30: 192. 1894; Pax in Bot. Jahrb. 25: 646. 1898; Burkill in J. Linn. Soc. Bot. 35: 54. 1901; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 357. 1914; Christophersen in Bishop Mus. Bull. 128: 122. 1935; Yuncker in op. cit. 178: 73. 1943, in op. cit. 184: 46. 1945; A. C. Sm. in J. Arnold Arb. 33: 387. 1952; Yuncker in Bishop Mus. Bull. 220: 162. 1959; J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 185. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 92. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 56, 61, 98. 1972.

Mappa harveyana Muell. Arg. in Flora 47: 467. 1864.

Tanarius harveyanus Kuntze, Rev. Gen. Pl. 2: 620. 1891.

Macaranga harveyana var. *glabrata* Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 357, nom. illeg. 1914.

In Fiji *Macaranga harveyana* is a sometimes spreading tree 3–10 m. high, occurring from near sea level to about 400 m. in dry forest or in thickets. Its fruits, bearing conspicuously flattened processes, are tinged with dull purple at maturity. Flowers and fruits have been observed on comparatively few Fijian specimens, in scattered months.

TIPIFICATION: The holotype of *Mappa harveyana* is *Harvey s. n.* (κ), collected on Vava'u or Lifuka, Tonga. *Macaranga harveyana* var. *glabrata* was intended to be the typical variety, since the Harvey specimen was included in it. Pax and Hoffmann's var. *puberula*, based on a Lister specimen from Tonga, seems scarcely significant.

DISTRIBUTION: Fiji and eastward in the southern Pacific to the Cook, Austral, and Society Islands. In Fiji it is comparatively infrequent.

LOCAL NAMES: *Mavu*, *ngandoa*.

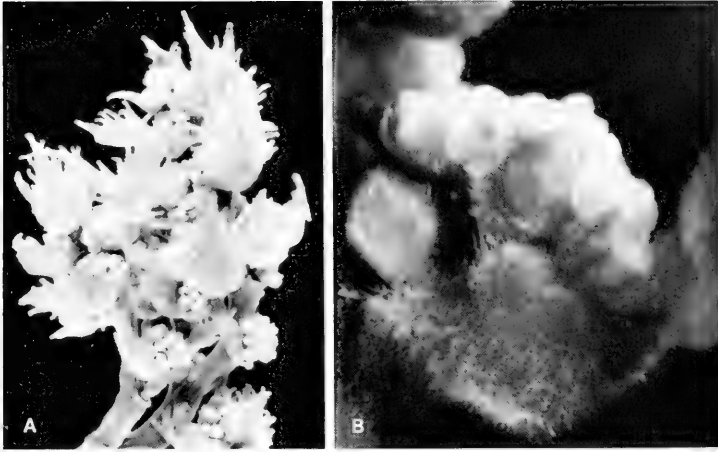


FIGURE 135. *Macaranga secunda*, from *Smith 8001*; A, portion of ♂ inflorescence, $\times 4$; B, cluster of ♂ flowers in axil of a bract, each glandular calyx when open disclosing 3-5 stamens, $\times 30$.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Vicinity of Namosi, *Gillespie 2885*. REWA: Vicinity of Lami, *Tohill 738*. YATHATA: Navakathuru, *DA 16196*. VANUA MBALAVU: Slopes of Korolevu, near Lomaloma, *Garnock-Jones 1146*. LAKEMBA: Near Tumbou, *Garnock-Jones 887*; near Tumbou Jetty, *Garnock-Jones 756*. FIJI without further locality, *U. S. Expl. Exped.* (GH, US 66263 & 66264), *Horne 472*.

9. *Macaranga secunda* Muell. Arg. in DC. Prodr. **15** (2): 996. 1866; Seem. Fl. Vit. 228. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 293. 1892; Pax & Hoffm. in Pflanzenr. **63** (IV. 147. VII): 354. 1914; A. C. Sm. in J. Arnold Arb. **33**: 389. 1952; J. W. Parham, Pl. Fiji Isl. 130. 1964, ed. 2. 186. 1972. FIGURES 134D, 135.

Macaranga harveyana sensu Seem. Fl. Vit. 228, p. p. (quoad *Seemann 395*), 1867; non Muell. Arg. *Tanarius secundus* Kuntze, Rev. Gen. Pl. **2**: 620. 1891.

A tree 3-17 m. high, occurring from near sea level to 500 m. in forest or on its edges or in thickets among reeds. The anthers are yellow, and flowering material has been obtained between April and September. The only dated fruiting specimen was collected in December.

TYPEFICTION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944716), collected in 1840 on Ovalau.

DISTRIBUTION: Endemic to Fiji and known to occur sparingly on four of the high islands.

LOCAL NAMES AND USE: Recorded names are *lutulutu*, *ovotu*, and *rote*; the timber is sometimes used in house-building.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Waimbale, near Namboutini, *Degener 15476*; hills between Wainingere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9671*. RA: Mataimera-vula, vicinity of Rewasa, near Vaileka, *Degener 15339*. NAITASIRE: Sawani-Serea road, *DA 11296*. OVA-

LAU: *Seemann 395* (GH as 359, K); slopes of Mt. Korotolutolu, west of Thawathi, *Smith 8001*. VANUA LEVU: MBUA: Southern portion of Seatovo Range, *Smith 1519*. THAKAUNDRUVE: Vaturova Tikina, *Howard 171*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4708*. FIJI without further locality, *Yeoward*.

While *Macaranga harveyana* and *M. secunda* are readily distinguished from one another by the bracts of the ♂ inflorescences and by characters of the styles and fruits, they are separated with difficulty when such diagnostic features are lacking from specimens. Some of the Fijian specimens originally referred to *M. harveyana* now seem better placed in *M. secunda*. As a rule, the leaf blades of *M. secunda* have their lower surfaces with darker, more conspicuous glands and a more apparent indument than those of *M. harveyana*, but sterile specimens of the two species should be placed with caution.

14. CLEIDION Bl. *Bijdr. Fl. Ned. Ind.* 612. 1826; Seem. *Fl. Vit.* 227, as *Cleidon*. 1867; Pax & Hoffm. in *Pflanzenr.* 63 (IV. 147. VII): 288. 1914, in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2. 19c: 127. 1931; A. C. Sm. in *J. Arnold Arb.* 36: 281. 1955.

Dioecious (our species) or monoecious trees or shrubs, usually essentially glabrous, without milky latex, the stipules fugacious; leaves alternate (spirally arranged), the blades pinnate-nerved, serrate to dentate; ♂ inflorescences axillary, racemose, with solitary or fasciculate flowers, these ovoid to globose and subacute in bud, the calyx with 3 (or 4) valvate lobes, the corolla, disk, and rudimentary pistil absent, the receptacle elevated and bearing 35–80 stamens, these with dorsifixed, 2-locular, introrse anthers, the connective broadened, short-apiculate to subulate, the thecae separated (anthers sometimes described as 4-locular); ♀ inflorescences axillary, few-flowered, the flowers cymose or paniculate on a slender peduncle or sometimes reduced to 1 or 2, with a persistent, deeply 3–5-lobed calyx, the corolla, disk, and staminal tube absent, the ovary subglobose, 3-locular (rarely 2-locular), each locule with a single ovule, the styles linear, bifid, with long, subulate arms, connate basally; fruit a schizocarp, the seeds globose, with a dry testa.

TYPE SPECIES: *Cleidion javanicum* Bl., the only original species.

DISTRIBUTION: Southeastern Asia eastward to New Caledonia and Fiji, and also in Africa and tropical America, with 20–25 species. The paleotropical range terminates in Fiji with a single endemic species.

1. ***Cleidion leptostachyum*** (Muell. Arg.) Pax & Hoffm. in *Pflanzenr.* 63 (IV. 147. VII): 293. 1914; Croizat in *Occas. Pap. Bishop Mus.* 18: 71. 1944; A. C. Sm. in *J. Arnold Arb.* 33: 390. 1952, in op. cit. 36: 281. 1955; J. W. Parham, *Pl. Fiji Isl.* 125. 1964, ed. 2. 179. 1972. FIGURE 136.

Acalypha? Seem. in *Bonplandia* 9: 258. 1861, Viti, 441. 1862.

Mappa leptostachya Muell. Arg. in *Linnaea* 34: 198. 1865.

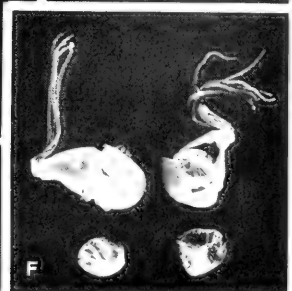
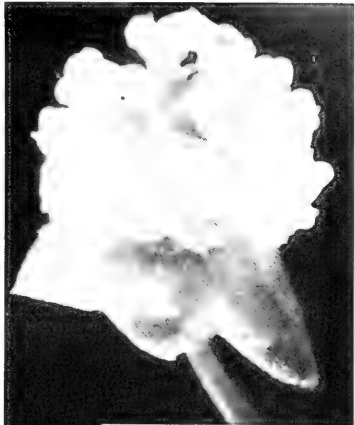
Cleidion vieillardii var. *vitiensis* Muell. Arg. in *DC. Prodr.* 15 (2): 986. 1866; Seem. *Fl. Vit.* 227, as *Cleidon* v. var. v. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 292. 1892.

Macaranga leptostachya Muell. Arg. in *DC. Prodr.* 15 (2): 1007. 1866.

Tanarius leptostachyus Kuntze, *Rev. Gen. Pl.* 2: 620. 1891.

Cleidion degeneri Croizat in *Sargentia* 1: 51. 1942.

FIGURE 136. *Cleidion leptostachyum*; A, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/3; B, fascicle of young ♂ flowers, × 10; C, ♂ flower, × 20; D, stamen, × 70; E, maturing ♀ flowers, with deeply bifid styles, × 2; F, cocci of dehiscent capsules, with styles still attached, and seeds, × 2. A from *Smith 1237*, B–D from *Parks 20488*, E from *Tabualewa 15570*, F from *Smith 1126*.



A small tree or shrub 1–4 m. high found from near sea level to 1,050 m. elevation in dense or dry forest or in thickets, sometimes near beaches and sometimes on limestone. The calyx is yellow-green or greenish, the anthers are white, the styles are red-tinged distally, and the fruit at length becomes white. Flowers have been noted throughout the year and fruits between January and July.

TIPIFICATION AND NOMENCLATURE: The only specimen cited by Mueller for *Mappa leptostachya* was *Seemann 388*, which was collected on Ovalau in October, 1860. The k sheet of this was annotated by Mueller and may be considered the holotype; there is an isotype at BM. *Cleidion vieillardii* var. *vitiensis* (sic) is typified by *Vieillard 33*, collected on Ovalau presumably in 1855 and deposited in the Lenormand Herbarium at CN (now transferred to P). The type of *C. degeneri* is *Tabualewa 15570* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected June 17, 1941, at Mbuyombuyo, near Namboutini, Serua Province, Viti Levu. It is now evident that only one species of *Cleidion* occurs in Fiji, as pointed out by Croizat (1944, cited above).

DISTRIBUTION: Endemic to Fiji and known from several islands, including some of the Lau Group; I have examined 28 collections.

LOCAL NAMES: Recorded names are *umbi ni mbau* (Kambara) and *tautaunova* (Fulanga).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1080*; Korovou, east of Tavua, *Degener 14962*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15505*. OVALAU: Slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8076*; hills southeast of valley of Mbureta River, *Smith 7404*; vicinity of Levuka, *Parks 20488*, p. p.; Ovalau without further locality, *U. S. Expl. Exped., Milne 246*. VANUA LEVU: MATHUATA: Vicinity of Lambasa, *Greenwood 531*. VANUA MBALAVU: Nambavatu, *Tohill 708*; northern limestone section, *Smith 1479*; vicinity of Lomaloma, *DA 13619*. KAMBARA: On limestone formation, *Smith 1237*. FULANGA: On limestone formation, *Smith 1126*. ONGEANDRIKI: In central forest, *Bryan 382*.

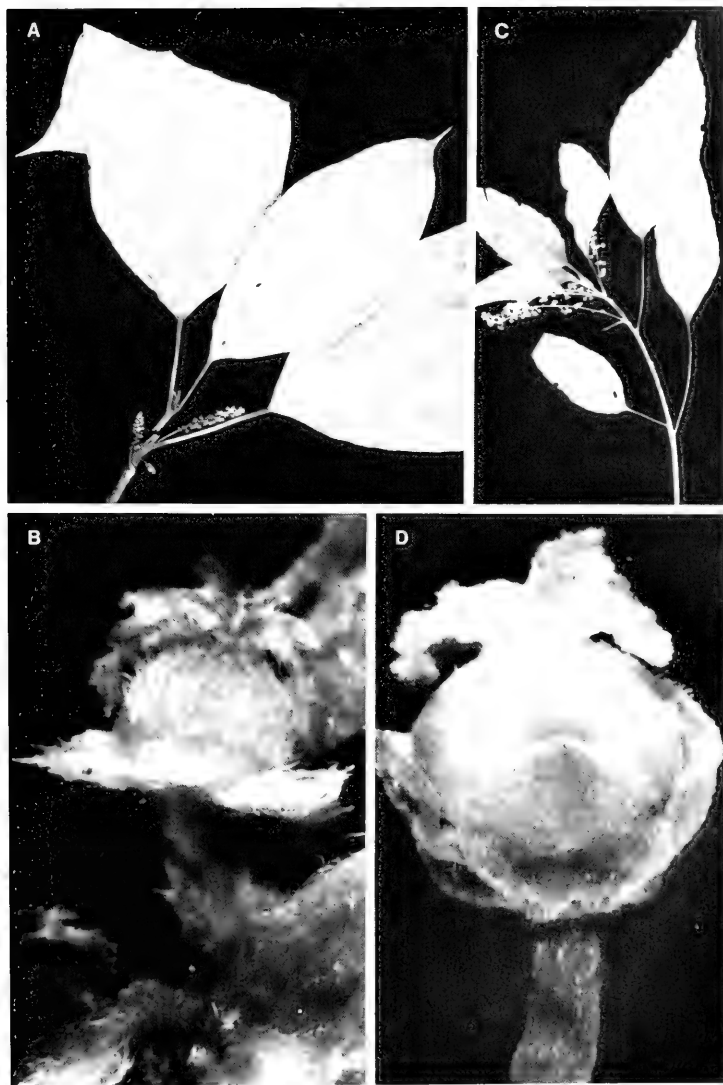
15. CLAOXYLON A. H. L. Juss. Euphorb. Gen. 43. 1824; Seem. Fl. Vit. 223. 1867; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 100. 1914, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 111. 1931.

Dioecious, stipulate trees or shrubs, without milky latex; leaves alternate (spirally arranged), the blades pinnate-nerved, often serrate or dentate; inflorescences axillary, racemiform; ♂ flowers in fascicles, the calyx with 3 or 4 valvate lobes, the corolla and rudimentary pistil absent, the receptacle elevated, the disk present, intrastaminal, the stamens numerous, mixed with disk glands, the anthers with a small connective and 2 locules connate only at base; ♀ flowers usually solitary on rachis, the calyx usually 3-lobed, the corolla and staminodes absent, the disk glands inconspicuous, free or united, the ovary usually 3-locular, each locule with a single ovule, the styles unlobed, spreading from base, mostly stigmatic, the stigmas entire or irregular, sometimes lobulate or short-fimbriate; fruit a schizocarp, the seeds globose, with a fleshy testa, in our species drying rugulose to asperate.

TYPE SPECIES: *Claoxylon parviflorum* A. H. L. Juss.

DISTRIBUTION: Paletropical, with 70–80 species, and extending eastward in the Pacific to the Society Islands and Hawaii. Three species are here recognized in Fiji, two of them endemic and one also occurring in Tonga.

FIGURE 137. A & B, *Claoxylon vitiense*; A, distal portion of branchlet, with foliage and ♀ inflorescences, × 1/3; B, ♀ flower, × 20. C & D, *Claoxylon fallax*; C, distal portion of branchlet, with foliage and ♂ inflorescences, × 1/3; D, maturing ♀ flower, × 20. A from *Smith 9085* (♀ plant), B from *Gillespie 2600*, C from *Smith 59*, D from *Smith 7072*.



KEY TO SPECIES

- Young parts, lower surfaces of mature leaf blades, inflorescence rachis, and sepals copiously spreading-pilose with yellow-brown hairs 0.3–0.6 mm. long; petioles (1–) 4–10 cm. long; leaf blades elliptic, usually 12–30 × 6–14 cm. and subtire to sinuate-crenate at margin, usually with arcuate-ascending secondary nerves; ovary densely pilose, the indument long-persistent in fruit, the stigmas 0.8–2 mm. long, obviously lobulate or short-fimbriate; pedicels of ♀ flowers and fruits 0.5–1.5 mm. long. 1. *C. vitiense*
- Young parts sericeous or strigose, scarcely spreading-pilose, the lower surfaces of mature leaf blades glabrous or strigose, only rarely spreading-pilose (and then stigmas not as above); leaf blades usually obviously serrate to crenate at margin, with secondary nerves characteristically ascending, not much curved; ovary strigose to sericeous, the indument usually sparse or lacking in fruit, the stigmas 0.3–1.5 mm. long, usually entire or verrucose but not lobulate or fimbriate; pedicels of ♀ flowers and fruits often 1–2 mm. long.
- Petioles 1.5–6.5 (–8) cm. long; leaf blades elliptic or elliptic-ovate to elliptic-lanceolate, about twice as long as broad, 7–20 (–23) × 3–10 (–11) cm. 2. *C. fallax*
- Petioles 1–4 cm. long; leaf blades prevailingly lanceolate, about three times as long as broad, 5–12 (–15) × 1.5–4.5 cm. 3. *C. echinospermum*

1. *Claoxylon vitiense* Gillespie in Bishop Mus. Bull. 91: 13, fig. 14. 1932; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 178. 1972. FIGURES 137A & B, 138A.

Claoxylon parviflorum sensu Seem. in Bonplandia 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non A. H. L. Juss.

An often slender tree or shrub 1.5–8 m. high, with a trunk up to 8 cm. in diameter, occurring from near sea level to 1,050 m. in dense, dry, or secondary forest, in patches of forest in grassland, or in crest thickets. The calyx is pale green to yellowish or cream-colored, the filaments are pale green, the anthers pale yellow, the ovary greenish yellow, and the mature fruits yellowish white with yellow seeds. Flowers and fruits have been obtained at all seasons.

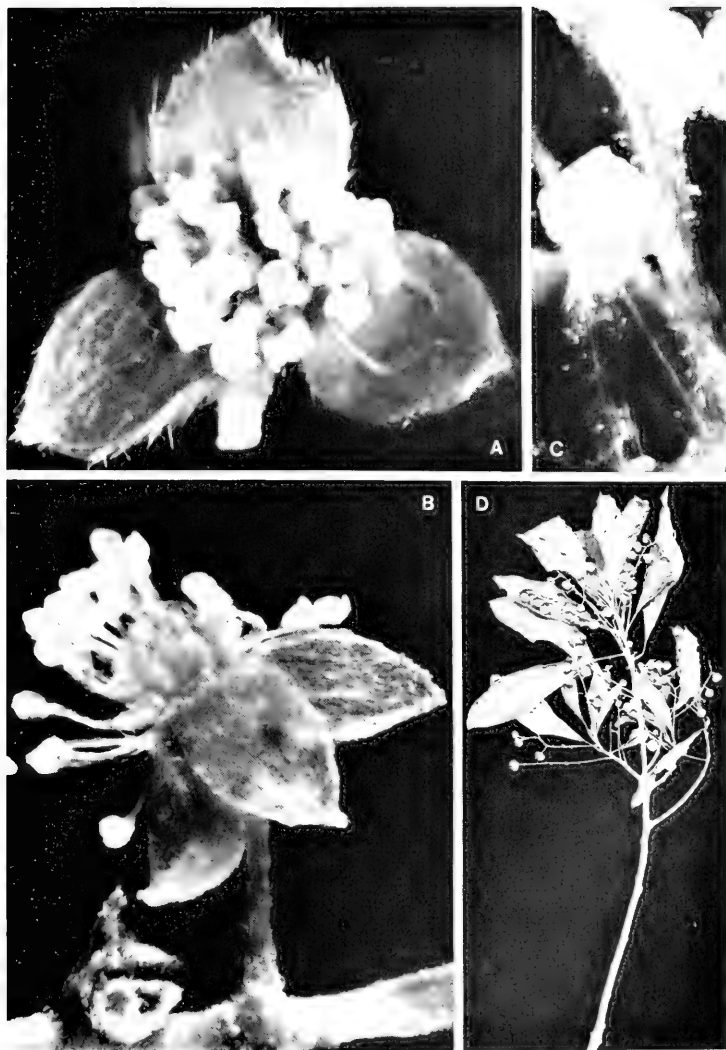
TYPIFICATION: The type is *Gillespie 2623* (HOLOTYPE and ISOTYPE at BISH), collected Sept. 5, 1927, in the vicinity of Namosi Village, Namosi Province, Viti Levu. The Seemann record noted above refers to his no. 394, which is a mixture, the ♂ portion being the type collection of *Claoxylon fallax* and the ♀ portion representing *C. vitiense*.

DISTRIBUTION: Endemic to Fiji and thus far known from only three islands; it would seem to be infrequent on Ovalau and Vanua Levu but common on Viti Levu. I have examined 58 collections.

LOCAL NAMES: Recorded names are *malenivia* and *molea*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 958*; Koro-O road, west of Nandarivatu, *DA 13517*; western slopes of Mt. Nanggaranambuluta, *Smith 6302*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4600*; Uluvatu, vicinity of Mbalo, near Vatukarasa, *Tabualewa 15628*. SERUA: Hills east of Navua River, near Nukusere, *Smith 9085* (from 2 plants, ♂ and ♀); north of Korovou, *St. John 18922*; Tawavulu Creek, north of Ngaloa, *Webster & Hildreth 14327*. NAMOSI: Saliandrau, Wayauyau Creek, *DA 15017*; vicinity of Namosi Village, *Gillespie 2600*; summit of Mt. Vakarongasiu, *DA 14701*. RA: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15351*. NAITASIRE: Viria, *DA 212*; Tholo-i-suva, *DA 13697*; vicinity of Nasinu, *Greenwood 1124*. TAILEVU: King's Road, 21 miles, *DA 854*. REWA: Mt. Korombamba, *Gillespie 2213*. OVALAU: Without further locality, *Seemann 394*, p. p. ♀. VANUA LEVU: MATHUATA: Lingangaugau, Natua, *DA 15345*; Mt. Ndelaikoro, *DA 13425*.

FIGURE 138. A, *Claoxylon vitiense*, ♂ flower, × 15. B–D, *Claoxylon echinospermum*; B, ♂ flower, × 15; C, stamens, × 50; D, distal portion of branchlet, with foliage and infructescences, × 1/3. A from *Smith 9085* (♂ plant), B & C from *Gillespie 4346*, D from *DA 14502*.



Of the three species of *Claoxylon* here recognized in Fiji, *C. vitiense* is the most sharply characterized, by virtue of the conspicuous indument of its vegetative parts, sepals, and ovaries. A few of the Vanua Levu collections of *C. fallax* have lower leaf surfaces with somewhat spreading rather than appressed hairs, but in these the fruits and stigmas are clearly indicative of *C. fallax* rather than of *C. vitiense*.

2. *Claoxylon fallax* Muell. Arg. in DC. Prodr. 15 (2): 780. 1866; Seem. Fl. Vit. 224. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 290. 1892; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 118. 1914; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 178. 1972.

FIGURES 137C & D, 139A.

Claoxylon parviflorum sensu Seem. in Bonplandia 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non A. H. L. Juss.

Claoxylon parvicoccum Croizat in Sargentia 1: 49. 1942; Yuncker in Bishop Mus. Bull. 220: 161. 1959; J. W. Parham, Pl. Fiji Isl. 125. 1964.

A tree or shrub 1.5–13 m. high, often slender or spreading, found from near sea level to 900 m. in dense, thin, or dry forest or on its edges, in patches of forest in open country, and in crest thickets. The calyx is green to greenish white, the filaments are white to greenish white, the anthers yellow, the ovary is white, with greenish white to pale yellow stigmas, and the maturing fruit is yellow. Often locally abundant, this species flowers and fruits throughout the year.

TIPIFICATION AND NOMENCLATURE: The type is *Seemann 394*, collected in 1860 on Ovalau. The κ sheet is a mixture, the part covered by Mueller's description being the glabrate σ portion (Mueller: "Flores foem. et fructus ignoti."). The remaining portion of the κ sheet (and the βM and GH sheets in their entirety) bears young fruits and definitely represents *Claoxylon vitiense*. It is probably safe to assume that the holotype is at G and is not a mixture; otherwise Mueller would have mentioned the indument and the fruit. The only isotype I have seen is *Seemann 394*, p. p. σ (κ). The type of *C. parvicoccum* is *Gillespie 4641* (GH HOLOTYPE; ISOTYPE at BISH), collected Feb. 21, 1928, in the vicinity of Wairiki, Taveuni. Croizat compared his new species with *C. fallax*, which he interpreted from *Seemann 394* (GH) and *Tabulewa 15598*, both of which represent *C. vitiense*. Specimens cited by Croizat as *C. parvicoccum* are not distinguishable from *C. fallax* in the sense of Mueller's σ type material.

DISTRIBUTION: Fiji and Tonga (at least 'Eua). In Fiji the species is known from several of the high islands, being less frequent on Viti Levu but much more frequent on Vanua Levu than *Claoxylon vitiense*. I have studied 46 Fijian collections.

LOCAL NAMES AND USE: Recorded Fijian names are *veraverau* (Tailevu), *maramarawa* (Kandavu), *vakatharendavui* (Mbua), *walinanggio* (Thakaundrove), *wouwou*, *ndalo mate*, and *thivi ni tia* (the last three from Taveuni); each of these names has been recorded only once and they must all remain questionable. An indefinite medicinal use of the species has been noted on Taveuni.

REPRESENTATIVE SPECIMENS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 373*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4297*. NANDRONGA & NAVOSA: Near Nathotholevu, *H. B. R. Parham 207*. SERUA: Coastal hills in vicinity of Taunovo River, *Smith 9587*. NAMOSI: Korombasambasanga Range, *DA 2217*. NAITASIRE: Sawani-Serea road, *DA 14209*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7072*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 59*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7547*; slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8085*. KORO: Eastern slope of main ridge, *Smith 1005*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7848*. VANUA LEVU: MBUA: Ndriti, on Nanganda Creek, *DA 14888*; southern portion of Seatovo Range, *Smith 1520*. MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6753*; Mt. Numbuiloa, east of Lambasa, *DA 14635*. THAKAUNDRIVE: Eastern drainage of Yanawai River, *Degener & Ordenez 14094*; Navonu Creek,

Natewa Peninsula, DA 14093. TAVEUNI: Western slope, between Somosomo and Wairiki, Smith 719; Mbouma, Weiner 71-7-1A.

3. *Claoxylon echinospermum* Muell. Arg. in DC. Prodr. 15 (2): 787. 1866; Seem. Fl. Vit. 224. 1867; Gibbs in J. Linn. Soc. Bot. 39: 169. 1909; Pax & Hoffm. in Pflanzenr. 63 (IV. 147. VII): 115. 1914; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 178. 1972. FIGURES 138B-D, 139B.

Claoxylon archboldianum Croizat in Sargentina I: 50. 1942; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 177. 1972.

Claoxylon sitibundum Croizat in Sargentina I: 51. 1942; J. W. Parham, Pl. Fiji Isl. 125. 1964.

A shrub or often slender tree 1-15 m. high, found from near sea level to 1,155 m. in dense, dry, or secondary forest, or in the forest-grassland transitional zone. The calyx is green or greenish yellow, the filaments are greenish yellow to white, the ovary is greenish white, and the seeds are pale yellow. Flowers have been obtained in most months, fruits between March and November.

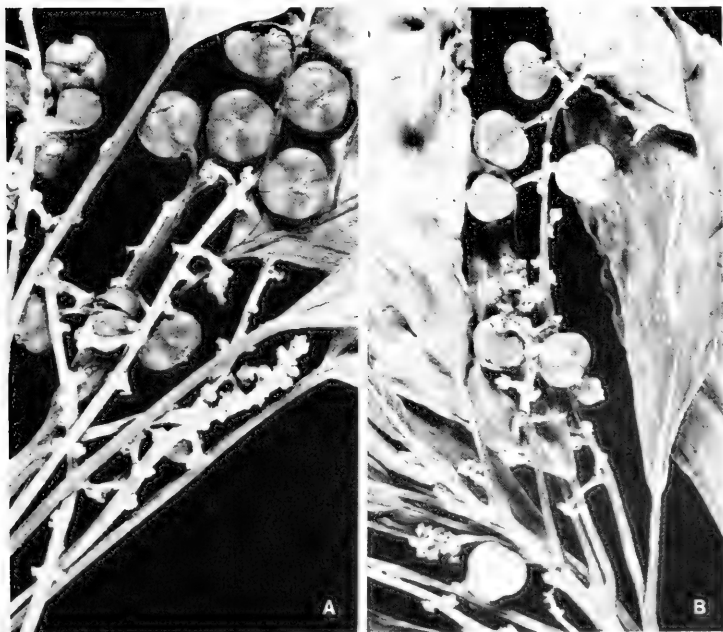


FIGURE 139. A, *Claoxylon fallax*, infructescences, $\times 2$, from Smith 719. B, *Claoxylon echinospermum*, infructescences, $\times 2$, from DA 14502.

TYPIIFICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (HOLOTYPE presumably at G; ISOTYPE at K), collected in 1840 on Ovalau; no duplicate has been located at US. The type of *Claoxylon archboldianum* is *Degener 14906* (A HOLOTYPE; ISOTYPES at BISH, K), collected March 26, 1941, in the vicinity of Nandrau, Nandronga & Navosa Province, Viti Levu; that of *C. sitibundum* is *Degener 15460* (A HOLOTYPE; ISOTYPES at BISH, K, US), obtained June 6, 1941, at Vatundamusewa, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu. When a considerable suite of specimens is examined, the characters utilized by Croizat to separate *C. archboldianum* and *C. sitibundum* from *C. echinospermum* do not appear significant. The degree of serration of leaf blade margins is quite variable, as are the precise shape of disk glands and the sculpturing of seeds. The type of *C. sitibundum* is apparently from a depauperate plant with much reduced ♀ inflorescences and sometimes even with solitary ♀ flowers. In fact, to separate *C. echinospermum* from *C. fallax* is fairly arbitrary, but the two species seem worth retaining pending a careful study of the entire genus.

DISTRIBUTION: Apparently endemic to Fiji and thus far known from three high islands. Like the very different *Claoxylon vitiense* and unlike the more closely related *C. fallax*, *C. echinospermum* is considerably more frequent on Viti Levu than on Vanua Levu. About 30 collections have been examined.

LOCAL NAMES: Recorded names are *laweto*, *mariko* (both from Nandronga & Navosa), and *nisimanavanua* (Mbuva); as each has been recorded only once, they should not be given much credence.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez 13648*; Mt. Evans Range, *Greenwood 1283*; vicinity of Nandarivatu, *Gibbs 670*; Mt. Nanggaranambuluta, *Gillespie 4346*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5403*. NAMOSE: Summit of Mt. Naitarandamu, *Gillespie 5112*; hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8535*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5729*. NAITASIRE: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6109*. OVALAU: *Horne 35*; Wainisavu, Lovoni Valley, *DA 14502*. VANUA LEVU: MBUA: Nasau, Rukuruku Bay, *H. B. R. Parham 10*. MATHUATA: District Farm Northern, *DA 15382*.

16. ACALYPHA L. Sp. Pl. 1003. 1753; Seem. Fl. Vit. 224. 1867; Pax & Hoffm. in Pflanzern. 85 (IV. 147. XVI): 12. 1924, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 134. 1931; Croizat in Occas. Pap. Bishop Mus. 18: 69. 1944; A. C. Sm. in J. Arnold Arb. 33: 390. 1952.

Herbs, shrubs, or small trees, monoecious or rarely dioecious, without milky latex, stipulate; leaves alternate (spirally arranged), the blades unlobed, pinnate-nerved or with 3 or 5 conspicuous basal nerves, often pellucid-glandular, often crenate to serrate proximally; inflorescences terminal or axillary, spiciform or rarely paniculate, unisexual or bisexual, the flowers lacking corolla and disk; ♂ flowers clustered in axils of small bracts, sessile, lacking a vestigial pistil, the calyx 4-parted, the lobes valvate in bud, the stamens 4-8, the filaments free or basally connate, the anther-sacs unilocular, more or less elongated and vermiform-pendulous from apex of filament; ♀ flowers sessile, 1-3 (-6) in axils of usually large, foliaceous bracts, these often lobed or parted, sometimes with glandular hairs, the calyx 3(-5)-parted, the segments small, imbricate, the ovary usually 3-locular, each locule with a single ovule, the styles free or basally connate, usually laciniate or lacerate into filiform segments; fruit a small schizocarp, sometimes surrounded by the accrescent subtending bract, the seeds ovoid, carunculate, smooth to pitted or tuberculate.

LECTOTYPE SPECIES: *Acalypha virginica* L. (vide Small in Britton & Brown, Ill. Fl. N. U. S. ed. 2: 457. 1913), one of Linnaeus's three original species.

DISTRIBUTION: Pantropical and subtropical, sometimes extending into temperate regions, with 400–450 species. Nine species are here considered to occur in Fiji, one being an adventive weed, three known only in cultivation, and five being indigenous (two of them endemic).

USEFUL TREATMENT OF GENUS: Smith, A. C. *Acalypha* L. J. Arnold Arb. 33: 390–401. 1952.

KEY TO SPECIES

Inflorescences bisexual, the distal flowers ♂; low annuals, the leaves with slender petioles 1–6 (–9) cm. long and submembranaceous ovate blades usually 3–7 (–11) cm. long; a weedy adventive.

1. *A. boehmerioides*

Inflorescences unisexual; ♀ spikes cylindrical; shrubs or trees.

Leaf blades comparatively broad, less than twice as long as broad, palmate-nerved, the 2 or 4 basal lateral nerves conspicuous, spreading, the distal pair of these with several spreading tertiary nerves on the basal side, the costa with spreading lateral nerves.

Indigenous species, the leaf blades not bronze or mottled or varicolored, often cordate at base, sometimes rounded or obtuse; petioles usually 6–15 (rarely 4–25) cm. long, not flattened at apex; stipules setaceous-lanceolate, 10–30 mm. long. 2. *A. grandis*

Cultivated only, the leaf blades bronze or variously mottled or colored, or the ♀ inflorescences crimson and showy, the leaf blades usually broadly obtuse or rounded at base.

Styles crimson, conspicuous; inflorescences (apparently only the ♀ known) pendulous, 10–50 cm. long, often 1–2.5 cm. broad, usually much exceeding leaves in length; bracts minute, entire, subtending clusters of flowers; petioles usually 3–9 cm. long, not flattened distally; stipules oblong-lanceolate, 5–10 mm. long. 3. *A. hispida*

Styles white or greenish to pale red, not conspicuous; inflorescences shorter than leaves, not conspicuous as to color or breadth; ♀ bracts 5–13-dentate, subtending single flowers.

Petioles 1–6 cm. long, somewhat flattened and broadened at base of blade, the blades often bronze to rich purple or red, sometimes with pink or yellow markings or margins; stipules oblong-lanceolate, 3–11 mm. long. 4. *A. wilkesiana*

Petioles 3–12 cm. long, slightly swollen but terete at base of blade, the blades variously blotched and margined, often green and pink or red, less frequently bronze; stipules setaceous-lanceolate, 10–30 mm. long. 5. *A. godseffiana*

Leaf blades variously shaped, 2 or more times as long as broad, pinnate-nerved, the basal secondaries not prominent nor with obvious basally directed tertiary nerves; indigenous species.

Leaves obviously petiolate, not amplexicaul.

Leaf blades narrowly obovate-lanceolate or subspathulate, 10–31 × 2–5.5 cm. (5–6 times as long as broad), gradually narrowed to an abruptly truncate or subcordate base, the petioles 0.5–3.5 cm. long; often growing along rivers or streams. 6. *A. rivularis*

Leaf blades lanceolate to ovate or elliptic, 2–4 times as long as broad, subcordate to acute at base but not gradually narrowed and abruptly truncate, the petioles (0.5–) 1–7 cm. long.

Indument of young branchlets usually copious, spreading, the hairs 0.2–1.2 mm. long and usually concealing the surface of distal internodes; petioles pilose like young branchlets, the hairs 0.3–1.2 mm. long; leaf blades often spreading-pilose on both surfaces or at least with an obvious indument on costa of lower surface; rachis of ♂ and ♀ inflorescence usually copiously puberulent or spreading-pilose, the ♂ calyx strigose-puberulent; ♀ bracts usually spreading-pilose, rarely glabrate, the ovary and fruit copiously strigose or spreading-pilose with hairs 0.2–0.5 mm. long (essentially glabrous only in var. *subvillosa*). 7. *A. insulana*

Indument of young branchlets comparatively close, strigose or puberulent, the hairs 0.05–0.2 mm. long, often not obscuring the surface of distal internodes; petioles pilose like young branchlets, usually soon glabrate; leaf blades essentially glabrous above and often beneath, sometimes spreading-pilose on costa or barbellate in nerve axils beneath; rachis of ♂ and ♀ inflorescence often glabrous, sometimes puberulent or spreading-pilose, the ♂ calyx puberulent or glabrous; ♀ bracts often glabrous, sometimes strigose, the ovary and fruit strigose-puberulent (hairs 0.1–0.3 mm. long) or glabrous. 8. *A. repanda*

Leaves appearing subsessile, the petioles 1–4 mm. long, the blades deeply cordate at base and amplexicaul. 9. *A. amplexicaulis*

1. *Acalypha boehmerioides* Miq. Fl. Ned. Ind. Suppl. 459. 1861; Muell. Arg. in DC. Prodr. 15 (2): 871. 1866; Seem. Fl. Vit. 226, as *A. boehmerioides*. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 291. 1892; Pax & Hoffm. in Pflanzenz. 85 (IV. 147. XVI): 96.

1924; Christophersen in Bishop Mus. Bull. **128**: 123. 1935; Yuncker in op. cit. **178**: 78. 1943, in op. cit. **184**: 47. 1945; A. C. Sm. in J. Arnold Arb. **33**: 392. 1952; Yuncker in Bishop Mus. Bull. **220**: 163. 1959; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 174. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 84. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 93. 1972.

Acalypha hispida sensu Benth. in London J. Bot. **2**: 232. 1843; non Burm. f.

Acalypha indica sensu Seem. in Bonplandia **9**: 258. 1861, Viti, 441. 1862; non L.

Acalypha boehmerioides var. *genuina* Pax & Hoffm. in Pflanzenz. **85** (IV. 147. XVI): 96, nom. inadmis. 1924.

A low, annual herb, occurring infrequently in Fiji near sea level as a weed in and near villages and along roadsides.

TIPIFICATION: The holotype, perhaps at u, was collected by W. S. Kurz ("J. Amann") on the island of Bangka.

DISTRIBUTION: A widespread weed throughout the Old World tropics, its precise native area probably being impossible to determine. It now occurs at least from western Malesia to Samoa and the Cook Islands. If the species is further divided, our material would fall into the typical infraspecific taxon.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Nukulau Island, *Barclay s. n.*, 5449. VITI LEVU without further locality, *Seemann 389*. KANDAVU: Ndaku Village, *DA 2953*. FIJI without further locality, *U. S. Expl. Exped.*

2. *Acalypha grandis* Benth. in London J. Bot. **2**: 232. 1843; Seem. Fl. Vit. 224. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 291. 1892; Guillaumin in J. Arnold Arb. **13**: 92. 1932; Christophersen in Bishop Mus. Bull. **128**: 124. 1935; Yuncker in op. cit. **184**: 47. 1945; A. C. Sm. in J. Arnold Arb. **33**: 392. 1952; Yuncker in Bishop Mus. Bull. **220**: 163. 1959; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 175. 1972; St. John & A. C. Sm. in Pacific Sci. **25**: 329. 1971.

Acalypha grandis var. *genuina* Muell. Arg. in Linnaea **34**: 10, nom. inadmis. 1865, in DC. Prodr. **15** (2): 806. 1866; Pax & Hoffm. in Pflanzenz. **85** (IV. 147. XVI): 150. 1924.

Acalypha consimilis Muell. Arg. in DC. Prodr. **15** (2): 807. 1866; Seem. Fl. Vit. 225. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 291. 1892.

Ricinocarpus consimilis Kuntze, Rev. Gen. Pl. **2**: 617. 1891.

Ricinocarpus grandis Kuntze, Rev. Gen. Pl. **2**: 618. 1891.

As it occurs in Fiji, *Acalypha grandis* is a shrub or small tree 1.5–5 m. high, usually found near sea level in coastal or lowland thickets but sometimes occurring up to 200 m. elevation on the edges of forest. Its styles are reddish to lavender, and its fruits become purple-brown to blue-black at maturity. Flowers and fruits do not seem to be seasonal.

LECTOTYPIFICATION AND NOMENCLATURE: Bentham cited material collected by Hinds and Barclay in Fiji and by Barclay on Amboina. Although the first set of Hinds and Barclay Fijian plants may be at BM, it is likely that Bentham depended largely on the duplicates at K. Therefore I designate as lectotype the excellent Barclay (unnumbered) specimen at K, collected between May 28 and June 16, 1840, on Nukulau Island, Rewa Province, Viti Levu; two Barclay collections at BM (one unnumbered and one indicated as 3452) are doubtless isocotypes. There are two Hinds specimens at K which probably also came from Nukulau. *Acalypha consimilis* is based on *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944713), collected in 1840 in Fiji without further locality. The two types are unquestionably referable to the same species.

DISTRIBUTION: From Malesia (at least from the Philippines and Amboina) eastward to Samoa and the Horne and Wallis Islands.

LOCAL NAMES: In the Lau Group, where this species is frequent, recorded variant names are *kalatimbuthi*, *kalakalatimbuthi*, and *kalakalajimbuthiu*.

AVAILABLE COLLECTIONS: VITI LEVU: TAILEVU: Track to Nandrano, near lower Waimbula River, *DA 13607*. REWA: Nukulau Island, *Tothill 748*. VANUA LEVU: MATHUATA or THAKAUNDROVE: Undu Point, *Tothill 691*. MOALA: *Bryan 296*. MATUKU: *Bryan 289*. YATHATA: *DA 13627*; Naveravula, *DA 15548*. VANUA MBALAVU: Vicinity of Lomaloma, *Smith 1407*, *Garnock-Jones 1021*; near Ndakuilomaloma Village, *Garnock-Jones 1130*. THIKOMBIA: *Tothill 705*. LAKEMBA: *Tothill 704*; near Tumbou Jetty, *Garnock-Jones 975*. KAMBARA: *Moore 48*, *Tothill 706*. FIJI without further locality, *U. S. Expl. Exped. (GH, US 66220)*.

3. *Acalypha hispida* Burm. f. *Fl. Ind.* 203 (err. 303). *pl. 61, fig. 1*. 1768; Muell. Arg. in DC. *Prodr.* **15** (2): 815. 1866; Merr. *Interpret. Rumph. Herb. Amb.* 323. 1917; Pax & Hoffm. in *Pflanzenr.* **85** (IV. 147. XVI): 140. 1924; Yuncker in Bishop Mus. *Bull.* **178**: 73. 1943, in op. cit. **184**: 47. 1945, in op. cit. **220**: 163. 1959; J. W. Parham in *Agr. J. Dept. Agr. Fiji* **29**: 31. 1959; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 84. 1970; J. W. Parham, *Pl. Fiji Isl. ed. 2*. 175. 1972.

A shrub 2–3 m. high, cultivated near sea level for its showy, pendulous, bright red ♀ inflorescences. It is very commonly grown in gardens, although seldom collected, and seems to flower throughout the year.

TIPIFICATION: Described and figured by Burman from a Javanese specimen, although he also cited Rumphius and Rheede (Merrill, 1917, cited above).

DISTRIBUTION: This is an ancient plant of cultivation, of which apparently only ♀ individuals are known, and its place of origin is speculative, perhaps in Malesia or western Melanesia. It is now found throughout the tropics as well as in temperate greenhouses. The Fijian records are recent and do not adequately indicate the abundance of the species in gardens.

LOCAL NAMES AND USE: *Cat's tail*, *red cat's tail*, *red-hot cattail*, and *chenille plant* are commonly used for this striking ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva Botanical Gardens, *DA 12100*; Suva, in private garden, *DA 16779*. VANUA LEVU: MBUA: Near Nambouwalu, *DA 16963*.

4. *Acalypha wilkesiana* Muell. Arg. in DC. *Prodr.* **15** (2): 817. 1866; A. C. Sm. in *J. Arnold Arb.* **33**: 393. 1952.

Several horticultural forms are known of this ornamental, which is a popular village plant throughout the Pacific. Probably the various forms are merely cultivars; only two of them are noted in Fiji. The wild parentage of *Acalypha wilkesiana* is not yet clear, and for the time being I prefer to follow Pax and Hoffmann (1924) in maintaining it as a species, although it seems definitely not to be indigenous in Fiji, as sometimes stated and as might be assumed from the type collection. I do not consider it a very close relative of *A. stipulacea* Kl. (*A. amentacea* sensu auct., non Roxb.), as sometimes implied in herbarium identifications.

KEY TO FORMS

- Leaf blades ovate or ovate-elliptic, (6–) 12–25 cm. long, (4–) 9–19 cm. broad, broadly obtuse or sometimes rounded at base, obtusely cuspidate at apex. 4a. *f. wilkesiana*
 Leaf blades suborbicular or reniform or broadly ovate, 3–14 cm. long and broad, often rounded at apex, somewhat flabellinerved. 4b. *f. circinata*

4a. *Acalypha wilkesiana* f. *wilkesiana*; A. C. Sm. in J. Arnold Arb. 33: 393. 1952; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 176. 1972.

Acalypha virgata sensu Seem. in Bonplandia 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non Forst. f.
Acalypha wilkesiana Muell. Arg. in DC. Prodr. 15 (2): 817. 1866; Seem. Fl. Vit. 225. t. 58. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 292. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 153. 1924; Yuncker in Bishop Mus. Bull. 178: 73. 1943, in op. cit. 184: 47. 1945, in op. cit. 220: 164. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 84. 1970.

Acalypha tricolor Hort. ex Seem. Fl. Vit. 225, pro syn. 1867.

Ricinocarpus wilkesianus Kuntze, Rev. Gen. Pl. 2: 618. 1891.

A shrub 2-5 m. high commonly cultivated in villages and gardens, usually near sea level, for its bronze to purple or reddish leaves; its inflorescences are often rich purple, or the ♀ bracts and styles may be pink or red. The species flowers freely throughout the year.

TYPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; putative isotypes at GH, K, US 1944717 & 1944718), collected in Fiji in 1840. One of the US sheets is marked "Rewa," but possibly all the specimens are not from the same plant.

DISTRIBUTION: The species is widely distributed in cultivation from Malesia eastward to the Tuamotus and Hawaii, as well as in other tropical areas, sometimes perhaps becoming naturalized. Forma *wilkesiana* is the only common form in Fiji, but I believe it to occur only in cultivation. Its place of origin is unknown; perhaps it is a sport of some Malesian species that has been aboriginally introduced eastward.

LOCAL NAMES AND USES: The usual Fijian name (for the species as a whole) is *kalambuthi ndamundamu*; other recorded names are *kalambuthi ndamu*, *kalakalambuthi ndamundamu*, *kalakalambuthi ndamu*, *lambuthi ndamu*, and *ruru*. The English names *acalypha* and *beefsteak plant* are sometimes heard. The species (and in Fiji especially f. *wilkesiana*) is widely used as an ornamental, especially for hedges, and the leaves are said to have (usually unspecified) medicinal value.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nathotholevu, *H. B. R. Parham* 193. NAMOSI: Nanggara Island, *H. B. R. Parham* 276. RA: Rewasa, near Vaileka, *Degener* 15445. NAITASIRI: Naeseuvou Village, Waindina River, *Weiner* 266; Toninaiwau, Tholo-i-suva, *DA* 16717, 16719, 16720. REWA: Suva, in private gardens, *DA* 12398, 16734; Suva Point, *Weiner* 158. OVALAU: Lovoni Village, *Smith* 7466. TAVEUNI: *Weiner* 71-7-9D; Somosomo, *Seemann* 392, p. p.; Waiyevo, *Smith* 8248.

4b. *Acalypha wilkesiana* f. *circinata* Muell. Arg. in DC. Prodr. 15 (2): 817. 1866; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 154. 1924; A. C. Sm. in J. Arnold Arb. 33: 394. 1952; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972.

Acalypha circinata A. Gray ex Seem. Fl. Vit. 225, pro syn. 1867.

The form with suborbicular or reniform leaf blades, which are often rounded at apex and flabellinerved, is not particularly distinguished from the typical form by Fijians, but it is considerably less frequent.

TYPIFICATION: Mueller cited two collections, one by Seemann (unnumbered); however, I have found no Seemann material of f. *circinata* and it is possible that Mueller was misled by the fact that Gray's manuscript name was cited in synonymy in *Flora Vitiensis*. As lectotype I indicate *U. S. Expl. Exped.* (probably at G; putative ISOLECTOTYPES at GH, K, US 66221). One or two sheets mention Ovalau as the locality, but they are not necessarily precise duplicates.

DISTRIBUTION: No material other than Fijian seems exactly to match this form.

AVAILABLE COLLECTION: VITI LEVU: RA: Rewasa, near Vaileka, *Degener* 15444.

5. *Acalypha godseffiana* Masters in Gard. Chron. III. 23: 241. fig. 87. 1898; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 155. 1924; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 84. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 174. 1972.

As cultivated in Fiji, *Acalypha godseffiana* is a shrub 2–5 m. high, commonly found from near sea level to about 250 m. Its leaf blades are variously mottled with green and red, rarely bronze, and often with pink margins. Its short and inconspicuous inflorescences are seen throughout the year.

TIPIFICATION: The type was a cultivated plant grown from material originally collected in New Guinea by Micholitz.

DISTRIBUTION: Although the type was cultivated in Europe, the species is probably Malesian, now found from Java eastward to the Society Islands and Hawaii. In Fiji it is much more frequent in gardens than indicated by the few available collections. Probably it is a comparatively recent introduction.

USE: Ornamental, usually grown in masses for the effect of its foliage.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Toninaiwau, Tholo-i-suva, DA 16723. REWA: Suva, Government Pharmacy compound, DA 12271; Suva, in private garden, DA 16731, 16732, 16733.

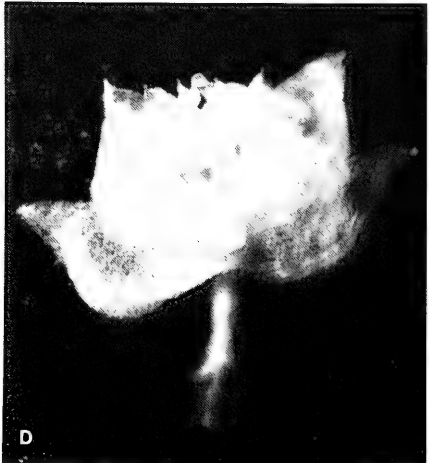
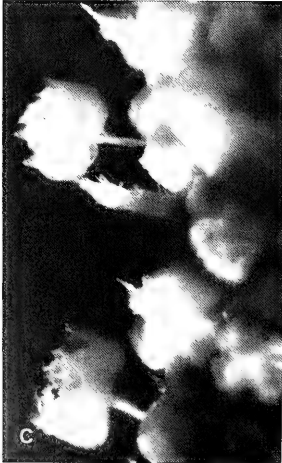
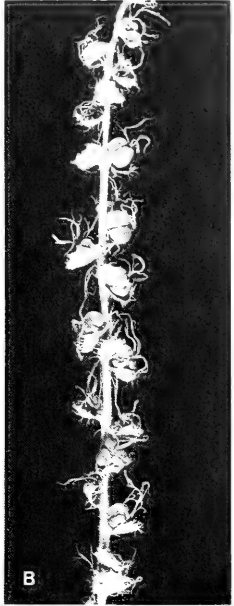
Acalypha godseffiana is often cultivated in the Pacific as a border or hedge plant, and it is sometimes referred to the synonymy of *A. wilkesiana* (cf. Pax & Hoffm., 1924; Backer & Bakh. f. Fl. Java 1: 489. 1963). While it is very probably a cultigen derived from some wild parentage, I doubt if it has a common ancestry with *A. wilkesiana*, from which it differs in its long and distally terete petioles, its setaceous-lanceolate and conspicuous stipules, and in a different, somewhat paler, array of foliage color. Only the typical variety of *A. godseffiana* has been noted in Fiji, but a variable, smaller-leaved var. *heterophylla* is popular elsewhere. The relationship of *A. godseffiana* is possibly to be sought with the Philippine *A. stipulacea* Kl. (*A. amentacea* sensu Merr. Enum. Philipp. Fl. Pl. 2: 444. 1923; non Roxb.; cf. Pax & Hoffm., 1924, cited above, p. 152). Other possible relatives are *A. novoguineensis* Warb. (1891) and *A. longispica* Schum. & Lauterb. (1901).

6. *Acalypha rivularis* Seem. in Bonplandia 9: 258, nom. nud. 1861, Viti, 441, nom. nud. 1862; Seem. ex Muell. Arg. in Flora 47: 439. 1864; Muell. Arg. in Linnaea 34: 14. 1865, in DC. Prodr. 15 (2): 817. 1866; Seem. Fl. Vit. 225. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 292. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 168. 1924; A. C. Sm. in J. Arnold Arb. 33: 394. 1952; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 175. 1972. FIGURES 140, 141.

Ricinocarpus rivularis Kuntze, Rev. Gen. Pl. 2: 618. 1891.

A shrub or small tree 1–4 m. high, often with red-nerved leaf blades dipping into water, occurring with some local abundance at elevations from near sea level to 850 m. in dense forest or on its edges, usually along rivers or streams or in wet places. Its sepals and filaments are greenish white, its anthers reddish to white, and its styles red to pale pink. Flowers and fruits are seen throughout the year.

TIPIFICATION: The title of Mueller's paper of 1864, in which this and various other Fijian species were first described, implies that most cited material was deposited in the Hooker Herbarium at Kew. The type of *Acalypha rivularis* is *Seemann 391* (K HOLOTYPE; ISOTYPES at BM, GII), collected between Aug. 21 and Sept. 5, 1860, on "banks of the Navua and Namosi Rivers," Serua or Namosi Province, Viti Levu. By "Namosi River" Seemann may have meant the Waindina near Namosi Village, but his material may have come from more than one locality.



DISTRIBUTION: Endemic to Fiji and thus far known to be fairly frequent on Viti Levu but rare on Kandavu and Vanua Levu. Twenty-nine specimens are at hand, all but two of them from Viti Levu.

LOCAL NAMES: The most frequently recorded name is *kandakanda* (Serua and Namosi), but also noted are *sosotiura* (Mba), *sotiura* (Nandronga & Navosa), *kalambuti* (Naitasiri), and *sasariwai* (Mbua).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Degener 14286*; valley of Nggaliwana Creek, north of the sawmill at Navai, *Smith 5382*. NANDRONGA & NAVOSA: Vicinity of Nandrau, *Degener 14921*; vicinity of Thuvu ("Nadroga harbour"), *Horne 641*. SERUA: Nathengathenga Creek, upper Navua River, *DA L.13481 (DF 1200; Damanu 223)*; hills east of Navua River, near Nukusere, *Smith 9075*. NAMOSI: Banks of Waindina River at Namosi, *Gillespie 2521*; banks of Wainikoroiuva River near Namua-mua, *Gillespie 2960*. NAITASIRI: Banks of Sovi River, Waandina Valley, *DA 15041*; between Viria and Naisonggo, *Parks 20455*; Tholo-i-suva, *DA 11993*. NAITASIRI OR REWA: Banks of Rewa River, *Milne 292*. TAILEVU: Wainivesi River, *DA 1661*; hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7125*. KANDAVU: Without further locality, *DA 5567*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1591*.

7. *Acalypha insulana* Muell. Arg. in *Flora* 47: 439. 1864; Croizat in *Occas. Pap. Bishop Mus.* 18: 70, p. 1944; A. C. Sm. in *J. Arnold Arb.* 33: 394. 1952.

In my notes of 1952 I mentioned the difficulties of recognizing stable populations in the *Acalypha insulana* complex but expressed my reluctance to follow Croizat (1944) in combining the six specific and several varietal taxa recognized by Mueller. It appears to me that the complex can readily be divided into two species, *A. insulana* and *A. repanda*, on the basis of vegetative indument (FIGURE 142A, C, D) and ♀ inflorescences (FIGURE 143A & B). Each of the two species is further divisible into varieties, although these are not fully satisfactory.

KEY TO VARIETIES

Ovary and fruit obviously pilose; indument of young branchlets and petioles copious; leaf blades often pilose on lower surface as well as on costa.

Leaf blades sparsely pilose or glabrous on upper surface with indument less obvious than that on lower surface. 7a. var. *insulana*

Leaf blades copiously spreading-pilose on both surfaces with hairs 0.3-1.2 mm. long, these especially dense on costa, the blades lanceolate to ovate, 7-25 × 2-10.5 cm., rounded or subcordate at base.

7b. var. *flavicans*

Ovary and fruits glabrous; indument of young branchlets and petioles comparatively sparse, the hairs scattered, 0.5-1.2 mm. long; leaf blades lanceolate, up to 14 × 4.5 cm., the indument usually limited to long hairs on costa and in nerve axils of lower surface. 7c. var. *subvillosa*

7a. *Acalypha insulana* var. *insulana*; A. C. Sm. in *J. Arnold Arb.* 33: 395. 1952; Yuncker in *Bishop Mus. Bull.* 220: 163. 1959; J. W. Parham, *Pl. Fiji Isl.* 123. 1964, ed. 2. 175. 1972; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 106. 1972. FIGURE 142A & B.

FIGURE 140. *Acalypha rivularis*; A, distal portion of branchlet, with foliage, several ♂ inflorescences toward apex, and a single ♀ inflorescence below them, × 1/3; B, portion of ♀ inflorescence past anthesis, × 2; C, portion of ♂ inflorescence, with 2 mature flowers, × 20; D, ♂ flower, × 50. A, C, & D from *Smith 1591*, B from *Gillespie 2960*.

- Acalypha virgata* sensu Seem. in *Bonplandia* 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non Forst. f.
Acalypha grandis sensu Seem. in *Bonplandia* 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non Benth.
Acalypha insulana Muell. Arg. in *Flora* 47: 439. 1864, in *DC. Prodr.* 15 (2): 818. 1866; Seem. *Fl. Vit.* 225. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 291. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 165. 1924; Croizat in *Occas. Pap. Bishop Mus.* 18: 70, p. p. 1944.
Acalypha insulana var. *stipularis* Muell. Arg. in *Flora* 47: 439. 1864, in *Linnaea* 34: 14, as *A. insula* var. *s.* 1865, in *DC. Prodr.* 15 (2): 818. 1866; Seem. *Fl. Vit.* 225. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 291. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 166. 1924.
Acalypha insulana var. *pubescens* Muell. Arg. in *Flora* 47: 439. 1864, in *Linnaea* 34: 14, as *A. insula* var. *p.* 1865, in *DC. Prodr.* 15 (2): 818. 1866; Seem. *Fl. Vit.* 225. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 292. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 166. 1924.
Acalypha insulana var. *villosa* Muell. Arg. in *DC. Prodr.* 15 (2): 818. 1866; Seem. *Fl. Vit.* 225. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 291. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 166. 1924.
Acalypha latifolia Muell. Arg. in *DC. Prodr.* 15 (2): 817. 1866; Seem. *Fl. Vit.* 225. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 292. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 167. 1924.
Acalypha stipularis Engl. in *Bot. Jahrb.* 7: 462. 1886.
Ricinocarpus insulanus Kuntze, *Rev. Gen. Pl.* 2: 618. 1891.
Ricinocarpus latifolius Kuntze, *Rev. Gen. Pl.* 2: 618. 1891.

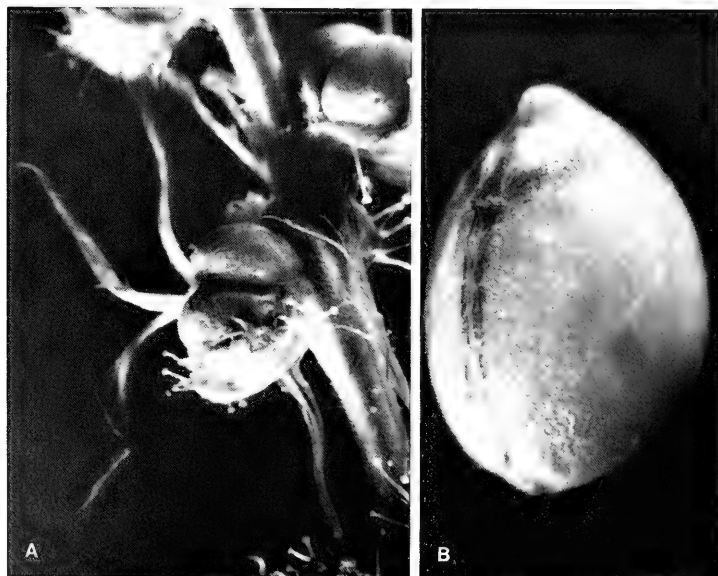


FIGURE 141. *Acalypha rivularis*, from Gillespie 2960; A, maturing ♀ flower, × 10; B, seed, × 40.

A frequent shrub or small tree 1-7 m. high, occurring from near sea level to about 800 m. in dry forest or on its edges, in lowland thickets, and in crest thickets. The sepals are greenish yellow, the stamens white, and the styles turning from white to red. Flowers and fruits seem always available.

LECTOTYPIFICATION AND NOMENCLATURE: Mueller did not designate a type for *Acalypha insulana*, but in 1864 he proposed three varieties, among which var. *stipularis* was indicated as var. α and consequently was designated as the type variety by me in 1952. Three syntypes were listed, all from Fiji without further locality: *Harvey*, *Seemann 392*, p. p. (BM, GH, K), and *Seemann 393*, p. p. (BM, GH, K). (The two Seemann numbers were mixtures and are always cited here in part.) By implication the K specimens are the actual syntypes. As lectotype (of *A. insulana*, *A. insulana* var. *stipularis*, and *A. stipularis*) I now designate *Harvey* (K LECTOTYPE; ISOLECTOTYPES at BM, GH), collected in November, 1855. *Acalypha insulana* var. *pubescens* also had three syntypes: *Seemann 393*, p. p. (BM, GH, K), from Fiji without further locality, *Milne 265*, and *Milne 169*, p. p. (K), from Ngau; I here designate the best of these, *Milne 265* (K), from Ovalau, as lectotype. *Acalypha insulana* var. *villosa* was based on two syntypes: *Vieillard 52* (CN, now at P), from Ovalau, and *U. S. Expl. Exped.* (SYNTYPE probably at G; ISOSYNTYPES at GH, US 66222), also from Ovalau; I prefer not to select a lectotype from these two collections. *Acalypha latifolia* is typified by *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at GH), from Fiji without further locality; no isotype has been located at US. In the light of currently available material, the differences among the cited specimens are negligible.

DISTRIBUTION: The typical variety of *Acalypha insulana* occurs from New Guinea eastward to Tonga and Samoa, and perhaps farther in each direction, but it seems abundant only in Fiji, from which more than 50 collections are available. It is probably to be anticipated on most Fijian islands.

LOCAL NAMES: The commonly used names are *kalambuthi* and *kalatimbuthi*, but also recorded are the variants *kalambuthi ni veikau*, *kalatimbuthi ni lekutu*, and *kalakalambuthi*.

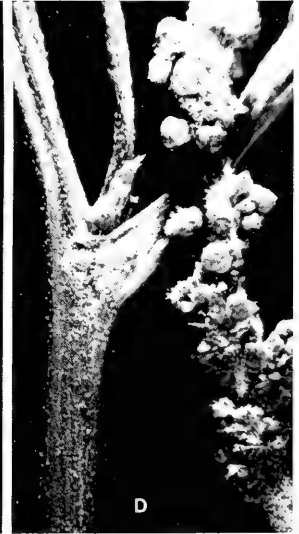
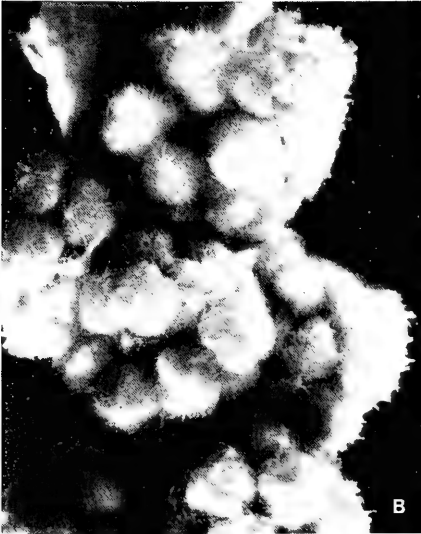
REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Natalau, between Lautoka and Nandi, *Degener 14989*; slopes of escarpment north of Nandarivatu, *Smith 6067*. NANDRONGA & NAVOSA: Singatoka, *Greenwood 775* (coll. *H. Phillips*). SERUA: Navutulevu, *DA 13857* (*DF 297*; *Damanu 25*). NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8756*. NAITASIRE: Wailoa River (Wainimala tributary), *Horne*; Tholo-i-suva, *DA 11560*. KANDAVU: Slopes of Mt. Mbuke Levu, *DA 14909*; Namalata isthmus region, *Smith 190*. OVALAU: Lovoni Valley, *Horne 172*; Levuka, *Parks 20499*. KORO: Eastern slope of main ridge, *Smith 1001*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7941*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6786*. THAKAUNDOVE: Near Wainingatata turnoff (head of Natewa Bay), *DA 16849*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4624*. KAMBARA: On limestone formation, *Smith 1252*.

7b. *Acalypha insulana* var. *flavicans* Muell. Arg. in DC. Prodr. 15 (2): 818. 1866; Seem.

Fl. Vit. 225. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 291. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 166. 1924; A. C. Sm. in J. Arnold Arb. 33: 396. 1952; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 175. 1972. FIGURE 143A.

A tree or shrub 2-4 m. high, occurring sporadically from near sea level to an elevation of 520 m. in thin or dry forest. The sepals are pale green and the styles pink. Flowers have been noted in scattered months, fruits only in January.

TIPIFICATION: The type of the variety is *U. S. Expl. Exped.* (HOLOTYPE probably at



G; ISOTYPES at GH, US 66225), collected in 1840 on Ovalau.

DISTRIBUTION: Known definitely only from scattered localities in Fiji, but perhaps to be sought in adjacent archipelagoes.

LOCAL NAME: *Kalambuthi*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Natobilibili, *DA 14195*. NANDRONGA & NAVOSA: Nathotholevu, *H. B. R. Parham 249*. NAMOSI: Vicinity of Namosi Village, *Gillespie 2830*; Sariwakawaka, *DA 5900*. NAITASIRI: Waindrandra Creek, *DA 905*. OVALAU: Vicinity of Levuka, *Gillespie 4402*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7863*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6803*.

7c. *Acalypha insulana* var. *subvillosa* (Muell. Arg.) A. C. Sm. in *J. Arnold Arb.* **33**: 397. 1952; *J. W. Parham*, *Pl. Fiji Isl.* **123**. 1964, ed. 2. 175. 1972.

Acalypha anisodonta Muell. Arg. in *DC. Prodr.* **15** (2): 818. 1866; Seem. *Fl. Vit.* **226**. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* **291**. 1892; Pax & Hoffm. in *Pflanzenr.* **85** (IV. 147. XVI): 167. 1924.

Acalypha anisodonta var. *subvillosa* Muell. Arg. in *DC. Prodr.* **15** (2): 819. 1866; Seem. *Fl. Vit.* **226**. 1867; Pax & Hoffm. in *Pflanzenr.* **85** (IV. 147. XVI): 167. 1924.

Ricinocarpus anisodontus Kuntze, *Rev. Gen. Pl.* **2**: 617. 1891.

Doubtless a shrub or small tree, distinguished from the typical variety of *Acalypha insulana* by its sparser indument, often limited on the lanceolate leaf blades to the costa and nerve axils of the lower surface. Found from near sea level to 1,050 m.

TYPEIFICATION: Of the two varieties into which Mueller divided his *Acalypha anisodonta*, var. *subvillosa* was indicated as α and therefore is taken to typify the species; it is based on *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at GH), collected in 1840 on Ovalau. No duplicate seems to remain at US.

DISTRIBUTION: Apparently endemic to Fiji and inadequately known.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1079*. OVALAU: *Milne 256*.

8. *Acalypha repanda* Muell. Arg. in *Flora* **47**: 439. 1864; A. C. Sm. in *J. Arnold Arb.* **33**: 397. 1952.

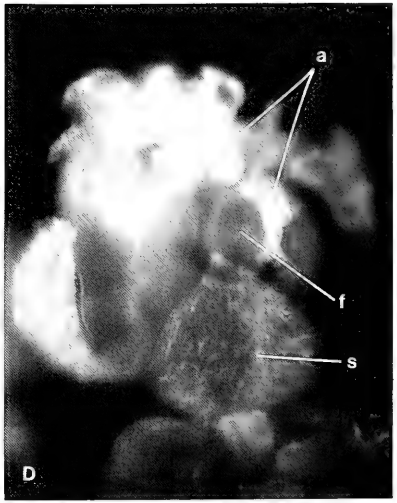
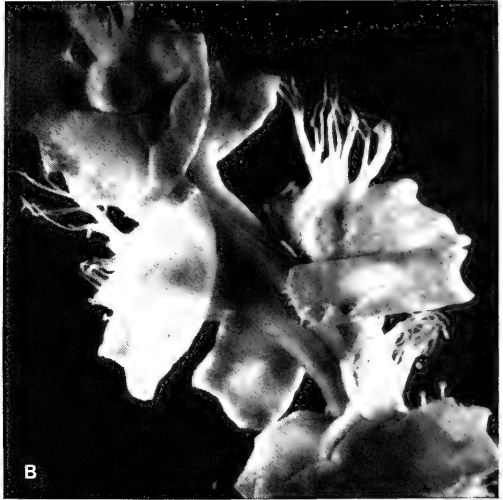
This most abundant species of *Acalypha* in Fiji seems readily separated from *A. insulana* as indicated in the above key and as discussed by me in 1952.

KEY TO VARIETIES

Petioles (0.7-) 1-7 (-8) cm. long, the leaf blades (6-) 9-25 \times 3-14 cm. or rarely larger, usually with 8-12 pairs of secondaries and a narrowed apex up to 20 mm. long; young branchlets and sometimes petioles usually puberulent or very closely tomentellous, the surfaces often obscured by indument; ovary and young fruit often copiously strigose with hairs 0.1-0.4 mm. long, the fruits at length subglabrate.

8a. var. *repanda*

FIGURE 142. A & B, *Acalypha insulana* var. *insulana*; A, indument of distal internode, stipule, and young petioles, $\times 10$; B, portion of young σ^7 inflorescence, $\times 20$. C, *Acalypha repanda* var. *repanda*, indument of distal internode, stipule, young petioles, and σ^7 inflorescence peduncles, $\times 10$. D, *Acalypha repanda* var. *denudata*, indument of distal branchlet, stipule, young petiole, and σ^7 inflorescence, $\times 10$. A from *Smith 190*, B from *Smith 27*, C from *Smith 211*, D from *Smith 8763*.



Petioles 0.5–3.5 cm. long, the leaf blades (4–) 5–14 × 1.5–6 cm., with 6–10 pairs of secondaries and a somewhat narrowed apex 5–15 mm. long; young branchlets and petioles obscurely puberulent or strigose, the surfaces not obscured by indument and soon glabrate; ovary and fruits sparsely strigose-puberulent with hairs 0.1–0.2 mm. long or glabrous. 8b. var. *denudata*

- 8a. *Acalypha repanda* var. *repanda*; A. C. Sm. in J. Arnold Arb. 33: 398. 1952; Yuncker in Bishop Mus. Bull. 220: 163. 1959; J. W. Parham, Pl. Fiji Isl. 123. 1964, ed. 2. 175. 1972. FIGURE 142C.

Acalypha grandis sensu Seem. in Bonplandia 9: 258, p. p. 1861, Viti, 441, p. p. 1862; non Benth.
Acalypha repanda Muell. Arg. in Flora 47: 439. 1864, in Linnaea 34: 14. 1865, in DC. Prodr. 15 (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 292. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 167. 1924.
Acalypha insulana var. *glabrescens* Muell. Arg. in Flora 47: 439. 1864, in DC. Prodr. 15 (2): 818. 1866; Seem. Fl. Vit. 226. 1867; Engl. in Bot. Jahrb. 7: 462. 1886; Drake, Ill. Fl. Ins. Mar. Pac. 292. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 166. 1924.
Acalypha anisodonta var. *subsericea* Muell. Arg. in DC. Prodr. 15 (2): 819. 1866; Seem. Fl. Vit. 226. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 291. 1892; Pax & Hoffm. in Pflanzenr. 85 (IV. 147. XVI): 167. 1924.
Ricinocarpus repandus Kuntze, Rev. Gen. Pl. 2: 618. 1891.
Acalypha insulana var. *stipularis* sensu Gibbs in J. Linn. Soc. Bot. 39: 169. 1909; non Muell. Arg.

A frequent shrub or small tree 1–5 m. high, found from near sea level to an elevation of 1,150 m. in dense or dry forest or on its edges, in thickets and clearings, and among reeds. The sepals are yellowish green, the stamens white, and the styles at length red. Flowers and fruits are found throughout the year.

TYPIFICATION AND NOMENCLATURE: The type of *Acalypha repanda* is Harvey (κ HOLOTYPE; ISOTYPES at BM, GH), collected in 1855 in Fiji without further locality. For *A. insulana* var. *glabrescens* Mueller originally cited six syntypes: *U. S. Expl. Exped.* (GH, κ), from Somosomo, Taveuni, *Milne 179*, *Milne 182* (κ), from Nairai, *Milne 129* (κ), from Matuku, *Milne 417* (κ), from Fiji without further locality, and *Seemann 393*, p. p. (BM, κ), also from Fiji without details. Among these I here indicate *Milne 179* (κ) as lectotype; it is an excellent specimen with both ♂ and ♀ inflorescences, collected on Nairai. *Acalypha anisodonta* var. *subsericea* is typified by *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at GH), collected in 1840 on Ovalau; there appears to be no duplicate at US. The cited type specimens offer no differentiating features.

DISTRIBUTION: New Guinea to Tonga and Samoa, as far as noted, but apparently most abundant in Fiji, from which about 70 collections are now available.

LOCAL NAMES: In addition to the essentially generic name *kalambuthi*, the names *kalambuthi ndamundamu* and *kalambuthi vulavula* have been recorded, but the first of these variants would appear inappropriate.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez 13721*; Mt. Evans Range, *Greenwood 1279*; vicinity of Tumbenasolo, valley of Namosi Creek, *Smith 4613*; western and southern slopes of Mt. Tomanivi, *Smith 5132*. NANDRONGA & NAVOSA: Singatoka River near Nandrau, *Horne 1001*; near Nakambuta, *H. B. R. Parham 259*. SERUA: Inland from Ngaloa, *DA 16599*. NAMOSI: Wainivisoa Creek, near Navunikambi, *DA 14986*; Mt. Voma, *DA 11679*. NAITASIRI: Wainina River Basin, *MacDaniels 1033*. TAILEVU: Hills east of Wainimbuka River, vicinity of Wailotua, *Smith 7247*; Naingani Island, *DA 3337*. KANDAVU: Mt. Mbuke Levu, *Smith 211*. OVALAU: Vicinity of Levuka, *Gillespie 4464.5*. NAIRAI: Tovu Lailai, *DA 17717*. NGAU: Hills east of Herald Bay, inland from Sawaieke, *Smith 7822*. VANUA LEVU: MATHUATA–THAKAUNDRIVE boundary: Between Navitho Pass and Mt.

FIGURE 143. A, *Acalypha insulana* var. *flavicans*, ♀ flowers, × 10. B–D, *Acalypha repanda* var. *denudata*; B, ♀ flowers, × 10; C, portion of ♂ inflorescence, × 20; D, ♂ flower, showing sepal (s), filament (f), and anther locules (a), × 70. A from *Smith 6803*, B from *Smith 9404*, C & D from *DA 16019*.

Ndelaikoro, *Smith 543*. THAKAUNDROVE: Savusavu Bay region, *Degener & Ordenez 14025*; vicinity of Korotasere, Natewa Bay, *DA 15297*.

- 8b. *Acalypha repanda* var. *denudata* (Muell. Arg.) A. C. Sm. in *J. Arnold Arb.* 33: 399. 1952; J. W. Parham, *Pl. Fiji Isl.* 123. 1964, ed. 2. 175. 1972.

FIGURES 142D, 143B-D.

Acalypha denudata Muell. Arg. in *DC. Prodr.* 15 (2): 819. 1866; Seem. *Fl. Vit.* 226. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 291. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 167. 1924.

Acalypha laevifolia Muell. Arg. in *DC. Prodr.* 15 (2): 853. 1866; Seem. *Fl. Vit.* 226. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 292. 1892; Pax & Hoffm. in *Pflanzenr.* 85 (IV. 147. XVI): 112. 1924.

Ricinocarpus denudatus Kuntze, *Rev. Gen. Pl.* 2: 617. 1891.

Ricinocarpus laevifolius Kuntze, *Rev. Gen. Pl.* 2: 618. 1891.

Acalypha insulana var. *glabrescens* sensu Gibbs in *J. Linn. Soc. Bot.* 39: 169. 1909; non Muell. Arg.

Acalypha repanda sensu Gibbs in *J. Linn. Soc. Bot.* 39: 170. 1909; non Muell. Arg.

An abundant tree or shrub 1-8 m. high, usually compact or slender but sometimes spreading, found from near sea level to an elevation of 1,175 m. in thin or open forest or in thickets, on open hillsides, or among reeds. The ♀ bracts are pink-tinged, the sepals and stamens are greenish white to pale yellow, and the styles are white, turning to pink or red. Flowering and fruiting seem not to be seasonal.

TIPIFICATION AND NOMENCLATURE: *Acalypha denudata* is typified by *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944714), collected in 1840 from Mathuata Province, Vanua Levu. The type of *A. laevifolia* is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 1944715), from Vanua Levu without further details. In combining these binomials of the same date, I selected the first in 1952 for the varietal epithet. The two collections clearly both represent the smaller-leaved and earlier glabrate variant of *A. repanda*.

DISTRIBUTION: As thus far noted, this variety would seem endemic to Fiji, but of course it may be found to approximate the range of the type variety when adequately studied. In Fiji it is known from about 90 collections, being particularly abundant in Mba Province, Viti Levu, and Mathuata Province, Vanua Levu.

LOCAL NAMES AND USE: *Kalambuthi*, *kalakalambuthi*; sticks from the stems are said to be used for digging yams in the Wainimala Valley.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Nakawa Gulch, west of Mbatinaremba, *St. John 18170*. VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1242*; Naloto Range, *DA 14776*; Korovou, east of Tavua, *Degener 14955*; slopes of escarpment north of Nandarivatu, *Gibbs 709*; Mt. Tomanivi, *O. & I. Degener 32069*. NADRONGA & NAVOSA: Between Naloka and Korolevu, *DA 1416*. SERUA: Near summit of Mt. Tikituru, *DA 14482*; flat coastal strip in vicinity of Ngaloa, *Smith 9404*; Karombo Beach, *DA 16019*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8763*; vicinity of Namosi Village, *Gillespie 2839*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15531*. NAITASIRI: Wainamo-Wainisavulevu divide, Wainimala Valley, *St. John 18278*; vicinity of Sawani, *DA 10977*. TAILEVU: Nggelekuro, *DA 13601*. REWA: Vicinity of Suva, *Meebold 17066*. OVALAU: Levuka, *Parks 20490*. WAKAYA: *Milne 324*. VANUA LEVU: MATHUATA: Seangganga Plateau, vicinity of Natua, *Smith 6751*; Mt. Ndelaikoro, *Howard 199*; hills northeast of Lambasa, *Krauss 451*. THAKAUNDROVE: Ngarakavukavu, *DA 16040*.

9. *Acalypha amplexicaulis* A. C. Sm. in *J. Arnold Arb.* 33: 400. 1952; J. W. Parham, *Pl. Fiji Isl.* 122. 1964, ed. 2. 174. 1972.

A shrub or small tree 2-5 m. high, sparingly occurring in crest thickets at elevations of 700-900 m., with greenish sepals. Flowering specimens have been obtained in May and November.

TIPIFICATION: The type is *Smith 4300* (A HOLOTYPE; ISOTYPES at K, US), collected May 9, 1947, in the northern portion of the Mt. Evans Range between Mt. Vatuyanitu and Mt. Natondra, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and infrequently collected in northern and north-western Viti Levu.

LOCAL NAME: The name *timbothe* was applied to the type collection.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandende Levu, Mt. Evans Range, DA 14059; vicinity of Nandarivatu, DA 8521; Mt. Nanggaranambuluta, east of Nandarivatu, DA 2445.

Foliage characters seem clearly to distinguish this seldom collected species from its probably closest relative, *Acalypha repanda*. The type collection suggests a trend toward unisexual inflorescences in having one or two ♀ bracts at the base of ♂ spikes, but these do not bear fertile flowers.

17. *MALLOTUS* Lour. Fl. Cochinch. 601, 635. 1790; Seem. Fl. Vit. 226. 1867; Pax & Hoffm. in Pflanzenz. 63 (IV. 147. VII): 145. 1914, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 113. 1931.

Diocious or rarely monoecious trees or shrubs, without milky latex, the stipules caducous, the indument composed of stellate hairs; leaves opposite (in some species spirally arranged), the blades in our species broadly ovate (in others sometimes peltate), granulose-glandular beneath, the basal nerves often elongated; inflorescences terminal at inception but soon appearing axillary or lateral, spicate, racemose, or paniculate; flowers usually fascicled (♂) or solitary (♀), the sepals 3-5, valvate (at least in ♂ flowers), without a disk; ♂ flowers with 15-many (in our species usually 80-90) stamens, the anthers dorsifixed, 2-locular, longitudinally dehiscent, a rudimentary pistil usually lacking; ♀ flowers with a usually 3-locular ovary, each locule with a single ovule, the styles short, connate, the stigmas spreading, subulate-linear, often copiously laciniate; fruit usually a muricate or echinate schizocarp, the seeds globose to ovoid, with a fleshy testa.

TYPE SPECIES: *Mallotus cochinchinensis* Lour.

DISTRIBUTION: Eastern and southeastern Asia (with two species in Africa and Madagascar) throughout Malesia to Fiji and Samoa (according to van Balgooy in Blumea Suppl. 6: 171. 1971; I have not located a Samoan record), with about 140 species. One widespread species extends eastward to Fiji.

1. *Mallotus tiliifolius* (Bl.) Muell. Arg. in Linnaea 34: 190, as *M. tiliaefolius*. 1865; Pax & Hoffm. in Pflanzenz. 63 (IV. 147. VII): 148. fig. 22, D. 1914; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 187. fig. 55. 1972. FIGURES 144, 145.

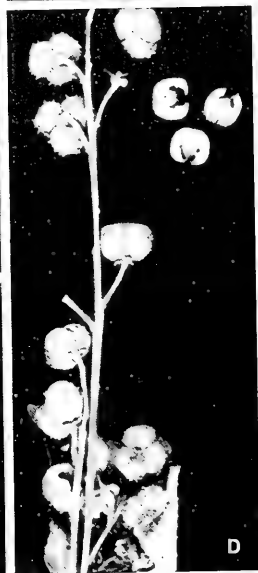
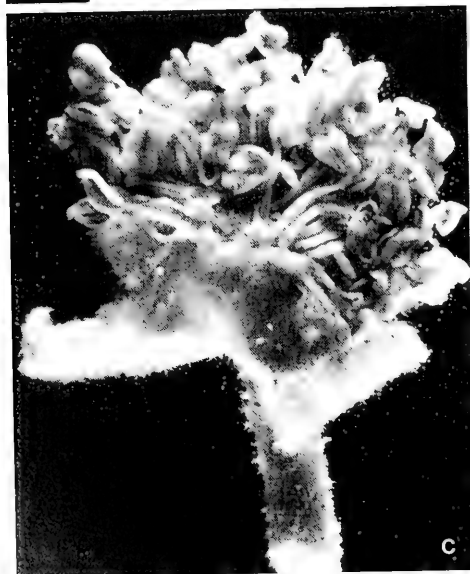
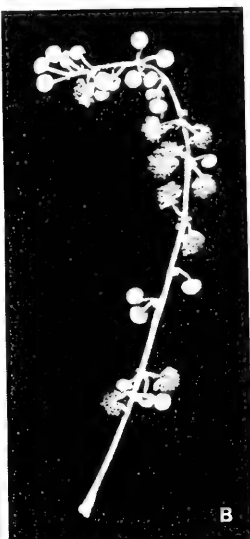
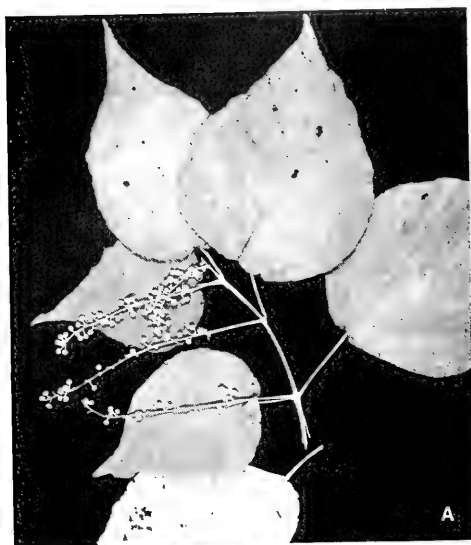
Rottlera tiliaefolia Bl. Bijdr. Fl. Ned. Ind. 607. 1826.

Rottlera acuminata sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862; non Miq.

Mallotus tiliaefolius Muell. Arg. in DC. Prodr. 15 (2): 969. 1866; Seem. Fl. Vit. 227. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 292. 1892.

As seen in Fiji, *Mallotus tiliifolius* is a tree or shrub 1.5-10 m. high occurring from near sea level to an altitude of 580 m., frequently in coastal thickets, but also inland in dry or open forest or in crest thickets. The sepals are yellow to pale green, the filaments white, and the anthers pale yellow. Flowering collections have been made in most months, but fruits have been obtained only between November and January.

TIPIFICATION AND NOMENCLATURE: The type of *Rottlera tiliaefolia* was presumably collected by Blume "ad littora insularum Nusae Kambangae et Javae" and is probably at *L. Mallotus tiliifolius* and *M. acuminatus* (Bl.) Muell. Arg. have seemed to present nomenclatural complications, and in fact Pax and Hoffman in 1914 cited *Milne 387* and *Seemann 407* under both taxa. The second is based on *Adisca acuminata* Bl. (Bijdr. Fl. Ned. Ind. 610. 1826), whereas *Rottlera acuminata* Miq. (Fl. Ned. Ind. 1 (2): 398. 1859) (sometimes accredited to A. H. L. Juss. Euphorb. Gen. 33. 1824, but not proposed there) is apparently a synonym of *M. tiliifolius*.



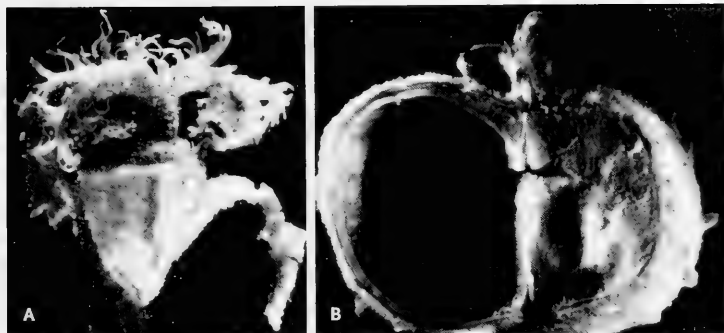


FIGURE 145. *Mallotus tilifolius*, from *Smith 6604*; A, ♀ flower, $\times 10$; B, two cocci of a schizocarp, the stigmas persistent, the left coccus split down the suture and empty, the right one intact and with its seed, $\times 7$.

DISTRIBUTION: Formosa, the Philippines, and western Malesia eastward to Fiji (and Samoa?). Thirty-one Fijian collections have been examined, but in certain coastal areas the species is more abundant than this would imply.

LOCAL NAMES: Recorded names are *nggetata*, *ngangata*, *wanggata*, and *araro*.

REPRESENTATIVE COLLECTIONS: YASAWAS: SAWA-I-LAU (south of Yasawa Island): *DA 13664*. VITI LEVU: MBA: Vicinity of Lautoka, *Greenwood 417*; north of Lomolomo, *Degener & Ordonez 13632*; Korovou, east of Tavua, *Degener 14948*. RA: Saulangitua, vicinity of Rewasa, near Vaileka, *Degener 15506*; near Thamboni, *DA 7153*. MAKONDRONGA: *Degener & Ordonez 13813*. WAKAYA: *Milne 387*; north end of island, *Bryan 613*. KORO: *Tothill 579*. VANUA LEVU: MBUA: Rukuruku Bay, *H. B. R. Parham 6*. MATHUATA: Track to Mt. Ndelanathau, *DA 16068*; vicinity of Lambasa, *Greenwood 537*; summit of Mt. Uluimbau, south of Lambasa, *Smith 6604*; near Tutu Island (east of Langalanga River), *Horne 597*. VANUA LEVU without further locality, *Seemann 407*. FIJI without further locality, *U. S. Expl. Exped.*

Ordinarily the species is characterized by its copious indument of stellate hairs, but occasionally (as in *Greenwood 537*) the leaf blades tend to become quite glabrous beneath, although the young leaves, inflorescences, etc., are typically pilose.

18. HEVEA Aubl. Hist. Pl. Guiane Fr. 871. 1775; Pax in *Pflanzenr.* **42** (IV. 147): 117. 1910; Pax & Hoffm. in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **19c**: 102. 1931; Seibert in *Ann. Missouri Bot. Gard.* **34**: 261. 1947.

Monoecious trees, with abundant milky latex, the stipules small, caducous; leaves spirally arranged or subopposite at ends of branchlets, the petioles long, with nectaries at apex, the blades 3-foliolate, glabrous, the leaflets short-petioliolate, entire, pinnate-nerved; inflorescences in axillary, many-flowered panicles composed of cymes, the central flower in each cyme ♀, the others ♂; flowers with a 5-dentate or 5-lobed calyx with induplicate-valvate aestivation, apetalous, the disk composed of 5 free or united

FIGURE 144. *Mallotus tilifolius*; A, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$; B, ♂ inflorescence, $\times 1$; C, ♂ flower, with many stamens removed, $\times 15$; D, infructescence, with detached fruit and dehisced cocci, $\times 1$. A-C from *Bryan 613*, D from *Smith 6604*.

glands; ♂ flowers with a columnar receptacle, the filaments adnate to column, the anthers sessile, 5 in 1 series or (as in our species) 10 in 2 superposed series, 2-locular, the column terminated by a rudimentary pistil; ♀ flowers with a sessile 3-locular ovary, each locule with a single ovule, the stigmas 3, sessile, broad, bilobed; fruit a 3-lobed schizocarp, large, woody, dehiscing explosively into 2-valved cocci, the seeds large, ellipsoid, ecarunculate.

TYPE SPECIES: *Hevea guianensis* Aubl.

DISTRIBUTION: South America, predominantly in the Amazon and Orinoco Valleys; sometimes treated as composed of eleven or twelve species, but only nine species are recognized by Schultes (1956, cited below). Most of the world's natural rubber is produced by the widely cultivated *Hevea brasiliensis*.

USEFUL TREATMENTS OF GENUS: Seibert, R. J. A study of *Hevea* (with its economic aspects) in the Republic of Peru. Ann. Missouri Bot. Gard. 34: 261-352. 1947. Schultes, R. E. The Amazon Indian and evolution of *Hevea* and related genera. J. Arnold Arb. 37: 123-147. 1956.

1. *Hevea brasiliensis* (Willd. ex A. H. L. Juss.) Muell. Arg. in *Linnaea* 34: 204. 1865, in DC. Prodr. 15 (2): 718. 1866; Pax in *Pflanzenr.* 42 (IV. 147): 121. 1910; J. W. Parham in *Agr. J. Dept. Agr. Fiji* 19: 98. 1948, Pl. Fiji Isl. ed. 2. 183. 1972; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 48. 1972.

Siphonia brasiliensis Willd. ex A. H. L. Juss. *Euphorb. Gen.* 113. pl. 12, fig. 38, B. 1824; H. B. K. *Nova Gen. et. Sp.* 7: 171. 1825.

In Fiji *Hevea brasiliensis* is apparently no longer cultivated, occurring only in abandoned plantations or perhaps seminaturalized. It is seen as a tree 12-20 m. high (up to 40 m. where indigenous), with copious white latex, near sea level. The calyx is cream-colored to yellow, and the stigmas are white. Fruiting material has not been noted in Fiji, but the large fruits are light brown with darker spots. Flowering collections have been noted between August and December.

TYPIIFICATION: *Siphonia brasiliensis* is often accredited to H. B. K., but Jussieu a year earlier published an illustration with analysis, and hence his publication is not a nomen nudum as indicated by Seibert (1947, cited above under the genus) (ICBN, Art. 44.1). A type was not cited, but Willdenow would doubtless have had the same specimens (at b) taken by Kunth as syntypes: *Humboldt & Bonpland* from San Fernando de Atabapo and from near Javita, R. Tuamini (Orinoco area), Venezuela.

DISTRIBUTION: Amazonian America, subsequently widely cultivated throughout the tropics.

LOCAL NAMES: *Pará rubber* is universally applied to this important economic plant; sometimes *rubber tree* or the corruption *rapa* is heard in Fiji. Many aspects of the uses, cultivation, origin, and distribution of *Hevea brasiliensis* are interestingly detailed by Purselove (*Trop. Crops, Dicot.* 146-171. 1968).

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Whaley's farm, *DA 12458*; in valley of Waivunu Creek, vicinity of Ngaloa, near abandoned plantation, *Smith 9440*. NAMOSI: Wainandoi Rubber Estate, *DA 16030*; on swampy flats in valley of Wainandoi River, *DF 432 (Damanu 97)*.

During World War II the commercial rubber tree was cultivated and tapped on several estates, especially along the south coast of Viti Levu, but now these efforts have been abandoned.

19. *ENDOSPERMUM* Benth. *Fl. Hongkong.* 304. 1861; Pax & Hoffm. in *Pflanzenr.* 52 (IV. 147. IV): 33. 1912, in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. 19c: 184. 1931; A. C. Sm. in *J. Arnold Arb.* 36: 281. 1955; Schaeffer in *Blumea* 19: 171. 1971. *Nom. cons.*

Dioecious trees (rarely with ♀ flowers but this not noted in Fiji), with colored or nearly colorless latex, the indument composed sometimes of simple hairs and sometimes of partly or wholly stellate hairs (as in our species), the stipules small, deltoid; leaves alternate, spirally arranged, the petioles often with conspicuous glands near apex, there extrorse (abaxial) or lateral (in all species except those of Fiji, in which the glands are introrse (adaxial) or lateral), the blades peltate or epeltate (mature blades always epeltate in our species), usually palmately nerved at base, the costa with few to many lateral nerves; inflorescences thyrsoid, the flowers subsessile to pedicellate, the calyx campanulate, with 3-6 imbricate lobes, the disk often carnosose and angled, the petals lacking; ♂ flowers with 5-17 stamens spiralled on an androphore, the filaments free, the anthers peltate, 3- or 4-locular, the cells dehiscing longitudinally, a rudimentary pistil lacking; ♀ flowers with a subglobose, 1-7-locular ovary, each locule with a single ovule, the stigma sessile, disciform; fruits drupaceous, indehiscent, 1-7-celled, the stigma persistent, the exocarp thin to thick and fleshy, the endocarp thin and woody, fibrous, the seeds ecarunculate, reticulately ribbed or tuberculate, with a hard testa.

TYPE SPECIES: *Endospermum chinense* Benth.

DISTRIBUTION: Southern China, Burma, and Sumatra and eastward through Malaysia to Fiji, with 14 or more species; the Fijian species are endemic and terminate the generic range.

USEFUL TREATMENTS OF GENUS: Schaeffer, J. Revision of the genus *Endospermum* Bth. (Euphorbiaceae). *Blumea* 19: 171-192. 1971. Smith, A. C. *Endospermum* Benth. *Allertonia* 1: 389-393. 1978.

KEY TO SPECIES

- Petioles of mature leaves usually glabrous but occasionally sparsely stellate-pilose, the apical glands pale, often yellowish; mature leaf blades usually 6.5-15 × 5-12 cm., rounded or subcordate to broadly obtuse at base, cuspidate to acuminate at apex, dark green and drying dark brown above, dull greenish and drying pale brown beneath, essentially glabrous or with sparse stellate hairs beneath (mostly on nerves), the hair branches 0.1-0.2 mm. long, the costa with 3 or 4 pairs of lateral nerves; calyx and infructescence rachis soon glabrate; fruiting pedicels 1-4 mm. long. 1. *E. macrophyllum*
- Petioles of mature leaves pilose with stellate hairs with arms 0.1-0.2 mm. long, tardily glabrate, the apical glands black or brown; mature leaf blades usually 14-25 × 12-17 cm., truncate or broadly obtuse at base or abruptly cuneate to petiole, rounded or obtuse or subacute at apex, dull green and drying pale brown above, usually yellowish and drying pale brown beneath, copiously and persistently stellate-tomentellous beneath, the hair branches 0.2-0.5 mm. long, the costa with 4-7 pairs of lateral nerves; calyx and infructescence rachis persistently stellate-pilose; fruiting pedicels 4-5 mm. long.
2. *E. robbianum*

1. *Endospermum macrophyllum* (Muell. Arg.) Pax & Hoffm. in *Pflanzenr.* 63 (IV. 147. VII): 418. 1914; A. C. Sm. in *Bishop Mus. Bull.* 141: 82. 1936, in *J. Arnold Arb.* 33: 390. 1952, in op. cit. 36: 281. 1955; G. Watkins in *Agr. J. Dept. Agr. Fiji* 31: 17. *fig.* 1961; J. W. Parham, *Pl. Fiji Isl.* 126. 1964, ed. 2. 180. 1972; Schaeffer in *Blumea* 19: 180, p. p. 1971; A. C. Sm. in *Allertonia* 1: 390. *fig.* 17. 1978.

Mappa macrophylla A. Gray ex Seem. in *Bonplandia* 9: 258, nom. nud. 1861, *Viti*, 441, nom. nud. 1862. *Macaranga macrophylla* Muell. Arg. in *DC. Prodr.* 15(2): 1001. 1866; Seem. *Fl. Vit.* 228. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* 293. 1892.

Tanarius macrophyllus Kuntze, *Rev. Gen. Pl.* 2: 620. 1891.

A tree 12-35 m. high, the trunk straight, to 1.5 m. in diameter and often clear to a height of 15 m., the crown often compact and small, the latex copious and nearly colorless. The species occurs from near sea level to an elevation of 900 m., often locally abundant in dense forest, sometimes in thickets near mangrove swamps. Flowers and fruits have been observed in most months.

TYPIFICATION: The type is *Seemann 396* (place of deposit not mentioned by

Mueller; holotype probably at G; ISOTYPES at BM, GH, K), collected in 1860 on Viti Levu without further locality.

DISTRIBUTION: Endemic to Fiji and known from several high islands; 48 collections have been examined.

LOCAL NAMES AND USES: The usual names are *kau vula*, *kau vulavula*, and *vulavula*, in reference to the whitish wood. Seemann recorded the name *mavu*, which usually refers to species of *Macaranga* (in which this species was originally placed). It is considered a valuable tree, providing a timber for building purposes, but the principal use of its soft, whitish wood seems to be for banana crates.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Mead 1991*; Waimongge Creek, *Berry 87*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 611 (S1403/1)*; track to Vanualevu Village, *Berry 80*. SERUA: Nambukelevu, upper Navua River, *DA 15661*; inland from Namboutini, *DF 577 (DF 801, S1403/7)*; inland from Ngaloa, *DF 578 (DF 802, S1403/6)*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8551*; Nambukavesi Creek, *DF 614 (S1403/4)*. NAITASIRE: Navuso Forest, *DA 280*; King's Road, 10 miles, *DA 2536*. TAILEVU: Waimaro River, *DA 1009*. REWA: Mt. Korombamba, *H. B. R. Parham 31*. KANDAVU: Naikorokoro, *DF 613 (S1403/3)*. OVALAU: Hills east of Lovoni Valley, *Smith 7268*. VANUA LEVU: MBUA: Mt. Seatura, *DA 15181*. MATHUATA: Sasa Tikina, *Howard 300*; vicinity of Lambasa, *DA 12474 (DF 123, Bola 25)*; Wainikoro River, *Greenwood 698*. THAKAUNDOVE: NAVONU Creek, Natewa Peninsula, *Howard 216*. TAVEUNI: Slopes of Mt. Manuka, east of Wairiki, *Smith 8350*.

2. *Endospermum robbianum* A. C. Sm. in *Bishop Mus. Bull.* **141**: 82. *fig. 42*. 1936, in *J. Arnold Arb.* **33**: 401. 1952, in op. cit. **36**: 281. 1955; J. W. Parham, *Pl. Fiji Isl.* **126**. 1964, ed. 2. **180**. *fig. 53*. 1972; A. C. Sm. in *Allertonia* **1**: 390. *fig. 18*. 1978.

A tree 8–15 m. high, often freely branched, occurring in a limited area between sea level and 200 m. in sometimes open forest or in patches of forest in open country. Flowers have been collected in May, November, and December, and the yellowish fruits in May and July.

TYPIIFICATION: The type is *Smith 1730* (BISH HOLOTYPE; many ISOTYPES), collected May 7, 1934, in the lower Wainunu River Valley, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and, as now known, restricted to a small area in central and southern Vanua Levu.

LOCAL NAMES AND USES: As for *Endospermum macrophyllum*.

AVAILABLE COLLECTIONS: VANUA LEVU: MBUA: Ridge above Thongea, Wainunu River, *DA 15770*. MATHUATA: Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6716*. THAKAUNDOVE: Mt. Kasi, *DA 15738*; Ndongoro Creek, *DA 15701, 15703*.

In 1978 I gave a more detailed justification for retaining this species as distinct from *Endospermum macrophyllum*, to which Shaeffer had reduced it without mentioning specimens.

20. MANIHOT Mill. *Gard. Dict. Abridg.* ed. 4. 1754; Seem. *Fl. Vit.* 229. 1867; Pax in *Pflanzenr.* **44** (IV. 147. II): 21. 1910; Pax & Hoffm. in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. **19c**: 174. 1931.

Monoecious, lactiferous shrubs (rarely trees or herbs), often with tuberous roots, the stipules small, caducous; leaves alternate (spirally arranged), long-petiolate, the blades usually palmately lobed and pale beneath; inflorescences terminal or pseudo-axillary, paniculate or racemose, the ♀ flowers long-pedicellate and on several lateral basal axes, the ♂ flowers shorter-pedicellate and more or less racemously arranged along the central axis, the calyx often petaloid, colored, campanulate, with imbricate lobes, the petals lacking; ♂ flowers with a cyathiform calyx, the disk central, intrastaminal, often with 5 bifid lobes, the stamens 10, free, biseriate, the anthers introrse, 2-locular, dehiscing longitudinally, a rudimentary pistil present or absent; ♀

flowers with the calyx more deeply lobed than the ♂, sometimes with staminodes, the disk pulviniform, the ovary 3-locular, each locule with 1 ovule, the styles 3, connate proximally, the stigmas dilated, often lacerate; fruit a dehiscent, sometimes winged capsule, the columella dilated distally, often persistent, the seeds smooth, carunculate, the testa thin, crustaceous.

LECTOTYPE SPECIES: *Manihot esculenta* Crantz (*Jatropha manihot* L.) (vide Adanson, Fam. Pl. 2: 356. 1763).

DISTRIBUTION: Southwestern U. S. to Argentina, but mostly concentrated in Brazil, with 100–200 species. A few species have been widespread in cultivation, but those producing rubber have mostly been abandoned. Only the cassava, *Manihot esculenta*, and a horticultural form of it are noted in Fiji.

1. *Manihot esculenta* Crantz, Inst. Rei Herb. 1: 167. 1766; Yuncker in Bishop Mus. Bull. 178: 74. 1943, in op. cit. 184: 47. 1945, in op. cit. 220: 165. 1959; Rogers in Bull. Torrey Bot. Club 90: 43. 1963; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 94. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 188. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 73, 123, 135. 1972.

Jatropha manihot L. Sp. Pl. 1007. 1753.

Manihot utilissima Pohl, Pl. Bras. Ic. Descr. 1: 32. pl. 24. 1826; Muell. Arg. in DC. Prodr. 15(2): 1064. 1866; Pax in Pflanzenz. 44 (IV. 147. II): 67. fig. 24. 1910; Christophersen in Bishop Mus. Bull. 128: 124. 1935; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 13: 42. 1942; J. W. Parham, Pl. Fiji Isl. 131. 1964.

Manihot Seem. in Bonplandia 9: 258. 1861.

Manihot aipi sensu Seem. Viti, 441. 1862; non Pohl.

Manihot palmata var. *aipi* sensu Seem. Fl. Vit. 229. 1867; non Muell. Arg.

Manihot palmata sensu Drake, Ill. Fl. Ins. Mar. Pac. 290. 1892; non Muell. Arg.

As seen in Fiji, *Manihot esculenta* is a shrub 1–3 m. high, widely cultivated as a staple crop from near sea level to an elevation of about 900 m. (i. e. the form producing edible roots tubers, with green or red-tinged petioles and leaf blades). The calyx is greenish white to yellow, often with pink streaks or tinged with red, the disk is orange, the ovary is greenish white with pink or red streaks, and the stigmas are white. Flowers and fruits occur throughout the year.

TYPIFICATION AND NOMENCLATURE: A large synonymy is applicable to *Manihot esculenta*. Above are listed only the names that have been applied in the Fijian Region. Crantz alludes to "Manihot Theveti etc.", probably a reference to the first species of the six listed by Miller in 1754 without binomials, and indirectly to Bauhin's treatment listed among others by Linnaeus in 1753. Pohl, in describing *M. utilissima*, cites many old references, including that of Bauhin. Hence, the binomials of both Crantz and Pohl rest on *Jatropha manihot* L., for which I have not noted a precise lectotypification.

DISTRIBUTION: Although *Manihot esculenta* is not known in a wild state, the principal centers of speciation of the genus are in Central America and northeastern Brazil. In pre-Columbian times cassava had reached its present limits of cultivation in the New World, and since then it has become an important crop plant throughout the tropics. Many cultivars have been developed and some have apparently hybridized with local native species in tropical America.

KEY TO INFRASPECIFIC TAXA

- Leaf blades green or red-tinged or with yellowish veins, usually palmately 3–several-lobed but occasionally simple; cultivated for its edible tubers. 1a. *M. esculenta*
 Leaf blades yellowish white with green margins, palmately 3-lobed to simple; cultivated as a garden ornamental. 1b. *M. esculenta* cv. 'Variegata'

1a. *Manihot esculenta*

LOCAL NAMES AND USES: The usual Fijian names are *yambia ni vavalangi*, *yambia ndamu*, *yambia vula*, and *tavioka*; also widely used are *cassava*, *kasava*, *tapioca*, and *kasera* (Hindi). Many other local names are listed by J. W. Parham (1972, cited above). Numerous cultivars or clones of the species are known; those with edible tubers are usually divided into (1) sweet cassavas, characterized by a relative freedom from poisonous properties, and (2) bitter cassavas, with a high hydrocyanic acid content, from which the poisonous juice must be squeezed out and dissipated. Only sweet cassavas are utilized in Fiji, their root tubers providing a food and carbohydrate source, although inferior to yams and taro because of a low protein content. Detailed discussions are found in Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 1434-1443. 1966) and Purseglove (Trop. Crops, Dicot. 172-180. 1968).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Nathotholevu, DA, in 1964. NAITASIRE: Nanduruloulou, DA 5647; Koronivia, DA 9818, 10071-10086 (inclusive, to show leaf variations). TAILEVU: East of Wainimbuka River, vicinity of Ndakuivuna, Smith 7232; Navuloa, DA 2713. OVALAU: Wainiloka, DA 1338. VANUA LEVU: THAKAUNDOVE: Along Hibiscus Highway east of Savusavu, Bierhorst F181. TAVEUNI: DA 2572. LAKEMBA: Between Levuka and Wathiwathi, Garnock-Jones 972. FIJI without further locality, Seemann 399 (noted by Seemann in cited references of 1861, 1862, and 1867 but not found in herbaria).

On the listed collections, DA 1338 has all its leaves simple; DA 5647 has both simple and lobed leaves.

1b. *Manihot esculenta* cv. 'Variegata'

Similar to cultivars with edible tubers, differing in having its leaf blades yellowish white (or sometimes greenish or grayish yellow) with green margins, the blades most often 3-lobed, sometimes simple.

TYPIFICATION: I have been unable to trace the origin of the trinomial, which is usually referred to as "var. *variegata*," although it would appear to be no more than an ornamental cultivar.

DISTRIBUTION: Widely cultivated in tropical countries, although its source is not known.

USE: Ornamental; widely cultivated in Suva and elsewhere in Fiji. The available collections, in flower and fruit in March and December, give an inadequate picture of the distribution.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: Nanduruloulou, DA 9816; Koronivia, DA 9819, 10088, 10089. REWA: Suva, in private garden, DA 16730. MBENGGGA: Ndakuimbengga, DA 9620.

21. *JATROPHA* L. Sp. Pl. 1006. 1753; Seem. Fl. Vit. 230. 1867; Pax in Pflanzenr. 42 (IV. 147): 21. 1910; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 160. 1931.

Monocious (rarely dioecious) shrubs or small trees (rarely herbs), with milky or watery latex, the stipules minute and caducous or entire or segmented or replaced by stalked glands; leaves alternate (spirally arranged), the blades entire, toothed, or palmately lobed; flowers in terminal, often long-stalked dichasia, the lower flowers ♀, the distal flowers ♂, the perianth biseriate, the calyx synsepalous, 5-lobed, the lobes imbricate or open in aestivation, the petals 5, imbricate to contorted, free or coherent; ♂ flowers with a usually dissected disk, the stamens 8-10, the filaments connate at least basally, the anthers biverticillate, a vestigial pistil lacking; ♀ flowers with a cupular or pulviniform disk, the ovary usually 3-locular, each locule with 1 ovule, the styles more or less connate at base, bifid, the style branches usually entire; fruit

capsular, the columella persistent, the mericarps crustaceous to woody, the seeds ellipsoid, carunculate, with a crustaceous testa.

LECTOTYPE SPECIES: *Jatropha gossypifolia* L. (vide McVaugh in Bull. Torrey Bot. Club 71: 457, as *J. gossypifolia*. 1944), one of Linnaeus's original seven species.

DISTRIBUTION: Tropical and subtropical in America and Africa (and a few species indigenous in Arabia and the southern Indian region), with 125-175 species, some of which are widely cultivated elsewhere. Four species are known to be cultivated in Fiji, one of them occasionally becoming naturalized.

USEFUL TREATMENT OF GENUS: McVaugh, R. The genus *Jatropha* in America; principal intrageneric groups. Bull. Torrey Bot. Club 72: 271-294. 1945.

In the above-cited treatment, McVaugh discusses the American species as falling into four sections, giving the technical characters of these. Each of the species present in Fiji belongs to a different section. The following key utilizes more obvious characters rather than technical ones; it is adapted from the key given by Backer and Bakhuizen van den Brink, Jr., Fl. Java 1: 494. 1963.

KEY TO SPECIES

- Stipules minute, subulate-deltoid, entire; petioles without stalked glands; fruits indehiscent or 3-coccos.
- Petioles 3-15 cm. long; leaf blades broadly ovate, 5-15 × 6-16 cm., 3- or 5-angled or shallowly lobed; calyx green; petals green to yellowish, 6-8 mm. long; fruits 2.5-3 cm. long, nearly unlobed, indehiscent; small tree, the trunk to 10 cm. or more in diameter. 1. *J. curcas*
- Petioles 1-7 cm. long; leaf blades usually ovate to panduriform, 6-16 × 4-10 cm., mostly entire, with obscure basal teeth or marginally incised or toothed; calyx red; petals rich pink to scarlet, 10-13 mm. long; fruits about 1 cm. long, shallowly lobed, breaking into 3 cocci; slender shrub. 2. *J. integerrima*
- Stipules well developed, divided into narrow segments or replaced by stalked glands; fruits breaking into 3 cocci.
- Petioles with stalked, viscid glands; leaf blades epeltate, orbicular to obovate, 6-20 × 7-22 cm., 3- or 5-lobed, with marginal stalked glands; stipules replaced by decurrent series of stalked glands; calyx glanduliferous, purple-tinged; petals dark red to purple, paler at base, 4-5 mm. long; fruits 10-12 mm. long; stems branching, not swollen near base. 3. *J. gossypifolia* var. *elegans*
- Petioles without stalked glands; leaf blades peltate, broadly ovate, 20-40 cm. in diameter, entire to 3- or 5-angled or -lobed; stipules divided into small, rigid segments; calyx eglandular, orange-red; petals red to vermilion, 7-8 mm. long; fruits about 15 mm. long; stems swollen near base, simple or few-branched. 4. *J. podagrica*

1. *Jatropha curcas* L. Sp. Pl. 1006. 1753; Muell. Arg. in DC. Prodr. 15 (2): 1080. 1866; Seem. Fl. Vit. 230. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 289. 1892; Pax in Pflanzenr. 42 (IV. 147): 77. fig. 30. 1910; Christophersen in Bishop Mus. Bull. 128: 124. 1935; Greenwood in Proc. Linn. Soc. 154: 104. 1943; Yuncker in Bishop Mus. Bull. 220: 165. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 74. fig. 33. 1959, Pl. Fiji Isl. 128. 1964, ed. 2. 185. 1972; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 61. 1972.

Curcas purgans Medik. Malv. 119. 1787; Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

A small tree 3-5 m. high, with milky latex, the trunk often to 10 cm. in diameter; cultivated and also naturalized along roadsides, on open slopes, and sometimes in forest. The fragrant flowers have the calyx green, the petals green to yellowish, and the stamens yellow; the fruits turn from green to yellow at maturity. Flowers and fruits have been noted in scattered months throughout the year.

TYPIIFICATION: Several prior references are given by Linnaeus.

DISTRIBUTION: Tropical America from Mexico and the West Indies to Brazil, now widely cultivated throughout the tropics and often naturalizing.

LOCAL NAMES AND USES: The usual English name is *physic nut*; recorded Fijian names are *wiriwiri*, *wiriwiri ni vavalangi*, *uto ni vavalangi*, *mbanindakai*, *manggele*, *ndrala*, and *fiki* (the last only on Lakemba). At present the species is primarily used as an ornamental, mostly in the form of living fences; the leaves and inner bark have been used medicinally as a purgative, and the light wood has been used to make canoe outriggers. The seeds are poisonous but produce a useful oil for paints, soaps, etc.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 355*. NANDRONGA & NAVOSA: Navula, Singatoka Valley, *DA 11328*. RA: Vicinity of Nasukamai, *Gillespie 4397*; Yanggara, *DA 10735*. NAITASIRI: Viria, *Meebold 17069*. TAILEVU: Korovou, *Weiner 101*. REWA: Suva, *DA 11069*. OVALAU: North of Levuka, *Gillespie 4576*; Nathula Point, *Weiner 166*. VANUA LEVU: THAKAUNDRIVE: Yaroi, near Savusavu, *DA 3778*; along Hibiscus Highway east of Savusavu, *Bierhorst F157*. KANATHEA: *Bryan 573*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 778*. "LAKEMBA and OVALAU": *Seemann 400* (cited by Seemann in 1861, 1862, and 1867 but not found in herbaria). FIJI without further locality, *Harvey*, Nov., 1855.

2. *Jatropha integerrima* Jacq. Enum. Syst. Pl. Carib. 32. 1760.

Jatropha hastata Jacq. Enum. Syst. Pl. Carib. 32. 1760. Select. Stirp. Amer. 256. t. 173, fig. 54. 1763; Pax in Pflanzenr. 42 (IV. 147): 51. 1910; J. W. Parham, Pl. Fiji Isl. ed. 2. 185. 1972.
Jatropha panduraefolia Andrews, Bot. Repos. 4: pl. 267. 1802, in Bot. Mag. 17: pl. 604. 1803.

A slender shrub 1–3 m. high, in Fiji infrequently cultivated near sea level. Its calyx is red and its petals rich pink to scarlet. The only available collection was in flower in March.

TYPIFICATION: *Jatropha integerrima* and *J. hastata* were based on West Indian collections, *J. panduraefolia* (original spelling) on a cultivated plant originally sent from Cuba in 1801 to Mr. J. Fraser, Chelsea. The name *J. hastata* is the one most frequently applied to this species, but in combining Jacquin's two simultaneously published taxa (as had been done previously but under a later synonym) McVaugh (1945, cited above under the genus, pp. 274–275) selected the epithet *integerrima*.

DISTRIBUTION: Native of the West Indies but now frequently cultivated elsewhere in tropical countries; probably originally endemic to Cuba.

LOCAL NAME AND USE: No name was noted in Fiji, but *red-flowered jatropha* is often applied to this attractive ornamental. It is presumably a comparatively recent introduction into Fiji.

AVAILABLE COLLECTION: VITI LEVU: REWA: Lami, in private garden, *DA 16456*.

3. *Jatropha gossypifolia* L. var. *elegans* (Pohl) Muell. Arg. in DC. Prodr. 15 (2): 1087, as *J. gossypifolia* var. *e*. 1866; Pax in Pflanzenr. 42 (IV. 147): 26. 1910.

Adenorhopium elegans Pohl, Pl. Bras. Ic. Descr. 1: 15. 1826.
Jatropha elegans Kl. in Seem. Bot. Voy. Herald, 102. 1853.

A branching shrub with viscid-hispid young foliage, infrequently cultivated near sea level. The calyx is purple-tinged and the petals dark red to purple, paler at base. The only available collection was flowering in January.

TYPIFICATION: The type was collected by Martius "ad Villam dos Ilhéos," Bahia, Brazil. It differs from the typical variety of *J. gossypifolia* L. (original and often used spelling) in having glabrous leaves.

DISTRIBUTION: West Indies and tropical America, now cultivated in other tropical countries.

LOCAL NAME AND USE: *Wiriwiri ni vavalangi*, the name usually applied to *Jatropha curcas*, was noted by Tothill, who provided the only known Fijian record of this

ornamental. Tothill also stated on his label: "becoming naturalized," which seems unlikely, since no other collections appear to have been made in Fiji.

AVAILABLE COLLECTION: OVALAU: Levuka (Jan. 22, 1927), *Tothill 727*.

4. *Jatropha podagrica* Hook. in Bot. Mag. 74: *pl.* 4376. 1848; Seem. Bot. Voy. Herald, 102. 1853; Muell. Arg. in DC. Prodr. 15 (2): 1093. 1866; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 91. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 185. 1972.

A shrub to 2 m. high, moderately common in cultivation near sea level. Its habit is distinctive, the stem being succulent, swollen near base, and simple or few-branched. The calyx is orange-red and the petals red to vermilion. Flowers and fruits have been noted in January but probably are to be found in most months.

TYPIIFICATION: Hooker indicated that his original material had been sent to him from Santa Marta, Colombia, but Seemann (1853, noted above) stated that he had first sent living specimens to Kew from Panama.

DISTRIBUTION: Central America and perhaps northern South America; now widely cultivated elsewhere in the tropics.

LOCAL NAMES AND USE: The usual English name is *gout stalk*, but *coral plant* has also been recorded in Fiji. The species is an attractive ornamental, with an unusual appearance because of its swollen stem.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, "Botanical Station," *Yeoward 13*; Suva Botanical Gardens, *DA 12302*; Suva, in private garden, *DA 16235*.

22. ALEURITES J. R. & G. Forst. Char. Gen. Pl. 56. 1775, ed. 2. 111. 1776; Seem. Fl. Vit. 222. 1867; Pax in Pflanzenz. 42 (IV. 147): 128. 1910; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 99. 1931.

Monoecious trees, often with white latex, the indument of stellate and simple hairs, the stipules small, soon caducous; leaves alternate (spirally arranged), long-petiolate, the petioles adaxially biglandular at apex, the blades entire or palmately lobed, palmately nerved; flowers in terminal, paniculiform cymes, the ♂ flowers maturing before the ♀, the perianth biseriate, the calyx calyptrate in bud, valvately or irregularly rupturing into 2-5 lobes at anthesis, the petals 5, imbricate or contorted in bud, the disk usually composed of 5 glands alternate with petals; ♂ flowers with 7-20 stamens, the filaments connate into a column, the anthers in 2-4 superposed series, 2-locular, longitudinally and introrsely (in all our species) dehiscent, a vestigial pistil lacking; ♀ flowers with a 2-5-locular ovary, each locule with 1 ovule, the styles free, bifid; fruits drupaceous, indehiscent or tardily dehiscent, the pyrene 1-5-locular, the seeds ecarunculate, with a thick and woody testa, the endosperm copious, oily.

TYPE SPECIES: *Aleurites triloba* J. R. & G. Forst. (= *A. moluccana* (L.) Willd.), the only original species.

DISTRIBUTION: Central and western China, southward and eastward through Malesia and into the Pacific (at least as aboriginally introduced), with five or six species. A discussion of the generic circumscription is provided by Webster in J. Arnold Arb. 48: 343. 1967. Of the three species noted as occurring in Fiji, one is firmly naturalized and the other two are merely in experimental cultivation.

KEY TO SPECIES

Abundant tree, appearing indigenous but doubtless aboriginally introduced; indument of branchlets, leaves, and inflorescences composed of whitish, stellate hairs; petals lanceolate, 6-10 mm. long (longer in ♀ flowers than in ♂); stamens about 20, usually 4-seriate; ovary 2-locular, the styles 2, deeply bifid; fruits ovoid-globose or semiglobose, to 6 × 7 cm., indehiscent, with 1 or 2 developed seeds; mature leaf blades

- deltoid- to ovate-oblong, to 24×12 cm., entire or shallowly 3-lobed, 3- or 5-nerved (larger and more deeply lobed when juvenile). 1. *A. moluccana*
- Sparsely and experimentally cultivated trees; indument of branchlets, leaves, and inflorescences composed of bifurcate or simple hairs; petals more than 15 mm. long; stamens 7-10, biseriate; ovary 3-5-locular, the styles 3-5; fruits 4-6 cm. in diameter, tardily dehiscent.
- Petiole glands stalked; mature leaf blades usually ovate, to 20×15 cm.; calyx splitting on one side; petals 7-8 mm. broad; fruits ovoid, wrinkled, with 3-5 longitudinal ribs and a few transverse ribs, brown-pilose. 2. *A. montana*
- Petiole glands sessile; mature leaf blades suborbicular, to 20 cm. long and broad; calyx irregularly rupturing, usually into 2 lobes; petals about 15 mm. broad; fruits subglobose, smooth, not transversely ribbed, glabrous. 3. *A. fordii*

1. *Aleurites moluccana* (L.) Willd. Sp. Pl. 4: 590. 1805; Seem. Fl. Vit. 223. 1867; Engl. in Bot. Jahrb. 7: 463. 1886; Drake, Ill. Fl. Ins. Mar. Pac. 289. 1892; Pax in Pflanzenr. 42 (IV. 147): 129. fig. 45. 1910; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 100. fig. 50. 1931; Guillaumin in J. Arnold Arb. 14: 60. 1933; Christophersen in Bishop Mus. Bull. 128: 121. 1935; Blackie in Agr. J. Dept. Agr. Fiji 8 (2): 36. 1936; Yuncker in Bishop Mus. Bull. 178: 74. 1943, in op. cit. 184: 46. 1945, in op. cit. 220: 164. 1959; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 85. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 329. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 54. 1972.

Jatropha moluccana L. Sp. Pl. 1006. 1753.

Aleurites triloba J. R. & G. Forst. Char. Gen. Pl. 56. t. 56. 1775, ed. 2. 112. t. 56. 1776; Forst. f. Fl. Ins. Austr. Prodr. 68. 1786; Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

As it occurs in Fiji, *Aleurites moluccana* is a tree 10-25 m. high, found from near sea level to an elevation of 825 m. in forest or along its edges, in thickets, and sometimes along the shore. The petals and filaments are white, the anthers yellow. Flowers and fruits are apparent throughout the year.

TYPIFICATION: The only reference cited by Linnaeus is a Hermann collection from Ceylon. *Aleurites triloba* is typified by a J. R. & G. Forster collection made in the Society Islands during Cook's second voyage; one of two sheets at BM, labelled "G. Forster's Herbarium" and "360. *Aleurites triloba*" may be taken as the lectotype.

DISTRIBUTION: Indigenous in Malesia, although the precise area of its nativity is probably impossible to establish because of its early aboriginal introduction to neighboring areas, doubtless including India and Ceylon as well as Melanesia and Polynesia. It is now abundant in many tropical areas. In Fiji it is firmly naturalized but does not seem to occur in deep forest, being most apparent near villages or old village sites or along streams. About 40 collections are at hand, but the tree is more frequent than this implies.

LOCAL NAMES AND USES: The most commonly used Fijian names are *lauthé*, *lauthi*, *toto*, and *sikethi*; also recorded are *tuitui*, *waiwai*, *sikeli*, and *nggerenggere*. The English name *candlenut* is frequently used. *Lauthé* was one of the most useful trees in pre-European Fijian economy, the oil from the fruit being used on hair and skin, as a polish for wood, and as a dye formerly used in tattooing. An early use for *candlenut* seeds was to arrange them on a cord or stick to provide a continuing source of light. The roots provided a reddish dye for bark cloth. Today the wood is said to provide a useful case timber.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4308*; Korovou, east of Tavua, *Degener 14957*; vicinity of Nandarivatu, *Gillespie 4249*. NANDRONGA & NAVOSA: Nggalinggali Creek, near Nandrau, *DA L.13483 (DF 1195)*. SERUA: Nambukelevu,

upper Navua River, *Berry 114*; Korovisilou, *DF 385 (Damanu 72)*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8855*; vicinity of Namosi Village, *Gillespie 2831*. NAITASIRI: Vicinity of Matawailevu, Wainimala River, *St. John 18249*; near Nanduruloulou, *DA 2503*. REWA: Suva Botanical Gardens (cult.), *DA 12090*. KANDAVU: Namalata isthmus region, *Smith 23*. OVALAU: Hills southeast of valley of Mbureta River, *Smith 7406*. KORO: Eastern slope of main ridge, *Smith 1059*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7945*. VANUA LEVU: THAKAUNDROVE: Waingiri Creek, *DA 12201 (DF 51)*; along Hibiscus Highway east of Savusavu, *Bierhorst F166*. TAKEUNI: Kolb Estate, *Weiner 71-7-33a*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 1046*. LAKEVEMBA: Between Yandrana and Vakano, *Garnock-Jones 950*. FIJI without further locality, *Seemann 403*.

2. *Aleurites montana* (Lour.) E. H. Wilson in Bull. Imp. Inst. Gr. Brit. **11**: 445, 460. 1913; Pax & Hoffm. in Pflanzenz. **68** (IV. 147. XIV): 8. 1919, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c**: 100. 1931; Merr. in Trans. Amer. Philos. Soc. n. s. **24** (2): 239. 1935; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972.

Vernicia montana Lour. Fl. Cochinch. 587. 1790.

In Fiji *Aleurites montana* occurs only as a small tree in experimental cultivation.

TIPIFICATION: The holotype is *Loureiro* (BM), from Cochinchina, as noted by Merrill (1935, cited above).

DISTRIBUTION: Southeastern China and adjacent areas to the south, now widely cultivated in tropical areas.

LOCAL NAMES AND USES: *Tung, mu tree*; the oil is of commercial importance for its use in the manufacture of varnishes, paints, linoleum, etc. Probably no attempts at commercial production have yet been made in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nanduruloulou, *DA 5522, 9817*. TAILEVU: Korovou, *DA 2599*.

3. *Aleurites fordii* Hemsl. in Hook. Icon. Pl. **29**: t. 2801, 2802. 1906; Pax in Pflanzenz. **42** (IV. 147): 132. 1910; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c**: 100. 1931; J. W. Parham, Pl. Fiji Isl. 124. 1964, ed. 2. 176. 1972.

A small tree in experimental cultivation only in Fiji.

TIPIFICATION: Hemsley cited six collections, all from China.

DISTRIBUTION: Central and western China; now widely cultivated in subtropical and temperate areas.

LOCAL NAME AND USES: *Tung*; a source of commercial tung oil, with the same uses as the preceding species. As *Aleurites fordii* is indigenous in the cooler parts of central and western China, it is not suitable for cultivation in tropical climates, although it has often been tried experimentally, as in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nanduruloulou, *DA 7405, 12258*.

23. CODIAEUM A. H. L. Juss. Euphorb. Gen. 33. 1824; Seem. Fl. Vit. 230. 1867; Pax & Hoffm. in Pflanzenz. **47** (IV. 147. III): 23. 1911, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **19c**: 157. 1931. Nom. cons.

Monocious shrubs or small trees, glabrous or glabrescent (but indument if present composed of simple hairs), stipulate; leaves alternate (spirally arranged), the blades simple; inflorescences axillary, racemose, solitary or paired, the flowers with a biserial perianth (σ only), the calyx usually with 5 (3-6) imbricate lobes; σ flowers fasciculate, the petals minute, 5 or 6, the disk extrastaminal, composed of glands alternating with petals, the stamens 15-35, free, not inflexed in bud, the anthers 2-locular, longitudinally dehiscent, a rudimentary pistil lacking; f flowers solitary, lacking petals and staminodes, the disk cupuliform, the ovary 3-locular, each locule

with 1 ovule, the styles unlobed; fruit a subglobose, 3-lobed, thin-walled schizocarp, dehiscent into 2-valved cocci.

TYPE SPECIES: *Codiaeum variegatum* (L.) A. H. L. Juss. (*Croton variegatum* L.).
Typ. cons.

DISTRIBUTION: Malesia, northern Australia, and eastward into the Pacific, with about 15 species. One species, *Codiaeum variegatum*, occurs indigenously (in its var. *moluccanum*) in Fiji.

1. *Codiaeum variegatum* (L.) A. H. L. Juss. Euphorb. Gen. 33. t. 9, fig. 30. 1824.

A myriad of cultivated forms with variegated leaves is encompassed in *Codiaeum variegatum*; probably these should be treated as cultivars, derived for the most part from *C. variegatum* var. *moluccanum*. Unfortunately, in this case the nomenclatural type of the species is a cultivated form, the "wild" form requiring a varietal name. The variegated forms are commonly referred to as *croton*, a misleading application of a common name, since the genus *Croton*, although related to *Codiaeum*, is very distinct. Probably so many intergrading forms occur in the complex denoted as "var. *variegatum*" that it is unwise to apply botanical names to them. However, the cultivars noted in Fiji may be grouped into two "forms," briefly discussed below.

KEY TO VARIETIES AND FORMS

Leaf blades uniformly green, essentially entire, lanceolate to oblong or obovate, 12-40 × 2-9 cm.; apparently indigenous. 1a. var. *moluccanum*

Leaf blades variable, white- to red-maculate or otherwise variegated, entire to lobed; cultivated forms. (1b.) var. *variegatum*

Leaf blades predominantly oblong-ovate, usually 3-9 cm. broad, not linear or spatulate and not with the lamina interrupted by one or more lengths of costa. 1b. var. *variegatum* f. *variegatum*

Leaf blades linear or spatulate and about 1 cm. broad, or sometimes lanceolate to narrowly obovate, up to 4 cm. broad, and with the lamina interrupted by one or more lengths of costa.

1c. var. *variegatum* f. *taeniosum*

1a. *Codiaeum variegatum* var. *moluccanum* (Dec.) Muell. Arg. in DC. Prodr. 15 (2): 1119. 1866; Seem. Fl. Vit. 231. 1867; Pax & Hoffm. in Pflanzenz. 47 (IV. 147. III): 24. 1911; Guillaumin in J. Arnold Arb. 13: 91. 1932; J. W. Parham, Pl. Fiji Isl. ed. 2. 179. 1972.

Codiaeum variegatum var. *c.* Bl. Bijdr. Fl. Ned. Ind. 606. 1826.

Codiaeum moluccanum Dec. in Nouv. Ann. Mus. Hist. Nat. 3: 485. 1834.

Croton sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Codiaeum variegatum var. *genuinum* sensu Seem. Fl. Vit. 231, p. p. 1867; non Muell. Arg.

In Fiji the "wild" variety of *Codiaeum variegatum* is a tree or shrub 2-6 m. high, with watery latex, occurring at elevations from near sea level to 600 m. in dense, open, or dry forest or in beach thickets, often with local abundance. The sepals and petals are white to greenish white, the filaments are similar in color, and the anthers are yellow. Flowers and fruits are found throughout the year.

TIPIFICATION: In making the varietal combination, Mueller suggested Timor as the type locality but gave no details. Decaisne cited Blume's "var. *c.*" as the only synonym of *Codiaeum moluccanum*, mentioning Java, Timor, Amboina, Port Praslin, and the Philippines but without citing specimens. It might be best to accept the Blume specimen (presumably at L) as the lectotype.

DISTRIBUTION: Malesia and eastward to Queensland, the New Hebrides, and Fiji. Although the green-leaved variety gives every appearance of being indigenous in Fiji, this cannot be asserted without qualification, as conceivably it was brought by abori-

ginal voyagers together with variegated forms that are seen only in cultivation. About 50 Fijian collections are at hand.

LOCAL NAMES AND USE: The green-leaved variety is usually referred to as *sathasatha*, *sathasatha ni veikau*, *sathasatha loa*, or *sathasatha ndamu*. Medicinal qualities are sometimes imputed to its leaves.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NADRONGA & NAVOSA: Tonuve, *H. B. R. Parham 136*; Nakalavo, *H. B. R. Parham 223*. SERUA: Coastal hills in vicinity of Taunovo River, east of Wainiyambia, *Smith 9575*; Ndeumba, *DA 9216 (McKee 2780)*. NAITASIRI: Navuso Forest, *DA 31*; Tholo-i-suva, *DF 330 (Bola 132)*; vicinity of Nasinu, *Gillespie 3405*. TAILEVU: Ndawasamu, *DA 13587*; Namulomulo, *DF 1049 (Damanu 184)*. OVALAU: *Seemann 409*. KORO: Munda, *DA 11801*. VANUA LEVU: MATHUATA: Ndreketi River, *DA 13447*; Mt. Numbuloa, east of Lambasa, *Smith 6346*. THAKAUNDROVE: Savundronro Creek, *DA 13165*; Maravu, near Salt Lake, *Degener & Ordonez 14160A*. TAVEUNI: Vicinity of Nggeleni, *DA 14409*; vicinity of Waiyevo, *Gillespie 4651*; slopes of Mt. Manuka, east of Wairiki, *Smith 8173*. NAYAU: Tothill 724.

1b. *Codiaeum variegatum* var. *variegatum* f. *variegatum*

Croton variegatum L. Sp. Pl. 1199. 1753.

Codiaeum variegatum A. H. L. Juss. Euphorb. Gen. 33. t. 9, fig. 30. 1824; Bl. Bijdr. Fl. Ned. Ind. 606. 1826; Seem. in Bonplandia 9: 259. 1861. Viti, 441. 1862; Drake, Ill. Fl. Ins. Mar. Pac. 290, p. p. 1892; Merr. Interpret. Rumph. Herb. Amb. 325. 1917; Yuncker in Bishop Mus. Bull. 178: 75. 1943, in op. cit. 220: 166. 1959; J. W. Parham in Agr. J. Dept. Agr. Fiji 29: 32. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 86. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 22. 1972; St. John in Phytologia 36: 369. 1977.

Croton pictum Lodd. in Bot. Cab. 9: t. 870. 1824.

Codiaeum pictum Hook. in Bot. Mag. 58: t. 3051. 1831.

Codiaeum variegatum var. *genuinum* Muell. Arg. in DC. Prodr. 15 (2): 1119, nom. inadmis. 1866.

Codiaeum variegatum var. *pictum* Muell. Arg. in DC. Prodr. 15 (2): 1119. 1866; Seem. Fl. Vit. 231. 1867; Guillaumin in J. Arnold Arb. 13: 91. 1932; Christophersen in Bishop Mus. Bull. 128: 124. 1935; Yuncker in op. cit. 184: 47. 1945.

Codiaeum variegatum var. *genuinum* subvar. *angustifolium* Muell. Arg. in DC. Prodr. 15 (2): 1120. 1866; Seem. Fl. Vit. 231. 1867.

Codiaeum variegatum var. *variegatum*; J. W. Parham, Pl. Fiji Isl. 125. 1964, ed. 2. 179. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 50, 86. 1972.

In Fiji the typical form of *Codiaeum variegatum* is a shrub 1.5–5 m. high, found only in cultivation near sea level (as noted in collections, but probably also in upland villages). Its flowers seem not different from those of var. *moluccanum*; although it flowers sporadically, it is often seen sterile.

TYPEIFICATION AND NOMENCLATURE: *Croton variegatum* is typified entirely by *Codiaeum chrysosticton* Rumph. Herb. Amb. 4: 65. t. 25. 1743, as noted by Merrill (1917, cited above). The basis of Hooker's plate of *Codiaeum pictum* was a cultivated plant in the Glasgow Botanic Gardens, originally sent from Mauritius; however, that binomial is based on *Croton pictum* Lodd., which in turn is based on Rumphius's vol. 4, t. 25, and hence is a direct synonym of *Croton variegatum* L. *Codiaeum variegatum* var. *genuinum* subvar. *angustifolium* was based by Mueller on *Codiaeum chrysosticton angustifolium* of Rumphius; also cited was *Seemann 411*. The nomenclature of this typical form is immensely more complex than indicated above, where only the names pertinent to cited occurrences in the Fijian Region are considered. There are doubtless many other cultivars, varieties, and forms that indirectly refer back to the original Rumphian name of 1743.

DISTRIBUTION: The nomenclaturally typical form of the species was probably derived from var. *moluccanum* by aboriginal selection, but whether such selection was local in various archipelagoes or whether the variegated forms were taken eastward

from Malesia is questionable. At present the form here discussed, or something very close to it, is found in cultivation throughout the tropics.

LOCAL NAMES AND USE: In addition to the misnomer *croton*, the names *sathasatha*, *sathasatha loa*, and *vasa ndamu* have been noted in Fiji. The form is a popular ornamental in gardens or in hedges; its leaves are variously variegated with green and red, red with green veins, green and white, green with yellow blotches, etc.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Singatoka Valley, DA 12590; Tonuve, H. B. R. Parham 201. NAITASIRE: Near Nasinu, Greenwood 611A. REWA: Suva, Dept. Agriculture compound, DA 12189; Suva, in private gardens, DA 16217, 16219, 16226, 16229. LAKEMBA: Seemann 411.

1c. *Codiaeum variegatum* var. *variegatum* f. *taeniosum* (Muell. Arg.) Muell. Arg. ex J. W. Parham, Pl. Fiji Isl. ed. 2. 179. 1972.

Croton variegatum var. β L. Sp. Pl. 1199. 1753.

Croton sp. Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862.

Codiaeum variegatum var. *genuinum* subvar. *taeniosum* Muell. Arg. in DC. Prodr. 15 (2): 1120. 1866; Seem. Fl. Vit. 231. 1867.

Codiaeum variegatum var. *pictum* f. *taeniosum* Muell. Arg. ex Pax & Hoffm. in Pflanzenr. 47 (IV. 147. III): 26. 1911.

Codiaeum variegatum f. *taeniosum* Muell. Arg. ex Merr. Interpret. Rumph. Herb. Amb. 325. 1917.

As noted in Fiji, this form is a shrub 1-3 m. high, cultivated near sea level. It is often sterile, but flowers and fruits are similar to those of var. *moluccanum* and occur in scattered months.

TYPIIFICATION AND NOMENCLATURE: *Croton variegatum* var. β L. (1753), upon which all the above names are based, is typified entirely by *Codiaeum taeniosum* Rumph. Herb. Amb. 4: 68. t. 26, fig. 1. 1743. Although the epithet *taeniosum* was utilized at the level of form by Pax and Hoffman and by Merrill, cited above, I have not found the appropriate quadrinomial used in full prior to 1972. The names here listed are pertinent only to records from the Fijian Region, but doubtless many other cultivars and forms may also be incorporated into this concept. Such forms as "*appendiculatum*" and "*interruptum*", with the lamina interrupted by lengths of costa, would seem noteworthy, but their instability is suggested by both interrupted and continuous laminae being sometimes borne on the same branchlet, as in the BM specimen of Seemann 410.

DISTRIBUTION: This form is widely cultivated in Pacific archipelagoes and doubtless elsewhere in the tropics.

LOCAL NAME AND USE: *Croton*; this form, like the typical one, is used ornamentally, its leaves being variously colored with yellow, red, and green.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Near coast between Ngaloa and Wainiyambia, Smith 9585. NAMOSI: Nanggara Island, H. B. R. Parham 272. REWA: Suva, DA L.9578; Suva, in private gardens, DA 16208, 16212, 16215. OVALAU: Seemann 410. VANUA LEVU: Without further locality, H. B. R. Parham 329. FIJI without further locality, U. S. Expl. Exped., Horne 313.

24. CROTON L. Sp. Pl. 1004. 1753; Seem. Fl. Vit. 221. 1867; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 83. 1931.

Monoecious (or infrequently dioecious) shrubs or trees (rarely herbs), often with colored or resinous latex, stipulate, the indument usually composed of stellate or lepidote trichomes; leaves alternate (spirally arranged), sometimes crowded and subopposite or pseudovericillate, often with 1 or 2 conspicuous glands at apex of petiole or near base of leaf blade margin, the blades simple (in our species) or lobed, pinnately (in our species) or palmately nerved, often minutely and copiously glandular; inflores-

cences usually spiciform racemes or thyrses with ♀ flowers borne proximally and ♂ flowers borne distally (some inflorescences occasionally with ♀ or ♂ flowers only), the flowers with biseriolate or uniseriate perianths, the ♂ flowers usually with petals, these reduced or absent in ♀ flowers, the calyx lobes imbricate in bud; ♂ flowers solitary or fascicled, the calyx usually 5-lobed, the petals as many as calyx lobes, free, small, often pilose within, the disk entire or with segments opposite calyx lobes, the stamens usually 8-32 (3-400), free, usually inflexed in bud, the anthers extrorse, 2-locular, a vestigial pistil lacking; ♀ flowers solitary, with or without staminodes, the calyx usually 5-7-lobed, sometimes accrescent and persistent, the disk usually annular, the ovary 2- or 3(or 4)-locular, each locule with 1 ovule, the styles free or connate at base, bifid or multifid; fruit a schizocarp, the columella usually persistent, the seeds terete to compressed, carunculate, the testa smooth and usually thin.

LECTOTYPE SPECIES: *Croton aromaticus* L., one of Linnaeus's original 14 species; Webster (in J. Arnold Arb. 48: 354. 1967) gives reasons for this choice rather than accepting *C. tiglium* L. as the lectotype species (vide Small in Britton & Brown, Ill. Fl. N. U. S. ed. 2: 2: 454. 1913). Although Linnaeus used *Croton* in the neuter, it is derived from a Greek word that should be treated as masculine.

DISTRIBUTION: Pantropical and subtropical, with 600-1,000 species. Four species are believed indigenous in Fiji, three of them being endemic. The Pacific range of the genus terminates to the east in Tonga (van Balgooy in Blumea Suppl. 6: 171. 1971).

KEY TO SPECIES

Indument of young parts, branchlets, petioles, lower leaf blade surfaces, and external inflorescence parts composed of closely contiguous membranous scales, these 0.3-0.5 mm. in diameter and with rays firmly connate to the short-fimbriate margin; petioles 0.5-3 cm. long; leaf blades ovate to elliptic, 3-8.5 × 1.5-4 cm., broadly acute to rounded at base, emarginate or rounded to callose-acute at apex. 1. *C. metallicus*
Indument composed of stellate hairs, the rays free at least in the distal half.

Rays of hairs subequal, 0.12-0.17 mm. long.

Petioles 0.3-2.7 cm. long, much shorter than leaf blades, these elliptic to ovate, 2-12.5 × 1-6.5 cm., obtuse to rounded or minutely subcordate at base, obtuse to obtusely acuminate at apex, the vegetative and inflorescence parts often essentially glabrate, the infructescence sometimes elongating to 12 cm., the fruiting pedicels 3-6 mm. long. 2. *C. microtiglium*

Petioles 1-5 cm. long, often half as long as leaf blades, these 5-8 cm. long, subsersistently pilose beneath; fruiting pedicels 12-16 mm. long. 3. *C. leptopus*

Rays of hairs often strikingly unequal, 1 or 2 central rays greatly elongated, the small rays 0.1-0.2 mm. long, the elongated rays setaceous, usually 0.5-2 mm. long; petioles 0.3-4 cm. long; leaf blades elliptic to ovate-lanceolate, 3-13.5 × 1.3-6 cm., rounded to narrowly subcordate at base, obtuse to short-callose-acuminate at apex; infructescence sometimes elongating to 12 cm. 4. *C. heterotrichus*

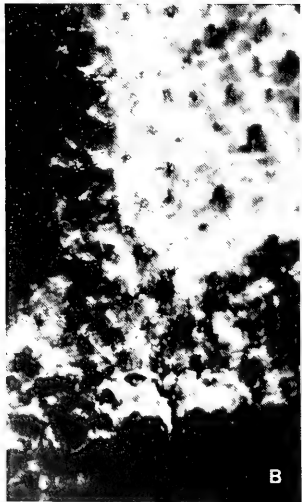
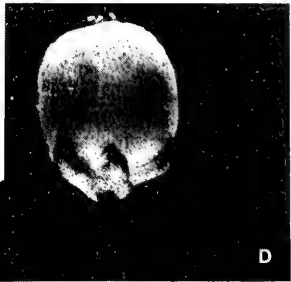
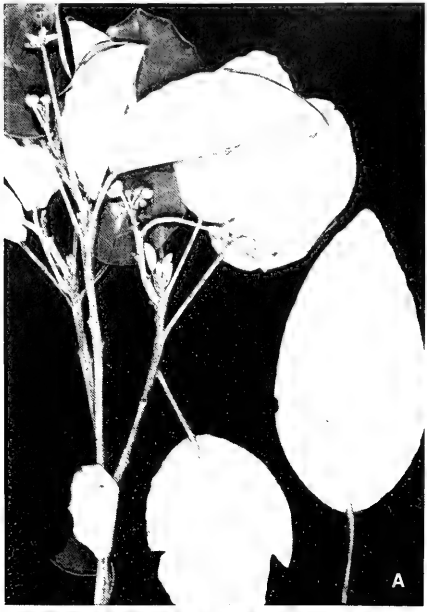
1. ***Croton metallicus*** Seem. ex Muell. Arg. in Linnaea 34: 103. 1865; Muell. Arg. in DC. Prodr. 15 (2): 572. 1866; Seem. Fl. Vit. 222. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 290. 1892; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 179. 1972. FIGURE 146.

Croton metallicum Seem. in Bonplandia 9: 259, nom. nud. 1861, Viti, 441, nom. nud. 1862, Fl. Vit. t. 56. 1867.

A slender shrub or tree 0.6-7 m. high, with a trunk up to 15 cm. in diameter, occurring at elevations from near sea level to 590 m. in dense forest or on its edges, or sometimes on limestone cliffs. The conspicuous and crowded scales, which impart an unmistakable aspect to the species, are silvery-white with a dark brown center, giving a metallic color to the perianth and fruits. Flowers have been obtained in scattered months, fruits only in March and July.

TYPIFICATION: The type is *Seemann 408* (G HOLOTYPE; ISOTYPES at BM, K), collected in October, 1860, along the coast of Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known with certainty only from the Yasawas,



northern Vanua Levu, and Kambara. Although it seems infrequent, it will doubtless be found on other islands.

LOCAL NAMES AND USE: Names each recorded once are *asirapu* (Waya), *asiravu* (Waya), and *lengalenga* (Kambara). The plant (part not specified) is said to be used to perfume oil in the Yasawas.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, west of Mbatinaremba, *St. John 18039*; Nangua, *St. John 18119*. VANUA LEVU: MATHUATA: Vicinity of Lambasa, *DA 13687*; mountains near Lambasa, *Greenwood 542*; summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6515, DA 14628*. KAMBARA: On limestone cliffs, *Smith 1280*. FIJI without further locality, *U. S. Expl. Exped., Horne 396*.

2. *Croton microtiglium* Burkill in J. Linn. Soc. Bot. **35**: 54. 1901. FIGURE 147.

Croton storckii Seem. in *Bonplandia* **10**: 297, nom. nud. 1862, Viti, 441, nom. nud. 1862; Seem. ex Jacks. *Ind. Kew.* **1**: 657, pro syn. 1893; Seem. ex A. C. Sm. in *Bishop Mus. Bull.* **141**: 83. 1936; Yuncker in op. cit. **220**: 166. 1959; J. W. Parham, *Pl. Fiji Isl.* **126**. 1964, ed. 2. 179. 1972.

Croton verreauxii var. *storckii* Muell. Arg. in *Linnaea* **34**: 117. 1865, in *DC. Prodr.* **15** (2): 621. 1866; Seem. *Fl. Vit.* **222**. t. 57. 1867; Drake, *Ill. Fl. Ins. Mar. Pac.* **290**. 1892.

Croton verreauxii sensu Gibbs in J. Linn. Soc. Bot. **39**: 169. 1909; non Baill.

A shrub or small tree 1–8 m. high, known from near sea level to an elevation of 1,030 m. in dense or dry forest, in thickets, and in the dense vegetation of crests and ridges. The perianth segments are greenish to yellowish white or dull white or pink-tinted, the anthers are white to cream-colored, and the fruits are dull yellow to pale orange. Flowers and fruits may be expected in any month.

TYPIFICATION AND NOMENCLATURE: The type of *Croton verreauxii* var. *storckii* is *Storck 905* (G HOLOTYPE; ISOTYPES at BM, GH, K), collected in December, 1860, at Port Kinnaird, Ovalau; that of *C. microtiglium* is *Crosby 150* (K HOLOTYPE), collected on Vava'u, Tonga. Although this species has usually passed as *C. storckii* Seem., Seemann's mention of the binomial in 1862 was as a nomen nudum. Use of the epithet *storckii* by Mueller, Seemann, and Drake was in a varietal combination only, and I cannot locate any valid proposal of this epithet in a binomial (in the sense of ICBN, Art. 32.1 (c)) prior to my use of *C. storckii* in 1936 (cited above). The name *C. microtiglium*, clearly representing the same taxon, therefore has priority at the specific level. The termination of *microtiglium* is correct because the epithet is used as a substantive derived from *Tiglium*, sometimes considered a segregate genus.

DISTRIBUTION: Fiji and Tonga (at least Vava'u); in Fiji it is known from several scattered islands, and below I listed all the collections known to me.

LOCAL NAME AND USE: The only definitely reported name is *sombusombu* (Waya, where the plant is used to perfume oil). Seemann had questioned Storck's use of the name *ndanindani*, and probably correctly so, as this is used for species of Araliaceae throughout Fiji.

FIGURE 146. *Croton metallicus*; A, distal portion of branchlet, with foliage and inflorescences, the upper left, long-pedicellate calyx disclosing the persistent columella of a dehiscent fruit, $\times 1$; B, juncture of petiole and lower surface of leaf blade, showing lepidote trichomes and a gland at apex of petiole, $\times 25$; C, σ flower with 1 calyx lobe and 2 petals removed, $\times 10$; D, maturing fruit, $\times 4$; E, ventral (left) and dorsal (right) surfaces of seed, $\times 10$. A from *Smith 1280* (detached leaf from *St. John 18119*, to show variation in shape), B from *Smith 6515*, C & E from *St. John 18119*, D from *Smith 1280*.



AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nangua, *St. John 18162*. VITI LEVU: MBA: Mt. Mbatilamu, Vunda Tikina, *DA 14166*; vicinity of Nandarivatu, *Gibbs 562, Tothill 702*; hills east of Nandala Creek, south of Nandarivatu, *Smith 5931*. SERUA: Near Mt. Nggamu, vicinity of Ngaloa, *Degener 15074*; hills between Wainingere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9534*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8467*. TAILIEVU: Naingani Island, *DA 3322*. REWA: Slopes and summit of Mt. Korombamba, *Gillespie 2343, 2394, Meebold 16790, DA 1152*, p. p., *1280, 3863, 16536, 17370*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7706*. VANUA LEVU: MATHUATA: Vicinity of Tutu Village (east of mouth of Langalanga River), *Horne 673*. THAKAUNDOVE: Yanawai River region, Mt. Kasi, *Smith 1779*; eastern drainage of Yanawai River, *Degener & Ordonez 14062*; summit of Mt. Mbatini, *Smith 706*. KANATHEA: *Graeffe 1546*. VANUA MBALAVU: Northern limestone section near Nambavatu, *Tothill 701, Smith 1466*. FIJI without further locality, *Gillespie 2335, DA 3926*.

3. *Croton leptopus* Muell. Arg. in DC. Prodr. **15** (2): 622. 1866; Seem. Fl. Vit. 222. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 290. 1892; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 179. 1972.

An apparently rare species, for which little information is available.

TIPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPES at GH, US 75127), collected in 1840 in Fiji without further locality.

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection.

In spite of our unsatisfactory knowledge of *Croton leptopus*, it appears to be a well-marked species related to *C. microtigilium*, differing in its proportionately long petiole and fruiting pedicel and its more persistent foliar indument.

4. *Croton heterotrichus* Muell. Arg. in DC. Prodr. **15**(2):620. 1866; Seem. Fl. Vit. 222. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 290. 1892; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 179. 1972. FIGURES 148, 149A.

Croton parhamii Croizat in J. Arnold Arb. **26**:98. 1945; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 179. 1972.

A shrub or small tree 2-8 m. high, occurring infrequently in dense forest at elevations of 100-910 m. Flowers have been obtained in January and between June and September, fruits only between June and September.

TIPIFICATION AND NOMENCLATURE: The type of *Croton heterotrichus* is a U. S. Exploring Expedition specimen obtained in 1840 in Fiji without further locality; the holotype is doubtless at G but no isotypes seem to be available. *Croton parhamii* is typified by *DA 2464* (coll. *B. E. V. Parham*) (A HOLOTYPE; ISOTYPES at BISH, K, SUVA), collected July 26, 1938, on a ridge between Naloka and Naraiyawa, near the boundary between Nandronga & Navosa and Namosi Provinces, Viti Levu. There can be no doubt that Mueller's description portrays the distinctive species here considered, including the type collection of *C. parhamii*; the slightly accrescent fruiting calyx of the latter, mentioned by Croizat, is not dependable as separating the available collections into two groupings.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAME: The only Fijian name recorded is *nokanoka* (*Smith 5572*).

FIGURE 147. *Croton microtigilium*; A, distal portion of branchlet, with foliage and an inflorescence, in which all the developed flowers are ♀, × 1; B, juncture of petiole and lower surface of leaf blade, showing stellate trichomes and a gland near base of blade, × 25; C, ♂ flower, × 15; D, infructescence, with dehiscent fruits, × 1. A from *Meebold 16790*, B from *Smith 706*, C from *Smith 1466*, D from *Smith 1779*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Navai Range, *DA 2321*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5572*. NANDRONGA & NAVOSA-NAMOSI boundary area: Ridge between Singatoka and Navua Rivers, *DA 2471*. SERUA: Inland from Namboutini, *DA 14252*.

25. *OMALANTHUS* A. H. L. Juss. Euphorb. Gen. 50. 1824.

Carumbium Reinw. in *Isis* 1: 319, nom. nud. 1823, in *Bl. Cat. Pl. Buitenz.* 105, nom. nud. 1823, in *Syll. Pl. Nov.* 2: 6. 1826; Seem. *Fl. Vit.* 231. 1867.

Homalanthus Reichenb. *Consp. Reg. Veg.* 194, orth. mut. 1828; Pax & Hoffm. in *Pflanzenr.* 52 (IV. 147. V): 42. 1912, in *Engl. & Prantl, Nat. Pflanzenfam.* ed. 2. 19c: 188. 1931.

Monoecious trees or shrubs, with milky latex, the stipules large, caducous; leaves alternate (spirally arranged), the petioles often elongate, with 2 sessile glands at or near apex or these on blade near its base, the blades simple, pinnate-nerved; inflorescences terminal, racemiform, often with 1 or several ♀ flowers near base and with many ♂ flowers distally, the bracts usually biglandular at base, the ♀ flowers sometimes borne separately and pseudoaxillary on distal portions of branchlets, the flowers with 1-3 broad, imbricate sepals, lacking petals and disk; ♂ flowers compressed-reniform, solitary or fasciculate, with 6-20 or more stamens, the filaments short and cohering proximally, the anthers 2-locular, longitudinally and extrorsely dehiscent, a rudimentary pistil lacking; ♀ flowers usually solitary, without staminodes, the ovary 2- or 3-locular, each locule with 1 ovule, the styles more or less connate proximally, the stigmas entire (in our species) or bifid, adaxially faintly papillose, somewhat truncate-swollen at apex; fruits borne on elongating pedicels, indehiscent or tardily dehiscent, the seeds carunculate, with a fleshy testa.

TYPE SPECIES: The ING cards do not yet cover *Omalanthus* or *Carumbium*.

DISTRIBUTION: Southeastern Asia through Malesia and eastward in the Pacific at least to the Society and Austral Islands, with 30-35 species. A single fairly widespread species is indigenous in Fiji.

The generic name is usually spelled as *Homalanthus*, and *homalos* is perhaps the better transcription of the Greek word for "equal" or "level"; nevertheless Reichenbach's orthographic mutant has not been conserved.

1. *Omalanthus nutans* (Forst. f.) Guillemain in *Ann. Sci. Nat. II. Bot.* 7: 186. 1837 (repr. *Zephyr.* Tait. 34. 1838). FIGURE 149B-D.

Croton nutans Forst. f. *Fl. Ins. Austr. Prodr.* 67. 1786.

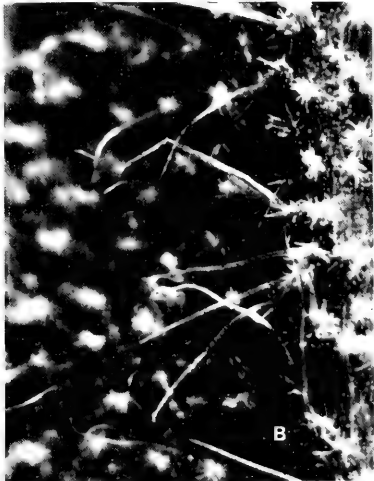
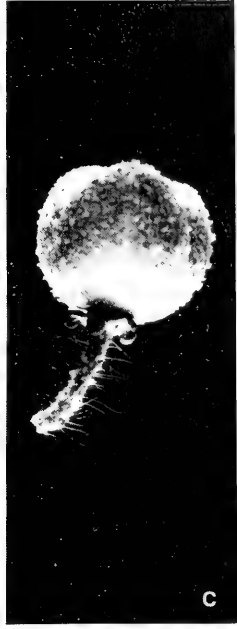
Omalanthus pedicellatus Benth. in *London J. Bot.* 2: 232. 1843; Seem. in *Bonplandia* 9: 259. 1861, Viti, 441. 1862.

Carumbium nutans Muell. Arg. in *DC. Prodr.* 15 (2): 1146. 1866; Seem. *Fl. Vit.* 232. 1867.

Carumbium nutans var. *genuinum* Muell. Arg. in *DC. Prodr.* 15 (2): 1146, nom. inadmis. 1866.

Homalanthus nutans var. *genuinus* Muell. Arg. in *DC. Prodr.* 15 (2): 1146, nom. inadmis. 1866; Pax & Hoffm. in *Pflanzenr.* 52 (IV. 147. V): 50. 1912.

FIGURE 148. *Croton heterotrichus*; A, distal portion of branchlet, with foliage, an inflorescence in flower, and a rachis from which flowers or fruits have fallen, and with a detached leaf to show variation in size, × 1; B, indument of costa of lower surface of leaf blade, × 25; C, maturing fruit, × 4; D, ♀ flower, × 15. A from *Smith 5572*, B-D (and also detached leaf of A) from *DA 14252*.



Homalanthus nutans Pax in Engl. & Prantl, Nat. Pflanzenfam. III. 5: 96. 1890; Drake, Ill. Fl. Ins. Mar. Pac. 293. 1892; Gibbs in J. Linn. Soc. Bot. 39: 170. 1909; Pax & Hoffm. in Pflanzenz. 52 (IV. 147. V): 50. 1912; Christophersen in Bishop Mus. Bull. 128: 125. 1935; Yuncker in op. cit. 178: 75. 1943, in op. cit. 184: 47. 1945, in op. cit. 220: 167. 1959; J. W. Parham, Pl. Fiji Isl. 128. 1964, ed. 2. 183. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 91. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 330. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 30, 34. 1972.

A shrub or tree 2-10 m. high, with a trunk to 25 cm. in diameter and with copious white latex, occurring at elevations from near sea level to 1,120 m. in dense, open, or secondary forest, in patches of forest in open country, in thickets, among reeds, on open slopes, and sometimes in beach thickets; frequently locally abundant. The anthers are yellow-green to bright yellow, the styles are yellowish green, and the fruits are pink, at length becoming deep red. Flowers and fruits are found throughout the year.

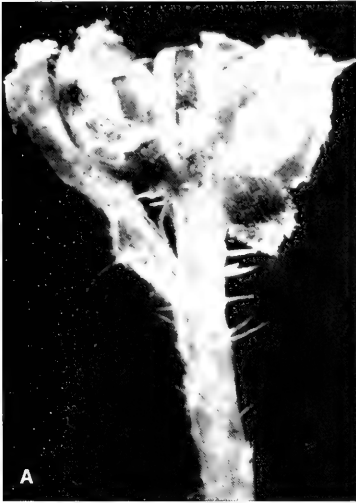
LECTOTYPIFICATION: In his publication of *Croton nutans*, Forster cited: "Societatis, Amicorum et nouarum Hebridum Insulae." The type material was collected by the Forsters on Cook's second voyage. There is one specimen at BM marked "G. Forster's Herbarium. 211. 354. *Croton nutans*," and at K there are two specimens: (1) "Forster Herbarium: Dalbardia nutans (Forster) Euphorbia cotonifolia," and (2) "Forster Herbarium: *Croton nutans* Forster Tonga Tabboo." As the second K sheet is the only one with a locality, I here indicate it as the lectotype: *J. R. & G. Forster* (K), a fruiting specimen from Tongatapu, Tonga. The other two sheets are not necessarily isolectotypes. The holotype of *Omalanthus pedicellatus* is *Barclay* (K), from Tonga without further details.

DISTRIBUTION: The Caroline Islands, New Caledonia, and the New Hebrides eastward to the Society Islands. Different species also occur in Samoa (and probably in the Cook Islands), the Society Islands, and Rapa, where the present species may be a weedy introduction. *Omalanthus nutans* is often mentioned as a pioneer species limited to disturbed areas, but in Fiji at least it appears sometimes at home in dense, indigenous forest. If the species is to be divided, our material would fall into the type-including taxon. About 65 Fijian collections have been examined, and one may expect the species on most of the islands.

LOCAL NAMES AND USES: The most frequently used Fijian names are *tautau*, *tandano*, and *mawamawa*, but also recorded are *ndatau*, *ndathau*, *ndaukau*, *moamoa*, and *ndrouwa*. The plant is said to have medicinal properties: an infusion of the leaves in water is drunk for stomach trouble, and a decoction of the fruits is said to relieve painful urination.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Along Wailevu Creek, *St. John 18085*. VITI LEVU: MBA: Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4094*; vicinity of Nandarivatu, *Gibbs 641*; Mt. Tomanivi, *DA 12773 (Melville et al. 7165)*. NANDRONGA & NAVOSA: Nausori Highlands, *Damanu 20*; Thuvu, west of Singatoka, *Greenwood 62*. SERUA: North of Korovou, *St. John 18936*. NAMOSI: Vicinity of Namuamua, *Gillespie 3254*; "Namosi and Viti Levu" (probably at least in part from Namosi Village), *Seemann 402*. NAITASIRE: Vatavulu, Wainimala Valley, *Gibbs 622*. TAILEVU: Uthunivanua, *DA 9254 (McKee 2820)*. REWA: Vicinity of Lami, *Tohill 756*. KANDAVU: Mt. Mbuke Levu, *Smith 212*. OVALAU: Vicinity of Levuka, *Gillespie 4457*. KORO: Eastern slope of main ridge, *Smith 959*. NGAU: *Milne 153*. VANUA LEVU: MBUA: Koromba Forest, *DA 15115*. MATHUATA: Mt. Ndelaikoro, *DA 12808*; Mt.

FIGURE 149. A, *Croton heterotrichus*, ♂ flower with 1 calyx lobe and 1 petal removed, × 20, from *Smith 5572*. B-D, *Omalanthus nutans*, from *Smith 212*; B, distal portion of branchlet, with foliage, inflorescences, and maturing fruits borne in leaf axils, the upper inflorescence with a single ♀ flower borne near its base, × 1; C, ♂ flowers, × 20; D, ♀ flower, × 10.



Numbulua, east of Lambasa, *Smith 6370*. THAKAUNDRIVE: Wainigata Station, east of Savusavu, *DA 12024*. TAVEUNI: Near Waiyevo, *Gillespie 4738*. MATUKU: *Milne 124*, p. p. (or 224?). THITHIA: Mambula, *DA 13252*. KAMBARA: Forest of central basin, *Bryan 502*. FULANGA: On limestone formation, *Smith 1121*.

26. EXCOECARIA L. Syst. Nat. ed. 10. 1288. 1759; Seem. Fl. Vit. 232, as *Excaecaria*. 1867; Pax & Hoffm. in Pflanzenz. 52 (IV. 147. V): 157. 1912, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 196. 1931.

Shrubs or trees, usually dioecious (but sometimes monoecious, the ♂ inflorescences with 1 or 2 proximal ♀ flowers), with milky latex, the stipules small; leaves alternate (spirally arranged) or rarely partially opposite, simple, the blades pinnate-nerved, with or without a marginal gland on each side toward base, crenate to serrate or entire; inflorescences axillary (or sometimes terminal at inception), solitary or aggregated, racemose or spiciform, sometimes with 1 or 2 ♀ flowers near base and many ♂ flowers distally, the ♀ inflorescences usually borne on separate plants and fewer-flowered, the flower-subtending bracts small, often proximally biglandular, sometimes lacinate to denticulate at margin, the flowers lacking petals and a disk, with a 3-lobed calyx, the lobes imbricate in bud; ♂ flowers solitary or fascicled, the stamens 2 or 3, the anthers 2-locular, the locules discrete, longitudinally dehiscent, a rudimentary pistil lacking; ♀ flowers without staminodes, the ovary 3-locular, each locule with 1 ovule, the styles connate, the stigmas unlobed, recurved; fruit a subtriquetrous or 3-lobed schizocarp, the pericarp coriaceous, the seeds ellipsoid to obovoid, ecarunculate, often maculate.

TYPE SPECIES: *Excoecaria agallocha* L., Linnaeus's only original species.

DISTRIBUTION: Tropical Africa and Asia and eastward through Malesia into the Pacific as far as Tonga and Niue, with 35-40 species. Three indigenous species occur in Fiji, two of them endemic.

KEY TO SPECIES

- ♂ inflorescences 3-7 cm. long, the flowers with ovate-deltoid calyx lobes; ♀ inflorescences to 3 cm. long; capsules 4-6 × 6-9 mm., the seeds ellipsoid, 3-4 mm. long; leaf blades elliptic to ovate, 4-10 × 1.5-5 cm., rounded or submarginate to obtusely short-acuminate at apex; usually occurring in beach thickets or mangrove swamps, infrequently inland on open slopes to about 400 m. elevation. .1. *E. agallocha*
- ♂ inflorescences 0.5-3.5 cm. long, the flowers with lanceolate calyx lobes; ♀ inflorescences less than 2 cm. long; capsules 8-15 × 10-20 mm., the seeds 5-8 mm. long; leaf blades 4.5-21 × 2-9.5 cm., acuminate or cuspidate at apex; occurring in forest away from beaches or mangrove swamps.
- Petioles slender, 1-2 cm. long; leaf blades ovate to elliptic-ovate, 4.5-13 × 2-4.5 cm., gradually tapering to an acuminate apex; ♂ inflorescences 0.5-3 cm. long, the flowers at maturity usually 7-12 per centimeter of rachis; ♀ inflorescences 0.5-1 cm. long; seeds oblong-ellipsoid, 5-6.5 mm. long and slightly narrower, rounded at both ends; occurring at elevations of 200-1,100 m., rarely near sea level. 2. *E. acuminata*
- Petioles robust, 1.3-3 cm. long; leaf blades oblong or oblong-elliptic, (7-) 9-21 × (3-) 5-9.5 cm., abruptly tapered to a cuspidate apex; ♂ inflorescences 2.5-3.5 cm. long, the flowers at maturity usually 15-22 per centimeter of rachis; ♀ inflorescences 1.5-2 cm. long; seeds obovoid, 7-8 × 4-5.5 mm., narrowed toward hilum; occurring at elevations up to 150 m. 3. *E. confertiflora*

1. *Excoecaria agallocha* L. Syst. Nat. ed. 10. 1288. 1759, Sp. Pl. ed. 2. 1451. 1763; Seem. in Bonplandia 9: 258. 1861, Viti, 441. 1862; Drake, Ill. Fl. Ins. Mar. Pac. 294. 1892; Pax & Hoffm. in Pflanzenz. 52 (IV. 147. V): 165. 1912; Merr. Interpret. Rumph. Herb. Amb. 327. 1917; Guillaumin in J. Arnold Arb. 13: 95. 1932; Yuncker in Bishop Mus. Bull. 178: 75. 1943, in op. cit. 220: 166. 1959; J. W. Parham, Pl. Fiji Isl. 127. 1964, ed. 2. 182. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 90. 1970.

FIGURE 150.

Excoecaria agallocha var. *genuina* Muell. Arg. in DC. Prodr. 15 (2): 1220, nom. inadmis. 1866; Pax & Hoffm. in Pflanzenr. 52 (IV. 147. V): 166, fig. 30. 1912.

Excaecaria agallocha L. ex Muell. Arg. in DC. Prodr. 15 (2): 1220. 1866; Seem. Fl. Vit. 232. 1867.

A tree 4–15 m. high, with copious white latex (rarely noted as a shrub 2 m. high), usually found at or near sea level in mangrove swamps and beach thickets or along lower river courses, rarely occurring on bare basalt hillsides inland to an elevation of 415 m. The inconspicuous flowers are greenish, and the leaves sometimes turn reddish before being shed. Although the plant is probably not seasonal, it is most often found flowering between October and February, fruiting between January and July.

TYPIFICATION: The whole basis of the Linnaean name is *Arbor excoecans* Rumph. Herb. Amb. 2: 237. t. 79, 80. 1741, as noted by Merrill (1917, cited above).

DISTRIBUTION: Hainan, India, and Ceylon through Malesia and Micronesia into the Pacific as far as Tonga and Niue; perhaps also in tropical Africa. It is abundant on



FIGURE 150. *Excoecaria agallocha*, distal portion of branchlet, with foliage and essentially mature fruits, about natural size, from Smith 7908.

Fijian coasts but is frequently ignored because of its irritating latex; below I cite all Fijian collections studied.

LOCAL NAMES AND USES: The usual Fijian names are *sinu* and *sinu nganga*, in reference to the poisonous latex; also recorded are *tuku* (Yasawas) and *sinu ni mbaravi* (referring to the seashore). The latex causes intense skin irritation and reputedly may cause blindness if rubbed into the eyes. The bark is said to have medicinal uses; smoke from the burning wood was at one time considered a cure for leprosy (see Seemann's Fl. Vit. 233), and it may still be used to reduce the inflammation caused by touching poisonous fish.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nangua, *St. John 18160*. VITI LEVU: MBA: Lautoka, *Greenwood 400*. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 259*. TAILEVU: Natongandravo, *DA 5680*; "Sankar's land," *DA 13590*. REWA: Lami, *DA 6012*; vicinity of Suva, *MacDaniels 1007*, *Meebold 17073*. KANDAVU: Namalata isthmus region, *Smith 1*. OVALAU: Vicinity of Levuka, *Tothill*, March, 1929 (coll. *Teulon*), *DA*, Aug. 24, 1939. NAIRAI: *Milne 180*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7908*. VANUA LEVU: MATHUATA: Banks of Nggawa River above Lambasa, *Smith 6613*. THAKAANDROVE: Maravu, near Salt Lake, *Degener & Ordenez 14247*; head of Natewa Bay, *Smith 483*. TAVEUNI: Mua Estate, *Weiner 71-7-11*. VANUA MBALAVU: Near Sawana Village, *Garnock-Jones 1059*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 792*. FULANGA: On limestone formation, *Smith 1201*. FIJI without further locality, *U. S. Expl. Exped., Seemann 398, Horne 486*.

If the species is to be infraspecifically divided, our material seems to fall into the type-including taxon with the possible exception of the single collection from the Yasawas (*St. John 18160*), which occurs away from the usual sea level habitat, is said to be a shrub rather than a tree, and has unusual, suborbicular leaf blades.

2. *Excoecaria acuminata* Gillespie in Bishop Mus. Bull. 91: 14. fig. 15. 1932; J. W. Parham, Pl. Fiji Isl. 127. 1964, ed. 2. 182. 1972; A. C. Sm. in *Allertonia* 1: 393. fig. 19 (seed inverted in *D*). 1978.

Glochidion sp. Seem. in *Bonplandia* 9: 259. 1861, Viti, 441. 1862.

A tree 2-7 m. high, infrequent in open or dry forest or in crest forest at elevations of 200-1,100 m. (or perhaps lower). Its latex is copious, yellowish or white, and thin; its flowers are inconspicuous and greenish, and the available fruits are recorded as green. Flowers have been obtained in scattered months, fruits between September and November.

TYPEIFICATION: The type is *Gillespie 3965* (BISH HOLOTYPE; ISOTYPES at GH, US), collected Nov. 22, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from inland Viti Levu and Mathuata Province, Vanua Levu. The only "lowland" specimen known is *DA 4056*, noted as from a village on the lower Wainikoro River, but of course this may actually have been obtained from inland hills nearby.

LOCAL NAME: The only recorded Fijian name is *manaivanua* (*DA 4056*).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Tothill 752*, *DA 2439*; Mt. Nanggaranambuluta, east of Nandarivatu, *Gillespie 4066*. NAMOSI: Vicinity of Namosi Village, *Seemann 414*, *Gillespie 2900*, *2905*. VANUA LEVU: MATHUATA: Mt. Numbuiloa, east of Lambasa, *Smith 6587*, *DA 14629*; Mouta, near mouth of Wainikoro River, *DA 4056*.

3. *Excoecaria confertiflora* A. C. Sm. in *Allertonia* 1: 393. fig. 20 (seed inverted in *E*). 1978.

A tree 3-10 m. high, with copious white latex, occurring in dense or dry forest at elevations from near sea level (but probably not below 50 m.) to 150 m. The bracts of the ♂ inflorescences are dull red in bud, when expanded green and red-tinged; the filaments are pale green and the anthers yellow with a reddish tinge; and the seeds,

doubtless like those of *Excoecaria acuminata*, are mottled with dark and pale brown. Flowering and fruiting material has been obtained only in November and December.

TIPIFICATION: The type is *Smith 9593* (US 2192029 HOLOTYPE; many ISOTYPES), collected Dec. 15, 1953, in coastal hills in the vicinity of Taunovo River, east of Wainiyambia, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the coastal hills of Serua Province, southern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Mbuyombuyo, vicinity of Namboutini, *Tabualewa 15580*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9299, 9464*; near Mt. Nggamu, east of Ngaloa, *Degener 15067*.

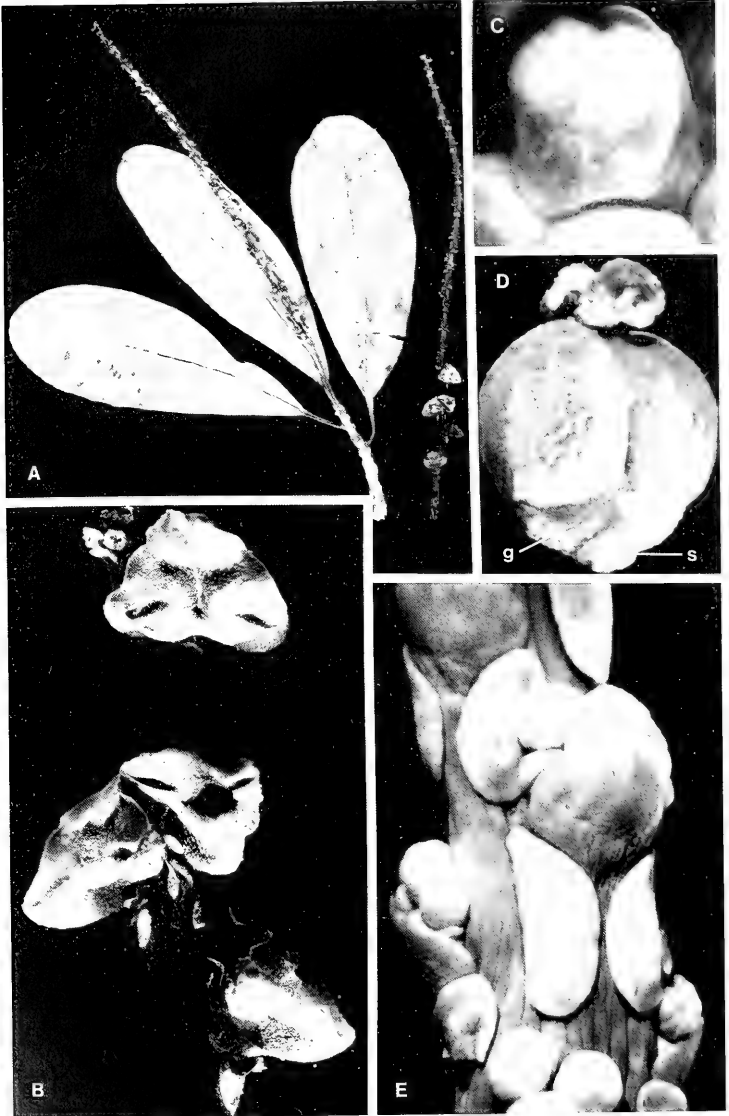
27. *STILLINGIA* Garden ex L. Syst. Nat. ed. 12. 2: 637. 1767, Mant. Pl. 19. 1767; Seem. Fl. Vit. 232. 1867; Pax & Hoffm. in Pflanzenr. 52 (IV. 147. V): 180. 1912, in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 198. 1931; Rogers in Ann. Missouri Bot. Gard. 38: 207. 1951; A. C. Sm. in J. Arnold Arb. 36: 281. 1955.

Monoecious shrubs, small trees, or herbs, glabrous, the latex sometimes milky, the stipules small, often glandular; leaves alternate (less often opposite or verticillate), the blades simple, pinnate-nerved, with or without basal glands, serrate (inconspicuously so in our species); inflorescences terminal, spiciform, with proximal ♀ flowers and distal ♂ flowers (occasional spikes in our species with ♂ flowers only), the flower-subtending bracts biglandular, the glands stalked or sessile (as in our species), the flowers lacking petals and disk; ♂ flowers in compact cymules or clusters, with a 2-lobed calyx, the lobes imbricate, the stamens 2, the filaments connate proximally, the anthers extrorse, a rudimentary pistil lacking; ♀ flowers solitary, with 3 imbricate sepals (or these lacking or subsistent), the ovary usually 3-locular (sometimes 2-locular), with an angled gynobase, each locule with 1 ovule, the styles somewhat connate, the stigmas unlobed, recurved, in our species caducous and leaving a minutely stipitate discoid scar; fruit a schizocarp mounted on a 3-horned, indurated gynobase left after dehiscence (gynobase in our species cupuliform-triangular, short-stipitate, with obtuse, thickened angles), the columella dilated distally, often caducous (as in our species), the seeds smooth or rugulose, carunculate.

TYPE SPECIES: *Stillingia sylvatica* Garden ex L.

DISTRIBUTION: Tropical and subtropical America (and northward into warm temperate areas), Mascarene Islands, Malesia (Lesser Sunda Islands and Moluccas only), and Fiji, with about 25 species. One indigenous species occurs in Fiji, terminating the Old World range of the genus to the east.

The Old World representatives of *Stillingia* fall into sect. *Pachycladae* Pax, but there is disagreement as to the status of Old World taxa. Van Steenis (in Blumea Suppl. 5: 302. 1966) refers all Old World material to *S. lineata* (Lam.) Muell. Arg., with subsp. *lineata* in the Mascarenes and subsp. *pacifica* in Malesia (where its distribution is quite limited in extent) and Fiji. Reviewing this problem in 1978 (cited below), I considered it advisable to reinstate the plant from Fiji and Malesia as a species distinct from that of the Mascarenes, in view of differences in foliage. The three Old World populations of *Stillingia* are doubtless remnants of a once more continuous distribution, and exchanges of disseminules among them must have ceased long ago. Malesian specimens are said to occur only on sandy beaches, whereas Fijian specimens are found in diverse habitats. Populations in the three widely separated Old World areas are probably diverging genetically, and a detailed comparison may indeed suggest that the Malesian population should be separated at some taxonomic level from that now stranded in Fiji.



1. *Stillingia pacifica* Muell. Arg. in DC. Prodr. 15 (2): 1156. 1866; Seem. Fl. Vit. 232. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 294. 1892; Pax & Hoffm. in Pflanzenr. 52 (IV. 147. V): 183. 1912; Croizat in Occas. Pap. Bishop Mus. 18: 71. 1944; A. C. Sm. in J. Arnold Arb. 36: 281. 1955; Airy Shaw in Kew Bull. 16: 372. 1963; J. W. Parham, Pl. Fiji Isl. 131. 1964, ed. 2. 189. 1972; A. C. Sm. in Allertonia 1: 397. 1978.

FIGURES 151, 152.

Stillingia lineata subsp. *pacifica* van Steenis in Blumea Suppl. 5: 302. map 169. 1966; Airy Shaw in Kew Bull. 27: 93. 1972.

An infrequent tree or shrub (2-) 4-6 m. high, with milky latex and with a trunk to 15 cm. in diameter, occurring from near sea level to 300 m. in dense forest, sometimes along streams, in patches of forest or on forest edges, in coastal thickets, and on limestone cliffs. The sepals and stamens are yellow, and the ovary is green, with purplish stigmas. As far as material is dated, flowers have been obtained in February, July, and December, and fruits in January, February, July, and December.

TIPIFICATION: The type is *U. S. Expl. Exped.* (HOLOTYPE probably at G; ISOTYPE at US 65524), collected in 1840 on Ovalau.

DISTRIBUTION: Several islands in Fiji and Malesia (Lesser Sunda Islands and Moluccas).

LOCAL NAMES: Recorded names are *vasa* (Waya), *kawa* (Serua), and *mbuaronda* (Fulanga); one note (*St. John 18057*) suggests that the latex is poisonous.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Yalombi, *DA 13668*; Narua Gulch, west of Mbatinaremba, *St. John 18057*. VITI LEVU: SERUA: Vicinity of Namboutini, *DF 952*. OVALAU: *Home*; vicinity of Levuka and overlooking hills, *Tohill*, March 9, 1929 (coll. *Teulon*), *Gillespie 4481*, *Greenwood 726*. MAKONGAI: *Tohill 736*. KORO: *Tohill 726*. TOTOYA: *Bryan 357*, *Tohill 725*. FULANGA: *DA 17823*. FIJI without further locality, *Horne 312*.

28. EUPHORBIA L. Sp. Pl. 450. 1753; Seem. Fl. Vit. 215, p. p. 1867; Pax & Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 19c: 208, p. p. 1931.

Monoecious or rarely dioecious herbs, shrubs, or trees, with abundant, whitish latex, the aerial parts sometimes succulent, the stipules present or absent, sometimes represented by glands; leaves alternate, less often opposite or whorled, persistent or deciduous, sometimes minute, the blades undivided (sometimes lobed), usually pinnate-nerved, eglandular; inflorescences bisexual (rarely unisexual) pseudanthia (cyathia) borne in terminal or axillary dichasia or pleiochasia (sometimes apparently solitary), each cyathium with a solitary ♀ flower subtended by 4 or 5 ♂ cymes, the bracts opposite these cymes fused into an involucre and with tips alternating with glands (nectaries), the glands sometimes with petaloid appendages; ♂ cymes with 1-10 or more flowers, the bracteoles reduced or absent, the flowers monandrous (simulating a single stamen), the perianth obsolete and represented by an articulation or absent, the anther dehiscing longitudinally and centripetally ("introrsely"); ♀ flower pedicellate, lacking petals, the sepals 3-6, united, and scalelike, or rudimentary or absent, the ovary usually 3-locular, often angled or carinate, each locule with 1 ovule, the styles

FIGURE 151. *Stillingia pacifica*; A, distal portion of branchlet, with foliage, an inflorescence with ♂ flowers only, and a detached inflorescence with gynobases of dehisced fruits proximally and ♂ flowers distally, × 1/2; B, gynobases of dehisced fruits, × 4; C, developing ♂ flower, × 30; D, ♀ flower, showing sepal (s) and gynobase (g), × 10; E, portion of ♂ inflorescence, showing clusters of flower buds subtended by basally biglandular bracts, × 10. A from *Bryan 357* (detached inflorescence from *Gillespie 4481*), B from *Gillespie 4481*, C from *DA 13668*, D from *St. John 18057*, E from *Bryan 357*.

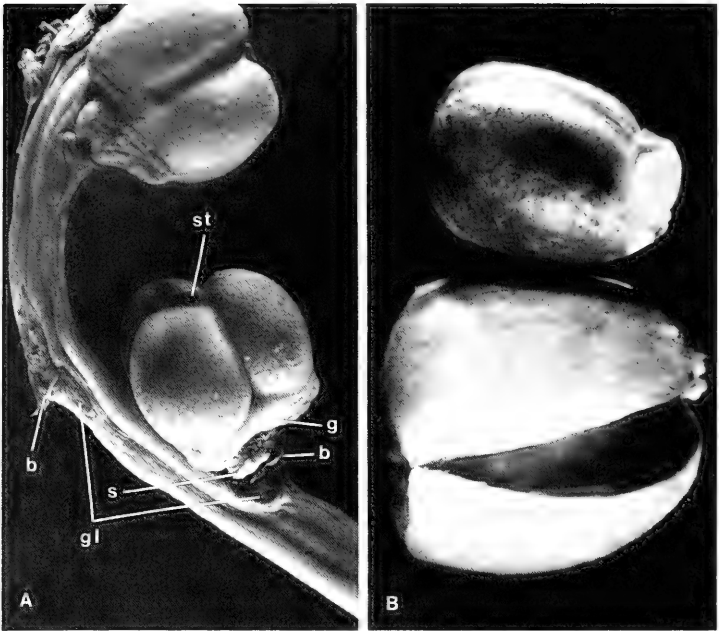


FIGURE 152. *Stillingia pacifica*, from Gillespie 4481; A, mature fruits, showing bracts (b) and their basal glands (gl), a persistent sepal (s), gynobase (g), and styler scar (st), $\times 4$; B, seed and dehiscent coccus, $\times 10$.

free or basally connate, bifid (rarely entire); fruit usually capsular and explosive, the columella more or less persistent, the seeds carunculate or not.

LECTOTYPE SPECIES: *Euphorbia antiquorum* L. (vide Millsp. in Publ. Field Columbian Mus., Bot. Ser. 2: 306. 1909), one of Linnaeus's original 56 species.

DISTRIBUTION: A vast, polymorphic, cosmopolitan genus, chiefly subtropical and warm temperate, with 1,500–2,000 species. The genus has often been divided into a few or numerous genera. The arguments for maintaining *Euphorbia* in the large, traditional sense, removing only *Chamaesyce* as a segregate genus, are summarized by Webster (in J. Arnold Arb. 48: 395–427. 1967). Six species are here noted as occurring in Fiji; one is indigenous (and endemic), three are known only in cultivation, and two are naturalized weeds.

KEY TO SPECIES

Branchlets obtusely angled, with 2–4 sharp stipular spines 1–4 cm. long at or near each node; leaf blades to 6 \times 2.5 cm.; bracts of cyathia bright red, sublunate, 6–15 mm. broad; cultivated, widely branched shrub.

1. *E. splendens*

Branchlets without spines; erect herbs, shrubs, or trees.

Involucres of cyathia with only 1 well-developed gland, the other glands absent or reduced; seeds tuberculate; upper leaves crowded below inflorescences, the blades entirely red (or reddish yellow to white) or red-blotched at base only.

Plant woody, usually exceeding 2 m. in height; leaves with petioles 3–8 cm. long, the larger blades to 21 × 15 cm., often with 1 or 2 deltoid-rounded lobes on each margin, the upper cauline leaf blades red (or reddish yellow to white); involucres of cyathia 8–10 mm. high, green with red segments, the bracts large, entire, red or less often yellowish; cultivated shrub. 2. *E. pulcherrima*

Plant annual, without thickened storage roots; leaves with petioles less than 2 cm. long, the larger blades to 10 × 5 cm., somewhat panduriform, pinnate-lobed, usually with a deep, rounded incision on each margin, the upper cauline leaf blades green, with a bright red basal blotch; involucres of cyathia about 5 mm. high, with 5 large and many small segments; erect naturalized weed, sometimes suffruticose at base. 3. *E. cyathophora*

Involucres of cyathia with 4 or 5 well-developed glands along upper margin; blades of upper leaves less conspicuous (i. e. not "poinsettia-like").

Glands of cyathia 4, semilunate, with 2 narrow angles; inflorescences near apices of stems, with 3 subumbellate main branches and with 2 opposite, broad bracts near each fork; leaf blades oblong-obovate, membranaceous, to 3 × 1.5 cm., obtuse to emarginate at apex; fruit with 2 narrow wings on each lobe, the seeds coarsely reticulate; slender, annual, erect herb, entirely glabrous; sparsely naturalized weed. 4. *E. peplus*

Glands of cyathia 4, transversely elliptic or orbicular; leaves densely congested distally, more or less fleshy, or absent; trees or shrubs with abundant milky latex.

Leaves soon caducous, the blades to 2.5 × 0.5 cm.; cymes terminal and axillary, with deltoid-semiorbicular bracts; ovary and styles pubescent; much-branched tree with slender, green, sparsely pubescent branchlets; cultivated. 5. *E. tirucalli*

Leaves more or less persistent, the blades elliptic-linear, to 9 × 1.5 cm., the petioles to 8 mm. long; cymes terminal, with ovate bracts; ovary and styles glabrous; shrub with stout, glabrous branchlets; indigenous. 6. *E. fijdiana*

1. ***Euphorbia splendens*** Bojer ex Hook. in Bot. Mag. 56: t. 2902. 1829; Boiss. in DC. Prodr. 15 (2): 79. 1862; Yuncker in Bishop Mus. Bull. 178: 77. 1943.

As sparingly cultivated in Fiji, *Euphorbia splendens* is a freely branching shrub 0.3–1.5 m. high, with a copiously spiny stem, occurring near sea level. The bracts are bright red or scarlet; the only available collection was in flower in January.

TIPIFICATION AND NOMENCLATURE: The original illustration, from a plant collected by Bojer in the Province of Emirne, Madagascar, may be taken as the type. According to Hooker, the plant was already in cultivation in 1829 by the Horticultural Society of London. The taxon is sometimes combined with *Euphorbia milii* Des Moul. as var. *splendens* (Bojer) Ursch & Leandri (as in our area by Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 89. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 181. 1972).

DISTRIBUTION: Indigenous in Madagascar; now widely cultivated in tropical areas.

LOCAL NAME AND USE: *Crown of thorns*; ornamental.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, in private garden, DA 16236.

2. ***Euphorbia pulcherrima*** Willd. ex Kl. in Allg. Gartenzeitung 2: 27. 1834; Boiss. in DC. Prodr. 15 (2): 71. 1862; Yuncker in Bishop Mus. Bull. 178: 76. 1943, in op. cit. 220: 169. 1959; J. W. Parham, Pl. Fiji Isl. vi. 1964, ed. 2. 181. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 90. 1970.

Poinsettia pulcherrima Graham in Edinburgh New Philos. J. 20: 412. 1836, in Bot. Mag. 63: t. 3493. 1836; Dressler in Ann. Missouri Bot. Gard. 48: 335. 1961.

In Fiji the commonly cultivated *poinsettia* is seen as a shrub 1–3 m. high from sea level to about 250 m. Its floral leaves are commonly red but pink- to yellow-leaved forms are also grown. Flowers have been noted in July and May.

TYPIFICATION: The original protologue refers back to Schlechtendal and Chamisso in *Linnaea* 6: 358. 1831, where three unnamed Mexican collections by Schiede and Deppe are cited. These syntypes are in the Willdenow herbarium (B) as nos. 9257, 9258, and 9259.

DISTRIBUTION: Indigenous in rocky canyons of western Mexico, in Nayarit, Jalisco, and Colima, and perhaps farther south (Dressler, 1961, cited above); now widely cultivated in tropical and subtropical areas and in temperate greenhouses.

LOCAL NAMES AND USE: *Poinsettia*, *yellow poinsettia* (both red and yellow forms of this ubiquitous ornamental are grown in Fiji).

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nanduruloulou, DA 12146; Toninaiwau, Tholo-i-suva, DA 16945. REWA: Suva, DA 12080. The *poinsettia* is much more abundantly cultivated in Fiji than suggested by these collections.

3. *Euphorbia cyathophora* Murray in Commentat. Soc. Regiae Sci. Gott. 7: 81. 1786; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 88. 1970.

Poinsettia cyathophora Kl. & Garcke in Abh. Königl. Akad. Wiss. Berlin 1859: 253. 1860; Dressler in Ann. Missouri Bot. Gard. 48: 338. 1961.

Euphorbia heterophylla sensu Greenwood in Proc. Linn. Soc. 154: 104. 1943; J. W. Parham in Dept. Agr. Fiji Bull. 35: 76. fig. 35. 1959, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972; non L.

An often abundantly naturalized weed in Fiji, *Euphorbia cyathophora* is seen as an herb 0.3–1.5 m. high, sometimes suffruticose at base, occurring from near sea level to about 100 m. in clearings, along roadsides and trails, and in coconut plantations and canefields; it is often abundant in coastal areas, frequently on sandy beaches. The floral leaves are marked with a bright red basal blotch, and the anthers are yellow. Flowers and fruits occur throughout the year.

TYPIFICATION: Dressler (1961, cited above) states: "There is a specimen from the Göttingen Botanical Garden (1794) in the Missouri Botanical Garden herbarium. While this was prepared after the description of *Euphorbia cyathophora*, it probably represents the population described by Murray." The distinctions between this species and *E. heterophylla* (as *Poinsettia h.*), with which it has been confused, are discussed by Dressler (1961, pp. 331–334).

DISTRIBUTION: Native in the West Indies or Central America, *Euphorbia cyathophora* has become established throughout the tropics as a weed. I have examined 21 Fijian collections, the oldest of which seems to be *Greenwood 144*, dated November 6, 1920.

LOCAL NAMES AND USE: Although the usual name elsewhere is *Mexican fire plant*, in Fiji only *wild poinsettia* has been noted. A specimen collected in the Suva Botanical Gardens suggests that the species is sometimes considered an ornamental, but most observers find little use for it.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mbekana Island, near Lautoka, *Degener & Ordenez 13690*; Lautoka, *Greenwood 144*; Solovi Estate, Nandi, DA 10704. NANDRONGA & NAVOSA: Volivoli, west of Singatoka, DA 10668; Korotongo, east of Singatoka, DA 8002. REWA: Suva Botanical Gardens, DA 12167. KANDAVU: Richmond (Natokalau), *Tothill 709*. VANUA LEVU: MBUA: Ngaloa Island (north of mouth of Lekutu River), DA 5760. MATHUATA: Nakuthi Island (north of mouth of Ndreketi River), DA 15280. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4801*. VANUA MBALAVU: Lomaloma, DA 10226. LAKEMBA: Near Tumbou, *Garnock-Jones 901*. FULANGA: On limestone formation, *Smith 1163*.

4. *Euphorbia peplus* L. Sp. Pl. 456. 1753; Boiss. in DC. Prodr. 15 (2): 141. 1862; Greenwood in J. Arnold Arb. 30: 81. 1949.

A slender, erect, annual herb to about 30 cm. high, sparingly naturalized (or perhaps evanescent) at an elevation of about 750 m.

TYPIFICATION: Several prior references are given by Linnaeus.

DISTRIBUTION: Indigenous in Europe but early becoming widespread as a weed. It is known from a single Fijian collection from a comparatively cool locality, and indeed it may no longer persist there.

LOCAL NAME: *Petty spurge* is the commonly used name, not recorded from Fiji.

AVAILABLE COLLECTION: VITI LEVU: MBA: Nandarivatu, *Greenwood 1171* (a weed in gardens and on cultivated ground).

5. *Euphorbia tirucalli* L. Sp. Pl. 452. 1753; Boiss. in DC. Prodr. **15** (2): 96. 1862; J. W. Parham, Pl. Fiji Isl. ed. 2. 182. 1972.

A freely branching tree or a large shrub 2-5 m. high, with abundant white latex, sparingly cultivated in Fiji near sea level, readily recognized by its slender, pencil-like branches and small, early caducous leaves.

TYPIFICATION: Several prior references are given by Linnaeus.

DISTRIBUTION: Indigenous in tropical Africa but early taken to India and parts of Malasia, and now widely cultivated in tropical areas as a curiosity.

LOCAL NAMES AND USES: *Pencil plant*, *pencil tree*, *milk bush*, and *tirucalli* are frequently used names, but only the first has been noted in Fiji. This curious ornamental has medicinal and other uses, as described by Burkill (Dict. Econ. Prod. Malay Penins. ed. 2. 997-998. 1966).

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, in private garden, *DA 16080*.

6. *Euphorbia fidjiana* Boiss. in DC. Prodr. **15** (2): 110. 1862; Seem. Fl. Vit. 217. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 285. 1892; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972.

Euphorbia norfolkica sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862; non *E. norfolkiana* Boiss.

Euphorbia tanensis sensu Seem. Fl. Vit. 217. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 286. 1892; non *E. tannensis* Spreng.

Euphorbia tannensis sensu J. W. Parham, Pl. Fiji Isl. 127. 1964, ed. 2. 182. 1972; non Spreng.

A shrub about 3 m. high, with abundant milky latex and with the branchlets and leaves becoming reddish purple, occurring in open, rocky places at elevations from sea level to about 550 m., and sometimes locally cultivated. Dates of flowering and fruiting are imprecise.

TYPIFICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (K HOLOTYPE; ISOTYPE at US 40446), collected in 1840 in Mathuata Province, Vanua Levu. In discussing *Euphorbia plumerioides* Teysm. (in Hassk. Hort. Bogor. Descr. Retz. 29. 1858), as which some specimens of *E. fidjiana* have been identified, D. C. Hassall (The genus *Euphorbia* in Australia. Austral. J. Bot. **25**: 429-453. 1977) limits that species to a range of Queensland, Java, New Guinea, and the Philippines. He implies that *E. fidjiana* and *E. norfolkiana* (Norfolk Island) are related but distinct species.

DISTRIBUTION: Endemic to Fiji and thus far known sparingly from five of the islands.

LOCAL NAMES AND USES: Recorded names are *vasa ndamu*, *soto*, *reanitua* (Waya), and *tavasa* (Mbengga). Medicinal properties are attributed to the species; in the Yasawas it is used for constipation, and on Mbengga a filtrate of the leaves is part of an internal tonic for weaning infants. One or two of the collections are from cultivated

plants, and the species is said to be used as a hedge to mark boundaries in village gardens.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Naruarua Gulch, west of Mbatinaremba, *St. John 18035*. VITI LEVU: M̄BA: Nalotawa, eastern base of Mt. Evans Range, cultivated in village, *Smith 4498*. REWA: Suva (escape from cultivation?), *DA 14427* (coll. R. Gatty). MBENGGGA: Malambi, *Weiner 189*. KANDA-VU: Without further locality, *Seemann 404*.

29. *Chamaesyce* S. F. Gray, *Nat. Arr. Brit. Pl.* 2: 260. 1821.

Euphorbia sensu Seem. *Fl. Vit.* 215, p. p. 1867; et auct.

Monococious or rarely dioecious annual herbs or subwoody or woody perennials, with whitish latex, without thickened, fleshy roots, the primary axis of stem abortive above the cotyledons, the apparent main axes actually sympodia, the stipules usually present, connate, and interpetiolar; leaves opposite, the blades entire to dentate, not lobed, usually inequilateral at base; inflorescences basically as in *Euphorbia*, the pseudanthia in pseudoaxillary cymes or solitary, the bracts of cymes usually inconspicuous, the involucre cupuliform, with 4 (rarely 5) glands, each usually with a (sometimes minute and obscure) petaloid appendage; ♂ flowers in 5 monochasia, each of 1–few flowers, the flowers lacking a perianth and disk; seeds ecarunculate.

TYPE SPECIES: *Chamaesyce maritima* S. F. Gray, nom. illeg. for *Euphorbia pepelis* L. (= *Chamaesyce pepelis* (L.) Prokh.).

DISTRIBUTION: A natural but not strongly defined genus of 250–350 species, mostly American but also in warmer parts of the Old World. Four species are recorded from Fiji, one a widespread indigenous plant typically found on seacoasts, the other three naturalized weeds.

Chamaesyce is easily distinguishable from other taxa referred to *Euphorbia* (sensu lato) by having the main stem abortive just above the cotyledons. The internal leaf structure in *Chamaesyce* is unusual in that chlorophyll is concentrated in the sheaths of veins, suggesting that the apparent foliage leaves are actually transformed bracts. For a justification of the maintenance of *Chamaesyce* at the generic level, the reader is referred to Croizat and Degener (in Degener, *Fl. Haw. Fam.* 190. 1936–1946) and Webster (in *J. Arnold Arb.* 48: 420–427. 1967).

KEY TO SPECIES

Slender, prostrate, much-branched herbs, the terete stem purplish, pilose on its upper surface with short hairs, otherwise glabrous; leaf blades ovate to elliptic, to 0.9×0.6 cm., rounded or emarginate at apex, serrulate, sparsely short-pilose or glabrous on both surfaces, the petioles 1 mm. long or less; stipules on lower surface of stem connate into a minute 2-parted scale; cyathia several, crowded, with purple glands with narrow petaloid appendages; fruits pilose on angles only; an often pernicious weed.

1. *C. prostrata*

Prostrate or erect herbs or low shrubs, the stem either glabrous or pilose equally on all surfaces (i. e. not merely on its upper surface); leaf blades to 5×2.5 cm. (rarely some as small as 0.5×0.3 cm.), the petioles 1–4 mm. long; cyathia less crowded, the ♂ cymes stalked, the involucre glands with minute appendages.

Plants entirely glabrous; stipules ovate-deltoid, often apically lacinate; leaf blades prevailing ovate-oblong, somewhat fleshy, often longer than internodes, glaucous, entire, obtuse to acute and mucronate at apex; involucre of cyathia usually 1.7–2.3 mm. high; fruits about 3 mm. long, the seeds ovoid to suborbicular, about 2 mm. long; erect or semierect herb, often subligulous, or shrub to 2 m. high; indigenous, often near beaches or on rocky coasts. 2. *C. atoto*

Plants with some indument on stems and usually on leaves; stipules subulate, not apically lacinate; leaf blades oblong to obovate, often shorter than internodes, serrate-dentate at least apically; involucre of cyathia less than 1.5 mm. high; fruits to 2 mm. long, often appressed-pilose, the seeds about 1 mm. long; prostrate to ascending or erect annual herbs to 0.6 m. high; naturalized weeds.

- Distal portions of stem with long, spreading, multicellular hairs 1–2 mm. long and also with short, appressed hairs; leaf blades spreading-pilose on both surfaces, often with a purple or brownish tinge; seeds angular. 3. *C. hirta*
- Distal portions of stem crispate-pilose or with short, spreading hairs or glabrate; leaf blades glabrous to appressed-pilose on both surfaces, usually green; seeds smooth to transversely ribbed. 4. *C. hypericifolia*

1. *Chamaesyce prostrata* (Ait.) Small, Fl. Southeast. U. S. 713. 1903.

- Euphorbia prostrata* Ait. Hort. Kew. 2: 139. 1789; Boiss. in DC. Prodr. 15(2): 47. 1862; Christophersen in Bishop Mus. Bull. 128: 126. 1935; Yuncker in op. cit. 178: 76. 1943, in op. cit. 184: 48. 1945, in op. cit. 220: 169. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 77. 1959, Pl. Fiji Isl. 127. 1964, ed. 2. 181. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 89. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 57. 1972.
- Euphorbia drummondii* sensu Greenwood in Proc. Linn. Soc. 154: 104. 1943, in J. Arnold Arb. 36: 399. 1955; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972; non Boiss.
- Euphorbia* cf. *australis* sensu Greenwood in J. Arnold Arb. 25: 402. 1944, in op. cit. 36: 399. 1955; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972; non Boiss.

An abundant, prostrate, or semiprostrate herb, with distinctly purplish stems and inflorescences, found at elevations from near sea level to about 150 m. as a weed in gardens, lawns, etc. It bears flowers and fruits throughout the year.

TYPEIFICATION: Aiton indicates the species as a native of the West Indies, cultivated in 1758 by Philip Miller; however, Fawcett and Rendle (Fl. Jam. 4: 341. 1920) state that the type is a Browne specimen at BM.

DISTRIBUTION: Tropical and subtropical America, now spread throughout all warm areas as a weed.

LOCAL NAME: Although no name has been indicated on Fijian specimens, the species elsewhere is often called *prostrate spurge*. It is a pernicious and ubiquitous weed, difficult to eradicate and doubtless spreading throughout Fiji, where it was a comparatively recent arrival; the oldest specimen I have seen is *Greenwood 154*, collected Oct. 18, 1920.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 154, 1284*. NANDRONGA & NAVOSA: Thuvu, west of Singatoka, *Greenwood 922*. NAITASIRI: Tamavua, *DA 11221*; N. T. C. compound, *DA 9875*; Koronivia, *DA 3296*. REWA: Suva, Department of Agriculture compound, *DA 7418, 11554, 11594*; Nukulua Island, *Tothill 753*. VANUA LEVU: THAKAUNDROVE: Vunalang, *DA 8956*.

2. *Chamaesyce atoto* (Forst. f.) Croizat in Degener, Fl. Haw. Fam. 190, sub *Chamaesyce*₄ (12/9) 1936.

- Euphorbia atoto* Forst. f. Fl. Ins. Austr. Prodr. 36. 1786; Seem. in Bonplandia 9: 259. 1861, in op. cit. 10: 297. 1862, Viti, 441. 1862; Boiss. in DC. Prodr. 15(2): 12. 1862; Seem. Fl. Vit. 216. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 284. 1892; Christophersen in Bishop Mus. Bull. 128: 126. 1935; Greenwood in Proc. Linn. Soc. 154: 104. 1943; Yuncker in Bishop Mus. Bull. 178: 76. 1943, in op. cit. 184: 48. 1945, in op. cit. 220: 167. 1959; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 88. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 329. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 12, 106, 137. 1972.
- Euphorbia ramosissima* Hook. & Arn. Bot. Beechey Voy. 69. 1832; Boiss. in DC. Prodr. 15(2): 14. 1862; Yuncker in Bishop Mus. Bull. 178: 76. 1943, in op. cit. 220: 169. 1959.
- Anisophyllum chamissonis* Kl. & Garcke in Abh. Königl. Akad. Wiss. Berlin 1859: 22. 1860.
- Euphorbia chamissonis* Boiss. in DC. Prodr. 15(2): 14. 1862; Seem. Fl. Vit. 216. 1867; Engl. in Bot. Jahrb. 7: 464. 1886; Drake, Ill. Fl. Ins. Mar. Pac. 284. 1892; Greenwood in Proc. Linn. Soc. 154: 104. 1943; Yuncker in Bishop Mus. Bull. 220: 168. 1959; J. W. Parham, Pl. Fiji Isl. 126. 1964, ed. 2. 180. 1972.

An often abundant, erect or semierect, often subligneous herb or a freely branching shrub 0.2–2 m. high, with white latex, occurring from sea level to an elevation of about 400 m. on rocky shores and islets, sea cliffs, beaches, and grassy slopes, and in clearings and other open places. Flowers and fruits occur throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: The type material was obtained in the Society Islands by J. R. and G. Forster on Cook's second voyage. I was unable to locate any Forster material of the species at BM and therefore designate as lectotype a K specimen labelled: "Forster Herbarium. *Euphorbia atoto* (Forster). Habitat in Tahiti." *Euphorbia ramosissima* is typified by a collection made during the voyage of H. M. S. Blossom on Elizabeth Island (i. e. Henderson Island), Tuamotus, probably deposited at GL (now at E). *Anisophyllum chamissonis* is based on a collection by Chamisso (probably at LE or B) "in insula Radack" (in modern terminology the Ratak Chain, Marshall Islands). As here defined, *Chamaesyce atoto* is perhaps an aggregate species; from it *Euphorbia ramosissima* and *E. chamissonis* are often maintained as distinct in herbaria, perhaps because of slight differences in habit, leaf size, and involucre glands. It may be hoped that a specialist in the family will attempt to clarify and evaluate the components of this relationship. However, members of the complex are so abundant on shores throughout the southern Pacific that they must be continuously interchanging disseminules, making a definition of segregates hazardous. Sykes's discussion (1970, cited above) of this complex on Niue seems pertinent.

DISTRIBUTION: As here interpreted, *Chamaesyce atoto* is a very widely distributed species, found at least from Ceylon eastward through Malesia, tropical Australia, and the southern Pacific to the Tuamotu Islands. Below I list all Fijian specimens examined by me, but the species is even more abundant locally than these indicate.

LOCAL NAMES: *Selekaleka*, *totolu*, and *totoyava* have been recorded.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 269*; Thelau, west of Mba, *O. & I. Degener 32143*. NANDRONGA & NAVOSA: Natumbakula, near Singatoka, *Degener 15108*; Korotongo, east of Singatoka, *DA 11160, 12576, 17322*. *O. & I. Degener 32125*. SERUA: Waimate Beach, Ndeumba, *DA 11595*. REWA: Makuluva Island, *Tothill 754*. KANDAVU: Western end of island, near Cape Washington, *Smith 311*. VANUA LEVU: MATHUATA: Without further locality, *Seemann 406*. MATUKU: Near summit of Mt. Ngilingilia, *Bryan 277*. VANUA MBALAVU: Near Sawana Village, *Garnock-Jones 1063*; southern limestone section, *Smith 1431*. THITHIA: Vatundamu, *DA 13253*. LAKEMBA: Vicinity of Nukunuku Village, *Garnock-Jones 821*. MOTHE: *Bryan 482*. FULANGA: On limestone formation, *Smith 1159*. ONGEA NDRIKI: Rocky islet off shore, *Bryan 390*. FIJI without further locality, *Home, Harvey*, November, 1855, *Storck 904*.

3. *Chamaesyce hirta* (L.) Millsp. in Publ. Field Columbian Mus., Bot. Ser. 2: 303. 1909.

Euphorbia hirta L. Sp. Pl. 454. 1753; Christophersen in Bishop Mus. Bull. 128: 126. 1935; Yuncker in op. cit. 178: 76. 1943, in op. cit. 184: 48. 1945, in op. cit. 220: 168. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 77. fig. 36, a-d. 1959, Pl. Fiji Isl. 127. 1964, ed. 2. 180. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 89. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 47. 1972.

Euphorbia pilulifera sensu Seem. in Bonplandia 9: 259. 1861, Viti, 441. 1862; Boiss. in DC. Prodr. 15 (2): 21, p. p. 1862; Seem. Fl. Vit. 216. 1867; Drake, Ill. Fl. Ins. Mar. Pac. 285. 1892; Gibbs in J. Linn. Soc. Bot. 39: 168. 1909; Greenwood in Proc. Linn. Soc. 154: 103. 1943; non L.

As seen in Fiji, *Chamaesyce hirta* is an abundant prostrate or semiprostrate herb to 60 cm. high, sometimes ascending or erect, with milky latex and red-tinged stems, found from near sea level to about 600 m. as a weed in waste places, clearings, villages, cultivated fields, and canefields, and often on river banks. Its inflorescence parts are pale green and often red- or purple-tinged; flowers and fruits occur throughout the year.

TYPIIFICATION AND NOMENCLATURE: *Euphorbia hirta* and *E. pilulifera* are each based on prior references, and perhaps each is to be lectotypified by material from Ceylon. Boissier in 1862 combined them under the name *E. pilulifera*; Merrill (Inter-

pret. Rumph. Herb. Amb. 328. 1917) combined them under the name *E. hirta*. However, Fawcett and Rendle (Fl. Jam. 4: 337, 341. 1920) consider the two taxa not synonymous, taking the common pilose weed to be *E. hirta* and reducing *E. pilulifera* to the synonymy of *E. hypericifolia*.

DISTRIBUTION: Worldwide in the tropics and subtropics; *Chamaesyce hirta* is of doubtful nativity but perhaps it was American and was spread early into the Old World. About 50 Fijian collections are at hand.

LOCAL NAMES AND USES: The usual Fijian names are *ndeniose*, *ndeniosi*, *samunggawe*, *ovuka*, and *ovoku*; the species is sometimes called *asthma plant*, but the usual English name *hairy spurge* is not noted in Fiji. The leaves are sometimes used as part of an internal remedy for chest pains. Elsewhere, many medicinal uses are attributed to the species (Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 994. 1966).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 28*; Nandi airport, *DA 10683*; Nalotawa, eastern base of Mt. Evans Range, *Smith 4320*; shores of Mba River near its mouth, *Smith 4746*; vicinity of Waikumbukumbu, *Gibbs 691*. NANDRONGA & NAVOSA: Singatoka Experimental Farm, *DA 5949*. SERUA: Vicinity of Ngaloa, *Smith 9447*. RA: Ndombuilevu, *DA 9517*. NAITASIRE: Vunindawa, *DA 10042*; Nanduruloulou, *DA 9584*; vicinity of Nasinu, *Gillespie 3543*. TAILEVU: Londoni, *DA 9970*; Mbau road, near Nuku, *DA 10630*. REWA: Samambula, Suva, *DA 3675*. VANUA LEVU: MATHUATA: Lambasa, *DA 10476*. THAKAUNDROVE: Along trail over Mt. Mariko, *Bierhorst F129*. NGGAMEA: Naiiviivi Village, *Weiner 71-7-44*. VANUA MBALAVU: Lomaloma, *DA 10208*. LAKEMBA: Near Tumbou, *Garnock-Jones 904*. FIJI without further locality, *Seemann 405*.

4. *Chamaesyce hypericifolia* (L.) Millsp. in Publ. Field Columbian Mus., Bot. Ser. 2: 302. 1909.

Euphorbia hypericifolia L. Sp. Pl. 454. 1753; Boiss. in DC. Prodr. 15 (2): 23. 1862; J. W. Parham in Dept. Agr. Fiji Bull. 35: 78. fig. 36, e-h. 1959, Pl. Fiji Isl. 127. 1964, ed. 2. 180. 1972.

An annual herb with a long taproot and white latex, 15–50 cm. high, with reddish-tinged stems, sparingly found as a weed along roadsides, in cultivated areas and fields, and in waste places. The inflorescence parts are green, with the involucre of cyathia white- or pink-tinged. Doubtless flowers and fruits are to be expected throughout the year.

LECTOTYPIFICATION: *Euphorbia hypericifolia* has been subjected to various interpretations, which are well discussed by D. Burch (in *Rhodora* 68: 160–163. 1966). Burch considers the appropriate lectotype to be Sloane's illustration (Voy. Jam. Nat. Hist. 1: t. 126. 1707), one of Linnaeus's original references, and the specimen on which the illustration was based, if it still exists in the Sloane Herbarium (BM).

DISTRIBUTION: Probably originally from the West Indies or other parts of tropical America, this weed is now widespread in tropical, subtropical, and warm temperate areas. It is not abundant in Fiji; J. W. Parham, in first recording it (1959, cited above), indicated that it had been common for some years prior to that date.

USE: Although the species is reputed to have medicinal properties (J. W. Parham, 1959), these are not clarified.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, *DA 12608*; Suva, Department of Agriculture compound, *DA 11307, 12223*. FIJI without further locality, *DA 3914*.

The occurrence of this species on Niue is noted by Sykes (in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 89. 1970) under the name *Euphorbia glomifera* (Millsp.) L. C. Wheeler (based on *Chamaesyce glomifera* Millsp. in Publ. Field Columbian Mus., Bot. Ser. 2: 377. 1913).

ORDER THYMELAEALES

The position of the order Thymelaeales in an angiosperm sequence has been subject to vicissitude. Takhtajan (1969) considers the order to have much in common with the Euphorbiales and Malvales, while Hutchinson (1973) relates it to his order Bixales (Flacourtiaceae and allies). Cronquist (1968) and Thorne (1976) do not grant the family Thymelaeaceae ordinal consideration but place it in the order Myrtales (sub-class Rosidae in the present treatment). Of these various opinions, that of Takhtajan receives support from the criteria summarized by Briggs and Johnson (1979, p. 162), who find the Thymelaeaceae to have no particular bearing on the relationships of the order Myrtales. Whether or not to divide the Thymelaeaceae into subfamilies or separate families is a value judgment, perhaps of little consequence. To keep the family intact is suggested by some students (i. e. Domke in *Biblioth. Bot.* 27 (Heft 111): 1-151. 1934; Airy Shaw and Ding Hou in papers cited below). The subfamilies are well marked, and to recognize them as separate families presents no serious problems (van Tieghem, Gilg, and Hutchinson, as cited below under Gonystylaceae).

KEY TO FAMILIES OCCURRING IN FIJI

Leaf blades usually pellucid-punctate; flowers with a short or inconspicuous tube; petaloid appendages 7-40, deltoid to linear-subulate, rarely joined into a low, entire annulus, inserted at base of floral tube; disk lacking; stamens 8-80, the filaments free, the anthers hippocrepiform; ovary usually 3-5-locular (rarely 2-8-locular); fruit a capsule, usually tardily dehiscent, the seeds usually arillate.

92. GONYSTYLACEAE

Leaf blades not pellucid-punctate; flowers with a hypocrateriform or cylindrical tube; petaloid appendages obscure and ridgelike or represented by scales; disk usually present; stamens (1-) often 10, usually diplostemonous, the filaments partly or entirely adnate to floral tube, the anthers oblong, dorsifixed or basifixed; ovary 1- or 2-locular; fruit drupaceous or baccate, indehiscent, the seeds exarillate.

93. THYMELAEACEAE

FAMILY 92. GONYSTYLACEAE

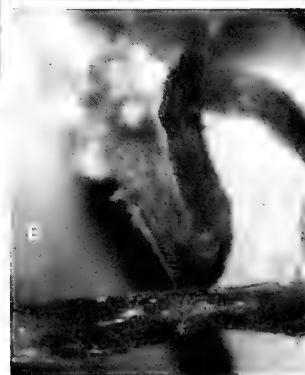
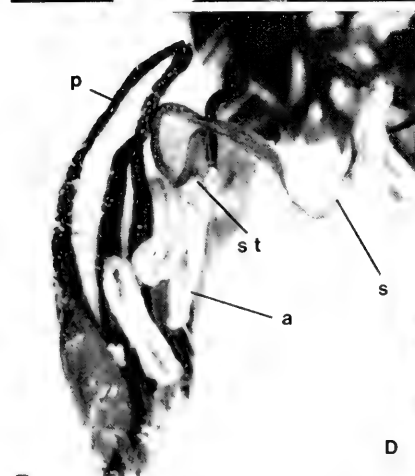
GONYSTYLACEAE Gilg in *Engl. & Prantl, Nat. Pflanzenfam. Nachtr. (Teil II-IV)* 1: 231. 1897.

Gonystylées v. Tiegh. in *Ann. Sci. Nat. Bot.* VII. 17: 249, nom. inadmis. 1893.

Thymelaeaceae subfam. *Gonystylodeae* Domke in *Biblioth. Bot.* 27 (Heft 111): 30, 33, 103. 1934.

Trees or rarely shrubs, without stipules; leaves alternate, spirally arranged, simple, the blades coriaceous, pinnate-nerved, usually glandular-punctate; inflorescences terminal or lateral, laxly cymose or paniculate, the bracts small, caducous; flowers ♂, actinomorphic; calyx with a short or inconspicuous 5-lobed tube, the lobes valvate or imbricate; disk lacking; corolla represented by petaloid appendages at base of floral tube, these 7-40, deltoid to linear-subulate, entire or bifid, free or united into a low, entire annulus; stamens 8-80, irregularly arranged or in 2 (rarely 1) series, the filaments free, short, slender, the anthers basifixed, 2-locular, hippocrepiform, longitudinally dehiscent; ovary superior, setulose, usually 3-5-locular (rarely 2-8-locular), the ovules solitary in each locule, anatropous, pendulous, the style terminal, filiform, elongated,

FIGURE 153. *Gonystylus punctatus*, from *DA 15651*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$; B, flower, $\times 4$; C, flower with 2 calyx lobes, some petaloid appendages, and some stamens removed, $\times 4$; D, floral parts, showing petaloid appendage (p), anther (a), style (s), and stigma (st), $\times 20$; E, stigma and apical portion of style, $\times 70$.



sometimes with a few long, threadlike processes (parastyles) around base, the stigma small, capitate; fruit a loculicidal capsule, this usually tardily dehiscent and 1-5-seeded, the mesocarp thick, fibrous, the seeds large, without a chalazal fold, usually arillate, with a hard testa, the endosperm lacking, the cotyledons thick, unequal.

DISTRIBUTION: Nicobar Islands, Malesia, Solomon Islands, and Fiji, centering in Borneo, with three genera (two of which are monotypic) and about 27 species. The genus *Gonystylus* is indigenously represented in Fiji.

USEFUL TREATMENTS OF FAMILY: Airy Shaw, H. K. Thymelaeaceae-Gonystylloideae. Fl. Males. I. 4: 349-365. 1953. Hutchinson, J. Gonystylaceae. Gen. Fl. Pl. 2: 239-241. 1967.

1. *GONYSTYLUS* Teysm. & Binn. in Bot. Zeitung 20: 265. 1862; A. C. Sm. in J. Arnold Arb. 36: 285. 1955.

Characters of the family; young parts sericeous, tomentose, or velutinous; leaf blades commonly with sparse persistent hairs beneath; inflorescences paniculate, basically racemose, the lateral branches few, short; calyx somewhat cupular, divided about 1/4-3/4 its length, the lobes thick, imbricate or subvalvate, slightly unequal (3 larger and 2 smaller), tomentose without, densely hispid-setulose within; petaloid appendages rigid, erect or incurved, glabrous or retrorse-hispid, sometimes pustulate, often shortly united proximally; stamens about equal in number to petaloid appendages, rarely twice as many, the anthers oblong or obovate, doubled back over the top of the linear-tetragonal connective and decurrent down its back; ovary subglobose, densely hispid-setulose; fruit woody, 2-5-valved, the exocarp thin-fleshy, the seeds with a smooth, soft-coriaceous testa, the aril thin, dorsal, arising from the fleshy funicle.

TYPE SPECIES: *Gonystylus miquelianus* Teysm. & Binn. (= *G. macrophyllus* (Miq.) Airy Shaw, based on *Aquilaria macrophylla* Miq.).

DISTRIBUTION: As of the family, with about 25 species, one endemic Fijian species terminating the generic range to the east.

USEFUL TREATMENTS OF GENUS: Airy Shaw, H. K. Notes on the genus *Gonystylus* Teijsm. et Binnend. (Thymelaeaceae). Kew Bull. 2: 9-16. 1947. Airy Shaw, H. K. New or noteworthy species of *Gonystylus* and related genera. Kew Bull. 5: 138-147. 1950. The 1947 paper includes a key to the species then known. The 1950 paper discusses the two additional genera and gives the group (subfamily or family) its present parameters.

1. *Gonystylus punctatus* A. C. Sm. in Sargentia 1: 65. fig. 4. 1942, in J. Arnold Arb. 36: 285. 1955; J. W. Parham, Pl. Fiji Isl. 104. fig. 46, A. 1964, ed. 2. 149. fig. 46, A. 1972. FIGURES 153, 154.

A tree 5-22 m. high, with a trunk to 50 cm. and probably more in diameter, found in dense or sometimes in secondary forest at elevations between 120 and 900 m. The calyx is yellowish brown and the fruits are brown at maturity; up to 9 × 6 cm. Flowers have been obtained between December and June, fruits between March and November. My previous description was based on a single collection, but the species has become so abundantly collected that the following amplification of the original description is possible:

Forest tree, attaining a height of at least 22 m.; petioles robust, to 4 mm. in diameter, up to 24 mm. long; leaf blades variable in size, up to 23 × 9 cm.; inflorescences terminal, narrowly paniculate, at anthesis up to 18 cm. long and 8 cm. broad, the lowest 1 or 2 nodes sometimes bearing a foliage leaf and 1 or more axillary flowers, the lateral branches 2-6, to 2 cm. in length but often much shorter, the flowers (1-) 2-7 per branch; pedicels stout, 15-30 mm. long; calyx cupuliform, 6-8 mm. long and 8-15 mm. in apical diameter at anthesis, 5-lobed about 3/4 its length, the lobes oblong, 3.5-5 mm. broad, obtuse, distally reflexed at anthesis; calyx and pedicel (like inflorescence branches) copiously setulose with fine, yellowish brown hairs 0.2-0.4 mm. long, the



FIGURE 154. *Gonystylus punctatus*, distal portion of branchlet, with foliage and mature fruits, \times about 1/3, from Smith 8541.

calyx within densely hispid-setose with hairs 0.7–1.5 mm. long; petaloid appendages 30–40, linear-subulate, 4–5 mm. long, usually free but sometimes shortly connate proximally; stamens subequal to appendages in number or fewer, the filaments filiform, 1–1.5 mm. long, the anthers oblong, 1–1.3 mm. long; ovary ellipsoid, copiously hispidulous with hairs 0.4–0.8 mm. long, the style filiform, elongate and tortuous, the stigma capitate, copiously but minutely papillose; parastyles lacking; fruits ellipsoid, not necessarily falcate, at maturity 8–9 \times 4–6 cm., eventually dehiscent into 3 or 4 valves, the mesocarp 6–10 mm. thick.

TYPIFICATION: The type is *Tabualewa 15607* (A HOLOTYPE; ISOTYPES at BISH, K, US, etc.), collected June 18, 1941, near Mbuyombuyo, vicinity of Namboutini, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, where it is most frequently found near the southern coast; about 35 collections have now been studied.

LOCAL NAMES AND USE: The widely used Fijian name is *mavota*; *ronga* has been recorded only for the type collection. The species is considered a very useful timber tree.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Nausori Highlands, vicinity of Mbukuya, *Berry 103*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13324*, *Damanu NH.18*. SERUA: Nathengathenga Creek (tributary of upper Navua River), *DA L.13606 (DF 1203)*; Navutulevu Creek, *Damanu NL.13*; inland from Namboutini, *DF 792 (DF 568, S1415/7)*; Korovisilou Creek, *Damanu KL.1*; Yarawa Creek, *DF 1061 (S1415/8)*; inland from Ngaloa, *DF 793 (DF 569, S1415/6)*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8541*; Wairoro Creek, *DA 13810*; Nambukavesi Creek, *Bola NL.11*. NAITASIRI: "Near Wai ni Sasa" (i. e. Wainisasi Plantation, at junction of Wainasasa Creek and Rewa River), *Horne 95*; Waimanu River, *DA 15651 (L.13831)*; Toninaiwau, Tholo-i-suva, *DA 16295*. TAILEVU: Without further locality, *Howard 318*.

Although it remained undescribed until 1942, *Gonystylus punctatus* is well known to foresters in Fiji. The earliest collection known to me is *Horne 95* (cited above), dated December, 1878, on the field label, although in view of Horne's itinerary and probable dates (cf. Vol. 1, p. 51, of this *Flora*), I believe that 1877 may have been intended.

The relationship of the Fijian species is probably with *Gonystylus macrophyllus* (Miq.) Airy Shaw, from which it differs in its longer petaloid appendages and larger fruits, as well as in details of foliage; *G. macrophyllus* is broadly interpreted by Airy Shaw (in 1953). A closer relative of *G. punctatus* may be *G. macrocarpus* C. T. White (in J. Arnold Arb. 31: 96. 1950), of the Solomon Islands, but the Fijian species has often larger leaf blades with longer petioles, and its fruits are distinctly ellipsoid rather than subglobose.

FAMILY 93. THYMELAEACEAE

THYMELAEACEAE Juss. Gen. Pl. 76, as *Thymelaeae*. 1789.

Trees or shrubs, rarely herbs, without milky latex, with strongly developed inner bark, without stipules; leaves usually alternate and spirally arranged, sometimes opposite, simple, the blades entire; inflorescences terminal, axillary, or borne on defoliate stems, spicate, racemose, capitate, or rarely composed of solitary flowers; flowers ♂ or rarely unisexual (plants then dioecious or polygamo-dioecious), actinomorphic or slightly zygomorphic; calyx with a conspicuous, hypocateriform or cylindrical tube, this often broadened around ovary, the lobes 4 or 5 (or 6), imbricate or rarely valvate; corolla absent or represented by petaloid appendages, these isomerous and alternating with calyx lobes or double in number and arranged in pairs, inserted at throat of floral tube or slightly lower, often scalelike; disk hypogynous, annular, cupular, composed of scales, or lacking; stamens usually diplostemonous in 1 or 2 series (rarely reduced to 1 or 2), the filaments filiform or slightly flattened, partly or entirely adnate to floral tube, the anthers 2-locular, free, introrse, longitudinally dehiscent; ovary superior, 1- or 2-locular, the ovules solitary in each locule, anatropous, pendulous from near apex or laterally adnate to placenta, the style filiform to obscure, terminal or excentric, the stigma often capitate; fruit drupaceous or baccate, the seeds with or without endosperm, the embryo straight, the cotyledons fleshy, often thick.

DISTRIBUTION: Nearly cosmopolitan but best developed in South Temperate areas, with 40-45 genera and 500-800 species. Two genera occur indigenously in Fiji.

USEFUL TREATMENTS OF FAMILY: Ding Hou. Thymelaeaceae. Fl. Males. I. 6: 1-48. 1960. Hutchinson, J. Thymelaeaceae. Gen. Fl. Pl. 2: 246-260. 1967.

KEY TO GENERA

Ovary 2-locular, the style filiform and sometimes exerted, the stigma capitate; fruit a drupe of 1 or 2 pyrenes, red to purple at maturity; inflorescences usually with decussate bracteoles, the uppermost 2 or more of these often involucrel and subtending flowers, the flowers sessile; calyx white to yellow, 4- or 5-lobed (in our species); petaloid appendages (facial scales) usually present; disk cupular or annular, sinuate or short-lobed; stamens 8 or 10 (in our species), often with slender filaments and exerted.

1. *Phaleria*

Ovary 1-locular, the style short, often obscure, the stigma often globose-capitate; fruit a 1-seeded berry, at length dull orange to red; inflorescences lacking bracts or these inconspicuous, the flowers subsessile or pedicellate; calyx greenish to yellow, 4-lobed; petaloid appendages lacking; disk usually composed of free, scalelike segments; stamens 8, sessile or with short filaments, usually included within calyx tube.

2. *Wikstroemia*

1. *Phaleria* Jack in Malayan Miscel. 2 (7): 59. 1822, in Companion Bot. Mag. 1: 156. 1835; A. C. Sm. in Sargentia 1: 67. 1942.

Drimyspermum Reinw. in Syll. Pl. Nov. 2: 15. 1826.

Drymisperrum Reichenb. Deutsche Bot. 1: 65, orth. mut. 1841; Seem. Fl. Vit. 207. 1867.

Leucosmia Benth. in London J. Bot. 2: 231. 1843; A. Gray in J. Bot. 3: 305. 1865.

Trees or shrubs; leaves opposite, often decussate, the blades often large, pinnate-nerved; inflorescences terminal or axillary or often cauligerous, capitate, fasciculate, or short-spicate, pedunculate or sessile, the peduncles often with decussate (persistent or soon caducous) bracts, the uppermost 2 or more of these often involucrel and subtending the flowers; flowers ♂, sessile; calyx tube infundibular or cylindrical, elongated, glabrous or pilose on one or both surfaces, the lobes 4 or 5 (in our species, sometimes 6 in others), often slightly unequal; petaloid appendages (faucial scales) obscure (but usually obvious and distinct in our species) or rimlike or lacking; disk hypogynous, cupular or annular, sinuate or short-lobed, often diaphanous and appressed to ovary; stamens twice as many as calyx lobes, biseriata, attached in calyx throat, often exerted and with slender filaments, sometimes included, the anthers oblong, dorsifixed, rarely sessile, the connective narrow; ovary ovoid or ellipsoid, glabrous or apically pilose, 2-locular (rarely 1-locular by abortion), the style terminal, filiform, often swollen apically, sometimes exerted, the stigma capitate or minutely lobed, sometimes papillose; fruits drupaceous, 1- or 2-seeded, the exocarp and mesocarp fleshy or fibrous, the endocarp coriaceous, the seeds without endosperm, the cotyledons thick, hemispherical.

TYPE SPECIES AND NOMENCLATURE: The type species of *Phaleria* is *P. capitata* Jack, that of *Drimyspermum* is *D. urens* Reinw. (= *Phaleria capitata* Jack, vide Ding Hou, 1960, cited above under the family), and that of *Leucosmia* is *L. burnettiana* Benth. (= *Phaleria disperma* (Forst. f.) Baill.). The synonymy of the three genera is now accepted by all students of the family.

DISTRIBUTION: Southeastern Asia and Ceylon through Malesia to Micronesia, Australia, and eastward in the Pacific to Samoa and Tonga, with 25-30 species. Nine species occur indigenously in Fiji, six of them being endemic.

USEFUL TREATMENT OF GENUS: Smith, A. C. *Phaleria* Jack. *Sargentia* 1: 67-73. 1942.

KEY TO SPECIES

- Inflorescences spicate or pseudocapitate, with 10-25 5-merous flowers borne on a cylindrical receptacle 5-15 mm. long, the peduncle 1-3 cm. long, the involucrel bracts 2 but very soon caducous; petioles stout, usually 7-10 mm. long, often reddish; leaf blades oblong-elliptic, 8-17 × 5-10 cm.; plants of sea cliffs and thickets near beaches. 1. *P. disperma*
- Inflorescences capitate, the flowers congested on a flattened, convex, or subglobose receptacle, often subtended by 2 or more, sometimes subsistent, involucrel bracts; inland plants.
- Calyx conspicuously pilose without, the flowers 5-merous, the involucrel bracts soon caducous but probably 2, the peduncle 10-22 mm. long; petioles 3-5 mm. long; leaf blades oblong- or ovate-lanceolate, 8-13 × 2-4.5 cm. 2. *P. pubiflora*
- Calyx glabrous without, the flowers 4-merous.
- Leaf blades subsessile (petioles 1-3 mm. long), subcordate at base; inflorescences associated with foliage; involucrel bracts paired, conspicuous, persistent past anthesis.
- Calyx 30-43 mm. long; involucrel bracts (10-) 15-20 × (8-) 12-20 mm.; leaf blades ovate to ovate-lanceolate, 5-16 × 2.3-6 cm. 3. *P. pulchra*
- Calyx 40-60 mm. long; involucrel bracts 7-10 mm. long and broad; leaf blades ovate-lanceolate, 9-20 × 3-7.5 cm. 4. *P. ixoroides*
- Leaf blades petiolate (petioles at least 3 mm. long, sometimes only 2 mm. long in no. 9), acute to obtuse at base (infrequently rounded or subcordate but then with an obvious petiole).
- Involucrel bracts persistent past anthesis, usually falling after the flowers and often present in fruiting specimens.
- Leaf blades ovate- or oblong-elliptic, usually 2-4 times as long as broad, 5-21 × 2-9 cm., obtuse to sometimes rounded (less often acute) at base, acute to acuminate at apex; petioles 3-12 mm. long.
- Flowers (5-) 10-20 per inflorescence; involucrel bracts 2, ovate or broadly ovate, usually broader than long, 6-13 × 7-21 mm., rounded or obtuse at apex; fruits often several per head; inflorescences axillary or on defoliate branchlets, solitary or sometimes 2 or 3 to

- gether, the peduncle 2-12 mm. long; petioles 5-12 mm. long; leaf blades usually 7-21 × 3-9 cm. 5. *P. glabra*
- Flowers 2 or 3 (-several) per inflorescence; involucre bracts 4-6, the inner 3-5 (rarely only 2) subequal in size, oblong-ovate, longer than broad, at anthesis 9-15 × 5-8 mm., acute to acuminate (rarely obtuse) at apex; fruits usually solitary; inflorescences associated with foliage, the peduncle 3-20 mm. long; petioles 3-8 mm. long; leaf blades usually 5-12 × 2-5 cm. 6. *P. montana*
- Leaf blades lanceolate-oblong, usually 5 or 6 times as long as broad, 12-27 × 2-6.5 cm., acute to obtuse at base, gradually long-acuminate at apex; petioles 7-20 mm. long; inflorescences usually borne on trunk and branches, many-flowered, the peduncle 2-6 mm. long; involucre bracts 3 or 4, ovate-orbicular, 5-11 × 5-10 mm., rounded to subacute at apex. 7. *P. angustifolia*
- Involucre bracts 2, evanescent, caducous before anthesis.
- Flowers 6-25 (-35) per head; calyx 35-55 mm. long; inflorescences associated with foliage or borne on branches or trunk; petioles 4-17 mm. long; leaf blades 7-20 (-25) × 2.5-10 (-11.5) cm. 8. *P. acuminata*
- Flowers usually 3 or 4 per head; calyx 27-30 mm. long; inflorescences associated with foliage or arising from defoliate branchlets; petioles 2-5 mm. long; leaf blades 4-8.5 × 1-2.2 cm. 9. *P. lanceolata*

1. *Phaleria disperma* (Forst. f.) Baill. in *Adansonia* 11: 318. 1875; Gilg in *Engl. & Prantl, Nat. Pflanzenfam.* III. 6a: 225. 1894; A. C. Sm. in *Sargentia* 1: 67. 1942; Yuncker in *Bishop Mus. Bull.* 220: 195. 1959; J. W. Parham, *Pl. Fiji Isl.* 105. 1964, ed. 2. 151. 1972; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 204. 1970; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 114. 1972.

Dais disperma Forst. f. *Fl. Ins. Austr. Prodr.* 33. 1786.

Leucosmia burnettiana Benth. in *London J. Bot.* 2: 231. 1843, *Bot. Voy. Sulphur*, 179. pl. 56. 1846; Meisn. in *DC. Prodr.* 14: 603. 1857; Seem. in *Bonplandia* 9: 258. 1861, in op. cit. 10: 154. 1862, *Viti*, 440. 1862; A. Gray in *J. Bot.* 3: 306. 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 281. 1892.

Drymispermum forsteri Meisn. in *DC. Prodr.* 14: 605, nom. illeg. 1857.

Drymispermum billardieri Dec. *Voy. Venus, Bot.* 16. 1864, *Atlas*, pl. 12. (1846).

Leucosmia ovata Dec. *Voy. Venus, Bot.* 17. 1864.

Drymispermum burnettianum Seem. *Fl. Vit.* 208. 1867.

Phaleria burnettiana P. Knuth, *Handb. Blütenbiol.* 3 (2): 522. 1905; Christophersen in *Bishop Mus. Bull.* 154: 19. 1938; Yuncker in op. cit. 184: 53. 1945.

A shrub or tree 2-8 m. high, often locally frequent, found on sea cliffs or at their bases or in beach thickets near sea level, or perhaps as high as 200 m. on sharp sea-facing slopes. The fragrant flowers have the calyx yellow or white, or yellow proximally and white distally; the fruit, at first green, turns red at maturity and bears brown seeds. Flowers have been obtained between December and July, fruits between April and January.

TIPIFICATION AND NOMENCLATURE: *Dais disperma* is based on material collected by the Forsters on Tongatapu, Tonga, during Cook's second voyage. The only specimen of this collection noted at BM consists of a single leaf, whereas the K specimen from the Forster herbarium is quite adequate and is herewith indicated as the lectotype. In his discussion of 1865, Gray indicated that Forster's concept seemed based on a mixture (and this is suggested by Forster's brief 1786 description), suggesting that *Dais disperma* be equated with *Leucosmia burnettiana* Benth. The material now at K and BM does not appear mixed. Gray believed the second element of Forster's concept to represent the new species which he then described as *Leucosmia acuminata*, typified by a Samoan plant. It is probable that Forster's second element represents *Phaleria glabra*; a Forster specimen is cited by Yuncker (in *Bishop Mus. Bull.* 220: 195. 1959) as *P. acuminata*, but, as discussed below under *P. glabra*, I now believe that *P. acuminata*

does not occur in Tonga. *Drymispermum forsteri* Meisn. is an illegitimate name because *Dais disperma* was cited as a synonym.

Three other taxa are obvious synonyms of *Phaleria disperma*, as recognized by Baillon and Gilg. Bentham's type citation for *Leucosmia burnettiana* is: "Feejee Islands, Mr. Hinds, Mr. Barclay." Of the two specimens now in the type cover at K, one is a Barclay specimen from Nukulau Island, consisting only of a flowering twig with several detached flowers and one detached leaf. The second is a fruiting specimen collected by Hinds without locality (but doubtless also from Nukulau); it bears a single dissected flower in the pocket which possibly came from the Barclay sheet. In this case I believe that the first sheet is the suitable lectotype because of its flowers and the fact that it bears the epithet published by Bentham (whereas the Hinds sheet is labelled "*Leucosmia fragrans* Benth."): *Barclay* (K LECTOTYPE), collected in 1840 on Nukulau Island, Rewa Province, Viti Levu. For *Drymispermum billardieri*, Decaisne cited Tongan collections by Labillardière and Hombron, both probably at P. The type of *Leucosmia ovata* (doubtless at P) was collected on Ovalau in 1838 by Jacquinet during Dumont d'Urville's second voyage.

DISTRIBUTION: Fiji, Samoa, and Tonga. Because *Phaleria disperma* is an attractive plant with very fragrant flowers, it is occasionally brought into cultivation; Sykes (1970, cited above) considers that as such it was a fairly recent introduction into Niue. About 25 Fijian collections have been examined, and the species may be expected throughout the group in suitable habitats.

LOCAL NAMES: Recorded Fijian names are *sinu*, *sinu ndina*, *sinu ndamu*, *sinu salusalu*, *sinu ni mbaravi*, *matiavi*, and *tarotaro*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NADRONGA & NAVOSA: Turnoff from Queen's Road to Burns Point, *DA 14424*; Thuvu Beach, *Greenwood 274*. NAITASIRI: Navuso, *Horne s. n.* (locality on Rewa River about 25 km. from mouth, unusually far inland for this species if label is correct). TAILEVU: Matavatathou, *DA 15372*. REWA: Suva, Department of Agriculture compound, *DA 8675*; Makaluva Island, *Tothill 687*. OVALAU: Vicinity of Thawathi, *Smith 8104*. NAIRAI: *Tothill 685*. VANUA LEVU: THAKAUNDROVE: Namale, *DA 16853*; along Hibiscus Highway east of Savusavu, *Bierhorst F161*. VANUA MBALAVU: Northern limestone section, *Smith 1495*; near Sawana Village, *Garnock-Jones 1067*. NAYAU: Bryan, Sept. 12, 1924. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 781*. KAMBARA: Bryan 496. F111 without further locality, *Seemann 383*.

2. *Phaleria pubiflora* (A. Gray) Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. 6a: 225. 1894; A. C. Sm. in *Sargentia* 1: 69. 1942; J. W. Parham, Pl. Fiji Isl. 105. 1964, ed. 2. 151. 1972.

Drymispermum sp. Seem. in *Bonplandia* 9: 258. 1861, Viti, 440. 1862.

Leucosmia pubiflora A. Gray in J. Bot. 3: 306. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Drymispermum pubiflorum Seem. Fl. Vit. 208. 1867.

A shrub or tree probably not much exceeding 3 m. in height, sometimes cauliflorous, occurring infrequently in dry areas and ravines, sometimes on limestone, at elevations from near sea level to about 150 m. Flowers and fruits have been noted between April and September.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 64970 HOLOTYPE; ISOTYPE fragment at BM), collected in 1840 in Fiji without further locality. In 1942 I erroneously suggested that the BM specimen was the holotype, but it consists only of two leaves and one calyx; surely the US specimen is the holotype.

DISTRIBUTION: Endemic to Fiji and thus far known from scattered localities.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Between Rarawai and Tavua, *Greenwood 729*; Korovou, east of Tavua, *Degener 14951*. KANDAVU: *Seemann 379* (label error as 279). VANUA MBALAVU: Nambavatu, northern limestone section, *Tothill 684*. FIJI without further locality, *Horne 507*.

3. *Phaleria pulchra* Gillespie in Bishop Mus. Bull. **91**: 21. *fig. 23*. 1932; A. C. Sm. in *Sargentia* **1**: 69. 1942; J. W. Parham, Pl. Fiji Isl. **105**. *fig. 46, B*. 1964, ed. 2. 151. *fig. 46, B*. 1972.

A shrub or small tree found in forest at elevations of 150–500 m. This infrequent species is said by Gillespie to have green involucre bracts and a red calyx, but the latter is unlikely, since all other Fijian species of the genus have the calyx white or yellow. The only dated specimen, in flower, is the type.

TIPIFICATION: The type is *Gillespie 2141* (BISH HOLOTYPE and ISOTYPE), collected Aug. 9, 1927, in the vicinity of Tamavua, Naitasiri Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known definitely only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Mt. Voma, *DA 1751*. FIJI without further locality, *DA L.13311* (coll. *Berry*).

4. *Phaleria ixoroides* Fosberg in Bull. Torrey Bot. Club **67**: 418, as *P. ixoroides*. 1940; A. C. Sm. in *Sargentia* **1**: 70, as *P. ixoroides*. 1942; J. W. Parham, Pl. Fiji Isl. **105**. 1964, ed. 2. 151. 1972.

A tree 1.5–5 m. high, found infrequently in light forest between sea level and 150 m. elevation. The flowers are fragrant, with a white calyx. Flowers have been noted between April and July, but fruits are as yet uncollected.

TIPIFICATION: The type is *St. John 18123* (BISH HOLOTYPE and 2 ISOTYPES), collected July 19, 1937, north of Yalombi, along Olo Creek, Waya, Yasawa Group.

DISTRIBUTION: Endemic to Fiji and known only from the type and a second collection from Viti Levu.

LOCAL NAME AND USE: Notes with the type collection indicate the Fijian name as *tarutaru* and that the plant is used medicinally for scabies.

AVAILABLE COLLECTION: VITI LEVU: SERUA: Vatutavathe, vicinity of Ngaloa, *Degener 15202*.

This species and the preceding, *Phaleria pulchra*, apparently rare, are readily distinguished from the remaining Fijian species of *Phaleria* with 4-merous flowers by their subsessile, subcordate leaf blades. They are sharply distinct from one another in foliage and inflorescence dimensions.

5. *Phaleria glabra* (Turrill) Domke in Biblioth. Bot. **27** (Heft 111): 55. 1934; A. C. Sm. in *Sargentia* **1**: 70. 1942; J. W. Parham, Pl. Fiji Isl. **105**. 1964, ed. 2. 151. 1972.

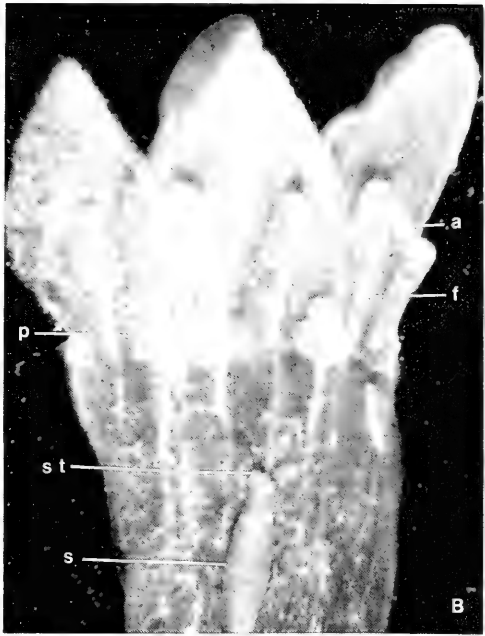
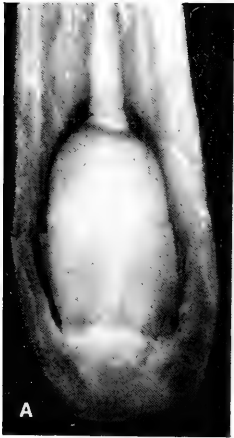
FIGURE 155A–C.

Leucosmia acuminata sensu Gibbs in J. Linn. Soc. Bot. **39**: 167. 1909; non A. Gray.

Leucosmia glabra Turrill in J. Linn. Soc. Bot. **43**: 37. 1915.

Phaleria acuminata sensu Yuncker in Bishop Mus. Bull. **220**: 195. 1959; non Gilg.

FIGURE 155. A–C, *Phaleria glabra*, from *Smith 8623*; A, ovary in base of calyx tube, showing disk and a couple of hairs near apex, $\times 20$; B, apical portion of calyx tube opened, showing anther (a) (lower right one lacking), filament (f), petaloid appendage (p), apical part of style (s), and stigma (st), $\times 10$; C, distal portion of branchlet with 4 inflorescences, showing paired, broadly ovate bracts subtending numerous flowers, $\times 1$. D, *Phaleria montana*, young inflorescence showing several, elongate, flower-subtending bracts, $\times 4$, from *Smith 4284*.



An often slender tree or shrub 2–10 m. high, found at elevations from near sea level to 1,195 m. in often dense forest or on its edges or in crest thickets. The inflorescences are sometimes associated with foliage and sometimes borne on defoliate branchlets or stems; the involucre bracts are green; the very fragrant flowers have the calyx yellowish to pure white; and the mature fruit becomes bright to dark red. Flowers and fruits have been obtained throughout the year.

TIPIFICATION: Although there is a single sheet of the holotype at κ , it bears branchlets from two plants: (1) "12. III. 1905. Kandavu. (common about Nandarivatu)"; (2) "72. 4.2.06." I interpret im Thurn's labels to imply that (2) refers to a branchlet collected at Nandarivatu, although I do not understand what "72" means. It is certain that im Thurn was on Kandavu during March, 1905. The holotype may be construed as (1) above: *im Thurn 12* (κ HOLOTYPE), collected March 12, 1905, on Kandavu without further locality.

DISTRIBUTION: Fiji and Tonga; the Tongan material mentioned by Yuncker seems better placed here than in *Phaleria acuminata*, which I now believe limited to Fiji and Samoa. *Phaleria glabra* appears to be the most abundant species of the genus in Fiji; I have examined some 65 collections from five of the high islands.

LOCAL NAMES: Local names recorded on Viti Levu are *thua ni lawa*, *rauwoi*, *mbuimbuita*, *sinu lau*, and *mativi*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: M β A: Mountains near Lautoka, *Greenwood 1297*; summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4216*; Nandarivatu, *Gibbs 608*, *Gillespie 3708*; Mt. Nanggaranambuluta, *DA 13562*; slopes of Mt. Tomanivi, *Smith 5747*. N β ANDRONGA & N β AVOSA: Nausori Highlands, *DA 13394*; northern portion of Rairaimatuku Plateau, *Smith 5488*; vicinity of Mbelo, near Vatukarasa, *Tabualewa 15562*. SERUA: Mt. Tuvutau, *DA 15527*; hills north of Ngaloa, *Smith 9418*. N β MOSI: Mt. Naitarandamu, *Gillespie 3362*; hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8623*. N β AITASIRI: Nasauvere, Wainimala River, *DA 14025*; Viria, *DA 474*; Tholo-i-suva, *DA 11095*; vicinity of Nasinu, *Gillespie 3583*. T β AILEVU: King's Road, *DA 853*. R β EWA: Near Lami, *Gillespie 4614*. K β ANDAVU: Kiombo, *DA 12435* (*DF 80*). O β VALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7640*. V β ANUA LEVU: M β ATHUATA: Mountains near Lambasa, *Greenwood 499*. T β HAKAUNDROVE: Mt. Kasi, Yanawa River region, *Smith 1819*; Vatunivumonde Mt., Savusavu Bay region, *Degener & Ordenez 14035*. T β AVEUNI: Vicinity of Nggele, *DA 14397*.

Phaleria glabra and *P. montana* are sometimes not readily distinguished from one another. In general, the inflorescences of *P. glabra* have only two, characteristically broadly ovate and rounded, involucre bracts, whereas those of *P. montana* are three or more, longer than broad, and frequently acute to acuminate. But occasionally the involucre bracts of *P. montana* are only paired. Fairly dependable characters are the facts that the inflorescences of *P. glabra* appear to be always solitary, comparatively many-flowered, and short-pedunculate, while those of *P. montana* are sometimes clustered, few-flowered, and with longer peduncles. The two species do not have mutually exclusive ranges.

6. *Phaleria montana* (Seem.) Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. 6a: 225. 1894; A. C. Sm. in *Sargentia* 1: 70. 1942; J. W. Parham, Pl. Fiji Isl. 105. 1964, ed. 2. 151. 1972. FIGURE 155D.

Drymisperrum montanum Seem. in *Bonplandia* 9: 258, nom. nud. 1861, Viti, 440, nom. nud. 1862; A. Gray in *J. Bot.* 3: 306, nom. nud. 1865; Seem. *Fl. Vit.* 209. t. 54. 1867.

Leucosmia montana Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

A shrub or tree 2–20 m. high, often slender, occurring in dense forest at elevations of 50–1,150 m. The involucre bracts are pale green; the fragrant flowers have pale yellow or white calyces, and the fruits are shining or dull red. Flowers have been obtained between May and January, fruits between December and September.

TIPIFICATION: The type is *Seemann 380* (K HOLOTYPE; ISOTYPE at BM), collected Sept. 6, 1860, on the slopes of Mt. Mbuke Levu, Kandavu.

DISTRIBUTION: Endemic to Fiji and known from three of the high islands.

LOCAL NAMES: Names recorded on Viti Levu are *nai viithi*, *matiaivi*, *sinu matiaivi*, *sembulumbulu*, and *kawasa*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Near Ambatha, east of Lautoka, *DA 14161*; northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, *Smith 4284*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4476*; Naloto Range, *DA 14784*; vicinity of Nandarivatu, *Gillespie 4186*; western and southern slopes of Mt. Tomanivi, *Smith 5123, 5275*. NANDRONGA & NAVOSA: Near Lomawai, *Greenwood 737*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5563*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15336, 15377, 15426*. VANUA LEVU: MATHUATA: Vicinity of Natua, Seangangga Plateau, *DA 15338*. THAKAUNDROVE: Uluinambathi Mt., Savusavu Bay region, *Degener & Ordenez 13930*.

7. *Phaleria angustifolia* A. C. Sm. in Bishop Mus. Bull. **141**: 101. *fig. 53*. 1936, in *Sargentia* **1**: 71. 1942; J. W. Parham, Pl. Fiji Isl. 105. 1964, ed. 2. 151. 1972.

A slender tree or shrub 2–5 m. high, found in dense forest at elevations of 100–500 m. The inflorescences are usually borne on the trunk and branches; the calyx is white or cream-white; and the fruit is red. Flowers have been obtained in April and June, fruits in July.

TIPIFICATION: The type is *Smith 1685* (BISH HOLOTYPE; many ISOTYPES), collected April 28, 1934, on the southern slope of Mt. Seatura, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and apparently rare, known only from Vanua Levu.

LOCAL NAME: The name *numbu* was noted for the type collection.

AVAILABLE COLLECTIONS: VANUA LEVU: MATHUATA: Seangangga Plateau, *DA 13474*; Valembasonga, east of Lambasa, *DA 16676*.

In 1942 I keyed *Phaleria angustifolia* as related to *P. glabra*, with only two involucre bracts. However, it is now seen that such bracts are three or four, and therefore perhaps the closer relative of *P. angustifolia* is *P. montana*. The combination of proportionately narrower leaf blades and persistent involucre bracts separates *P. angustifolia* from *P. acuminata*.

8. *Phaleria acuminata* (A. Gray) Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. **6a**: 225. 1894; Christophersen in Bishop Mus. Bull. **154**: 18. 1938; A. C. Sm. in *Sargentia* **1**: 71. 1942; Yuncker in Bishop Mus. Bull. **184**: 53. 1945; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 149. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 56, 105, 114. 1972.

Drymispermum subcordatum Seem. in Bonplandia **9**: 258, nom. nud. 1861, Viti, 440, nom. nud. 1862; A. Gray in J. Bot. **3**: 306, nom. nud. 1865; Seem. Fl. Vit. 209. *t.* 53. 1867.

Drymispermum sp. Seem. in Bonplandia **9**: 258. 1861, Viti, 440. 1862.

Leucosmia acuminata A. Gray in J. Bot. **3**: 306. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Drymispermum acuminatum Seem. Fl. Vit. 209. 1867.

Leucosmia subcordata Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 281. 1892.

Phaleria subcordata Gilg in Engl. & Prantl, Nat. Pflanzenfam. III. **6a**: 225. 1894.

An often slender tree or shrub 1–9 m. high, found in dense or open forest or in forest patches at elevations from near sea level to 900 m. The inflorescences are often borne on branches and stems; the fragrant flowers have a white calyx and yellow anthers; and the fruits become red or purple. Flowers have been collected between August and January and fruits in months scattered throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: *Leucosmia acuminata* is typified by *U. S. Expl. Exped.* (US 62123 LECTOTYPE; ISOLECTOTYPES at BM, K, NY), collected in 1839 in Samoa without further locality. As Gray originally cited "Samoan and Fijian Islands," my citation of 1942 may be considered a lectotypification; no Fijian *U. S. Exploring Expedition* material annotated by Gray has been located. In his protologue of *Drymisperrum subcordatum*, Seemann cited his numbers 381 and 383; the latter should have been 382 and is so corrected in the Kew copy of *Flora Vitiensis*. Number 381, from Viti Levu, is an excellent flowering specimen and bears preliminary sketches for Seemann's *t.* 53. Number 382, from Taveuni, bears detached leaves and a few scrappy flowers. A proper citation therefore is: *Seemann 381* (K LECTOTYPE; ISOLECTOTYPE at BM), collected in August, 1860, in Rewa Province, Viti Levu. Between August 2 and 13 Seemann was travelling from Mbau Island through the Rewa delta, staying in part at Rewa Village or at the nearby Mataisuva Mission, near the junction of the Nasali River with the Rewa. The difficulties of separating the two taxa here concerned were discussed by me in 1942; variability of the leaf blade base seems to make such a separation inadvisable.

DISTRIBUTION: Fiji and Samoa; Tongan material formerly placed here is now believed to represent *Phaleria glabra*. Twenty-two Fijian collections have been examined.

LOCAL NAMES: Recorded Fijian names are *matiavi*, *sinu matiavi*, *songo ni wai*, *toatoa*, and *kau ndamu*; I am inclined to question the last three of these.

REPRESENTATIVE COLLECTIONS: WAKAYA: *Tothill 419* (coll. *Dietrich*), *Beck*, Oct. 17, 1924. VANUA LEVU: MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6879*. THAKAUNDOVE: Eastern drainage of Yanawai River, *Degener & Ordenez 14121*; southern slope of Korotini Range, below Navitho Pass, *Smith 488*; southwestern slope of Mt. Mbatini, *Smith 621*; Mt. Mariko, *Smith 450*; hills south of Nakula River, *Smith 336*; Maravu, near Salt Lake, *Degener & Ordenez 14198*. TAVEUNI: Borders of lake east of Somosomo, *Smith 928*. MOALA: Near Maloku, *Smith 1338*. NAVUTU-I-RA: *Bryan 467*. NAVUTU-I-LOMA: *Bryan 456*.

While the character of subsistent as opposed to evanescent involucre bracts, utilized in my key, is not very satisfactory, *Phaleria acuminata* can otherwise be distinguished from *P. glabra*, the only species with which it is likely to be confused, by its often larger and longer-petiolate leaf blades and its larger fruits. *Phaleria glabra* is abundant on Viti Levu and infrequent on Vanua Levu, whereas *P. acuminata* is rare on Viti Levu, abundant on Vanua Levu, and also known from some of the eastern islands of Fiji.

9. *Phaleria lanceolata* (A. Gray) Gilg in Engl. & Prantl, *Nat. Pflanzenfam.* III. 6a: 225. 1894; A. C. Sm. in *Sargentina* 1: 73. 1942; J. W. Parham, *Pl. Fiji Isl.* 105. 1964, ed. 2. 151. 1972.

Drymisperrum lanceolatum A. Gray in *J. Bot.* 3: 304. 1865; Seem. *Fl. Vit.* 208. 1867.
Leucosmia lanceolata Benth. & Hook. f. ex Drake, *Ill. Fl. Ins. Mar. Pac.* 281. 1892.

There is little documentation as to *Phaleria lanceolata*, although Seemann remarks that its flowers are "white and fragrant." Presumably it is a small, slender, sometimes rambling shrub.

TYPIIFICATION: The type is *U. S. Expl. Exped.* (US 62112 HOLOTYPE; ISOTYPE fragment at BM), collected in 1840 "in the mountains behind Macuata" (i. e. probably opposite Mathuata-i-wai Island in the Mathuata Range, Mathuata Province, Vanua Levu).

DISTRIBUTION: Endemic to Fiji and rare, presumably found only in western and northern Vanua Levu.

AVAILABLE COLLECTIONS: VANUA LEVU: MBUA: "Navakasinga District" (presumably Naivaka Peninsula, north of Rukuruku Bay), *H. B. R. Parham 388*; Rukuruku Bay, *H. B. R. Parham 11*. FIJI without further locality, *U. S. Expl. Exped.* (US 654008). (The last specimen, although it may indeed be from the type plant, cannot be considered part of the type collection; the label bears no reference of Gray to *Phaleria*, but to "Rhamnaceae"; the indication of the genus *Phaleria* is in some other hand.)

Whether or not the early caducous involucre bracts of this and the preceding species provide a useful character, *Phaleria lanceolata* is at once distinguished from other species of our area by its very small leaves and short calyces.

2. *WIKSTROEMIA* Endl. Prodr. Fl. Norfolk. 47, as *Wickstroemia*. 1833, corr. Endl. Ench. Bot. 209. 1841; Seem. Fl. Vit. 206. 1867. Nom. cons.

Shrubs or small trees; leaves opposite, sometimes decussate, rarely ternate or alternate, the blades glabrous at maturity; inflorescences terminal or axillary, fasciculate, spicate, racemose, umbelliform, or capitate (or flowers sometimes solitary), often ebracteate; flowers ♂ (perhaps often functionally unisexual), subsessile or pedicellate, 4- or 5-merous; calyx tube cylindrical, tubular, or hypocrateriform, elongated, the lobes 4, spreading, usually slightly imbricate in pairs, the outer ones cucullate and often larger than the inner ones; petaloid appendages lacking; disk hypogynous, membranaceous, crenate, dentate, or deeply lobed, the segments usually free and scalelike (small and linear- or obovate-oblong in our species, probably 4 in number but readily caducous); stamens 8, sessile or with short, thin filaments, biseriate, usually borne in upper half of calyx tube but included within it, the anthers oblong, basifixed, the connective inconspicuous; gynoecium sessile, rarely short-stipitate, included within calyx tube, the ovary somewhat ellipsoid, glabrous or apically pilose, 1-locular, the style terminal, short, often obscure, the stigma large, capitate or globose-capitate, rarely cylindrical to ovoid; fruits baccate, 1-seeded, sometimes surrounded by the marcescent calyx tube, the pericarp fleshy or membranaceous, the seed usually without endosperm, the cotyledons thickened or flattened.

TYPE SPECIES: *Wickstroemia australis* Endl.

DISTRIBUTION: Southeastern Asia throughout Malesia to Australia and into the Pacific, including Hawaii, with about 70 species.

1. *Wikstroemia foetida* (L. f.) A. Gray in J. Bot. 3: 302. 1865.

Daphne foetida L. f. Suppl. Pl. 223. 1781.

Referring the southern Pacific material (at least that from the Societies westward to Fiji) of *Wikstroemia* to *W. foetida* is perhaps an unsatisfactory solution, but until careful studies are undertaken this may be more desirable than utilizing the Asian *W. indica* (L.) C. A. Mey. as an aggregate species for southern Pacific as well as Malesian material of this relationship. Ding Hou (1960, cited above under the family) considers *W. indica* to extend as far east as Fiji, but, if that interpretation is accepted, the range must be extended still farther eastward. Until a review of southern Pacific taxa of the genus (perhaps comparable to that of Hawaiian taxa summarized by Skottsberg and completed by B. Peterson in Acta Reg. Soc. Sci. Gothob. Bot. 1: 1-166. 1972) has been undertaken, I believe that *W. foetida* is a more appropriate binomial for our material than *W. indica*.

In making the specific combination (typified by a Tahitian collection from the second Cook voyage), Gray proposed four new varieties, of which var. *tahitensis* was doubtless intended to include the type of the species and is therefore illegitimate. To

separate from this typical variety *Wikstroemia coriacea* Seem. (Fl. Vit. 206. 1867), based on a Banks and Solander collection from the Societies, is questionable. Another of Gray's trinomial, var. *oahuensis*, is the basionym of *W. oahuensis* (A. Gray) Rock, a Hawaiian endemic. Varieties *vitiensis* and *samoensis* are here considered essentially similar and are combined under the first epithet.

- 1a. **Wikstroemia foetida** var. **vitiensis** A. Gray in J. Bot. 3: 303. 1865; Seem. Fl. Vit. 207. 1867; Turrill in J. Linn. Soc. Bot. 43: 37. 1915; J. W. Parham, Pl. Fiji Isl. ed. 2. 152. 1972. FIGURE 156.

Daphne rotundifolia L. f. Suppl. Pl. 223. 1781.

Wikstroemia rotundifolia C. A. Mey. in Bull. Cl. Phys.-Math. Acad. Imp. Sci. St. Pétersb. 1: 357. 1843; A. Gray in J. Bot. 3: 302. 1865; Yuncker in Bishop Mus. Bull. 220: 195. 1959.

Wikstroemia indica sensu Seem. in Bonplandia 9: 258. 1861, Viti, 440. 1862; Drake, Ill. Fl. Ins. Mar. Pac. 280, p. p. 1892; non C. A. Mey.

Wikstroemia foetida var. *samoensis* A. Gray in J. Bot. 3: 303. 1865.

Wikstroemia viridiflora sensu Gibbs in J. Linn. Soc. Bot. 39: 167. 1909; J. W. Parham, Pl. Fiji Isl. 105. 1964; non Meisn.

Wikstroemia foetida sensu Christophersen in Bishop Mus. Bull. 128: 153. 1935; non sensu typi.

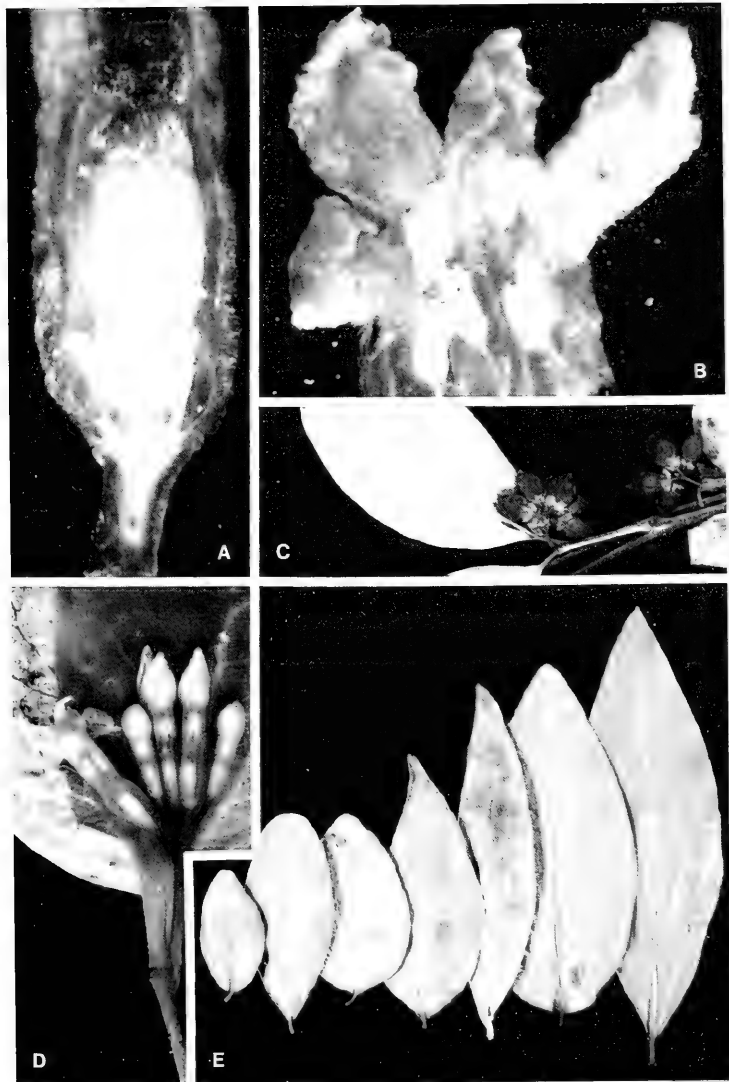
A small tree or shrub, often freely branched, (0.5-) 1-5 m. high, occurring from near sea level to an elevation of 1,195 m. in open rocky places, thin forest or on its edges, ridge forest, crest thickets, and the forest-grassland transition, and sometimes on open hillsides. The calyx is greenish to yellow, often green with yellow lobes, and the fruits at length become dull orange or red. Flowering and fruiting material occurs throughout the year.

TIPIFICATION AND NOMENCLATURE: The type of *Wikstroemia foetida* var. *vitiensis* is U. S. Expl. Exped. (US 62687 HOLOTYPE), collected in Fiji in 1840 without further information. The oldest binomial applicable to this varietal concept, *Daphne rotundifolia*, is based on a Forster collection from Tongatapu, Tonga, made during Cook's second voyage. (*Daphne rotundifolia* and *D. foetida* were simultaneously described by the younger Linnaeus; both types should be sought at either LINN or UPS, having originally been in the herbarium of A. Bäck.) *Wikstroemia foetida* var. *samoensis* is typified by a U. S. Exploring Expedition specimen (US 62686 HOLOTYPE) from Samoa. Variations among Samoan and Tongan material essentially parallel those noted in Fiji.

DISTRIBUTION: Fiji, Samoa, and Tonga, perhaps extending to adjacent archipelagoes. As implied above, the present disposition of *Wikstroemia* in the Fijian Region must be considered provisional, pending a detailed study of all the available southern Pacific material of the genus by a specialist. The taxon as here interpreted is abundant in Fiji and is to be expected on practically all the islands. Sixty-five Fijian collections have been examined.

LOCAL NAMES AND USES: Recorded local names are *sinu*, *sinu matiavi*, *sinu ndamu*, *sinu lau*, *sinu ni lekutu*, *matiavi*, *senimatiavi*, and *mundu*. Fiber from the bark is used for cordage, fishing nets, etc., and the leaves and bark are used medicinally for chills, coughs, etc.

FIGURE 156. *Wikstroemia foetida* var. *vitiensis*; A, gynoeceum in base of calyx tube, showing 2 linear-obovate disk lobes, $\times 30$; B, apical portion of calyx tube opened, showing 8 stamens, $\times 20$; C, infructescences, $\times 1$; D, inflorescence, $\times 4$; E, foliage variation: lower surfaces of leaf blades, $\times 1$. A & B from DA 10723, C from Smith 432, D from O. & I. Degener 32154, E (left to right) from DA 10723, Smith 6564, Smith 340, Smith 698, O. & I. Degener 32185, Bryan 572, Smith 138.



REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Rocky headland near Yalombi, *St. John 18006*. VITI LEVU: MBA: Tavakumbu, *DA 10723*; summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4180*; Mt. Koromba, *DA 14746*; Thelau, west of Mba, *O. & I. Degener 32154*; vicinity of Nandarivatu, *Gibbs 553, im Thurn 56*; western and southern slopes of Mt. Tomanivi, *Smith 5218*. NANDRONGA & NAVOSA: NAUSORI Highlands, *O. & I. Degener 32185*; northern portion of Rairaimatuku Plateau, *Smith 5448*; Thuvu, west of Singatoka, *Greenwood 63*. SERUA: Waimate Beach, *DA 10121*. RA: Yanggara, *DA 10738*. TAILEVU: Queen Victoria School Farm, *DA 7780*; Naingani Island, *DA 3325*. REWA: Mt. Korombamba, *Gillespie 2396*. "VITI LEVU and LAKEMBA." *Seemann 384*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 138*. OVALAU: Summit of Mt. Ndelaiovalau and adjacent ridge, *Smith 7585*. VANUA LEVU: MBUA: Between Mbuu and Ndama, *DA 1121*. MATHUATA: Mt. Numbuiloo, east of Lambasa, *Smith 6564*. THAKAUNDOVE: Summit of Mt. Mbatini, *Smith 698*; Mt. Mariko, *Smith 432*; hills south of Nakula Valley, *Smith 340*. TAVEUNI: Vicinity of Somosomo, *Gillespie 4770*. MOALA: Ndelaimoala, *Smith 1374*. KANA-THA: *Bryan 572*. LAKEMBA: Ridge east of Levuka Valley, *Garnock-Jones 829*. FULANGA: On lagoon cliff, *Smith 1222*.

ORDER LECYTHIDALES

Traditionally the Lecythidaceae (sensu lato) have been placed in the order Myrtales (subclass Rosidae), but it is interesting to note that J. Miers as early as 1875 (in *Trans. Linn. Soc. Bot.* 1: 47-118) had already rejected a close relationship among the Lecythidaceae, Barringtoniaceae, and Myrtaceae, believing the first two of these families related to the Rhizophoraceae, which some students now remove from the vicinity of the order Myrtales.

In treatments of recent phylogenists, the Lecythidaceae are placed directly in the order Myrtales by Melchior (1964), Takhtajan (1969), and Hutchinson (1973). Thorne (1976) places the family as the sole member of his suborder Lecythidineae, order Theales, superorder Theiflorae. Cronquist (1968) accepts the family as the sole member of his order Lecythidales, placed in the subclass Dilleniidae and related to such orders as Malvales and Theales. In their recent discussions of the Myrtaceae, Briggs and Johnson (1979) find no convincing reasons to retain the Lecythidaceae in the order Myrtales, believing it better placed in the dilleniid group of orders. A separate order, as placed by Cronquist, seems a logical solution.

Payens (1968, cited below under *Barringtonia*), has ably reviewed the various concepts of the Lecythidaceae, concluding that arguments for recognizing more than one family are unacceptable. Nevertheless, prevailing concepts (Melchior, 1964; Thorne, 1976) often call for the recognition of three subfamilies. Airy Shaw (in Willis, *Dict. Fl. Pl. Ferns*, ed. 7. 1966) accepts four separate families in the complex (although considering the fourth such family, Foetidiaceae, a remote relative). Hutchinson (1973, and in his more extended treatment in *Evol. Phyl. Fl. Pl.* 326-332. 1969) recognizes three separate families, albeit these are scattered within his concept of the order Myrtales. Payens's contrary conclusions notwithstanding, these separate families do have essentially discrete geographic distributions.

KEY TO FAMILIES OCCURRING IN FIJI

- Stamens monadelphous (and equally arranged around disk) or diadelphous (as in our genus, and united into 2 unequal bundles, one of these ligulate and curved over gynoeccium); fruits woody, fibrous, or fleshy, indehiscent or apically operculate (in our genus globose and indehiscent), the seeds 1-many (many in our genus); cultivated only in Fiji. 94. LECYTHIDACEAE
- Stamens numerous, in several concentric series, the filaments free or (as in our genus) connate at base; fruits drupaceous and fibrous or berrylike, the seeds often reduced to 1 (always in our genus); indigenous in Fiji. 95. BARRINGTONIACEAE

FAMILY 94. LECYTHIDACEAE

LECYTHIDACEAE Poit. in Mém. Mus. Hist. Nat. 13: 143, as *Lecythidaee*. 1825.

Trees or shrubs, sometimes cauliflorous, exstipulate, without milky latex; leaves alternate, simple, the blades not gland-dotted but sometimes with large marginal glands; inflorescences racemose, paniculate, or composed of solitary flowers; flowers ♀, actinomorphic or zygomorphic, usually large and showy, epigynous; calyx 4-6-lobed, the lobes valvate or slightly imbricate; petals 4-6, usually free and imbricate; disk present, sometimes lobed; stamens numerous, in several series, monadelphous and equally arranged around disk and all with fertile anthers, or diadelphous and united into 2 unequal bundles, one of these ligulate and curved over the gynoeceum and often with sterile anthers, the anthers basifixed, bent inward in bud, 2-locular, laterally dehiscent; ovary inferior or semi-inferior, 2-several-locular, the ovules 1-many in each locule, anatropous, the placentation axile, the style usually simple, the stigma capitate or lobed; fruits woody, fibrous, or fleshy, indehiscent or apically operculate, the seeds without endosperm, the embryo divided or entire.

DISTRIBUTION: Tropical America, with about 15 genera and 325 species. One genus is found in cultivation in Fiji.

1. *COUROUPITA* Aubl. Hist. Pl. Guiane Fr. 708. 1775.

Trees, the leaves congested toward apices of branchlets, the blades entire or shallowly crenate-dentate; inflorescences borne on trunk and branches, racemiform, drooping, elongating to 2 m. or more; calyx tube turbinate, not produced beyond ovary, the limb 6-lobed; petals 6, slightly unequal; stamens diadelphous, all fertile, the filaments unequal; ovary semi-inferior, 5-7-locular, each locule with many ovules, the style short, the stigma lobed; fruits large, globose, indehiscent, bearing distantly separated calyx lobes near middle, many-seeded, the pericarp hard.

TYPE SPECIES: *Couroupita guianensis* Aubl.

DISTRIBUTION: Tropical America, with about 20 species, one of which is widely cultivated.

1. *Couroupita guianensis* Aubl. Hist. Pl. Guiane Fr. 708. t. 282. 1775; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 98. fig. 11. 1948, in op. cit. 29: 32. 1959, Pl. Fiji Isl. ed. 2. 205. 1972.

The well-known cannonball tree, sparingly cultivated in Fiji, is seen as a tree to 20 m. high (to 25 m. or more where indigenous) with a trunk 60 cm. or more in diameter, growing only near sea level. The large, fragrant flowers attain a diameter of about 10 cm.; the petals are 5-6 cm. long and red to pinkish or orange in color, often yellowish toward base without; and the stamens are white. The brown fruit attains a diameter of 20 cm., having a verrucose pericarp and abundant yellow-green pulp which soon turns purplish and emits a strong, unpleasant odor; the numerous seeds are small and brown. Flowers occur from April to October, and the fruits take nine months or more to mature.

TIPIFICATION: The type is presumably a specimen obtained by Aublet in French Guiana, probably deposited at p.

DISTRIBUTION: Northern South America, from Trinidad and Colombia southward to Brazil and Peru.

LOCAL NAME AND USE: As in many other tropical areas, the species is known as *cannonball tree* and is cultivated as a striking ornamental curiosity.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva Botanical Gardens, *MacDaniels 1129*, *DA 12093*.

FAMILY 95. BARRINGTONIACEAE

BARRINGTONIACEAE Rudolphi, Syst. Orb. Veg. 56, as *Barringtonieae*. 1830.

Trees or rarely shrubs, exstipulate (or stipules minute and caducous); leaves alternate, simple, mostly large and elongated, often sessile and congested toward ends of branchlets, the blades entire to serrate, not glandular-punctate; inflorescences axillary or terminal, racemose, spicate, or paniculiform; flowers ♂, actinomorphic, epigynous; calyx 4- or 5-lobed, sometimes entirely closed before anthesis and becoming 2-4-lobed, the lobes subvalvate or imbricate, long-persistent in fruit; petals 4, rarely 5 or absent, free or proximally adhering to staminal tube; disk present within stamens; stamens numerous, in several concentric series, incurved or inflexed in bud, the filaments free or forming a tube at base, sometimes the inner ones anantherous, the anthers basifixed, 2-locular, dehiscent lengthwise; ovary inferior, usually 2-4-locular, the ovules 1-many in each locule, anatropous, the placentation axile, the style simple, often elongate, rarely divided or dilated at apex; fruit drupaceous and fibrous or berrylike, rarely laterally winged, the seeds often reduced to 1, the embryo straight or circinnate, divided or entire.

DISTRIBUTION: Africa to tropical Asia and eastward into the Pacific, with 5-7 genera and about 125 species. One genus is represented by indigenous species in Fiji.

1. BARRINGTONIA J. R. & G. Forst. Char. Gen. Pl. 38. 1775, ed. 2. 75. 1776; Seem. Fl. Vit. 82. 1866; Knuth in Pflanzenn. **105** (IV. 219): 10. 1939; Payens in Blumea **15**: 175. 1968. Nom. cons.

Trees (our species) or shrubs, the stipules deltoid, minute, caducous; leaves alternate (spirally arranged), often congested toward apices of branchlets, the petioles flattened or shallowly canaliculate above, often stout, frequently diverse in length within a species, the blades usually obovate to oblanceolate, cuneate at base, rounded or emarginate to acuminate at apex, serrate to entire at margin, pinnate-nerved; inflorescences racemose or spicate, terminal or lateral on branchlets, sometimes borne on trunks and branches, usually pendulous and elongate, with small, caducous bracts; flowers pedicellate or sessile, subglobose in bud, the calyx tube obconical, often 4-angled or 4-lobed, the calyx limb convex, sometimes closed in bud (as in our species) and with or without an apical pore, rupturing into 2-4 (-5) segments or circumscissile above base, or with the calyx lobes free in bud and imbricate; petals 3-5, usually 4, free or proximally adnate to staminal tube, cochlear-imbricate in aestivation, the outer ones often the smaller; stamens numerous, the filaments connate at base in 3-8 whorls, the inner 1 (-3) whorl anantherous, the anthers dehiscent laterally; disk intrastaminal, surrounding base of style; ovary inferior, usually 2- or 4-locular, sometimes incompletely so distally, the ovules 1-6 in each locule, pendulous, the style filiform, tortuous in bud, the stigma slightly dilated; fruits ellipsoid, obovoid, or fusiform, terete or angled or alate, the exocarp thin, the mesocarp fibrous or spongy, the endocarp thin or fibrous or coriaceous, the seed solitary.

TYPE SPECIES: *Barringtonia speciosa* J. R. & G. Forst. (= *B. asiatica* (L.) Kurz).

DISTRIBUTION: Eastern Africa and Madagascar to southeastern Asia and eastward through Malesia to Australia and into the southern Pacific. In his 1968 revision Payens recognizes 39 species, dividing the genus into two sections; our species belong to sect. *Barringtonia*. This approach is doubtless more realistic than that of R. Knuth (in Pflanzenn. **105** (IV. 219): 1-82. 1939), who recognized 109 species in *Barringtonia*. Four species are indigenous in Fiji (two of them endemic) and are sharply distinct from one another.

USEFUL TREATMENT OF GENUS: Payens, J. P. D. W. A monograph of the genus *Barringtonia* (Lecythidaceae). *Blumea* **15**: 157-263. 1968.

KEY TO SPECIES

- Racemes erect, comparatively short, 2-15 (-20) cm. long; pedicels obvious, 2-9 cm. long; calyx rupturing into 2 (or 3) large lobes 2-4 × 2-3 cm.; petals elliptic to ovate, at anthesis 4-8.5 × 2.5-4.5 cm.; filaments 4-12 cm. long; style 6-15 cm. long; fruits acutely tetragonous, 8.5-11 cm. long and broad, buoyant for a long period, the pericarp thick (mesocarp spongy, 2-2.5 cm. thick), the seeds 4-5 × 2.5-4 cm.; leaves subsessile, the petioles 1-5 mm. long, the blades obovate or oblong-obovate, (12-) 20-40 (-60) × (6-) 10-20 (-24) cm., entire at margin, usually obtuse to slightly emarginate at apex; plant of beaches and lowland rivers, seldom found inland. 1. *B. asiatica*
- Racemes pendulous, comparatively long, rarely less than 20 cm. long and often 50 cm. or more long; pedicels comparatively short, usually less than 1.5 cm. long; calyx rupturing into 2-4 (-5) lobes, these comparatively small, rarely exceeding 1.5 cm. in length and breadth; petals at anthesis not exceeding 4 × 3 cm.; filaments not exceeding 5 cm. in length; style not more than 6.5 cm. long; fruits about twice as long as broad, not exceeding 10 × 7 cm., the pericarp not more than 2 cm. thick, the seeds not exceeding 4 × 2.5 cm.; leaves with blades serrate-crenulate at margins, sometimes inconspicuously so toward apex only and entire proximally, obtuse to acuminate at apex; plants of forests and woodlands, sometimes found near sea level but seldom near beaches.
- Petioles 0.2-1.5 cm. long (distal leaves appearing sessile), the leaf blades usually 14-43 × 4-16 cm., obviously serrate-crenulate at margin nearly to base; racemes 20-80 (-100) cm. long; pedicels 3-15 (-25) mm. long; calyx lobes to 1.5 × 1.3 cm. at anthesis; petals 1.5-3 × 0.5-1.5 cm.; fruits narrowly ovoid, obtusely quadrangular, 5-9 × 2-4 (-5.5) cm., buoyant for a long period, the pericarp 3-12 mm. thick, the endocarp fibrous. 2. *B. racemosa*
- Petioles 0.5-8 cm. long (those of distal leaves sometimes nearly obsolete but those of lower leaves obviously elongate), the leaf blades inconspicuously serrate-crenulate toward apex, entire at proximal margins; racemes at anthesis not exceeding 50 cm. in length (up to 65 cm. long in fruit); fruits with the inner part of mesocarp and the endocarp coriaceous and ligneous.
- Rachis, pedicels, and calyx tube closely tomentellous or puberulent, the pedicels 3-10 mm. long; calyx rupturing into 2-4 lobes 8-17 × 5-15 mm.; petals 2.5-4 × 1.2-3 cm.; ovary with 2-4 ovules per locule, the style 4-7 cm. long; fruits ellipsoid to obovoid-ellipsoid, 6-10 × 4-7 cm., terete in cross section or faintly and obtusely quadrangular toward base, buoyant for a period of a few weeks, the pericarp 10-18 mm. thick, the seeds 3-3.5 × 1-2 cm.; petioles stout, 3-7 mm. in diameter; leaf blades obovate-oblong to oblanceolate, (15-) 20-45 (-55) × (5.5-) 7-20 cm., the costa with (8-) 12-20 secondary nerves per side. 3. *B. edulis*
- Rachis, pedicels, and calyx tube glabrous, the pedicels none (or calyx tube attenuate proximally into a pedicel sometimes 1-4 mm. long); calyx rupturing into 4 lobes about 4-5 mm. long and broad; petals 1.5-2.2 × 1-1.5 cm.; ovary with 1 or 2 ovules per locule, the style 3-4.5 cm. long; fruits obovoid, tetragonous (rarely trigonous), 5-8 × 2-3.5 cm., narrowly winged or sharply angled, nonbuoyant, the pericarp about 4 mm. thick, the seeds 1.5-2 × 0.5-1 cm.; petioles slender, 1-3 mm. in diameter; leaf blades elliptic-obovate to oblong, usually 10-25 × 4-12 cm., the costa with 7-12 secondary nerves per side. 4. *B. seaturae*

1. *Barringtonia asiatica* (L.) Kurz, Prelim. Rep. For. Veg. Pegu, App. A. lxx. 1875, in J. Asiat. Soc. Bengal **45**: 131. 1876; Christophersen in Bishop Mus. Bull. **128**: 154. 1935; Knuth in Pflanzenr. **105** (IV. 219): 10. fig. 3, J, K. 1939; Yuncker in Bishop Mus. Bull. **178**: 88. 1943, in op. cit. **184**: 53. 1945, in op. cit. **220**: 196. 1959; J. W. Parham, Pl. Fiji Isl. **143**. 1964, ed. 2. 204. 1972; Payens in Blumea **15**: 184. photogr. 1, 2, fig. 1, a-c, 2, B, C. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 49. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 335. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 41. 1972.

FIGURES 157, 158A.

Mammea asiatica L. Sp. Pl. 512. 1753.

Barringtonia speciosa J. R. & G. Forst. Char. Gen. Pl. 38. t. 38. 1775, ed. 2. 76. t. 38. 1776; Benth. in London J. Bot. **2**: 221. 1843; A. Gray, Bot. U. S. Expl. Exped. **1**: 508. 1854; Seem. in Bonplandia **9**: 255. 1861, Viti, 436. 1862, Fl. Vit. **82**. 1866; J. W. Parham in J. Agr. Dept. Agr. Fiji **19**: 98. 1948, in op. cit. **29**: 31. 1959.

Barringtonia butonica J. R. & G. Forst. ex Cuzent, Iles Soc. Tahiti, 213, nom. illeg. 1860; Drake, Ill. Fl. Ins. Mar. Pac. **171**. 1890.



FIGURE 157. *Barringtonia asiatica*, from Smith 1082, growing along the shore on the island of Koro.

As seen in Fiji, *Barringtonia asiatica* is a tree 10–20 m. high, with large, spreading branches, found near sea level along beaches, in coastal thickets and on edges of forest near shore, on the inner edges of mangrove swamps, and along lowland rivers but seldom far inland. Its large flowers have a green calyx, white petals, white filaments red- or pink-tinged distally, yellow anthers, and a white style red- or pink-tinged distally; the conspicuous fruits are quadrangular, green and shining, and up to 11 × 11 cm. Flowers have been obtained in practically every month, fruits between March and November.

TIPIFICATION AND NOMENCLATURE: The only specimen cited by Linnaeus is *Osbeck*, and the type is *Osbeck* s. n. (LINN HOLOTYPE; ISOTYPE at s), collected on Prinsen Island, off West Java (Payens, 1968, p. 186). *Barringtonia speciosa* is based on a J. R. & G. Forster specimen (BM HOLOTYPE) collected on the second Cook expedition in Tahiti, Society Islands. The two concepts are identical.

DISTRIBUTION: This widespread species occurs from the area of Madagascar and the Seychelles to India and Formosa, eastward through Malesia and Micronesia to Queensland and into the Pacific to the Society Islands; it is frequently cultivated elsewhere in suitable tropical situations. About 25 Fijian specimens are at hand, but the species is abundant in appropriate habitats.

LOCAL NAMES AND USES: Recorded Fijian names are *vutu*, *vuto*, *vutu ndina*, *vuto nganga*, *vutu rakaraka*, and *vutu vala*. The fruits are scraped on stones, mashed, and used as a fish poison; in an earlier period the fruits were used as floats for fishing nets.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 307*. SERUA: Vicinity of Ngaloa, *Degener 15104*. RA: Viti Levu Bay, *DA 12777 (Melville et al. 7169)*. NAITASIRI: Waimanu River, *DA L.13294 (Berry 25)*. TAILEVU: Korovou, *Valentine 27*; Wainimbokasi River, *DA 813*. REWA: Lami, *DA 6005*; Nukulau Island, *Barclay 3427*. KORO: West coast, *Smith 1082*. NGAU: Shore of Herald Bay, vicinity of Sawaeke, *Smith 7919*. VANUA LEVU: MBUA: Nukulekaleka Island (north of Kumbulau Point), *DA 13172*. THAKAUNDOVE: Ndromoninuku, *DA 16820*. TAVEUNI: *Seemann 148*. MOALA: *Bryan 335*. VANUA MBALAVU: Lomaloma Botanical Gardens, *DA 10211*. LAKEMBA: Near Tumbou Jetty, *Garnock-Jones 788*. FIJI without further locality, *U. S. Expl. Exped., Home*.

2. *Barringtonia racemosa* (L.) Spreng. Syst. Veg. 3: 127. 1826; Bl. ex DC. Prodr. 3: 288. 1828; Seem. Fl. Vit. 83. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 171. 1890; Guillaumin in J. Arnold Arb. 12: 259. 1931; Knuth in Pflanzenz. 105 (IV. 219): 17. fig. 3, A-H. 1939; J. W. Parham, Pl. Fiji Isl. 143. 1964, ed. 2. 205. 1972; van Balgooy & Payens in Blumea Suppl. 5: 27, 292. map 164. 1966; Payens in Blumea 15: 192. fig. 2, A. 1968. FIGURE 158B & C.

Eugenia racemosa L. Sp. Pl. 471. 1753.

Barringtonia excelsa sensu A. Gray, Bot. U. S. Expl. Exped. 1: 508. 1854; non Bl.

Barringtonia samoensis sensu Seem. in Bonplandia 9: 255. 1861, Viti, 436. 1862; non A. Gray.

In Fiji *Barringtonia racemosa* is found as a tree 5–18 m. high, at elevations from near sea level to 400 m., in dense or open forest, often along rivers, and occasionally on inner edges of mangrove swamps, but seldom near beaches. Its flowers have red buds opening into red or purple calyces, or these green with a reddish tinge, white petals and filaments, cream-colored to yellow anthers, and a white style pinkish distally; the fruits are green, sometimes with a reddish tinge. Flowers have been obtained between December and July, fruits between February and July.

LECTOTYPIFICATION: Of the three prior references mentioned by Linnaeus, that referring to Fl. Zeyl. 191. 1747 is the most suitable; Payens (1968, p. 195) indicated Hermann's figs. 212, 213, and 339 (BM) as syntypes.

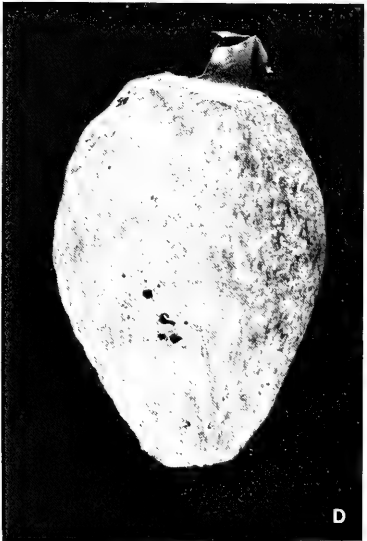
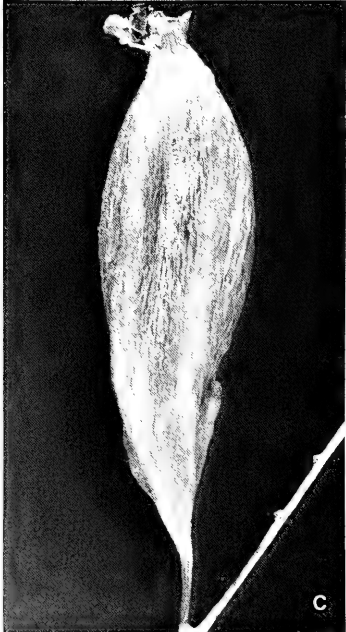
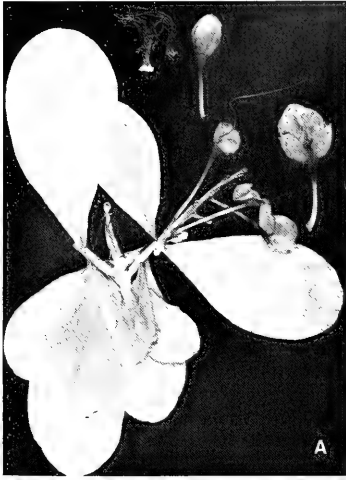
DISTRIBUTION: Eastern and southern Africa including the Madagascar region to India and the Ryukyu Islands, eastward through Micronesia and Malasia to Queensland and into the Pacific as far as Samoa. It is less abundant in Fiji than *Barringtonia asiatica*, and all specimens examined by me are cited below.

LOCAL NAMES AND USE: Fijian names are *vutuvutu*, *vutu wai*, *vutu ni wai*, and *vutu vala*. Seemann indicates that the fruits are considered poisonous, but I find no other such record, and perhaps his informant was referring to the use of the preceding species as a fish poison.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Nakavu (in provincial enclave on Navua River), *Parks 20410*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7098*. REWA: Lami, *DA 6006*. VITI LEVU without further locality, *Parks 20931*. MBENGGGA: Rukua Village, *Weiner 72-7-7B*. OVALAU: *U. S. Expl. Exped.* KORO: Western slope, *Smith 1083*. VANUA LEVU: MBUA: Mbu Bay, *U. S. Expl. Exped.* MATHUATA: Lambasa, *Greenwood 561*. THAKAUNDOVE: Slopes of Mt. Mariko, *Bierhorst F121*; between Mbalanga and Valetih, Savusavu Bay, *Degener & Ordonez 13986, 14048*. TAVEUNI: *Gillespie 4764*. LAKEMBA: Near Nukunuku Village, *Garnock-Jones 801*. FIJI without further locality, *Seemann 149, Parks s. n.*

3. *Barringtonia edulis* Seem. Fl. Vit. 82. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 171. 1890; Knuth in Pflanzenz. 105 (IV. 219): 26. 1939; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 13: 44. 1942; J. W. Parham, Pl. Fiji Isl. 143. 1964, ed. 2. 204. 1972; Payens in Blumea 15: 208. 1968; A. C. Sm. in Allertonia 1: 404. 1978.

FIGURES 158D, 159A.



Barringtonia excelsa sensu Seem. in *Bonplandia* 9: 255. 1861, Viti, 436. 1862; non Bl.

Butonica edulis Miers in *Trans. Linn. Soc. Bot.* 1: 76. 1875.

Huttum edule Britten in *J. Bot.* 39: 67. 1901.

Barringtonia seaturae sensu Payens in *Blumea* 15: 203, quoad descr. (excl. fr.) et spec. 1968; *J. W. Parham*, *Pl. Fiji Isl.* ed. 2. 205, p. p. 1972; non Guppy.

A tree 6–24 m. high, occurring in dense or open forest or on its edges at elevations from near sea level to 400 m., occasionally cultivated or semicultivated. The flowers have the calyx greenish and puberulent in bud, the petals pure white or pink-tinged distally, the filaments white or toward apices reddish or pink-tinged, and the style white, with a reddish or purple tinge distally; the fruits are green at maturity. Flowers and fruits have been observed in most months of the year.

TYPIFICATION: The K material is mounted on two sheets, and it is now impossible to tell which part came from the localities mentioned by Seemann; therefore they are best taken together as the holotype: *Seemann 150* (K HOLOTYPE; ISOTYPES AT BM, P), collected in 1860 in part on Viwa Island, Tailevu Province, Viti Levu, and in part at Koroivonu (June 4), Natewa Peninsula, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands; thirty collections have been studied. The two collections cited as *B. seaturae* by Payens in 1968, both from Viti Levu, are among those cited below.

LOCAL NAMES AND USES: Recorded Fijian names are *vutu*, *vutu kana*, *vutu kata*, *vutu ni veikau*, *vala*, *vutu vala*, and *vutu wai*. The tree is considered to produce timber useful as a casewood, and the seeds are edible either raw or cooked, for which reason the name *vutu kana* is the most appropriate.

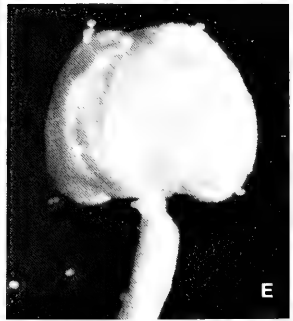
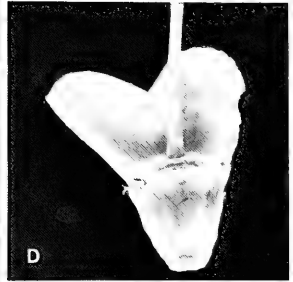
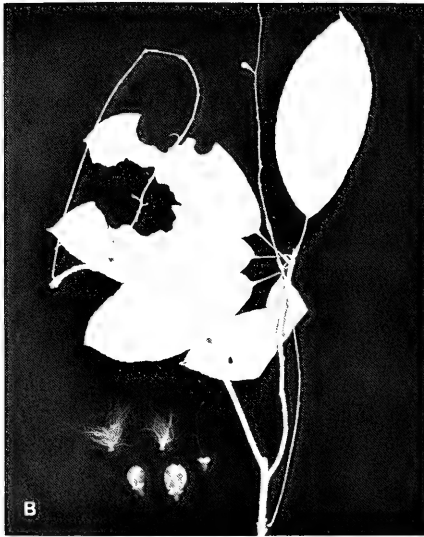
REPRESENTATIVE COLLECTIONS: VITI LEVU: SERUA: Nathengathenga Creek, upper Navua River, *DF 1012*; inland from Namboutini, *DF 780 (Damanu R18)*; Korovisilou Creek, *DF 784*; Yarawa Creek, *DF 1063 (S1555/4)*; hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9484*; inland from Ngaloa, *DA 16808*. NAITASIRI: Tholo-i-suva Forest Reserve, *DF 785 (Damanu C4)*. REWA: "Vicinity of Suva," *Meebold 18503*. MBENGA: Savusavukalou, *Weiner 209*. KANDAVU: Western end of island, near Cape Washington, *Smith 307*; hills above Namalata and Ngaloa Bays, *Smith 194*. OVALAU: Near Levuka, *Degener & Ordenez 13993*. VANUA LEVU: MATHUATA: Ridge above Nasingasinga, *Berry 55*. THAKAUNDROVE: Tuvamila, Natewa Peninsula, *Howard 74*. MATUKU: *Bryan 292*. VANUA MBALAVU: Near Lomaloma, *Garnock-Jones 1034*. LAKEMBA: Southern limestone peninsula, *Bryan 535*.

4. *Barringtonia seaturae* Guppy, *Obs. Nat. Pac.* 2: 574. 1906; Payens in *Blumea* 15: 203, tantum quoad nomen et fructus, excl. spec. 1968; *J. W. Parham*, *Pl. Fiji Isl.* ed. 2. 205, p. p. 1972; *A. C. Sm.* in *Allertonia* 1: 404. 1978. **FIGURE 159B–E.**

Barringtonia petiolata A. C. Sm. in *Bishop Mus. Bull.* 141: 102, fig. 54. 1936; Knuth in *Pflanzenr.* 105 (IV. 219): 36. 1939; *A. C. Sm.* in *Bull. Torrey Bot. Club* 70: 546. 1943; *J. W. Parham*, *Pl. Fiji Isl.* 143. 1964, ed. 2. 204. 1972; Payens in *Blumea* 15: 204. 1968.

A tree 4–20 m. high, occurring in dense or dry forest at elevations from near sea level to 600 m. The flowers have a green calyx, sometimes pink-tinged, white or pale green petals, usually tinged with deep pink, filaments rich pink and usually paler proximally, pale yellow anthers, and a rich pink style; the fruits are sharply 4- or rarely 3-angled and green at apparent maturity. Flowers have been noted between October and May, fruits between April and December.

FIGURE 158. A, *Barringtonia asiatica*, distal portion of branchlet, with foliage and an inflorescence, with detached bud, an opening flower, and a few filaments, $\times 1/4$. B & C, *Barringtonia racemosa*; B, distal portion of branchlet, with foliage and inflorescences, with detached buds and immature flowers, $\times 1/4$; C, fruit, $\times 1$. D, *Barringtonia edulis*, fruit, $\times 1$. A from *Smith 1082*, B from *Smith 1083*, C from *Smith 7098*, D from *DA 16808*.



TYPIFICATION AND NOMENCLATURE: The species was observed by Guppy on the slopes of Mt. Seatura, Mbua Province, Vanua Levu, at an elevation of about 1,000 ft., and was subsequently very sketchily described by him. In my 1978 discussion I pointed out that both the neotype and "paratype" indicated by Payens for *Barringtonia seaturae* were unsuitable, being from southern Viti Levu and obviously representing *B. edulis*. As neotype I then suggested a precise topotype, *Smith 1626* (BISH, etc.), collected April 27, 1934. While a neotype merely represents an opinion, there can be no doubt that this topotype and the specimens cited below precisely match the concept discussed by Guppy, who unfortunately retained no material. The type of *B. petiolata* is *Smith 597* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 24, 1933, in hills between the Vatukawa and Wainio Rivers, Ndrekeniwai Valley, Thakaundrove Province, Vanua Levu. The specimens I have identified as *B. petiolata* definitely represent *B. seaturae*, overlooked prior to Payens's revision.

DISTRIBUTION: Endemic to Fiji and thus far known only from the two largest islands.

LOCAL NAMES AND USE: *Vutu* is the only Fijian name I have noted, but probably Seemann (Fl. Vit. 83. 1866) was correct in interpreting a description given him by Fijians as representing an undescribed species known as *vutu ndina*, with an edible seed like that of *Barringtonia edulis* but with an even harder endocarp.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Coastal hills in vicinity of Taunovo River, east of Wainiyambia, *Smith 9591*. NAMOSI: Hills east of Wainikoroiluva River, near Namuamua, *Smith 8942*. NAITASIRE: Tholo-i-suva, *DA 9863, 14612*; vicinity of Nasinu, *Gillespie 3584*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7159*. REWA-NAITASIRE boundary: Mt. Kombalevu, *Parks 20309*. REWA: Track to Mt. Korombamba, *DA 16983*. VANUA LEVU: MBUA: Southern slope of Mt. Seatura, near old village site of Seatura, *DA 15174*. MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6758*. THAKAUNDROVE or MATHUATA: Between Waiwai and Lomaloma, *Horne 619*. THAKAUNDROVE: Natua (Wailevu Tikina), *DA 15699*.

The first collection of this species known to me is *Horne 619*, dated April, 1878.

ORDER RHIZOPHORALES

Traditionally the Rhizophoraceae have been referred to the order Myrtales, a position still maintained by Melchior (1964), Takhtajan (1969), and Hutchinson (1973). Cronquist (1968) and Thorne (1976) have placed the family in the order Cornales, although Cronquist opines that it might merit a separate order, and Thorne places it alone in a suborder. All such placements have the Rhizophoraceae in the subclass Rosidae (or superorder Corniflorae of Thorne), but some of the mentioned students seem uncomfortable with the position adopted and suggest other affinities. Briggs and Johnson (1979, p. 162) point out the probable lack of cohesion among groups now assigned to the Rhizophoraceae; they suggest, on the basis of many prior

FIGURE 159. A, *Barringtonia edulis*, distal portion of branchlet, with foliage, a detached inflorescence, calyx, a petal, stamens, and a detached leaf from lower part of branchlet, $\times 1/4$. B-E, *Barringtonia seaturae*: B, distal portion of branchlet, with foliage and inflorescences, with detached flowers, stamens, and a calyx with style, $\times 1/4$; C, fruit, $\times 1$; D, calyx with 2 lobes of limb removed, showing disk surrounding base of style, $\times 4$; E, anther, $\times 40$. A from *Smith 307* (detached leaf from *Berry 55*), B from *DA 9863* (detached parts from *Smith 597*), C from *Smith 1626*, D & E from *Smith 597*.

studies cited by them, that a derivation of most component genera from a dilleniid rather than a rosidae ancestry is probable. It may be noted that Hutchinson (1973) closely groups the families Lecythidaceae, Barringtoniaceae, and Rhizophoraceae (albeit in the order Myrtales), and that (Evol. Phyl. Fl. Pl. 332. 1969) he suggest an affinity of the Rhizophoraceae with the Theaceae or Tiliaceae. Since removal of the Rhizophoraceae from the Myrtales and from the Rosidae seems now to be required, I here refer the family to its own order in the vicinity of the order Lecythidales of the subclass Dilleniidae. It may be noted that Dahlgren (1980, pp. 96, 102) places the Rhizophoraceae (excluding subfam. Anisophylloideae) in a separate order, still relating it to the Myrtales.

FAMILY 96. RHIZOPHORACEAE

RHIZOPHORACEAE R. Br. in Flinders, Voy. Terra Australis 2: 549, as *Rhizophoreae*. 1814.

Trees or shrubs, often with stilt-roots or aerial roots, the branchlets often swollen at nodes, the stipules interpetiolar, caducous and leaving an annular scar (rarely lacking, but present in our genera); leaves opposite and decussate (rarely alternate but not in our genera), simple, the blades entire, often coriaceous or leathery; inflorescences axillary, cymose, racemose, fasciculate, or rarely composed of solitary flowers; flowers ♂ (rarely unisexual or functionally so), usually epigynous (rarely hypogynous but not in our genera), actinomorphic; calyx tube adnate to ovary, the lobes 3-16, valvate, persistent; petals as many as calyx lobes and alternating with them, often smaller than calyx lobes, often clawed and apically lacinate or emarginate, convolute or inflexed in bud, caducous; disk present, epigynous or perigynous; stamens 8-many, usually 2-4 times as many as petals and uniseriate, often in pairs opposite petals or on outer edge of disk, the filaments usually short, the anthers basifixed or dorsifixed, introrse, usually 4-locular, rarely many-locular, sometimes 2-locular, longitudinally dehiscent or sometimes dehiscent by valves; ovary inferior or semi-inferior (rarely superior but not in our genera), 2-28-locular or 1-locular by suppression of septa, the ovules (1 or) 2 per locule or rarely more, anatropous, pendulous, the placentation axile, the style simple with a simple or lobed stigma or rarely styles free; fruits usually drupaceous or baccate or dry and indehiscent, sometimes dehiscent, the seeds usually 1 per locule (or 1 per fruit), sometimes germinating while attached to tree, sometimes arillate or carunculate, the endosperm present and fleshy or lacking, the embryo straight or curved.

DISTRIBUTION: Pantropical and subtropical, sometimes warm temperate, mostly in the Old World, with about 16 genera and 120 species, many of which are viviparous components of mangrove swamps. Three genera occur in Fiji with indigenous species.

USEFUL TREATMENTS OF FAMILY: Ding Hou. Rhizophoraceae. Fl. Males. I. 5: 429-493. 1958. Tomlinson, P. B., R. B. Primack, & J. S. Bunt. Preliminary observations on floral biology in mangrove Rhizophoraceae. Biotropica 11: 256-277. 1979.

KEY TO GENERA

- Plants of mangrove swamps, occurring only at or near sea level; seeds 1, rarely 2 or 3, germinating in fruit while the latter is still attached to plant, the hypocotyl protruding from fruit; stigma simple or obscurely lobed.
- Calyx limb always 4-lobed, accrescent and reflexed in fruit; petals entire, without appendages; stamens 8-16 (8 in our species), inserted on margin of disk, the anthers triangular in cross section, multilocular, dehiscent by a large ventral valve; ovary semi-inferior, 2-locular; stems supported by numerous, branched stilt-roots. 1. *Rhizophora*
- Calyx limb 8-14 (-16)-lobed, the lobes subulate-lanceolate, not reflexed in fruit; petals as many as calyx lobes, bilobed or emarginate, each embracing a pair of stamens; stamens twice as many as petals, paired, epipetalous, the anthers linear, 4-locular, dehiscent by longitudinal slits; ovary inferior, 2-4-locular; buttressed trees, often with geniculate pneumatophores (knee roots). . . . 2. *Bruguiera*

Plants of inland habit; seeds not germinating in fruit while it is still attached to plant, the fruit incompletely 4–28-locular or unilocular, many-seeded; calyx limb 4–(7)-lobed to base; petals 4–6 (–7); stamens 8–30, sometimes 3 or more times as many as petals, inserted on disk, the anthers 2-locular, longitudinally dehiscent; ovary semisuperior, radiate-striate on distal surface, incompletely 4–28-locular, the septa often evanescent, the stigma discoid or with spreading lobes. 3. *Crossostylis*

1. RHIZOPHORA L. Sp. Pl. 443. 1753; Seem. Fl. Vit. 91. 1866; Ding Hou in Fl. Males. I. 5: 448. 1958, in *Blumea* 10: 625. 1960; Tomlinson & Womersley in *Contr. Herb. Austral.* 19: 1. 1976; Tomlinson in *J. Arnold Arb.* 59: 156. 1978.

Trees, the stems supported by stilt-roots, these numerous, branched, the taproot abortive, the stipules lanceolate; leaves decussate, the blades coriaceous, entire, glabrous; inflorescences cymose, pedunculate, dichotomously or trichotomously branched, the flowers ♂; calyx subtended at base by cupular, connate bracteoles, the tube produced beyond ovary, the limb deeply 4-lobed, becoming coriaceous, accrescent, and reflexed in fruit; petals 4, lanceolate, entire, caducous; stamens 8–16 (8 in our species), inserted on margin of a crenulate disk, the filaments short or lacking, the anthers areolate, elongate, acute, triangular in cross section, multilocular, dehiscent by a large ventral valve; ovary semi-inferior, subconical at free apex, 2-locular, the ovules 2 in each locule, the style simple, short or to 6 mm. long, the stigma simple or obscurely 2-lobed; fruits ovoid or obpyriform, the seeds usually 1, rarely 2 or 3, germinating while fruit is attached to tree, the cotyledons connate, continuous with hypocotyl, this clavate, elongate, perforating apex of fruit and eventually falling from it.

LECTOTYPE SPECIES: *Rhizophora mangle* L. (vide Britton & Shafer, *N. Amer. Trees*, 716. 1908).

DISTRIBUTION: Pantropical, with seven to nine species, the Indo-Pacific distribution terminating in Tonga and Samoa. Two species and a sterile hybrid between them are indigenous in Fiji.

USEFUL TREATMENTS OF GENUS: Salvoza, F. M. *Rhizophora*. *Nat. Appl. Sci. Bull. Univ. Philipp.* 5: 179–237. 1936. Ding Hou. A review of the genus *Rhizophora* with special reference to the Pacific species. *Blumea* 10: 625–634. 1960. Tomlinson, P. B. *Rhizophora* in Australasia—some clarification of taxonomy and distribution. *J. Arnold Arb.* 59: 156–169. 1978. The last paper is particularly valuable in clarifying the status of taxa of the Fijian Region; from it the following key is abstracted.

Local names for *Rhizophora* and *Bruguiera* are listed below as recorded by collectors, but at present they are not very useful in designating the genera or species in Fiji; all seem to be called either *ndongo* or *tiri*, with local variants, as though modern Fijians were satisfied to use a collective name for mangroves. Guppy (*Obs. Nat. Pac.* 2: 441. 1906), however, indicates that at the time of his Fijian work names were more carefully applied, as follows (using the botanical nomenclature here adopted): *ndongo* for *Bruguiera gymnorrhiza*, *tiri wai* for *Rhizophora samoensis*, *tiri tambua* for *R. stylosa*, and *selala* for *R. selala*.

KEY TO SPECIES

- Apex of leaf blades with a long-persistent (but sometimes brittle) mucro 2–3 mm. long; leaf blades usually 8–15 cm. long; inflorescences exclusively dichotomously branched, never trifurcated, the peduncle scarcely flattened, the flowers never in groups of 3, the mature flower buds white (but sepals sometimes becoming yellowish), about 15 mm. long, rounded in cross section; petals conspicuously tomentose on margins; style about 3 mm. long. 1. *R. stylosa*
- Apex of leaf blades without a prominent mucro; leaf blades often less than 10 cm. long (but occasionally to 15 cm.); inflorescences with the axis flattened and frequently trifurcated at first node, the peduncle often flattened, the flowers commonly in groups of 3 (but sometimes paired), the mature flower buds 10–14 mm. long, somewhat angular in cross section; petals copiously tomentose on inner surface; style not exceeding 2 mm. in length.
- Leaf blades with the apex blunt, recurved; peduncle of inflorescence 2–2.5 cm. long or longer, 2–2.4 mm. in diameter, rarely branching beyond 2 orders, the flowers usually 2–5 per inflorescence; bracteoles scarcely developed and represented by a narrow band of tissue; mature flower buds yellow, 10–12

mm. long at maturity, angular in cross section and with a distinct basal shoulder (abruptly narrowed below); ovary steeply conical at apex and without a distinct style; plants fertile, with fruits and viviparous seedlings. 2. *R. samoensis*
 Leaf blades with the apex at first with an indistinct but usually soon deciduous or recurved micro-
 peduncle of inflorescence 2.5–4 cm. long, (2-) 2.6–3.2 mm. broad, commonly branching beyond 2
 orders, the flowers 2–9 per inflorescence; bracteoles distinct, 1–3 mm. long; mature flower buds
 usually white, 12–14 mm. long, not sharply angular in cross section, not abruptly narrowed to a
 distinct shoulder at base; ovary extended at apex into a distinct style 1–2 mm. long; plants sterile,
 lacking fruits and viviparous seedlings. 3. *R. × selala*

1. *Rhizophora stylosa* Griffith, Notul. Pl. Asiat. 4: 665. 1854, Icon. Pl. Asiat. 4: t. 640. 1854; Ding Hou in Fl. Males. I. 5: 456. fig. 13. 1958, in Blumea 10: 629. 1960; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 206. 1972; Tomlinson & Womersley in Contr. Herb. Austral. 19: 5. fig. 3. 1976; Tomlinson in J. Arnold Arb. 59: 158. fig. 3, 4, D-F. 1978.

Rhizophora mucronata sensu A. Gray, Bot. U. S. Expl. Exped. 1: 613. 1854; Seem. in Bonplandia 9: 256. 1861, Viti, 436. 1862, Fl. Vit. 91. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 165. 1890; Guppy, Obs. Nat. Pac. 2: 445. fig. 1–10 (opp. 452). frontisp. 1906; Yuncker in Bishop Mus. Bull. 220: 197. 1959; Ding Hou in Blumea 10: 629, p. p. 1960; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 206. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 129, p. p. 1972; non Lam.

Rhizophora mucronata var. *stylosa* Schimper, Bot. Mitt. Tropen 3: 92. 1891; Guillaumin in J. Arnold Arb. 12: 252. 1931; Salvoza in Nat. Appl. Sci. Bull. Univ. Philipp. 5: 218. 1936.

As seen in Fiji, *Rhizophora stylosa* is a tree 4–15 m. high, with conspicuous stilt-roots, often locally abundant at sea level as one of the principal components of mangrove swamps, usually found on the seaward side of such swamps, and less often along beaches; it is often associated with the two following taxa. Its flower buds are white, with sepals often becoming yellowish or pale yellow; its petals are white; and its anthers are yellow, often dull in color. The hypocotyl of the developing seedling is often purple-green. Flowers and fruits in various stages are seen throughout the year.

TYPEIFICATION: The type, presumably collected by Griffith, was cited as: "Malacca. In littoribus limosis, Pulo Bissar." Doubtless the κ sheet is the holotype.

DISTRIBUTION: Formosa to Malesia and Australia and eastward to New Caledonia, Samoa, and Tonga. Although abundant in Fiji, it seems much less common in Samoa and Tonga. Twenty-one Fijian collections have been examined, but this is by no means a true indication of the abundance of the species, which is a principal component of the extensive mangrove swamps, often ignored by collectors.

LOCAL NAMES AND USES: Often recorded local names are *ndongo*, *tiri*, *tiri wai*, and *tiri tambua* (the last noted only on Ngau); collectors have recorded no uses for this species in recent times, but Seemann indicates that the wood is hard and durable and that the red latex was used to dye hair and to paint pottery. The stilt-roots are flexible and were still used, at the time of Seemann's visit, for making bows. Probably his comments (Viti, 365. 1862, Fl. Vit. 91. 1866) are equally applicable to the following species, but some of them may better refer to *Bruguiera*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Shores of Mba River near its mouth, *Smith 4745* (see comment under *R. × selala*). SERUA: Mouth of Taunovo River, *DA*, April 18, 1962 (*Damanu 39*). TAILEVU: Tombuninggio, *DA 10063*. REWA: Lami, *DA 6009*; Tathi (Notho Tikina), *DA 872*. OVALAU: *Seemann 185*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7896*. VANUA LEVU: MATHUATA: Nakuthi Island (near mouth of Ndreketi River), *DA 15283*; Undu Peninsula, *M. D. Baker*, in 1965. THAKAUNDROE: Nasinu, Natewa Bay, *DA 16836*; Ndromoninuku, *DA 16821*. VANUA MBALAVU: Near Ndakuiloma-loma, *Garnock-Jones 1145*. FULANGA: *Smith 1181*. FIJI without further locality, *U. S. Expl. Exped.*

Although *Rhizophora mucronata* has been reported to occur as far east as Tonga, Tomlinson (1978, cited above) indicates its eastern limit as the New Hebrides; specimens so identified from Fiji, Samoa, and Tonga represent *R. stylosa*.

2. ***Rhizophora samoensis*** (Hochr.) Salvoza in Nat. Appl. Sci. Bull. Univ. Philipp. **5**: 220. 1936; Tomlinson & Womersley in Contr. Herb. Austral. **19**: 3. 1976; Tomlinson in J. Arnold Arb. **59**: 158. fig. 2 (above), 4, A-C. 1978. FIGURE 160.

Rhizophora mangle sensu Guppy, Obs. Nat. Pac. **2**: 445. fig. 11-20 (opp. 453). frontisp. 1906; Yuncker in Bishop Mus. Bull. **220**: 197. 1959; Ding Hou in Blumea **10**: 630, p. p. 1960; J. W. Parham, Pl. Fiji Isl. **144**. 1964, ed. 2. 206. 1972; non L.

Rhizophora mangle var. *samoensis* Hochr. in Candollea **2**: 447. 1925; Christophersen in Bishop Mus. Bull. **128**: 156. 1935.

Rhizophora mucronata sensu B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 129, p. p. 1972; non Lam.

In Fiji *Rhizophora samoensis* is a tree 2-10 m. high, with the same habit as *R. stylosa* and occurring together with it in the same habitats. Its flower buds and sepals are pale yellow; its petals are white or pale yellow; its anthers are orange or dull yellow; and its gynoecium is greenish yellow. Flowers, fruits, and seedlings occur throughout the year.

TYPEIFICATION: *Rhizophora mangle* var. *samoensis* is typified by *Hochreutiner 3423* (G HOLOTYPE), collected at Apia, Upolu, Samoa.

DISTRIBUTION: New Caledonia, Fiji, Samoa, and Tonga. Separation of this Pacific species from *Rhizophora mangle*, of tropical America and western Africa, is discussed and illustrated by Tomlinson (1978, cited above). In Samoa and Tonga this species is much more abundant than *R. stylosa*, but in Fiji it is equally abundant. I have examined 23 collections, but this merely reflects the distaste of many collectors for mangrove swamps.



FIGURE 160. *Rhizophora samoensis*, from *Smith 7895*, growing on the shore of Herald Bay on the island of Ngau.

LOCAL NAMES AND USES: Recorded Fijian names are *ndongo*, *tiri ndina*, and *tiri wai*. The uses noted by Seemann for *Rhizophora stylosa* are probably equally referable to *R. samoensis*; a few recent collectors note that the wood of this species is sometimes used for building, and that the bark is used as a dye and in medicine.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Lomolomo, *Degener & Ordenez 13644*. SERUA: Vicinity of Wainiyambia, mouth of Waisese Creek, *Webster & Hildreth 14052*. TAILEVU: Matavata-thou, *DA 9229 (McKee 2794)*. REWA: Between Suva and Lami, *Gillespie 2070*; Suva Bay, *Bryan 196*, p. p.; Lauthala Bay, *DA 16488*. KANDAVU: Namalata isthmus region, *Smith 2* (excl. some flowers). KORO: East coast, *Smith 1095*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7895*. VANUA LEVU: MATHUATA: Banks of lower Lambasa River, *Smith 6619*. THAKAUNDROVE: Nasinu, Natewa Bay, *DA 16837*; Vatundamu, *DA 16827*. VANUA MBALAVU: Lomaloma, *DA 10239*. FIJI without further locality, *U. S. Expl. Exped.* (us 69730).

3. *Rhizophora* × *selala* (Salvoza) Tomlinson in *J. Arnold Arb.* **59**: 159, fig. 1, 4, G-M. 1978.

Selala Guppy, *Obs. Nat. Pac.* **2**: 443, 445, *frontisp.* 1906.

Rhizophora mucronata var. *selala* Salvoza in *Nat. Appl. Sci. Bull. Univ. Philipp.* **5**: 219. 1936.

Rhizophora 'selala' Tomlinson & Womersley in *Contr. Herb. Austral.* **19**: 9, nom. illeg. sine basionymo. 1976.

As noted in Fiji, this hybrid is a sterile tree 4–10 m. high, occurring in mangrove swamps only in company with *Rhizophora stylosa* and *R. samoensis*. The mature flower buds are usually white but sometimes yellowish, and the petals are white. The flowering specimens cited below have been obtained in June and November, but doubtless the hybrid flowers more or less throughout the year.

TYPEIFICATION: Salvoza based his variety on Guppy's discussion and did not cite specimens. Apparently no material was preserved by Guppy, and therefore his ample discussion (1906, as cited above but actually scattered throughout his Chapter XXX, pp. 440–467) and his illustration may be taken as the type.

DISTRIBUTION: Known only from New Caledonia and Fiji. In my herbarium observation *Rhizophora samoensis* is common in Samoa and Tonga but *R. stylosa* is very infrequent there. Perhaps this accounts for the fact that no specimens of *R. × selala* have yet come to attention from those archipelagoes.

LOCAL NAMES: *Selala* (Guppy), *voli* (*Smith 4747*), *ndongo*, and *ndongo yalewa* (the last two from Garnock-Jones).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Shores of Mba River near its mouth, *Smith 4747*. REWA: Suva Bay, *Bryan 196*, p. p.; Kinoye Village, near Suva, *Tomlinson & Richmond*, Nov. 18, 1974. LAKEMBA: Near Nukunuku Village, *Garnock-Jones 804*; near Wathiwathi Village, *Garnock-Jones 940*. The *selala* is to be expected in any Fijian mangrove swamp; Guppy (1906, cited above) indicates that he frequently observed it on both the north and south coasts of Vanua Levu and in the Rewa delta of Viti Levu.

It is not always as easy to distinguish between *R. stylosa* and *R. × selala* as indicated in Tomlinson's (1978) discussion. For instance, my field numbers 4745 and 4747 represent a sampling of the extensive mangrove formation found near the mouth of the Mba River. (*Rhizophora samoensis* certainly also occurs there but no voucher was obtained.) In this area the *Rhizophorae* often seem not to fall readily into the three distinct taxa implied in my key. Individual leaves of the two mentioned numbers are not always sharply identifiable as belonging to *R. stylosa* and *R. × selala*, the shape of the mucro not being as totally dependable a character as suggested by Tomlinson's fig. 4, E, F (*R. stylosa*) and fig. 4, H–M (*R. × selala*). However, other key characters seem dependable: the usually trifurcated first inflorescence node and the short style of *R. × selala* as opposed to the exclusively dichotomously branched inflorescence and the long style of *R. stylosa*. As to the samples represented by the two mentioned numbers,

the photographs accompanying my specimens belong with no. 4745 (*R. stylosa*). Herbaria holding duplicates of these two numbers may contain mixed specimens, but the intention was to represent *R. stylosa* by the photographs, the local name *ndongo*, and the specimens with dichotomously branched inflorescences (no. 4745); *R. × selala* is represented by the local name *voli* and the specimens with often trifurcated first inflorescence nodes (no. 4747). I believe that another mixture is represented by *Bryan 196*, from Suva Bay, which appears to represent *R. samoensis* with the exception of certain detached leaves of *R. × selala*.

2. *BRUGUIERA* Lam. Tabl. Encycl. Méth. Bot. 2: 517. 1793; Savigny in Lam. Encycl. Méth. Bot. 4: 696. 1798; Seem. Fl. Vit. 91. 1866; Ding Hou in Fl. Males. I. 5: 457. 1958.

Buttressed trees, often with geniculate pneumatophores (knee roots), the stipules lanceolate; leaves decussate, the blades usually coriaceous, entire, glabrous; inflorescences cymose, pedunculate, with 2-7 flowers, or flowers solitary (as in our species); flowers ♂, ebracteolate; calyx articulate with pedicel at base, the tube produced beyond ovary, the limb coriaceous, accrescent, 8-14 (-16)-lobed, the lobes subulate-lanceolate, acute, usually 12-14 in our species; petals as many as calyx lobes, each embracing a pair of stamens, bilobed or emarginate, caducous; stamens twice as many as petals, epipetalous in pairs, the filaments filiform, unequal in length, the anthers linear, 4-locular, dehiscing by longitudinal slits; ovary inferior, 2-4-locular, the ovules 2 in each locule, the style filiform, the stigma obscurely 2-4-lobed; fruits campanulate, included in calyx tube or adnate to it, the seeds usually 1, rarely 2, germinating while fruit is attached to tree, the cotyledons connate at base, the hypocotyl terete or angular, obtuse, perforating apex of fruit and eventually falling with it, the calyx falling with fruit but soon becoming detached.

TYPE SPECIES: *Bruguiera gymnorrhiza* (L.) Lam. (*Rhizophora gymnorrhiza* L.).

DISTRIBUTION: Tropical eastern Africa to southeastern Asia and eastward throughout Malesia to Australia, the Marshall Islands, Tonga, and Samoa, with six species. One species is indigenous in Fiji.

1. *Bruguiera gymnorrhiza* (L.) Lam. Tabl. Encycl. Méth. Bot. 2: 517, as *B. gymnorrhiza*. t. 397. 1793; Ding Hou in Fl. Males. I. 5: 461. 1958; St. John & A. C. Sm. in Pacific Sci. 25: 336. 1971.

Rhizophora gymnorrhiza L. Sp. Pl. 443. 1753.

Bruguiera gymnorrhiza Savigny in Lam. Encycl. Méth. Bot. 4: 696. 1798; J. W. Parham, Pl. Fiji Isl. 143. 1964, ed. 2. 205. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 129. 1972.

Bruguiera rheedii Bl. Enum. Pl. Javae, 92. 1827; Seem. Fl. Vit. 91. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 165. 1890; Guppy, Obs. Nat. Pac. 2: 461. fig. 21-26 (opp. 453). 1906.

Bruguiera rumphii Bl. Mus. Bot. Ludg.-Bat. 1: 138. 1850; A. Gray, Bot. U. S. Expl. Exped. 1: 614. 1854. *Bruguiera rumphii* Bl. ex Seem. in Bonplandia 9: 256. 1861, Viti, 436. 1862.

Bruguiera conjugata sensu Merr. in Philipp. J. Sci. Bot. 9: 118. 1914; Christophersen in Bishop Mus. Bull. 128: 157. 1935; Yuncker in op. cit. 220: 198. 1959; non *Rhizophora conjugata* L. (nomen confusum). *Bruguiera eriopetala* sensu Guillaumin in J. Arnold Arb. 12: 252. 1931; non Wight & Arn. ex Arn.

In Fiji *Bruguiera gymnorrhiza* is seen as a tree 4-15 m. high (to 36 m. high in Malesia), with inconspicuously buttressed trunks, often locally abundant at sea level as one of the principal components of mangrove swamps, usually occurring toward the landward side of such swamps, and less often in muddy places along beaches. Its calyx is yellow-green to dull yellow or reddish; its petals are white, fading to brown; and its styles are pale green. Although flowers and fruits occur throughout the year, the

principal flowering season is between November and February, and fruiting occurs profusely after March.

TYPEIFICATION AND NOMENCLATURE: For *Rhizophora gymnorhiza* Linnaeus cited three prior references, including one to Rheede, Hort. Ind. Malabar. 6: 57. t. 31, 32, which probably provides the best lectotype. The spelling *gymnorhiza* is correct in Greek compounds of this sort, in spite of the frequent use of *gymnorhiza*. *Bruguiera rheedii* is based on the same Rheede reference. *Bruguiera rumphii* may be construed as based on *Mangium celsum* Rumph. Herb. Amb. 3: 102. t. 68. 1743, cited with other references by Blume. The combination *Bruguiera conjugata* (L.) Merr. was based on *Rhizophora conjugata* L.; Ding Hou (in Fl. Males. I. 5: 453. 1958) has rejected this Linnaean name as a mixture of two species of different genera, *Bruguiera* and *Rhizophora*, the precise species of each genus being uncertain.

DISTRIBUTION: Tropical southern and eastern Africa and the Madagascan area to southeastern Asia and the Ryukyu Islands, throughout Malesia to Micronesia and Australia, and eastward in the Pacific to Samoa and Tonga. About 30 Fijian collections have been examined, but the species is locally much more abundant than this implies.

LOCAL NAMES AND USES: *Ndongo* (general), *lilai* (Mba), *tiri* (Serua), *tiri wai* (Koro), *ndongo sahsalu* (Mathuata), *ndongo kana* (Lau), *ndongo tangane* (Lau). The reddish wood is hard and durable and is sometimes used for building purposes, more frequently as firewood. The bark provides a dye and is said to be used for unspecified medicinal purposes. Seemann states that at the time of his visit the aerial roots were used for making bows; *Bruguiera* species sometimes do have aerial roots when young, but possibly Seemann was referring to the stilt-roots of *Rhizophora*. He also indicates that in times of scarcity the fruits (i. e. seedlings) were made into *mandrai* (bread).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: North of Lomolomo, *Degener & Ordonez 13645*; shores of Mba River near its mouth, *Smith 4729*. SERUA: Mouth of Taunovo River, *DA 13850 (Damanu 38)*. NAMOSI: Near Melimeli, *DA 11587*. TAILEVU: Matavatathou, *DA 9236 (McKee 2801)*. REWA: Queen's Road, about 20 miles from Suva, *Vaughan 3310*; Lami, *DA 12901*; near Suva, *MacDaniels 1004*. KORO: East coast, *Smith 1100*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7897*. VANUA LEVU: MATHUATA: Banks of Ngawa River above Lambasa, *Smith 6612*. THAKA ANDROVE: Ndromoninuku, *DA 16816*. TAVEUNI: *Seemann 186*. VANUA MBALAVU: Near Ndakuilomaloma, *Garnock-Jones 1133*. LAKEMBA: Near Wathiwathi Village, *Garnock-Jones 939*. FULANGA: On limestone, *Smith 1169*. FIJI without further locality, *U. S. Expl. Exped. (US 69729)*.

3. *Crossostylis* J. R. & G. Forst. Char. Gen. Pl. 44. 1775, ed. 2. 87. 1776; Seem. Fl. Vit. 427. 1873.

Haplopetalon A. Gray in Proc. Amer. Acad. Arts 3: 53. 1853, Bot. U. S. Expl. Exped. 1: 608. 1854; Seem. Fl. Vit. 90. 1866.

Small trees or shrubs, sometimes polygamo-dioecious, the stipules interpetiolar, imbricate, caducous; leaves decussate, the blades often coriaceous, entire or serrulate, pinnate-nerved; inflorescences axillary, solitary or paired, subtended by soon caducous involucre bracts, short-pedunculate, simple or dichotomously branched, 2-many-flowered, the pedicels usually ebracteolate; flowers ♂ or sometimes functionally ♀; calyx tube adnate to ovary, the limb 4-6(-7)-lobed to base, the lobes valvate, deltoid, glabrous or pilose, usually tufted-hispidulous at apex, usually persistent and reflexed in fruit; petals 4-6 (-7), inserted at margin of disk, unguiculate, carinate or not, entire to emarginate or few-toothed, involute in aestivation, caducous; disk perigynous, annular or cupuliform or pulvinate, surrounding base of style; stamens uniseriate, 8-31 (at least 12 in our species, often 2-4 opposite each calyx lobe and 1 between calyx lobes, but sometimes less symmetrically arranged), inserted on disk,

sometimes alternating with staminodes or these lacking (or only staminodes like small, sterile anthers present in functionally ♀ flowers), the filaments short to subulate, incurved, the anthers ovoid to oblong, 2-locular, longitudinally dehiscent; ovary semisuperior, flattened or convex on upper surface at anthesis, distally elongating in fruit, 4-28-radiate-striate, incompletely 4-28-locular (in our species 4-16-locular) or at length unilocular, the septa often evanescent, the ovules 2 per locule, often pendulous, affixed to central column in pairs, the style simple, terete to striate or sulcate, the stigma discoid or 4-many-lobed with spreading, usually linear to filiform, stigmatose lobes; fruits subglobose to ovoid, incompletely 4-28-locular or unilocular, many-seeded, tardily septicidally dehiscent or operculate, the seeds with a carunculate funicle, the testa black or brown and shining, the endosperm oily, the cotyledons narrowly ovate.

TYPE SPECIES AND NOMENCLATURE: The type species and only original species of *Crossostylis* is *C. biflora* J. R. & G. Forst. *Haplopetalon* is typified by *H. richii* A. Gray, first published in a descriptio generico-specifica. Schimper (in Engl. & Prantl, Nat. Pflanzenfam. III. 7: 50. 1893) correctly combined the two genera and has been followed by most subsequent users. Although Seemann in 1873 took up the older name, he gave no indication that he considered it the same as *Haplopetalon*, which he had used in 1866 in an earlier part of *Flora Vitiensis*. Gillespie (in Bishop Mus. Bull. 91: 21-23. 1932) still used *Haplopetalon* for the two species he discussed.

DISTRIBUTION: Solomon Islands, New Hebrides, and New Caledonia eastward to the Society and Marquesas Islands, with about eleven species. Five endemic species occur in Fiji.

Although *Crossostylis* is often mentioned as having ♂ flowers, it is evident that many individuals bear only functionally ♀ flowers in which the stamens are reduced to staminodes, these with negligible filaments and small but obviously sterile anthers. Other individuals, however, have fully ♂ flowers that produce mature fruits.

The Fijian land mangroves (*tiri vanua*) present taxonomic problems in their vegetative variability and in the questionable value of such floral characters as the number of stamens and gynoecial parts. It appears reasonable to recognize five species, among which *Crossostylis seemannii* and *C. parksii* are very distinct. The three remaining species, *C. richii*, *C. pedunculata*, and *C. harveyi*, should be considered together with two relatives from the New Hebrides and Santa Cruz Islands, *C. banksiana* and *C. cominsii*, the full variability of which remains to be seen. The problems involved are discussed in comments on individual species; for the time being all the Fijian species are treated as endemic, but the present disposition should be considered provisional.

KEY TO SPECIES

- Lower surfaces of leaf blades glabrous or pilose only on costa and soon glabrate; stipules glabrous or soon glabrate, 6-20 mm. long
 Ovary locules and stigmatic lobes 5-9; free part of ovary copiously strigose-hispidulous, infrequently glabrous; fruits usually subpersistently pilose but sometimes glabrous; distal internodes of branchlets pilose; pedicels 3-10 mm. long
 Distal internodes of branchlets slender, 1-2 (-3) mm. in diameter, the indument composed of predominantly appressed hairs 0.3-0.8 mm. long; petioles slender, 0.6-1.5 mm. in diameter, 3-17 mm. long, soon glabrate; leaf blades elliptic to lanceolate-oblong, (2.5-) 5-11 × (1-) 2-5.5 cm., with 5-7 (-8) pairs of secondary nerves; inflorescences simple, 2-4-flowered, the peduncle slender, 0.7-1.5 mm. in diameter, 1-4 mm. long; pedicels glabrous or with appressed hairs; calyx lobes sparsely pilose on both surfaces with appressed hairs, soon glabrate; stamens (or staminodes in functionally ♀ flowers) 12-25, the functional stamens with filaments 1.5-2 mm. long and anthers 0.3-0.5 mm. long; ovary locules and stigmatic lobes 5 or 6, the latter free nearly to base; fruits 5- or 6-radiate-striate. *I. C. richii*

- Distal internodes of branchlets stout, (2-) 3-4 mm. in diameter, the indument composed of predominantly spreading hairs 0.3-0.8 mm. long; petioles stout, (1-) 1.5-3 mm. in diameter, 10-25 mm. long, often pilose like branchlets but at length glabrate; leaf blades elliptic to elliptic-obovate, (7-) 9-17 × (4-) 5-10 cm., with 8-13 pairs of secondary nerves; inflorescences simple or dichotomously once-branched, 2-8-flowered, the peduncle stout, (1-) 1.5-3.5 mm. in diameter, 1-9 (-20) mm. long, the secondary peduncles if present equally stout, to 1.5 mm. long; pedicels with spreading hairs; calyx lobes spreading-pilose on both surfaces, at length glabrate; stamens (or staminodes in functionally ♀ flowers) 16-25, the functional stamens with filaments 2-3 mm. long and anthers 0.7-0.9 mm. long; ovary locules and stigmatic lobes (6-) 7-9, the latter usually proximally coadnate; fruits (6-) 7-9-radiate-sulcate. 2. *C. pedunculata*
- Ovary locules and stigmatic lobes (75-) 10-16, the latter proximally coadnate; gynoecea and fruits glabrous, the fruits (75-) 10-16-radiate-sulcate; vegetative parts of plant glabrous; distal internodes of branchlets stout, 2-4 mm. in diameter; petioles stout, 1.3-2.5 mm. in diameter, 7-17 mm. long; leaf blades elliptic-obovate, (5-) 7-14 × (2.5-) 3-7 cm., with 7-11 pairs of secondary nerves; inflorescences simple or dichotomously once-branched, 2-8-flowered, the peduncle stout, 2-3 mm. in diameter, 1-10 mm. long, the secondary peduncles if present equally stout but short; pedicels glabrous, 5-14 mm. long; calyx lobes sericeous-tomentellous within; stamens (or staminodes in functionally ♀ flowers) (16-) 20-30, the functional stamens with filaments 1-2 mm. long and anthers 0.5-1 mm. long. 3. *C. harveyi*
- Lower surfaces of leaf blades copiously and persistently soft-spreading-pilose with hairs 0.3-0.6 mm. long; young branchlets and petioles similarly pilose but at length glabrate; inflorescences simple, 2-4-flowered; free part of ovary usually pilose at anthesis.
- Branchlets slender, the distal internodes 1.5-2 mm. in diameter; stipules 6-13 mm. long, soon glabrate; petioles 5-13 mm. long, slender, 1-1.5 mm. in diameter; leaf blades lanceolate to oblong-elliptic, (4-) 6-10 × (1.5-) 2-4 cm., with 6-8 pairs of secondary nerves; peduncle slender, about 0.5 mm. in diameter, 2-8 mm. long; calyx lobes 4 or 5, essentially glabrous at anthesis, usually 2-2.5 × 1.5-2 mm.; stamens (or staminodes in functionally ♀ flowers) 12-15; ovary 4- or 5-locular, the style slender, 0.2-0.5 mm. long, with 4 or 5 slender stigmatic lobes free nearly to base; fruits sparsely appressed-pilose, at length glabrate, 4- or 5- striate. 4. *C. parksii*
- Branchlets stout, the distal internodes 2-5 mm. in diameter; stipules 10-25 mm. long, subpersistently appressed-pilose; petioles 10-25 mm. long, stout, (1-) 2-3 mm. in diameter; leaf blades broadly elliptic to obovate, (6-) 10-23 × (3.5-) 5-13 cm., with (7-) 9-14 pairs of secondary nerves; peduncle stout, 1-2 mm. in diameter, 1-5 mm. long; calyx lobes 4-6, copiously pilose on both sides at anthesis, usually 2-4 × 1.5-3 mm.; stamens (or staminodes in functionally ♀ flowers) (12-) 16-24; ovary 6-11-locular, the style stout, 0.5-1.5 mm. long, with 6-11 carnosse stigmatic lobes; fruits persistently spreading-pilose, 6-11-striate. 5. *C. seemanii*

1. *Crossostylis richii* (A. Gray) A. C. Sm. in Bishop Mus. Bull. 141: 104, excl. syn. C. *harveyi*. 1936. FIGURE 161A-C.

Haplopetalon richii A. Gray in Proc. Amer. Acad. Arts 3: 54. 1853, Bot. U. S. Expl. Exped. 1: 608. 1854, Atlas, pl. 76. 1856; Seem. Viti, 436. 1862, Fl. Vit. 90. 1866.

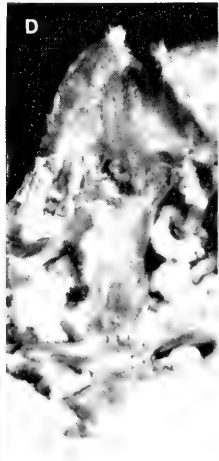
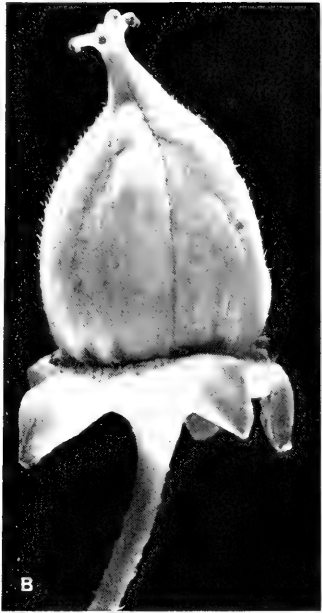
Haplopetalum richii A. Gray ex Drake, Ill. Fl. Ins. Mar. Pac. 165. 1890.

Crossostylis richii var. *stenophylla* A. C. Sm. in Bishop Mus. Bull. 141: 104, fig. 55. 1936; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 205. 1972.

Crossostylis richii var. *richii*; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 205. 1972.

A shrub or tree 2-15 m. high, often slender, compact, or gnarled, with a trunk to 25 cm. in diameter, occurring at elevations from near sea level to 1,200 m. and sometimes locally abundant, in dense forest, crest thickets, patches of forest in open areas, and in the forest-grassland transition. The petioles and pedicels are sometimes reddish; the calyx lobes and petals are white to greenish or pale yellow, as are the filaments; the

FIGURE 161. A-C, *Crossostylis richii*; A, distal portion of branchlet, with foliage and inflorescences with functionally ♀ flowers, × 1; B, maturing fruit from functionally ♀ flowers, the staminodes persistent, the petals fallen, × 6; C, portion of ♂ flower, showing 2 sepals, 2 petals, stamens, and upper part of ovary, the style 5-lobed, × 15. D, *Crossostylis harveyi*, section through ♂ flower, showing tips of 2 sepals, stamens, section through ovary with attached ovules, and style with 11 lobes, × 15. A from Parks 20849, B from Smith 1647, C from Smith 1670, D from Smith 9570.



anthers are pink or purple; the disk and ovary are greenish or pale yellow; the stylar lobes are purplish; and the fruits are dull yellow, becoming red-tinged. Flowers and fruits have been obtained throughout the year.

TIPIFICATION AND NOMENCLATURE: *Haplopetalon richii* is typified by *U. S. Expl. Exped.* (US 47837 HOLOTYPE; ISOTYPE at GH), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu. The type of *Crossostylis richii* var. *stenophylla* is *Smith 1765* (BISH HOLOTYPE; many ISOTYPES), collected May 10, 1934, on Mt. Kasi, Yanawai River region, Thakaundrove Province, Vanua Levu. On comparison with the abundant material now at hand, it is seen that reasonable variation in leaf shape must include such narrow-leaved individuals. I now believe that my 1936 reduction of *C. harveyi* Benth. to *C. richii* was an error, and Bentham's species is here taken to replace *C. pachyantha*, which I subsequently described.

DISTRIBUTION: Endemic to Fiji and thus far known from five of the high islands; more than 50 collections have now been examined.

LOCAL NAMES: In addition to the generic name *tiri vanua*, the following have been reported: *sivia* (Mba), *sukau* (Mba), *ndakua ni ndrimbangrimbi* (Namosi), and *waka-there* (Mbua).

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Mt. Ndelaioo, on escarpment west of Nandarivatu, *Smith 5065*; Nandarivatu, *Parks 20849*; Mt. Nanggaranambuluta, east of Nandarivatu, *Smith 4757*; slopes of Mt. Tomanivi, *Gillespie 4089*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13887*; northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5392*; Singatoka River Valley, near Keiyasi, *DA 9291 (McKee 2861)*. SERUA: Mt. Tikituru, *DA 14469*. NAMOSI: Mt. Naitarandamu, *Gillespie 5123*; Mt. Voma, *Gillespie 2667*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6146*; Namboumbutho Creek, Wainimala River drainage, *Horne 968*. TAILEVU: Without further locality, *DA 8717*. OVALAU: Near summit of main range west of Levuka, *Gillespie 4429*. NGAU: Slopes of Mt. Ndelaitho, on northern spur toward Navukailangi, *Smith 7892*. VANUA LEVU: Mba: Summit of Mt. Seatura, *Smith 1647, 1670*. MATHUATA: Mbatiri, Ndreketi River, *DA 12921*; Natindoyanga Creek, drainage of Korovuli River, *DA 12906*; Mt. Numbuloa, east of Lambasa, *Smith 6511*; Ndongotuki Tikina, *Howard 152*. TAVEUNI: Summit ridge east of Somosomo, *Gillespie 4827*.

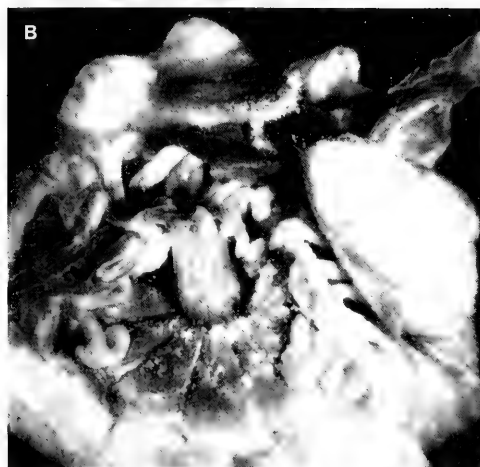
Many specimens from upland Viti Levu, in comparison with those from Vanua Levu, tend to have more congested leaves with shorter petioles, smaller, essentially entire leaf blades, and smaller flowers. However, the species is abundant and variation within it, as it is here delimited, appears to be reasonable.

2. *Crossostylis pedunculata* A. C. Sm. in *J. Arnold Arb.* 33:98. 1952; *J. W. Parham, Pl. Fiji Isl.* 144. 1964, ed. 2. 205. 1972.

A slender or spreading tree or shrub 3-8 m. high, found in dense or open forest at elevations of 100-460 m. Its calyx lobes, petals, disk, and stigmatic lobes are white to pale yellow, its filaments white, and its fruits at length reddish-tinged. Flowers have been collected between April and September, fruits between July and November.

TIPIFICATION: The type is *Smith 1925* (US 1676416 HOLOTYPE; many ISOTYPES), collected June 8, 1934, in hills west of Korotasere, Natewa Bay region, Thakaundrove Province, Vanua Levu.

FIGURE 162. A & B, *Crossostylis harveyi*; A, distal portion of branchlet, with foliage and inflorescences with functionally ♀ flowers, × 1/2; B, ♂ flower with 7 sepals (4 removed), showing 2 petals, stamens, upper part of ovary with 11 locules, and style with 11 lobes, × 15. C & D, *Crossostylis seemanii*; C, maturing functionally ♀ flower, showing persistent staminodes, developing ovary, and 7-lobed style, × 6; D, cluster of seeds suspended from fruit axis, showing persistent style, caruncles, and persistent staminodes, the pericarp removed, × 6. A from *DA 9842*, B from *Smith 9570*, C from *DA 15222*, D from *Smith 9111*.



DISTRIBUTION: Endemic to Fiji and known only from the two largest islands, from which 16 collections have now been studied.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8428*; Mt. Voma, *DA 1787*. SERUA: Hills east of Navua River, near Nukusere, *Smith 9078*; hills above Navua River, *Greenwood 1029*, p. p. TAILEVU: L. Hunt's farm, *DA 11434*. VANUA LEVU: MATHUATA: Nanduri, *Tothill 454*; Tambia River region, *Howard 127*; mountains near Lambasa, *Greenwood 513, 513A*. THAKAUNDOVE: Vatuova Tikina, *Howard 165*; near Korotasere, *DA 15487*; Navonu Creek, Natewa Peninsula, *DA 13407, 15070*. FIJI without further locality, *DA 3912, 3923*.

Crossostylis richii and *C. pedunculata* appear very distinct in their typical forms; in general *C. pedunculata* is obviously more robust in vegetative parts, and its indument is composed of spreading rather than appressed hairs. The number of gynoeceal parts seems dependable, these being five or six in *C. richii* and (six-) seven to nine in *C. pedunculata*. When six such parts are found, an examination of other flowers or fruits on the same individual has in my observation always indicated variability toward five (*C. richii*) or seven (*C. pedunculata*).

3. *Crossostylis harveyi* Benth. in J. Proc. Linn. Soc. Bot. 3: 77, as *Crossostyles h.* 1858.

FIGURES 161D, 162A & B.

Crossostylis harveyi Seem. Fl. Vit. 428. 1873.

Crossostyles harveyi Benth. ex Drake, Ill. Fl. Ins. Mar. Pac. 166, p. p. 1890.

Crossostylis pachyantha A. C. Sm. in J. Arnold Arb. 33:99. 1952; J. W. Parham, Pl. Fiji Isl. 143. 1964, ed. 2. 205. 1972.

A tree 2–10 m. high, obtained in dense or dry forest at elevations from near sea level to 600 m. The pedicels and disk are noted as rich pink, the calyx lobes as pale green, the petals, filaments, and styles as white, and the anthers as pale yellow. Flowers have been noted between June and February, fruits between January and June.

TYPIFICATION AND NOMENCLATURE: The type of *Crossostylis harveyi* Benth. is *Harvey* (K HOLOTYPE; ISOTYPE at GH), collected in 1855 in Fiji without further locality. Seemann apparently overlooked Bentham's publication and by a strange coincidence described a new species in 1873 with the same epithet, based on a BM duplicate (HOLOTYPE) of *C. harveyi* Benth. My 1936 reduction of this name to *C. richii* (as there noted) is now seen to be erroneous. *Crossostylis pachyantha* is based on *Vaughan 3370* (BM HOLOTYPE; ISOTYPE at K), collected Feb. 23, 1947, near Tholo-i-suva, Naitasiri Province, Viti Levu. On further study I refer my 1952 binomial to the synonymy of *C. harveyi*.

DISTRIBUTION: Endemic to Fiji and fairly frequent in southeastern Viti Levu, with a single collection known from southern Vanua Levu.

LOCAL NAMES: Only the Fijian generic names *tiri vanua* and *tiri ni vanua* have been noted.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Coastal hills near Taunovo River, east of Wainiyambia, *Smith 9570*. NAITASIRI: Waimanu River, *DA 15834*; Tamavua-Sawani road, *Setchell & Parks 15006*; Tholo-i-suva, *DA 504, 7587, 9842, 11884, 11965, 13805, 14608, DF 528 (Watkins 790), DF 533 (Watkins 795), Vukicea*, June 30, 1950; Prince's Road, *DA 153*; Central Road, *Tothill 494, 499*; vicinity of Nasinu, *Gillespie 3650*. REWA: 6 miles south (west?) of Suva, *Meebold 17072*. VANUA LEVU: Thakaundrove: Upper Yanawai River, *DA 15748*.

Crossostylis harveyi is clearly distinguishable from *C. richii* and *C. pedunculata* in its lack of indument (except for the slight indument of the inner surfaces of calyx lobes and the petals on both surfaces) and in its increased number (10–16) of stigmatic lobes, ovary locules, and fruit segments. A closer ally of *C. harveyi* appears to be the New Hebridean *C. banksiana* Guillaumin, which may be separated from the Fijian taxon by

its leaf blades with fewer (5-7) and more definitely ascending secondary nerves, its more slender peduncles and pedicels, and its 7-9 gynoecial parts.

In regard to the gynoecial parts of *Crossostylis harveyi*, it must be noted that Bentham indicated the gynoecium as 5-7-merous and Seemann noted it as 6-8-merous. The accuracy of these two careful observers should not be questioned, and yet the type material of *C. harveyi* now appears to me (without a floral dissection) identical with *C. pachyantha*. It is probably best assumed, pending a more careful review of the entire genus, that the species here referred to *C. harveyi* is unusually variable in the number of its gynoecial parts.

An affinity of *Crossostylis harveyi* to *C. cominsii* Hemsl., of the Santa Cruz Islands, should also be examined. On the basis of Hemsley's protologue (in J. Linn. Soc. Bot. 30: 212. pl. 10. 1894) and Ding Hou's comments (in Blumea 16: 131. fig. 1, i-m. 1968), *C. cominsii* has more membranaceous and larger leaf blades than *C. harveyi*; its stipules are 22-30 mm. long, its inflorescence buds are globose, and its fruits have transverse, lenticel-like clefts. In *C. harveyi* the stipules are 7-15 mm. long, the inflorescence buds are distinctly acute or apiculate, and the fruits lack transverse clefts or ridges. Nevertheless, the relationships among the three Fijian species of this alliance (*C. richii*, *C. pedunculata*, and *C. harveyi*), *C. cominsii*, and *C. banksiana* must be reexamined by a future monographer.

4. *Crossostylis parksii* (Gillespie) A. C. Sm. in Bishop Mus. Bull. 141: 105. 1936; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 205. 1972.

Haplopetalon parksii Gillespie in Bishop Mus. Bull. 91: 21. fig. 24. 1932.

A shrub or tree 3-5 m. high, occurring in some abundance but in a restricted area at elevations of 725-1,120 m. The calyx lobes, petals, disk, and filaments are white or pale yellow, the anthers and gynoecium yellow, and the fruit white, turning yellow. Flowers have been collected in most months, fruits between March and August.

TYPEFICTION: The type is *Gillespie 3802* (BISH HOLOTYPE and ISOTYPE), collected Nov. 16, 1927, on the summit of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and limited to the type locality, with a single collection from slightly south of it.

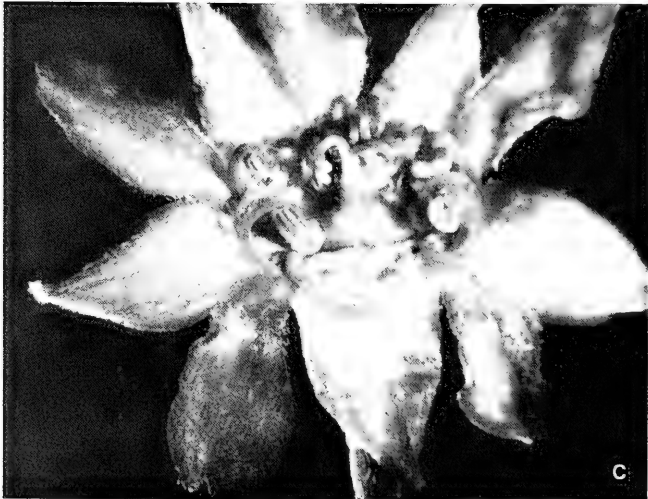
LOCAL NAME: The only recorded Fijian name is *kai mothi* (*Smith 5641*).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Slopes and summit of Mt. Nanggaranambuluta, east of Nandarivatu, *Parks 20775*, *Greenwood 1176*, *Smith 4882*, *Vaughan 3383*, *Stauffer & Koroiveibau 5834*, *DA 2357*, *12533*, *13556*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5641*. FIJI without further locality, *DA 3876*.

Although *Crossostylis parksii* is for convenience keyed with *C. seemannii*, its closer relative is probably *C. richii*, from which it differs not only in obvious characters of indument, but also in its more slender inflorescences, smaller calyx lobes, fewer stamens or staminodes (not more than 15), and in having its ovary often with only four locules and its style with four stigmatic lobes.

5. *Crossostylis seemannii* (A. Gray) Schimper in Engl. & Prantl, Nat. Pflanzenfam. III. 7: 51. 1893; J. W. Parham, Pl. Fiji Isl. 144. 1964, ed. 2. 206. 1972.

FIGURES 162C & D, 163.



Crossostylis biflora sensu Seem. in Bonplandia 9: 256. 1861, Viti, 436. 1862; non J. R. & G. Forst. *Haplopetalum seemanni* A. Gray in Proc. Amer. Acad. Arts 5: 318. (Jan.) 1862, in Bonplandia 10: 36. (Feb. 15) 1862; Seem. Viti, 436. 1862, Fl. Vit. 90. 1866; Gillespie in Bishop Mus. Bull. 91: 22. fig. 25. 1932.

Haplopetalum seemanii A. Gray ex Drake, Ill. Fl. Ins. Mar. Pac. 166. 1890.

A shrub or tree 2–10 m. high, often locally frequent from near sea level to an elevation of 700 m. in dense or open forest or on its edges, sometimes in swampy places. The calyx lobes and disk are pale green, the petals, filaments, and styles white, and the anthers yellowish. Flowering occurs from April to September, and fruits have been obtained between July and December.

TIPIFICATION: The type is *Seemann 184* (GH HOLOTYPE; ISOTYPES at BM, K), collected in August or September, 1860, on Kandavu. Since the description was based on a duplicate in the set of plants Seemann had sent to Gray, in this case the holotype must be taken as the GH specimen.

DISTRIBUTION: Endemic to Fiji and known only from southern Viti Levu, with the exception of the type collection. The labels of this provide no locality, but Kandavu is noted in *Flora Vitiensis*. On Viti Levu *Crossostylis seemanii* is the most common member of the genus, occurring at lower elevations than *C. parksii*. More than 60 collections of *C. seemanii* from Viti Levu are at hand.

LOCAL NAMES AND USE: *Tiri vanua*, *tiri ni vanua*, *wai ni mara* (Namosi), and *mandiri tambua* (Namosi) have been recorded. The bark of the stem and roots and the inner bark of stems are used medicinally (Weiner), with other plants, to relieve headache, paleness, or to treat the occurrence of blood in urine.

REPRESENTATIVE COLLECTIONS: VITI LEVU: SERUA: Mt. Tuvutau, *DA 15529*; upper Navua River, *Howard 6*; hills east of Navua River, near Nukusere, *Smith 9111*; vicinity of Ndeumba, *DA 9200 (McKee 2764)*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8435*; track to Mt. Vakarongasiu, *DA 16170*; vicinity of Namosi Village, *Weiner 15B*; vicinity of Namuamua, *Gillespie 3020*; Nakavu, on Navua River, *Parks 20374*; Wainandoi River, *DA 8355*. NAITASIRI: Viria, *Meebold 17068*; Waimanu River near Adi Cakobau School, Sawani, *DA 15222*; near Nasinu, *Greenwood 1029A*. TAILEVU: King's Road, *DA 1328*. REWA: Waimbue Creek, Waimanu River tributary, *DA 15568*; between Suva and Lami, *Gillespie 2072*.

The closest relative of *Crossostylis seemanii* is probably *C. pedunculata*, although the latter is at once distinguished by its comparatively sparse indument. *Crossostylis seemanii* usually has the larger leaf blades, a more slender inflorescence peduncle, shorter petals, and functional stamens with shorter filaments and anthers.

ORDER VIOLALES

Nine families of plants occurring in Fiji (although only five of them have indigenous species) fall into the old concept of "Parietales," an ordinal name now often replaced by Violales if taken in a comprehensive sense (Cronquist, 1968). An order Cucurbitales is often detached from this concept (Melchior, 1964), and sometimes an additional order Begoniales (Takhtajan, 1969). Thorne (1976) uses the ordinal name Cistales in place of Violales; he and Dahlgren (1980) further remove one or two

FIGURE 163. *Crossostylis seemanii*; A, distal portion of branchlet, with foliage and inflorescences with functionally ♀ flowers, × 1/3; B, portion of lower surface of leaf blade, × 10; C, ♂ flower, with 5 petals and sepals, stamens (2 removed), upper part of ovary, and style with 11 lobes, × 10. A & B from *DA 15222*, C from *DA 15568*.

families of the complex into the order Malvales. Hutchinson (1973) refers most of the "parietalean" families to five orders, and Takhtajan (1969) utilizes an order Passiflorales for five of the families. A separation between Violales and Passiflorales seems difficult (cf. Cronquist, 1968, p. 204), but I here follow Takhtajan in recognizing the Cucurbitales and Begoniales as distinct.

KEY TO FAMILIES OCCURRING IN FIJI

- Plants without milky latex, usually stipulate; leaves usually alternate, not notably clustered terminally; flowers with free or shortly united petals or apetalous.
- Flowers with a convex to tubular receptacle, ♂ or unisexual; sepals usually 3-6 (2-15), often 5; petals 3-8, often 5, sometimes lacking; stamens sometimes numerous but sometimes only as many as petals; ovary unilocular, the ovules usually numerous but sometimes few, the styles free to completely united into a single style; herbs, shrubs, or trees, sometimes scandent; leaves simple or infrequently compound, the blades pinnately or palmately nerved.
- Trees or shrubs (our species) with simple leaves; flowers ♂ or unisexual, actinomorphic, the sepals usually 3-6 (2-15), free or connate, the petals usually 3-8, sometimes lacking, a corona lacking, the stamens often numerous, sometimes as many as petals and opposite them, the filaments free or united into phalanges or a tube; ovary with 2-10 (usually 3-5) parietal placentas or these intruded and united, the styles as many as placentas, free to completely united; fruit a loculicidally dehiscent capsule or a berry or drupe. 97. FLACOURTIACEAE
- Trees or shrubs or herbs, sometimes scandent plants; leaves simple or infrequently compound; flowers usually ♂, sometimes unisexual, actinomorphic or zygomorphic, the sepals often 5 (3-8), free or basally connate, sometimes unequal, the petals often 5 (3-8), sometimes unequal, a corona sometimes present; stamens 5 (3-10); ovary usually with 3 (2-5) parietal placentas, these sometimes intruded, the styles often simple, often 3 and free or united; fruit a loculicidally dehiscent capsule or a berry.
- Flowers without a corona (or this sometimes present, short, and thin in Family 99); sepals and petals 5; stamens 5 (very rarely more); trees, shrubs, or herbs, sometimes scandent but not tendrillous.
- Flowers ♂ or sometimes unisexual, hypogynous or slightly perigynous, often zygomorphic; sepals free or shortly connate; petals free or shortly connate, usually unequal, the lowermost (anterior) often the largest and spurred; anthers often connivent around ovary, the connective often produced; style often simple, the stigma entire or divided; our indigenous species trees, shrubs, or lianas. 98. VIOLACEAE
- Flowers ♂, perigynous, actinomorphic; sepals often joined into a tubular calyx; petals inserted on calyx tube or at its base, equal; anthers not connivent around ovary, the connective not produced; styles 3, usually free and slender, the stigmas often fimbriate or laciniate; our species (not indigenous) a shrub or coarse herb. 99. TURNERACEAE
- Flowers actinomorphic, ♂ or unisexual, usually with a conspicuous corona arising from receptacle between perianth and androecium, the receptacle often cupuliform or tubular and sometimes with a central gynophore or androgynophore; sepals and petals 3-5 (-8); stamens 3-5 (-10); plants often climbing by tendrils. 100. PASSIFLORACEAE
- Flowers with a flat to convex receptacle, ♂; sepals and petals usually 5, the petals free; stamens numerous, the anthers dehiscing by short slits at or near apex; ovary unilocular, the ovules numerous, the style 1, simple, slender; trees or shrubs with colored sap; leaves simple, the blades palmately nerved.
- Ovary with 2 placentas, the stigma bilobed; fruit a compressed, loculicidally 2-valved capsule, often densely echinate-setose, the embryo straight; anthers narrowly hippocrepiform. 101. BIXACEAE
- Ovary with 3-5 placentas, these often intruded and the ovary sometimes 3-locular with axile placentation (but not in our genus), the stigma minutely denticulate; fruit a large 3-5-valved capsule, not echinate, the inner and outer layers separating to form alternating valves, the embryo curved; anthers linear. 102. COCHLOSPERMACEAE
- Plants with abundant milky latex, estipulate; leaves clustered terminally, the blades in our species simple and lobed; flowers (at least ♂) with petals united into a slender, tubular corolla; stamens 10 (sometimes 5 in ♂ flowers); ovary with 5 placentas (or 5 spurious locules), the stigmas 5. 103. CARICACEAE

FAMILY 97. FLACOURTIACEAE

FLACOURTIACEAE DC. Prodr. 1: 255, as *Flacourtiaceae*. 1824.

Trees and shrubs (our species), rarely scandent plants, sometimes dioecious or polygamodioecious, the stipules usually small and early caducous, rarely large and

persistent, sometimes absent; leaves usually alternate (spirally arranged or distichous), simple, the blades sometimes glandular at base, entire or crenate or serrate, often pellucid-glandular or -lineolate; inflorescences axillary or terminal, sometimes borne on old wood, fasciculate or basically cymose, sometimes racemose or paniculate or with solitary flowers, rarely epiphyllous (not in our genera); flowers actinomorphic, ♂ or unisexual, the pedicel often articulated near base, the receptacle convex, sometimes bearing an entire, lobed, or glandular disk; sepals 2-15 (usually 3-6), free or connate, imbricate, rarely valvate, sometimes not clearly separable from petals; petals hypogynous, usually 3-8, sometimes perigynous, very rarely epigynous, imbricate, rarely valvate, often more numerous than sepals, sometimes as many as sepals and alternating with them, sometimes lacking, often small and inconspicuous, sometimes with a scalelike appendage within the base; stamens hypogynous (less often perigynous), often numerous, sometimes as many as petals and opposite them, the filaments free or united into phalanges opposite petals, rarely united into a tube, the anthers 2-locular, linear or short, dehiscing by longitudinal slits (in all our genera) or rarely by terminal pores, staminodes sometimes present; ovary superior, rarely semi-inferior, very rarely inferior, unilocular, the placentas 2-10 (usually 3-5), parietal, sometimes intruded into middle of ovary and there uniting, the ovules 2 or more on each placenta, anatropous, the styles as many as placentas, free to completely united into a single style, rarely branched or absent, the stigmas as many as placentas; fruit a loculicidally dehiscent capsule or an indehiscent berry or drupe, the seeds 1-many, sometimes arillate, usually with copious endosperm, the embryo usually straight, the cotyledons usually broad.

DISTRIBUTION: Mostly pantropical and subtropical, with 84-93 genera and 1,000-1,300 species. Some genera produce useful timber or oil, and a few have edible fruits. The family is represented in Fiji by seven genera, five with indigenous species and two known only in cultivation.

USEFUL TREATMENTS OF FAMILY: Sleumer, H. Flacourtiaceae. Fl. Males. 1. 5: 1-106. 1954. Hutchinson, J. Flacourtiaceae. Gen. Fl. Pl. 2: 201-232. 1967.

KEY TO GENERA

Petals present.

Sepals and petals 7-13, spirally arranged, gradually merging from one to the other without a sharp distinction, the inner ones gradually smaller; flowers lacking a disk; fruit a tardily dehiscent, coriaceous capsule; indigenous species. 1. *Erythrospermum*

Sepals and petals in separate whorls and readily distinguishable from each other.

Petals lacking a scalelike appendage within the base; sepals, petals, and stamens more or less perigynous; stamens as many as petals and opposite them or (as in our species) in fascicles opposite petals and alternating with disk glands; ovary semisuperior; fruit a capsule, dehiscent or not; indigenous species. 2. *Homalium*

Petals with a scalelike appendage within the base; fruit a berry, often thick-walled; cultivated only. 3. *Hydnocarpus*

Petals lacking.

Sepals and stamens hypogynous; flowers (in all our species) unisexual, with a disk; fruit a drupe or berry.

Styles 2 or more, free or proximally connate (rarely connate essentially to apices); ovary incompletely 2-10-locular by false, imperfect septa.

Fruit an indehiscent drupe, globose when fresh, irregularly shaped when dry, the pyrenes usually twice as many as styles, with hard endocarps, the seeds 1 or 2 per pyrene; inflorescences usually short-racemose; our indigenous species without spines. 4. *Flacourtia*

Fruit a pulpy berry; inflorescences fasciculate (♂) or with solitary flowers (♀); plants with axillary spines; cultivated only. 5. *Dovyalis*

Styles lacking or short and cylindric, the stigmas 2-4 or single and 2-4-lobed; ovary unilocular, with 2-4 (-6) parietal placentas; fruit a dry berry, globose to elliptic both fresh and dry, usually few-seeded; inflorescences short-racemose; our species without spines, their leaf blades with 1 or 2 pairs of round marginal glands at base or at apex of petiole; indigenous species. 6. *Xylosma*

Sepals and stamens more or less perigynous; flowers ♂; stamens 5-12, uniseriate, alternating with staminodes; fruit a capsule; pedicels articulated; leaf blades usually pellucid-glandular or -lineolate; indigenous species. 7. *Casearia*

I. ERYTHROSPERMUM Lam. Tabl. Encycl. Méth. Bot. 2: 407. t. 274. 1792. Nom. cons.

Trees or shrubs, estipulate; leaves alternate, the blades entire to undulate-crenate, pinnate-nerved; inflorescences axillary or subterminal, racemose or paniculate, the pedicels articulate at base, minutely bibracteolate; flowers ♂ or rarely polygamous; perianth segments 7-13, spirally arranged, imbricate, reflexed after anthesis and caducous, the inner ones gradually smaller and somewhat petal-like; stamens 5-15 (-16), hypogynous, the filaments glabrous, the anthers reflexed in bud, dorsifixed, oblong or lanceolate, sagittate at base; ovary unilocular, with 3 or 4 parietal placentas, the ovules several-many, the style short, the stigmas entire or lobed; fruit a coriaceous, subglobose-ovoid, verrucose, tardily dehiscent, 3- or 4-valved capsule, the seeds 1-6, irregular in shape from mutual pressure, arillate.

TYPE SPECIES: *Erythrospermum pyrifolium* Lam. Typ. cons.

DISTRIBUTION: Madagascar to southeastern Asia and eastward through Malesia to Fiji and Samoa, with five-seven species. A single species in Fiji and Samoa terminates the generic range to the east.



FIGURE 164. *Erythrospermum acuminatissimum*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$; B, distal portion of branchlet, with foliage and infructescences, $\times 1/3$. A from Smith 1599, B from Smith 6340.

1. *Erythrospermum acuminatissimum* (A. Gray) A. C. Sm. in Bishop Mus. Bull. **141**: 99. 1936; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 145. fig. 44. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 62. 1972.

FIGURES 164, 165.

Casearia acuminatissima A. Gray, Bot. U. S. Expl. Exped. **1**: 80. 1854; Seem. Viti, 432. 1862, Fl. Vit. 98. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 174. 1890.

Erythrospermum polyandrum Oliver in Hook. Icon. Pl. **14**: 24. pl. 1333. 1881; Christophersen in Bishop Mus. Bull. **128**: 151. 1935.

A shrub or tree, often slender, freely branched, or spreading, 1.5–15 m. high and sometimes with a trunk to 30 cm. (or more?) in diameter, often locally abundant at elevations from near sea level to 700 m. in dense, dry, open, or secondary forest or in thickets. The fragrant flowers have white or often pink-tinged sepals and petals, white filaments, yellow or greenish anthers, and a greenish white ovary; the fruit turns from green to dark red or dull purple and is as much as 2 cm. in diameter, and the seeds have a red aril. Flowers and fruits are seen in all months.

TIPIFICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (us 47729 HOLOTYPE; ISOTYPE at GH), collected in 1840 in Mbua Province, Vanua Levu. For *Erythrospermum polyandrum* there are three Samoan specimens in the type cover at K: *Powell 334*, *Powell s. n.*, and *Whitmee s. n.*; I have not attempted to indicate a lectotype. While this reduction seems warranted, it may be noted that many of the Fijian specimens have only five stamens, but in some cases these vary upward toward twelve or 15, numbers more often found in Samoan material.

DISTRIBUTION: Fiji and Samoa. In Fiji this species is one of the most frequent small trees at low and medium elevation. About 100 Fijian collections are at hand, and the plant may be anticipated on most islands.

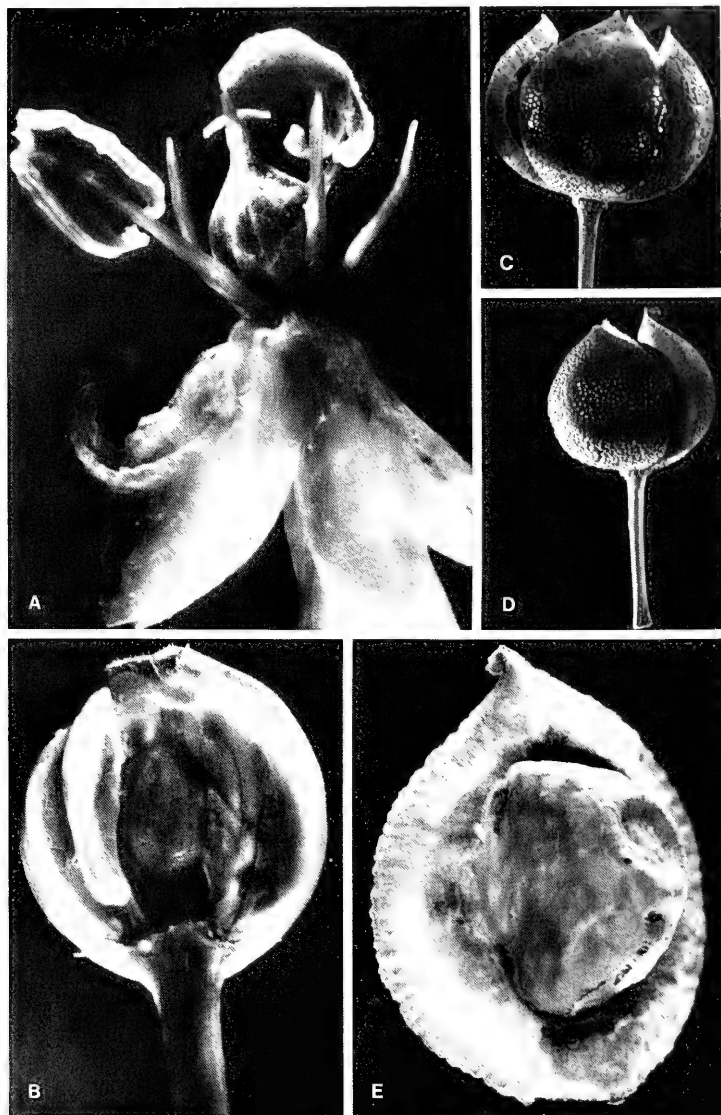
LOCAL NAMES AND USE: The usual Fijian names are *mavinda*, *nggetata*, and *ndulewa*; also recorded are *ndakariwai* (Wayu) and *kauloa* (Mbua). The wood is useful as a firewood, as which it can be used even when green.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Along Wailevu Creek, *St. John 18073*. VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *DA 12642* (*Melville et al. 7015*); Mbelo, near Vatukarasa, *Tabualewa 13039*. SERUA: Nathengathenga Creek, upper Navua River, *DA L. 13464* (*DF 1202*); inland from Namboutini, *DA 14259*; Tawavulu Creek, north of Ngaloa, *Webster & Hildreth 14351*; hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith 9018*. NAMOSI: Mt. Vakarongasiu, *DA 14594*; Nakavu, on Navua River, *Parks 20371*; Nambukavesi Creek, *DA 11585*. NAITASIRE: Track to Mendrausuthu Range, *DA 15024*; Viria, *DA 197*; Tamavua-Sawani road, *Setchell & Parks 15101*; Prince's Road, *Vaughan 3330*. TAILEVU: Naingani Island, *DA 3432*; Waindalithi River, *DA 7660*. REWA: Na Vasi, *Horne 1052*; Mt. Korombamba, *Parks 20340*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 151*. OVALAU: Lovoni Valley, *Horne 150*. VANUA LEVU: MBUA: Vicinity of Nasarowangga, *DA 14313*; upper Ndama River Valley, *Smith 1599*; Mt. Seatura, *DA 14898*. MATHUATA: Mbasakalave, *Stauffer & Kuruvoli 5845*; Mt. Numbuloa, east of Lambasa, *Smith 6340*; Wainikoro River, *Greenwood 665A*. THAKAUNDRIVE: Hills south of Natewa, Natewa Peninsula, *Smith 1961*. TAVEUNI: Vicinity of Somosomo, *Gillespie 4776*; vicinity of Wairiki, *Gillespie 4667*. VANUA MBALAVU: Northern limestone section, *Smith 1470*. KAMBARA: On limestone formation, *Smith 1254*.

Erythrospermum acuminatissimum differs from the related Malesian *E. candidum* (Becc.) Becc. in having its sepals and petals somewhat larger, its pedicels at anthesis and in fruit much longer, and its filaments and anthers substantially longer.

2. *HOMALIUM* Jacq. Enum. Syst. Pl. Carib. 5. 1760; Seem. Fl. Vit. 95. 1866; A. C. Sm. in *Sargentia* **1**: 58. 1942.

Trees or shrubs, the stipules minute and caducous or lacking; leaves alternate, the blades pinnate-nerved, entire to crenate-serrate, the crenations often with a single gland on lower surface; inflorescences axillary, slender, racemose (or subspicate) or paniculate, many-flowered; flowers ♂, solitary or fasciculate on rachis, subsessile or



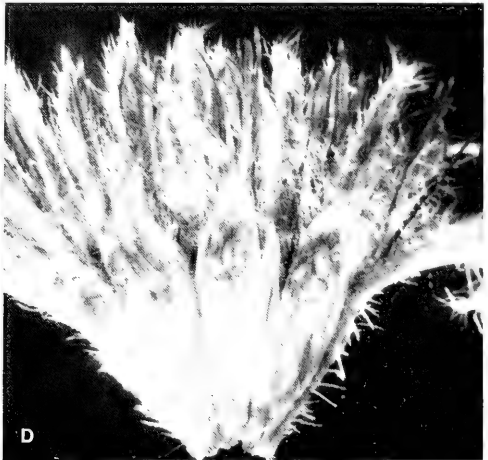
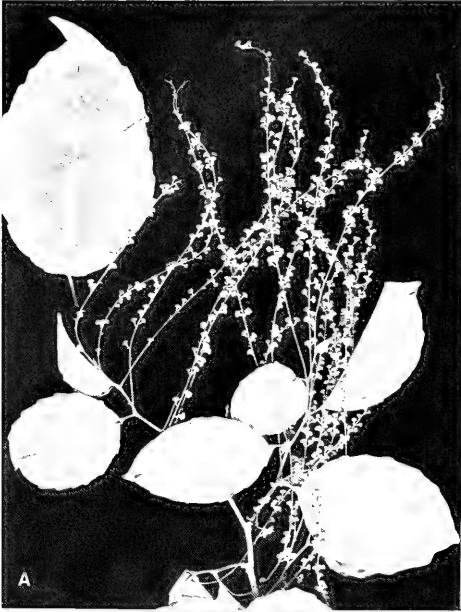
pedicellate, each subtended by a small bract (sterile flowers sometimes present, these larger than fertile flowers but lacking a hypanthium, with a sterile superior ovary and small, sterile stamens); calyx proximally connate with ovary to form a hypanthium, this turbinate, often costate, tapering proximally and there articulate with pedicel, the free lobes (sepals) 4-12 (-13), linear or lanceolate to obovate-spathulate, persistent, often accrescent and winglike on fruit; petals as many as sepals and alternating with them, often slightly smaller, similar in shape and texture, persistent and often accrescent; stamens in our species in fascicles of 3 (2-4) borne at apex of hypanthium opposite petals (elsewhere sometimes solitary or in fascicles of 2-8, rarely epipetalous or irregularly arranged), the filaments filiform, the anthers small, subglobose, didymous, extrorse; disk glands in our species subglobose, alternating with stamen fascicles (elsewhere rarely fused); ovary semisuperior or nearly inferior, unilocular, often pilose on inner surface, with 2-6 (-8) parietal placentas (3-5 in our species), the ovules (1-) 3-7 borne distally on each placenta, the styles 2-5 (-7) (3-5 in our species), free or connate toward base, the stigmas small or punctiform; fruit a small 2-8-valved capsule, sometimes indehiscent, the seeds 1-few, small.

TYPE SPECIES: *Homalium racemosum* Jacq.

DISTRIBUTION: Pantropical and subtropical, with more than 200 species. In the Pacific the genus extends eastward to Pitcairn Island (cf. St. John in Mitt. Deutsch. Dendrol. Ges. 69: 35-47. 1977). Four indigenous (and apparently endemic) species occur in Fiji.

In his discussion of *Homalium* in New Caledonia, Sleumer (in *Blumea* 22: 141. 1974) notes the difficulties of delimiting species, due to the frequent accrescence of floral parts and the variation in indument. The Fijian species have few dependable differentiating characters; all have the young parts puberulent or minutely pilose, the branchlets and leaves very early glabrate, and the leaf blades coriaceous and with a conspicuous, raised reticulum of veinlets. The inflorescences are all racemose or paniculate with 2-4 racemiform branches. The inflorescence indument is conspicuous on all parts and offers no useful characters. The bracts are uniformly 1-2 (-3) mm. long and the pedicels 0.5-2 mm. long (sometimes to 3.5 mm. in *H. laurifolium*). The number of sepals and petals is (6-) 7-10 each in all our species (rarely as many as 13 in *H. vitiense*), and the stamens are in fascicles of 3 (rarely 2 or 4) opposite each petal. These listed characters are apparently of little consequence in delimiting species. The few dependable characters, in our species, seem to refer to the proportionate length of perianth and stamens at anthesis, the size, texture, and direction (flaccid or spreading) of perianth segments in fruit (although this is known for only two of our species), and within very broad limits the size and margins of leaf blades.

FIGURE 165. *Erythrospermum acuminatissimum*; A, mature flower with most inner perianth segments fallen but some partially destroyed ones remaining, 5 filaments (2 with anthers), and gynoecium with 3-parted style, $\times 10$; B, mature flower bud with 6 perianth segments removed, showing reflexed anthers, gynoecium, and inner perianth segments, $\times 10$; C, mature 4-valved fruit, $\times 2$; D, mature 3-valved fruit, $\times 2$; E, fruit valve with seed attached to placenta, $\times 6$. A & B from *Smith 1254*. C-E from *Parks 20371*.



KEY TO SPECIES

Stamens and styles subequal to perianth segments at anthesis or exceeding them in length; disk glands glabrous or sparsely pilose.

Flowers comparatively small, the sepals and petals at anthesis 1-2.5 mm. long, the filaments 1.5-3 mm. long; disk glands essentially glabrous; racemes or racemiform branches of panicles 6-20 (-25) cm. long; petioles 3-10 mm. long; leaf blades ovate to lanceolate-elliptic, 3-11 × 2-6 cm., obtusely cuspidate or obtusely short-acuminate at apex, entire to inconspicuously or obviously crenate at margin; fruits with perianth segments lengthening to 3-4 mm. but remaining flaccid and suberect, not spreading or winglike. 1. *H. vitiense*

Flowers larger, the sepals and petals at anthesis 3.5-4.5 mm. long, the filaments 3-4 mm. long; disk glands sparsely pilose; racemes or racemiform branches of panicles 6-9 cm. long; petioles 6-13 mm. long; leaf blades broadly elliptic or ovate, 5-11 × 4-7 cm., rounded or obtuse at apex, conspicuously to slightly undulate-crenate at margin; fruits not known. 2. *H. pallidum*

Stamens and styles at anthesis about half as long as perianth segments; disk glands copiously pilose.

Flowers with perianth segments 2.5-4 mm. long at anthesis, the filaments 1-2 mm. long; racemes or racemiform branches of panicles 10-18 cm. long; petioles 4-10 mm. long; leaf blades elliptic-ovate to ovate-lanceolate, 4.5-9.5 × 3.5-7 cm., rounded to obtusely short-acuminate at apex, entire to sparsely crenulate at margin; fruits not known. 3. *H. nitens*

Flowers with perianth segments 3-5 mm. long at anthesis, the filaments 0.7-1.5 mm. long (later elongating but remaining shorter than the accrescent perianth segments); racemes or racemiform branches of panicles 16-30 cm. long; petioles 10-18 mm. long; leaf blades elliptic-ovate, (6-) 8-15 × (4-) 6-9 cm., obtusely cuspidate to short-acuminate at apex, conspicuously undulate-crenate at margin; fruits with perianth segments lengthening to 7 mm. and becoming rigid, spreading, and winglike, the filaments and styles elongating after anthesis to 4 mm. and 2.5 mm. respectively but remaining obviously shorter than sepals and petals. 4. *H. laurifolium*

1. *Homalium vitiense* Benth. in J. Linn. Soc. Bot. 4: 36. 1859; Seem. Fl. Vit. 95. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; A. C. Sm. in Sargentia 1: 59. 1942; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 13: 51. 1942; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 147. 1972. FIGURE 166.

Homalium gillespiei A. C. Sm. in Sargentia 1: 59. 1942; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 147. 1972.

A shrub or slender tree 2-14 m. high, rarely indicated as a forest tree to 23 m., occurring at elevations from near sea level to 950 m. in wet or dry forest or on its edges, in secondary forest, or in open country. The fragrant flowers have white or cream-colored perianth segments and filaments, and may be found throughout the year together with fruits, which are scarcely distinguishable from flowers.

TYPEFICTION AND NOMENCLATURE: The type is *Milne 187* (K HOLOTYPE), collected on Viti Levu. The holotype consists of two sheets which indicate that it was obtained in the mountains of Viti Levu in December, 1855. I think it likely that the date is incorrect, as apparently Milne collected in the mountainous parts of Viti Levu only when he and Macdonald (1857; cf. Vol. I of this *Flora*, pp. 43, 86) ascended the Waindina River in 1856. They were based in Namosi Village for a few days in August and September, and it seems possible that the specimens from Mt. Voma cited below are from the general area of the type locality. *Homalium gillespiei* is based on *Gillespie 3394.6* (GH HOLOTYPE; ISOTYPES AT BISH, K, NY), collected Dec. 27, 1927, near Nasuka-

FIGURE 166. *Homalium vitiense*; A, distal portion of branchlet, with foliage and inflorescences, × 1/2; B, flower at anthesis, with stamens and styles exceeding perianth segments in length, × 10; C, central portion of flower, showing upper part of ovary (o), styles (s), filaments (f), anther (a), and disk glands (g), × 30; D, opened flower, showing ovules on distal portions of placentas, styles, stamens (most anthers fallen), and perianth segments, × 20. A from *DA 11581* (detached leaf from *Smith 831*), B from *DA 11685*, C from *Degener 14969*, D from *Gillespie 3394.6*.

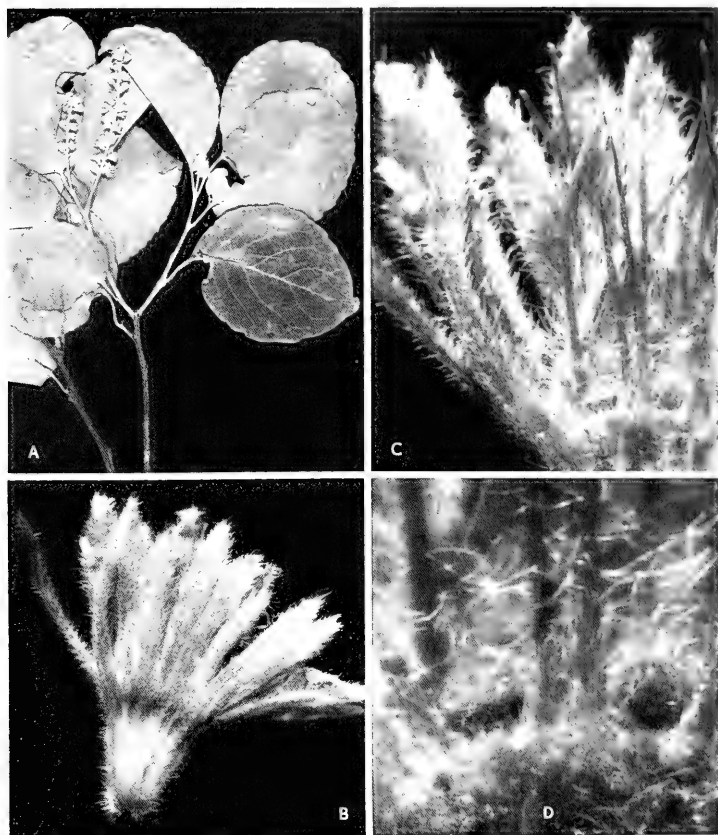


FIGURE 167. *Homalium pallidum*, from Smith 1221; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/3$; B, flower at anthesis, with stamens about as long as perianth segments, $\times 7$; C, flower with some perianth segments removed, showing disk glands, filaments, styles, and perianth segments, $\times 15$; D, 2 disk glands and a fascicle of filaments, $\times 40$.

mai, on Naiava Creek, headwaters of Lawaki River, a tributary of the Wainimbuka River, Ra Province, Viti Levu. Examination of the abundant material of *H. vitiense* now available indicates that *H. gillespiei* falls within its reasonable limits.

DISTRIBUTION: Endemic to Fiji and known from several islands; this is the only frequently collected Fijian *Homalium*. Thirty-three collections have been examined.

LOCAL NAMES AND USE: The usual name on Viti Levu is *molatha*, or sometimes *molatha vula* or *molatha ndamu*; *lera* has been recorded from Kandavu, and *tura* from Waya, where it is reported to have a medicinal use for relapses.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Nakawa Gulch, west of Mbatinaremba, *St. John 18146*. MAMANUTHAS: NGGALITO Island, Malolo Group, *O. & I. Degener 32214*. VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1064*; Vatia, west of Tavua, *Degener 14969*; South Ridge, Nandarivatu, *DA 14432 (DF 1083)*. SERUA: Vicinity of Namboutini, *DA L.22315 (DF 107)*. NAMOSI: Mt. Voma, *DA 11681, 11685*. NAITASIRI: Waimanu River above Sawani, *DA 972*; Tholo-i-suva, *DA 11581*; vicinity of Tamavua, *Gillespie 2018*. REWA: Department of Agriculture compound, cultivated from plant originally taken from Mt. Korombamba, *DA 11567*. KANDAVU: *DA 11948 (DF 28, Watkins 697)*. VANUA LEVU: MBUA: Mt. Seatura, *DA 15164*. MATHUATA: Nasealevu, Sasa Tikina, *DA 15250*; islands off coast, *Greenwood 679*. THAKAUNDOVE: Hills west of Mbutha Bay, Natewa Peninsula, *Smith 831*. MOALA: *Tothill 9*.

2. *Homalium pallidum* A. C. Sm. in *Sargentia* 1: 60. 1942; J. W. Parham, *Pl. Fiji Isl.* 104. 1964, ed. 2. 147. 1972. FIGURE 167.

A tree 9–15 m. high, growing in forest on shallow soil over limestone at elevations from near sea level to 125 m. The perianth segments are white; the only flowering specimen was noted in February.

TIPIFICATION: The type is *Smith 1221* (NY HOLOTYPE; many ISOTYPES), collected Feb. 26, 1934, in forest on limestone formation on Fulanga.

DISTRIBUTION: Endemic to Fiji and thus far known from three different islands of the Lau Group.

LOCAL NAMES AND USE: Recorded names are *mbolovatu* (Fulanga), *seasea ndamu* (Vanua Mbalavu), and *vesivesiwai* (Lakemba). The wood is hard and is locally considered useful for house posts and frames.

AVAILABLE COLLECTIONS: VANUA MBALAVU: Ndalithoni, *DA*, Sept. 11, 1942 (coll. *A. R. Waqatabu*). LAKEMBA: Near airport, *Garnock-Jones 874*. Both cited collections are sterile but agree well in foliage with the type.

Homalium pallidum seems more closely related to *H. aneityense* Guillaumin (in *J. Arnold Arb.* 12: 262. 1931) than to *H. vitiense*, but it differs from the New Hebridean species in its stouter and somewhat shorter petioles, usually more obviously crenate leaf blades, smaller perianth segments, and fewer stamens (uniformly three per fascicle; although Guillaumin notes that his species has three–five stamens per fascicle, dissections indicate that five is the usual number).

The recently described *Homalium tongaense* and *H. whitmeeanum* of Tonga and Samoa respectively (St. John in *Mitt. Deutsch. Dendrol. Ges.* 69: 43–46. fig. 5, 6. 1977) are related to *H. pallidum*. On the basis of the few specimens now available from Lau, Tonga, and Samoa, the three species appear to be endemic to their respective areas.

3. *Homalium nitens* Turrill in J. Linn. Soc. Bot. **43**: 23. 1915; A. C. Sm. in *Sargentina* **1**: 59. 1942; J. W. Parham, *Pl. Fiji Isl.* 103. 1964, ed. 2. 147. 1972. FIGURE 168.

A shrub or slender or spreading tree 2-8 m. high, occurring in forest and thickets from near sea level to an elevation of 830 m. The perianth segments are white, flowers having been obtained between January and May.

TYPIIFICATION: The type is *in Thurn 132* (K HOLOTYPE; ISOTYPES at BM, NY), collected March 6, 1906, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

LOCAL NAMES AND USES: Recorded Fijian names are *molatha* (Mba), *tarotaro* (Serua), and *molatha ndamu* (Naitasiri). Near Nandarivatu the strong stems are used as digging forks and an infusion of bark is reported to be used as a tonic; in Serua the inflorescences are said to be used for necklaces.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Tohill 182*, *Reay 18*. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9315*; vicinity of Ngaloa, *Degener 15087*. NAMOSI: Nambukavesi Creek, *DA 11586*. NAITASIRI: Tholo-i-suva, *DA 1483*. NAITASIRI OF REWA: "Vicinity of Suva," *Meebold 8175*. FIJI without further locality, *DA 3219*.

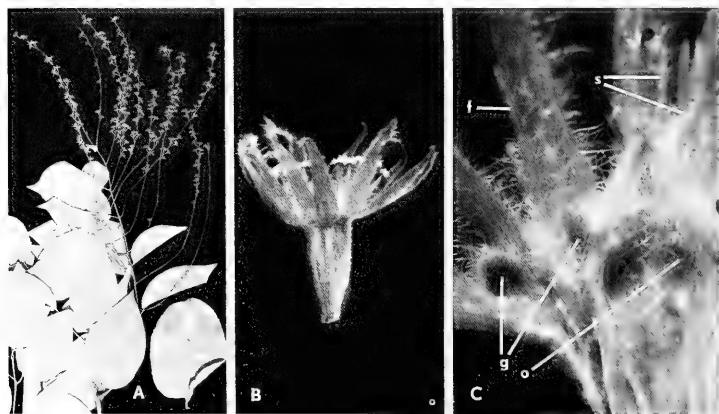


FIGURE 168. *Homalium nitens*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$; B, flower at anthesis, with stamens shorter than perianth segments, $\times 7$; C, section through flower, showing an ovule (o), styles (s), a filament (f), and disk glands (g), $\times 20$. A from *DA 11586* (detached leaf from *Meebold 8175*), B from *DA 11586*, C from *Degener 15087*.

In 1942 I cited *Meebold 8175* as *Homalium laurifolium*; more abundant material of both species now being at hand, I refer the Meebold collection to *H. nitens*. The two species, which are partly sympatric, are closely related, but in general *H. laurifolium* is the more robust, with usually larger and more obviously crenate leaf blades, longer inflorescences, and slightly larger flowers. The tendency of perianth segments to become accrescent, rigid, and winglike after anthesis is striking in *H. laurifolium*; thus far specimens of *H. nitens* in such a condition have not been available.

4. *Homalium laurifolium* A. C. Sm. in *Sargentia* 1: 59. 1942; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 147. 1972. FIGURE 169.

A sometimes slender tree 3–20 m. high, found at elevations from near sea level to 250 m. in dense or open forest. The perianth segments, filaments, and styles are white, but after anthesis the inflorescences, pedicels, and hypanthium become dull red. Flowers and young fruits have been obtained between October and May.

TIPIFICATION: The type is *Degener 15307* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected May 18, 1941, at Naruku, vicinity of Mbalo, near Vatukarasa, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from southern and eastern Viti Levu.

LOCAL NAMES AND USES: Recorded Fijian names are *sakisakivuto* (Nandronga & Navosa), *ndatha*, and *molatha* (Tailevu). Degener noted that a cold water extract from the wood is used medicinally, and that the inflorescences are used for necklaces.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Vicinity of Namboutini, *DF 992* (possibly mixed label); hills east of Navua River near Nukusere, *Smith 9097*. NAMOSI: Wainambua Creek (south of Mt. Naitarandamu), *DA 14213*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7198*; Waisomo Bridge, Nayavu (near Sote, Waindalithi River), *DA 1002*.

3. *Hydnocarpus* Gaertn. *Fruct. Sem. Pl.* 1: 288. 1788.

Dioecious or monoecious trees or shrubs, the stipules soon caducous; leaves alternate, the petioles distally thickened, the blades pinnate-nerved, entire to serrate; inflorescences axillary, cymose, the ♂ sometimes paniculate and arising from trunk or branches, the ♀ often with solitary flowers or fasciculate; flowers with 4 or 5 (3–11) free or basally connate, imbricate sepals, the petals 4 or 5 (–15), with a pilose, scalelike appendage within base; ♂ flowers with 5–many stamens, the filaments free, the anthers oblong to reniform, with the connective dilated; ♀ flowers with or without 5–many staminodes, the ovary unilocular, with 3–6 parietal placentas, each with 2 or 3 ovules, the stigma sessile, with 3–6 radial, shortly lobed branches; fruit a berry, usually globose or ovoid, indehiscent, the pericarp thick and hard to thin and fragile, the seeds few–many, arillate, embedded in pulp.

TYPE SPECIES: *Hydnocarpus venenata* Gaertn.

DISTRIBUTION: Southeastern Asia and Malesia, with about 40 species. The seeds of several species of *Hydnocarpus* yield an oil that has long been used to cure wounds and eczema. Experiments in using *chaulmoogra* oil, usually from *H. kurzii* (King) Warb., as a remedy for leprosy have led to the introduction of various species to other tropical areas. One species is recorded in cultivation in Fiji.

USEFUL TREATMENT OF GENUS: Sleumer, H. *Monographie der Gattung Hydnocarpus* Gaertn. *Bot. Jahrb.* 69: 1–94. 1938.

Although *Hydnocarpus* has often been treated as a feminine generic name (e. g. Sleumer, 1938, cited above, and in *Fl. Males. I.* 5: 14–33. 1954), the ICBN, *Rec. 75A.2*, recommends masculine usage for compounds ending in *-carpus*.

1. *Hydnocarpus wightianus* Bl. Rumphia 4: 22, as *H. wightiana*. 1849; J. W. Parham, Pl. Fiji Isl. 104, as *H. wightiana*. 1964, ed. 2. 148. 1972.

Munnicksia laurifolia Dennst. Schlüs. Hort. Malabar. 13, 27, nom. nud. 1818.

Hydnocarpus laurifolia Sleumer in Bot. Jahrb. 69: 33, nom. illeg. 1938.

A large tree where indigenous, presumably introduced experimentally into other tropical areas.

TYPEIFICATION AND NOMENCLATURE: Dennstedt based his *Munnicksia laurifolia* on Rheede, Hort. Ind. Malabar. 1: t. 36. 1678. Blume's species was based on Wight, Ill. Ind. Bot. t. 16. 1831. Although Sleumer in 1938 reduced *Hydnocarpus wightiana* to *H. laurifolia* (comb. nov.), Dennstedt's new genera in his 1818 work are considered nomina nuda and the specific epithets associated with them therefore invalidly published (cf. H. Manitz in Taxon 17: 496-501. 1968; Stafleu and Cowan, Tax. Lit. ed. 2. 1: 622. 1976). It would seem, therefore, that the present species should continue to be known as *H. wightianus*.

DISTRIBUTION: Southwestern India, and now cultivated elsewhere.

LOCAL NAME AND USE: *Chaulmoogra*. Parham (1972, cited above) states that the species was introduced into Fiji in 1932 and was established at Nasinu and Singatoka (Viti Levu) and Makongai Island. The two vouchers cited below (only at SUVA) do not indicate whether plants are still in cultivation. The oil from the fruit was once used in the treatment of leprosy, and presumably it was introduced for experimental purposes.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Singatoka Experimental Farm, DA 5961. TAILEVU: Nalovo, DA 1228.

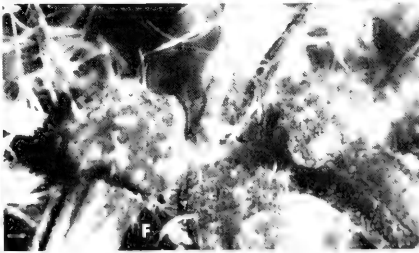
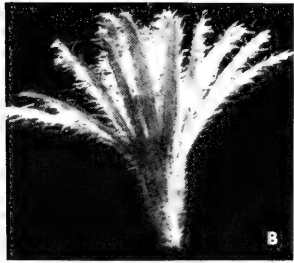
I cannot verify the specific identity of the *Hydnocarpus* that was introduced into Fiji in 1932 under the name *H. wightiana*, although this may be correct. More commonly introduced into tropical areas such as Hawaii is *H. kurzii* (King) Warb., of Burma, Siam, and Assam, which has been grown in the Singapore Botanic Gardens since 1921 (Burkill, Dict. Econ. Prod. Malay Penins. ed. 2. 1228. 1966). Because Singapore is a likely source of the Fijian introduction, it is possible that our material should be referred to *H. kurzii*.

4. FLACOURTIA Commerson ex L'Hér. Stirp. Nov. 59. 1786.

Thacombauia Seem. Fl. Vit. 426. 1873.

Usually dioecious (sometimes hermaphrodite, rarely polygamous) trees or shrubs, stipulate, sometimes spiny (but not in our indigenous species); leaves alternate (spirally arranged), short-petiolate, the blades pinnate-nerved, often crenate or dentate; inflorescences axillary or subterminal, sometimes congested on branchlets below leaves, usually short-racemose; flowers small, unisexual (rarely ♀, but not in our species), the perianth segments (sepals) 4-6 (3-7), slightly connate at base, imbricate, subsistent, the petals none; ♂ flowers with the disk extrastaminal, usually composed of free glands in pairs opposite each sepal, the stamens 15-numerous, free,

FIGURE 169. *Homalium laurifolium*; A, distal portion of branchlet, with foliage and inflorescences, × 1/4; B, flower at anthesis, × 7; C, flower with several perianth segments removed, showing stamens and styles shorter than perianth segments, × 15; D, inflorescences after anthesis, × 1/3; E, flower past anthesis, with rigid, winglike perianth segments, × 7; F, 2 disk glands opposite sepals and a fascicle of filaments opposite a petal, × 35. A & D from Smith 9097, B & C from Degener 15307, E & F from DA 14213.



the anthers ellipsoid, extrorse, dorsifixed and more or less versatile, a rudimentary gynoeceum lacking; ♀ flowers usually with the disk entire or crenulate, without staminodes or (in our indigenous species) these commonly present within the disk, filiform or clavate, often persistent in fruit, the ovary incompletely 2-10-locular by false, imperfect septa, the ovules 2 per locule, inserted on the septa, the styles as many as locules, free or proximally connate (rarely connate essentially to apices), the stigmas emarginate or shortly bilobed; fruit an indehiscent drupe, berrylike, fleshy, with pyrenes usually twice as many as styles, usually drying obovoid, rugose, and with the pyrenes superposed, the seeds 1 or 2 per pyrene, obovoid or oblong, the testa thin-crustaceous.

TYPE SPECIES: *Flacourtia ramontchi* L'Hér. (= *Flacourtia indica* (Burm. f.) Merr.). The type species of *Thacombauia* is *T. vitiensis* Seem. (= *Flacourtia vitiensis* (Seem.) A. C. Sm., q. v.).

DISTRIBUTION: Tropical and subtropical Africa to southeastern Asia and eastward in the Pacific to Fiji, with about 25 species. Several species have edible fruits and are cultivated and sometimes naturalized elsewhere in tropical areas. Five endemic species terminate the generic range in Fiji, where two or three cultivated species are also recorded. Van Balgooy (in *Blumea* Suppl. 6: 172. 1971) indicates that *Flacourtia* is indigenous in Samoa and Tonga, but I believe that such records refer to naturalized species.

KEY TO SPECIES

- Leaf blades persistently soft-pilose beneath with spreading hairs 0.2-0.6 mm. long.
 Petioles 2-10 mm. long, comparatively slender, 1-1.5 mm. in diameter; leaf blades not exceeding 15 × 7 cm. (or juvenile ones slightly larger).
 Branchlets and petioles subsersistently pilose, the petioles 2-3 mm. long, the leaf blades lanceolate, (5-) 8-15 × (1.5-) 2.5-5.5 cm., narrowly but obviously cordate at base, conspicuously crenate at margin nearly to base. 1. *F. mollipila*
 Branchlets and petioles glabrous, the petioles 5-10 mm. long, the leaf blades ovate-elliptic to ovate-lanceolate, 11-15 × 4.5-7 cm. (juvenile blades up to 18 × 10 cm.), obtuse to rounded at base, entire or obscurely undulate at margin. 2. *F. amalotricha*
 Petioles robust, 9-25 mm. long, 2-5 mm. in diameter; leaf blades ovate (infrequently ovate-lanceolate), (11-) 15-42 × (4.5-) 8-22 cm., rounded to broadly but shallowly cordate at base. 3. *F. vitiensis*
 Leaf blades glabrous beneath (or in *F. rukam*, cultivated, sometimes puberulent on costa and secondaries).
 Styles (in both flower and fruit) entirely free or united at base into a short column and distally spreading.
 Leaves comparatively large and robust, the petioles 9-25 mm. long and 2-5 mm. in diameter, the blades coriaceous or subcoriaceous, ovate, ovate-elliptic, or infrequently ovate-lanceolate, (11-) 15-42 × (4.5-) 8-22 cm., rounded to broadly but shallowly cordate at base; mature fruits when dry 8-12 × 6-10 mm., the styles in fruit united at base into a short, stout column, spreading in distal portions. 3. *F. vitiensis*
 Leaves less robust, the petioles 3-20 mm. long and 1-2 mm. in diameter, the blades chartaceous or papryraceous, (5-) 7-26 × (1.5-) 3-9.5 cm.; styles often free from one another and borne in a circle on apex of fruit, sometimes radiating from a common base, sometimes essentially lacking, the stigmas then subsessile on fruit apex.
 Plants indigenous in Fiji; branchlets and leaves glabrous, the blades crenulate to entire at margin; mature fruits when dry not exceeding 10 mm. in diameter.
 Leaf blades prevalently ovate-lanceolate, entire or inconspicuously undulate-crenulate at margin; ♂ flowers at anthesis comparatively small (pedicels 1.5-3 mm. long above articulation; sepals 1-1.5 × 1.4-1.8 mm.; filaments 1-2 mm. long). 4. *F. subintegra*
 Leaf blades prevalently ovate, conspicuously crenulate at margin; ♂ flowers at anthesis larger (pedicels 3-7 mm. long above articulation; sepals usually 1.5-2.5 mm. long and broad; filaments 2-3 mm. long). 5. *F. degeneri*
 Plants in cultivation only in Fiji; branchlets often short-pilose distally; leaves with the petioles, costa, and secondaries sometimes puberulent, the blades obviously or sometimes coarsely crenate at margin; mature fruits when dry (12-) 20-25 mm. in diameter. 6. *F. rukam*

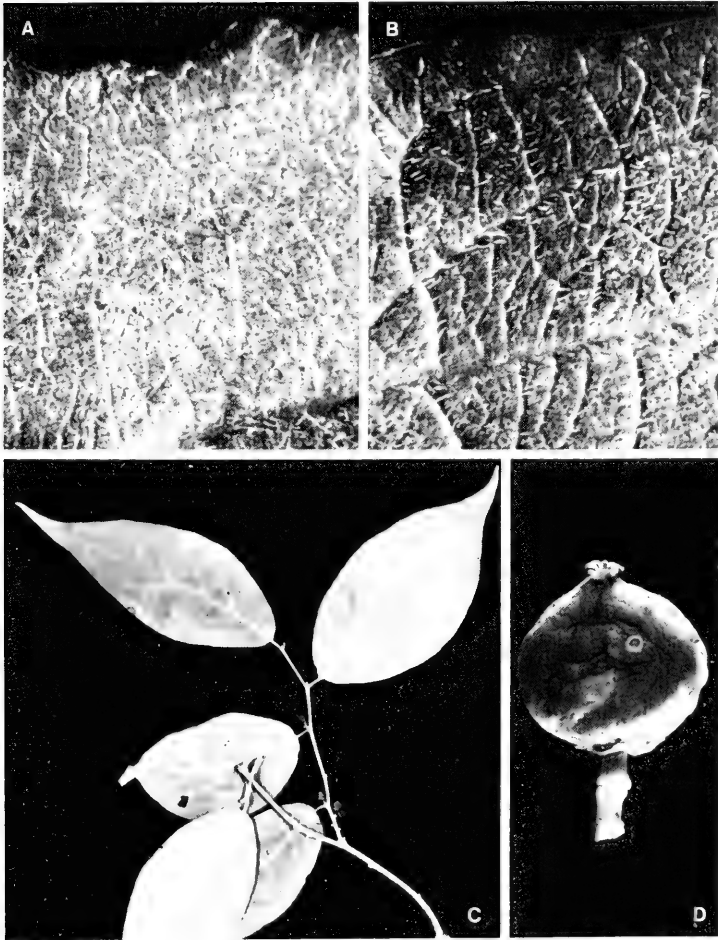


FIGURE 170. A, *Flacourtia mollipila*, portion of lower surface of leaf blade, $\times 10$, from Gillespie 4588. B-D, *Flacourtia amalotricha*, from Smith 7181; B, portion of lower surface of leaf blade, $\times 10$; C, distal portion of branchlet, with foliage and young fruits, $\times 1/3$; D, maturing fruit, $\times 4$.

Styles (in both flower and fruit) connate into a distinct column, the stigmas very short and spreading, somewhat appanate; petioles 5-8 mm. long, slender; leaf blades membranaceous to thin-chartaceous, glabrous, ovate-oblong to ovate-lanceolate, (5-) 7-11 × (2-) 3-4 (-5.5) cm.; cultivated species. *F. jangomas*

1. *Flacourtia mollipila* Sleumer in Repert. Sp. Nov. **45**: 12. 1938; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 147. 1972. FIGURE 170A.

An apparently rare shrub growing at an elevation of about 20 m. on limestone rocks; flowers were obtained in February.

TIPIFICATION: The type is *Gillespie 4588* (BISH HOLOTYPE and 2 ISOTYPES), collected Feb. 6, 1928, in a quarry near Lami, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and still known only from the type collection.

The first two species here treated, both inadequately known, are very distinct from other Fijian species of *Flacourtia* in having their leaf blades persistently soft-pilose beneath; they also differ sharply from one another in the shape, base, and margins of leaf blades. The present species is known only from a collection with ♂ flowers, while *F. amalotricha* is known only in fruiting condition.

2. *Flacourtia amalotricha* A. C. Sm. in Pacific Sci. **25**: 493. 1971. FIGURE 170B-D.

The rare *Flacourtia amalotricha* is known only as a slender, freely branching tree 4-6 m. high, found in dense forest along a stream at elevations of 100-200 m. The developing ovary and stigmas are greenish white and the young fruit, seen in April, is green.

TIPIFICATION: The type is *Smith 7181* (US 2190157 HOLOTYPE; many ISOTYPES), collected April 22, 1953, in hills east of Wainimbuka River, vicinity of Ndakuivuna, Tailevu Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu. The second collection, cited below, is presumably from southeastern Viti Levu.

AVAILABLE COLLECTION: VITI LEVU without further locality, *MacDaniels 12* (K).

3. *Flacourtia vitiensis* (Seem.) A. C. Sm. in J. Arnold Arb. **26**: 102. 1945; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 147. *fig. 45*. 1972. FIGURE 171A.

Thacombauia vitiensis Seem. Fl. Vit. 426. *t. 100*. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 126. 1890.

Flacourtia ovata Gillespie in Bishop Mus. Bull. **83**: 27. *fig. 34* (excl. *a, f, g*). 1931; A. C. Sm. in Sargentina **1**: 61. 1942.

A tree 2-7 m. high, often few-branched, or a shrub, occurring at elevations from near sea level to about 700 m. in dense forest or on its edges or in secondary forest. The sepals and filaments are greenish yellow. Flowers and fruits have been observed between March and October.

TIPIFICATION AND NOMENCLATURE: The type of *Thacombauia vitiensis* is *Storck s. n.* (K HOLOTYPE), collected in Viti Levu without further data. I was unable to locate the specimen in 1971 or 1974; in case it is not found, Seemann's excellent illustration can serve as the lectotype. The type of *Flacourtia ovata* is *Gillespie 2446* (BISH HOLOTYPE; ISOTYPES at BISH, GH, K, NY), collected Aug. 27, 1927, in the vicinity of Tamavua, Naitasiri Province, Viti Levu. Seemann referred his new genus *Thacombauia* to the Humiriaceae, and some later authors subsequently referred it to the Euphorbiaceae. The "staminal tube" described and figured by Seemann is actually a crenulate disk, and his "clavate glands" are staminodes, the persistence of which is usual in Fijian *Flacourtiaceae*. Of the four specimens cited by Gillespie as *F. ovata*, the

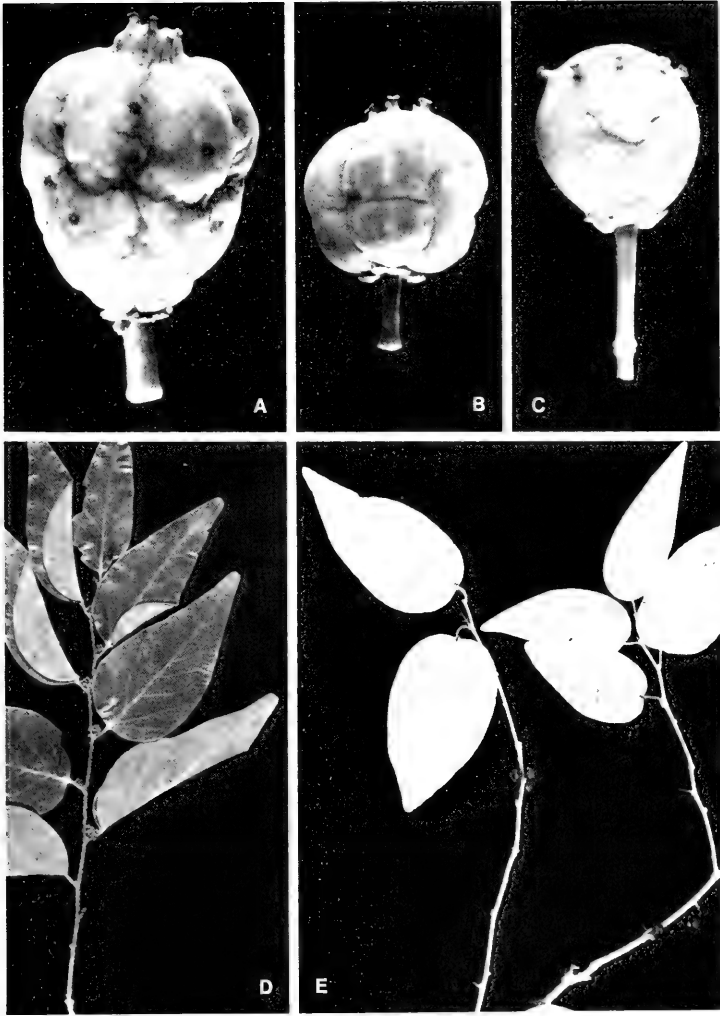


FIGURE 171. A, *Flacourtia vitiensis*, mature fruit, $\times 4$. B-E, *Flacourtia subintegra*; B, mature fruit, $\times 4$; C, mature fruit with more numerous and more widely spaced styles, $\times 4$; D, distal portion of branchlet, with foliage and young σ inflorescences, $\times 1.2$; E, distal portion of branchlet, with mature fruits, $\times 1.3$. A from Gillespie 2446, B & E from Smith 9476, C from DA 14645, D from Degener 15435a.

type and his no. 2175 are referable to *F. vitiensis*, but Gillespie 3963 and Horne 301 represent *F. subintegra*. Other Gillespie specimens not cited by him belong to one or the other species.

DISTRIBUTION: Endemic to Fiji and known only from Viti Levu, with the exception of a single sterile collection from Vanua Levu.

LOCAL NAME: The only recorded Fijian name is *meme* (*MacDaniels 1031*).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *DA 13304, 13392, O. & I. Degener 32177A*. SERUA: Nathengathenga Creek, upper Navua River, *DA L.13465 (DF 1201)*; Vatuvilakia, vicinity of Ngaloa, *Degener 15152*; Vatutavathe, vicinity of Ngaloa, *Degener 15202a*. NAMOSI: Saliandrau, Wayauyau Creek, *DA 15008*. NAMOSI OR NAITASIRI: Upper Waindina River, *MacDaniels 1031*. NAITASIRI: Vicinity of Tamavua, *Gillespie 2175*; vicinity of Nasinu, *Gillespie 3626*. VANUA LEVU: THAKAUNDRÖVE: Nakawanga, Nukumbolu Creek, *Gressitt 2498 (us)*.

Some specimens of *Flacourtia vitiensis* differ from the typical, glabrous-leaved form represented by the type collections of *Thacombauia vitiensis* and *F. ovata* in having the lower surfaces of leaf blades copiously and persistently soft-pilose with very perceptible hairs about 0.2 mm. long. These pilose-leaved individuals (e. g. *DA 13392, DF 1201, MacDaniels 1031*) occur here and there throughout the range of the species, but in other respects they appear typical of *F. vitiensis*, possibly representing an extreme shade form. As some intermediates (e. g. *Degener 15202a*) with scarcely perceptible indument may be noted, I do not at this time believe that nomenclatural recognition of the pilose form is advisable. The species is well characterized by its very robust habit and its large, obovate fruits with the styles basally joined into a stout column.

4. *Flacourtia subintegra* A. C. Sm. in *Sargentina* 1: 61. 1942; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 147. 1972. FIGURES 171B-E, 172A.

Flacourtia ovata sensu Gillespie in Bishop Mus. Bull. 83: fig. 34, a, f, g, non sensu typi. 1931.

Xylosma archboldianum A. C. Sm. in *Sargentina* 1: 61. 1942, in Bull. Torrey Bot. Club 70: 546. 1943; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 149. 1972.

A tree 2-10 m. high, often slender or freely branched, or a shrub, found from near sea level to an elevation of 900 m. in forest (dense, thin, open, dry, or secondary) and thickets or on dry, forested forehills. The sepals have been noted as white, the filaments as white to pale yellow, the anthers as pale yellow, and the fruit as green and becoming deep red. Flowers and fruits have been collected in months scattered throughout the year.

TIPIFICATION AND NOMENCLATURE: The type of *Flacourtia subintegra* is *Smith 1939* (NY HOLOTYPE; many ISOTYPES), collected June 8, 1934, in hills west of Korotasere, Natewa Bay region, Thakaundrove Province, Vanua Levu. *Xylosma archboldianum* is typified by *Degener 15435a* (A HOLOTYPE), obtained June 3, 1941, at Mataimeravula, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu. In describing the latter in 1942 I had not become aware of the difficulties of distinguishing ♂ specimens of *Flacourtia* from those of *Xylosma*. As pointed out by Sleumer (in Fl. Males. I. 5: 6. 1954), there are no reliable differences between the two genera vegetatively or in the ♂ inflorescences. With abundant material of *F. subintegra* now at hand, it is obvious that the type of *X. archboldianum* is merely a young ♂ collection of that species.

DISTRIBUTION: Endemic to Fiji and known from several islands. This appears to be the most abundant species of *Flacourtia* in Fiji, some 40 collections being available.

LOCAL NAME: The only recorded local name is *tandruka* (*H. B. R. Parham 43*, from Mbua).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 1089*; Korovou, east of Tavua, *Degener 14953*; vicinity of Nandariavatu, *Gillespie 3963*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 313 (Bola 117)*. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9476*; hills between Wainingere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9631*. RA: Vicinity of Penang, *Greenwood 763*. NAITASIRI: Mendrausuthu Range, *DA 15481*; Viria, *Meebold 17016*; near Nasinu, *Greenwood 1126*. REWA: Mt. Korombamba, *Gillespie 2359, DA 1269*. OVALAU: "Common on the mountains," *Horne 301*; hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7622*. VANUA LEVU: MBUA: Nasau Estate, Rukuruku Bay, *H. B. R. Parham 43*; southern portion of Seatovo Range, *Smith 1700*. MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6793*; Nasealevu, Sasa Tikina, *DA 15244*; Mt. Numbuiloa, *DA 14645*. THAKAUNDROVE: Nakoroutari, inland from Lambasa, *DA 15238*. VANUA MBALAVU: Slopes of Korolevu, near Lomaloma, *Garnock-Jones 1032*.

In describing *Xylosma simulans* in 1950 (in *J. Arnold Arb.* **31**: 316) I mentioned the difficulty of distinguishing it from *Flacourtia subintegra* in the absence of fruiting material; in fact, the ♀ flowers of the two are also strikingly different (in accord with the generic characters), but ♂ specimens have been erroneously assigned. A dependable character may be noted in the pedicels of both ♂ and ♀ flowers: in *F. subintegra* the pedicel is jointed near the middle or at least noticeably above the base, whereas in *X. simulans* the pedicel is jointed at the very base. A foliage difference is also evident: *F. subintegra* lacks glands on the leaf blade margins near base (or such glands are very obscure and form mere linear thickenings), while the leaf blades of *X. simulans* bear one or two pairs of fairly obvious, round, marginal glands at base (or the lower ones may be borne at apex of petiole, as figured in *Allertonia* **1**: 367, *fig. 9, D.* 1978). Such glands are not uniformly present in *Xylosma* (cf. *Sleumer in Blumea* **22**: 129-137, 1974), but they are present in the two species of the genus that occur in Fiji. Application of these criteria makes it apparent that *Xylosma archboldianum*, mentioned above in the typification discussion, is definitely a species of *Flacourtia*.

5. *Flacourtia degeneri* A. C. Sm. in *Sargentia* **1**: 62. 1942; J. W. Parham, *Pl. Fiji Isl.* 103. 1964, ed. 2. 146. 1972. FIGURE 172B-D.

A tree 2-6 m. high occurring in forest from elevations of about 200 m. (or less?) to 1,195 m. The sepals and stamens are yellow or greenish, and the fruit as thus far known is green. Flowers and fruits have been obtained between January and April.

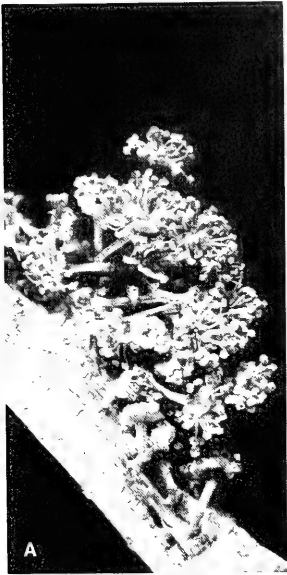
TYPIFICATION: The type is *Degener 14890* (A HOLOTYPE; ISOTYPES at BISH, K), collected March 26, 1941, in the vicinity of Nandrau, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Mbatilamu, Vunda, *DA 14130, 14805*; Natualevu, Mt. Evans Range, *DA 14189*; Mt. Koroyanitu, summit of Mt. Evans Range, *DA 14142, 14150*. NAITASIRI: Navuakethe, Waindrandra Creek, *DA 176*; Tholo-i-suva, *DA 2634*. NAITASIRI or REWA: "Vicinity of Suva," *Meebold 8189*. REWA: Mt. Korombamba, *DA 1268*.

6. *Flacourtia rukam* Zoll. & Moritz ex Moritz, *Syst. Verz. Zollinger*, 33. 1845 or 1846; Christophersen in *Bishop Mus. Bull.* **128**: 151. 1935; Yuncker in op. cit. **184**: 52. 1945; Sleumer in *Fl. Males. I.* **5**: 73, *fig. 31-33*. 1954; Yuncker in *Bishop Mus. Bull.* **220**: 191. 1959; St. John & A. C. Sm. in *Pacific Sci.* **25**: 334. 1971; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 147. 1972; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 32. 1972.

A tree 5-15 m. high (to 20 m. where indigenous), with a trunk to 40 cm. in diameter, often thorny on trunk and branches, cultivated in gardens and experimental plots near sea level. The sepals are greenish yellow, the anthers yellow, and the fruits maturing



pink to dark red or purplish. In Fiji flowers have been noted in October, fruits between October and July.

DISTRIBUTION: Malesia, but rare in the Moluccas and New Guinea, and not indigenous in southeastern Asia as noted by various authors; the species is widely cultivated and often naturalized in other tropical areas.

TYPE: The type is *Zollinger 1572*, obtained in Java.

LOCAL NAMES AND USES: Usually known in Fiji as *Governor's plum*, this species is known in other parts of the Fijian Region as *filimoto* (or a variant) and elsewhere as *Indian prune*. The fruit is edible and is usually used for making jams and pies, and the hard wood is sometimes used on Rotuma for house posts.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Plant Introduction and Quarantine Station, Nanduruloulou, DA 5524, 12175; Nasinu Experimental Station, DA 1566, 2633, 12996. TAILEVU: Visama, Mbau road, DA 1502. REWA: Suva Botanical Gardens, MacDaniels 1126.

Flacourtia rukam seems to be known only in cultivation in Fiji, but in some nearby areas, including Rotuma, Tonga, Futuna, and especially Samoa, it appears to be abundantly naturalized.

7. ***Flacourtia jangomas*** (Lour.) Raeusch. Nomencl. Bot. ed. 3. 290. 1797; B. E. V.

Parham in Agr. J. Dept. Agr. Fiji **10**: 115. 1939; Sleumer in Fl. Males. **1**: 5: 72. fig. 30, a-d. 1954.

Stigmarota jangomas Lour. Fl. Cochinch. 634. 1790.

A small tree (to 14 m. high where long cultivated), the trunk and branches thorny when young. The fresh fruit is subglobose, becoming red to purple or blackish, and up to 2.5 cm. in diameter.

TYPE: The type is from a specimen cultivated in Cochinchina.

DISTRIBUTION: Not known in the wild state, but possibly indigenous in the area of Assam and Burma, and now cultivated in many tropical areas.

LOCAL NAMES AND USE: Recorded as *Indian cherry* by Parham, and in other areas as *Indian plum* or *rukam*. The fruit is edible but is tart when fresh, more often being used in making preserves.

No Fijian voucher is available for *Flacourtia jangomas*, but Parham (1939, cited above) recorded it as having been introduced in 1918 and as having borne flowers and fruits on the property of W. L. Wallace, Tovu Island, Ra Province, Viti Levu. This record may well be correct, since the species is known to be in cultivation at least in Hawaii and on Niue (from which it was erroneously noted as *Xylosma samoensis* (Christophersen) Sleumer by Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 96. fig. 8. 1970).

Another cultivated *Flacourtia* in Fiji was reported as *F. inermis* Roxb. by J. W. Parham (Pl. Fiji Isl. 103. 1964, ed. 2. 146. 1972) without listed documentation. The presence of *F. inermis* is indeed possible, since it is known to be cultivated elsewhere in the Pacific, but J. W. Parham's record could conceivably refer to *F. jangomas*. A full discussion of all three species of *Flacourtia* that have been recorded as cultivated in Fiji is provided by Sleumer in Fl. Males. **1**: 5: 70-75. 1954.

FIGURE 172. A, *Flacourtia subintegra*, ♂ inflorescences, × 4. B-D, *Flacourtia degeneri*; B, ♂ inflorescences, × 4; C, foliage and ♂ inflorescences, × 1/2; D, portion of ♂ flower showing 2 sepals, disk glands, and stamens, × 20. A from Smith 9631, B & C from Degener 14890, D from DA 14150.

5. *Dovyalis* E. Meyer ex Arn. in J. Bot. (Hooker) 3: 251. 1841.

Diocious shrubs or small trees with axillary spines; leaves alternate, the blades pinnate-nerved, entire or dentate; inflorescences axillary, the ♂ fasciculate, the ♀ with solitary flowers, the flowers with 5-8 scarcely imbricate sepals, without petals; ♂ flowers with a glandular disk, the stamens numerous, with short anthers; ♀ flowers with a lobed disk, the ovary imperfectly 2-6-locular, the ovules 2-8 inserted on each septum, the styles 2-8, distally stigmatose; fruit a pulpy berry, the seeds with a glabrous or tomentose testa.

TYPE SPECIES: *Dovyalis zizyphoides* E. Meyer ex Arn. (*Dovyalis rhamnoides* (Burch.) Harv.).

DISTRIBUTION: Tropical and southern Africa and Ceylon, with about 25 species, some of which have edible fruits. One species is sparingly cultivated in Fiji.

1. *Dovyalis hebecarpa* (Gardner) Warb. in Engl. & Prantl, Nat. Pflanzenfam. III. 6a: 44, as *Doryalis h.* 1893; J. W. Parham, Pl. Fiji Isl. ed. 2. 145. 1972.

Roumea hebecarpa Gardner in Calcutta J. Nat. Hist. 7: 449. 1847.

Aberia gardneri Clos in Ann. Sci. Nat. Bot. IV. 8: 236, nom. illeg. 1857.

A shrub or small tree to 5 m. high (in Fiji), sparingly cultivated near sea level. The fruits are purplish or red, about 2.5 cm. in diameter, with purplish pulp.

TIYPIFICATION AND NOMENCLATURE: The type of *Roumea hebecarpa* was collected in the Central Province of Ceylon, presumably by Gardner (HOLOTYPE at K). *Aberia gardneri* is based on collections made by Walker and Gardner in Ceylon, but the name is illegitimate because *Roumea hebecarpa* was mentioned as a synonym.

DISTRIBUTION: Ceylon; now widely cultivated in other tropical areas.

LOCAL NAMES AND USES: Names applied to this species are *Ceylon gooseberry* and *ketambilla*; the fruit is edible raw but is bitter and is usually used for jams and curries.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Model Farm, Mbatiki, DA 11741. REWA: Suva, in private garden, DA 5652.

6. *XYLOSMA* Forst. f. Fl. Ins. Austr. Prodr. 72. 1786; Seem. Fl. Vit. 7. 1865. Nom. cons.

Myroxylon J. R. & G. Forst. Char. Gen. Pl. 63. 1775, ed. 2. 125. 1776. Nom. rejic. vs. *Myroxylon* L. f. (1781).

Diocious trees or shrubs, stipulate, often spiny (not our species); leaves alternate (spirally arranged), short-petiolate, the blades pinnate-nerved (our species with 1 or 2 pairs of round marginal glands near base or at apex of petiole), crenate to serrate, infrequently entire; inflorescences axillary, short-racemose, few-flowered, with small, subsistent bracts; flowers with pedicels articulated near or at base, the perianth segments (sepals) 4-8, slightly connate at base, imbricate, the petals none, the disk carnos, 4-8-lobed or entire; ♂ flowers with the disk extrastaminal, the stamens numerous, exserted, the filaments filiform, the anthers subglobose, basifixed, somewhat gibbous, a rudimentary gynoeceum lacking; ♀ flowers with the ovary sessile, unilocular, the placentas 2-4 (-6), parietal, the ovules few on each placenta, the style lacking or short and cylindric, the stigmas 2-4 (or single and 2-4-lobed), often sessile; fruit a dry berry, the pericarp usually thin-coriaceous, the seeds few, usually obovoid, with a thin aril.

TYPE SPECIES: *Xylosma orbiculatum* (J. R. & G. Forst.) Forst. f. (*Myroxylon orbiculatum* J. R. & G. Forst.). Typ. cons.

DISTRIBUTION: Tropical and subtropical America and southeastern Asia, and eastward in the Pacific to Australia and Polynesia, including Hawaii, with about 100 species. Two species occur indigenously in Fiji. A third species, *Xylosma archboldianum*, is now referred to *Flacourtia subintegra*, q. v.

KEY TO SPECIES

- Scrambling or trailing shrub 0.3–1 m. high, the stem slender; petioles 3–5 mm. long; leaf blades obovate or elliptic, (1.5–) 2.5–4.5 × 1–3 cm., gradually narrowed to an acute or obtuse base, rounded at apex, narrowly revolute at margin, the lowest pair of marginal glands usually obscure but present; rachis of ♂ inflorescence 7 mm. long or less, with 2–8 flowers, the pedicels at anthesis 2.5–5 mm. long; fruiting pedicels 5–6 mm. long, the fruits 8–9 × 5–7 mm., the style obvious, 0.5–1 mm. long, appearing truncate but with the stigma obscurely 2-lobed. 1. *X. orbiculatum*
- Tree 3–15 m. high, the stem (of young plants) or trunk 5–50 cm. in diameter; petioles (6–) 8–25 mm. long; leaf blades ovate or oblong-ovate to suborbicular, (4–) 8–14 × (3.5–) 4–12 cm., obtuse to rounded at base, cuspidate to rounded at apex, not conspicuously revolute at margin, the lowest pair of marginal glands often conspicuous; rachis of ♂ inflorescence 10–30 mm. long, with 5–10 flowers, the pedicels at anthesis 4–9 mm. long; fruiting pedicels 5–10 mm. long, the fruits 8–13 × 5–13 mm., the stigma sessile, conspicuously 3- or 4-lobed. 2. *X. simulans*

1. ***Xylosma orbiculatum*** (J. R. & G. Forst.) Forst. f. Fl. Ins. Austr. Prodr. 72. 1786; Drake, Ill. Fl. Ins. Mar. Pac. 109, p. p. 1890; Sleumer in Notizbl. Bot. Gart. Berlin 14: 295, p. p. 1938; Yuncker in Bishop Mus. Bull. 178: 86. 1943; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 96. 1970; Sleumer in Blumea 22: 131, p. p. 1974; A. C. Sm. in Allertonia 1: 365. fig. 8. 1978.

Myroxylon orbiculatum J. R. & G. Forst. Char. Gen. Pl. 63. t. 63. 1775, ed. 2. 126. t. 63. 1776.

Xylosma bryanii A. C. Sm. in Bull. Torrey Bot. Club. 70: 545. 1943; Yuncker in Bishop Mus. Bull. 220: 190. 1959; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 149. 1972.

A shrub 0.3–1 m. high, usually scrambling and trailing, occurring near sea level (–20 m. elevation) on rocky islets and seaside cliffs. The sepals are greenish to yellow, the carpels white, and the fruits becoming purple at maturity. Throughout the limited range of the species, flowers have been obtained in January, April, July, and November, and fruits only in July.

TIPIFICATION AND NOMENCLATURE: The type of *Myroxylon orbiculatum* is a J. R. & G. Forster collection (BM LECTOTYPE; ISOLECTOTYPE at K) from Niue (Savage Island), obtained on Cook's second voyage. *Xylosma bryanii* is based on *Bryan 392* (BISH HOLOTYPE), collected July 26, 1924, on a rocky islet offshore from Ongea Ndriki, Lau Group. The circumstances involving my first interpretation of *X. orbiculatum* and needless description of *X. bryanii* are discussed in my 1978 treatment.

DISTRIBUTION: Fiji, Tonga, and Niue; in Fiji the species is known only from the type collection of *Xylosma bryanii*, but it is more frequent in Tonga and on Niue.

Sleumer (in *Blumea* 22: 131. 1974) considers *Xylosma orbiculatum* also to occur in New Caledonia (where it would be the only non-endemic among 18 species known from New Caledonia). Earlier (in *Notizbl. Bot. Gart. Berlin* 14: 295. 1938) Sleumer had combined material of *X. orbiculatum* and *X. simulans* (described only in 1950), which appear to be very distinct species. Therefore I believe that he interprets *X. orbiculatum* too broadly, to include most material from our general area having leaf blades with marginal and basal glands; it seems likely that the representative of this small group in New Caledonia is better referred to the endemic *X. liorale* Däniker.

2. ***Xylosma simulans*** A. C. Sm. in J. Arnold Arb. 31: 316. 1950; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 149. 1972; A. C. Sm. in Allertonia 1: 366. fig. 9, 10. 1978.

Xylosma orbiculatum sensu A. Gray, Bot. U. S. Expl. Exped. 1: 78. 1854, Atlas, pl. 4. 1856; Seem. in Bonplandia 9: 254. 1861, Viti, 432. 1862, Fl. Vit. 7, p. p. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 109, p. p. 1890; Hemsl. in J. Linn. Soc. Bot. 30: 169. 1894; Burkill in op. cit. 35: 26. 1901; Sleumer in Notizbl. Bot. Gart. Berlin 14: 295, p. p. 1938; Yuncker in Bishop Mus. Bull. 220: 190. 1959; J. W. Parham, Pl. Fiji Isl. 104. 1964, ed. 2. 149. 1972; non Forst. f.

A tree 3–15 m. high, with a trunk 5–50 cm. in diameter, occurring from near sea level to an elevation of 300 m. in dense or open forest, in coastal thickets, or on seaside limestone cliffs. The sepals are greenish yellow, the stamens white, and the fruits at maturity red to black. Throughout the range of the species, flowers have been observed between June and October, fruits between December and May.

TYPEIFICATION: The type is *Smith 6851* (A HOLOTYPE; many ISOTYPES), collected Dec. 4, 1947, at the southern base of the Mathuata Range, north of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Fiji and Tonga; in Fiji it is not abundant but is now known from several islands (but not from Viti Levu), while in Tonga it seems to be more frequent, as discussed by me in 1978, cited above.

LOCAL NAMES: The only Fijian names recorded are *tui ni nduna* (Mathuata) and *matandra* (Thithia).

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nakawa Gulch, west of Mbatinaremba, *St. John 18166*. VANUA LEVU: MATHUATA: Seanggangga Farm, *DA 12884*; vicinity of Lambasa, *Greenwood 504, 504A, 504B*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6400*. TAVEUNI: *Seemann 10*. VANUA MBALAVU: Vicinity of Narothiso Village, *Garnock-Jones 1128*. THITHIA: Lowland plain, *Bryan 557*.

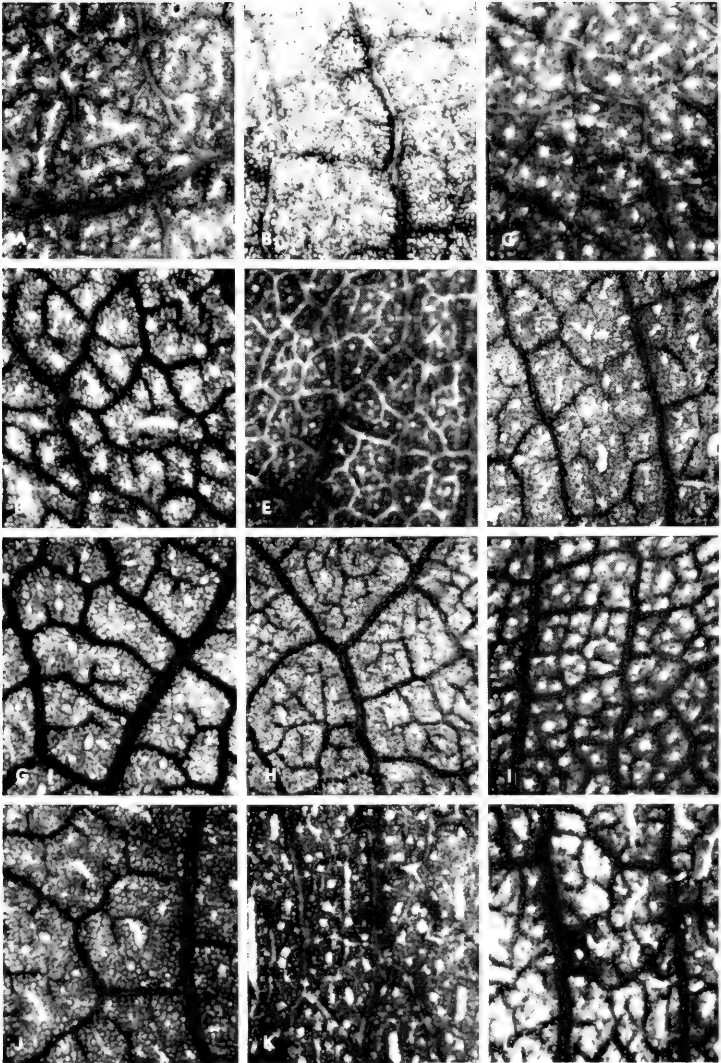
7. CASEARIA Jacq. Enum. Syst. Pl. Carib. 4. 1760; Seem. Fl. Vit. 97. 1866.

Melistaureum J. R. & G. Forst. Char. Gen. Pl. 72. 1775, ed. 2. 143. 1776.

Shrubs or trees, the stipules usually small and caducous, sometimes variously shaped and subsistent; leaves alternate, distichous, the blades entire to crenate or serrate, pinnate-nerved, usually pellucid-punctate or -lineolate; inflorescences axillary, small, usually densely fasciculate or short-amentiform, often many-bracteate, rarely pedunculate, sometimes composed of solitary flowers; flowers ♂, the pedicels articulated above base and there bracteolate, the subtending bracts often small and scalelike; calyx semi-perigynous, the lobes (sepals) 5 (4–6), imbricate, persistent, rarely reflexed at or after anthesis; petals none; stamens 5–12 (usually 10 in our species), uniseriate, the filaments free or sometimes united proximally, usually alternately unequal in length, the anthers short, sometimes with an apically penicillate connective; staminodes as many as stamens and alternating with them, clavate or oblong, usually pilose at least distally, sometimes united with filaments proximally; ovary free, superior, ovoid to short-cylindric, with 3 or 4 parietal placentas, the ovules few—many on each placenta, the style lacking or short, the stigmas capitate or lobed; fruit a (2 or) 3- or 4-valved, loculicidally dehiscent, succulent to dry capsule, the seeds few—many, ovoid to obovoid or angular by mutual pressure, with a fleshy, colored, fimbriate aril, the testa coriaceous or crustaceous.

TYPE SPECIES: The lectotype species of *Casearia* is *C. nitida* (L.) Jacq. (*Samyda nitida* L.) (vide Britton & Millsp. Bahama Fl. 285. 1920). The type species of *Melistaureum* is *M. distichum* J. R. & G. Forst. (= *Casearia disticha* (J. R. & G. Forst.) A. Gray); the rationale for accepting Gray's binomial as a new combination (to replace *C. melistaureum* Spreng., 1825, nom. illeg.) instead of a new species was discussed by me in *Allertonia* 1: 360–362. 1978.

FIGURE 173. Pellucid glands in leaf blades of *Casearia* as seen by transmitted light, all $\times 20$. A, *C. parhamii*, from *Smith 7046*. B, *C. fissistipula*, from *DA 1511*. C, *C. myrsinoides*, from *Smith 1772*. D, *C. richii*, from *Smith 9549*. E, *C. procera*, from *Smith 5119*. F, *C. adiantoides*, from *Smith 1682*. G, *C. angustifolia*, from *Smith 411*. H, *C. longifolia*, from *Degener 15390*. I, *C. longifolia*, from *DA 13667*. J, *C. crassipes*, from *Smith 586*. K, *C. stenophylla*, from *Gillespie 4830*. L, *C. pubipes*, from *DA 15553*.



DISTRIBUTION: Pantropical and subtropical, with about 200 species. The Indo-Malesian range of *Casearia* is indicated as terminating in Fiji by van Balgooy (in *Blumea* Suppl. 6: 172. 1971), but Sleumer (in *Blumea* 22: 137. 1974) states that the genus is represented by apparently undescribed species in Samoa, Tonga, and the Society Islands. Eleven endemic species (including two here described) occur in Fiji.

In 1955 (in *J. Arnold Arb.* 36: 284) I erroneously recorded *Rinorea* (Violaceae) among genera with distributions terminating in Fiji. The record was based on *R. storckii* (Seem.) Melchior (*Alsodeia storckii* Seem.), which Jacobs (in *Blumea* 15: 138. 1967) correctly referred to *Casearia*. The pertinent synonymy is here discussed under *C. richii* A. Gray, q. v.

As Sleumer (in *Fl. Males. I.* 5: 82. 1954) has pointed out in reference to the Malesian species, *Casearia* offers few useful differentiating characters for species recognition in its flowers. Among Pacific species such vegetative characters as indument, type of stipule, length of petiole, and shape, base, apex, margin, and venation of leaf blade provide usable differentiating characters, if cautiously utilized. The leaf blades of certain species bear acarodomatia in the lower nerve axils beneath, and the presence or absence of these seems a dependable specific character. In fact, the form of domatium may prove useful: whether it is uniformly webbed or consists primarily of a tuft of hairs, partially webbed or not. Pellucid glands of the leaf blades of *Casearia* are characteristic of species, within broad limits, being in the form of very fine dots, larger elliptic dots, and short, fine lines. Combinations of these gland types are difficult to define but often give a certain "signature" to a species that is definable in other respects as well.

KEY TO SPECIES

Stipules 1.5–5 mm. long, usually deeply divided into 2–5 unequal, linear or lanceolate lobes (these 0.1–0.6 mm. broad); leaf blades truncate to rounded or faintly subcordate at base, lacking domatia.

Leaf blades (3–) 4–9 × 1.5–2.8 cm., obviously and closely crenulate-serrate at margin with antorsely spinulose teeth, often pilose beneath (with hairs sometimes subpersistent on costa and nerves); filaments alternately about 1 mm. and 0.7 mm. long, the staminodes about 0.7 mm. long; leaf blade glandulation of lines and minute dots. 1. *C. parhamii*

Leaf blades (5–) 7–11 × (2–) 2.5–4.2 cm., entire or inconspicuously undulate at margin, soon glabrate; filaments alternately about 0.6 mm. and 0.4 mm. long, the staminodes about 0.3 mm. long; leaf blade glandulation of crowded, minute dots, the lines comparatively few. 2. *C. fissistipula*

Stipules deltoid or oblong-deltoid to lanceolate, not divided, 0.5–5 mm. long, 0.3–1.5 mm. broad.

Apex of leaf blades rounded, the blades oblong or obovate-oblong, 3.5–5 × 1.4–2 cm., attenuate at base, with webbed, pilose domatia in lower nerve axils beneath; stipules deltoid, minute, about 0.5 × 0.3 mm.; leaf blade glandulation of large and small dots, with comparatively few lines. 3. *C. myrsinoides*

Apex of leaf blades obtuse to acuminate.

Leaf blades prevailingly oblong to elliptic, usually 2–2.5 (rarely –3) times as long as broad.

Stipules deltoid to lanceolate, (1–) 2–4.5 (–6) × 0.6–1.5 (–2) mm., at first dorsally pilose but soon glabrate except at margin; leaf blades (4–) 6–15 (–20) × (2–) 3–6.5 (–9) cm., lacking domatia, the glandulation of minute, crowded dots or these mixed with larger, elliptic dots and lines. 4. *C. richii*

Stipules deltoid, 0.6–0.9 × 0.5–0.7 mm., usually copiously pilose dorsally and/or densely fimbriate-margined; leaf blades 3–4.5 (–5.5) × 1.2–2.5 (–3.5) cm., with webbed, pilose domatia in lower nerve axils beneath, the glandulation of minute dots, these not crowded, sometimes mixed with lines. 5. *C. procera*

Leaf blades prevailingly lanceolate or oblong-lanceolate, usually 3–5 times as long as broad.

Petioles 2–3 mm. long; leaf blades broadly obtuse to rounded or faintly subcordate at base.

Leaf blades lanceolate-deltoid, (4–) 4.5–8 × 1.5–2.3 cm., broadest toward base, subtirent or remotely undulate-crenulate, lacking domatia, the glandulation of lines, large elliptic dots, and minute dots. 6. *C. adiantoides*

Leaf blades oblong-lanceolate, 6-11 × 2-3 cm., broadest toward middle, minutely serrulate with antrorse teeth at least distally, with barbellate but obscurely webbed domatia in lower nerve axils beneath, the glandulation of elliptic dots and minute dots, with very few lines.

Petioles (2-) 3-12 mm. long; leaf blades acute to attenuate at base, (6-) 8-19.5 × (1.2-) 1.5-5 cm.

Branchlets, petioles, and pedicels glabrous or soon glabrate; sepals glabrous or essentially so at anthesis.

Leaf blades with 7-13 secondary nerves per side.

Pedicels at anthesis 0.5-1 mm. long; petioles (4-) 5-10 mm. long, comparatively slender (1-1.2 mm. in diameter); leaf blades entire or obscurely undulate-crenulate at margin, without domatia, the glandulation of elliptic dots and minute dots, with few lines.

Pedicels of young fruits 3-4 mm. long; petioles (2-) 3-5 mm. long, comparatively stout (1.3-2 mm. in diameter); leaf blades inconspicuously serrulate at margin with minute, glandular, antrorse teeth, with webbed domatia frequent in lower nerve axils beneath, the glandulation of fine dots and lines, with few large elliptic dots. 7. *C. angustifolia*

Leaf blades with 4-7 secondary nerves per side, entire or obscurely undulate-crenulate at margin, with webbed, pilose domatia in lower nerve axils beneath, the glandulation of lines, large elliptic dots, and minute dots; petioles 3-10 mm. long, slender (0.5-1.2 mm. in diameter); pedicels at anthesis 1-3 mm. long. 8. *C. longifolia*

Branchlets, petioles, and pedicels (3-4 mm. long at anthesis) copiously pilose; sepals dorsally pilose at anthesis; leaf blades with 8-11 secondary nerves per side, with copiously tufted-pilose domatia in lower nerve axils beneath, the hairs projecting from the minute web between costa and nerve or the domatia unwebbed, the glandulation of lines, large elliptic dots, and minute dots. 9. *C. crassipes*

. 10. *C. stenophylla*

. 11. *C. pubipes*

1. *Casearia parhamii* A.C. Sm. in J. Arnold Arb. 31: 317. 1950; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972. FIGURES 173A, 174A & B.

A slender tree or shrub 2-7 m. high, occurring in dense forest at elevations of 100-200 m. The sepals and filaments are white or greenish white, the anthers white. Flowers have been obtained between April and November.

TIPIFICATION: The type is DA 25 (coll. B. E. V. Parham) (A HOLOTYPE; ISOTYPE AT SUVA; fragment and photo at US), obtained in June, 1936, at "Waindina Falls," Tailevu Province, Viti Levu. I have been unable to find any "Waindina Falls" in Tailevu Province, this locality obviously having no reference to the Waindina River, of Namosi and Naitasiri Provinces. Since Parham collected another specimen of the species in the vicinity of Wailotua a couple of months prior to the date of the type collection, and since he often travelled along the King's Road in Tailevu, it may be that his label should read "Wailotua Falls." Wailotua is a village on the Wainimbuka River at the outlet of Wailotua Creek, which may be expected to have a "falls." The Tailevu locality near Ndakuivuna, cited below, is a few kilometers southeast of Wailotua.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, where it is infrequent.

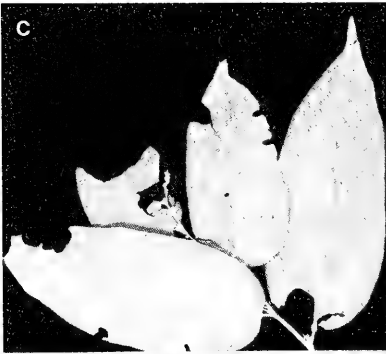
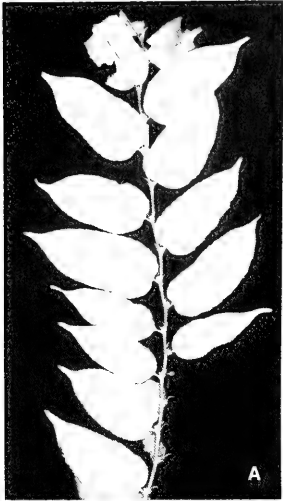
AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills east of Navua River, near Nukusere, Smith 9129. NAITASIRI: Waimanu River region, "SE Nasele," DA 15428. TAILEVU: Vicinity of Wailotua, DA, April 13, 1936 (coll. B. E. V. Parham); hills east of Wainimbuka River, vicinity of Ndakuivuna, Smith 7046.

Casearia parhamii and the following novelty are distinct among Fijian species in having their stipules deeply divided into several narrow lobes. A resemblance between *C. parhamii* and *C. adiantoides*, discussed by me in 1950, is entirely superficial.

2. *Casearia fissistipula* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 173B, 174C-E.

A shrub (or more likely a small, slender tree) about 3 m. high, apparently rare and



obtained in forest at an elevation of about 50 m. The only available collection was in flower in May.

TIPIFICATION: The type is *DA 1511* (coll. *B. E. V. Parham*) (BISH HOLOTYPE; ISOTYPE AT SUVA), collected May 11, 1939, at "Nayacini," Naitasiri Province, Viti Levu. I have not found any such locality as Nayathini ("Nayacini"). This place name has been added to the field label in some hand other than Parham's, and possibly it refers to Nativuthini, a village near the junction of Wailase Creek with the Wainimala River. The latter locality lies only a few kilometers west of Vunindawa, a Government station well known to Parham and which he may often have used as a field headquarters.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

Although the only available collection is not entirely adequate, bearing only a few flowers (and these with deformed gynoecia, a very frequent occurrence in Fijian *Caseariae*), it is so obviously distinct from *C. parhamii*, its only close relative, in the size and margin of its leaf blades and in minor staminal characters that I venture to describe it.

3. *Casearia myrsinoides* Sleumer in Bishop Mus. Bull. **141**: 98. fig. 51, b. 1936; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972. FIGURE 173C.

A shrub about 1 m. high, seemingly rare and obtained in dense bush at an elevation of 300–430 m. The sepals are pale yellow in the only available collection, obtained in May.

TIPIFICATION: The type is *Smith 1772* (BISH HOLOTYPE; many ISOTYPES), collected May 10, 1934, on Mt. Kasi, Yanawai River region, Thakaundrove Province, Vanua Levu.

This very distinct species, the only Fijian member of the genus with leaf blades distinctly rounded at apex, has not been approached among more recent collections.

4. *Casearia richii* A. Gray, Bot. U. S. Expl. Exped. **1**: 82. 1854, Atlas, pl. 5, B. 1856; Seem. Viti, 432. 1862, Fl. Vit. 98. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 174. 1890; Gibbs in J. Linn. Soc. Bot. **39**: 148. 1909; A. C. Sm. in Sargentia **1**: 63. 1942; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 145. 1972; A. C. Sm. in Allertonia **1**: 362. 1978. FIGURES 173D, 175A–C.

Casearia disticha sensu A. Gray, Bot. U. S. Expl. Exped. **1**: 81. 1854, Atlas, pl. 5, A. 1856; Seem. in Bonplandia **9**: 254. 1861, Viti, 432. 1862, Fl. Vit. 98. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 174. 1890; Briquet in Ann. Conserv. Jard. Bot. Genève **2**: 64. 1898; A. C. Sm. in Sargentia **1**: 62. 1942; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972; Jacobs in Blumea **15**: 138. 1967; quoad spec. vit., typo excl.

Alsodeia sp. Seem. in Bonplandia **10**: 295. 1862, Viti, 432. 1862.

Alsodeia storckii Seem. in J. Bot. **2**: 75. 1864, Fl. Vit. 7. 1865; Drake, Ill. Fl. Ins. Mar. Pac. 109. 1890. *Casearia seemanni* Briquet in Ann. Conserv. Jard. Bot. Genève **2**: 65, sphalm. 1898.

Rinorea storckii Melchior in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; A. C. Sm. in J. Arnold Arb. **36**: 284. 1955; J. W. Parham, Pl. Fiji Isl. 109. 1964.

FIGURE 174. A & B, *Casearia parhamii*, from *Smith 7046*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$; B, stipule and inflorescence with 1 developing flower, $\times 15$. C–E, *Casearia fissistipula*, from *DA 1511*; C, foliage, $\times 1/2$; D, stipule attached to young branchlet, an older branchlet at right, $\times 15$; E, partly deformed flower with most sepals removed, showing stamens and staminodes, with 1 sepal at right and deformed gynoecium in background, $\times 40$.

A sometimes compact tree or shrub 1.5–8 m. high, frequent at elevations from near sea level to 1,127 m. in dry, dense, or secondary forest or in thickets. The sepals and filaments are white to greenish white or greenish yellow, the anthers are white, the mature fruit is dull yellow, and the seeds have a red aril. Flowers and fruits are to be expected in any month.

TYPIFICATION AND NOMENCLATURE: The type of *Casearia richii* is *U. S. Expl. Exped.* (US 47730 HOLOTYPE), collected on Ovalau in 1840. In providing his new combination for *C. disticha* (based on the New Caledonian *Melistaureum distichum* J. R. & G. Forst.), Gray described and subsequently illustrated the taxon represented by *U. S. Expl. Exped.* (GH, K, US 65208), from Mbua Bay, Mbua Province, Vanua Levu; this collection has no type status. *Alsodeia storckii* is based on *Storck 867* (K HOLOTYPE; ISOTYPE at BM), collected in December, 1860, at Port Kinnaird, Ovalau. *Casearia seemanni* seems best considered a name inadvertently used by Briquet in his discussion of *C. disticha*; the name doubtless refers to *Seemann 11* (G, GH, K), from Ovalau. My 1978 discussion, cited above, considers the nomenclature in more detail and indicates some of the variability to be expected in *C. richii*.

DISTRIBUTION: *Casearia richii* is the only species of the genus that can be considered common in Fiji, although it appears to be endemic. Material from five islands is at hand, but *C. richii*, of which about 75 collections are available, may be expected on any of the high islands.

LOCAL NAMES: The name *ngalo* has been used on Viti Levu, and on Ovalau Storck recorded the use of *serirakavono* (probably better as *sererakavono*).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1078*; Mt. Yoö, west of Nandarivatu, *Webster & Hildreth 14144*; vicinity of Nandarivatu, *Gibbs 588*; summit of Mt. Nanggaranambuluta, *Gillespie 3342*; western and southern slopes of Mt. Tomanivi, *Smith 5214*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15355*; Thuvu, west of Singatoka, *Webster & Hildreth 14306*. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9472*; near Mt. Nggamu, vicinity of Ngaloa, *Degener 15073*; hills between Wainggere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9549*. NAMOSI: Mt. Naitaramamu, *Gillespie 3343*; hills east of Wainikoroiluva River, near Namuamua, *Smith 9029*. RA: Mountains near Penang, *Greenwood 765*. NAITASIRE: Vicinity of Navuso, *DA 12602*; Central Road, *Tohill 411*. REWA: Mt. Korombamba, *DA 17373*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 165*. OVALAU: Lovoni Valley, *Horne 149*; vicinity of Levuka, *Gillespie 4427*. VANUA LEVU: MBUA: Mt. Seatura, *DA 14893*. MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6854*. THAKAUNDROVE: Savuthuru Mt., near Valethi, Savusavu Bay region, *Degener & Ordonez 13849*; hills west of Mbutha Bay, Natewa Peninsula, *Smith 833*. RAMBI: On tops of mountains, *Horne 454*.

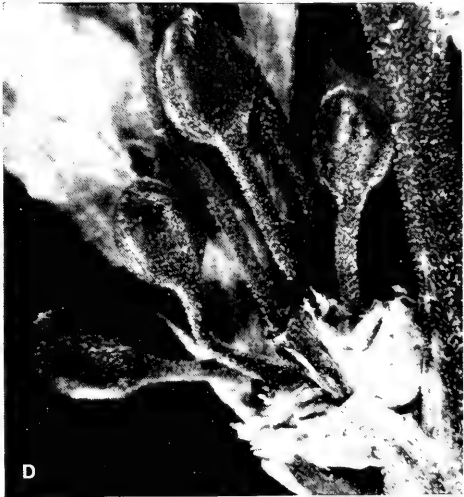
5. *Casearia procera* A. C. Sm. in *J. Arnold Arb.* 31: 318. 1950; J. W. Parham, *Pl. Fiji Isl.* 102. 1964, ed. 2. 145. 1972. FIGURES 173E, 176.

A tree 3–20 m. high, known from dense forest at elevations of 500–1,150 m. The sepals and filaments are white or greenish white. Flowers have been obtained only in July and November.

TYPIFICATION: The type is *Smith 5119* (A HOLOTYPE; many ISOTYPES), collected July 7, 1947, on the western and southern slopes of Mt. Tomanivi, Mba Province, Viti Levu.

FIGURE 175. A–C, *Casearia richii*; A, upper surfaces of leaves to show some of the variability, $\times 1/2$; B, mature fruit, with arillate seeds, $\times 2$; C, stipules, 1 at antepenultimate node and others subtending a vegetative bud, $\times 15$. D, *Casearia angustifolia*, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$. A, left to right, from *Webster & Hildreth 14144*, *Degener 15073*, *Smith 6854*, *Webster & Hildreth 14306*, *Smith 833*, B from *Smith 9472*, C from *DA 14893*, D from *Smith 411*.





DISTRIBUTION: Endemic to Fiji and known only from the two largest islands.

LOCAL NAME: The name *mbonukiwambu* was given me for the type collection.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Summit of Mt. Nambui, third peak of Korombasambasanga Range, DA 14548, p. p. (mixed number, the other part being referred to *Glochidion brunnescens*). VANUA LEVU: MATHUATA: Summit ridge of Mt. Numbuloa, east of Lambasa, Smith 6503. FIJI without further locality, Gillespie 3302.

The known distribution of *Casearia procera* is unsatisfactory, but the single collection from Vanua Levu has small leaves with characteristic domatia, features that readily distinguish the species from *C. richii*. The Gillespie specimen seems precisely similar to that from Mt. Nambui and may well have come from one of the Namosi Province mountains where he collected.

6. *Casearia adiantoides* Sleumer in Bishop Mus. Bull. 141: 98, fig. 51, a. 1936; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972. FIGURE 173F.

A slender shrub about 1 m. high, known from dense forest at an elevation of about 600 m. The only known collection was flowering in April. Some of the flowers have been replaced by red galls about 8 mm. in diameter composed of innumerable protuberances, some tipped by seeming anthers. These apparently insect-induced malformations are readily taken for spiny fruits.

TIPIFICATION: The type is Smith 1682 (BISH HOLOTYPE; many ISOTYPES), collected April 27, 1934, on the southern slopes of Mt. Seatura, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

7. *Casearia angustifolia* A. C. Sm. in Sargentia 1: 63. 1942; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972. FIGURES 173G, 175D.

A shrub or small tree about 4 m. high, apparently rare in dense forest at an elevation of 400-600 m. The sepals are green, and the only known collection was flowering in November.

TIPIFICATION: The type is Smith 411 (GH HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, on the southern slopes of Mt. Mariko, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the type collection.

8. *Casearia longifolia* A. C. Sm. in Sargentia 1: 64. 1942; J. W. Parham, Pl. Fiji Isl. 102. 1964, ed. 2. 145. 1972. FIGURES 173H & I, 177.

A tree 3-10 m. high, with a trunk sometimes to 40 cm. in diameter, occurring in often dry forest between sea level and an elevation of 300 m. The sepals and filaments are white, the anthers dorsally dull pink. Flowers have been noted in scattered months between June and February, and fruits in June and November.

TIPIFICATION: The species is typified by Degener 15390 (A HOLOTYPE; ISOTYPES at BISH, K, NY, US), collected June 2, 1941, at Vatundamu, vicinity of Rewasa, near Vaileka, Ra Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and now known from the Yasawas and Viti Levu.

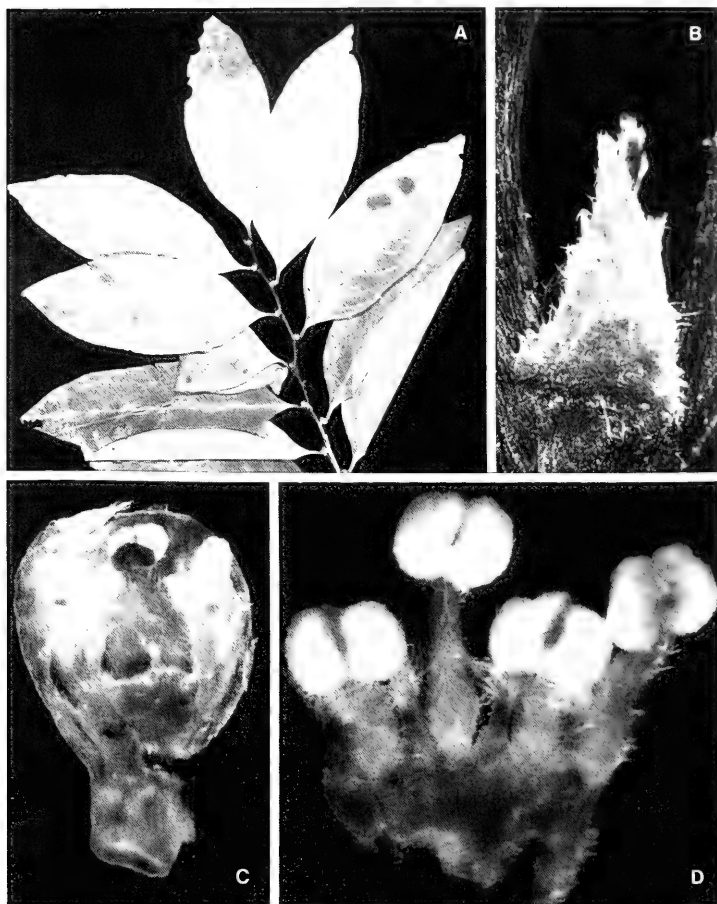


FIGURE 177. *Casearia longifolia*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$; B, stipule, $\times 20$; C, flower with 3 sepals and several stamens removed, $\times 30$; D, stamens and staminodes, abaxial surface, $\times 40$. A & B from *St. John 18111*, C & D from *DA 13667*.

LOCAL NAME: *Mbombongua* (St. John 1811).

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Yalombi, DA 13667; Nangua, St. John 1811. VITI LEVU: SERUA: Hills between Wainingere and Waisee Creeks, between Ngaloa and Wainiyambia, Smith 9367, 9539.

Specimens from the Yasawas (FIGURE 173I) differ in leaf blade glandulation from those of Viti Levu (FIGURE 173H) in having a greater proportion of large glands to small and in lacking glandular lines. However, no other differences of consequence are noted; the species is well separated from its close allies in its very short pedicels and lack of leaf domatia.

9. *Casearia crassipes* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 173J, 178.

A simple-stemmed shrub 50 cm. high, rare in forest at an elevation of 200–500 m. Young fruits, with attached floral parts, were obtained in November.

TYPIFICATION: The type is *Smith 586* (BISH HOLOTYPE; ISOTYPE at NY), collected Nov. 24, 1933, in hills between the Vatukawa and Wainio Rivers, Ndrekeniwai Valley, Thakaundrove Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and represented only by the type collection.

Although the new species is represented by only two specimens with immature fruits, enough floral parts persist at fruit bases to permit its adequate description. From its seemingly closest relative, *Casearia longifolia*, it differs in its much longer pedicels, its short, stout petioles, its leaf blades with antrorsely serrulate margins like those of *C. angustifolia*, and the presence of domatia which are essentially webbed only, lacking the tufted hairs associated with the domatia of *C. stenophylla*. From the latter species *C. crassipes* differs in leaf characters such as petiole length and diameter, venation, margin, type of domatia, and details of glandulation.

10. *Casearia stenophylla* A. C. Sm. in J. Arnold Arb. 31: 318. 1950; J. W. Parham, Pl. Fiji Isl. 103. 1964, ed. 2. 145. 1972. FIGURE 173K.

A shrub or small tree 0.5–4 m. high, occurring in dense forest, in patches of forest in open rolling country, and in crest thickets at elevations of 100–750 m. The sepals are white. Flowers have been obtained in March, May, June, and November, and fruits only in the last month.

TYPIFICATION: The type is *Smith 6701* (A HOLOTYPE; ISOTYPE at US), collected Nov. 28, 1947, on the Seangangga Plateau, in drainage of Korovuli River, vicinity of Natua, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from Vanua Levu and Taveuni.

AVAILABLE COLLECTIONS: VANUA LEVU: MBUA: Koromba Forest, DA 15135. THAKAUNDRIVE: Mt. Ndikeya, on eastern buttress, *Smith 1889*; Mt. Ndikeya, on eastern slope, *Smith 1906*. TAVEUNI: Slopes inland from Somosomo, *Gillespie 4816, 4830*.

It may be noted that this species and the preceding are known only from Vanua Levu (and Taveuni), while the related *Casearia longifolia* is known only from Viti Levu and the Yasawas. It would seem that in *Casearia* more intensive speciation has been occurring on Vanua Levu, producing well-marked but apparently infrequent species, than on Viti Levu.

11. *Casearia pubipes* A. C. Sm. in Pacific Sci. 25: 492. 1971. FIGURE 173L.

A tree to 18 m. high, collected in forest near sea level. The sepals are light green, and flowers have been obtained only in April.

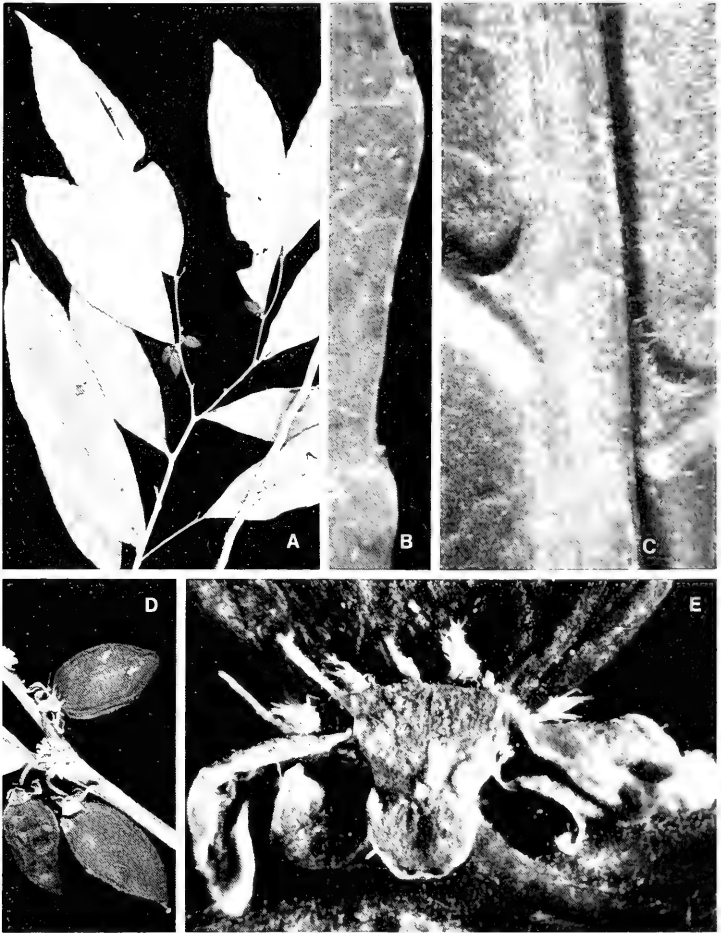


FIGURE 178. *Casearia crassipes*, from Smith 586; A, distal portion of plant, with foliage and young fruits, $\times 1/3$; B, margin of lower surface of leaf blade, showing 2 antrorsely spinulose crenations, $\times 20$; C, domatia in nerve axils of lower leaf surface, $\times 20$; D, advanced inflorescence with maturing fruits, $\times 2$; E, sepals, filaments, and staminodes persisting at base of fruit, $\times 20$.

TYPIFICATION: The type is *DA 15553* (coll. *D. Koroiveibau*) (BISH HOLOTYPE; ISOTYPES at CHR, K, MASS, SUVA), collected April 2, 1968, near Navakathuru, Yathata Island (northern Lau Group).

DISTRIBUTION: Endemic to Fiji and thus far known only from the type collection.

This very sharply marked species, related only to the three preceding ones, represents the easternmost station for *Casearia* in Fiji. Otherwise the genus seems strangely absent from the Lau Group.

DESCRIPTIONS OF NEW SPECIES OF CASEARIA

2. *Casearia fissistipula* A. C. Sm., sp. nov.

Frutex vel arbor ad 3 m. alta, ramulis petiolis et foliorum laminarum faciebus minute puberulis mox glabris, ramulis pallidis gracilibus parce lenticellatis; stipulis 1.5–4 mm. longis puberulis in lobos 3–5 profunde fissis, lobis anguste oblongo-linearibus 0.1–0.5 mm. latis subacutis; petiolis gracilibus 2–4 mm. longis supra complanatis; foliorum laminis chartaceis in sicco fuscis oblongo-ovatis, (5-) 7–11 cm. longis, (2-) 2.5–4.2 cm. latis, basi truncato-rotundatis et in petiolum abrupte decurrentibus, in acuminem ad 1 cm. longum angustatis, margine integris vel inconspicue undulatis, costa supra subelevata subtus prominente, nervis secundariis utrinsecus 6–8 arcuato-patentibus ut rete venularum intricato supra planis subtus prominulis; inflorescentiis fasciculatis vel minute amentiformibus paucifloris, bracteis numerosis imbricatis oblongo-deltaeoides 1–1.5 mm. longis; pedicellis gracilibus 1.5–2.5 mm. longis; sepalis 5 oblongis 1.6–2 × 0.7–0.9 mm. glabris subcucullatis obtusis; staminibus 10, filamentis liberis alternatim circiter 0.6 mm. et 0.4 mm. longis, antheris ellipsoideis ad 0.3 mm. longis apice rotundatis; staminodiis oblongo-spathulatis 0.3 mm. longis superne obscure pilosis; gynoecii deformibus non nisi visis. HOLOTYPE: FIJI: VITI LEVU: NATASIRE: *DA 1511* (coll. *B. E. V. Parham*) (BISH).

9. *Casearia crassipes* A. C. Sm., sp. nov.

Frutex caule simplicis ad 50 cm. altus, ramulis paucis juvenibus superne minute puberulis infra nodos complanatis mox glabris teretibus parce lenticellatis; stipulis lanceolatis 1–1.4 × 0.3–0.5 mm., dorso parce strigillosis, margine et apice acuto fimbriato-pilosis mox glabris; petiolis (2-) 3–5 mm. longis incrassatis (1.3–2 mm. diametro) supra canaliculatis; foliorum laminis in sicco fuscis crasso-chartaceis elliptico-lanceolatis, 10–19.5 cm. longis, 3–4.5 cm. latis, basi acutis vel attenuatis et in petiolum decurrentibus, superne in acuminem obtusum ad 1.5 cm. longum angustatis, margine dentibus minutis glandulosis antrorsis inconspicue serrulatis, primo secus nervos minute puberulis mox glabris, costa valida supra plana subtus prominente, nervis secundariis utrinsecus 8–10 arcuato-patentibus supra planis vel prominulis subtus acute elevatis, rete venularum copioso supra subplano subtus prominulo, domatis telas raro pilosas formantibus in axillis infernis subtus frequentibus; inflorescentiis axillaribus fasciculatis, bracteis numerosis oblongis 0.5–1 mm. longis latisque glanduloso-lineolatis apice erosulo-obtusis, pedicellis sub fructu juveni 3–4 mm. longis basim versus articulatis; sepalis 5 persistentibus deltaeoido-oblongis, 2–3 mm. longis, 1.2–1.7 mm. latis, apice obtusis vel rotundatis, margine incurvatis evanide et minute ciliolatis; staminibus 10, filamentis gracilibus alternatim circiter 1.3 mm. et 0.6 mm. longis, antheris ellipsoideis ad 0.3 mm. longis latisque; staminodiis oblongis ad 0.6 mm. longis praesertim distaliter copiose strigosis; fructibus immaturis ovoideo-ellipsoideis ad 13 × 7 mm., stylo subpersistenti ad 0.5 mm. longo, stigmatibus subcapitato circiter 0.5 mm. diametro. HOLOTYPE: FIJI: VANUA LEVU: THAKAUNDROVE: *Smith 586* (BISH).

FAMILY 98. VIOLACEAE

VIOLACEAE Batsch, Tab. Affin. Regni Veg. 57, as *Violariae*. 1802.

Herbs (rarely annual), shrubs, or trees, often scandent, sometimes dioecious or polygamodioecious, the stipules usually small or much reduced and caducous, sometimes large; leaves alternate, sometimes in rosettes or cauline, the blades simple, entire or dissected; inflorescences axillary, sometimes cauligerous, basically cymose, racemiform or paniculiform or composed of solitary flowers; flowers actinomorphic or zygomorphic, ♂ or unisexual, sometimes cleistogamous, the pedicels usually bibracteolate; sepals 5, free or shortly connate, imbricate, persistent, sometimes unequal; petals 5, free or shortly connate, hypogynous or slightly perigynous, imbricate or contorted, often unequal with the median (anterior) one the largest and spurred; stamens 5 (very

rarely more), hypogynous or perigynous, alternating with petals, the filaments short or lacking, the anthers erect, introrse, often connivent around ovary, 2-locular, dehiscing by longitudinal clefts, the abaxial ones often spurred at base, the connective often produced; ovary superior, sessile, unilocular, the placentas (2-) 3 (-5), parietal, the ovules numerous, anatropous, rarely only 1 or 2 on each placenta, the style often simple, thickened or subulate at apex, the stigma entire or divided; fruit a loculicidal capsule or baccate, the seeds rarely arillate, sometimes winged or tomentose, the endosperm usually copious, the embryo straight, the cotyledons flat and usually broad.

DISTRIBUTION: Essentially cosmopolitan but primarily tropical and subtropical, with 16-22 genera and 800-900 species. Two genera with indigenous species and one with a cultivated species are recorded from Fiji.

USEFUL TREATMENTS OF FAMILY: Hutchinson, J. *Violaceae*. Gen. Fl. Pl. 2: 326-335. 1967. Jacobs, M., & D. M. Moore. *Violaceae*. Fl. Males. 1. 7: 179-212. 1971.

KEY TO GENERA

- Petals subequal; inflorescences fasciculate; fruit a berry, the seeds subglobose; trees or shrubs, usually dioecious; indigenous species. 1. *Melicytus*
- Petals unequal, the lowermost the largest, spurred or saccate at base; fruit a 3-valved capsule; plants with ♀ flowers.
- Sepals not produced at base; inflorescences racemose to paniculate; capsule somewhat woody, the seeds compressed and winged, imbricate; indigenous lianas. 2. *Agatea*
- Sepals produced at base below point of insertion; flowers 1 or rarely 2 on axillary peduncles; capsule elastically 3-valved, the seeds ovoid to globose; herbs (our species) or shrubs; cultivated only. 3. *Viola*

1. **MELICYTUS** J. R. & G. Forst. Char. Gen. Pl. 62. 1775, ed. 2. 123. 1776; A. C. Sm. in *Allertonia* 1: 368. 1978.

Usually dioecious trees or shrubs, the stipules small and inconspicuous; leaves alternate, the blades pinnate-nerved, subtire to crenate or serrate; inflorescences axillary or borne on branchlets below leaves, fasciculate, often few-flowered; flowers (at least functionally) unisexual (perhaps sometimes ♀), actinomorphic, the pedicels slender; sepals 5, subequal, proximally connate; petals 5, subequal, broadened at base; stamens 5, the filaments short, the anthers ovoid, dehiscing by introrse-lateral clefts, with a dorsal, scalelike nectary, the connective produced into a dorsal, membranaceous scale; ovary unilocular (rudimentary or lacking in functionally ♂ flowers), the placentas 3 (-5), the ovules many on each placenta, the style 3-divided or the stigmas 3 (-5) and essentially sessile; fruit a globose to ovoid berry, usually with 4-6 (1-12) seeds, these subglobose.

TYPE SPECIES: *Melicytus ramiflorus* J. R. & G. Forst.

DISTRIBUTION: New Zealand, Norfolk Island, and the Kermadecs north to the Santa Cruz Islands, New Hebrides, Fiji, Samoa, and Tonga, with five or six species. One indigenous species occurs in Fiji.

1. **Melicytus fasciger** Gillespie in Bishop Mus. Bull. 91: 20. fig. 22. 1932; J. W. Parham, Pl. Fiji Isl. 109. fig. 47, A. 1964; van Steenis in *Blumea* 22: 168. 1975; A. C. Sm. in *Allertonia* 1: 369. 1978.

Melicytus ramiflorus sensu Gibbs in J. Linn. Soc. Bot. 39: 140. 1909; J. W. Parham, Pl. Fiji Isl. 109. 1964; non J. R. & G. Forst.

Melicytus ramiflorus subsp. *fasciger* P. S. Green in Kew Bull. 23: 345. 1969; J. W. Parham, Pl. Fiji Isl. ed. 2. 156. fig. 48, A. 1972; P. S. Green in Bramwell, Plants and Islands, 44. 1979.

An often freely branched tree or shrub 2-10 m. high, found at elevations of 300-1,195 m. in dense forest or in forest on crests and ridges. The faintly fragrant

flowers have cream-white sepals and white or cream-white petals. Flowers have been collected between January and August, fruits only in August.

TIPIFICATION: The type is *Parks 20645* (BISH HOLOTYPE; ISOTYPES at SUVA, UC, US), collected in July, 1927, on a high ridge near Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Santa Cruz Islands, New Hebrides, and Fiji. In the last archipelago it is known from three high islands but not yet from Vanua Levu.

LOCAL NAME: The only Fijian name noted is *thanggolongolo* (FD 1187).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Koroyanitu, summit of Mt. Evans Range, DA 14144; Mt. Mbatilamu, Vunda, DA 14121; western slopes of Mt. Mangondro, Webster & Hildreth 14274; Savundamatau Creek, west of Nandarivatu, Webster & Hildreth 14258; Nandarivatu, im Thurn 59, Gillespie 3851, Stauffer & Koroiveibau 5827; Mt. Nanggaranambuluta, west of Nandarivatu, DA 13946; between Nandarivatu and Navai, Gibbs 749; lower slopes of Mt. Tomanivi, Vaughan 3415. NANDRONGA & NAVOSA: Vaturua, Nandrau, DA L.13471 (DF 1187); northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, Smith 5647; near Koronayalewa, DA 1467, p. p. NGAU: Hills east of Herald Bay, inland from Sawaieke, Smith 7746. TAVEUNI: Vicinity of Waiyevo, Gillespie 4723; slopes of Mt. Manuka, east of Wairiki, Smith 8143.

Meliclytus fasciger differs from *M. samoensis* (Christophersen) A. C. Sm., of Samoa and Tonga, in its larger, lanceolate, acuminate petals (at least in ♂ flowers) and its leaf blades with comparatively irregular and more numerous marginal serrations. In 1978, cited above, I expressed the opinion that the taxa of the Fijian Region are not very closely related to the New Zealand *M. ramiflorus* J. R. & G. Forst., but of course the opinion is subjective and should be reviewed by a reviser of the entire genus. Apparently overlooked by earlier collectors, *M. fasciger* seems to have been first obtained in Fiji by im Thurn in 1906.

2. AGATEA A. Gray in Proc. Amer. Acad. Arts 2: 323. 1852, Bot. U. S. Expl. Exped. 1: 89. 1854; Seem. Fl. Vit. 6. 1865; A. C. Sm. in J. Arnold Arb. 36: 284. 1955; Jacobs & Moore in Fl. Males. I. 7: 192. 1971.

Agation Brongn. in Bull. Soc. Bot. France 8: 79, nom. superfl. 1861.

Scandent shrubs or lianas, the stipules small, inconspicuous, subsistent or caducous; leaves alternate (spirally arranged), the blades pinnate-nerved, entire to crenate; inflorescences axillary and terminal, racemose to narrowly or broadly paniculate, bracteate, the pedicels bibracteolate below middle and articulate slightly higher; flowers ♂, zygomorphic; sepals 5, subequal, caducous; petals 5, sessile, unequal, the posterior (adaxial) pair the smallest, symmetrical, the middle pair larger, asymmetrical, the anterior (abaxial) one the largest, gibbous at base, narrowed in middle portion, broadened distally; stamens 5, subequal, 4 connate at base, the posterior one separate, the filaments of the other 4 slightly thickened and pilose without, the 2 anterior ones spurred, the anthers with introrse-lateral dehiscence and with a small thecal appendage, the connectives membranaceous, ovate-deltoid, about twice as long as anthers; gynoecium slightly longer than androecium, the ovary subglobose, the placentas parietal, each with many ovules, the style curved toward the anterior petal, the stigma clavate; fruit an elongate, dehiscent, 3-valved capsule, the seeds numerous, flat, imbricate, irregularly circumalate.

TYPE SPECIES: *Agatea violaris* A. Gray.

DISTRIBUTION: Northern New Guinea to New Caledonia, Fiji, and Tonga, possibly with 8-12 species but more probably (cf. Jacobs and Moore, 1971, cited above) to be interpreted as composed of a single species. My indication (1955, cited above) of termination of the generic range in Fiji is now negated by discovery of the genus in Tonga.

1. *Agatea violaris* A. Gray in Proc. Amer. Acad. Arts 2: 324. 1852.

Gray's name, discussed below as *f. violaris*, was first published as part of a descriptio generico-specifica.

KEY TO FORMS

Leaf blades glabrous on both sides (or occasionally very sparsely puberulent along nerves, infrequently sparsely pilose on lower surfaces), the branchlets, petioles, inflorescence branches, and pedicels glabrous to puberulent or closely pilose with hairs seldom exceeding 0.2 mm. in length. 1a. *f. violaris*
 Leaf blades beneath and sometimes above copiously soft-pilose with spreading hairs (0.2-) 0.5-1 mm. long, these usually especially abundant on costa beneath, the branchlets, petioles, inflorescence branches, and pedicels usually similarly pilose. 1b. *f. mollis*

1a. *Agatea violaris* A. Gray *f. violaris*; J. W. Parham, Pl. Fiji Isl. 109. 1964, ed. 2. 156. 1972. FIGURES 179, 180A-C.

Agatea violaris A. Gray in Proc. Amer. Acad. Arts 2: 324. 1852. Bot. U. S. Expl. Exped. 1: 89. 1854, Atlas, pl. 7. 1856; Seem. in Bonplandia 9: 254. 1861, Viti, 432. 1862; A. Gray in Bonplandia 10: 34. 1862, in Proc. Amer. Acad. Arts 5: 315. 1862; Seem. Fl. Vit. 6. 1865; Gibbs in J. Linn. Soc. Bot. 39: 140. 1909; Turrill in op. cit. 43: 16. 1915; A. C. Sm. in J. Arnold Arb. 36: 284. 1955; Yuncker in Bishop Mus. Bull. 220: 189. 1959; Jacobs & Moore in Fl. Males. I. 7: 194. fig. 4. 1971.

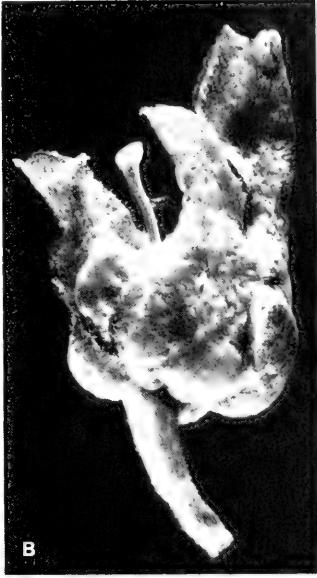
Agation violare Brongn. in Bull. Soc. Bot. France 8: 80. 1861; Drake, Ill. Fl. Ins. Mar. Pac. 108. 1890. *Agatea violaris f. typica* A. C. Sm. in Sargentina 1: 57, nom. inadmis. 1942.

In Fiji *Agatea violaris f. violaris* is seen as a liana at elevations from near sea level to 1,195 m. in dense or open forest or on its edges or in thickets. The petals have been noted as pink to white, cream-colored, pale yellow, or dull yellow; the fruit, at first green, becomes purple with maturity. Flowers and fruits have been obtained in most months.

TIPIFICATION: Gray described two varieties of *Agatea violaris* without naming them. In 1942, cited above, I selected his var. β as the lectotype; this is *U. S. Expl. Exped.* (US 7687 LECTOTYPE; ISOLECTOTYPES at GH, K), collected in 1840 on Ovalau.

DISTRIBUTION: Northern New Guinea, the Solomon Islands, Fiji, and Tonga. Jacobs and Moore (1971, cited above) have reduced the taxa from New Guinea (*Agatea macrobotrys* K. Schum. & Lauterb.) and Bougainville (*A. salomonensis* Merr. & Perry) to the species previously believed limited to Fiji and Tonga (the Tongan record is based on the sterile *Yuncker 15348*, from 'Eua, which is probably correctly placed here). Fully mature flowering material from Fiji seems to have the inflorescences broadly and copiously paniculate rather than sparingly branched (cf. Jacobs and Moore, 1971, fig. 4, a), but it seems likely that the distribution recorded in *Flora Malesiana* is acceptable. Jacobs and Moore also suggest that the seven species of *Agatea* described from New Caledonia may be reducible to *A. violaris*, perhaps a reasonable solution, although infraspecific taxa may prove desirable for certain forms. Forma *mollis*, here recognized, is certainly not very strong but is maintained for the time being. About 70 collections of *f. violaris* from six of the high Fijian islands have been examined, but it is to be expected on many other islands.

FIGURE 179. *Agatea violaris f. violaris*; A, distal portion of branchlet, with foliage and inflorescences including maturing ovaries, $\times 1/2$; B, flower, the largest (anterior) petal at right, $\times 10$; C, flower with perianth removed, showing the separate posterior stamen at left and one of the anterior stamens at right with a spur, $\times 20$; D, androecium with 2 stamens removed, showing 3 stamens with membranaceous connectives, and gynoecium, $\times 20$. A from *Smith 66*, B-D from *Smith 8475*.



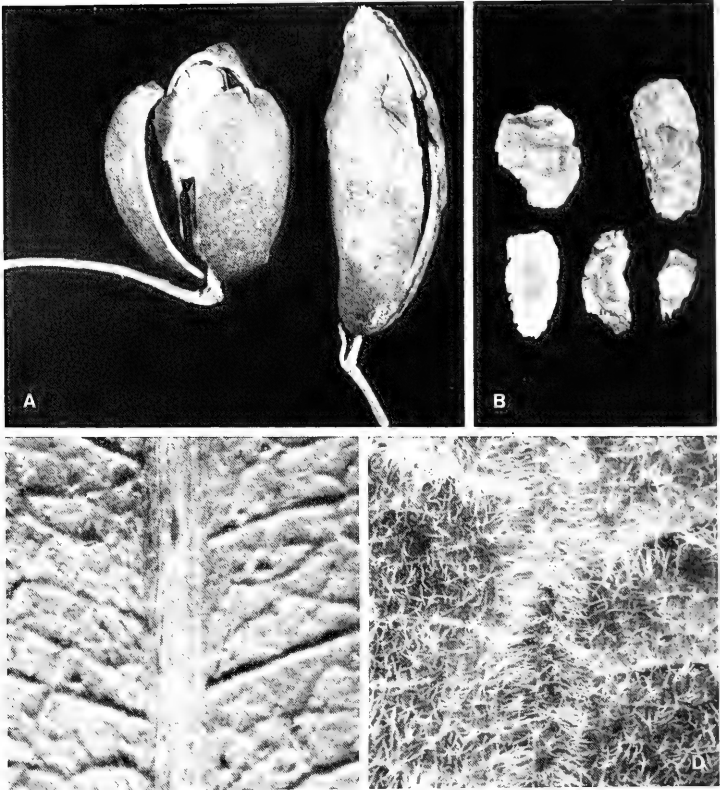


FIGURE 180. A-C, *Agatea violaris* f. *violaris*; A, variations in mature fruits, $\times 1$; B, variations in mature seed size and shape, $\times 1$; C, portion of lower leaf blade surface including costa, $\times 10$. D, *Agatea violaris* f. *mollis*, portion of lower leaf blade surface including costa, $\times 10$. A from Smith 5210 (left) and Smith 8781 (right), B (upper left to lower right) from Smith 5210, Smith 8781, St. John 18177, Parks 20847, Smith 346, C from Smith 8475, D from Degener 15314.

LOCAL NAMES AND USE: The commonly used name is *wa watu*, but also recorded are *tamba ni singa* (Mba), *wa ni mba* (Mba), *wa kokoko* (Naitasiri), and *wa kula* (Kandavu). In Naitasiri the stems, after being heated, are sometimes used to tie house timbers together.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 506A*; summit of Mt. Koroyanitu, Mt. Evans Range, *Smith 4204*; Nandarivatu, *Gibbs 558*, in *Thurn 61*; slopes of Mt. Tomanivi, *Parks 20847*, *Smith 5210*. NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8781*; hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8475*; Mt. Voma, *DA 1991*. RA: Saulangitua, vicinity of Rewasa, near Vaileka, *Degener 15507*. NAITASIRI: Wainamo Creek, near Matawailevu, Wainimala River, *St. John 18177*; Waindina River, *DA 3832*; vicinity of Tamavua, *Gillespie 2034*. TAILEVU: Waisere Creek, *DA 2684*. REWA: Veisari, *DA 10992*; vicinity of Suva, *Tohill 7*. KANDAVU: Ngaloa Bay, *U. S. Expl. Exped.* (GH, US 7688) (Gray's var. α); hills above Namalata and Ngaloa Bays, *Smith 66*. VANUA LEVU: MBUA: Rukuruku Estate, *H. B. R. Parham 370*. MATHUATA: Near Naravuka, Ndreketi River, *DA 12865*. MATHUATA: Mountains near Lam-basa, *Greenwood 609*. THAKAUNDROVE: Mt. Mariko, *Smith 457*; hills south of Nakula Valley, *Smith 346*. TAVEUNI: *Seemann 12*; borders of lake east of Somosomo, *Smith 861*; vicinity of Waiyevo, *Gillespie 4785*. MOALA: *Milne 121, 128*.

1b. *Agatea violaris* f. *mollis* A. C. Sm. in *Sargentia* 1: 58. 1942; J. W. Parham, Pl. Fiji Isl. 109. 1964, ed. 2. 156. 1972. FIGURE 180D.

Similar in habit to the typical form, f. *mollis* is known from elevations from near sea level to a few hundred meters. Flowers have been obtained between April and October but no specimens in fruit have yet been noted.

TYPIFICATION: The type is *Degener 15314* (A HOLOTYPE; ISOTYPES at BISH, K, US), collected May 18, 1941, at Naruku, vicinity of Mbalo, near Vatukarasa, Nandronga & Navosa Province, Viti Levu.

DISTRIBUTION: Presumably endemic to Fiji, f. *mollis* has been noted on three of the high islands.

LOCAL NAME AND USE: Notes on the type collection indicate the local name as *wa ndrengandrenga* and that the leaves, steeped in water, can be used internally for sore throat.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Mbulu, near Sovi Bay, *Degener 15046*. SERUA: Inland from Ngaloa, *DA 16600*. NAITASIRI: Near Wainitakala Creek, Wainimala River, *DA 14024*. OVALAU: Near streams in mountains, *Horne 67*. VANUA LEVU: MATHUATA: Vuniwambua Creek, Korovuli River, *DA 12923*; vicinity of Natua, *DA 15337*. FIJI without further locality, *DA 3878*.

3. *VIOLA* L. Sp. Pl. 933. 1753.

Perennial or rarely annual herbs (sometimes shrubby), the stipules persistent, often conspicuous and divided; leaves alternate, the blades suborbicular to lanceolate, subentire to serrate or crenate; inflorescences axillary, the peduncle 1-flowered (rarely 2-flowered); flowers σ , zygomorphic (cleistogamous flowers of different form often produced); sepals 5, subequal, produced into appendages below point of insertion, persistent; petals 5, unequal, the lowermost (anterior) one saccate or spurred at base, the lateral pair smaller than the upper (posterior) pair and often bearded within; stamens 5, shorter than petals, the filaments short, connivent around gynoecium, the 2 lower anthers often spurred at base, the connectives distally produced into a membrane; ovary unilocular, the placentas 3, each with many ovules, the style filiform to clavate, sometimes geniculate, the stigma terminal or subterminal and anterior; fruit a loculicidally, elastically, 3-valved capsule, the seeds numerous, ovoid to globose.

LECTOTYPE SPECIES: *Viola odorata* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 546. 1913), one of Linnaeus's original 19 species.

DISTRIBUTION: Cosmopolitan in temperate areas throughout the world, with 300-500 species, several of which are widely cultivated, one of them in gardens in Fiji.

1. *Viola odorata* L. Sp. Pl. 934. 1753; Jacobs & Moore in Fl. Males I. 7: 201. fig. 8 (3). 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 156. 1972.

In Fiji *Viola odorata* is occasionally cultivated for garden borders and as a ground cover at elevations from near sea level to 250 m. (and probably higher). It is a tufted herb 5–20 cm. high, with small, long-petiolate leaves and fragrant flowers which have petals variable in color from deep purple to pink or white. Cleistogamous flowers are sometimes numerous and produce seeds. The only available collection was flowering in June.

TYPIIFICATION: Linnaeus gives several earlier references, some probably based on cultivated plants.

DISTRIBUTION: A native of Europe and western Asia, this perennial violet is widely grown in tropical and subtropical areas, seeming to tolerate a wide range of climatic conditions.

LOCAL NAME AND USE: *Violet*; said to be grown ornamentally in many European gardens in Fiji, but certainly infrequently collected.

AVAILABLE COLLECTION: VITI LEVU: NAITASIRI: Toninaiwau, Tholo-i-suva, DA 16646.

FAMILY 99. TURNERACEAE

TURNERACEAE DC. Prodr. 3: 345. 1828.

Herbs or shrubs (rarely trees), the stipules small or absent; leaves alternate (spirally arranged), simple, the blades entire or lobed or pinnatifid, pinnately nerved, often basally biglandular; inflorescences usually composed of solitary, axillary flowers, sometimes racemiform monochasia; flowers actinomorphic, ♂, perigynous, often dimorphic and heterostyled, the receptacle cupuliform or tubular; sepals 5, imbricate, often joined into a tubular calyx; petals 5, inserted on calyx tube or at its base, often clawed, contorted in bud, sometimes with a short corona at base; stamens 5, inserted on calyx tube or at its base, alternating with petals, the filaments free or adnate to sepals or hypanthium, the anthers 2-locular, dorsifixed, introrse, longitudinally dehiscent; ovary superior, unilocular, the placentas 3, parietal, sometimes intruded, very rarely subbasal, the ovules numerous (rarely 1–3), anatropous, horizontal or erect, the styles 3, usually free and slender, the stigmas often fimbriate or lacinate; fruit a loculicidally dehiscent 3-valved capsule, the seeds reticulate, striate, or pitted, arillate, the aril entire or lacerate, the endosperm copious, the embryo large, straight or curved.

DISTRIBUTION: Mostly tropical, subtropical, and subtemperate America, with some species in Africa and southern Asia, with 7–9 genera and 90–120 species. One species of *Turnera*, originally introduced, has become an occasional weed in Fiji.

USEFUL TREATMENT OF FAMILY: Hutchinson, J. Turneraceae. Gen. Fl. Pl. 2: 349–353. 1967.

1. *TURNERA* L. Sp. Pl. 271. 1753.

Erect perennial herbs, often woody at base (or shrubs); leaves alternate, the petiole in our species with 2 lateral glands at apex, the blades dentate to serrate at margin; flowers axillary and solitary (in our species), the pedicel with 2 apical bracteoles; calyx cylindrical-tubular, the lobes often acute to acuminate; petals obovate, short-clawed, caducous; stamens inserted on calyx tube above base, the anthers oblong; ovary globose to ovoid, the styles 3 (rarely connate at base), sometimes of different lengths (our species homostylous), the stigmas flabellately multifid; capsule ovoid to oblong, 3-valved nearly to base, the valves recurved distally, bearing numerous seeds in middle portion, the seeds globose to oblong, curved, reticulate, with a one-sided aril.

TYPE SPECIES: *Turnera ulmifolia* L., the only original species.

DISTRIBUTION: Tropical and subtropical America, with 50–100 species, some of which are cultivated and naturalized elsewhere.

1. *Turnera ulmifolia* L. Sp. Pl. 271. 1753; A. C. Sm. in *Sargentia* 1: 64. 1942; Greenwood in *J. Arnold Arb.* 30: 77. 1949; J. W. Parham in *Dept. Agr. Fiji Bull.* 35: 38. fig. 13. 1959, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972.

A coarse, subliguous herb 0.3–1.5 m. high, naturalized and locally abundant especially in coconut plantations near sea level. The faintly fragrant flowers have yellow petals and the seeds have a white aril; flowers and fruits seem to occur throughout the year.

TYPIFICATION: Several prior references are given by Linnaeus.

DISTRIBUTION: Indigenous in tropical America, now widespread as an ornamental and naturalized in many tropical areas.

USE: Introduced as an ornamental between 1880 and 1886, probably by Thurston (cf. Vol. 1 of this *Flora*, pp. 47, 87), who listed it in his *Catalogue*. Although it is widespread as a weed of coconut plantations in Fiji, I find no records from Viti Levu nor from elsewhere in the Fijian Region.

AVAILABLE COLLECTIONS: KANDAVU: Wainalotu, near Namalata, DA 2993. OVALAU: Levuka (observed by R. J. Lever in 1945, no voucher available). VANUA LEVU: THAKAUNDOVE: Savusavu, Krauss 1023; Maravu, near Salt Lake, Degener & Ordenez 14193; Namawa Estate, DA 8818; Wina Estate, DA 13955. TAVEUNI: Waiyevo, DA 5714; Waitavala Estate, DA 8904, 11514; Ndevo, Nggathavula Estate, DA 9109, 9623. NAITAMBA: DA 11799. VANUA MBALAVU: Lomaloma Botanical Gardens, DA 10220; near Namalata Village, Garnock-Jones 1115. MANGO: R. J. Lever. LAKEMBA: Vakano Village, Garnock-Jones 961.

FAMILY 100. PASSIFLORACEAE

PASSIFLORACEAE Juss. ex Kunth in H. B. K. *Nova Gen. et Sp.* 2: 126, as *Passifloreae*. 1817.

Herbs or shrubs or often vines with axillary tendrils, hermaphrodite or infrequently monoecious or dioecious or polygamous, the stipules usually small, deciduous; leaves alternate (spirally arranged), simple or infrequently compound, the petioles sometimes glandular, the blades entire or lobed, pinnately or palmately nerved; inflorescences basically dichasial or monochasial cymes, often racemiform or corymbiferous or with solitary flowers, sometimes tendrillous; flowers actinomorphic, ♂ or unisexual, the receptacle often cupuliform or tubular and sometimes with a central gynophore or androgynophore; sepals 3–5 (–8), free or basally connate, imbricate, persistent; petals 3–5 (–8) (rarely absent), free or shortly united, imbricate, often smaller than sepals; corona (rarely absent) arising from receptacle between perianth and androecium, often appearing petaloid or staminodial, composed of 1 or more rows of filiform organs or scales or annular; stamens 3–5 (–10), hypogynous to perigynous, often opposite petals, sometimes arising from apex of gynophore, the filaments shortly united or free, the anthers 2-locular, longitudinally dehiscent, staminodes sometimes present; ovary superior, sometimes borne on a gynophore or androgynophore, unilocular, the placentas 3 (–5), parietal, often intruded, the ovules usually numerous on each placenta, anatropous, the styles free or united (and then simple or branched), the stigmas often capitate; fruit a loculicidally 3–5-valved capsule (rarely indehiscent) or berry, the seeds 1–numerous, arillate, the endosperm fleshy, the embryo large, straight.

DISTRIBUTION: Pantropical and subtropical, with 10–23 genera and 500–700 species. Only the genus *Passiflora* occurs in Fiji, where it is represented by indigenous, adventive, and cultivated species, some of the latter being sparsely naturalized.

USEFUL TREATMENTS OF FAMILY: Hutchinson, J. *Passifloraceae*. *Gen. Fl. Pl.* 2: 364–374. 1967. Wilde, W. J. J. O. de. *Passifloraceae*. *Fl. Males.* 1: 7: 405–434. 1972.

1. *PASSIFLORA* L. Sp. Pl. 955. 1753; de Wilde in Fl. Males. I. 7: 407. 1972.

Disemma Labill. Sert. Austro-Caled. 78. 1825; Seem. Fl. Vit. 96. 1866.

Climbing plants with axillary, undivided tendrils (rarely erect), the stipules minute or foliaceous; leaves simple or compound, the petioles with or without glands, the blades entire, lobed, or partite; inflorescences sessile or pedunculate, 1-many-flowered, often tendrillous, with small bracts; flowers ♂, 5 (rarely 4)-merous, the receptacle (hypanthium) cupuliform to cylindrical; sepals usually free, often colored; petals often resembling sepals, sometimes absent; corona usually double, the outer composed of numerous filaments or membranaceous and tubular, the inner (operculum) tubular and flat or plicate (or absent), an annular nectary ring sometimes present; androgynophore present and often elongated, with or without a disk at base; stamens usually 5 (-8), borne on androgynophore at base of ovary, the filaments free, at first erect, at length usually reflexed, the anthers elliptic to linear, dorsifixed, versatile; ovary globose to fusiform, the styles usually 3 and elongate, the stigmas capitate; fruit a dry or pulpy berry, usually globose, the seeds enveloped in fleshy arils.

TYPE SPECIES: Among Linnaeus's original 24 species, the lectotype species is *Passiflora incarnata* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2: 565. 1913). The type species of *Disemma* is *D. aurantia* (Forst. f.) Labill. (*Passiflora aurantia* Forst. f.).

DISTRIBUTION: Tropical and subtropical America, southeastern Asia, Malasia, Australia, and extending eastward in the Pacific to Samoa, Tonga, and Niue, with 370-500 species, of which only about 20 are indigenous in the Old World. Many species are widely cultivated as ornamentals or for their edible fruits, and some have become extensively naturalized. In Fiji two species are indigenous and six are cultivated and/or naturalized.

USEFUL TREATMENTS OF GENUS: Green, P. S. *Passiflora* in Australasia and the Pacific. Kew Bull. 26: 539-558. 1972. Wilde, W. J. J. O. de. The indigenous Old World Passifloras. Blumea 20: 227-250. 1972.

In addition to the eight species keyed below, another American species has been noted in Tonga and consequently may be anticipated in Fiji: *Passiflora triloba* Ruiz & Pavon ex DC. (Prodr. 3: 330. 1828; P. S. Green in Kew Bull. 26: 558. 1972); this is represented by *Yuncker 15055*, from Tongatapu, which Yuncker (in Bishop Mus. Bull. 220: 193. 1959) recorded as *P. subpeltata* Ortega. The latter species is also listed by Green as occurring in Tonga, but apparently only on the basis of Yuncker's mention. *Passiflora triloba* is also represented from Tongatapu by *Krauss 1296* (BISH).

The following key is abstracted from that of Green, with added notes from de Wilde's *Flora Malesiana* treatment.

KEY TO SPECIES

Leaf blades lobed or divided in outline.

Margins of leaf blades entire, the blades with 3-5 lobes; stipules linear-subulate or lacking; glands on petiole lacking or stipitate, 0.5-2 mm. long, 1-3 mm. broad.

Sepals 2.5-5 cm. long; petals half to three-quarters the length of sepals or lacking; flowers cream-colored or pink to orange, turning darker and reddish with age, the corona filaments purplish red; fruits subglobose to ellipsoid, 2.5-5 cm. in diameter; stipules linear, less than 1 cm. long, or lacking; stems and petioles glabrous; indigenous species.

Leaf blades divided for one-third to two-thirds their length, (3-) 4-9 cm. long (except in juvenile foliage), the lobes bluntly obtuse or rounded, the central lobe broadest at base; stipules lacking or rudimentary. 1. *P. aurantia*

Leaf blades divided for two-thirds to three-quarters their length, 2-4 cm. long, the lobes rounded, the central lobe broadest above base; stipules linear-subulate, variable in length, caducous.

2. *P. barclayi*

Sepals to 1 cm. long; petals lacking; flowers greenish, sometimes with a purplish corona; fruits to 1.2 cm. in diameter; stipules linear-subulate, 4-6 (-8) mm. long; petioles with crisped hairs at least on abaxial groove and margins; naturalized species. 3. *P. suberosa*

- Margins of leaf blades serrate, denticulate, or more or less dentate, the blades variously 3-lobed; naturalized or cultivated species.
- Stems and petioles densely long-hispid-villose; margins of leaf blades unevenly dentate, the teeth ending in large glandular hairs; central lobes of leaf blades usually broadest at base; inflorescence bracts prominently 2- or 3-pinnatisect; flowers greenish, 2.5-5 cm. in diameter, the corona filaments rich blue to purplish proximally; fruits subglobose, about 2 cm. in diameter. 4. *P. foetida* var. *hispidula*
- Stems and petioles glabrous; margins of leaf blades regularly serrate, the teeth gland-tipped but not with large glandular hairs; central lobes of leaf blades usually broadest above base; inflorescence bracts shorter than calyx, 2-2.5 cm. long; flowers greenish white, 4-6 cm. in diameter, the corona filaments white, pink or purple at base; fruits ellipsoid, 4-6 cm. long. 5. *P. edulis*
- Leaf blades entire in outline, ovate or elliptic; naturalized or cultivated species.
- Stems 4-angled, winged; petioles with 3 pairs of nearly sessile glands; flowers 7-10 cm. in diameter, purple-red, the corona filaments banded purple and white; fruits oblong-ellipsoid, 12-30 cm. long. 6. *P. quadrangularis*
- Stems terete or subangular, not winged; petioles with 1 pair of subsessile glands or 2 or 3 pairs of filiform glands.
- Leaf blades 1.5-4 cm. broad, with 3 or 4 primary nerves per side, 2 of them prominent from base to at least half the length of blade; flowers less than 1.5 cm. in diameter; floral bracts minute, caducous. 3. *P. suberosa*
- Leaf blades (4-) 6-16 cm. broad.
- Texture of leaf blades more or less coriaceous, the blades elliptic or narrowly elliptic, rounded at base; floral bracts distinct to base; flowers about 8 cm. in diameter, flushed with purple or purple-dotted, the corona filaments purple with white cross bands; fruits ovoid or oblong-ellipsoid, 5-8 cm. long. 7. *P. laurifolia*
- Texture of leaf blades chartaceous, the blades ovate, truncate or slightly cordate at base; floral bracts proximally united for about one-third their length; flowers about 10 cm. in diameter, mottled purple-red, the corona filaments banded; fruits globose, 4-5 cm. in diameter. 8. *P. maliformis*

1. *Passiflora aurantia* Forst. f. Fl. Ins. Austr. Prodr. 62. 1786; Guillaumin in J. Arnold Arb. 12: 262. 1931; P. S. Green in Kew Bull. 26: 542. 1972; de Wilde in Blumea 20: 245. fig. 7. 1972.

Disemma aurantia Labill. Sert. Austro-Caled. 78. t. 79. 1825.

Passiflora sp. Seem. in Bonplandia 9: 256, p. p. 1861, Viti, 437, p. p. 1862.

Disemma caerulescens Seem. in Bonplandia 10: 366. 1862, Fl. Vit. 96. 1866; Hemsl. in J. Linn. Soc. Bot. 30: 178. 1894; Yuncker in Bishop Mus. Bull. 220: 193. 1959.

Disemma storckii Seem. Fl. Vit. 96. 1866.

Disemma vitiensis Seem. Fl. Vit. 96. 1866.

Passiflora vitiensis Mast. in Trans. Linn. Soc. 27: 634. 1871; Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; Gibbs in J. Linn. Soc. Bot. 39: 148. 1909; Turill in op. cit. 43: 23. 1915; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972.

Passiflora storckii Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; J. W. Parham, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972.

Passiflora samoensis Exell in J. Bot. 63: 203. 1925; Christophersen in Bishop Mus. Bull. 128: 153. 1935; Yuncker in op. cit. 178: 87. 1943, in op. cit. 220: 193. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 164. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 98. 1972.

Passiflora aurantia var. *aurantia*; de Wilde in Fl. Males. I. 7: 415. 1972, in Blumea 20: 246. fig. 3, t. 1972.

Passiflora aurantia var. *samoensis* de Wilde in Fl. Males. I. 7: 416. 1972, in Blumea 20: 246. fig. 3, u. 1972.

As seen in Fiji, *Passiflora aurantia* is a climbing vine occurring in forest or on its edges at elevations from near sea level to about 800 m. The sepals, corona, and androgynophore are pink or orange, becoming reddish with age; the petals are cream-colored to reddish; the corona filaments are purplish red; and the fruits are pale green, becoming purplish. Dated specimens are too few to give any indication of seasonal blooming.

TYPIIFICATION AND NOMENCLATURE: The type was collected in New Caledonia by J. R. and G. Forster on Cook's second voyage. Three Forster specimens are found in the type cover at BM, one of which, annotated as the lectotype by Green, is indicated: "G. Forster's Herbarium. *Passiflora aurantia*. 200. 326. *Passiflora aurantia*." De Wilde (in Blumea, 1972) cites *Forster 106* (s) as the type, but neither the number nor the

depository seem to suggest an appropriate lectotype. *Disemma caerulescens* is based on "Cook" (BM HOLOTYPE), from Tonga without further information. The type of *Disemma storckii* is Seemann 190, p. p. (K HOLOTYPE), collected on Taveuni in June, 1860. Seemann's second Fijian species, *D. vitiensis*, is based on a Milne specimen (K HOLOTYPE) from Viti Levu, "in Voyage of Herald Bot. 6." The type of *Passiflora samoensis* is P. Buxton & G. H. E. Hopkins 640G (BM HOLOTYPE), collected in May, 1924, about three miles south of Apia, Upolu, Samoa.

These are only a few of the many names reduced to *Passiflora aurantia* by Green, namely those typified by collections from the Fijian Region. The Samoan specimens of *P. samoensis* Exell have been recognized by de Wilde as representing a variety, distinct from var. *aurantia* in having glands in the lower quarter of the petiole rather than in the upper half, and in having laminal glands approximate to the nerve bases rather than scattered between the main nerves. In discussing glandular characters, Green concludes that they do not justify the recognition of infraspecific taxa, retaining as distinct only an Australian f. *pubescens* (recognized as a variety by de Wilde). The Fijian material of *P. aurantia* falls into the typical form (of Green) or variety (of de Wilde).

DISTRIBUTION: Eastern New Guinea (but not in the Solomons) and eastern tropical Australia to Samoa, Tonga, and Niue. The species is uncommon in Fiji and seems to have no local name; all the specimens I have seen are cited below (or above as types).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Western slopes of Mt. Mangondro, Webster & Hildreth 14283; Nandarivatu, in Thurn 292; Lewa road (southwest of Nandarivatu), DA 14461. NAITASIRI: Vatavala, Nambathara Hill, Gibbs 512. MATUKU: Milne 107. FIJI without further locality, Horne 374.

2. *Passiflora barclayi* (Seem.) Mast. in Trans. Linn. Soc. 27: 634. 1871; Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; Harms in Engl. & Prantl, Nat. Pflanzenfam. III. 6A: 89. 1893; J. W. Parham, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972; P. S. Green in Kew Bull. 26: 548. 1972.

Passiflora sp. Seem. in Bonplandia 9: 256, p. p. 1861, Viti, 437, p. p. 1862.

Disemma barclayi Seem. Fl. Vit. 96. 1866.

A slender climber, rare near sea level. The flowers are said to be pale orange.

TYPEIFICATION: The species is known in Fiji from only three collections (and two of these may be from the same gathering) and has not been obtained there since 1860. Seemann cited two collections, *Barclay 3459* (BM), collected between May 30 and June 14, 1840, on Nukulau Island, Rewa Province, Viti Levu, and *Seemann 190*, p. p. (BM LECTOTYPE indicated by Green; ISOLECTOTYPES at GH, K), collected at Port Kinnaird, Ovalau, in July, 1860.

DISTRIBUTION: New Caledonia and Fiji only, according to Green (1972, cited above), who points out minor differences between the few available specimens from the two localities in leaf texture, petioles, and glands, concluding that taxonomic separation is not advisable at this time, very little material being available. De Wilde (in Fl. Males., 1972, p. 415) has included *Passiflora barclayi* in his typical variety of *P. aurantia*.

AVAILABLE COLLECTION: Fiji without further locality, Hinds, in 1841 (K) (but doubtless obtained in 1840 on Nukulau Island and perhaps even a precise duplicate of *Barclay 3459*).

3. *Passiflora suberosa* L. Sp. Pl. 958. 1753; Killip in Publ. Field Mus. Nat. Hist., Bot. Ser. 19: 88. 1938, in A. C. Sm. in Sargentia 1: 65. 1942; Greenwood in J. Arnold

Arb. 25: 399. 1944; J. W. Parham in Dept. Agr. Fiji Bull. 35: 55. 1959, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; P. S. Green in Kew Bull. 26: 557. 1972.

A climbing or scrambling vine, naturalized on edges of dense or dry forest or in thickets at elevations from near sea level to about 350 m. The sepals, filaments, and gynoecium are pale green; the corona and androgynophore are purple-spotted; the anthers are yellow; and the fruit when mature is deep purple to black. Flowers and fruits may be anticipated in most months.

LECTOTYPIFICATION: Killip (1938, cited above) indicates Hispaniola as the probable type locality.

DISTRIBUTION: Tropical America, but now widely naturalized throughout the Old World tropics. Nineteen collections from Fiji have been examined, from five islands; the species seems especially well established on Ovalau.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 730B*. RA: Rakiraki, *DA 7936*. NAITASIRI: Yee Joy's farm, *DA 11222*. TAILEVU: Naingani Island, *DA 3810*; Korovou, *DA 11536*. REWA: Suva, *DA 3779*. OVALAU: Slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8087*; hills east of Lovoni Valley, *Smith 7288*; Levuka, *Greenwood 730*. WAKAYA: *Toihill 187*. NGAU: Shore of Herald Bay, vicinity of Sawaieke, *Smith 7923*. VANUA LEVU: MATHUATA: Nambalivaliva, Ndreketi River, *DA 10518*.

Passiflora suberosa, a common, weedy adventive, is very variable in leaf shape (and hence is double-keyed above); it simulates the indigenous species but, even when sterile, may readily be distinguished from them by its pilose petioles.

4. *Passiflora foetida* L. var. *hispida* (DC. ex Triana & Planch.) Killip in Bull. Torrey Bot. Club. 58: 408. 1931, in Publ. Field Mus. Nat. Hist., Bot. Ser. 19: 494. 1938, in A. C. Sm. in *Sargentia* 1: 65. 1942; Greenwood in J. Arnold Arb. 25: 399. 1944; J. W. Parham in Dept. Agr. Fiji Bull. 35: 55. 1959, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972; P. S. Green in Kew Bull. 26: 555. 1972.

Passiflora hispida DC. ex Triana & Planch. in Ann. Sci. Nat. Bot. V. 17: 172. 1873.

Passiflora foetida sensu Christophersen in Bishop Mus. Bull. 128: 153. 1935; Greenwood in Proc. Linn. Soc. 154: 99. 1943; Yuncker in Bishop Mus. Bull. 220: 192. 1959; non L. sensu str.

A scrambling and twining vine, naturalized as a weed along roadsides and in coastal thickets, patches of forest, and canefields at elevations from near sea level to about 200 m. The floral bracts are often red-tinged, the sepals, stamens, and gynoecium pale green, the petals white, the corona filaments rich blue proximally and white distally, and the fruit yellow to orange with greenish vertical lines. Flowers and fruits are seen throughout the year.

TYPIFICATION: Although Triana and Planchon listed several specimens, Killip (1938, cited above) indicates as the type a specimen (P) from Brazil, collector unknown; apparently this is the sheet bearing de Candolle's herbarium name.

DISTRIBUTION: Tropical America, but now widely distributed throughout the tropics as a weed. Other varieties of *Passiflora foetida* are apparently known in some parts of the Pacific, but var. *hispida* is by far the most widespread. Twenty-six collections from three Fijian islands have been examined, the weed being especially abundant on Viti Levu.

LOCAL NAMES: Recorded Fijian names are *sou* (Mathuata) and *loliloli ni kalavo* (Lakemba); other local names are *wild passion fruit* and *love-in-a-mist*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 820*; north of Lomolomo, *Degener & Ordonez 13686*; Toko, Tavua, *DA 9481*. NANDRONGA & NAVOSA: Near Ndumbalevu, Singatoka Valley, *DA 11350*; Singatoka, *Greenwood 820A*. SERUA: Flat coastal strip in vicinity of Ngaloa, *Smith 9341*. RA: Yanggara, *DA 10747*; near Penang, *DA 7045*. NAITASIRI: Mbatiki, Nanduruloulou, *DA 11740*; Koronivia, *DA 6033*; Nasinu, *DA 11810*. TAILEVU: Matavatathou, *DA 9945*; Vuthi Road, Raralevu, *DA 10606*. VANUA LEVU: MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua,

Smith 6908. THAKAUNDOVE: Vicinity of Savusavu, *Bierhorst F17*. LAKEMBA: Nukunuku Village, *Garnock-Jones 820*.

5. *Passiflora edulis* Sims in Bot. Mag. **45**: t. 1989. 1818; Killip in Publ. Field Mus. Nat. Hist., Bot. Ser. **19**: 393. 1938; Greenwood in Proc. Linn. Soc. **154**: 94. 1943; Yuncker in Bishop Mus. Bull. **178**: 86. 1943, in op. cit. **220**: 191. 1959; J. W. Parham, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 162. 1970; P. S. Green in Kew Bull. **26**: 554. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 97. 1972.

A cultivated and sparingly naturalized vine found from near sea level to an elevation of 850 m. The sepals are greenish, the petals white, the corona filaments pink or purple proximally and white distally, and the fruits yellow to purplish when ripe. Flowers and fruits have been noted in Fiji in February and November.

TIPIFICATION: Killip (1938, cited above) notes the type as a plant cultivated in Europe, probably originally from Brazil.

DISTRIBUTION: Tropical America, now widely cultivated but not commonly seen in Fiji.

LOCAL NAME AND USE: *Passion fruit*; the fruits are edible and are also used commercially for fruit juice, although apparently no such product has been developed in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Navai Tea Block, *DA 15093*. NAITASIRE: Cocoa Station, Nanduruloulou, *DA 12252*; Wainimbuku Creek, Nasinu, *DA 7363*.

6. *Passiflora quadrangularis* L. Syst. Nat. ed. 10. 1248. 1759; Killip in Publ. Field Mus. Nat. Hist., Bot. Ser. **19**: 335. 1938; Yuncker in Bishop Mus. Bull. **178**: 87. 1943, in op. cit. **220**: 192. 1959; J. W. Parham, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 164. 1970; P. S. Green in Kew Bull. **26**: 557. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 98. 1972.

A climbing vine with conspicuously 4-angled or 4-winged stems, cultivated only in Fiji at elevations from near sea level to about 800 m. The sepals and petals are greenish without and pink to purple-red within; the corona filaments are banded with purple, blue, and white; and the fruit is large, oblong-ellipsoid, up to 30 cm. long and greenish yellow when ripe. Flowering and fruiting are probably not seasonal in Fiji.

TIPIFICATION: The type is *Browne* (LINN), from Jamaica.

DISTRIBUTION: Tropical America, and now widely cultivated.

LOCAL NAME AND USE: *Granadilla* (the widespread name); the fruit may be eaten fresh when ripe or boiled as a vegetable when green.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Nandarivatu, in European garden, *Smith 5029*. NAITASIRE: Cocoa Station, Nanduruloulou, *DA 12253*. REWA: Suva, *Lady Cecil 238*.

7. *Passiflora laurifolia* L. Sp. Pl. 956. 1753; Killip in Publ. Field Mus. Nat. Hist., Bot. Ser. **19**: 365. 1938; Yuncker in Bishop Mus. Bull. **178**: 86. 1943, in op. cit. **220**: 192. 1959; J. W. Parham, Pl. Fiji Isl. 111. 1964, ed. 2. 158. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 162. 1970; P. S. Green in Kew Bull. **26**: 556. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 97. 1972.

A cultivated and sparingly naturalized climbing vine found in Fiji near sea level (said to be naturalized by J. W. Parham, but no voucher available); the flowers are white, flushed with red or purple or purple-spotted; the corona filaments are banded

purple and white; and the mature fruit is yellow to orange. The only available Fijian collection was flowering in November.

LECTOTYPIFICATION: Among the several Linnaean references, Killip (1938, cited above) has indicated as the lectotype that from Merian, *Hist. Gén. Insectes Surinam*, 21, *pl. 21*.

DISTRIBUTION: Tropical America, now widely cultivated and sometimes naturalized elsewhere.

LOCAL NAMES AND USE: Names used in Fiji are *passion fruit* and *bell apple*; the fruit is edible.

AVAILABLE COLLECTION: VANUA LEVU: THAKAUNDOVE: Savusavu, cultivated, *Smith 400*.

8. *Passiflora maliformis* L. Sp. Pl. 956. 1753; Killip in *Publ. Field Mus. Nat. Hist., Bot. Ser.* **19**: 352. 1938, in A. C. Sm. in *Sargentia* **1**: 65. 1942; Yuncker in *Bishop Mus. Bull.* **178**: 86. 1943; Greenwood in *Proc. Linn. Soc.* **154**: 98. 1943, in J. Arnold *Arb.* **25**: 399. 1944; Yuncker in *Bishop Mus. Bull.* **220**: 192. 1959; J. W. Parham, *Pl. Fiji Isl.* 111. 1964, ed. 2. 158. 1972; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 164. 1970; P. S. Green in *Kew Bull.* **26**: 556. 1972; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 97. 1972; St. John in *Phytologia* **36**: 369. 1977.

A climbing vine, cultivated and sparingly naturalized near sea level, then scrambling over forest edges and in thickets. The flowers are yellow to white, mottled with red or purple; the corona filaments are banded purple and white; and the fruit is yellow-green, becoming purple when ripe.

TYPIIFICATION: Linnaeus gave four prior references, Killip (1938, cited above) merely indicating Hispaniola as the likely source.

DISTRIBUTION: Tropical America, now cultivated and naturalized in other tropical areas.

LOCAL NAME AND USE: *Hard-shelled passion fruit*; introduced as an ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 216*. RA: Nanukulua, *Degener & Ordonez 13673*. VANUA LEVU: MATHUATA: Nasolo, Ndreketi River, *DA 12952*. THITHIA: *Bryan 560*.

FAMILY 101. BIXACEAE

BIXACEAE Link, *Handb.* **2**: 371, as *Bixinae*. 1831.

Shrubs or small trees with colored sap, the stipules small, caducous, the indument composed of tufted or peltate hairs; leaves alternate (spirally arranged), simple, long-petiolate, the blades entire, palmate-nerved; inflorescences terminal, thyrsiform; flowers ♂, actinomorphic, the pedicels with 5 or 6 apical glands; sepals (4 or) 5, imbricate, biglandular at base, deciduous; petals (4-) 5 (-7), imbricate, free, large, lacking a basal scale; disk hypogynous, annular; stamens numerous, inserted on disk, the filaments essentially free, elongate, the anthers narrowly hippocrepiform, 2-locular, dehiscing by short slits toward apex; ovary superior, unilocular, the placentas 2, parietal, the ovules numerous, anatropous, the style slender, elongate, recurved in bud, the stigma bilobed; fruit a compressed, loculicidally 2-valved capsule, densely echinate-setose to smooth, the valves thick, the seeds numerous, obovoid, with a red, fleshy testa, the endosperm copious, the embryo large, with broad cotyledons.

DISTRIBUTION: Tropical America, with a single monotypic genus now widely cultivated and naturalized throughout the tropics, as it is in Fiji.

1. *Bixa* L. Sp. Pl. 512. 1753.

Characters of the family.

TYPE SPECIES: *Bixa orellana* L.

DISTRIBUTION: Tropical America and the West Indies, usually considered to be composed of a single variable species, although sometimes three or four are recognized.

1. *Bixa orellana* L. Sp. Pl. 512. 1753; Horne, A Year in Fiji, 258. 1881; Setchell in Carnegie Inst. Wash. Publ. **341**: 68. 1924; Guillaumin in J. Arnold Arb. **12**: 225. 1931; Christophersen in Bishop Mus. Bull. **128**: 149. 1935; A. C. Sm. in Sargentia **1**: 57. 1942; Greenwood in Proc. Linn. Soc. **154**: 94. 1943; Yuncker in Bishop Mus. Bull. **184**: 52. 1945; Backer in Fl. Males. I. **4**: 239. *fig. 1, 2*. 1951; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 54. 1959, in Agr. J. Dept. Agr. Fiji **29**: 31. 1959, Pl. Fiji Isl. **102**. 1964, ed. 2. 144. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 51. 1970; St. John & A. C. Sm. in Pacific Sci. **25**: 334. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 67. 1972.

As it is seen in Fiji, *Bixa orellana* is a shrub or tree 1–6 m. high, noted from near sea level to an elevation of about 600 m., usually cultivated but also occasionally naturalized on edges of forest, in thickets, and in waste places. Its petals are pale pink, somewhat paler proximally; its stamens have filaments yellow at base, white above, and purple or pink distally, the anthers being pale purple; its ovary is densely covered with thick red bristles; and its young fruit is deep red, turning brown, with long, soft, reddish bristles and with scarlet or vermilion seeds. Flowers and fruits have been obtained in months scattered throughout the year.

TIPIFICATION: Several prior references were noted by Linnaeus.

DISTRIBUTION: As of the genus; specimens are now available from most Pacific archipelagoes.

LOCAL NAMES AND USES: The usual Fijian names are *nggisa* or *nggesa*, although the widespread name *annatto* (or *annatto*) is also used. In Fiji its only use seems to be as an ornamental, often grown in hedges; elsewhere in the Pacific a dye from the seeds has been used to color bark cloth. The dye annatto is obtained from the pulp around the seeds by macerating them in water and is used commercially for coloring foodstuffs such as butter, cheese, and chocolate.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 424*. NANDRONGA & NAVOSA: Nandrau, *Degener 14898*; Nathotholevu Agricultural Station, *H. B. R. Parham 111*. NAITASIRI: Wainameka, Waandina River, *DA 273*; Nanduruloulou Plant Introduction and Quarantine Station, *DA 396*. TAILEVU: Korovou, *Valentine 5*. REWA: Suva Botanical Gardens (recorded by J. W. Parham, no voucher). VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6783*; Lambasa, *Greenwood 424A*. THAKAUDROVE: Near Valethi, Savusavu, *Bierhorst F70*; Namale, near Savusavu, *DA 16856*; Ngasauva, *DA 13482*. FIJI without further locality, *Horne s. n.*

The species was introduced into Fiji in the 1870's (J. W. Parham, 1959) and was first recorded by Horne in 1881.

FAMILY 102. COCHLOSPERMACEAE

COCHLOSPERMACEAE Planch. in London J. Bot. **6**: 305, as *Cochlospermeae*. 1847.

Trees or shrubs with colored sap, often deciduous, the stipules small, caducous; leaves alternate (spirally arranged), simple, the blades palmatilobed; inflorescences terminal or axillary, paniculate or racemose; flowers ♂, actinomorphic or slightly zygomorphic, showy; sepals (4 or) 5, free, imbricate, deciduous; petals (4 or) 5, free,

imbricate or subcontorted; stamens numerous, the filaments essentially free, equal or unequal, the anthers linear, basifixed or dorsifixed, 2-locular, dehiscing by short, often confluent, porelike, terminal slits; ovary superior, unilocular, the placentas 3-5, parietal, often intruded into locule, the ovary sometimes (not in our genus) 3-locular with axile placentation, the ovules numerous, the style simple, filiform, the stigma minutely denticulate; fruit a large, 3-5-valved capsule, the inner and outer layers separating to form alternating valves, the seeds numerous, glabrous or copiously tomentose, straight or cochleate-reniform, the endosperm copious, the embryo large, curved, with broad cotyledons.

DISTRIBUTION: Pantropical and subtropical, northward into subtemperate parts of America, with two genera and 20-38 species. One species is sparingly cultivated in Fiji.

USEFUL TREATMENT OF FAMILY: Hutchinson, J. *Cochlospermeaceae*. Gen. Fl. Pl. 2: 232-234. 1967.

1. **COCHLOSPERMUM** Kunth in H. B. K. *Nova Gen. et Sp.* 5: 297. 1822. Nom. cons.

Characters of the family, but distinguished from the second genus (*Amoreuxia* Moç. & Sessé ex DC.) by having the ovary unilocular (the placentas sometimes meeting in the middle or at each end), the capsule incompletely 3-5-locular, and the seeds copiously tomentose; *Amoreuxia* has the ovary completely 3-locular throughout, the capsule loculicidally 3-valved, and the seeds essentially glabrous.

TYPE SPECIES: *Bombax gossypium* L., nom. illeg. = *Cochlospermum religiosum* (L.) Alston (*Bombax religiosum* L., as *B. religiosa*) (vide Nicolson in *Taxon* 28: 368. 1979).

DISTRIBUTION: Tropical and subtropical America, tropical Africa, and south-eastern Asia to northern Australia, but rare (one species) in Malesia, with 15-30 species.

1. **Cochlospermum vitifolium** (Willd.) Spreng. *Syst. Veg.* 4 (2): 206. 1827; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 149. 1972.

Bombax vitifolium Willd. *Enum. Pl. Hort. Berol.* 720. 1809.

A tree, infrequently cultivated near sea level in Fiji, where indigenous up to 12 m. high, deciduous, and with a slender trunk and few branches. The terminal panicles bear large flowers with yellow-green sepals, yellow petals, and orange stamens. The fruits (not to be expected in cultivation) are elliptic, dark brown capsules 7-8 cm. long, with brown seeds surrounded by soft white hairs.

TIPIFICATION: The type was a plant cultivated at Berlin, said by Willdenow to have come originally from Brazil. However, in his revision of the genus (as *Maximiliana*), Blake (in *J. Wash. Acad. Sci.* 11: 128. 1921) suggests that the original material may have been obtained in Campeche, Mexico.

DISTRIBUTION: Continental tropical America from western Mexico to Peru, Bolivia, and Brazil, now widely cultivated.

LOCAL NAMES AND USE: No local name was noted in Fiji, but in cultivation elsewhere the species is commonly known as *buttercup tree* or *Brazilian rose*. It is a striking ornamental.

AVAILABLE COLLECTION: VITI LEVU: MBA: Lautoka, DA 14535.

FAMILY 103. CARICACEAE

CARICACEAE Dumort. *Anal. Fam. Pl.* 37, 42. 1829.

Shrubs or small trees, often with simple stems, usually dioecious or monoecious, occasionally hermaphrodite, with abundant milky latex, estipulate; leaves clustered terminally, alternate, long-petiolate, simple or digitately compound, the blades usually

lobed; inflorescences axillary, cymose or paniculiform, sometimes of solitary flowers; flowers actinomorphic, usually unisexual, sometimes ♂; ♂ flowers with a small, 5-lobed calyx, the lobes free or shortly connate, the petals united into a slender, tubular corolla with contorted or valvate lobes, the stamens 10, inserted on corolla in 2 whorls, the filaments free or connate at base, the anthers 2-locular, longitudinally dehiscent, a rudimentary gynoeceum present or not; ♀ flowers with a similar calyx, the petals at first connivent into a corolla, becoming essentially free, the ovary superior, sessile, unilocular, the placentas 5, sometimes intruded and meeting to form a spuriously 5-locular ovary, the ovules numerous on each placenta, anatropous, the style short or essentially none, the stigmas 5, entire or fimbriate; ♂ or polygamous flowers with 5 or 10 stamens; fruit a thick-walled, pulpy berry, the seeds with fleshy endosperm and a straight embryo.

DISTRIBUTION: Tropical and subtropical America and Africa, with 4 or 5 genera and 50-65 species. The well-known *Carica papaya* is extensively cultivated in Fiji, as in most tropical and subtropical areas.

USEFUL TREATMENT OF FAMILY: Hutchinson, J. Caricaceae. Gen. Fl. Pl. 2: 423-426. 1967.

1. CARICA L. Sp. Pl. 1036. 1753.

Papaya Mill. Gard. Dict. Abridg. ed. 4. 1754; Seem. Fl. Vit. 97. 1866.

Usually simple-stemmed trees leafy at apex, the stems smooth, not prickly, the leaf blades simple, deeply subpeltately lobed or partite; inflorescence characters of the family, the ♂ flowers in panicles, the filaments free from one another, the ♀ flowers solitary or in few-flowered cymes; fruits not winged at base.

LECTOTYPE SPECIES: *Carica papaya* L. (vide L. Gen. Pl. ed. 5. 458. 1754; Britton, Fl. Bermuda, 250. 1918).

DISTRIBUTION: Tropical and subtropical America, with about 50 species.

1. *Carica papaya* L. Sp. Pl. 1036. 1753; Benth. in London J. Bot. 2: 222. 1843; A. Gray, Bot. U. S. Expl. Exped. 1: 640. 1854; Seem. in Bonplandia 9: 256. 1861, Viti, 437. 1862; Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; Christophersen in Bishop Mus. Bull. 128: 153. 1935; B. E. V. Parham in Agr. J. Dept. Agr. Fiji 13: 46. 1942; Yuncker in Bishop Mus. Bull. 178: 87. 1943; Greenwood in J. Arnold Arb. 25: 399. 1944; Yuncker in Bishop Mus. Bull. 184: 53. 1945, in op. cit. 220: 193. 1959; J. W. Parham, Pl. Fiji Isl. 113. 1964, ed. 2. 161. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 57. fig. 44. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 22, 48. 1972.

Papaya vulgaris Poir. in Lam. Encycl. Méth. Bot. 5: 2. 1804; Seem. Fl. Vit. 97. 1866.

The papaya is a soft-wooded, short-lived tree, usually unbranched and 2-10 m. high, with a straight stem usually not exceeding 20 cm. in diameter and with the large leaves clustered near apex. It is usually seen cultivated and sometimes naturalized in Fiji near sea level. The corolla is cream-white or yellow and the ovary pale green; the fruits are yellow to orange when ripe, and the numerous seeds are black or grayish. Flowers and fruits in various cultivars occur throughout the year.

TIPIFICATION: Linnaeus listed several prior references, and I have not noted a precise lectotypification.

DISTRIBUTION: Although *Carica papaya* seems unknown in a wild state, it is believed indigenous in Central America; in the early period of European occupation the seeds were widely carried to other tropical areas. Apparently it reached Fiji only in the early part of the nineteenth century.

LOCAL NAMES AND USES: In addition to the usual name *papaya*, such European

names as *papaw*, *pawpaw*, *mammey apple*, and *mummy apple* have been used. Recorded names among Fijians are *oleti*, *weleti*, *maoli*, *seaki*, *wi*, and *papita*. The flesh of the ripe fruit is edible without preparation and is also used for preserves, soft drinks, flavoring, etc. Unripe fruits may be cooked and used as a vegetable. The papaya also produces an enzyme that is used commercially as a meat-tenderizer and for many other purposes.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRE: DA 2707; Koronivia Principal Agricultural Station, DA 6020. REWA: Department of Agriculture compound, Suva, DA 11476; Nukulau Island, *Barclay s. n.* VITI LEVU without further locality, *Graeffe 1409*. TAVEUNI: *Seemann 191*. LAKEMBA: Tumbou River forks, *Garnock-Jones 850*.

ORDER CUCURBITALES

FAMILY 104. CUCURBITACEAE

CUCURBITACEAE Juss. Gen. Pl. 393. 1789.

Usually scandent or prostrate, annual or perennial, usually tendrillous, monoecious or dioecious (rarely hermaphrodite) herbs or woody plants, with watery sap, without stipules; leaves alternate (spirally arranged), simple or palmately or pedately divided or compound, the blades entire or lobed, frequently cordate; inflorescences axillary, basically cymose, sometimes racemiform or paniculiform, often composed of solitary flowers; flowers actinomorphic, infrequently somewhat zygomorphic, unisexual (rarely ♀); calyx adnate to ovary, the lobes usually 5 (2-6); corolla usually sympetalous, adnate to calyx tube, the lobes 5 (3-6), imbricate or induplicate-valvate, rarely free, sometimes lacinate, a disk present or absent; ♂ flowers with 3 or 5 (1-5) stamens inserted on calyx tube, the filaments separate or united, the anthers separate or coherent into a head (this sometimes horizontally dehiscent), when 3 in number usually bilocular (2) and unilocular (1), when 5 in number all unilocular, the locules straight or arcuate to triplicate or contorted, extrorse, usually longitudinally dehiscent, a rudimentary gynoeceum often present; ♀ flowers with the calyx produced above ovary, this inferior or nearly so, unilocular, the placentas often 3 and parietal, intruded and sometimes confluent (the ovary then spuriously 2-6-locular), the ovules usually numerous, rarely few or solitary, horizontal, pendulous, or ascending, anatropous, often immersed in pulp, the style usually 1 (sometimes styles 3 and free), the stigmas entire or lobed, the staminodes 3 or absent; fruit usually a berry or a pepo and indehiscent, rarely dehiscent by valves or by an operculum, the pericarp fleshy or dry and hardened, the endocarp sometimes fibrous, the seeds 1-many, often compressed, rarely winged, without endosperm, the embryo straight, with foliaceous cotyledons.

DISTRIBUTION: Pantropical and subtropical, less frequently in temperate areas, with 100-125 genera and 500-1,000 or more species. The family includes many important economic plants such as melons, cucumbers, pumpkins, gourds, etc. Twelve genera are recorded as occurring in Fiji, three of them with indigenous species, one represented by a naturalized weed, and eight known only in cultivation (or some of them perhaps sparingly naturalized).

USEFUL TREATMENTS OF FAMILY: Jeffrey, C. Notes on *Cucurbitaceae*, including a proposed new classification of the family. *Kew Bull.* 15: 337-371. 1962. Jeffrey, C. *Cucurbitaceae*. In: Milne-Redhead & Polhill (eds.), *Fl. Trop. E. Afr. Cucurb.* 1-156. 1967. Hutchinson, J. *Cucurbitaceae*. *Gen. Fl. Pl.* 2: 376-419. 1967. Purseglove, J. W. *Cucurbitaceae*. *Trop. Crops, Dicot.* 100-138. 1968. Heiser, C. B., Jr. *The Gourd Book*. 248 pp. Univ. Oklahoma Press. 1979.

The earlier systems of classification of the Cucurbitaceae, such as those of Cogniaux (in DC. *Monogr. Phan.*, 1881) and Cogniaux and Harms (in *Pflanzenr.*, 1916, 1924), were based primarily on stamen morphology, which is also emphasized by Hutchinson (1967). Jeffrey's 1962 classification (concisely summarized by Airy Shaw in Willis, *Dict. Fl. Pl. Ferns*. ed. 7. 306-308. 1966) utilizes many characters; an

application of it to tropical East Africa is seen in his 1967 work, which includes many of the species commonly cultivated throughout the tropics. The interrelationships of genera are very complex, even when only a few are under consideration. In the following key, which in general follows Jeffrey's sequence, the addition of the better known English names applied to cultivated species may be helpful.

KEY TO GENERA

Tendrils simple or proximally 2-6-divided, spiralling only above point of branching (or distally when simple); style 1; ovules mostly horizontal (except pendulous in *Sechium*); seeds unwinged; our species with simple (but often deeply lobed) leaf blades.

Calyx tube relatively short, broadly campanulate to turbinate or infundibular; corolla lobes not fimbriate.

Corolla rotate-campanulate, the lobes 5, nearly free, 1-3 of them with an incurved scale within at base; ♂ and ♀ flowers in our species solitary; stamens in our species 3, the anthers bilocular (2) and unilocular (1), coherent, the locules triplicate; fruit in our species dehiscent and 3-valved, the seeds dependent from valve faces; tendrils in our species simple; presumably indigenous; *bitter gourd*.
1. *Momordica*

Corolla lobes without scales.

Ovules numerous, mostly horizontal; monoecious or dioecious plants, the ♂ and ♀ flowers not borne in the same inflorescence; filaments not united into a column (except sometimes in *Coccinia*).

Anther locules triplicate; hairs of interior of calyx tube not papillose; tendrils simple, bifid, or more than 2-branched.

Fruit fleshy, smooth in our species; stamens 3 (rarely 2 or 4 in *Coccinia*).

Anthers free (except in *Coccinia*), bilocular (2) and unilocular (1) (except sometimes in *Coccinia*); tendrils simple or 2-4-branched.

Corolla rotate to campanulate, often deeply 5-lobed; petioles without apical, lateral glands.

Leaf blades entire to palmately lobed or angled; fruit baccate, indehiscent.

Corolla rotate, yellow and 6-12 cm. in diameter; ♂ and ♀ flowers solitary; stamens 3, free, the anthers bilocular (2) and unilocular (1); fruit oblong-terete, up to 35 × 20 cm., at first hispid, becoming glabrous, dark green, and covered with white wax; cultivated only; *wax gourd*. 2. *Benincasa*

Corolla campanulate, in our species white to pale yellow or pale orange and 2-3 cm. in diameter; ♂ flowers solitary, clustered, or in short racemes; ♀ flowers solitary; stamens usually 3, the filaments connate or coherent distally or entirely, the anthers all bilocular or sometimes 1 unilocular, connate or coherent at base into a globose head; fruit in our species ellipsoid, up to 6 × 3 cm., bright red, not waxy; naturalized weed. 3. *Coccinia*

Leaf blades usually deeply pinnate-lobed; corolla broadly campanulate, in our species pale yellow and 2.5-3 cm. in diameter; fruit large, subglobose to ellipsoid, fleshy, indehiscent, not waxy, greenish, in our species to 60 cm. or more long; cultivated and sparingly naturalized; *watermelon*. 4. *Citrullus*

Corolla composed of 5 free, spreading petals, these white, in our species broadly obovate and up to 5 × 4 cm.; ♂ and ♀ flowers in our species solitary; fruit large, terete, hard-shelled, fleshy, indehiscent, in our species often lageniform to clavate and 1 m. or more long, green to yellowish; leaf blades entire to shortly palmate-lobed, the petiole with a pair of apical, lateral glands; cultivated and probably naturalized; *bottle gourd*.
5. *Lagenaria*

Anthers united into an oblong head, bilocular (2) and unilocular (1); flowers solitary (or ♂ flowers fasciculate), large, with a yellow corolla lobed to middle or below, the ♂ flowers long-pedunculate, the ♀ flowers short-pedunculate; fruit baccate and often large, fleshy, indehiscent; tendrils multifid; cultivated only; *squash* and *pumpkin*. . . . 6. *Cucurbita*

Fruit fibrous, dry, operculate, in our species smooth and essentially terete; ♂ flowers in racemes; stamens 5, the anthers all unilocular (in 2 pairs with 1 separate) or united and appearing to be 3 and bilocular (2) and unilocular (1); tendrils usually proximally 3-6-divided, less often bifid; monoecious plants, the ♂ flowers in racemes, the ♀ flowers solitary; cultivated and perhaps sparingly naturalized; *loofah*. 7. *Luffa*

Anther locules straight or arcuate (but triplicate in *Cucumis*); hairs of filaments and interior of calyx tube papillose; stamens 3 (2-4 in *Zehneria*); tendrils simple.

Fruit variable but often 20 cm. or more in length, globose to ellipsoid or cylindrical, smooth or with pustules or tubercles, green or yellow to brown; corolla yellow; anthers bilocular (2) and unilocular (1), the locules triplicate; cultivated only; *melon* and *cucumber*. 8. *Cucumis*

- Fruit small, globose to fusiform, smooth, usually becoming red; corolla pale yellow or white; anthers all bilocular, the locules straight or arcuate; indigenous. 9. *Zehneria*
- Ovule solitary, pendulous; monoecious plants with racemose inflorescences bearing both ♂ and ♀ flowers, the ♂ subs fasciculate, the ♀ solitary and larger than the ♂; stamens with filaments united into a central column, the anthers 3, bilocular (2) and unilocular (1), the locules triplicate; fruit obovoid to pyriform, 1-seeded; cultivated only; *choyote*. 10. *Sechium*
- Calyx tube long in both ♂ and ♀ flowers, oblong to cylindrical; corolla rotate, the lobes fimbriate; ♂ flowers in racemes, the stamens 3, the anthers connate, bilocular (2) and unilocular (1), the locules triplicate; ♀ flowers solitary; fruit in our species slender and elongate, indehiscent; cultivated only; *snake gourd*. 11. *Trichosanthes*
- Tendrils bifid, spiralling below point of bifurcation, the bifurcation distal and the branches spiralling and short; styles 3, free; ovules pendulous, numerous; fruit dehiscent by an apical operculum, smooth, terete or angled, the seeds apically winged, compressed; stamens 5, all unilocular; our species with compound leaves; indigenous. 12. *Nealsomitra*

1. *MOMORDICA* L. Sp. Pl. 1009. 1753; Seem. Fl. Vit. 104. 1866; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 8. 1924; Jeffrey in Fl. Trop. E. Afr. Cucurb. 17. 1967.

Dioecious or monoecious (as in our species), climbing or trailing vines, the tendrils simple (as in our species) or proximally bifid; leaves simple or pedately 3-7-foliolate or pedately biternately 7-15-foliolate (in our species the blades deeply palmately 5-9-lobed); ♂ inflorescences umbellate to short-racemose or fasciculate or composed of solitary flowers (as in our species), the peduncle with an apical, clasping bract, the flowers with the calyx tube short and broad, the lobes 5, entire, the corolla rotate-campanulate, with 5 nearly free, entire lobes, 1-3 of them with an incurved scale within at base, the stamens 2 or 3 (as in our species) and then bilocular (2) and unilocular (1), the anthers in our species coherent and with triplicate locules; ♀ flowers solitary, similar to ♂ flowers, the calyx lobes linear, reflexed at apex, the petals smaller, the ovary usually ribbed, tuberculate, or papillose, with 3 placentas, the ovules many and horizontal (or few and pendulous or erect), the style slender, the stigmas 3, lobed; fruit ovoid-ellipsoid to elongate-fusiform (in our species with about 8 longitudinal rows of subconical tubercles with smaller tubercles between the rows), indehiscent or dehiscent and 3-valved (as in our species), then exposing the seeds dependent from valve faces, the seeds compressed, the testa usually sculptured.

LECTOTYPE SPECIES: *Momordica balsamina* L. (vide Britton & Millsp. Bahama Fl. 425. 1920), one of Linnaeus's original six species.

DISTRIBUTION: Tropics and subtropics of the Old World, with 40-50 species, mostly African. One widespread species is presumably indigenous in Fiji.

1. *Momordica charantia* L. Sp. Pl. 1009. 1753; Seem. in J. Bot. 2: 48. 1864, Fl. Vit. 105. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 176. 1890; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 24, fig. 3, A-C. 1924; Greenwood in Proc. Linn. Soc. 154: 99. 1943, in J. Arnold Arb. 30: 77. 1949; Yuncker in Bishop Mus. Bull. 220: 260. 1959; J. W. Parham in Dept. Agr. Fiji Bull. 35: 56. 1959, Pl. Fiji Isl. 112. 1964, ed. 2. 160. 1972; Jeffrey in Fl. Trop. E. Afr. Cucurb. 31. 1967; Purseglove, Trop. Crops, Dicot. 132. fig. 21. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 79. 1970; Heiser, Gourd Book, 63. 1979.

Momordica charantia var. *abbreviata* Sringee in DC. Prodr. 3: 311. 1828; Christophersen in Bishop Mus. Bull. 128: 207. 1935.

An annual, climbing or trailing vine, occurring in coastal thickets or along creeks and rivers up to an elevation of perhaps 100 m. The corolla is pale yellow to orange-yellow; the fruit is reddish orange, paler distally, with seeds sheathed in red pulp. Flowers and fruits have been obtained in scattered months.

LECTOTYPIFICATION AND NOMENCLATURE: Jeffrey (1967, cited above) indicates as

lectotype a specimen (BM) from a plant cultivated at Hartekamp, Holland. The type of *Momordica charantia* var. *abbreviata* is from Ceylon; the variety is not retained by Jeffrey.

DISTRIBUTION: Tropical and subtropical in the Old World, introduced into America. It is probably indigenous in the southern Pacific, having been obtained in Tahiti by the first Cook expedition. It could, of course, have been an aboriginal introduction, but this is not suggested by its usually coastal habitat.

LOCAL NAMES AND USES: *Kerala* (Hindi); elsewhere it is usually known as *bitter gourd* or *balsam pear*. In India (and probably among Indians in Fiji) the young fruits are cooked and used as a vegetable, and the fruit may be pickled or used as an ingredient of curries, etc.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 143*. NAITASIRE: Principal Agricultural Station, Koronivia, *DA 12137*; Tamavua, *DA 10794*. TAILEVU: Nanggia, Wainimbuka River, *DA 10964*. REWA: Nambukalou Creek, Suva, *DA 10191*. KANDAVU: Western end of island, near Cape Washington, *Smith 309*. FIJI without further locality, *Williams* (BM) (cited by Seemann, 1866, as "probably Vanua Levu").

2. **BENINCASA** Savi in *Biblioth. Ital.* **9**: 158. 1818; Cogn. & Harms in *Pflanzenr.* **88** (IV. 275. II): 163. 1924.

Monoecious, annual herb, decumbent or climbing, spreading-pilose throughout, the tendrils bifid; leaves petiolate, the blades reniform-ovate, 5-11-lobed or -angled, deeply cordate; flowers solitary, the calyx tube broadly campanulate, the lobes 5, recurved, dentate, the corolla rotate, 5-lobed nearly to base, the lobes obovate, entire; ♂ flowers with 3 free stamens, the filaments short, the anthers bilocular (2) and unilocular (1), the locules triplicate, a rudimentary glandlike gynoeceium present; ♀ flowers with 3 staminodes, the ovary ovoid, the placentas 3, with numerous, horizontal ovules, the style thick, the stigmas 3, undulate; fruit baccate, indehiscent, oblong-terete, at first hispid, becoming glabrous and covered with white wax, the seeds numerous, compressed, thick-margined.

TYPE SPECIES: *Benincasa cerifera* Savi (= *B. hispida* (Thunb.) Cogn.).

DISTRIBUTION: A monotypic genus, probably indigenous in tropical Asia and parts of Malesia, now cultivated throughout the tropics.

1. **Benincasa hispida** (Thunb.) Cogn. in *DC. Monogr. Phan.* **3**: 513. 1881; Cogn. & Harms in *Pflanzenr.* **88** (IV. 275. II): 164. *fig. 17*. 1924; Yuncker in *Bishop Mus. Bull.* **220**: 261. 1959; Purseglove, *Trop. Crops, Dicot.* **101**. *fig. 13*. 1968; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 82. 1972; Heiser, *Gourd Book*, 61. 1979.

Cucurbita hispida Thunb. *Fl. Jap.* 322. 1784.

Benincasa cerifera Savi in *Biblioth. Ital.* **9**: 158. *pl.* 1818; J. W. Parham, *Pl. Fiji Isl.* 112. 1964, ed. 2. 159. 1972.

A decumbent or climbing vine, sparingly cultivated. The flowers are large and yellow, the fruits dark green and covered with white wax at maturity.

TYPIFICATION: The type of *Cucurbita hispida* was obtained near Nagasaki, Japan, presumably by Thunberg; that of *Benincasa cerifera* was from a plant cultivated in the Botanical Garden at Pisa.

DISTRIBUTION: Probably indigenous in southeastern Asia and perhaps in parts of Malesia, now widely cultivated. Although it occurs in cultivation in Fiji (cf. J. W. Parham, cited above), no herbarium vouchers are available and no date of introduction is known.

LOCAL NAME AND USES: The commonly used name is *wax gourd*. The ripe fruits can be utilized as condiments or preserves, and the young and ripe fruits, as well as young foliage, are cooked and used as vegetables.

3. *COCCINIA* Wight & Arn. Prodr. Fl. Ind. Orient. 347. 1834; Jeffrey in Fl. Trop. E. Afr. Cucurb. 56. 1967.

Dioecious, climbing or trailing, mostly perennial herbs with tuberous roots, the tendrils simple (as in our species) or proximally 2-partite; leaves petiolate, the blades simple (in our species ovate to orbicular, entire or sinuate at margin, variably 3-5-lobed); flowers medium-sized to large, the calyx tube campanulate to turbinate, the lobes usually small, the corolla campanulate, 5-lobed, the lobes entire; ♂ inflorescences short-racemose or composed of solitary or clustered flowers (usually 1 or 2 in our species), the stamens usually 3, the filaments connate or coherent distally or entirely and then forming a column, infrequently free, the anthers all bilocular or sometimes 1 unilocular, connate or coherent at base into a globose head, rarely free, the locules triplicate, the connective broad, a rudimentary gynoeceum lacking; ♀ flowers solitary (as in our species) or rarely in racemes, with 3 oblong or subulate staminodes, the ovary smooth, with 3 placentas, the ovules numerous, horizontal, the style elongated, slender, the stigmas 3, bilobed; fruit globose to ellipsoid or cylindrical, baccate, indehiscent, the seeds numerous, small, compressed.

TYPE SPECIES: *Coccinia indica* Wight & Arn., nom. illeg. (*Bryonia grandis* L.) = *C. grandis* (L.) Voigt.

DISTRIBUTION: Mostly tropical and southern Africa (one species more widespread in Old World tropics), with about 30 species. One species is widely cultivated and naturalized.

The generic name has sometimes been misspelled as *Coccinea*, but in the following references this has not been indicated.

1. *Coccinia grandis* (L.) Voigt, Hort. Suburb. Calcut. 59. 1845; Jeffrey in Fl. Trop. E. Afr. Cucurb. 68. 1967.

Bryonia grandis L. Mant. Pl. 126. 1767.

Coccinia cordifolia sensu Cogn. in DC. Monogr. Phan. 3: 529 (typo excl.). 1881; A. C. Sm. in Sargentia 1: 140. 1942; Greenwood in J. Arnold Arb. 25: 400. 1944, in op. cit. 36: 398. 1955; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; non sensu *Bryonia cordifolia* L.

A naturalized weed of waste places, canefields, roadsides, etc., near sea level, perhaps originally intentionally introduced; a sprawling or creeping vine. The corolla is white to pale yellow or pale orange, the lobes sometimes red-tipped, and the fruit is ellipsoid, up to 6 × 3 cm., and bright red when mature. Dated specimens do not indicate flowers or fruits to be seasonal.

LECTOTYPIFICATION: Jeffrey (1967, cited above) indicates a specimen from India (LINN) as the lectotype.

DISTRIBUTION: Northern tropical Africa, tropical Asia, Malesia, and tropical Australia; introduced and naturalized elsewhere, including tropical America. It is apparently a comparatively recent introduction into Fiji; Greenwood (1944, cited above) first noticed it about 1940.

USE: The fruits are used by Indians in Fiji in making curries; no local name has been noted in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 825* (Jan. 18, 1940), *825A*, *DA 14363*; Nandi, *DA 9693*. NANDRONGA & NAVOSA: Near Singatoka, *DA 16706*; Mbaravi, east of Tumbakula Creek, *Webster & Hildreth 14394*. OVALAU: Vuma, north of Levuka, *DA 17043*.

4. *CITRULLUS* Schrader in Ecklon & Zeyher, Enum. Pl. Afr. 279. 1836; Seem. Fl. Vit. 104. 1866; Cogn. & Harms in Pflanzenr. **88** (IV. 275. II): 102. 1924; Jeffrey in Fl. Trop. E. Afr. Cucurb. 44. 1967. Nom. cons.

Monoecious, annual or perennial, trailing or climbing herbs, our species with soft-pilose stems, the tendrils simple or proximally 2-4-divided, sometimes absent; leaves petiolate, the blades simple, usually deeply pinnate-lobed; flowers solitary; the calyx tube short, campanulate, the lobes narrow, the corolla broadly campanulate, deeply 5-lobed; ♂ flowers with 3 free stamens, the anthers bilocular (2) and unilocular (1), triplicate, the connectives broad, a rudimentary glandlike gynoeceium present; ♀ flowers with ligulate staminodes, the ovary ovoid or ellipsoid, pilose, the 3 placentas with numerous horizontal ovules, the style short, columnar, the stigmas 3, reniform, lobed; fruit large, subglobose to ellipsoid, fleshy, indehiscent, the seeds numerous, ovate or oblong, compressed.

TYPE SPECIES: *Citrullus vulgaris* Schrader (*Cucurbita citrullus* L.) (= *C. lanatus* (Thunb.) Mansf.). Typ. cons.

DISTRIBUTION: Africa and Asia, with three species, one of which is widely cultivated and sometimes naturalized in tropical and subtropical areas.

1. *Citrullus lanatus* (Thunb.) Mansf. in Kulturpflanze, Beih. 2: 421. 1959; Jeffrey in Fl. Trop. E. Afr. Cucurb. 46. fig. 5. 1967; Purseglove, Trop. Crops, Dicot. 102. fig. 14. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 77. 1970.

Cucurbita citrullus L. Sp. Pl. 1010. 1753.

Momordica lanata Thunb. Prodr. Pl. Cap. 13. 1794.

Citrullus vulgaris Schrader in Ecklon & Zeyher, Enum. Pl. Afr. 279. 1836; Seem. in J. Bot. 2: 48. 1864, Fl. Vit. 104. 1866; Cogn. in DC. Monogr. Phan. 3: 508. 1881; Cogn. & Harms in Pflanzenr. **88** (IV. 275. II): 103. 1924; Christophersen in Bishop Mus. Bull. **128**: 207. 1935; Yuncker in op. cit. **178**: 114. 1943; Greenwood in J. Arnold Arb. **25**: 399. 1944; Yuncker in Bishop Mus. Bull. **184**: 66. 1945, in op. cit. **220**: 261. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 81. 1972.

The watermelon is cultivated in Fiji and also sparingly naturalized in waste places; its corolla is pale yellow and its fruits are large and greenish, usually with red pulp and black seeds.

TIPIFICATION AND NOMENCLATURE: As lectotype of *Cucurbita citrullus*, a specimen at LINN, doubtless from a cultivated plant, is mentioned by Jeffrey (1967, cited above); *Citrullus vulgaris* is based on Linnaeus's concept. The type of *Momordica lanata* is *Thunberg* (UPS HOLOTYPE), from Cape Province, South Africa. The correct combination, based on the earliest available epithet, was made as recently as 1959.

DISTRIBUTION: Indigenous in tropical and subtropical Africa, early introduced into Mediterranean areas and India, and now widespread in cultivation and frequently naturalized. It was recorded by Seemann as an early European introduction into Fiji, but no herbarium material is available.

LOCAL NAME AND USE: The common English name *watermelon* is widely used, and the pulp of the ripe fruit is edible fresh.

5. *LAGENARIA* Seringe in Mém. Soc. Phys. Genève 3: 26. 1825; Seem. Fl. Vit. 105. 1866; Cogn. & Harms in Pflanzenr. **88** (IV. 275. II): 200. 1924; Jeffrey in Fl. Trop. E. Afr. Cucurb. 47. 1967.

Monoecious (as in our species) or dioecious, annual, climbing or trailing herbs (our species densely soft-pubescent throughout), the tendrils proximally bifid (as in our species) or simple; leaves petiolate, the petiole with a pair of apical, lateral glands, the blades simple (in our species suborbicular to ovate-reniform, cordate, sometimes

shortly 5–9-palmate-lobed); flowers with the calyx tube campanulate to infundibular, the lobes lanceolate or subulate, the petals 5, free, spreading, orbiculate to obovate; ♂ flowers solitary (as in our species) or in racemes, the stamens 3, the filaments free, the anthers bilocular (2) and unilocular (1), free but often coherent, somewhat contorted, triplicate; ♀ flowers solitary, the ovary ovoid to cylindrical, pilose, with 3 placentas, the ovules numerous, horizontal, the style short, thick, the stigmas 3, bilobed; fruit large, polymorphic (in our species subglobose to lageniform or clavate), hard-shelled, indehiscent, with spongy pulp, the seeds many, compressed, oblong to ovate-oblong, somewhat 2-horned at broader end, each face with 2 flat, submarginal ridges.

TYPE SPECIES: *Lagenaria vulgaris* Seringe (*Cucurbita lagenaria* L.) (= *L. siceraria* (Molina) Standl.).

DISTRIBUTION: Tropical Africa and Madagascar, with six species, one of which has a pantropical distribution.

1. *Lagenaria siceraria* (Molina) Standl. in Publ. Field Columbian Mus., Bot. Ser. 3: 435. 1930; Jeffrey in Fl. Trop. E. Afr. Cucurb. 51. fig. 6 (9). 1967; Pursglove, Trop. Crops, Dicot. 124. fig. 19. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 78. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 23. 1972; Heiser, Gourd Book, 72. 1979.

Cucurbita lagenaria L. Sp. Pl. 1010. 1753.

Cucurbita siceraria Molina, Saggio Stor. Nat. Chile, 133. 1782.

Cucurbita leucantha Lam. Encycl. Méth. Bot. 2: 150, nom. illeg. 1786.

Lagenaria vulgaris Seringe in Mém. Soc. Phys. Genève 3: 29. t. 2. 1825; Seem. Viti, 437. 1862, in J. Bot. 2: 48. 1864, Fl. Vit. 106. 1866; Cogn. in DC. Monogr. Phan. 3: 417. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 175. 1890; Cogn. & Harms in Pflanzentr. 88 (IV. 275. II): 201. fig. 24, A-C. 1924; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972.

Cucurbitaceae Seem. in Bonplandia 9: 256. 1861.

Lagenaria leucantha Rusby in Mem. Torrey Bot. Club 6: 43. 1896; Yuncker in Bishop Mus. Bull. 178: 115. 1943.

A trailing or climbing vine, cultivated and probably naturalized in Fiji; the petals and anthers are white, the fruit green to yellowish, attaining a length of a meter or more.

TYPIIFICATION AND NOMENCLATURE: Jeffrey (1967, cited above) indicates the type (LINN) of *Cucurbita lagenaria* to be from a specimen cultivated at Uppsala; *C. leucantha* and *Lagenaria vulgaris* are new names for Linnaeus's concept. *Cucurbita siceraria* is based on a collection by Molina (type probably destroyed) from Chile. Standley's binomial is now universally accepted for this much discussed species.

DISTRIBUTION: The bottle gourd has been cultivated and utilized in the Old and New World for thousands of years, and its original source has been a long-standing source of discussion. Pursglove (1968, cited above, p. 125) and Heiser (1979, cited above, pp. 71–117) conclude that it originated in Africa and spread to other parts of the Old World and to America by seawater flotation in prehistoric times. In much of the Pacific it was doubtless an aboriginal introduction. Morphological variability is pronounced, and Heiser discusses the possibility of recognizing two subspecies, one in Africa and America and one in Asia and the Pacific. At the time of Seemann's visit (Viti, 1862, cited above, p. 379) the bottle gourd was extensively used in Fiji, and he records his collection number 195 (err. 495 in Fl. Vit.). It is probable that the bottle gourd is still cultivated and used in some parts of Fiji, as it is on Niue (Sykes, 1970, cited above) and in Samoa (B. E. V. Parham, 1972, cited above).

LOCAL NAMES AND USE: Fijian names are *vango*, *ndango*, *ndaimbe*, and *ndindi*, the commonly used English name being *bottle gourd*. The woody outer pericarp of the

fruit is (or was) used as a container for oils and other fluids and for many other domestic purposes.

AVAILABLE COLLECTION: VITI LEVU: TAILEVU: Namara, *Seemann 195* (K, 2 sheets with same data, July, 1860).

6. *CUCURBITA* L. Sp. Pl. 1010. 1753; Seem. Fl. Vit. 107. 1866.

Monoecious, annual or perennial herbs, scandent or trailing, often rooting at nodes, the tendrils multifid; leaves simple, the blades scabrid, cordate at base, shallowly to deeply lobed; flowers large, solitary (or ♂ flowers fasciculate), the calyx tube campanulate, rarely elongated, the lobes 5 (4-7), the corolla yellow, campanulate, 5(4-7)-lobed to middle or below, the lobes recurved at apex; ♂ flowers long-pedunculate, with 3 stamens, the filaments free, the anthers linear, united into an oblong head, bilocular (2) and unilocular (1), the locules elongated, triplicate, a rudimentary gynoeceum lacking; ♀ flowers short-pedunculate, with 3 staminodes, the ovary oblong, with 3 (-5) placentas, the ovules numerous, horizontal, the style short, thick, the stigmas 3 (-5), bifid or lobed; fruit baccate, often very large, fleshy, indehiscent, the seeds numerous, ovate or oblong, flattened, thick-margined.

LECTOTYPE SPECIES: ING (1979) lists as the lectotype species *Cucurbita lagenaria* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 3: 291. 1913). As this is the basis of *Lagenaria vulgaris* Seringe, which is the type species of *Lagenaria*, it would seem that a different lectotype should be indicated for *Cucurbita*. In selecting *Cucurbita lagenaria* as the "type" of the genus *Cucurbita*, Britton and Brown took up the generic name *Pepo* Mill., with the type species *Cucurbita pepo* L., for the various species always referred to *Cucurbita*.

DISTRIBUTION: Tropical and subtropical America, with about 25 species, several of which are widely cultivated in tropical and temperate areas, two being recorded from Fiji.

LOCAL NAMES AND USES: The only Fijian name referable to *Cucurbita* that I have noted is *wa vukeni*, applied to *C. pepo* but perhaps generic in nature. Common English names for the various species with edible fruits have been greatly confused, all species passing as *squash* or *pumpkin*. Purselove (Trop. Crops, Dicot. 118. 1968) combines a discussion of common names and usage; as this involves the two species recorded from Fiji, one may note the following. *Pumpkin* and *winter squash* refer to either *C. maxima* or *C. pepo* when the mature fruits are used as a table vegetable, baked in pies, made into preserves, or used as a livestock feed. *Summer squash* and *vegetable marrow* are generally applicable to *C. pepo* when the immature fruits are used as a table vegetable. *Ornamental gourds* (cf. Heiser, Gourd Book, 38-47. 1979) of great diversity are considered a nonedible variety of *C. pepo* (var. *ovifera*).

KEY TO SPECIES

- Stems soft, terete, the leaf blades shallowly lobed, like the stems hispid or moderately bristly; fruit stalk terete, spongy, unexpanded; seeds white. 1. *C. maxima*
 Stems hard, sharply angular and grooved, the leaf blades deeply lobed, like the stems coarsely hispid or with spiculate bristles; fruit stalk hard, ridged, slightly expanded; seeds pale buff. 2. *C. pepo*

1. *Cucurbita maxima* Duchesne ex Lam. Encycl. Méth. Bot. 2: 151. 1786; Seem. Fl. Vit. 107. 1866; Cogn. in DC. Monogr. Phan. 3: 544. 1881; Yuncker in Bishop Mus. Bull. 220: 261. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; Purselove, Trop. Crops, Dicot. 119. 1968; Heiser, Gourd Book, 34. 1979.
 Annual, long-running vine, cultivated only in Fiji. The corolla is bright yellow and

the stigmas are yellow. The fruit is variable, often extremely large, soft- or hard-shelled, dull to bright-colored yellow and orange, the flesh yellowish, the seeds white.

TYPIFICATION: Several pre-Linnaean references were given by Lamarck.

DISTRIBUTION: Apparently indigenous in South America and there domesticated, widely distributed in post-Columbian times to most parts of the world. Only one Fijian voucher is available, but *Cucurbita maxima*, probably of comparatively recent introduction, is found in many vegetable gardens in Fiji. It had not yet reached Fiji at the time of Seemann's visit.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, Mbaniwai road, DA 12092.

2. *Cucurbita pepo* L. Sp. Pl. 1010. 1753; Seem. in J. Bot. 2: 50. 1864, Fl. Vit. 107. 1866; Cogn. in DC. Monogr. Phan. 3: 545. 1881; Yuncker in Bishop Mus. Bull. 178: 115. 1943; Greenwood in J. Arnold Arb. 25: 400. 1944; Yuncker in Bishop Mus. Bull. 220: 261. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 78. 1970; Pursseglove, Trop. Crops, Dicot. 122. 1968; Heiser, Gourd Book, 38. 1979.

Annual, long-running vine, cultivated only in Fiji or perhaps sparsely naturalized near settlements. The corolla is bright yellow to orange-yellow and the stigmas are yellow; the fruit is very variable in size, shape, and color, soft- or hard-shelled, the flesh white to dark yellow, the seeds pale buff-colored.

TYPIFICATION: Several references are listed by Linnaeus, but I have not noted a lectotypification.

DISTRIBUTION: Presumably indigenous and domesticated in Mexico but widely distributed across the area of the United States in pre-Columbian times, now widely cultivated in tropical and temperate areas. It was an early European introduction into the Pacific apparently brought to Tahiti in 1767 by Wallis, the first European navigator to visit that island. Although it is commonly found in gardens in Fiji, no herbarium vouchers are available.

7. *LUFFA* Mill. Gard. Dict. Abridg. ed. 4. 1754; Seem. Fl. Vit. 105. 1866; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 61. 1924; Jeffrey in Fl. Trop. E. Afr. Cucurb. 75. 1967.

Monoecious, annual, climbing or trailing herbs, the stem angled, the tendrils proximally 3-6-divided, less often bifid; leaves petiolate, simple, the blades broadly ovate or ovate-reniform, angular or palmately lobed; flowers medium-sized to large, yellow, the calyx tube short-campanulate, the lobes 5, large, entire, enclosing petals in bud, the petals 5, free, obovate or obcordate, entire or erose; ♂ inflorescences racemose, the flowers with 5 stamens, the filaments free, the anthers all unilocular, arranged in 2 pairs with 1 separate, or the anthers sometimes united and appearing to be 3 and bilocular (2) and unilocular (1), the locules triplicate, a rudimentary gynoeceum present and glandlike or absent; ♀ flowers solitary, with thick staminodes, the ovary elongated, smooth to ribbed, tuberculate, or spiny, with 3 placentas, the ovules many, horizontal, the style columnar, the stigmas 3, bilobed; fruit medium-sized to large, subglobose to short-cylindric, smooth and essentially terete (as in our species) to ribbed or spiny, dry, fibrous within, dehiscent by an apical operculum, the seeds compressed, oblong-elliptic, in our species with a narrow, membranaceous, winglike margin.

TYPE SPECIES: *Luffa aegyptiaca* Mill. (*Momordica luffa* L.) (= *L. cylindrica* (L.) M. Roemer).

DISTRIBUTION: Pantropical, with six to eight species, two being widely cultivated but probably of Old World origin, two being American, and the others being indigenous in the Old World tropics. One species is cultivated in Fiji.

1. *Luffa cylindrica* (L.) M. Roemer, Fam. Nat. Syn. Monogr. 2: 63. 1846; Drake, Ill. Fl. Ins. Mar. Pac. 176. 1890; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 62. fig. 8. 1924; Greenwood in J. Arnold Arb. 25: 400. 1944; Jeffrey in Kew Bull. 15: 355. 1962, in Fl. Trop. E. Afr. Cucurb. 76. fig. 10. 1967; Pursglove, Trop. Crops, Dicot. 129. fig. 20, A. 1968; St. John in Phytologia 36: 373. 1977.

Momordica cylindrica L. Sp. Pl. 1009. 1753.

Momordica luffa L. Sp. Pl. 1009. 1753.

Luffa aegyptiaca Mill. Gard. Dict. ed. 8. 1768; Heiser, Gourd Book, 51. 1979.

Luffa insularum A. Gray, Bot. U. S. Expl. Exped. 1: 644. 1854; Seem. in Bonplandia 9: 256. 1861, Viti, 437. 1862, in J. Bot. 2: 48. 1864, Fl. Vit. 105. 1866.

Luffa cylindrica var. *insularum* Cogn. in DC. Monogr. Phan. 3: 459. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 176. 1890; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 64. 1924; Christophersen in Bishop Mus. Bull. 128: 207. 1935; Yuncker in op. cit. 184: 66. 1945, in op. cit. 220: 260. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 78. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 82. 1972.

A trailing or climbing herbaceous vine, cultivated in Fiji and perhaps sparingly naturalized, said by Seemann to be common in 1860 but at present infrequently seen. The petals are deep yellow to golden-yellow, the fruits brownish when mature, ellipsoid to cylindrical and up to 30 cm. or more long, with blackish seeds.

TYPIFICATION AND NOMENCLATURE: The type of *Momordica cylindrica* was apparently a cultivated plant, of which no specimen has been traced (Jeffrey, 1962, cited above); that of *Momordica luffa* was presumably also from a cultivated plant (LINN LECTOTYPE) (Jeffrey, 1967, cited above). *Luffa aegyptiaca* is based on *Momordica luffa*. There are two sheets at US indicated by Gray as *Luffa insularum*: (1) U. S. Expl. Exped., collected in 1840 in Mathuata Province, Vanua Levu, and composed of one large leaf and flowers; and (2) U. S. Expl. Exped. (us 47876), collected in 1839 or 1841 in Samoa, composed of two smaller leaves, a partial fruit, and a single seed. Since the description goes into detail as to the flowers, I herewith indicate the first of these (us 47877) as the lectotype. The common form that is cultivated and often naturalized in Pacific archipelagoes, usually indicated as var. *insularum*, was probably an aboriginal introduction that may have been variously modified by selection, but it scarcely seems to merit nomenclatural separation from *L. cylindrica*. Whether to adopt the name *Luffa cylindrica* or *L. aegyptiaca* for the smooth loofah remains a debatable point; I here adopt the usage of Jeffrey (1962, cited above).

DISTRIBUTION: *Luffa cylindrica* is of ancient cultivation in the Old World, probably first having been domesticated in tropical Asia. It is now widely cultivated and naturalized in many tropical areas.

LOCAL NAMES AND USES: The only recorded Fijian names are *vusovuso* or *wa vusovuso*; the usual English names are *loofah* or *smooth loofah*. The fibrous network of the fruit furnishes the loofah or vegetable sponge, which is used for bathing purposes and also industrially for various types of insulation, filters, etc. In Asia the fruits are used as a vegetable when young and tender.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Suva, DA 12394. TAVEUNI: Somosomo, Seemann 193. FIJI without further locality, Hinds (κ, doubtless from Nukulau Island, Rewa Province, Viti Levu).

8. *CUCUMIS* L. Sp. Pl. 1011. 1753; Seem. Fl. Vit. 106. 1866; Cogn. & Harms in Pflanzenr. **88** (IV. 275. II): 116. 1924; Jeffrey in Fl. Trop. E. Afr. Cucurb. 94. 1967.

Monoecious, rarely dioecious, annual, climbing or trailing herbs, the stem usually hispid or scabrid-pilose, the tendrils simple; leaves petiolate, the blades simple, palmately 3-7-lobed or -angular; flowers small to medium-sized, the calyx tube campanulate to turbinate, with a basal nectary or nectariferous disk, the lobes 5, small, filiform, the corolla subcampanulate or rotate, deeply 5-lobed, the lobes oblong or ovate; ♂ flowers solitary or in few-flowered fascicles, the stamens 3, free, the filaments short, the anthers bilocular (2) and unilocular (1), the locules triplicate, the connective apically produced, a rudimentary gynoeceum glandlike and minute; ♀ flowers usually solitary, often with 3 subulate staminodes, the ovary ovoid to globose, pilose or with soft papillae, the placentas 3-5, the ovules numerous, horizontal, the style short, the stigmas 3-5, obtuse; fruit fleshy, globose to ellipsoid or cylindrical, usually firm-walled, indehiscent, smooth to reticulate or tuberculate-echinate, the seeds numerous, ovate to elliptic, compressed, not margined.

LECTOTYPE SPECIES: *Cucumis sativus* L. (vide Britton & Wilson, Sci. Surv. Porto Rico **6**: 264. 1925), one of Linnaeus's seven original species.

DISTRIBUTION: Tropical and southern Africa to tropical Asia, Malesia, and Australia, with 25-40 species, two of them widespread in cultivation.

KEY TO SPECIES

- Ovary and fruit pilose, without pustules or tubercles, the fruit often glabrate at maturity, ovoid to oblong-ellipsoid, variable in size, 4-100 cm. long, the pulp white to orange or reddish; leaf blades with obtuse lobes. 1. *C. melo*
 Ovary and fruit with scattered pustules or tubercles, each ending in a hyaline bristle or its dark basal remnant, the mature fruit at length often smooth, ellipsoid to cylindrical, often curved, 10-30 cm. long, the pulp pale green; leaf blades with acute lobes. 2. *C. sativus*

1. *Cucumis melo* L. Sp. Pl. 1011. 1753; Seem. in J. Bot. **2**: 49. 1864, Fl. Vit. 106. 1866; Cogn. in DC. Monogr. Phan. **3**: 482. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 176. 1890; Cogn. & Harms in Pflanzenr. **88** (IV. 275. II): 120. 1924; Christophersen in Bishop Mus. Bull. **128**: 207. 1935; Yuncker in op. cit. **178**: 115. 1943, in op. cit. **184**: 66. 1945, in op. cit. **220**: 261. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; Jeffrey in Fl. Trop. E. Afr. Cucurb. 106. 1967; Pursglove, Trop. Crops, Dicot. 110. fig. 16. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 78. 1970; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. **85**: 17. 1972.

Cucumis acidus Jacq. Obs. Bot. **4**: 14. 1771; Seem. in J. Bot. **2**: 49. 1864, Fl. Vit. 106. 1866; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972.

Cucumis pubescens Willd. Sp. Pl. **4**: 614. 1805; A. Gray, Bot. U. S. Expl. Exped. **1**: 646. 1854; Seem. in Bonplandia **9**: 256. 1861, Viti, 437. 1862.

A softly pilose, trailing herb, cultivated only in Fiji, with a yellow corolla. The fruit is very variable in size, shape, and outer surface, pale to deep yellow or brown or green, with white to green, yellow, or reddish flesh.

TIPIFICATION AND NOMENCLATURE: *Cucumis melo* is lectotypified by a specimen (BM) from a plant cultivated at Hartekamp, Holland (Jeffrey, 1967, cited above). Although Jacquin did not so state, Seemann (1866, cited above) indicates the type of *C. acidus* to be Jacquin (BM). For *C. pubescens*, Willdenow indicated only "v. v." These names are now commonly combined.

DISTRIBUTION: Indigenous in eastern tropical Africa and India, widely cultivated and spread throughout tropical and temperate areas. Presumably it was an aboriginal introduction into many Pacific archipelagoes, as it was noted in Tahiti on Cook's first

voyage. Although the species is often seen in gardens in Fiji, only one herbarium collection is available.

LOCAL NAMES AND USES: The name *timo* was recorded by Seemann as in use on Viti Levu, although his herbarium voucher came from Taveuni. The commonly used name is *melon*, but many cultivars are known under such names as cantaloupe, muskmelon, casaba, winter melon, honeydew melon, etc. The flesh of the fruit is edible fresh, and the fruits of some cultivars are used as vegetables and for preserves.

AVAILABLE COLLECTION: TAVEUNI: *Seemann 194* (BM, K).

2. *Cucumis sativus* L. Sp. Pl. 1012. 1753; Seem. in J. Bot. 2: 49. 1864, Fl. Vit. 106. 1866; Cogn. in DC. Monogr. Phan. 3: 498. 1881; Cogn. & Harms in Pflanzenr. 88 (IV. 275. II): 143. 1924; Yuncker in Bishop Mus. Bull. 178: 115. 1943, in op. cit. 220: 261. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 159. 1972; Jeffrey in Fl. Trop. E. Afr. 94, 97. 1967; Purselove, Trop. Crops, Dicot. 114. fig. 17. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 78. 1970.

A trailing or climbing vine, with stiff, bristly hairs, cultivated only in Fiji. The corolla is yellow, the fruit variable in size and shape, with pale green flesh.

TYPIFICATION: Several earlier references are listed by Linnaeus.

DISTRIBUTION: *Cucumis sativus* is believed to be a cultigen possibly originating in India but early spread to other Asian areas and to the Mediterranean, now widely cultivated throughout warm and temperate areas. It was apparently a European introduction into Fiji and other Pacific archipelagoes.

LOCAL NAME AND USES: Only the usual name *cucumber* has been noted in Fiji; there are many named cultivars. The fruits are used before full maturity as a salad or as a cooked vegetable; when small they are made into pickles. The young leaves can also be eaten as salad or cooked like spinach.

No Fijian herbarium vouchers are available, although cucumbers are widely cultivated in the archipelago.

9. *Zehneria* Endl. Prodr. Fl. Norfolk. 69. 1833; Jeffrey in Fl. Trop. E. Afr. Cucurb. 119. 1967.

Karivia sensu Seem. Fl. Vit. 103. 1866; non Arn. (= *Solena* Lour.).

Melothria sensu Cogn. in DC. Monogr. Phan. 3: 572, p. p. 1881, in Pflanzenr. 66 (IV. 275. I): 75, p. p. 1916; non L.

Monoecious or dioecious (our species), annual or perennial, climbing or trailing herbs, the stems herbaceous, sometimes becoming thickened and woody, the tendrils simple; leaves petiolate, the blades simple, entire or 3-5-palmate-lobed, thin-textured (the upper surface in our species often white-gland-dotted and scabrid); inflorescences racemiform, subumbelliform, fasciculate, or composed of solitary flowers, the flowers with the calyx tube campanulate, the lobes 5, small, dentiform, the corolla campanulate, 5-lobed, the lobes small, united at base, the disk prominent, free from calyx tube, rarely lacking; ♂ flowers with 3 (2-4) stamens, the filaments free, short or long (as in our species), the anthers all bilocular, the locules short and arcuate (as in our species) or straight, the connective sometimes produced, a rudimentary gynoeceium present; ♀ flowers usually with 3 staminodes, the ovary subglobose to fusiform, smooth, usually glabrous, with 3 placentas, the ovules numerous, horizontal, the style short, the stigmas 2 or 3; fruits solitary or clustered, small, baccate, globose to fusiform (ovoid and to 15 × 9 mm. in our species), smooth, the seeds small, elliptic to broadly ovate, compressed.

TYPE SPECIES: *Zehneria baueriana* Endl. (= *Z. mucronata* (Bl.) Miq.).

DISTRIBUTION: Southern Africa and Madagascar through tropical Africa and Asia to Japan, Malesia, and Australia, and eastward in the Pacific at least to the Society Islands, with about 30 species. One species is widespread into the Pacific.

1. *Zehneria mucronata* (Bl.) Miq. Fl. Ned. Ind. 1: 656. 1856; Jeffrey in Kew Bull. 15: 367, 371. 1962.

Bryonia mucronata Bl. Bijdr. Fl. Ned. Ind. 923. 1826.

Zehneria baueriana Endl. Prodr. Fl. Norfolk. 69. 1833.

Melothria samoensis A. Gray, Bot. U. S. Expl. Exped. 1: 641. 1854; Seem. Fl. Vit. 108. 1866; Yuncker in Bishop Mus. Bull. 178: 114. 1943, in op. cit. 184: 65. 1945; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 82. 1972.

Karivia samoensis A. Gray, Bot. U. S. Expl. Exped. 1: 643. 1854; Seem. in Bonplandia 9: 256. 1861, Viti, 437. 1862, in J. Bot. 2: 47. 1864.

Karivia samoensis var. *vitiensis* A. Gray, Bot. U. S. Expl. Exped. 1: 643. 1854; Seem. Fl. Vit. 104. 1866.

Melothria baueriana F. v. Muell. Fragm. Phyt. Austral. 6: 188. 1868; Cogn. in Pflanzenr. 66 (IV. 275. 1): 109. 1916.

Melothria grayana Cogn. in DC. Monogr. Phan. 3: 591. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 177. 1890; Gibbs in J. Linn. Soc. Bot. 39: 148. 1909; Cogn. in Pflanzenr. 66 (IV. 275. 1): 91. 1916; Yuncker in Bishop Mus. Bull. 220: 260. 1959; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 160. 1972.

Melothria mucronata Cogn. in DC. Monogr. Phan. 3: 608. 1881, in Pflanzenr. 66 (IV. 275. 1): 108. 1916.

Melothria rechingeri Cogn. in Repert. Sp. Nov. 5: 257. 1908, in Pflanzenr. 66 (IV. 275. 1): 95. 1916; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 79. 1970.

A scrambling or sprawling vine, occurring on open banks of streams or in forest clearings at elevations from near sea level to 1,130 m. The calyx is greenish, the corolla is pale yellow or white, and the fruit is green, probably becoming red. The available Fijian collections were flowering between September and January and fruiting in January and May.

TYPOIFICATION AND NOMENCLATURE: The type of *Bryonia mucronata* is *Blume* (L HOLOTYPE), from Java; that of *Zehneria baueriana* was collected on Norfolk Island by F. L. Bauer. *Melothria samoensis* is typified by *U. S. Expl. Exped.* (US 15176 HOLOTYPE), collected in Samoa in 1839 or 1841. *Karivia samoensis* (for which *Melothria grayana* was a new name) is based on *U. S. Expl. Exped.* (US 47858 HOLOTYPE), obtained in Samoa in 1839 or 1841. The type of *K. samoensis* var. *vitiensis*, collected on Ovalau in 1840, is *U. S. Expl. Exped.* (US 47859 HOLOTYPE). *Melochia rechingeri* is based on *Rechinger 1035* and *5244*, collected on Savaii, Samoa; a photograph of no. 5244 is available at BISH. Material from the Fijian Region and the Societies does not seem to differ notably from Malesian collections, although of course a specialist may eventually decide that the complex is divisible into more than one taxon at some rank. In his treatment of *Melothria* in the *Pflanzenreich*, Cogniaux recognized as distinct species *M. grayana* (based on *Karivia samoensis*), *M. rechingeri*, *M. mucronata*, and *M. baueriana* (to which he reduced *M. samoensis*), but the key characters used to separate them seem unreliable.

DISTRIBUTION: Formosa to Malesia and tropical Australia and eastward to the Society Islands.

LOCAL NAME: The only Fijian name noted is *wa mandrali* (*Gillespie 4354*).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *Gibbs 595*; summit and slopes of Mt. Nangaranambuluta, east of Nandarivatu, *Gillespie 4354*, *DA 14676*. NAMOSI: Hills bordering Wainavindrau Creek, in vicinity of Wainimakutu, *Smith 8890*. TAVEUNI: Vicinity of Somosomo, *Seemann 192*.

10. *SECHIUM* P. Br. Hist. Jam. 355. 1756. Nom. cons.

Monoecious, annual, climbing or sprawling herbs, the tendrils 3(2-5)-branched; leaves petiolate, the blades membranaceous, angular or lobed, cordate at base; inflorescences racemose, bearing both ♂ and ♀ flowers, the calyx tube campanulate, densely pubescent, the lobes 5, spreading, lanceolate, the corolla rotate, deeply 5-lobed, the lobes ovate-oblong, pubescent; ♂ flowers subfasciculate, with 3 stamens, the filaments short, connate into a column, the anthers free, bilocular (2) and unilocular (1), the locules triplicate, a rudimentary gynoeceum absent; ♀ flowers solitary, larger than ♂ flowers, without staminodes, the ovary unilocular, obovoid, setose, the ovule solitary, pendulous, the style short, slender, the stigma capitate, shortly lobed, the lobes recurved; fruit obovoid to pyriform, longitudinally grooved, 1-seeded, the seed ovate to elliptic, with a smooth, woody testa and acute margins.

TYPE SPECIES: *Sechium edule* (Jacq.) Sw. (*Sicyos edulis* Jacq.). Typ. cons.

DISTRIBUTION: A monotypic genus indigenous in Mexico and Central America, cultivated throughout tropical America and in other parts of the tropics.

1. *Sechium edule* (Jacq.) Sw. Fl. Ind. Occ. 1150. 1800; Cogn. in DC. Monogr. Phan. 3: 901. 1881; Yuncker in Bishop Mus. Bull. 178: 115. 1943; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 160. 1972; Pursglove, Trop. Crops, Dicot. 134. fig. 22. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 80. 1970.

Sicyos edulis Jacq. Enum. Syst. Pl. Carib. 32. 1760, Select. Stirp. Amer. 258. t. 163. 1763.

A robust, climbing or sprawling vine, cultivated only in Fiji and apparently infrequent. The calyx is pale green, the corolla greenish to cream-colored, and the fruit green to whitish, up to 20 cm. in length, and with a single white seed 3-5 cm. long.

TYPIFICATION: The type was a specimen collected in Cuba by Jacquin.

DISTRIBUTION: Mexico and Central America, now widely cultivated in tropical areas. No Fijian herbarium vouchers have been noted, the cultivation of the species in Fiji having been recorded by Parham (1964, 1972, cited above); its presence in our area has also been noted on Niue.

LOCAL NAMES AND USE: American names widely used in other areas are *choko*, *choyote*, and *chayote*. The fruits, the large tuberous roots, and the young leaves may be cooked and eaten as vegetables.

11. *TRICHOSANTHES* L. Sp. Pl. 1008. 1753.

Monoecious (our species) or dioecious, climbing, annual or perennial herbs, sometimes with large underground tubers, the tendrils simple or 2-5-parted; leaves petiolate, the blades entire, angled or 3-7-lobed, cordate at base; flowers with the calyx tube oblong to cylindrical, broadened toward apex, the lobes 5, the corolla rotate, 5-lobed, the lobes oblong to lanceolate, fimbriate; ♂ flowers in racemes, with 3 stamens, the filaments free, the anthers connate, bilocular (2) and unilocular (1), the locules triplicate, the rudimentary gynoecea 3, filiform; ♀ flowers solitary, without staminodes, the ovary oblong or globose, with 3 placentas, the ovules numerous, horizontal, the style slender, the stigmas 3, linear; fruit ovoid or globose or (in our species) slender and elongate, smooth or sulcate, fleshy, indehiscent, the seeds numerous, smooth or with thickened margins, embedded in pulp.

LECTOTYPE SPECIES: *Trichosanthes anguina* L. (vide M. L. Green, Prop. Brit. Bot. 190. 1929), one of Linnaeus's four original species (= *T. cucumerina* L.).

DISTRIBUTION: Eastern and southeastern Asia through Malesia to Australia, with about 15 species, one of which is widely cultivated.

1. *Trichosanthes cucumerina* L. Sp. Pl. 1008. 1753; Cogn. in DC. Monogr. Phan. 3: 357. 1881; Purseglove, Trop. Crops, Dicot. 136. fig. 23. 1968; Heiser, Gourd Book, 57. 1979.

Trichosanthes anguina L. Sp. Pl. 1008. 1753; Cogn. in DC. Monogr. Phan. 3: 359. 1881; J. W. Parham, Pl. Fiji Isl. 112. 1964, ed. 2. 160. 1972; Heiser, Gourd Book, 57. 1979.

Trichosanthes cucumerina var. *anguina* Haines, Forest Fl. Chota Nagpur, 167. 1910.

A climbing annual herb, with a slender, angled stem, sparsely cultivated in Fiji. The corolla is white, with delicately fringed lobes; the fruit is slender, sometimes curled, up to 150 cm. in length, greenish white when young, at length orange to red, the seeds brownish.

TYPIFICATION AND NOMENCLATURE: Under each of his simultaneously published names Linnaeus gave prior references. Apparently the two binomials were first combined by Haines in 1910 under *Trichosanthes cucumerina*. Heiser (1979, cited above) indicates that the epithet *anguina* is often applied to the wild form and *cucumerina* to the cultivated forms.

DISTRIBUTION: Southeastern Asia, Malesia, and Australia; often cultivated elsewhere. The Fijian record is based on Parham's report (1964, 1972, cited above), but no vouchers have been noted.

LOCAL NAME AND USE: The name *snake gourd* is widely used for the species; the immature fruits may be cooked and eaten as a vegetable or used in curries.

12. *NEOALSOMITRA* Hutchinson in Ann. Bot. n. s. 6: 97. 1942; A. C. Sm. in J. Arnold Arb. 36: 289. 1955.

Dioecious, woody, climbing shrubs, the tendrils distally bifid; leaves simple or 3-5-foliolate (as in our species), the leaflets sometimes biglandular at base; inflorescences laxly paniculate or racemose, the calyx tube cupuliform, the lobes 5, the corolla rotate, with 5 erose segments; ♂ flowers with 5 free stamens, the filaments short, the anthers oblong, all unilocular, at length recurved; ♀ flowers lacking staminodes, the ovary unilocular or imperfectly 3-locular, the ovules numerous, pendulous, the styles 3 (or 4), free, the stigmas semilunate; fruit clavate or cylindrical, terete or somewhat 3-angled, broadly truncate and 3-valved at apex, the seeds imbricate, compressed, terminated by a thin, elongate wing, the margins undulate-tuberculate, the testa crustaceous.

TYPE SPECIES: *Neosalsomitra sarcophylla* (Wall.) Hutchinson (*Zanonia sarcophylla* Wall.).

DISTRIBUTION: Southeastern Asia and Formosa, through Malesia to eastern Australia, and with one disjunct species extending to Fiji.

1. *Neosalsomitra integrifoliola* (Cogn.) Hutchinson in Ann. Bot. n. s. 6: 99. 1942; Jacobs in Blumea 7: 622. fig. 3. 1954; A. C. Sm. in J. Arnold Arb. 36: 289. 1955.
Gynostemma integrifoliola Cogn. in DC. Monogr. Phan. 3: 916. 1881.

A climbing woody vine, apparently very rare on edge of forest. The only available Fijian collection was in mature fruit in September.

TYPIFICATION: Cogniaux cited *Cuming* 767 and 517, from the Philippines, as cotypes of *Gynostemma integrifoliola*; Hutchinson cited both numbers without indicating a lectotype.

DISTRIBUTION: Formosa, the Philippines, Celebes, and Morotai; otherwise known only from a single collection from Fiji. The genus, except for the Fijian collection made in 1878 by Horne, has an eastern limit of New Guinea, the Bismarck Archipelago, and

Queensland. Horne's fruiting specimen precisely agrees with Philippine material of *Neosalsmitra integrifoliola*, and there seems no reason to doubt Hutchinson's inclusion of it in 1942. This disjunct range is so extraordinary that one might be inclined to question the accuracy of the collection data; Horne's handwritten field notes are: "Climber on trees & bushes on the edge of the forests in the district of Bua, Vanua Levu, & not seen in any other locality. J. Horne. Sept. 1878." These data, in Horne's inimitable handwriting, indicate that no doubt should be attached to the Fijian record. In discussing the remarkable range extension, C. Jeffrey (personal communication) expressed the opinion that such disjunctions are not unusual in the Cucurbitaceae, where high-climbing lianas of this sort seem to be readily overlooked in the forest. Most Malasian species that extend eastward to Fiji occur in New Guinea and the Solomons (and frequently also in the under-collected New Hebrides); in the present case the winged seeds may reasonably explain an unusual distribution, which appears to skip over New Guinea and the Solomons. It is possible that *N. integrifoliola* may eventually be reduced to *N. trifoliolata* (F. v. Muell., 1866) Hutchinson, of northeastern Australia and New Guinea, but Hutchinson's distinctions seem to hold: *N. trifoliolata* has comparatively thin leaflets (only 3 in lower leaves) without basal glands, whereas *N. integrifoliola*, at least as represented by Philippine collections and the Horne specimen, has thicker leaflets (5 in lower leaves) of which the middle one is usually biglandular at base.

AVAILABLE COLLECTION: VANUA LEVU: MBUA: Without further locality, *Horne 1074*.

ORDER BEGONIALES

FAMILY 105. BEGONIACEAE

BEGONIACEAE C. Agardh, Aphor. Bot. 200. 1825.

Monoecious, perennial or annual, usually succulent herbs with jointed stems and watery sap, sometimes undershrubs or climbers, the stipules free, persistent or caducous, often large and membranaceous; leaves alternate, distichous, simple, the blades entire to lobed, often asymmetrical, palmately or pinnately nerved; inflorescences axillary or terminal, basically cymose, often bostrychoid, bracteate; flowers unisexual, zygomorphic or actinomorphic, often brightly colored; ♂ flowers with 2 or 4 (-10) perianth segments, these free or connate, valvate or imbricate, petaloid, the stamens numerous or rarely few, usually in many whorls, the filaments free or variously connate, the connective often elongate, the anthers basifixed, 2-locular, dehiscing longitudinally or rarely by pores, a gynoeceum lacking; ♀ flowers with 2-8 imbricate, petaloid perianth segments, lacking staminodes, the ovary inferior (rarely half-inferior), usually 2- or 3(1-6)-locular, often winged or costate, the placentas axile (simple or branched or arising from septa) or parietal, the ovules numerous, anatropous, the styles 2 or 3 (-6), free or basally connate, variously divided, the stigmas papillose, often twisted; fruit usually a 1-3(-6)-winged capsule, loculicidally (or irregularly or apically) dehiscent, or rarely a berry, the seeds very numerous, minute, the endosperm lacking or scanty, the embryo straight.

DISTRIBUTION: Pantropical and subtropical, with five genera and 800-900 species, of which all but about 20 belong to the genus *Begonia*. This is the only genus of the family found in Fiji, where one indigenous species occurs.

1. BEGONIA L. Sp. Pl. 1056. 1753; A. C. Sm. in J. Arnold Arb. 36: 285. 1955.

Characters of the family; distinguished from the other genera by having the perianth segments less than 10 (usually 2-6, infrequently as many as 9), free in both ♂

and ♀ flowers, not in 2 regularly alternating series and thus usually not differentiated as sepals and petals, the ovary fully inferior, and the fruit loculicidally or irregularly (but not apically) dehiscent or rarely baccate.

TYPE SPECIES: *Begonia obliqua* L., the only original species.

DISTRIBUTION: As of the family (but not in Hawaii, where only the endemic *Hillebrandia* is indigenous). The genus includes many striking ornamentals. Six species are recorded from Fiji, one of them indigenous (and endemic) and terminating the Asian-Pacific distribution of the genus. The other five recorded species are cultivated, one of them being infrequently naturalized. It is very probable that other species (or cultivars) are to be found in gardens in Fiji.

The technical characters used to divide this vast and difficult genus into smaller taxa are complex and usable only by a specialist. In discussing the cultivated species I have utilized only obvious, nontechnical characters, in part depending for data on L. H. Bailey (*Standard Cyclopedia of Horticulture* and *Manual of Cultivated Plants*) and on *Hortus Third*.

KEY TO SPECIES

Indigenous species; terrestrial, rhizomatous, succulent herb; petioles 10–15 cm. long; leaf blades broadly orbicular, 12–15 × 15–18 cm., like petioles reddish-pilose; perianth segments 4, white; stamens about 20; ovary 3-winged, the styles basally joined and distally 2-parted. 1. *B. vitiensis*
Cultivated or infrequently naturalized species.

Plants with fibrous roots, the rootstock small or none, the peduncles associated with foliage.

Plants becoming 60–150 cm. high, entirely glabrous, cultivated only; leaf blades obliquely ovate or ovate-oblong, 10–25 cm. long, strongly inaequilateral at base, acute to acuminate at apex.

Leaf blades green or reddish-tinged above, reddish-flushed to brick-red or dark red beneath and sometimes red-margined, usually more than twice as long as broad, with a nearly closed sinus, the petiole 1.5–3 cm. long; cymes borne on peduncles usually 4–8 cm. long; perianth segments red or pinkish. 2. *B. coccinea*

Leaf blades green with reddish nerves, copiously white- or silver-dotted, usually less than twice as long as broad, with an open sinus, the petiole 2–5 cm. long; cymes borne on peduncles usually 9–20 cm. long; perianth segments white to pink. 3. *B. × argenteo-guttata*

Plants 15–50 cm. high, sometimes sparsely spreading-pilose on stems and leaves, cultivated and sometimes naturalized; leaf blades green, sometimes bronze-red or mahogany-red or green variegated with white, ovate to broadly ovate, 4–11 cm. long, oblique at base but not strongly inaequilateral, rounded to obtuse at apex, the petiole slender, 1–7 cm. long; cymes borne on slender peduncles usually 1–5 cm. long; perianth segments white to pink.

4. *B. × semperflorens-cultorum*

Plants with short, horizontal rhizomes, upright, the inflorescences ascending on erect peduncles; petioles and peduncles spreading-pilose; perianth segments rose-pink.

Leaf blades orbicular, (5–) 7–30 cm. in diameter, not dependent from petiole, with 5–9 short, deltoid, dentate, acute lobes, aequilaterally cordate at base, dark green above, purplish red beneath.

5. *B. × ricinifolia*

Leaf blades obliquely ovate, 10–30 × 6–25 cm., vertically dependent from petiole, sinuate-dentate or angled at margin, inaequilaterally cordate at base with a closed or overlapping sinus, variously shaded, blotched, and marbled, sometimes metallic-green above with a silvery white zone midway between costa and margin, often reddish beneath. 6. *B. rex*

1. *Begonia vitiensis* A. C. Sm. in Bishop Mus. Bull. **141**: 99. fig. 52. 1936, in J. Arnold Arb. **36**: 285. 1955; J. W. Parham, Pl. Fiji Isl. **113**. fig. 47, *B.* 1964, ed. 2. 161. fig. 48, *B.* 1972.

Begonia sp. n. Horne, A Year in Fiji, 258. 1881.

Terrestrial succulent herb about 50 cm. high, with a creeping, reddish rhizome, apparently rare in dense forest at elevations up to about 800 m. The long petioles and the broadly orbicular, cordate leaf blades are persistently pilose with reddish hairs. The comparatively short, axillary inflorescences are few-flowered (♂ and ♀ flowers

apparently occurring in the same inflorescence), with reddish-pilose, narrowly winged peduncles and branches, and with white bracts. The perianth segments and filaments are white, the anthers yellow. Fruits are not known; flowers have been obtained in May and November.

TYPIFICATION: The type is *Smith 466* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 14, 1933, in a wet, shaded ravine slightly west of the summit of Mt. Mariko, Thakaundrove Province, Vanua Levu, at an elevation of about 800 m.

DISTRIBUTION: Endemic to Fiji and thus far known from only two collections from Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: MATHUATA OR THAKAUNDOVE: Forests between Waiwai (Thakaundrove) and Lomaloma (Mathuata), *Horne 618* (K), May, 1878.

There seems no doubt that *Begonia vitiensis* is indigenous, the two known collections having been made in undisturbed, dense forest on the windward slope of Vanua Levu; its seeming rarity may be due to the fact that this area has been infrequently visited by collectors. It was common in the type locality on Mt. Mariko, but I did not find it elsewhere. The Horne specimen, without elevation notes but probably from hills between 200 and 500 m., was obtained about 18–20 km. west of Mt. Mariko.

Begonia vitiensis falls into sect. *Diploclinium* in Irmscher's division of *Begonia* (in Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 21: 572–586. 1925). The section extends from southeastern Asia through Malesia to Fiji and is said to include about 70 species. In our species both ♂ and ♀ flowers have four perianth segments; the stamens are about 20, with basally connate filaments; the ovary is equally and narrowly three-winged, with bilamellate placentas; and the styles are three, basally joined and distally two-parted. It is hoped that an eventual student of *Begonia* in Malesia will better indicate the relationship of the Fijian species.

2. *Begonia coccinea* Hook. in Bot. Mag. 69: t. 3990. 1843; L. H. Bailey, Stand. Cycl. Hort. 1: 482. fig. 527. 1914; J. W. Parham, Pl. Fiji Isl. ed. 2. 160. 1972.

A fibrous-rooted succulent herb 1–1.5 m. high, cultivated only in Fiji at low elevations. The inflorescence is large and dependent, the perianth segments red or pinkish. Available collections were flowering in March and July.

TYPIFICATION: The type was a cultivated plant grown by Veitch's Nursery from material collected by Lobb in the Organ Mts. of Brazil in 1841.

DISTRIBUTION: Brazil, but now a widely cultivated favorite.

LOCAL NAMES AND USE: This ornamental has been called *red begonia* in Fiji; perhaps the better known name elsewhere is *angel-wing begonia*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Toninaiwau, Tholo-i-suva, DA 16747; Principal Agricultural Station, Koronivia, DA 12124.

3. *Begonia* × *argenteo-guttata* Lemoine, Nursery Cat., 109. 1888; Gérome in Rev. Hort. 80: 275. 1908; L. H. Bailey, Stand. Cycl. Hort. 1: 483. fig. 529. 1914; J. W. Parham, Pl. Fiji Isl. ed. 2. 160. 1972.

Begonia sp. Yuncker in Bishop Mus. Bull. 184: 53. 1945.

A fibrous-rooted succulent herb 0.6–1.5 m. high, cultivated only in Fiji at low elevations. The large, dependent inflorescences have white to pink perianth segments. From the available collections it seems that flowers may be expected throughout the year.

TYPIFICATION: The type was a cultivated plant apparently without much documen-

tation; the taxon is now considered a hybrid between *Begonia albo-picta* Bull and *B. olbia* Kerch., both indigenous in Brazil.

DISTRIBUTION: A widely cultivated *Begonia*.

LOCAL NAMES AND USE: A common ornamental known in Fiji as *pink begonia* or *bush begonia*; elsewhere its usual names are *trout-leaf begonia* and *angel-wing begonia*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Toninaiwau, Tholo-i-suva, DA 16748; Principal Agricultural Station, Koronivia, DA 12135. REWA: Suva Botanical Gardens, DA 17228; Suva, in private garden, DA 16222.

4. *Begonia* × *semperflorens-cultorum* Hort.

Begonia semperflorens Link & Otto, Icon. Pl. Rar. Berol. t. 5. 1828; L. H. Bailey, Stand. Cycl. Hort. 1: 478. fig. 517. 1914; J. W. Parham, Pl. Fiji Isl. 113. 1964, ed. 2. 160. 1972.

A fibrous-rooted succulent herb 15–50 cm. high, cultivated in Fiji at low elevations and also an occasional weed in shade houses and along roadsides. It has white to pink perianth segments and has been noted in flower in March and September.

TYPIFICATION: The well-known bedding begonia has most often been known as *Begonia semperflorens*, the type of which was a cultivated plant originally sent to Berlin by Sellow from southern Brazil. It is now considered to be a group of hybrids originally derived from crosses between *B. cucullata* Willd. var. *hookeri* (A. DC.) L. B. Sm. & Schubert (*B. semperflorens*) and *B. schmidtiana* Regel, both from Brazil.

DISTRIBUTION: A widely cultivated and frequently naturalized *Begonia*.

LOCAL NAMES AND USE: An ornamental known in Fiji (and doubtless generally) as *bedding begonia* or *wild begonia*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Plant Introduction and Quarantine Station, Nanduruloulou, DA 9573; Toninaiwau, Tholo-i-suva, DA 16746, 16749.

5. *Begonia* × *ricinifolia* A. Dietr. in Allg. Gartenzeitung 15: 282. 1847; L. H. Bailey, Stand. Cycl. Hort. 1: 477. 1914; J. W. Parham, Pl. Fiji Isl. ed. 2. 160. 1972.

Begonia glabra sensu J. W. Parham, Pl. Fiji Isl. 113. 1964; non Aubl.

A rhizomatous herb, cultivated only in Fiji near sea level, with the leaves basal and the flowering stems ascending to 40 cm. or more. The perianth segments are rose-pink, and the only available collection was flowering in September.

TYPIFICATION: Dietrich indicated his plant to have come from Brazil; however, the taxon is now considered to be a hybrid between *Begonia heracleifolia* Cham. & Schlechtendal and *B. peponifolia* Hort. ex Vis., both from Mexico or Central America rather than Brazil.

DISTRIBUTION: A frequently cultivated *Begonia*.

LOCAL NAMES AND USE: An ornamental indicated in Fiji as *pink begonia*, known horticulturally as *star begonia*, *bronze-leaf begonia*, or *castor-bean begonia*. The only specimen at hand is small-leaved but otherwise seems correctly placed here.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, Department of Agriculture garden, DA 12186.

6. *Begonia rex* Putz in Fl. Serres Jard. Eur. II. 2: 141. t. 1255–1258. 1857; L. H. Bailey, Stand. Cycl. Hort. 1: 476. fig. 513. 1914; J. W. Parham, Pl. Fiji Isl. ed. 2. 160. 1972.

A rhizomatous succulent herb 15–25 cm. high, cultivated only in Fiji at low elevations. Flowers, with rose-pink perianth segments, were noted in March but presumably occur throughout the year.

TYPIFICATION: The type was indicated as a cultivated plant introduced by Linden,

who received it from Assam. The original form of the species is seldom found in cultivation, it having been hybridized with several other species to form many cultivars perhaps best known collectively as *Begonia rex-cultorum* L. H. Bailey.

DISTRIBUTION: Widely cultivated.

LOCAL NAMES AND USE: An ornamental often pot-grown for its variegated leaves, known in Fiji (as elsewhere) as *rex begonia*; another horticulturally used name is *painted-leaf begonia*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Toninaiwau, Tholo-i-suva, DA 16761, 16762, 16763.

ORDER CAPPARALES

KEY TO FAMILIES OCCURRING IN FIJI

- Flowers hypogynous; sepals and petals often 4; ovary usually with 2 parietal placentas; fruit a berry or drupe or a 2-valved (or rarely indehiscent) capsule; trees, shrubs, lianas, or herbs, the leaves simple (sometimes pinnately lobed, infrequently pinnately compound) or digitately foliolate.
- Stamens few to many but never tetradynamous; ovary usually stipitate and borne on an obvious gynophore, but sometimes sessile; leaves simple or digitately foliolate, the blades usually entire.
- Woody plants (our species), the indument if present not glandular; leaves simple (*Capparis*) or 3-foliolate (our species of *Crateva*); fruit (in our genera) a 1-celled berry with a leathery pericarp, borne on a conspicuous, woody gynophore, the seeds embedded in pulp. . . . 106. CAPPARACEAE
- Herbaceous plants (our species), with usually glandular indument; leaves (in our species) 3-7-foliolate; fruit a silique, sessile or borne on a gynophore, the valves falling away and leaving a persistent replum. 107. CLEOMACEAE
- Stamens usually 6 and tetradynamous (the 2 outer ones shorter than the 4 inner ones), rarely more numerous or fewer; ovary usually sessile, or if stipitate rarely borne on a conspicuous gynophore, divided by a spurious, membranous septum (replum); fruit a podlike capsule (silique or silicle), bivalvately dehiscent (rarely indehiscent), the valves usually separating from base upward and remaining attached at apex, the replum persistent; leaves often pinnately dissected but without distinct, articulated leaflets; herbs (rarely somewhat shrubby). 108. BRASSICACEAE
- Flowers perigynous; calyx lobes, petals, and functional stamens 5 each; ovary with 3 parietal placentas; fruit a 3-valved, podlike capsule (subtorulose in our species); trees with pinnately to tripinnately compound leaves (tripinnate in our species); cultivated only. 109. MORINGACEAE

FAMILY 106. CAPPARACEAE

CAPPARACEAE JUSS. Gen. Pl. 242, as *Capparides*. 1789.

Trees or shrubs (sometimes lianas, rarely herbs), the indument not glandular, the stipules reduced to thorns or spines or minute or lacking; leaves alternate (spirally arranged), simple to digitately foliolate, the blades usually entire, pinnate-nerved; inflorescences axillary or terminal, often racemose; flowers ♂ (very rarely unisexual), actinomorphic or somewhat zygomorphic, often large and showy; receptacle short or elongated, often with glandular outgrowths and with a gynophore; sepals 4 (or 6), 1- or 2-seriate, imbricate or valvate (or only the outer 2 valvate), free or the outer ones coherent basally, subequal or the inner 2 the smallest, sometimes with a basal scale; petals 4 (rarely 1-8 or absent), imbricate or rarely valvate, sometimes unguiculate; stamens few-numerous, usually all fertile, the filaments free or basally adnate to gynophore, the anthers dorsifixed, oblong, introrse, longitudinally dehiscent, the connective inconspicuous; ovary usually stipitate, unilocular or 2-6-locular with spurious septa, the placentas parietal, often 2, the ovules numerous, campylotropous, the style mostly short or lacking, the stigma usually orbicular; fruit a berry or drupe, indehiscent, the seeds reniform or angular, often immersed in pulp, the endosperm lacking or scanty, the embryo curved.

DISTRIBUTION: Pantropical to warm temperate, often growing in arid regions, with 30-32 genera and 500-650 species. Two genera occur indigenously in Fiji.

USEFUL TREATMENTS OF FAMILY: Jacobs, M. *Capparidaceae*. Fl. Males. I: 6: 61-105. 1960. Hutchinson, J. *Capparidaceae*. Gen. Fl. Pl. 2: 303-317. 1967.

KEY TO GENERA

- Leaves simple; petals not unguiculate; filaments free, not basally connate with gynophore; ovary usually with 4 placentas; plants often with indument on young parts and sometimes with stipular thorns or spines. 1. *Capparis*
 Leaves 3-foliolate; petals unguiculate; filaments basally connate with gynophore; ovary with 2 placentas; plants glabrous throughout, the stipules small, caducous. 2. *Crateva*

1. *CAPPARIS* L. Sp. Pl. 503. 1753; Seem. Fl. Vit. 6. 1865; Jacobs in *Blumea* 12: 405. 1965.

Shrubs, frequently sprawling or climbing, or rarely small trees, with eglandular indument or glabrous, the stipules reduced to thorns or spines or knobs or lacking; leaves simple, the blades entire, pinnate-nerved, with curved secondaries anastomosing toward margin; inflorescences axillary or terminal, racemose or serially subumbellate or paniculiform or with solitary flowers, the bracts soon caducous; flowers somewhat zygomorphic, ♂ (or gynoecium sometimes abortive), the receptacle somewhat conical, with a small adaxial disk; sepals 4, biseriata, mostly imbricate, those of outer pair usually strongly concave and enveloping the bud, rarely connate in bud; petals 4, imbricate, delicate, not unguiculate, the 2 lower ones free, the 2 upper ones asymmetrical and coherent at base; stamens usually numerous, (6-) 20-200, free, glabrous, exceeding petals in length, the anthers small; gynophore usually as long as or longer than stamens, irregularly coiled in bud; ovary unilocular, with 4 (2-10) placentas, the ovules mostly numerous, the stigma sessile, small; fruit a globose to ellipsoid berry, borne on a thickened and sometimes lengthened gynophore, the pericarp leathery or corky, the seeds usually numerous, obliquely reniform, embedded in pulp.

LECTOTYPE SPECIES: *Capparis spinosa* L. (vide Britton & Millsp. *Bahama* Fl. 150. 1920), one of Linnaeus's three original species.

DISTRIBUTION: Pantropical and subtropical, with about 250 species. Two species are indigenous in Fiji, but they are only distantly related to one another, falling into sect. *Capparis* (*C. cordifolia*) and sect. *Monostichocalyx* (*C. quiniflora*) in Jacobs's 1965 classification.

USEFUL TREATMENTS OF GENUS: Jacobs, M. The genus *Capparis* (Capparaceae) from the Indus to the Pacific. *Blumea* 12: 385-541. 1965. St. John, H. Revision of *Capparis spinosa* and its African, Asiatic, and Pacific relatives. *Micronesica* 2: 25-44. 1965.

Jacobs (1960, 1965) considered sect. *Capparis* to be composed of a single polymorphic species, *C. spinosa* L., which (1965) he divided into five varieties, placing all the East Malesian, Australian, and Pacific material in var. *mariana* (Jacq.) K. Schum. The range of var. *mariana* is completely separate from that of var. *spinosa*, which produces the commercial caper. Jacobs explained the disjunction by suggesting that *C. spinosa* had been introduced into the Indo-Pacific area as a cultigen in post-Columbian time. Considering this assemblage in 1965, St. John concluded that *C. spinosa* (sensu lato) is readily divisible into six species. Botanists familiar with the vegetation of Pacific islands, especially that of isolated, sparsely inhabited, limestone islands, must agree with St. John that sect. *Capparis* cannot have been a human introduction into the region. The various taxa appear to be indubitably indigenous in their respective, discrete areas. St. John's distinctions among them appear usable and reasonable, and his use of *C. cordifolia* for the widespread southern Pacific taxon of sect. *Capparis* is here adopted.

KEY TO SPECIES

- Nodes unarmed or rarely with straight stipular spines less than 0.5 mm. long; petioles 8–25 (–40) mm. long; leaf blades suborbicular or rounded-elliptic, up to about 8 × 6.5 cm.; pedicels 30–90 mm. long in flower and fruit; flowers solitary in leaf axils, comparatively large, the sepals up to 28 × 20 mm., the petals obovate-suborbicular, 22–45 × 20–40 mm.; stamens 80–110, the filaments 30–50 mm. long; gynophore up to 50 mm. long in flower, incrassate (2–3 mm. in diameter) and up to 70 mm. long in fruit, the fruit fusiform-ellipsoid, up to 50 × 15 mm. 1. *C. cordifolia*
- Nodes, especially on sterile plants, with stout, sharp, recurved stipular thorns 1–3 mm. long, but usually lacking thorns on fertile branches; petioles 5–20 mm. long; leaf blades very variable in shape, sometimes narrowly lanceolate (and then on sterile, very thorny branches), sometimes ovate (and then on older or fertile branches usually lacking thorns) and up to 10 × 6 cm. or slightly larger; pedicels 6–20 mm. long in flower, greatly thickened and up to 50 mm. long in fruit; flowers 2–10 serially arranged in axillary or subterminal rows, comparatively small, the sepals up to 5 × 3 mm., the petals up to 7 × 4 mm.; stamens 7–12, the filaments 20–27 mm. long; gynophore up to 25 mm. long in flower, becoming woody (3–6 mm. in diameter) and up to 70 mm. long in fruit, the fruit subglobose-ellipsoid, up to 40 × 35 mm. 2. *C. quiniflora*

1. ***Capparis cordifolia*** Lam. *Encycl. Méth. Bot.* 1: 609. 1785; St. John in *Micronesica* 2: 33. *pl. 1, a; fig. 2.* 1965; Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 56. 1970; J. W. Parham, *Pl. Fiji Isl. ed. 2.* 154. 1972. FIGURE 181.

Capparis mariana Jacq. *Pl. Rar. Hort. Schoenbr.* 1: 57. *pl. 109.* 1797.

Capparis sandwichiana sensu A. Gray, *Bot. U. S. Expl. Exped.* 1: 69. 1854; Christophersen in *Bishop Mus. Bull.* 128: 94. 1935; Yuncker in *op. cit.* 178: 56. 1943, in *op. cit.* 220: 121. 1959; non DC.

Capparis spinosa var. *mariana* K. Schum. in *Bot. Jahrb.* 9: 201. 1888; Jacobs in *Fl. Males. I.* 6: 89, p. p. 1960, in *Blumea* 12: 420, p. p. 1965.

A prostrate woody vine or scrambling shrub, occurring near sea level at edge of beach, on limestone cliffs, and scrambling over rocks near shore, seldom attaining a height of more than 1 m. The young parts are white-tomentose and soon glabrate. The nocturnal flowers have white petals that turn pink or purple during the first morning and wither to brown the same afternoon; the filaments are white and bear lavender or pink or purple anthers, but the stamens also wither during the first day. Specimens at hand indicate that flowers are borne in Fiji between May and November; fruits have been obtained only in October and November.

TIPIFICATION AND NOMENCLATURE: The type of *Capparis cordifolia* is *Sonnerat* (P HOLOTYPE), from the Mariana Islands; that of *C. mariana*, also from the Mariana Islands, is an anonymous collection probably at w (Jacobs, 1965). The possibility may be entertained that the two types are parts of the same collection. The epithet *cordifolia* appears not to have been used at the varietal level, in which the epithet *mariana* thus has nomenclatural priority.

DISTRIBUTION: Palau and Mariana Islands eastward to Henderson Island.

LOCAL NAME: The only name noted in Fiji is *mbitumbite* (Bryan 494).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Thuvu, west of Singatoka, on limestone headlands, *Greenwood 917.* VATULELE: *Tothill & Payne 6.* KANDAVU: Western end of island, near Cape Washington, *Smith 319.* ONO (northeast of Kandavu): *DA 14952.* VANUA MASI: On edge of sand beach and on limestone walls, *Bryan 537.* AIWA: On limestone cliff, *Bryan 494A.* KOMO NDRITI: On rocks, *Bryan 494.*

2. ***Capparis quiniflora*** DC. *Prodr.* 1: 247. 1824; Jacobs in *Fl. Males. I.* 6: 89. *fig. 22.* 1960, in *Blumea* 12: 482. 1965; J. W. Parham, *Pl. Fiji Isl. ed. 2.* 154. 1972. FIGURE 182.

Capparis richii A. Gray, *Bot. U. S. Expl. Exped.* 1: 69. 1854; Seem. *Viti*, 432. 1862, *Fl. Vit.* 6: 1865; Drake, *Ill. Fl. Ins. Mar. Pac.* 107. 1890; J. W. Parham, *Pl. Fiji Isl.* 108. 1964.

As it occurs in Fiji, *Capparis quiniflora* is a liana scrambling over trees and shrubs and perhaps sometimes high-climbing, found from near sea level to an elevation of 580

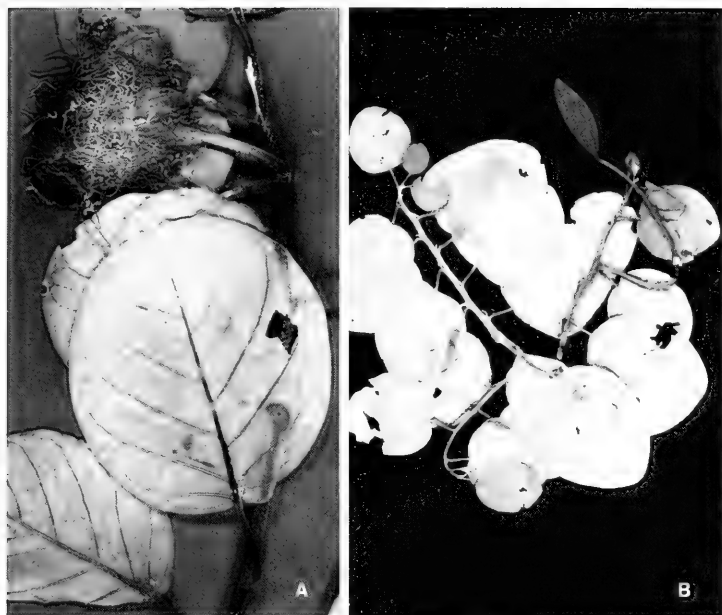


FIGURE 181. *Capparis cordifolia*, from Smith 319; A, foliage and a withered flower, $\times 1$; B, distal portion of branchlet, with a mature fruit, $\times 1/3$.

m. in forest, lowland thickets, coastal thickets, and on low, dry hillsides. Its petals are white and its fruit green; the only fertile and dated collection at hand was in fruit in July.

TYPEIFICATION AND NOMENCLATURE: The holotype of *Capparis quiniflora* is a specimen at P (collector?) from the northern coast of Australia. Of *C. richii* there are three *U. S. Expl. Exped.* specimens at US, collected in Fiji in 1840. Two of these represent the very thorny, narrow-leaved, sterile form discussed by Jacobs (1960, 1965), possibly juvenile specimens from dry and exposed areas. The leaf blades of these two Fijian specimens are 7–11 \times 1–2.5 cm. One of them (us 6790) is from mountains of Mathuata Province, Vanua Levu, the other (us 6792) from Namenalala (Direction Island), a narrow, hilly, densely wooded, uninhabited island about 1.5 km. long, without water, situated on a tongue of reef at 17°06' S. and 179°06' E., belonging to Vuya Tikina, Mbua Province, Vanua Levu. This is the only plant specimen I have seen indicated as from Namenalala, at which an Exploring Expedition boat must have briefly touched. The third specimen of *C. richii* (us 6791 LECTOTYPE herewith indicated) is from Fiji without further locality; it is now also sterile but bears normal leaves for the

species, about 6.5×3.5 cm., and lacks thorns. Gray's description of the flowers was apparently prepared from a drawing made under Rich's supervision, but this is not attached to the US specimen. The synonymy indicated by Jacobs (1965) is doubtless correct.

DISTRIBUTION: Malesia (from Celebes and Lombok) eastward to northeastern Australia, New Caledonia, Fiji, and Tonga. The Tongan record, unknown to Jacobs, is based on recent collections from Vava'u and 'Eua by Sykes and Buelow. The species seems infrequent in Fiji, occurring in dry lowland areas but also in forested hilly areas, where it may become a high-climbing liana that is easily overlooked.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, DA 13895. RA: Near Thamboni Beach, on dry hillside, DA 7152.

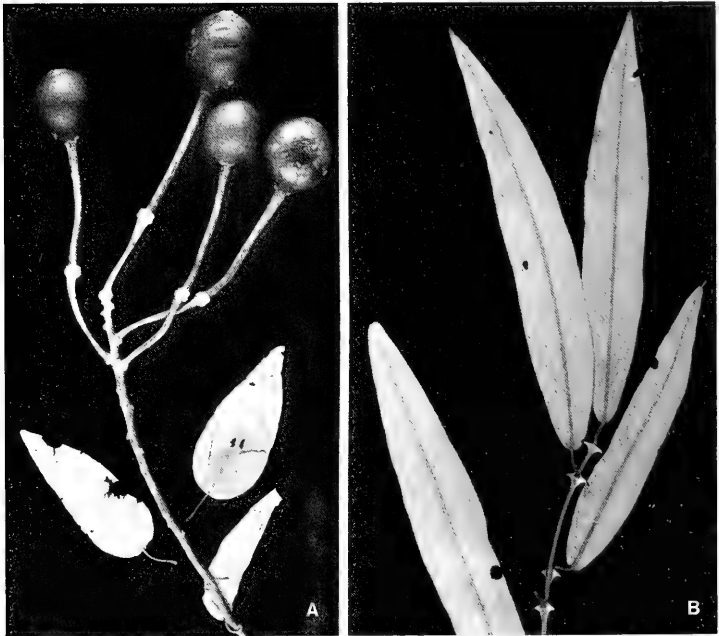


FIGURE 182. *Capparis quiniflora*; A, distal portion of fertile branchlet, with mature fruits, $\times 1/3$; B, branchlet, stipular thorns, and leaves from a sterile plant growing in an exposed area, $\times 1$. A from DA 13895, B from DA 7152.

2. *CRATEVA* L. Sp. Pl. 444. 1753; Jacobs in *Blumea* 12: 186. 1964.

Trees, often briefly deciduous (but our species in full foliage when flowering), glabrous throughout, with small, caducous stipules (subulate and to 1 mm. long in our species); leaves 3-foliolate, the petiole sometimes with small, distal, glandlike appendages, the leaflets thin in texture (as in our species) to subcoriaceous, sessile or subsessile (as in our species) to short-petiolate, the lateral blades obliquely asymmetrical; inflorescences terminal, racemose or corymbiform, bracteate; flowers ♂, pedicellate, the pedicels spreading, the receptacle broad, lined by a patelliform disk bearing perianth parts on its outer margin; sepals 4, equal, valvate, ovate-spathulate, caducous soon after anthesis; petals 4, subequal, ovate to rhomboid, unguiculate, the lower pair slightly the smaller; stamens (8-) 12-30, the filaments filiform, basally connate with gynophore, this slender, about as long as stamens; ovary unilocular, with 2 intruded but not coalescent placentas, the ovules few-many, usually in 2 rows on each placenta, the style short, the stigma conspicuous, discoid, soon obsolete; fruit a globose to ellipsoid berry, borne on a somewhat woody pedicel and gynophore, the pericarp leathery and hard, papillate (as in our species) or smooth, the endocarp spongy, the seeds hippocrepiform, embedded in pulp.

LECTOTYPE SPECIES: *Crateva tapia* L. (vide Correa in *Trans. Linn. Soc.* 5: 222. 1800), one of Linnaeus's two original species, the other, *C. marmelos*, being the type species of *Aegle* Correa (Rutaceae). The various elements of Linnaeus's concept of the genus have been interestingly discussed by Jacobs (1964).

DISTRIBUTION: Pantropical and subtropical (but not in Australia or New Caledonia), with eight or nine species. One species is indigenous in Fiji. The generic name has often been misspelled as *Crataeva*; this has not been noted in some of the following citations.

USEFUL TREATMENT OF GENUS: Jacobs, M. The genus *Crateva* (Capparaceae). *Blumea* 12: 177-208. 1964.

1. *Crateva religiosa* Forst. f. Pl. Esc. Ins. Oc. Austr. 45. 1786, Fl. Ins. Austr. Prodr. 35. 1786; Christophersen in *Bishop Mus. Bull.* 128: 94. 1935; Greenwood in *Proc. Linn. Soc.* 154: 94. 1943; Yuncker in *Bishop Mus. Bull.* 184: 40. 1945; Merr. in *Pacific Sci.* 8: 38. 1954; Jacobs in *Blumea* 12: 191. 1964; J. W. Parham, *Pl. Fiji Isl.* 108. 1964, ed. 2. 154. 1972.

A tree usually 5-15 m. high, infrequently occurring near sea level in Fiji. The sepals are green, the petals white, becoming cream-colored or yellowish, the filaments distally pink or purple, and the fruit pale green, up to 20 × 9.5 cm. but usually smaller, drying grayish.

LECTOTYPIFICATION: Jacobs (1964) designated a Forster specimen (κ), from the Society Islands, as the type. The only specimen I have located that is clearly indicated as a collection of J. R. & G. Forster is indeed the specimen at κ, which is best indicated as the lectotype. At BM there is a specimen from Tahiti marked "Capt. Cook;" this may be either a part of the type material (from Cook's second voyage) or it may have been from the first voyage and briefly discussed as "*Crataeva frondosa*" Parkinson, nom. nud. (1773), as noted by Merrill (in *Chron. Bot.* 14: 350. 1954).

DISTRIBUTION: Himalayan India and Burma eastward through Micronesia and Malesia to the Gambier Islands in the Tuamotus. Although it is known in Fiji from only a single collection, there is no reason to believe that it is not indigenous. In many parts of its Pacific range the species seems rare; it has probably dispersed eastward by sporadic oceanic drift.

AVAILABLE COLLECTION: VITI LEVU: MBA: Vicinity of Lautoka, *Greenwood* 413.

FAMILY 107. CLEOMACEAE

CLEOMACEAE Airy Shaw in Kew Bull. 18: 256. 1965. Nom. cons. prop.

Capparidaceae subfam. Cleomoideae Pax in Engl. & Prantl, Nat. Pflanzenfam. III. 2: 220. 1891; Pax & Hoffm. in op. cit. ed. 2. 17b: 210. 1936.

Usually annual herbs (rarely shrubs, trees, or lianas), usually with glandular indument, without stipules; leaves alternate (spirally arranged), simple or usually digitately 3-7-foliolate, the blades usually entire, pinnate-nerved; inflorescences terminal or axillary, mostly racemose; flowers ♂ (rarely unisexual), actinomorphic or somewhat zygomorphic, the receptacle sometimes dorsally appendaged; calyx 4-lobed or -partite, or the lobes free; petals usually 4 (rarely 2), imbricate, often unguiculate; stamens usually 6 (4-7, rarely only 1 fertile), the filaments free or basally adnate to androgynophore, the anthers dorsifixed, introrse, longitudinally dehiscent, some infrequently aborted; ovary sessile or stipitate, unilocular, the placentas 2 (or 3), parietal, the ovules numerous to few, campylotropous, the style usually filiform, sometimes lacking, the stigma punctiform or capitate; fruit a 2(or 3)-valved capsule, the valves falling away and leaving a persistent replum, the seeds often reniform, smooth or sculptured, lacking endosperm.

DISTRIBUTION: Pantropical or warm temperate, with 10-12 genera and about 275 species. Only the genus *Cleome* occurs in Fiji.

USEFUL TREATMENT OF FAMILY: Hutchinson, J. Cleomaceae. Evol. Phyl. Fl. Pl. 512-516. 1969.

As established by Airy Shaw, the family Cleomaceae is intermediate between Capparaceae and Brassicaceae trib. Stanleyeae, differing from the former in its usually annual, herbaceous habit, its glandular indument, and in its fruit being a silique, with the valves falling away from a replum bearing the seeds, and from the latter in having digitately 3-7-foliolate (rarely simple) leaves, often zygomorphic flowers, and rarely tetradynamous stamens. Most phylogenists are satisfied to leave *Cleome* and its relatives in a comprehensive family Capparaceae, but in that case the distinction between Capparaceae and Brassicaceae becomes difficult to maintain, as discussed by Airy Shaw and Hutchinson (in above-cited references and elsewhere).

As pointed out by Airy Shaw when he proposed elevating subfamily Cleomoideae to family rank, the family name should be conserved against Cleomaceae Horan. Prim. Lin. Syst. Nat. 92, nom. illeg. 1834 (= Capparaceae).

1. CLEOME L. Sp. Pl. 671. 1753; Jacobs in Fl. Males. I. 6: 99. 1960.

Gynandropsis DC. Prodr. 1: 237. 1824. Nom. cons. non nisi vs. *Pedicellaria* Schrank.

Annual herbs (less often perennial), often pilose and usually with glandular hairs, the stipules none; leaves petiolate, palmately 3-7-foliolate, the blades often herbaceous in texture (as in our species); inflorescences terminal, leafy or bracteate, racemose or paniculate; flowers ♀ (rarely ♂ by reduction), pedicellate, slightly zygomorphic, the receptacle without glandular outgrowths, the disk small or obsolete; sepals 4, free; petals 4, unguiculate or narrowed to a cuneate base; stamens 6-many, usually all fertile, the filaments sometimes free but often basally connate to a gynophore and thus producing a sometimes conspicuous androgynophore; ovary unilocular, borne on a gynophore or sessile, with 2 (or 3) parietal placentas, the ovules numerous, the style short or none, the stigma discoid or subcapitate; fruit a 2(or 3)-valved capsule, linear, terete, beaked, dehiscent from base or from apex, the placenta forming a persistent, framelike replum, the seeds orbicular to hippocrepiform, often dorsally sculptured or scaly.

LECTOTYPE SPECIES AND NOMENCLATURE: The type species of *Cleome* is *C. ornithodioides* L. (vide M. L. Green, Prop. Brit. Bot. 172. 1929), one of Linnaeus's original

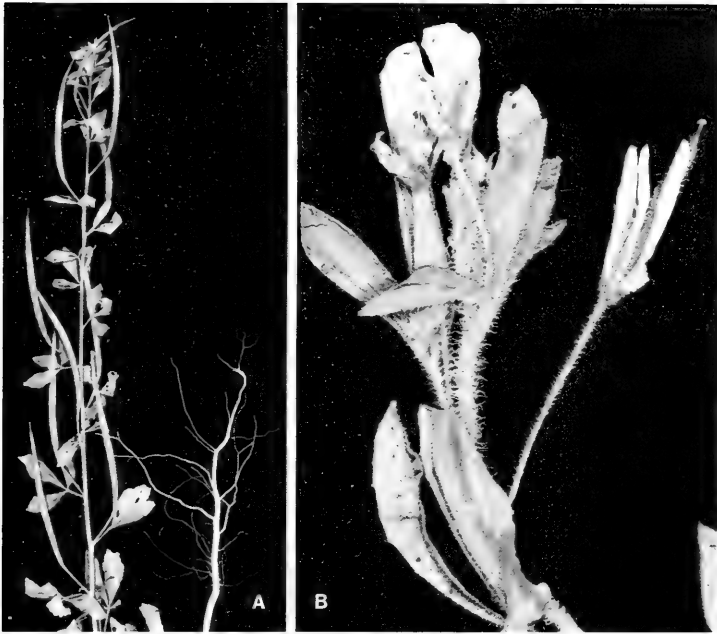


FIGURE 183. *Cleome viscosa*; A, plant with mature fruits, the underground portion bent upward, $\times 1/3$; B, distal portion of inflorescence, the flower on right showing the sessile ovary and the stamens shorter than petals, $\times 2$. A from DA 10822, B from DA 9752.

eight species. The type species of *Gynandropsis* is *G. pentaphylla* (L.) DC., nom illeg. (*Cleome pentaphylla* L., nom. illeg.; *Cleome gynandra* L.) = *G. gynandra* (L.) Briq. *Gynandropsis* is sometimes used in the literature pertaining to our area, but it is one of several genera now universally referred to *Cleome*.

DISTRIBUTION: Pantropical and subtropical, with more than 150 species, mostly in America, Africa, and the Middle East, but some in Asia and Malesia. Several species are now widespread either in cultivation or as weeds. Three unrelated species occur in Fiji, none of them indigenous.

USEFUL TREATMENT OF GENUS: Iltis, H. H. Studies in the Capparidaceae—VII. Old World Cleomes adventive in the New World. *Brittonia* 12: 279–294, 1960.

KEY TO SPECIES

Flowers and fruits appearing solitary in axils of well-developed distal leaves; petals pale to bright yellow or orange-yellow, gradually attenuate to base, 7–14 mm. long; stamens usually 16–26 (10–30), free, shorter than petals at anthesis, the filaments 5–8 mm. long, the anthers 1.5–3 mm. long; androgynophore none, the ovary sessile, copiously glandular; mature siliques with strongly raised longitudi-

- nal veins, the valves persistent, dehiscent from apex; seeds markedly transverse-rugose, obscurely longitudinally striate; plants viscid-glandular-pilose on stems, petioles, pedicels, and siliques; petioles 1-6 cm. long; leaflets 3-5. 1. *C. viscosa*
- Flowers and fruits few or many in racemes 10-40 cm. long; petals strongly unguiculate; stamens 6, exerted at anthesis, basally fused with gynophore to form an androgynophore at least 5 mm. long, their free portions more than 8 mm. long; gynophore (portion above insertion of stamens) at least 3 mm. long; petioles 3-12 (-17) cm. long; leaflets 3-7, usually 5.
- Stems, foliage, and siliques glandular-pubescent, subglabrate; central leaf blades with 5-9 pairs of nerves; flowers borne in axils of trifoliolate bracts; pedicels (in flower and fruit) 12-25 mm. long; corolla always open, the petals (white or pale yellow to pink or purplish) minute in bud and at no time covering stamens, 12-20 mm. long at anthesis; androgynophore 5-25 mm. long, the free portions of filaments 8-22 mm. long, the anthers 2-3 mm. long; gynophore (portion above insertion of stamens) 3-20 mm. long; mature siliques with slightly raised longitudinal veins, the valves deciduous; seeds longitudinally striate, slightly transverse-rugose or tuberculate. 2. *C. gynandra*
- Stems, foliage, and siliques glabrous or early glabrescent; central leaf blade with 12-25 pairs of nerves; flowers borne in axils of undivided bracts; pedicels (in flower and fruit) 25-35 mm. long; corolla closed in bud, the petals (rose-pink to reddish violet, infrequently white), overlapping the stamens until anthesis (bud remaining closed until 20 mm. or more long), 25-40 mm. long at anthesis; androgynophore 5-10 mm. long, the free portions of filaments 30-60 mm. long, the anthers about 7 mm. long; gynophore (portion above insertion of stamens) 45-60 mm. long; mature siliques with indistinct longitudinal veins; seeds tuberculate, with small, pale, scattered scales. 3. *C. speciosa*

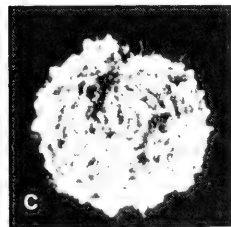
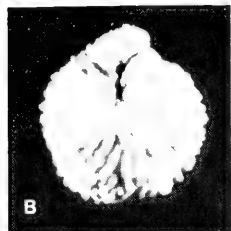
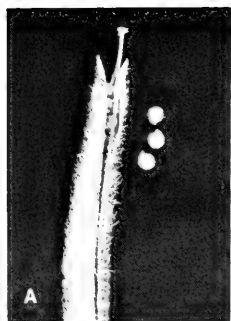
1. *Cleome viscosa* L. Sp. Pl. 672. 1753; Greenwood in Proc. Linn. Soc. **154**: 94. 1943; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 39. 1959; Iltis in Brittonia **12**: 281. 1960; Jacobs in Fl. Males. I. **6**: 103. fig. 32, c, d. 1960; J. W. Parham, Pl. Fiji Isl. 109. 1964, ed. 2. 154. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 57. 1970. FIGURES 183, 184A & B.
- Cleome icosandra* L. Sp. Pl. 672. 1753; Burkill, Dict. Econ. Prod. Malay Penins. 581. 1935, ed. 2. 588. 1966.
- Polanisia viscosa* DC. Prodr. I: 242. 1824; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 39. fig. 14. 1959.
- Polanisia icosandra* Wight & Arn. Prodr. Fl. Ind. Orient. 22. 1834; Christophersen in Bishop Mus. Bull. **128**: 94. 1935.

An annual herb 20-100 cm. high, often locally abundant as a naturalized weed near sea level in cultivated fields, along roadsides, and especially in canefields. Its petals are bright yellow, sometimes paler or orange-tipped, its anthers are pale blue, and the fruits, like vegetative parts, are viscid. Flowers and fruits are seen throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: Iltis (1960, cited above) indicates the specimen numbered 850.11 (LINN) as the lectotype of *Cleome viscosa*; no. 850.10 (LINN) is taken as the type of *C. icosandra*. De Candolle was apparently the first author to unite these two concepts, under the binomial *Polanisia viscosa*, thus choosing between the two epithets of the same date. Many other names are included in the synonymy provided by Iltis.

DISTRIBUTION: Of Old World origin, probably indigenous in Asia, but now widespread as an adventive throughout the tropics of both hemispheres. Nineteen Fijian collections are at hand, but the species is a much more abundant weed than this

FIGURE 184. A & B, *Cleome viscosa*; A, distal portion of dehiscent silique, showing replum and seeds, $\times 2$; B, seed, $\times 20$. C-F, *Cleome gynandra*; C, seed, $\times 20$; D, distal portion of silique and seeds, $\times 2$; E, plant with flowers and fruits, $\times 1/3$; F, distal portion of inflorescence, with flowers in different stages, the central flowers with minute petals not covering stamens, the flowers on left with strongly unguiculate petals, long androgynophores, and still short gynophores, the flower on right with an elongating gynophore and filaments from which anthers have fallen, $\times 2$. A & B from O. & I. Degener 32048, C-F from DA 11394.



suggests, especially in northern and western Viti Levu. Its appearance in Fiji is apparently comparatively recent.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 197*; Ndrasa Sector canefield, Lautoka, *DA 10331*; Ndreketi, south of Lautoka, *DA 11154*; Korovutu, south of Nandi, *DA 10690*; Votua, lower Mba River, *DA 10440*; Tavua, *O. & I. Degener 32048*. NANDRONGA & NAVOSA: Naveisamasama, *DA 9752*. RA: Penang, *Greenwood 197A*; District Farm, Ndombulevu, *DA 5679*. NAITASIRI: Korongganga, *DA 10822*. REWA: Suva Point, *DA 1051*. VANUA LEVU: MATHUATA: Vunimoli, *DA 10516*. TAVEUNI: Waivevo, *DA 11522*.

2. *Cleome gynandra* L. Sp. Pl. 671. 1753; Iltis in *Brittonia* **12**: 284. 1960; Jacobs in *Fl. Males. I. 6*: 101. 1960; J. W. Parham, *Pl. Fiji Isl.* 109. 1964, ed. 2. 154. 1972.

FIGURE 184C-F.

Cleome pentaphylla L. Sp. Pl. ed. 2. 938. 1763.

Gynandropsis pentaphylla DC. Prodr. **1**: 238. 1824.

Gynandropsis gynandra Briq. in *Ann. Conserv. Jard. Bot. Genève* **17**: 382. 1914; Greenwood in *Proc. Linn. Soc.* **154**: 94. 1943; J. W. Parham in *Dept. Agr. Fiji Bull.* **35**: 40. 1959.

A coarse herb to 1 m. high, locally abundant in northwestern Viti Levu as a naturalized weed near sea level, in cultivated fields, especially canefields, and along roadsides. The petals are white to pink or purplish, the filaments mauve. Flowers and fruits occur throughout the year.

LECTOTYPIFICATION AND NOMENCLATURE: As no specimen under the name *Cleome gynandra* is found in the Linnaean Herbarium, Iltis (1960, cited above) has indicated as the lectotype the only illustration originally cited by Linnaeus: Rheede, *Hort. Ind. Malabar. 9: t. 24*. 1689. The specimen numbered 850.4 (LINN) is taken as the lectotype of *C. pentaphylla*. Many other synonyms are combined with this concept by Iltis.

DISTRIBUTION: Indigenous in the Old World, widespread in Asia and Africa, and now adventive throughout the tropics and subtropics. It is a comparatively recent arrival in Fiji, apparently first noted by Greenwood, and not yet spread from western and northwestern Viti Levu.

USES: Although *Cleome gynandra* is used for many medicinal and edible purposes in Africa and Asia, where it is cultivated, it can only be considered a weed of cultivation in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 196*; Saweni Beach and Ndreketi, south of Lautoka, *DA 10310, 10317, 11155, 11394, 11396*; Nandi, *DA 9629*. NANDRONGA & NAVOSA: Singatoka, *Greenwood 196A*.

3. *Cleome speciosa* Raf. *Fl. Ludov.* 86. 1817; H. B. K. *Nova Gen. et Sp.* **5**: 84. *t. 436*. 1821; Jacobs in *Fl. Males. I. 6*: 101. 1960; J. W. Parham, *Pl. Fiji Isl.* 109. 1964, ed. 2. 154. 1972.

Gynandropsis speciosa DC. Prodr. **1**: 238. 1824; A. C. Sm. in *Bull. Torrey Bot. Club* **70**: 540. 1943.

A few-branched herb 1-1.5 m. high, probably cultivated only in Fiji; the petals as noted are rose-pink, but elsewhere they vary to reddish violet and infrequently to pure white.

TYPIIFICATION: *Cleome speciosa* was based on a plant cultivated in Louisiana, mentioned by Robin, *Voy. Louis.* **3**: 469. 1807, as *Mozambe lilas*.

DISTRIBUTION: Tropical and subtropical America from Mexico to Peru, now cultivated in many other areas and often naturalized. Unfortunately Gillespie's collection provides no locality, but it seems likely to have come from a garden plant. The species may still occur in private gardens in Fiji; if naturalized it probably would have been noted again.

AVAILABLE COLLECTION: FIJI without further locality, in 1927 or 1928, *Gillespie 2821*.

FAMILY 108. BRASSICACEAE

BRASSICACEAE Burnett, Outl. Bot. 1123. 1835.

Cruciferae Juss. Gen. Pl. 237. 1789. Nom. alt.

Annual, biennial, or perennial, terrestrial or aquatic herbs, rarely somewhat shrubby, often with watery sap, the indument often of medifixed or stellate hairs, rarely glandular, the stipules lacking (or reduced to fine bristles or glands); leaves usually alternate (spirally arranged), in rosettes or cauline, simple to pinnately compound; inflorescences terminal or axillary, usually racemose or corymbose, sometimes composed of few or solitary flowers, mostly ebracteate; flowers ♂, actinomorphic (rarely somewhat zygomorphic), hypogynous; sepals 4, free, equal or unequal, usually imbricate in 2 series, rarely valvate; petals 4, imbricate or contorted, sometimes lacking, if present usually equal and unguiculate; stamens usually 6, tetradynamous in 2 whorls (the outer whorl of 2 short stamens), rarely more numerous or fewer, the filaments usually free, sometimes winged or dentate, the anthers mostly sagittate, 2-locular (rarely 1-locular), introrse, longitudinally dehiscent; disk annular or composed of extrastaminal or intrastaminal glands; ovary sessile or rarely stipitate, unilocular with 2 parietal placentas and divided by a spurious, membranous septum (replum), sometimes transversely several- or many-locular, the ovules usually many (sometimes few or 1) on each placenta, anatropous or campylotropous, the style sometimes obsolete, the stigma discoid or capitate or bilobed; fruit a podlike capsule (an elongated silique or a short silicle), bivalvately dehiscent, the valves separating from base upward, remaining attached at apex, the false septum (replum) persistent, usually thin and membranous, or fruit rarely indehiscent, the seeds 1-many, the embryo large, the endosperm none or scanty.

DISTRIBUTION: Cosmopolitan, primarily in the Northern Hemisphere, with 300-375 genera and 2,500-3,200 species. The family produces many familiar food crops and ornamentals. Five genera have been noted in Fiji, none of them represented by indigenous species.

USEFUL TREATMENTS OF FAMILY: Schulz, O. E. *Cruciferae*. In: Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 17b: 227-658. 1936. Purselove, J. *Cruciferae*. Trop. Crops, Dicot. 89-99. 1968.

KEY TO GENERA

- Ovary and fruit segmented into a basal valve-bearing (or abortive) portion and a terminal indehiscent portion, either or both containing seeds; plants glabrous or with simple hairs; lower leaves densely congested or rosulate, the blades often pinnatifid or lyrate; sepals often saccate at base.
- Lower segment of fruit seed-bearing, subterete or angled, 2-valved, larger and with more seeds than upper segment, this a usually seedless (sometimes 1- or 2-seeded) beak; seeds uniseriate in each locule of lower segment; upper leaf blades amplexicaul or not, entire; petals usually yellow; disk glands relatively conspicuous. 1. *Brassica*
- Lower segment of fruit much smaller than upper segment, seedless or abortive, the upper segment terete, sometimes torulose, indehiscent, divided into 1-seeded compartments by constrictions or spongy partitions; upper leaf blades deeply incised or not, serrate-dentate; petals in our species purple to white; disk glands minute. 2. *Raphanus*
- Ovary and fruit not divided into a basal and terminal segment; leaves cauline; sepals not saccate at base. Fruit a short silicle, compressed contrary to the narrow septum, each locule globular, indehiscent but eventually separating from septum, 1-seeded, wrinkled (as in our species) or tuberculate; plant glabrous or with simple hairs; leaf blades in our species deeply pinnatisect; petals white, sometimes reduced or lacking; ovary short, subglobose, with 2 ovules. 3. *Coronopus*
- Fruit not compressed, or compressed parallel to septum, dehiscent by 2 valves.
- Indument composed of bifid hairs; fruit a subglobose to ovoid silicle, in our species with 2 seeds; leaf blades lanceolate-linear, entire; petals rounded, entire or emarginate, in our species white or pale purple; ovary with 2-10 ovules (2 in our species). 4. *Lobularia*

Indument lacking or composed of simple hairs; fruit a cylindrical to ellipsoid silique, with many seeds; leaf blades dentate or pinnatifid or pinnately lobed or compound; petals yellow or white or lacking; ovary subcylindrical, with many ovules. 5. *Rorippa*

1. *BRASSICA* L. Sp. Pl. 666. 1753; O. E. Schulz in Pflanzenr. 70 (IV. 105): 21. 1919.

Annual, biennial, or rarely perennial herbs, glabrous or with simple hairs, sometimes with tuberous roots; leaves often densely congested, the lower ones petiolate and often with pinnatifid or lyrate blades, the upper ones short-petiolate or sessile, amplexicaul or not, with entire blades; inflorescences usually terminal, racemose, many-flowered; sepals erect or spreading, often saccate at base; petals equal, with erect, long claws and widely spreading blades, usually yellow; stamens 6, the filaments slender, edentate, the anthers oblong; disk glands 4, relatively conspicuous, one in axil of each shorter stamen, one on a basal surface of each pair of longer stamens; ovary subcylindrical, with few-many ovules, the style short, the stigma capitate; siliques transversely divided into 2 segments, the upper segment an indehiscent and usually seedless (sometimes 1- or 2-seeded) beak, the lower segment subterete or angled, 2-valved, the valves 1-5-nerved or subreticulate-veined, the seeds several-many, uniseriate in each locule (rarely irregularly biseriate), subglobose, unwinged.

LECTOTYPE SPECIES: *Brassica oleracea* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 192. 1913), one of Linnaeus's original nine species.

DISTRIBUTION: North temperate parts of the Old World, especially in the Mediterranean area, with 33-40 often very polymorphic species. The genus includes many important crop plants (cabbage, mustard, etc.). Four species are known to be cultivated or naturalized in Fiji. Additionally, *Brassica rapa* L. (turnip) is to be expected in cultivation but has not yet been recorded.

The present treatment of the representatives of *Brassica* known to occur in Fiji is adapted from the treatment of Purselove (1968, cited above under the family).

KEY TO SPECIES

- Plants glaucous; leaf blades thick, glabrous; inflorescence elongated and open at anthesis, 10-25 cm. long; flowers large, 1.2-1.5 cm. long. 1. *B. oleracea*
 Plants grass-green; leaf blades thin, often with scattered hairs; flowers smaller, less than 1.2 cm. long.
 Leaf blades lobed.
 Stem leaves not amplexicaul. 2. *B. juncea*
 Stem leaves amplexicaul, broad-based. 3. *B. campestris*
 Leaf blades not lobed, the basal ones broad, shining, 20-50 cm. long, with thickened white petioles, not forming a compact head. 4. *B. chinensis*

1. *Brassica oleracea* L. Sp. Pl. 667. 1753; O. E. Schulz in Pflanzenr. 70 (IV. 105): 27. 1919; Purselove, Trop. Crops, Dicot. 94. 1968.

Only two varieties of the important crop plant *Brassica oleracea* have been recorded as cultivated in Fiji, but it would seem probable that the following varieties are also grown there: var. *acephala* DC. (collard, kale), var. *gemmifera* Zenker (brussels sprouts), and var. *gongyloides* L. (kohlrabi).

TYPIFICATION: Linnaeus gives four references to the species and two additional ones to his var. *sylvestris*, which, as the first variety and lacking a Greek letter, is presumably to be interpreted as var. *oleracea*.

DISTRIBUTION: Indigenous in southwestern Europe and the Mediterranean area, long cultivated and now grown throughout the world, with many races and cultivars, of which the better known are usually designated as varieties.

KEY TO VARIETIES RECORDED FROM FIJI

Terminal bud arrested, compact, much swollen; inflorescence not developed in first year. 1a. var. *capitata*
 Inflorescence partly developed in first year, forming a compact mass of thickened, colorless peduncles,
 bracts, and undeveloped flowers. 1b. var. *botrytis*

1a. ***Brassica oleracea* var. *capitata*** L. Sp. Pl. 667. 1753; O. E. Schulz in Pflanzentr. **70**
 (IV. 105): 31. 1919; Yuncker in Bishop Mus. Bull. **220**: 123. 1959; Purseglove,
 Trop. Crops, Dicot. 95. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull.
200: 75. 1970.

Brassica oleracea var. *bullata* DC. Reg. Veg. Syst. Nat. 2: 584. 1821; O. E. Schulz in Pflanzentr. **70** (IV.
 105): 31. 1919; J. W. Parham, Pl. Fiji Isl. 224. 1964, ed. 2. 312. 1972.

TYPIFICATION AND NOMENCLATURE: For his var. *capitata*, Linnaeus listed only a
 reference to Bauhin, Pinax, 111. 1623. Many old references were listed by de Candolle
 for var. *bullata*. Apparently, although Schulz retains them both, vars. *capitata* and
bullata are now construed as applicable to the common cultivated cabbage.

DISTRIBUTION: Cultivated throughout most of the world. No Fijian vouchers are at
 hand, but the variety is widely grown and locally marketed.

LOCAL NAMES AND USE: *Kapeti kovu*, *cabbage*, *English cabbage*; cooked as a
 vegetable or used as a salad.

1b. ***Brassica oleracea* var. *botrytis*** L. Sp. Pl. 667. 1753; O. E. Schulz in Pflanzentr. **70**
 (IV. 105): 32. 1919; Yuncker in Bishop Mus. Bull. **220**: 123. 1959; J. W. Parham,
 Pl. Fiji Isl. 224, as var. *botritis*. 1964, ed. 2. 312, as var. *botritis*. 1972; Purseglove,
 Trop. Crops, Dicot. 94. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull.
200: 75. 1970.

TYPIFICATION: Linnaeus originally listed three prior references.

DISTRIBUTION: Widely cultivated, although apparently on a small scale and for
 local markets in Fiji, from which no vouchers are available.

LOCAL NAMES AND USE: *Broccoli*; *cauliflower*; no Fijian name has been recorded.
 The variety produces a popular vegetable.

2. ***Brassica juncea* (L.) Czern. & Cosson** in Czern. Consp. Pl. Chark. 8. 1859; Cosson in
 Bull. Soc. Bot. France **6**: 609. 1859; O. E. Schulz in Pflanzentr. **70** (IV. 105): 55.
 1919; Greenwood in Proc. Linn. Soc. **154**: 94. 1943; Yuncker in Bishop Mus. Bull.
178: 57. 1943; J. W. Parham in Dept. Agr. Fiji Bull. **35**: 41. 1959, Pl. Fiji Isl. 224.
 1964, ed. 2. 311. 1972; Purseglove, Trop. Crops, Dicot. 91. 1968; Sykes in New
 Zealand Dept. Sci. Indust. Res. Bull. **200**: 75. 1970.

Sinapis juncea L. Sp. Pl. 668. 1753.

Sinapis nigra sensu Seem. in Bonplandia 9: 254. 1861, Viti, 432. 1862, Fl. Vit. 5. 1865; non L.

Brassica nigra sensu J. W. Parham, Pl. Fiji Isl. 224. 1964, ed. 2. 311. 1972; non Koch.

An annual herb 20–100 cm. high, cultivated on a small scale and also seen as a
 naturalized weed in waste places and in canefields from near sea level to about 150 m.
 The petals are pale to bright yellow, the seeds reddish brown. Flowers and fruits
 probably occur throughout the year, although documented by dated collections only
 in July and August.

TYPIFICATION: Linnaeus gives two references for *Sinapis juncea*, the first, to his
 Hort. Ups. 191. 1748, marked by an asterisk.

DISTRIBUTION: Possibly of African origin (Purseglove, 1968) but spreading to Asia
 early, and now widespread as a cultivated plant and also as a weed. It was presumably a

European introduction into Fiji (according to Seemann, discussing *Sinapis nigra* in 1865). The record of *Brassica nigra* (L.) Koch (black mustard) in Fiji seems to rest only on Seemann 9, which is better placed in *B. juncea*.

LOCAL NAMES AND USES: *Indian mustard* is the commonly used name for this species, but in Fiji it is also known simply as *mustard* or *saiso* (Hindi). It is one of the most pungent cultivated mustards, the oil from its seeds being used for cooking and as a substitute for olive oil. The leaves may be used as a potherb or for curry.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Lautoka, *Greenwood 301*. NANDRONGA & NAVOSA: Near Momi, *DA 11466*. NAITASIRI: Vicinity of Nasinu, *Gillespie 3548*. KANDAVU and MBUA Province, VANUA LEVU: Seemann 9. VANUA LEVU: MATHUATA: Ndaku, *DA 11481*; Wainikoro River, *Greenwood 301A*. FIJI without further locality, *DA 2542*.

3. *Brassica campestris* L. Sp. Pl. 666. 1753; O. E. Schulz in *Pflanzenr.* 70 (IV. 105):45. *fig. 14, E-L*. 1919; Purselglove, *Trop. Crops, Dicot.* 91. 1968; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 311. 1972.

A coarse herb 40–100 cm. high, occasionally cultivated and also naturalized as a weed in canefields, waste places, etc., near sea level. Its petals are pale to bright yellow and its seeds blackish. The available material bore flowers and fruits in June and July.

TYPIFICATION: Several references to European plants were given by Linnaeus.

DISTRIBUTION: Indigenous area uncertain, but now widespread in cultivation and as an adventive. Presumably it is a comparatively recent introduction into Fiji, possibly from India, where it is an important oil seed crop.

LOCAL NAMES AND USE: *Field mustard* and *wild mustard* are probably the most widespread names outside of Fiji, where Parham (1972) attributes to it the name *muraya*. The name *rape* (also mentioned by Parham) is actually applicable to *Brassica napus* L., which may be cultivated in Fiji but is not documented by a voucher. In India *B. campestris* is extensively cultivated as a source of cooking oil, and for this purpose it may also be used by the Indian community in Fiji.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Lautoka, *DA 10364*. FIJI without further locality, *DA 404*.

4. *Brassica chinensis* L. *Amoen. Acad.* 4:280. 1755 (Cent. I. Pl.); J. W. Parham, *Pl. Fiji Isl.* 224. 1964, ed. 2. 311. 1972; Purselglove, *Trop. Crops, Dicot.* 91. *fig. 12*. 1968; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 44. 1972. *Brassica napus* var. *chinensis* O. E. Schulz in *Pflanzenr.* 70 (IV. 105): 45. 1919.

A biennial herb, cultivated as an annual and occasionally naturalized; the petals are pale yellow.

TYPIFICATION: In the original publication Linnaeus cited only a collection from China made by Osbeck.

DISTRIBUTION: Indigenous in eastern Asia and there extensively cultivated, but now also worldwide in cultivation. No Fijian vouchers are available, but the species is commonly seen in markets.

LOCAL NAMES AND USE: *Chinese cabbage*; *pak-choi*. The leaves are edible as a salad or cooked as a vegetable.

The Chinese cabbage has also been recorded from Niue (Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 75. 1970) and Samoa (B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* 85: 44. 1972) as *Brassica pekinensis*

Rupr., which is referred by Purseglove to *B. chinensis* var. *pekinensis* (Rupr.) Sun, the variety often known as *pe-tsai*. It is possible that either or both varieties occur in Fiji.

2. *RAPHANUS* L. Sp. Pl. 669. 1753; O. E. Schulz in Pflanzern. **70** (IV. 105): 194. 1919.

Annual, biennial, or perennial herbs, glabrous or with simple hairs, the taproot often thickened (especially in cultivars); lower leaves rosulate, with lyrate-pinnatifid blades, the upper leaf blades deeply incised or not, serrate-dentate; inflorescences racemose, elongate, many-flowered; sepals erect, the 2 lateral ones subsaccate at base; petals subequal, obovate, entire, long-clawed, in our species purple to white; stamens 6-10, tetradynamous if 6, the disk glands minute; ovary cylindrical, with 2-many ovules, gradually tapering into a long style, the stigma capitate or bilobed; siliques transversely divided into 2 segments, the lower segment very short, seedless or abortive, the upper segment much larger, terete, sometimes torulose, divided into 1-seeded compartments by constrictions or spongy partitions, indehiscent, the seeds globose.

LECTOTYPE SPECIES: *Raphanus sativus* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. **2**: 194. 1913), one of Linnaeus's three original species.

DISTRIBUTION: Western and central Europe and Mediterranean area to central Asia, with eight species, some of them well known as crop plants. One species is cultivated in Fiji.

1. *Raphanus sativus* L. Sp. Pl. 669. 1753; O. E. Schulz in Pflanzern. **70** (IV. 105): 205.

1919; Yuncker in Bishop Mus. Bull. **220**: 123. 1959; J. W. Parham, Pl. Fiji Isl. 224. 1964, ed. 2. 312. 1972; Purseglove, Trop. Crops, Dicot. 96. 1968; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. **200**: 77. 1970.

A coarse annual herb 30-150 m. high, cultivated on a small scale and also seen as a naturalized weed in canefields and waste places. The plant often has a bristly indument and a swollen taproot of various shapes and colors in cultivation; the petals are purple to white, variously veined, sometimes yellow-tinged; and the seeds are yellowish to reddish brown. Flowers and fruits have been noted only in February and July but probably occur at any time.

TYPIFICATION: Linnaeus gives several prior references.

DISTRIBUTION: Probably indigenous in western Asia and early spread throughout the Mediterranean area, now cultivated throughout the world. There are many cultivars, to some of which varietal names are applied.

LOCAL NAME AND USE: The root of the well-known *radish* can be eaten either raw or cooked, and the leaves and flowering tops are also edible as a salad.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Near Sambeto River, DA 11467; Korovuto, south of Nandi, DA 10692.

3. *CORONOPUS* Zinn, Cat. Pl. Gotting. 325. 1757; Sprague in Kew Bull. **1934**: 218. 1934.

Nom. cons.

Annual, biennial, or perennial herbs, glabrous or with simple hairs, diffuse or prostrate, sometimes mat-forming; leaves simple or compound (in our species the lower leaves petiolate, with deeply pinnatisect blades, the upper leaves sessile, smaller); inflorescences terminal and axillary or leaf-opposed, racemose, slender, the pedicels short or filiform, the flowers small; sepals spreading, scarious-margined; petals white, spatulate, sometimes reduced or lacking; stamens 6, all fertile or some sterile (in our species 2 fertile, the others staminodial), the disk glands 4, minute; ovary short, subglobose, 2-locular, the locules with 1 ovule each, the style short or none, the stigma capitate; fruit a short silicle, broader than long (emarginate at apex in our species), compressed contrary to the linear or narrowly elliptic septum, each locule globular,

indehiscent but eventually separating from septum, 1-seeded, reticulate-veined (as in our species) to verrucose or tuberculate.

TYPE SPECIES: *Coronopus ruellii* Allioni (*Cochlearia coronopus* L.).

DISTRIBUTION: A nearly cosmopolitan genus with eight-ten species apparently indigenous in Europe, Asia, Africa, and South America, some of them adventive elsewhere. One species is recorded from Fiji as a weed.

1. **Coronopus didymus** (L.) Sm. Fl. Brit. 2: 691. 1800; Yuncker in Bishop Mus. Bull. 178: 57. 1943, in op. cit. 220: 122. 1959; J. W. Parham, Pl. Fiji Isl. 224. 1964, ed. 2. 312. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 76. 1970.

Lepidium didymum L. Mant. Pl. 92. 1767.

Senebiera didyma Pers. Syn. Pl. 2: 185. 1806; Greenwood in Proc. Linn. Soc. 154: 93. 1943; A. C. Sm. in Bull. Torrey Bot. Club. 70: 540. 1943.

An annual herb with a taproot, recorded in Fiji only as an infrequent weed in waste places at an elevation of 750-800 m. The branches are spreading or ascending, to 30 cm. long; the flowers are fragrant and have white or greenish white petals; and the silicle is about 2 mm. broad.

TYPIFICATION: In the original publication Linnaeus cited no specimen and listed no prior reference; Fawcett and Rendle (Fl. Jam. 3 (1): 244. 1914) state that the type is a specimen at LINN.

DISTRIBUTION: Probably indigenous in South America and now widespread as an adventive.

LOCAL NAME: No name is recorded for the single Fijian collection, but elsewhere the name *wart-cress* is sometimes used for the species.

AVAILABLE COLLECTION: VITI LEVU: MBA: Nandarivatu, Greenwood 880.

4. **LOBULARIA** Desv. in J. Bot. Agric. 3: 162. 1814. Nom. cons.

Annual or perennial herbs or small shrubs, the stem and branches with longitudinally subappressed, bifid hairs; leaves spirally arranged, the blades lanceolate-linear, entire, narrowed at base; inflorescences racemose, many-flowered; sepals spreading, not saccate at base; petals small, equal, undivided, with slender, short claws; stamens 6, the filaments broadened at base, not dentate, the anthers subtetragonal, obtuse; disk glands 6, some of them subulate; ovary sessile or subsessile, the ovules 2-10, the style short, the stigma capitate; fruit a subglobose to ovoid silicle, erostrate, swollen, the valves membranous, the seeds solitary (as in our species) or 2-several in each locule, narrowly winged.

TYPE SPECIES: *Lobularia maritima* (L.) Desv. (*Clypeola maritima* L.).

DISTRIBUTION: Mediterranean region, including the Cape Verde and Canary Islands, with about five species. A single species is sparingly cultivated in Fiji.

1. **Lobularia maritima** (L.) Desv. in J. Bot. Agric. 3: 162. 1814; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 76. 1970; J. W. Parham, Pl. Fiji Isl. ed. 2. 312. 1972.

Clypeola maritima L. Sp. Pl. 652. 1753.

Alyssum maritimum Lam. Encycl. Méth. Bot. 1: 98. 1783.

A perennial herb 8-15 cm. high, sparingly cultivated in Fiji but naturalized in various other Pacific areas (e. g. the Kermadecs, cf. Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 219: 103. 1977). The fragrant flowers have the sepals green, paler at margins, and the petals white or pale purple; the silicles are 2.5-3.5 mm. long. The only available collection was flowering in September.

TYPIIFICATION: In his original description Linnaeus listed three references.

DISTRIBUTION: Indigenous in Europe, now cultivated and sometimes naturalized elsewhere.

LOCAL NAME AND USE: No name was applied to the species in Fiji, but it is elsewhere usually known as *sweet alyssum*. It is an attractive ornamental for its fragrant flowers and small, sericeous leaves, useful in garden borders.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva Botanical Gardens, DA 12183.

5. *RORIPPA* Scop. Fl. Carn. 520. 1760.

Nasturtium R. Br. in Ait. f. Hort. Kew. ed. 2. 4: 109. 1812. Nom. cons. non nisi vs. *Nasturtium* Mill. (1754).

Annual to perennial herbs, glabrous or sparsely pilose with simple hairs, the stems sometimes hollow; leaves cauline, simple with the blades dentate or pinnatifid or pinnately lobed, or pinnately compound; inflorescences terminal and axillary, racemose, many-flowered, the flowers small; sepals erect to spreading, not saccate at base; petals equal, yellow or white, rounded or slightly emarginate and short-clawed, or lacking; stamens 6, the filaments linear, the anthers yellow, ovoid to oblong, obtuse; disk glands 4 or 6 (1 larger gland on each side of each shorter stamen, and 1 smaller gland between the longer stamens of each pair, or the smaller glands lacking); ovary subcylindric, glabrous, the ovules many, the style short, the stigma capitate or slightly bilobed; siliques cylindric to ellipsoid, terete, often curved, erostrate, bivalved, the valves strongly convex, membranous, weakly 1-nerved or nerveless, the seeds many, uniseriate or biseriata in each locule, ellipsoid, usually reticulate or verrucose, not or hardly winged.

TYPE SPECIES AND NOMENCLATURE: The type species of *Rorippa* is *R. sylvestris* (L.) Besser (*Sisymbrium sylvestre* L.); that of *Nasturtium* R. Br. is *N. officinale* R. Br. (*Sisymbrium nasturtium-aquaticum* L.) (typ. cons.). Students of the family are now in general agreement that the two concepts are not generically separable; the correct name of the combined taxon therefore is *Rorippa*.

DISTRIBUTION: Subcosmopolitan, especially in northern and southern temperate areas and in tropical mountains, with about 70 species. Some species are widespread in cultivation and others as adventives. Three species are recorded from Fiji.

KEY TO SPECIES

- Leaves deeply imparipinnately 3-9-lobed or compound, the rachis very narrowly winged or not, the segments or leaflets suborbicular to ovate; petals present, white to pale yellow; siliques with biseriata seeds in each locule.
- Blades of leaflets subentire or sinuate-dentate; aquatic herb, the stems hollow, the leaves often floating; cultivated or infrequently naturalized. 1. *R. nasturtium-aquaticum*
- Blades of leaf segments conspicuously rounded-crenate; naturalized in villages and along roadsides, often in wet places but not aquatic nor with floating leaves, the stems not hollow. 2. *R. sarmentosa*
- Leaves simple or infrequently pinnatifid with 1 or 2 segments per side, the blades 2-7 × 0.5-2.5 cm., conspicuously serrate-dentate, contracted basally into a long, winged petiole; petals lacking; siliques with uniseriate seeds in each locule. 3. *R. indica* var. *apetala*

1. *Rorippa nasturtium-aquaticum* (L.) Hayek ex Mansf. in Repert. Sp. Nov. 46: 117. 1939; P. S. Green in Rhodora 64: 38. 1962; J. W. Parham, Pl. Fiji Isl. ed. 2. 312. 1972.

Sisymbrium nasturtium-aquaticum L. Sp. Pl. 657. 1753.

Nasturtium officinale R. Br. in Ait. f. Hort. Kew. ed. 2. 4: 110. 1812; Purselove, Trop. Crops, Dicot. 96. 1968; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 45. 1972.

An aquatic, perennial herb with a creeping rhizome, cultivated and infrequently naturalized in Fiji. The stems are hollow, angular, 10-60 cm. long, rooting at nodes

and then ascending or floating; the petals are white; and the siliques are 1–2 cm. long.

TYPIFICATION AND NOMENCLATURE: In the original publication Linnaeus gave several prior references, and Brown's name is based on the same concept.

DISTRIBUTION: Indigenous in Europe and western Asia, now cultivated and often naturalized in many other parts of the world. No herbarium vouchers from Fiji have been seen, but the plant occurs in small gardens and is offered in local markets.

LOCAL NAME AND USE: The usual name *watercress* is used in Fiji; the leaves and stems of the plant are edible as a salad.

2. *Rorippa sarmentosa* (DC.) Macbride in Field Mus. Nat. Hist., Bot. Ser. 13(2):966. 1938; J. W. Parham, Pl. Fiji Isl. ed. 2. 312. 1972.

Cardamine sarmentosa Solander ex Forst. f. Fl. Ins. Austr. Prodr. 91, nom. nud. 1786; DC. Reg. Veg. Syst. Nat. 2: 265. 1821, Prodr. 1: 153. 1824; A. Gray, Bot. U. S. Expl. Exped. 1: 51. 1854; Seem. in Bonplandia 9: 254. 1861, Viti, 432. 1862, Fl. Vit. 5. 1865, op. cit. 425. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 105. 1890; O. E. Schulz in Bot. Jahrb. 32: 595. 1903; Greenwood in Proc. Linn. Soc. 154: 94. 1943; J. W. Parham in Dept. Agr. Fiji Bull. 35: 41, p. p. 1959.

Nasturtium sarmentosum Schinz & Guillaumin in Sarasin & Roux, Nova Caledonia Bot. 146. 1920; Christophersen in Bishop Mus. Bull. 128: 94. 1935; Yuncker in op. cit. 178: 57. 1943, in op. cit. 184: 40. 1945; St. John in Occas. Pap. Bishop Mus. 18: 79. 1945; Yuncker in Bishop Mus. Bull. 220: 122. 1959; J. W. Parham, Pl. Fiji Isl. 224. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 77. 1970; St. John in Willdenowia 6: 284. 1971; St. John & A. C. Sm. in Pacific Sci. 25: 326. 1971; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 12, 63. 1972.

A short-stemmed herb 15–50 cm. high, found at elevations from near sea level to 600 m., naturalized in villages and waste places, in cultivated areas, and along roadsides, and sometimes in wet places such as gravel banks along streams. The small flowers have white to very pale yellow petals, and the siliques are 1.5–3 cm. long. Flowers and fruits probably occur throughout the year.

TYPIFICATION: The first mention of *Cardamine sarmentosa* was that of G. Forster in 1786 as a nomen nudum, the binomial being accredited to Solander and the locality mentioned as "Teautea." This locality has been identified by St. John (in Occas. Pap. Bishop Mus. 18: 80. 1945) as Takaroa in the Tuamotu Archipelago, an island visited by the Forsters on Cook's second voyage. Forster must have attributed the name to Solander because he also saw a specimen obtained on the first Cook voyage. The first description of the species was that of de Candolle in 1821; this is based on specimens in the Banks and Lambert herbaria. In his 1824 publication de Candolle parenthetically mentioned Forster's earlier publication of the name and cited only a specimen in the Lambert herbarium; therefore it seems advisable to accept the J. R. & G. Forster specimen in the Lambert herbarium (now at BM) as the lectotype.

DISTRIBUTION: Solomon Islands and New Caledonia throughout the southern Pacific to the Tuamotus and also in Hawaii. Although the species is usually recorded by collectors as a weed, St. John (1945, cited above) gives cogent reasons for considering it a medicinal and food plant that was an intentional aboriginal introduction into Polynesia. Presumably it was indigenous somewhere in the western portion of its range, west of Fiji.

LOCAL NAMES AND USES: Fijian names are *rongomi*, *sewathi*, and *wathi ni vanua*. The plant is considered edible fresh as greens, and it is attributed medicinal uses such as treating piles. An extended discussion of many uses and local names throughout the Pacific is given by St. John (1945, cited above, pp. 81–83).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains east of Lautoka, along "Watercress Creek," Greenwood 253; Mt. Evans Range, Greenwood 451; Nalotawa, eastern base of Mt. Evans Range, Smith 4324. NAMOSI: Namosi Village, Weiner 11. NAITASIRI: Nanduruloulou, DA 750; Central Agricultural

Station, Navuso, DA 2564. TAILEVU: Raralevu Village, *Weiner 119*. MBENGA: Raviravi Village, *Weiner 191*. TAVEUNI: Somosomo ("and all over Fiji"), *Seemann 8*; Waimanggere Estate, DA 8925. MOALA: *Milne 113*. FIJI without further locality, *Home, Harvey*. Apparently first noted in Fiji by the U. S. Exploring Expedition in 1840 (cf. A. Gray, 1854, cited above), but no voucher was obtained.

Rorippa sarmentosa presumably also occurs in Peru, although the only Peruvian specimen mentioned by Macbride in 1938 was *U. S. Expl. Exped.*, from Lima (also mentioned by A. Gray, 1854, cited above). Macbride considered the species Polynesian and remarked: "An introduction in Peru, if the record is correct." If indeed the species was an introduction into Peru before 1839 (the year of the Exploring Expedition visit), it could conceivably have been carried eastward by visiting Polynesians, or alternatively it could have been inadvertently introduced from Polynesia by Peruvian "black-birders" (cf. Sykes in *Allertonia* 2: 323. 1981). On the other hand, some of the Exploring Expedition labels are not entirely reliable, and this may be another case of a mixed label.

3. *Rorippa indica* (L.) Hiern var. *apetala* (DC.) Hochr. in *Candollea* 2: 370. 1925; Rollins in *Rhodora* 71: 552. 1969; J. W. Parham, *Pl. Fiji Isl. ed. 2*. 312. 1972.

Sisymbrium apetalum Desf. *Tabl. Ecole Bot. Mus. Hist. Nat.* 130. 1804; non Lour. (1790).

Sisymbrium dubium Pers. *Syn. Pl.* 2: 199. 1806.

Nasturtium indicum var. *apetalum* DC. *Prodr.* 1: 139. 1824.

Rorippa dubia Hara in *J. Jap. Bot.* 30: 196. 1955; Backer & Bakh. *f. Fl. Java* 1: 190. 1963.

Cardamine sarmentosa sensu J. W. Parham in *Dept. Agr. Fiji Bull.* 35: 41, p. p. 1959; non DC.

An annual herb to 20 cm. high, erect or with the lower part of the stem creeping, found as an occasional weed in waste places from near sea level to about 400 m. The siliques are straight or slightly curved, 1.5–3 cm. long.

TYPIIFICATION AND NOMENCLATURE: *Sisymbrium apetalum* Desf. was apparently based on a plant growing in the garden at Paris. As the binomial had been otherwise used by Loureiro, Persoon proposed the new name *S. dubium*. In proposing *Nasturtium indicum* var. *apetalum*, de Candolle cited both the earlier references, but he and not Desfontaines must be cited as the parenthetical author when the taxon is transferred to *Rorippa*. An informative discussion of *R. indica* (L.) Hiern (*Cat. Welw. Afr. Pl. pt. 1*, following p. XXV. 1896), based on *Sisymbrium indicum* L. (*Mant. Pl.* 93. 1767), and the nomenclature of the two varieties is provided by Rollins (1969, cited above).

DISTRIBUTION: Indigenous in eastern Asia, where both the petalous (var. *indica*) and apetalous varieties are present. While both varieties have become naturalized in many parts of the world, var. *apetala* (often recorded as a distinct species *R. dubia* (Pers.) Hara) is the more common as a weed, especially in America.

LOCAL NAME: *Sewathi* (DA 2459).

AVAILABLE COLLECTIONS: VITI LEVU: RA: Navolau, DA 2459. REWA: Department of Agriculture garden plot, DA 7420. VANUA LEVU: THAKAUNDROVE: Mt. Kasi, DA 3495.

FAMILY 109. MORINGACEAE

MORINGACEAE Dumort. *Anal. Fam. Pl.* 43, 48. 1829.

Trees with thick stems and gummy bark or shrubs with large underground rootstocks, the stipules minute, knoblike; leaves alternate, pinnately to tripinnately compound, with stipitate glands at bases of petiolules and pinnae, the pinnae and leaflets opposite, the blades entire; inflorescences axillary, paniculate, many-flowered; flowers ♂, perigynous, zygomorphic, the receptacle cupuliform, forming a disk-lined hypan-

thium; calyx lobes 5, imbricate, subequal or unequal, spreading or reflexed; petals 5, imbricate, shortly connate at base, unequal, the lowermost (anticous) the largest, erect, the others reflexed; androecium inserted on margin of disk, the perfect stamens 5, epipetalous, the filaments free, the anthers dorsifixed, oblong, unilocular, longitudinally dehiscent, the staminodes 5, subulate, sometimes with rudimentary anthers; ovary superior, stipitate, unilocular, with 3 parietal placentas, the ovules numerous, anatropous, pendulous in 2 series on each placenta, the style filiform, the stigma small; fruit a 3-valved, podlike capsule, elongated, beaked, sometimes more or less torulose, the valves thick, spongy, the seeds large, 3-winged or unwinged, the embryo straight, without endosperm.

DISTRIBUTION: A family composed of a single genus occurring, usually in semiarid areas, from southwestern Africa to northeastern tropical Africa and Madagascar eastward to India, often cultivated or naturalized elsewhere.

1. *MORINGA* Adanson, Fam. Pl. 2: 318. 1763.

Characters of the family; our species with tripinnate leaves, unequal calyx lobes, and a subtorulose capsule 15–45 cm. long, the valves with 3 stout, blunt ribs, the seeds winged.

TYPE SPECIES: *Moringa oleifera* Lam. (*Guilandina moringa* L.) (vide van Steenis in Fl. Males. I. 5: 554. 1958).

DISTRIBUTION: As the family, with ten–twelve species, some of them cultivated and occasionally naturalized in other tropical areas. One species occurs in cultivation in Fiji.

1. *Moringa oleifera* Lam. Encycl. Méth. Bot. 1: 398. 1785; Burkill, Dict. Econ. Prod.

Malay Penins. 1495. 1935, ed. 2. 1520. 1966; van Steenis in Fl. Males. I. 4: 45. fig.

1. 1949, in op. cit. I. 5: 554. 1958; J. W. Parham, Pl. Fiji Isl. ed. 2. 155. 1972.

Guilandina moringa L. Sp. Pl. 381. 1753.

Moringa pterygosperma Gaertn. Fruct. Sem. Pl. 2: 314. t. 147, fig. 2. 1791; J. W. Parham, Pl. Fiji Isl. 109. 1964; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 128. 1970.

A tree to 10 m. high, frequently cultivated in Fiji near sea level. The fragrant flowers have the petals white, greenish proximally; the fruits are brown at maturity, 15–45 cm. long, 3-angled, and with winged seeds about 10 mm. in diameter. Flowers and fruits are infrequent in Fiji, but in Malesia the species flowers throughout the year and bears fruits mostly between September and November (van Steenis, 1949, cited above).

TYPIFICATION AND NOMENCLATURE: For *Guilandina moringa*, Linnaeus gave several references, including one to his Fl. Zeyl. 155. 1747, and indicated the habitat as Ceylon. By implication of the epithet, *Moringa oleifera* may be typified by the Linnaean binomial, but Lamarck's description seems to have been based on inflorescences sent by Sonnerat and complete fruits by Jussieu (p). For *M. pterygosperma*, Gaertner cited several Linnaean and pre-Linnaean references. By a strict application of ICBN, Art. 63.2, it might be argued that the binomial *M. oleifera* is illegitimate; however, Lamarck excluded a cited synonym, *Balanus myrepsica* Garsault, by implication, and the justification for utilizing *M. oleifera* outlined by van Steenis (1958, cited above) seems acceptable.

DISTRIBUTION: Indigenous in northwestern India, now spread throughout the tropics in cultivation. Apparently it does not become naturalized, although it may be found as a relic of cultivation in abandoned places.

LOCAL NAMES AND USES: The usual English names *horse radish tree* and *drumstick tree* are used in Fiji. The Sanskrit name *sajina* seems sometimes used by Indians in Fiji.

The tree is ornamental and is used in fences and hedges. The flowers, leaves, and immature fruits are edible as a vegetable, and the root provides a seasoning. The bark, root, and leaves are used medicinally in India, and the seeds yield an oil (ben oil) which has commercial uses. The species is probably a fairly recent introduction into Fiji as a curiosity or for use by the Indian community.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Nathotholevu, Singatoka, DA 17323. TAILEVU: Nausori, DA 957. FIJI without further locality, DA 11176.

ORDER SALICALES

FAMILY 110. SALICACEAE

SALICACEAE Mirbel, *Elém. Phys. Vég. Bot.* 2: 905, as *Salicineae*. 1815.

Diocious trees or shrubs, the stipules free, sometimes foliaceous; leaves alternate, often deciduous, the blades entire to serrate or dentate, rarely lobed, pinnate-nerved; inflorescences catkinlike erect or pendulous spikes or rarely racemes, the bracts membranaceous; flowers unisexual, solitary in axils of bracts, without sepals or petals, the disk composed of 1 or 2 glandlike scales, these sometimes cyathiform or cupular, entire to variously lobed; ♂ flowers with 2–30 stamens, the filaments filiform, free or connate, the anthers ovoid or oblong, 2-locular, longitudinally dehiscent, a rudimentary gynoeceum normally lacking; ♀ flowers with a sessile or stipitate unilocular ovary, the placentas 2–4, parietal or subbasal, the ovules anatropous, usually numerous on each placenta, the style short, the stigmas 2–4, emarginate or bilobed; fruit a dehiscent 2–4-valved capsule, the seeds small, surrounded by silky hairs arising from funicle, the endosperm scanty or lacking, the cotyledons flat.

DISTRIBUTION: Mostly North Temperate, but extending southward from arctic areas to southern South America, southern Africa, and Malesia, lacking in New Guinea and Australia, with two genera and 300–500 species. Some species are elsewhere cultivated and naturalized.

I. SALIX L. Sp. Pl. 1015. 1753.

Trees or shrubs, sometimes low and creeping (but not our species); leaf blades usually elliptic to linear (lanceolate-linear in our species); inflorescences composed of catkins borne on short, axillary axes, with densely and spirally arranged sessile flowers, each subtended by a small, entire bract, the disk composed of 2 anticus and posticus scales or of 1 posticus scale, the scales fleshy, glandlike; ♂ flowers with 2–15 stamens (2 in our species); ♀ flowers with the ovary with 2 placentas, the ovules 4–8 on each placenta, the stigmas 2, often divided; fruit a 2-valved capsule.

LECTOTYPE SPECIES: Linnaeus originally included 29 species in *Salix*, but the genus has not yet been satisfactorily lectotypified. The lectotype has been indicated as *S. alba* L. (vide Britton & Brown, *Ill. Fl. N. U. S.* ed. 2. 1: 591. 1913) and as *S. pentandra* L. (vide M. L. Green, *Prop. Brit. Bot.* 190. 1929); but Rafinesque (*Alsogr.* 13, 15. 1838) had referred *S. alba* to his genus *Argorips* and *S. pentandra* to his genus *Amerina* (ING, 1979).

DISTRIBUTION: Cool and temperate regions of the Northern Hemisphere except for a few tropical and subtropical species, with 300–500 species. One species is sparingly cultivated and naturalized in Fiji.

I. *Salix babylonica* L. Sp. Pl. 1017. 1753; Jacobs in *Fl. Males.* I. 5: 109. *fig. 1, i.* 1954; Yuncker in *Bishop Mus. Bull.* 220: 95. 1959; J. W. Parham in *Agr. J. Dept. Agr.*

Fiji 29: 33. 1959, Pl. Fiji Isl. 86. 1964, ed. 2. 130. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 184. 1970.

Salix sp. Greenwood in J. Arnold Arb. 30: 81. 1949.

A shrub or tree to 3 m. high or more, with the branches dependent nearly to the ground, occasionally cultivated in Fiji near sea level and infrequently naturalized at elevations up to 150 m. on sand and shingle in the open at edges of creeks.

TYPEIFICATION: Three prior references were given by Linnaeus.

DISTRIBUTION: Indigenous in Asia, the species is now widespread in cultivation; in our area it is also known from Tonga and Niue.

LOCAL NAME AND USE: *Weeping willow*; ornamental. Parham (1959, cited above) indicated that the species was at that time growing in the Suva Botanical Gardens, but no herbarium voucher is available.

AVAILABLE COLLECTION: VITI LEVU: MBA: Namosi Creek, near Tumbenasolo, *Greenwood 1191* (naturalized).

ORDER ERICALES

KEY TO FAMILIES OCCURRING IN FIJI

- Leaf blades usually pinnately nerved; flowers in our genera pedicellate and without bracteoles immediately below calyx, this free or adnate to ovary; stamens usually 10 (rarely 5-20), the anthers 2-locular, usually dehiscent by terminal or oblique pores; ovary superior to inferior, the ovules in our genera numerous in each locule; fruit a capsule or berry. 111. ERICACEAE
- Leaf blades basically palmately nerved; flowers in our genus sessile, each subtended by a bract and 2 bracteoles immediately below calyx, this free from ovary; stamens as many as and alternating with corolla lobes, the anthers 1-locular, dehiscent by longitudinal slits; ovary superior, the ovules in our genus solitary in each locule; fruit in our genus a berrylike drupe. 112. EPACRIDACEAE

FAMILY 111. ERICACEAE

ERICACEAE Juss. Gen. Pl. 159, as *Ericae*. 1789.

Trees or shrubs (rarely herbs), without stipules; leaves alternate (spirally arranged), sometimes opposite or pseudowhorled, the blades simple, at margin entire, crenate, or serrate; inflorescences terminal or axillary, usually racemose, sometimes paniculiform or umbelliform or fasciculate or reduced to solitary flowers; flowers ♂ (rarely functionally unisexual), usually actinomorphic and 5(4-7)-merous; sepals usually connate proximally into a calyx tube, this free or adnate to ovary, the calyx lobes imbricate or open in bud; corolla sympetalous (petals rarely free), campanulate to infundibular, urceolate, or cylindrical, sometimes slightly zygomorphic, caducous, the lobes usually imbricate, rarely valvate in bud; disk hypogynous or epigynous, entire or lobed; stamens usually 10 (rarely 5-20), inserted on outer margin of disk or adnate to base of corolla, the filaments usually free, the anthers 2-locular, dorsifixed or subbasifixed, often appendaged, the locules sometimes produced into free or connate tubules, dehiscent by terminal pores or introrse (rarely extrorse) slits, the pollen grains in tetrads; gynoecium syncarpous, the ovary superior to inferior, usually 5-locular or pseudo-10-locular (rarely 2-7-locular), the placentation axile, the placentas often protruding into locules, the ovules usually many (rarely few or 1) per locule, anatropous or obliquely amphitropous, the style 1, the stigma obtuse to peltate, often capitate, sometimes 5-7-lobed; fruit a septicidal or loculicidal capsule or a dry to fleshy berry, the seeds usually numerous, small, sometimes slightly winged at ends, with copious endosperm, the testa thin.

DISTRIBUTION: Subcosmopolitan, variously circumscribed by different students. In the comparatively inclusive sense maintained by Sleumer and Stevens, cited below, the family includes 100–125 genera and 3,000–3,500 species. Many genera include ornamental plants and some have edible fruits. Two genera are recorded from Fiji, each with a single species, one indigenous and one only in cultivation.

USEFUL TREATMENTS OF FAMILY: Sleumer, H. *Ericaceae*. Fl. Males. 1. 6: 469–914. 1966, 1967. Stevens, P. F. A classification of the *Ericaceae*: subfamilies and tribes. Bot. J. Linn. Soc. 64: 1–53. 1971.

KEY TO GENERA

Ovary superior, the calyx free, the disk hypogynous, lobed; fruit a septicidal capsule; cultivated only.

1. *Rhododendron*

Ovary inferior, the calyx tube adnate to ovary, the disk epigynous, annular; fruit a berry; indigenous.

2. *Paphia*

1. *RHODODENDRON* L. Sp. Pl. 392. 1753.

Shrubs or small trees, evergreen or deciduous, sometimes epiphytic; leaves alternate, opposite, or pseudowhorled, the petioles usually obvious, the blades often coriaceous, entire or crenulate, often with distinctive scales or hairs especially on lower surface; inflorescences terminal, sometimes lateral, perulate in bud, racemose, usually condensed and umbelliform or composed of solitary flowers, the pedicel bibracteolate at base; calyx cupuliform to discoid, deeply 5(–7)-partite to subentire, persistent; corolla campanulate to infundibular or hypocrateriform, actinomorphic to slightly zygomorphic, 5(–7)-lobed to various degrees, the lobes imbricate in bud, erect to spreading at anthesis; disk hypogynous, 5–10(–14)-lobed; stamens 5–10(–14), inserted at base of corolla, often unequal, the filaments linear to filiform, the anthers dorsifixed, not apically produced into tubules, dehiscing by terminal or oblique pores; ovary superior, 5(–7)-locular, the ovules numerous, borne on bifid placentas, the style usually as long as stamens, the stigma capitate or peltate to lobed; fruit a capsule, septicidally dehiscent from apex, the columella persistent, the seeds numerous, minute, sometimes appendaged.

LECTOTYPE SPECIES: *Rhododendron ferrugineum* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2: 680. 1913), one of Linnaeus's five original species.

DISTRIBUTION: Northern Hemisphere, mostly Asian and extending through Malaysia to northern Queensland and the Solomon Islands, with about 850 species, many of which are extensively cultivated and horticulturally important. Hybrids and cultivars are very numerous. One species is occasionally cultivated in Fiji.

1. *Rhododendron* × *pulchrum* Sweet, Brit. Fl. Gard. II. 2: t. 117. 1831; J. W. Parham, Pl. Fiji Isl. ed. 2. 190. 1972.

A shrub 1–2 m. high, cultivated at elevations up to about 800 m.; the corolla is rich pink to rosy purple, with red markings within, infundibular and spreading at apex to 8 cm. in diameter; the filaments and style are rich pink. Flowering specimens have been collected in March and July.

TYPIFICATION: Sweet indicates that *Rhododendron* × *pulchrum* was proposed to replace *R. indicum* γ *smithii* Sweet (Hort. Brit. ed. 2. 343. 1830), which he considered a hybrid between *R. ledifolium* (Hook.) G. Don and *R. indicum* (L.) Sweet.

DISTRIBUTION: A garden hybrid, presumably from Asian parentage.

LOCAL NAME AND USE: Called *azalea* in Fiji, this taxon has been cultivated for many years at Nandarivatu and now is to be seen in many gardens at lower elevation. It is an attractive ornamental. Other species of *Rhododendron* may also occur in Fijian gardens, but only this is supported by vouchers.

AVAILABLE COLLECTIONS: VITILEVU: MBA: Nandarivatu, *Smith 5086*. NAITASIRI: Toninaiwau, Tholo-isuva, *DA 16764*.

The identification of cultivated forms of *Rhododendron* is hazardous for a nonspecialist, but the Fijian collections seem to represent one of the many hybrids involving *R. indicum* and agree well with other material identified as *R. × pulchrum*.

2. PAPHIA Seem. in J. Bot. 2: 77. 1864, Fl. Vit. 146. 1866; A. C. Sm. in J. Arnold Arb. 36: 286. 1955, in Allertonia 1: 370. 1978.

Agapetes subgen. *Paphia* sect. *Paphia* Stevens in Notes Roy. Bot. Gard. Edinburgh 32: 20, p. p. (excl. *A. neo-caledonica*). 1972.

Shrubs, often epiphytic, sometimes scandent; leaves alternate, the blades subcoriaceous, often revolute at margin and entire or glandular-dentate or minutely lobulate; inflorescences axillary, shortly corymbiform or fasciculate or 1-flowered, the flowers comparatively large and showy, the pedicels thickened distally and articulate with calyx, the bracts and bracteoles small; calyx tube adnate to ovary, forming a cupuliform hypanthium, this smooth or angled, the calyx limb 5-lobed; corolla tubular to elongate-urceolate or infundibular, often 5-angled or 5-costate or narrowly 5-winged, shallowly 5-lobed; disk epigynous, entire, annular; stamens 10, the filaments oblong-linear, free to shortly connate, equal, the anthers exceeding or shorter than filaments in length, equal or alternately slightly unequal, not spurred, extending into 2 free tubules dehiscing by introrse-terminal pores or slits; ovary 5-locular (never falsely 10-locular), the ovules numerous, the style filiform, sometimes slightly exerted, the stigma essentially truncate or inconspicuously tuberculate; fruit a 5-locular, many-seeded berry, the calyx limb and disk persistent.

TYPE SPECIES: *Paphia vitiensis* Seem., the only original species.

DISTRIBUTION: New Guinea, northeastern Australia, and Fiji, with about 17 species, one of which is a Fijian endemic.

USEFUL TREATMENT OF GENUS: Stevens, P. F. Notes on the infrageneric classification of *Agapetes*, with four new taxa from New Guinea. Notes Roy. Bot. Gard. Edinburgh 32: 13–28. 1972.

In 1978 (in Allertonia 1: 370–372) I briefly summarized some of the earlier opinions as to the separation of *Agapetes* D. Don ex G. Don (1834) and *Paphia* Seem. (1864) or their combination under the earlier name. The latter course is the preference of Sleumer and Stevens (1967, 1972, both cited above). The second of these papers thoroughly reviews the situation, Stevens concluding that “continental *Agapetes*” (*Agapetes* sensu str.) and “oceanic *Agapetes*” (*Paphia*) have too many features in common to be more than subgenerically separated. At the same time he pointed out various anatomical features (or at least firm trends) that are different in the two groups. The groups (whether genera or subgenera) are well separated geographically, with two exceptions. One of these is the Malayan *A. scortechinii* (King & Gamble) Sleumer, which Stevens considers to represent a distinct section (subgen. *Paphia* sect. *Pseudagapetes* Airy Shaw), a geographically separated species with so many striking characters that to accept it as a separate genus demands no great concessions. The

second species not strictly conforming with "oceanic *Agapetes*" is *A. neo-caledonica* Guillaumin, the only member of the complex isolated in New Caledonia. However, *A. neo-caledonica* has a nonarticulated calyx tube. Whether the pedicel is continuous with or sharply articulated with the calyx has, more often than not, been considered a character of generic significance in subfam. Vaccinioideae tribe Vaccinieae. Generic limits in this tribe have been troublesome to every student who has considered them, and to date conclusions seem highly subjective. In the present case, even without utilizing the supportive anatomical characters so well expounded by Stevens, it may well be argued that *Agapetes* is readily divisible into four geographically separated genera: (1) *Agapetes* (about 80 predominantly Himalayan species, with falsely 10-locular ovaries and indument composed of long-stalked hairs with abruptly expanded heads); (2) *A. scortechinii* (similar in many respects, but with 5-locular ovaries which are falsely 10-locular only at apex); (3) *A. neo-caledonica* (differing from *Paphia* proper in having nonarticulated, comparatively long, and prominently winged calyx tubes); and (4) *Paphia* (with about 17 species in New Guinea, northeastern Australia, and Fiji, with articulated calyx tubes, strictly 5-locular ovaries, and indument composed of short-stalked hairs with scarcely differentiated heads). This conclusion (which would require the recognition of two additional genera) is as subjective as most

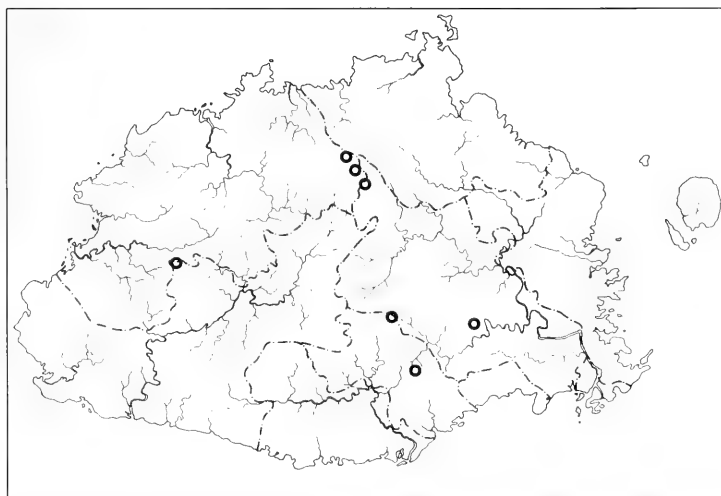


FIGURE 185. Map of Viti Levu showing known distribution of *Paphia vitiensis*. For details of localities see Vol. 1 of this *Flora*, FIGURE 4 (p. 22).

current in the family (where the user is given an inordinate number of alternative choices as to generic limits), but I suggest it as at least feasible, in view of the discrete geographical ranges of the four groups and the "state of the art" in the Ericaceae.

1. *Paphia vitiensis* Seem. in J. Bot. 2: 77. 1864, Fl. Vit. 147. t. 28. 1866; A. C. Sm. in J. Arnold Arb. 36: 286. 1955; J. W. Parham, Pl. Fiji Isl. 134, fig. 51. 1964, ed. 2. 191. fig. 56. 1972; A. C. Sm. in Allertonia 1: 371. 1978. FIGURES 83 (upper), 185, 186.

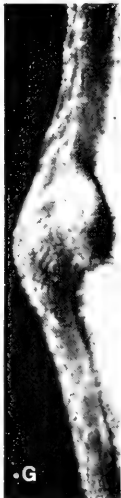
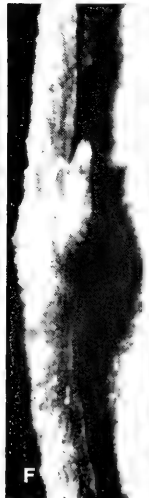
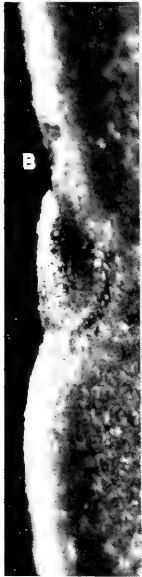
Epigynum vitiense Seem. in Bonplandia 9: 257, nom. nud. 1861, Viti, 438, nom. nud. 1862.

Agapetes vitiensis Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 223. 1892; Gibbs in J. Linn. Soc. Bot. 39: 155. 1909; Turrill in op. cit. 43: 29. 1915; Sleumer in Bot. Jahrb. 70: 101. 1939; Stevens in Notes Roy. Bot. Gard. Edinburgh 32: 27. fig. 2, G. 1972.

The species now being much better represented than when described by Seemann, his description may be amplified: Shrub or small tree (1-) 2-7 m. high, glabrous throughout or with vegetative indument sparse and scattered at maturity, sometimes epiphytic, occurring in dense or often mossy forest at elevations of 450-1,323 m., usually on upland peaks and ridges; petioles stout, 3-10 mm. long and distally broadened; leaf blades coriaceous, elliptic, (3-) 4-8.5 cm. long, (1.5-) 2-4.5 cm. broad, cuneate-attenuate at base, obtusely cuspidate at apex, glandular-denticulate in slight marginal indentations (or becoming merely crenulate to subentire) or revolute-margined and minutely lobulate, with 3-6 pairs of ascending nerves, these obvious beneath and interconnected by coarsely reticulate venation; inflorescences subfasciculate, 1-3-flowered, the pedicels (2-) 2.5-4 cm. long, conspicuously thickened upward and bibracteolate toward base; calyx with a smooth, cupuliform, red hypanthium about 5 mm. long and broad at anthesis, the limb 2-3 mm. long, greenish distally, with short, deltoid lobes; corolla pale yellow, pink- or red-tinged distally, tubular in bud, at anthesis becoming infundibular, 3-4 cm. long, 1.5-3 cm. in diameter at the open apex, very narrowly 5-winged to apices of lobes; stamens with white filaments about 5 mm. long, the anthers yellow, 2.5-3.5 cm. long, incurved at base, the tubules slightly shorter than thecae and dehiscing by elongate-elliptic pores, these becoming slitlike; disk pink to reddish; style white or greenish yellow, pink to reddish distally; mature fruit deep red, at length becoming black, subglobose, and 10-15 mm. in diameter. Flowers and fruits have been observed in practically all months.

LECTOTYPIFICATION: The lectotype (vide A. C. Sm. in Allertonia 1: 371. 1978) is *Graeffe 45* (BM), a flowering specimen collected in 1862 on Viti Levu without further locality; this was one of the two specimens originally cited by Seemann and apparently was the principal basis of his specific and generic concept. Graeffe's Viti Levu material seems to have come only from the southern part of the island, and no. 45 is very likely from Mt. Voma, accessible from Namosi Village and in an area almost certainly visited by Graeffe.

FIGURE 186. *Paphia vitiensis*; A, flower, $\times 2$; B, margin of lower surface of mature leaf blade, with a conical tooth, $\times 50$; C, margin of lower surface of mature leaf blade, with a recurved lobule and type of indument sometimes associated with leaf blade margins, $\times 50$; D, margin of lower surface of young leaf blade, with a developing tooth, $\times 50$; E, portion of lower surface of young leaf blade, with *Paphia*-type glandular hairs and developing marginal teeth, $\times 50$; F, margin of lower surface of young leaf blade, with a developing tooth, $\times 50$; G, margin of lower surface of young leaf blade, with incipient lobule partially concealing the tooth, $\times 50$. A & D from *DA 13964* (Mt. Voma), B from *Gillespie 3162* (Mt. Naitarandamu), C from *Smith 5144* (Mt. Tomanivi), E from *Parks 20810* (Mt. Tomanivi), F & G from *DA 14653* (Mt. Tomanivi).



DISTRIBUTION: Endemic to Fiji and thus far known only from a few montane areas on Viti Levu at elevations of 450–1,323 m. In my 1978 discussion I stated that the lowest known elevation was 751 m., but since then a specimen from the Nausori Highlands at about 450 m. (*DA 18857*) has become available. The species is rare at elevations below 870 m. and becomes increasingly frequent above that. Because of the interest attached to *Paphia vitiensis*, both for its distribution and its striking beauty, all collections known to me are here listed.

LOCAL NAMES: In my observation Fijians have no local name for the species, but Gillespie (nos. 2781, 4120) has recorded the names *molatha*, *membu*, *thembu*, and *lera ni mbuisa*. The names *vunga* and *vunga ndina* have been noted by some collectors, but these names are more correctly applied to *Metrosideros* (Myrtaceae).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA (or MBA?): Nausori Highlands, *DA 18857*. MBA: Near summit of Mt. Nanggaranambuluta, east of Nandarivatu, *DA 15261* (coll. Schuster); summit and upper slopes of Mt. Tomanivi, *in Thurn 17, Gibbs 783, Parks 20810, Gillespie 4120, Smith 5144, DA 2191, 7123, 13065, 14648, 14653, Webster & Hildreth 14195, O. & I. Degener 32067*. NAMOSI: Summit and upper slopes of Mt. Voma, *Seemann 284, Gillespie 2781, DA 589, 607, 1923, 1982, 13964*; Namosi without further locality, *Graeffe 1362*. NAMOSI–NAITASIRI boundary: Summit of Mt. Naitarandamu, *Gillespie 3162*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6149*; summit of Mt. Nambukelevu, high point of Mendrausuthu Range, *Horne 976, DA 15465*. VITI LEVU without further locality, *Thurston*, April, 1886, *DA 3225*.

An interesting incipient divergence is seen in the leaf blades of the populations of *Paphia vitiensis* in the northern and southern parts of its restricted range on Viti Levu (FIGURE 185). The mature leaf blades in the "southern" areas (Mt. Voma, Mt. Naitarandamu, and the Mendrausuthu Range) have thickened margins with hard, conical teeth about 0.5 mm. long (FIGURE 186B) arising from inconspicuous notches (the teeth often deciduous, leaving only slight marginal indentations). Mature leaf blades in the "northern" areas (Mt. Tomanivi and adjacent ridges and the Nausori Highlands) have narrowly revolute margins with very obvious oblong lobules 0.4–0.8 mm. long and broad (FIGURE 186C). On first consideration these conditions, with firm geographical correlations, seem consequentially different. However, examination of leaf blades just emerging from buds (FIGURE 186D–F) shows that only conical teeth are at first developed in both geographical areas. In the northern population each tooth seems to arise from a more obvious callose (FIGURE 186F), which soon develops into an incipient lobule that begins to cover and conceal the tooth (FIGURE 186G) and soon completely obscures it (as in FIGURE 186C), the tooth eventually being totally concealed or deciduous. As no other diverging characters (of indument, flowers, etc.) are apparent in the northern and southern populations, the differences in leaf margin are probably not worth nomenclatural recognition.

FAMILY 112. EPACRIDACEAE

EPACRIDACEAE R. Br. Prodr. Fl. Nov. Holl. 535, as *Epacrideae*. 1810.

Shrubs or small trees, without stipules; leaves spirally arranged, sometimes imbricate or crowded and pseudowhorled, the blades usually narrow, stiff, coriaceous, and entire, with basically palmate venation; inflorescences terminal or axillary, bracteate, spicate or racemose, rarely reduced to a single flower; flowers actinomorphic, ♀ (rarely unisexual), each subtended by 1 bract (rarely absent) and 2–several opposite or imbricate bracteoles below calyx; calyx 4- or 5(or 6)-lobed, the lobes imbricate, persistent; corolla proximally campanulate or tubular, with a deeply divided limb and 5 (or 6) spreading, valvate or imbricate lobes; disk lobed or consisting of scales;

stamens hypogynous or inserted on corolla tube, as many as and alternating with corolla lobes, the anthers medifixed, not appendaged, 1-locular, dehiscent by longitudinal slits, the pollen grains in tetrads; ovary superior, usually 4- or 5-locular (1-10-locular), the placentation axile, the ovules 1-many in each locule, anatropous, the style simple, the stigma entire; fruit a many-seeded, loculicidal capsule or a berrylike drupe (the pyrene if 1 with as many locules as ovary, or pyrenes several and separate in the pulpy mesocarp), the seeds with fleshy endosperm, the testa thin.

DISTRIBUTION: Southeastern Asia through Malesia and eastward in the Pacific to New Zealand, Rapa, the Marquesas, and Hawaii, with one species in southern South America. The family includes 21-30 genera and about 400 species, the greater part of them occurring in Australia and Tasmania. One genus is represented by an indigenous species in Fiji.

USEFUL TREATMENTS OF FAMILY: Sleumer, H. *Flora Malesianae praecursores* XXXVII. Materials toward the knowledge of the Epacridaceae mainly in Asia, Malaysia, and the Pacific. *Blumea* 12: 145-171. 1963. Sleumer, H. *Epacridaceae*. *Fl. Males.* 1. 6: 422-444. 1964. Virot, R. *Epacridacées*. *In: Aubréville & Leroy, Fl. Nouv. Caléd. et Dépend.* 6: 1-160. 1975.

In the treatments cited above, Sleumer and Virot have taken the genus *Styphelia* in a very inclusive sense, submerging into it such genera as *Cyathopsis*, *Lissanthe*, *Leucopogon*, and *Cyathodes*. In considering placement of the single species in Fiji (in *Allertonia* 1: 372-375. 1978) I was willing to follow them, although that species had previously been referred to *Leucopogon*. The Australian species are now being reviewed by Jocelyn M. Powell, who indicates (personal communication) that she and other Australian botanists consider *Styphelia* and related genera to be very distinct from one another morphologically and palynologically. In view of the opinion to be expressed in a forthcoming definitive treatment of the family in Australia, I now intend to recognize *Leucopogon* as generically distinct from *Styphelia*; this alternative seems preferable to accepting *Styphelia* as composed of extremely distinct subgenera. In more carefully reviewing the New Caledonian and Fijian material referred to *Styphelia cymbulae*, I have reached the conclusion (doubtless a subjective one) that the species is treated unnecessarily broadly by Virot (1975, cited above, pp. 82-103), although his seven "variations" seem to be interrelated by certain intermediate individuals. Therefore I now reverse my 1978 opinion and alter both my generic and specific placement of the single species of the family in Fiji.

1. *LEUCOPOGON* R. Br. *Prodr. Fl. Nov. Holl.* 541. 1810; Seem. *Fl. Vit.* 147. 1866; A. C. Sm. in *J. Arnold Arb.* 36: 286. 1955. *Nom. cons. non nisi vs. Perojoa* Cav.

Styphelia subgen. *Leucopogon* Drude in *Engl. & Prantl, Nat. Pflanzenfam.* IV. 1: 78. 1889; Sleumer in *Blumea* 12: 146. 1963.

Usually slender shrubs or small trees with characters noted under the family; inflorescences usually spiciform, rarely 1-flowered, the axis with 2-many sterile bracts in lower portion (our species usually many-bracteate); flowers sessile, usually 5-merous (rarely 6-merous), each with a subtending bract and 2 strictly opposite bracteoles immediately below the calyx; disk cupuliform, lobed (superficially so in our species); stamens inserted toward apex of corolla tube, entirely or partially included; ovules 1 in each locule of ovary, the style short, not or slightly projecting from corolla; fruit a berrylike drupe, the pyrene with a woody endocarp and as many locules as ovary (or fewer by abortion).

TYPE SPECIES: *Leucopogon lanceolatus* R. Br., *nom. illeg. (Styphelia parviflora* Andrews, = *L. parviflorus* (Andrews) Lindl.). *Typ. cons.*

DISTRIBUTION: Extreme southeastern Asia through Malesia and Australia to New

Zealand, Chatham Island, New Caledonia, the New Hebrides, and Fiji (cf. van Steenis & van Balgooy in *Blumea* Suppl. 5: 304. map 170. 1966), perhaps with as many as 150 species. The genus, as here interpreted, reaches the eastward extension of its Melanesian range in Fiji, where a single species occurs.

Although the New Hebridean and Fijian specimens of *Leucopogon* fall into *L. cymbulae* in the inclusive sense adopted by Virost in 1975 (as *Styphelia cymbulae*), they fit best into his "variation ex-*Styphelia septentrionalis*." This variation has prevailingly lanceolate leaf blades 25-170 × 4-25 mm., inflorescences 6-15 mm. long and with (4-) 6-12 flowers, corollas 3-5 mm. long, and anthers about 0.8 mm. long. *Leucopogon cymbulae* in the typical sense (Virost's "variation à petites fleurs") has leaf blades 10-50 × 2-10 mm., inflorescences 4-12 mm. long and with 2-8 flowers, corollas 2-3 mm. long, and anthers scarcely 0.4 mm. long. (Comparable inflorescences, flowers, and fruits are shown in *Allertonia* 1: 374. fig. 11. 1978.) Virost (1975, cited above, p. 84) indicates that further study may make desirable the recognition of his "variations" as infraspecific or even specific taxa. Since only one of the variations seems to have reached the New Hebrides and Fiji from the New Caledonian matrix of *L. cymbulae* sensu lato, I now believe that clarity is best served by recognizing it at the specific level.

1. *Leucopogon septentrionalis* Schlechter in Bot. Jahrb. 39: 224. 1906.

FIGURE 187A-C.

Leucopogon cymbulae sensu Seem. in *Bonplandia* 9: 257. 1861, Viti, 438, as *L. cymbula*. 1862, Fl. Vit. 147. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 225. 1892; Guillaumin in Bull. Soc. Bot. France 74: 699. 1928, in J. Arnold Arb. 13: 11. 1932, in Bull. Soc. Bot. France 82: 350. 1935; A. C. Sm. in J. Arnold Arb. 33: 105. 1952, in op. cit. 36: 286. 1955; J. W. Parham, Pl. Fiji Isl. 133. 1964, ed. 2. 190. 1972; non Labill. sensu str. *Leucopogon vitiensis* A. Gray in Proc. Amer. Acad. Arts 5: 326, nom. nud. 1862, in *Bonplandia* 10: 36, nom. nud. 1862.

Styphelia septentrionalis Sleumer in *Blumea* 12: 154. 1963.

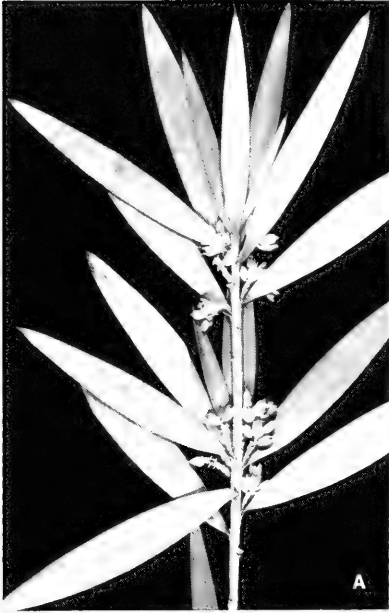
Styphelia cymbulae sensu Virost in Aubréville & Leroy, Fl. Nouv. Caléd. et Dépend. 6: 82, p. p. ("variation ex-*Styphelia septentrionalis*," pl. 14, fig. 1, 2, 4). 1975; A. C. Sm. in *Allertonia* 1: 373, p. p. fig. 11, A-C. 1978; P. S. Green in Bramwell, Plants and Islands, 45, as *S. cymbalae*. 1979; non Spreng. sensu str.

As it occurs in Fiji, *Leucopogon septentrionalis* is a shrub or tree 1-5 m. high, found at elevations from near sea level to 1,075 m. in usually dry forest or on exposed peaks and ridges or in *talasinga* (dry zone vegetation). The corolla is white or cream-colored and the fruit is bright to dull orange. Flowers and fruits do not seem seasonal.

TYPIFICATION: The type is *Schlechter 15585* (B HOLOTYPE probably destroyed; ISOTYPES at P, Z), collected Dec. 27, 1902, in mountains near Oubatche, vicinity of Pouébo, New Caledonia, at about 1,000 m.

DISTRIBUTION: New Caledonia, the New Hebrides, and Fiji, where it is known only from Viti Levu, Kandavu, and Vanua Levu. On Viti Levu the species occurs sporadically on exposed peaks and ridges between 400 and 1,075 m., whereas on Vanua Levu it is abundant in the *talasinga* of the northern slope (but not exclusively there) at elevations from near sea level to 590 m. Because of this interesting distribution I venture to repeat the citations given in *Allertonia* in 1978.

FIGURE 187. A-C, *Leucopogon septentrionalis*; A, distal portion of branchlet, with inflorescences, × 1; B, distal portion of branchlet, with inflorescences and a fruit, × 1; C, inflorescence and detached flower, × 8. D, *Leucopogon cymbulae*, for comparison, distal portion of branchlet, with inflorescences and fruits, × 1. A & C from *Smith 6493*, B from *DA 15475*, D from *McMillan 5026* (New Caledonia).



LOCAL NAMES AND USE: Recorded Fijian names are *tangatangalesa*, *seruserumala*, and *mavindi*. In Vanua Levu the wood is used in making small hand drums.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Upper slopes of Mt. Koromba, *Smith 4700*. NADRONGA & NAVOSA: Nausori Highlands, *DA*, March 7, 1962 (*Bola 114*), *13788 (DF 342)*, *Vetawa 4, O. & I. Degener 32181*. NAMOSI: Korombasambasanga Range, Mt. Nambui track, *DA 14556*. NAITASIRE: Summit of Mt. Nambukelevu, Mendrausuthu Range, *DA 15475*. REWA: Mt. Korombamba, *DA 1167*. KANDAVU: In mountains (probably Mt. Mbuke Levu), *Seemann 285* (source of the name *L. vitiensis*). VANUA LEVU: MBUA: Nggonggovu, between Nawailevu and Mbua, *DA 1115*; track to Mt. Seatura, *DA 17540*; Mbua without further locality, *H. B. R. Parham*, Jan. 7, 1937. MBUA or MATHUATA: Between Nasarowangga and Ndreketi, *DA 1094*. MATHUATA: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6667, DA 12850, 13432, Berry 11*; summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6493*; Wainikoro River area, *Greenwood 703*. FIJI without further locality, *U. S. Expl. Exped., Horne 654, 1107*.

ORDER EBENALES

KEY TO FAMILIES OCCURRING IN FIJI

Plants without a latex system; indument when present not (or very rarely) composed of 2-armed hairs; stamens, if as many as corolla lobes or in fascicles, alternate with corolla lobes; ovules pendulous from axile placentas.

Flowers ♂ (often functionally unisexual); calyx tube more or less adnate to ovary, this inferior to semi-inferior; corolla usually divided nearly to base; stamens 4-numerous (in our species frequently 40-75), often in 5 fascicles alternate with corolla lobes, the anthers small, medifixed; ovary with 2-4 unitegmic ovules per locule; style solitary, slender; fruit a drupe with a single 1-5-locular pyrene, the seeds solitary in each locule of pyrene. 113. SYMPLOCACEAE

Flowers unisexual (rarely ♂ but not in our genus); calyx tube free, the ovary superior; corolla usually divided only in distal half; stamens 2-4 times as many as corolla lobes, sometimes as many as corolla lobes and alternate with them, the anthers basifixed or dorsifixed near base; ovary with (1 or) 2 bitegmic ovules per locule; styles 2-8, free or proximally united; fruit a berry, the seeds fewer than ovules. 114. EBENACEAE

Plants with a well-developed latex system; indument when present often composed of 2-armed hairs (one arm sometimes reduced or obsolete); flowers ♂; stamens more numerous than corolla lobes and in 2 or 3 (or more) whorls (but sometimes the outer whorl(s) staminodial or absent) or the fertile stamens as many as corolla lobes and opposite them; the ovules solitary in each locule, unitegmic, ascending or pendulous from axile placentas; fruit a usually hard berry, the seeds with a bony, often shining testa and a dull, ventral to basal scar. 115. SAPOTACEAE

FAMILY 113. SYMPLOCACEAE

SYMPLOCACEAE Desf. in *Mém. Mus. Hist. Nat.* 6: 9, as *Symploceae*. 1820.

Trees or shrubs, estipulate, the indument if present composed of simple hairs; leaves alternate (spirally arranged), simple, rarely pseudoverticillate, the blades penninerved, entire, serrate, or dentate, often coriaceous and drying yellowish; inflorescences axillary or terminal, spicate, racemose, fasciculate, or sometimes composed of solitary flowers, the bracts small; flowers ♂ (often functionally unisexual, the plant then polygamodioecious), actinomorphic, basically 5-merous; calyx tube short-campanulate, more or less adnate to ovary, the lobes 3-5, valvate; corolla gamopetalous but usually divided nearly to base, the lobes usually 5 (3-11) and quincuncially imbricate; stamens 4-numerous, often in 5 fascicles alternate with corolla lobes (in our species frequently 40-75), the filaments basally connate into a tube adnate to corolla, the anthers short, ovoid or subglobose, medifixed, introrse, 2-locular, dehiscing lengthwise; ovary inferior to semi-inferior, 2-5-locular, the ovules 2-4 per locule, anatropous (epitropous) or amphitropous, unitegmic, tenuinucellate, pendulous from axile placentas, the style slender, the stigma small, punctiform or peltate; fruit an indehiscent drupe with a single pyrene, this 1-5-locular, smooth or variously sculptured, the seeds solitary in each locule of pyrene, the endosperm copious, the embryo straight or curved, the calyx lobes persistent.

DISTRIBUTION: Tropical and subtropical Asia (and northward into temperate areas), Australasia, Melanesia, and America, with a single genus.

1. SYMPLOCOS Jacq. Enum. Syst. Pl. Carib. 5, 24. 1760; Seem. Fl. Vit. 152. 1866; Brand in Pflanzentr. 8 (IV. 242): 13. 1901; A. C. Sm. in J. Arnold Arb. 36: 286. 1955; Nootboom in Fl. Males. I. 8: 205. 1977.

Characters of the family.

TYPE SPECIES: *Symplocos martinicensis* Jacq.

DISTRIBUTION: As of the family, with perhaps 300-500 species. Nootboom's treatments, cited below, may be considered conservative by many; he estimates the number of species as about 250. The Indo-Pacific portion of the range terminates in Fiji, with two indigenous species as here treated.

USEFUL TREATMENTS OF GENUS: Nootboom, H. P. Revision of the Symplocaceae in the Old World New Caledonia excepted. Leiden Bot. Ser. I: 1-335. 1975. Nootboom, H. P. Symplocaceae. Fl. Males. I. 8: 205-274. 1977.

Nootboom (1977, cited above, p. 209) believes that the reported dispersal of drupes of *Symplocos* by birds or bats is not very likely. In respect to the dispersal of *Symplocos* over areas of saltwater, one may note that *S. leptophylla* is one of the most abundant plants of the Fijian high islands at all elevations, but yet the genus does not occur in the Lau Group nor in Tonga or Samoa. This would suggest that *Symplocos* is not readily dispersed, and for this reason a frequent interchange of genetic material among insular areas is not likely. The distribution of a species such as *S. cochinchinensis* (Lour.) S. Moore from continental Asia to Australia and Melanesia may be contemplated with a degree of skepticism. If disseminules are infrequently transported over saltwater, the division of *S. cochinchinensis* into four subspecies and 34 varieties, as proposed by Nootboom, does not seem entirely logical. In at least the eastern part of its range, *S. cochinchinensis* sensu lato would seem better treated as a complex of long-isolated and related (but gradually differentiating) species. As Nootboom wrote about the varieties of his subsp. *leptophylla*: "They all represent the same level, giving the impression that they form the beginning of new species."

KEY TO SPECIES

- Leaf blades glabrous or sparsely and evanescently strigillose on costa beneath (hairs not longer than 0.3 mm.); inflorescence branches, outer surface of bracts, and calyces glabrous or puberulent or sparsely and minutely strigillose (hairs seldom longer than 0.2 mm.). 1. *S. leptophylla*
 Leaf blades hispidulous-pilose beneath, especially on costa and nerves, with spreading hairs 0.3-0.7 mm. long, these persistent especially on costa; inflorescence branches, outer surface of bracts, and calyces copiously sericeous with hairs 0.2-0.4 mm. long. 2. *S. turrilliana*

1. ***Symplocos leptophylla*** (Brand) Turrill in J. Linn. Soc. Bot. 43: 30. 1915; Gillespie in Bishop Mus. Bull. 74: 15. fig. 18. 1930; A. C. Sm. in J. Arnold Arb. 36: 287. 1955; J. W. Parham, Pl. Fiji Isl. 83. 1964, ed. 2. 125. 1972; A. C. Sm. in Allertonia 1: 375. 1978. FIGURES 83 (lower), 188A-C, 189A & B.

Symplocos spicata sensu Seem. in Bonplandia 9: 257. 1861, Viti, 439. 1862; A. Gray in Proc. Amer. Acad. Arts 5: 326. 1862; Seem. Fl. Vit. 153. 1866; Drake, Ill. Fl. Ins. Mar. Pac. 230. 1892; Gibbs in J. Linn. Soc. Bot. 39: 156. 1909; non Roxb.

Symplocos stawellii var. *leptophylla* Brand in Pflanzentr. 8 (IV. 242): 37. 1901.

Symplocos leptophylla f. *compacta* Turrill in J. Linn. Soc. Bot. 43: 31. 1915.

Symplocos cochinchinensis subsp. *leptophylla* Nootboom in Leiden Bot. Ser. I: 162, p. p. 1975, in Fl. Males. I. 8: 250, p. p. 1977.



Symplocos cochinchinensis subsp. *leptophylla* var. *leptophylla*; Nootboom in Leiden Bot. Ser. 1: 165, p. 1975, in Fl. Males. 1. 8: 251, p. p. fig. 7, 16-4g. 1977.

As it occurs in Fiji, this often abundant species is a tree (rarely noted as a shrub) 2-15 m. high, occurring from near sea level to 1,323 m. elevation in dense forest or on its edges, secondary forest, patches of forest in grassland, frequently in the mossy forest and thickets of crests and ridges, and occasionally in coastal thickets. Its fragrant flowers have the corolla white or yellowish and sometimes red-tinged, the filaments white, and the anthers yellow. The fruits at maturity turn from dull red or purple to blackish. Flowers and fruits are profusely borne throughout the year.

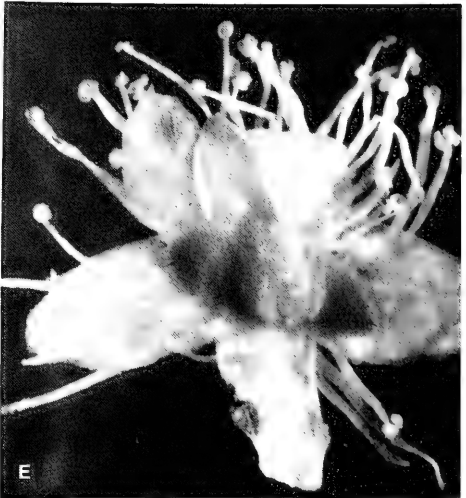
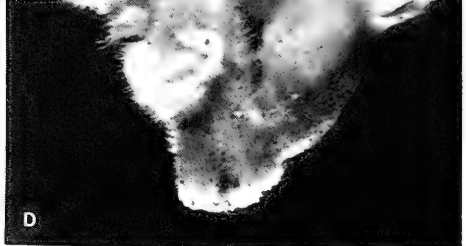
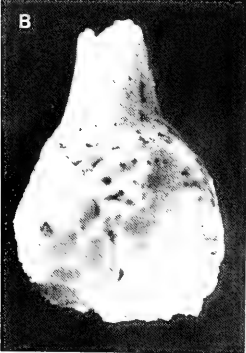
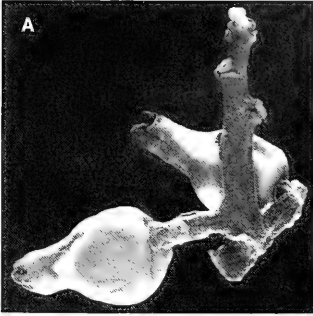
LECTOTYPIFICATION AND NOMENCLATURE: Since Brand, in describing *Symplocos stawellii* var. *leptophylla* and basing it on *Seemann 294*, did not indicate a precise locality or a place of deposit, I suggested in my 1978 discussion that Turrill, in proposing the binomial, had adequately lectotyped the species by citing the Kandavu specimen of *Seemann 294*. It is evident that Seemann's specimens numbered 294 came from various localities by the fact that in 1866 (as *S. spicata*) he mentioned only: "On the coast of Viti Levu." In fact, the two specimens of no. 294 remaining at K are from Port Kinnaird (Ovalau) and Kandavu. I consider the typification to be best indicated as: *Seemann 294* (K LECTOTYPE), obtained on Kandavu in August or September, 1860; the K specimen from Ovalau is not an isolectotype. Neither are specimens of *Seemann 294* deposited at BM, G, MEL, P, and W necessarily isolectotypes. *Symplocos leptophylla* f. *compacta* is typified by *in Thurn 225* (K HOLOTYPE; ISOTYPE at BM), collected March 30, 1906, at Nandarivatu, Mba Province, Viti Levu, a collection that does not materially differ from many other Fijian specimens of the species.

DISTRIBUTION: Nootboom (in 1975 and 1977) indicates the range of *Symplocos cochinchinensis* subsp. *leptophylla* var. *leptophylla* to extend from the Moluccas to Fiji. This is probably a reasonable distribution, although some of the New Guinean material so identified by him seems fairly diverse in drupe configuration. One can safely indicate the distribution as extending from Fiji westward to the Santa Cruz Islands, but if a narrow viewpoint is taken the material from New Guinea and the Moluccas may require reexamination. One of the most common plants of the Fijian high islands, *S. leptophylla* is represented there by about 120 available collections.

LOCAL NAMES AND USE: There is no lack of local names for the species, perhaps most frequently indicated as *ravulevu* or *ndravulevu*. Other recorded names are *molau ni veikau*, *memeou*, *vithi*, *vulawai*, *wamuwamu* (Mba); *aisusu*, *vulawa*, *wai ni mari* (Namosi); *naisusu* (Naitasiri); *roro* (Mathuata); and *ndrondro* (Thakaundrove). The species produces a good firewood.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 446*; summit of Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4209*; Nandarivatu, *Gibbs 668*; Mt. Nanggaranambuluta, east of Nandarivatu, *Stauffer & Koroiveibau 5829*; summit and slopes of Mt. Tomanivi, *Gillespie 4113*, *Smith 5278*. MBA or NAITASIRI: Between Navai and Nasonggo, *Gibbs 541*. NANDRONGA & NAVOSA: Nausori

FIGURE 188. A-C, *Symplocos leptophylla*; A, distal portion of branchlet, with inflorescences, $\times 1/3$; B, lower surface of leaf blade, with costa and bases of secondaries, $\times 10$; C, distal portion of inflorescence with 2 flowers, showing sparsely pilose bracts and essentially glabrous calyces, $\times 10$. D, *Symplocos turrilliana*, lower surface of leaf blade, with costa and bases of secondaries, $\times 10$. A from *DA 3009*, B from *Smith 5278*, C from *Smith 8803*, D from *Smith 4206*.



Highlands, *DA 13501*; Uluvatu, vicinity of Mbalo, near Vatukarasa, *Tabualewa 15560*. SERUA: Nathengathenga Creek, upper Navua River, *DA 14274*; vicinity of Namboutini, *DF 967*; north of Ngaloa, valley of Tawavulu Creek, *Webster & Hildreth 14350*; Taunovo River, *Vaughan 3446*. NAMOSI: Summit of Mt. Naitarandamu, *Gillespie 5115*; valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8803*; vicinity of Namosi Village, *Gillespie 2846*; Nambukavesi Creek, *Bola 80*. RA: Ridge from Mt. Namama to Mt. Tomanivi, *Smith 5716*. NAITASIRI: West of Matawailevu, Wainimala River, *St. John 18296*; between Navutu and Nanduna, *DA 3009*; Tholo-i-suva, *DA L.13455 (DF 597)*. TAILEVU: Waisere Creek, *DA 2686*; Lawaki, Namena, *DA 1677*. REWA: Vicinity of Suva, *Yeoward 99*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 127*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7694*; Levuka Creek, *Milne 266*. NGAU: "Mountains," *Milne 226*. VANUA LEVU: MATHUATA: Mt. Ndelanathau, *DA 16064*; Seangganga Plateau, *DA 13475*; summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6476*. THAKAUNDRIVE: Mt. Vatunivumonde, Savusavu Bay region, *Degener & Ordonez 14023*; Navonu Creek, Natewa Peninsula, *DA 15062*. FIJI without further locality, *U. S. Expl. Exped.*

2. *Symplocos turrilliana* A. C. Sm. in *J. Arnold Arb.* 33: 111. 1952, in op. cit. 36: 287. 1955; *J. W. Parham*, *Pl. Fiji Isl.* 83. 1964, ed. 2. 125. 1972; A. C. Sm. in *Allertonia* 1: 376. 1978. FIGURES 188D, 189C-E.

A tree 5-10 m. high occurring in dense forest or in the dense thickets of ridges at elevations of 1,100-1,195 m. Its corolla and filaments are white, its anthers yellow, and its immature fruits green. Flowers have been obtained in May and June, fruits only in May.

TIPIFICATION: The type is *Smith 4845* (A HOLOTYPE; many ISOTYPES), collected June 23, 1947, near the summit of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from two high areas on Viti Levu.

LOCAL NAME: *Kai namo* (from type collection).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Summit of Mt. Koroyanitu, high point of Mt. Evans Range, *Smith 4206, 4222*.

The taxon is closely allied to the variable *Symplocos leptophylla*, but because of its pronounced indument I believe that its recognition at some level is justified, even though it occurs where *S. leptophylla* is also known.

FAMILY 114. EBENACEAE

EBENACEAE Gürke in Engl. & Prantl, *Nat. Pflanzenfam.* IV. 1: 153. 1891.

Usually dioecious (less often monoecious, rarely hermaphrodite) trees or shrubs, often with hard and blackish or reddish heartwood, lacking stipules; leaves alternate (distichous) (rarely opposite or verticillate), simple, the blades often coriaceous, usually entire, penninerved; inflorescences axillary, short-cymose or fasciculate or composed of solitary flowers; flowers actinomorphic, usually unisexual (as in our genus), 3-7-merous; calyx gamosepalous, persistent and often accrescent in fruit, the lobes valvate or imbricate in bud; corolla gamopetalous, hypogynous, often thick-carnose or leathery, often urceolate, caducous, the lobes spreading, usually contorted in bud; ♂ flowers with stamens hypogynous or attached to base of corolla and usually 2-4 times as many as corolla lobes, sometimes as many as corolla lobes and alternate

FIGURE 189. A & B, *Symplocos leptophylla*; A, infructescence with 2 fruits, × 2; B, pyrene, × 6. C-E, *Symplocos turrilliana*; C, fascicle of stamens alternate with corolla lobes, × 10; D, inflorescence with bracts and calyces, the corollas fallen, × 10; E, proximal surface of flower, with sericeous calyx, spreading corolla lobes, and stamens, × 10. A & B from *Smith 6476*, C-E from *Smith 4845*.

with them, the filaments free or united in pairs, the anthers basifixed or dorsifixed near base, 2-locular, introrse, dehiscent lengthwise, a vestigial gynoeceum usually present; ♀ flowers often solitary and with staminodes, the ovary superior, 2-16-locular, the ovules (1 or) 2 in each locule, pendulous from axile placentas, anatropous, bitegmic, the styles 2-8, free or proximally united; fruit a berry, more or less succulent or sometimes leathery, the seeds fewer than ovules, with a thin testa, the endosperm copious, hard, the embryo straight or slightly curved.

DISTRIBUTION: Pantropical and subtropical, infrequently extending into temperate areas, abundant in Indo-Malesia, with 3 or 4 genera and 400-500 species. The family includes many species with valuable woods, such as ebony, and a few with edible fruits. The only large genus, *Diospyros*, occurs indigenously in Fiji.

USEFUL TREATMENT OF FAMILY: Bakhuizen van den Brink, R. C. *Revisio Ebenacearum Malayensium*. Bull. Jard. Bot. Buitenzorg III. 15: 1-515. 1936-1941; i-xx, pl. 1-92. 1955.

1. DIOSPYROS L. Sp. Pl. 1057. 1753; A. C. Sm. in J. Arnold Arb. 52: 369. 1971.

Maba J. R. & G. Forst. Char. Gen. Pl. 61. 1775, ed. 2. 121. 1776; Seem. Fl. Vit. 151. 1866.

Characters of the family, the flowers unisexual, the corolla lobes contorted in bud and sometimes appearing agglutinated, the calyx often notably accrescent in fruit.

TYPE SPECIES: The lectotype species of *Diospyros* is *D. lotus* L. (vide Britton & Brown, Ill. Fl. N. U. S. ed. 2. 2: 720. 1913), one of Linnaeus's two original species. The type species of *Maba* is *M. elliptica* J. R. & G. Forst., the only original species. The two concepts are now combined by practically all students of the family.

DISTRIBUTION: As of the family, and including all but 20-25 of its species. Seven species are indigenous in Fiji.

USEFUL TREATMENT OF GENUS: Smith, A. C. Studies of Pacific Island plants, XXIII. The genus *Diospyros* in Fiji, Samoa, and Tonga. J. Arnold Arb. 52: 369-403. 1971.

The heterogeneous nature of Bakhuizen's concept of *Diospyros ferrea* (Willd.) Bakh. has been puzzling to botanists concerned with Malesian and Pacific Ebenaceae. In 1971 (cited above) I retained the name *D. ferrea* for Fijian plants of this general relationship, referring them to three varieties. Kostermans (in *Blumea* 23: 449. 1977, in *Ceylon J. Sci., Biol. Sci.* 12: 98-100. 1977) considers *D. ferrea* in a reasonable sense to occur in India (the holotype being *Koenig* (B) from the Malabar coast) and Ceylon; he does not indicate a firm eastern limit for the species but implies that it probably does not occur in Malesia and certainly not in the Pacific. I believe that Kostermans's interpretation of *D. ferrea* will clarify an understanding of *Diospyros* in the Pacific, and here I accept his combination *D. gillespiei* for the taxa I indicated in 1971 as *D. ferrea* vars. *gillespiei* and *nandarivatensis*. However, my third variety, var. *phlebodes*, seems sufficiently distinct to be raised to specific rank. No taxa of this immediate relationship are known from Tonga or Samoa. With this alteration in a concept of *D. ferrea*, the following is abstracted from my 1971 treatment.

KEY TO SPECIES

Calyx lobes and corolla lobes usually 3 (rarely 4); ovary 3- or 6-locular (rarely 4-locular), the ovules 6 (rarely 8) per ovary (subgen. *Maba*).

Ovary 3-locular (rarely 4-locular), the locules each with 2 ovules; ovary and fruit pilose but the latter sometimes eventually glabrate; fruiting calyx not conspicuously accrescent; stamens (in our species) 3-10 (sect. *Maba*).

Foliage, flowering, and fruiting parts comparatively small; leaf blades usually 2.5-16 × 1.5-9 cm.; ♂ and ♀ inflorescences with inconspicuous bracts not more than 4 × 3 mm., the calyx at anthesis 2-4 mm. long and broad, the corolla at anthesis 3-6 mm. long, the stamens about 3 mm. long; fruiting calyx 4-9 mm. in diameter; fruits 8-28 × 6-16 mm., the seeds 10-17 mm. long.

- Flowering inflorescences (both ♂ and ♀) cymose, branched from base or often pedunculate, several-many-flowered (flowers usually 3–15 or more, very rarely 2); fruiting inflorescences branched, or if simple composed of a peduncle-branchlet axis with usually obvious lateral scars, the axis at least 4 (rarely only 2) mm. long, with 1–several fruits; stamens in ♂ flowers 3 or occasionally 6. 1. *D. elliptica*
- Flowering inflorescences usually simple, the ♀ composed of a pulvinate or cylindrical peduncle 0.2–1 (–3) mm. long and 1-flowered (or flowers very rarely more than 1), the ♂ similar or rarely 2- or 3-branched, the branchlets then 0.5–1 mm. long and each 1-flowered; fruiting inflorescences composed of a stout pulvinate-cylindrical axis 0.5–3 mm. long without perceptible lateral scars and with a single terminal fruit; stamens in ♂ flowers 6–10.
- Peduncle (or peduncle-branchlet axis) of fruiting inflorescences 0.5–3 mm. long, the fruiting calyx soon glabrate on both surfaces, the lobes not reflexed, the fruit closely strigose and very early glabrate; petioles 1–5 mm. long; leaf blades with inconspicuous and often immersed venation, the lowermost secondary nerves not conspicuously ascending. 2. *D. gillespiei*
- Peduncle of fruiting inflorescences pulvinate-cylindrical, less than 1 mm. long, the fruiting calyx copiously strigose without and persistently densely sericeous within, the lobes spreading or reflexed, the fruit copiously and subpersistently sericeous with hairs 0.3–1 mm. long; petioles inconspicuous, essentially none or to 2 mm. long; leaf blades with conspicuous and often prominulous venation, the lowermost 2 or 3 secondary nerves sharply ascending from near base of blade or from petiole. 3. *D. phlebodes*
- Foliage, flowering, and fruiting parts comparatively robust; leaf blades usually 7–21 × 4–11 cm.; ♂ and ♀ inflorescences with an irregularly subglobose or short-cylindrical peduncle 1–3 mm. long, the bracts conspicuous, 6–8 × 4–6 mm., the calyx at anthesis 5–9 mm. long and broad, the corolla at anthesis 14–15 mm. long, the stamens 6–9, at anthesis 6–7 mm. long; fruiting calyx 9–15 mm. in diameter; fruits solitary, at maturity 25–45 (–60) × 15–30 mm., copiously pilose with short hairs and also hispidulous with stiff hairs 1–2 mm. long, the seeds 15–25 mm. long. 4. *D. major*
- Ovary 6-locular, the locules each with 1 ovule; ovary and fruit glabrous; fruiting calyx conspicuously accrescent (sect. *Rhipidostigma*); our species with leaf blades 5–20 × 1.5–7 cm., dichotomous-cymose inflorescences (♂ 10–25-flowered, ♀ sometimes only 3-flowered), calyces 1.5–3 mm. (accrescent to 10–17 mm.) in diameter, corollas 4–6 mm. long, stamens 8–26 in number, and fruits 7–20 mm. in diameter. 5. *D. fasciculosa*
- Calyx lobes and corolla lobes usually 4 or 5 (rarely 3); ovary 8- or 10-locular, the locules each with 1 ovule; ovary (in our species) sericeous but the fruit soon glabrate; fruiting calyx conspicuously accrescent (subgen. *Diospyros*); our species with petioles 3–15 cm. long, leaf blades 5–20 × 2.5–12.5 cm., cymose or congested-cymose inflorescences (♂ 3–13-flowered, ♀ 1–3-flowered), calyces at anthesis 3–5 mm. long and broad, corollas 8–15 mm. long, stamens 8–20 (–24) in number, fruits ellipsoid or globose to obovate, 20–40 × 20–30 mm., and seeds 10–15 mm. long.
- Inflorescences pedunculate, the fruits borne on a simple peduncle or a combined peduncle-branchlet axis 4–15 mm. long, this comparatively slender, 1.5–2.5 mm. in diameter, abruptly swollen at apex to 3–5 mm.; fruiting calyx composed of a conspicuously flattened, coriaceous, sharp-margined disk 12–17 mm. in diameter, the limb sharply reflexed at an abrupt right angle, the lobes coriaceous but striate with coarse veins, ovate or broadly ovate, slightly broader than long, 5–10 × 7–12 mm., obtuse or rounded at apex. 6. *D. samoensis*
- Inflorescences congested-cymose, often glomerulate, the fruits borne on a simple peduncle (or branchlet) 2–4 mm. long, 2–5 mm. in diameter, and gradually swollen toward apex; fruiting calyx composed of a flattened disk 11–15 mm. in diameter, the limb, if reflexed, less sharply so, at less than a right angle, the lobes thick-coriaceous, not striate (venation fully immersed), deltoid to oblong-ligulate, 5–18 × 3–12 mm., subacute to obtuse at apex. 7. *D. vitiensis*

1. *Diospyros elliptica* (J. R. & G. Forst.) P. S. Green in Kew Bull. 32: 340. 1969; A. C. Sm. in J. Arnold Arb. 52: 371. 1971.

Maba elliptica J. R. & G. Forst. Char. Gen. Pl. 61. t. 61. 1775, ed. 2. 122. t. 61. 1776.

DISTRIBUTION: The species is often assigned a broad distribution from southeastern Asia and Malesia to Tonga and Samoa. Seven varieties from Fiji, Tonga, and Samoa were recognized in my 1971 treatment, five of them occurring in Fiji. I am not prepared to evaluate the many infraspecific taxa that have been attributed a range west of Fiji, but the situation parallels that discussed above for *Diospyros ferrea*. It is probable that *D. elliptica* does not extend as far west as Asia, and its occurrence in

Malesia is also open to question. For *D. ferrea* the type of the species is Indian, whereas the type of *D. elliptica* is Tongan.

KEY TO VARIETIES OCCURRING IN FIJI

- Leaf blades elliptic to oblong- or ovate-elliptic, usually about twice as long as broad, 2.5–16 × 1.5–9 cm.; fruits not larger than 24 × 16 mm.
- Young parts appressed-strigose or strigose-hispidulous with hairs 0.1–1 mm. long, the foliage and fruiting parts soon glabrate; leaf blades acute to obtuse at base and often decurrent on petiole.
- Petioles 2–6 mm. long; leaf blades 4–16 × 2–9 cm., obtuse or obtusely cuspidate or rounded at apex; fruiting calyx 5–7 mm. in diameter.
- Fruiting inflorescences pedunculate with 2–several lateral branchlets or reduced to a simple peduncle-branchlet axis, sometimes with a single maturing fruit; fruits 13–20 × 6–12 mm., the seeds 10–13 mm. long; young parts and inflorescences strigose-hirtellous with hairs 0.3–1 mm. long; leaf blades usually 4–10 × 2–4.5 cm. 1a. var. *elliptica*
- Fruiting inflorescences congested-cymose, epedunculate, usually irregularly 3–8-branched from base and with several maturing fruits; fruits 18–24 × 10–13 mm., the seeds 14–17 mm. long; young parts and (presumably) inflorescences closely appressed-strigose with hairs 0.1–0.3 mm. long; leaf blades usually 10–16 × 5–9 cm. 1b. var. *fructuosa*
- Petioles 1–2 mm. long; leaf blades usually 3–5.5 × 1.5–2.5 cm., narrowed to an obtusely acuminate or cuspidate apex; inflorescences sericeous on external surfaces with hairs 0.2–0.3 mm. long; fruiting calyx 4–5 mm. in diameter. 1c. var. *fijiensis*
- Young parts copiously tomentellous-villose or hispidulous with hairs 0.6–1 mm. long, the foliage and fruiting parts subsperisistently pilose; petioles 1–2.5 (–4) mm. long; leaf blades usually 2.5–4.7 × 1.5–2.5 cm., subcordate or rounded at base. 1d. var. *foliosa*
- Leaf blades lanceolate, about 4 times as long as broad, (6–) 8–11 × 1.8–2.5 cm., coriaceous, dull on both sides, often persistently strigose-hispidulous on lower surface of costa; fruits 13–16 × 8–10 mm. 1e. var. *opaca*

1a. *Diospyros elliptica* var. *elliptica*; A. C. Sm. in J. Arnold Arb. 52: 373. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 225. 1972.

Maba elliptica J. R. & G. Forst. Char. Gen. Pl. 61. t. 61. 1775, ed. 2. 122. t. 61. 1776; A. Gray in Proc. Amer. Acad. Arts 5: 326, p. p. 1862; Hiern in Trans. Cambridge Philos. Soc. 12: 122. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 230, p. p. 1892; Hemsl. in J. Linn. Soc. Bot. 30: 184. 1895; Burkill in op. cit. 35: 45. 1901; Christophersen in Bishop Mus. Bull. 128: 172. 1935; non "*Diospyros elliptica* nov. var." Hort. ex E. André, 1887.

Ferreola ellipticifolia Stokes, Bot. Mat. Med. 4: 556, nom. illeg. 1812.

Ebenus elliptica Kuntze, Rev. Gen. Pl. 2: 408. 1891.

Maba buxifolia sensu Hemsl. in J. Linn. Soc. Bot. 30: 184. 1895; non Pers.

Diospyros ellipticifolia Bakh. in Gard. Bull. Straits Settlement. 7: 162. 1933, in Bull. Jard. Bot. Buitenzorg III. 15: 65, sensu typi. 1938; Yuncker in Bishop Mus. Bull. 178: 94. 1943, in op. cit. 184: 57. 1945; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 80. 1970.

Diospyros ellipticifolia var. *elliptica* Fosberg in Bull. Torrey Bot. Club. 65: 611. 1939; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 431, 437. 1941; Yuncker in Bishop Mus. Bull. 220: 212. 1959.

Diospyros major var. *elliptica* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 431. 1941.

Diospyros ferrea sensu Yuncker in Bishop Mus. Bull. 220: 213. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 81. 1970; non Bakh.

Diospyros elliptica sensu P. S. Green in Kew Bull. 32: 340. 1969; St. John & A. C. Sm. in Pacific Sci. 25: 337. 1971.

A tree 2.5–10 m. high, with a trunk to 25 cm. in diameter, occurring from near sea level to an elevation of 300 m. in forest, thickets, or grassland, often (or perhaps usually) on limestone. The corolla is white to greenish yellow, and the fruit turns from yellow to red. Flowers are usually observed from December to June and fruits somewhat later. (These notes refer to other archipelagoes than Fiji.)

TYPIFICATION: The species and typical variety are based on a collection made by J. R. & G. Forster (BM LECTOTYPE) on either Tongatapu or Nomuka, Tonga, during Cook's second voyage.

DISTRIBUTION: Variety *elliptica* is the only variety of *Diospyros elliptica* known to occur in Tonga, Niue, and the Wallis Islands; in Tonga it is abundant. It is also

frequent in Samoa, but in Fiji it is represented only by the Lauan collections cited below. Reports of its occurrence west of the Lau Group are almost certainly incorrect.

LOCAL NAMES AND USES: Although no names are recorded from Fiji, this variety is well known in Tonga as *kanume* and in Samoa as *anume*. The timber is considered useful, the fruit edible, and the bark medicinal, although Fijian collections do not so indicate.

AVAILABLE COLLECTIONS: VANUA MBALAVU: On limestone ridges at north end of island, *Bryan 579A*. LAKEMBA: Tumbou, *DA L.22346 (DF 119)* (coll. *K. Vaiseva*, Sept. 23, 1974).

1b. *Diospyros elliptica* var. *fructuosa* A. C. Sm. in J. Arnold Arb. 52: 375. 1971.

FIGURE 190A.

A tree about 10 m. high, known from dense forest at elevations of 30–150 m. Only ♀ flowers and fruits accompany the specimens; the fruit turns from yellow to red and has been obtained in June and November.

TIPIFICATION: The type is *Smith 9185* (US 2192180 HOLOTYPE; many ISOTYPES), collected Nov. 19, 1953, in hills north of Ngaloa, in drainage of Waininggere Creek, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from a limited area near the southern coast of Viti Levu.

AVAILABLE COLLECTION: VITI LEVU: REWA: Between Veisari River and Na Vasi. *Horne 1050a*.

1c. *Diospyros elliptica* var. *fijiensis* (Bakh.) A. C. Sm. in J. Arnold Arb. 52: 376. 1971.

Diospyros ellipticifolia var. *fijiensis* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 431, 437. 1941.

Diospyros ferrea var. *nandarivatisensis* sensu P. S. Green in Kew Bull. 23: 342. 1969; non sensu typi.

An often compact tree 3–10 m. high, occurring at elevations of 100–900 m. in dense or dry forest or in the forest of ridges. The flower buds are pale pink and were observed in November; fruits have been obtained between April and July.

LECTOTYPIFICATION: As Bakuhuizen originally cited three Vanua Levu collections without indicating a type, in 1971 I selected *Smith 1564* (BO LECTOTYPE; many ISOLECTOTYPES), collected April 20, 1934, in the southern portion of the Seatovo Range, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and thus far known from Ovalau and Vanua Levu.

LOCAL NAMES: On Vanua Levu I noted the names *sisiruwai* and *lato*.

AVAILABLE COLLECTIONS: OVALAU: Summit and adjacent slopes of Mt. Korotolutolu, west of Thawathi, *Smith 8033*; slopes above Levuka, *Gillespie 4508*. VANUA LEVU: MATHUATA-THAKAUNDROVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 544*. THAKAUNDROVE: Mt. Ulingala, Natewa Peninsula, *Smith 1982*.

1d. *Diospyros elliptica* var. *foliosa* (Rich ex A. Gray) A. C. Sm. in J. Arnold Arb. 52: 377. 1971.

FIGURE 191A.

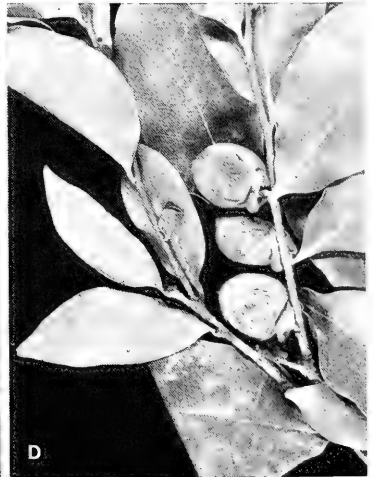
Maba foliosa Rich ex A. Gray in Proc. Amer. Acad. Arts 5: 326. 1862; Seem. Viti, 439. 1862, Fl. Vit. 152. 1866; Hiern in Trans. Cambridge Philos. Soc. 12: 113. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 230. 1892.

Ebenus foliosa Kuntze, Rev. Gen. Pl. 2: 408. 1891.

Diospyros foliosa Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 444, 447. 1941; A. C. Sm. in J. Arnold Arb. 33: 110. 1952; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 225. 1972.

A tree 2–10 m. high, occurring at elevations of 30–1,100 m. in thin or rocky forest or in forest on ridges. Pistillate flowers have been obtained in December and fruits, which turn from yellow to red or orange, between July and November.

TIPIFICATION: The type is *U. S. Expl. Exped.* (US 65907 HOLOTYPE; ISOTYPE at GH), collected in 1840 from "Muthuata and Ovalau." It is likely that the specimens came



from Mathuata Province, Vanua Levu, since no other collections support the Ovalau record.

DISTRIBUTION: Endemic to Fiji and known with certainty only from Viti Levu and northern Vanua Levu.

LOCAL NAMES: *Nganga ni sau* (Mba), *ulalo* (Mathuata).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Mt. Nanggaranambuluta, east of Nandarivatu, *Gillespie* 4062. NAITASIRI (?): Waimanu River basin, watershed southeast of Nasele, *DA* 15439. VANUA LEVU: MBUA: Without further locality, *H. B. R. Parham*, Jan., 1937. MATHUATA: Vicinity of Lambasa, *Greenwood* 486; Mt. Numbuloa, east of Lambasa, *Smith* 6439, 6443, *DA* 14630. VANUA LEVU without further locality, *H. B. R. Parham* 18, 37.

Bakhuizen erroneously discussed this very distinctive taxon as New Caledonian, as noted in my 1971 treatment, p. 379.

1e. *Diospyros elliptica* var. *opaca* A. C. Sm. in *J. Arnold Arb.* 52: 381. 1971.

FIGURE 190B.

A small tree 2-3 m. high, collected in forest at comparatively low elevation (probably less than 100 m.). The fruit turns from green to yellow and dark red. Pistillate flowers and fruits were obtained in April.

TYPIFICATION: The type is *DA* 14883 (coll. *Koroivebau & Qoro*) (BISH HOLOTYPE; ISOTYPES at MASS, SUVA), collected April 22, 1966, on banks of the upper Navua River, Serua Province, Viti Levu.

DISTRIBUTION: This distinctive taxon, referable to a reasonable concept of *Diospyros elliptica*, is thus far known only from the type collection.

2. *Diospyros gillespiei* (Fosberg) Kostermans in *Blumea* 23: 459. 1977.

Diospyros ferrea var. *gillespiei* Fosberg in *Bull. Torrey Bot. Club* 65: 610. 1939.

DISTRIBUTION: Endemic to Fiji, with two varieties. As discussed above under the genus, the old concept of *Diospyros ferrea* as a taxon extending from Asia to Hawaii must be abandoned. As here constituted, *D. gillespiei* is a readily recognized taxon related to but easily distinguished from *D. elliptica*.

KEY TO VARIETIES

- Petioles 1-3 mm. long; leaf blades coriaceous, elliptic to oblong-elliptic, about twice as long as broad, obtuse at base, obtuse to rounded at apex. 2a. var. *gillespiei*
 Petioles 2-5 mm. long, conspicuously winged distally; leaf blades thin-coriaceous or chartaceous, lanceolate or oblong-lanceolate, about 3 times as long as broad, narrowed to a subacute base and long-decurrent on petiole and there conspicuously revolute, narrowed to an obtusely acuminate or cuspidate apex. 2b. var. *nandarivatensis*

FIGURE 190. A, *Diospyros elliptica* var. *fructuosa*, infructescence and seeds, the left one a lateral view of a triquetrous seed, the right one showing the flattened introrse surface of a semiellipsoid seed, $\times 2$. B, *Diospyros elliptica* var. *opaca*, distal portion of branchlet, with \varnothing inflorescences and fruits, $\times 1/2$. C & D, *Diospyros phlebodes*; C, distal portion of branchlet, with 1-flowered \varnothing inflorescences, $\times 1$; D, branchlet with foliage and mature fruits, $\times 1$. A from *Smith* 9185, B from *DA* 14883, C from *O. & I. Degener* 32224, D from *DF* 251.



FIGURE 191. A, *Diospyros elliptica* var. *foliosa*, distal portion of branchlet, with ♂ inflorescences, $\times 1$. B, *Diospyros fasciculosa*, distal portion of branchlet, with ♂ inflorescences, $\times 1/2$. A from DA 14630, B from DA 13801.

2a. *Diospyros gillespiei* var. *gillespiei*.

Maba elliptica sensu Seem. in Bonplandia 9: 257. 1861, Viti, 439, p. p. 1862; non J. R. & G. Forst.

Diospyros ferrea var. *gillespiei* Fosberg in Bull. Torrey Bot. Club 65: 610. 1939; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 435, 441. 1941; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 225. 1972; A. C. Sm. in J. Arnold Arb. 52: 385. 1971.

Diospyros ferrea var. *subimpressa* Fosberg in Bull. Torrey Bot. Club 65: 611. 1939; J. W. Parham, Pl. Fiji Isl. 160. 1964.

Diospyros ferrea var. *gillespiei* f. *impressa* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 435, nom. illeg. 1941.

Diospyros ferrea var. *gillespiei* f. *subimpressa* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 435. 1941.

Diospyros ferrea var. *glabrescens* f. *impressa* Bakh. ex P. S. Green in Kew Bull. 23: 341, nom. illeg. 1969.

Diospyros gillespiei sensu Kostermans in Blumea 23: 459. 1977.

An often slender tree 2–15 m. high, occurring at elevations of 15–960 m. in dense or open forest. The fruit turns from yellow to bright orange or red. Flowers have been noted only in November, fruits between April and November.

TYPEFICTION AND NOMENCLATURE: The type of *Diospyros ferrea* var. *gillespiei* is *Gillespie 2146* (BISH HOLOTYPE; ISOTYPES at A, BISH, US), collected Aug. 9, 1927, near Tamavua, Naitasiri Province, Viti Levu; that of *D. ferrea* var. *subimpressa* is *Gillespie 2324* (BISH HOLOTYPE), obtained Aug. 23, 1927, near the summit of Mt. Korombamba, Rewa Province, Viti Levu. As indicated in my 1971 discussion, the two varieties are scarcely distinguishable; in first combining them Bakhuizen used the epithet *gillespiei*, unfortunately proposing the epithet *impressa* for his type form.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands.

LOCAL NAMES: Recorded Fijian names are *kauloa*, *kaukau loa*, *mamba*, *mathendre*, and *mula*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mountains near Lautoka, *Greenwood 200*. SERUA: Near summit of Mt. Tikituru, *DA 14481*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8443*; summit of Mt. Nambui, Korombasambasanga Range, *DA 14549*; Nakavu, on Navua River, *Horne 823*. NAITASIRI: Nanggarathangithangi, Mendrausuthu Range, *DA 15031*; Waindrandra Creek, *DA 791*; vicinity of Tamavua, *Gillespie 2450*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7169*. REWA: Ngogoya Forest Reserve, *DF475 (Damanu 124)*; Mt. Korombamba, *Webster & Hildreth 14045, DA 17368*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 126*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7644*; Mt. Ndelaiovalau, *DA 14501*. VANUA LEVU: MATHUATA: Southern slopes of Mt. Numbuloo, east of Lambasa, *Smith 6367*. FIJI without further locality, *Seemann 295*.

2b. *Diospyros gillespiei* var. *nandarivatensis* (Gillespie) A. C. Sm., comb. nov.

Maba nandarivatensis Gillespie in Bishop Mus. Bull. 74: 13. fig. 15. 1930.

Diospyros ferrea var. *nandarivatensis* Fosberg in Bull. Torrey Bot. Club 65: 610. 1939; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 435, 441. 1941; J. W. Parham, Pl. Fiji Isl. 160. fig. 61, B (err. legend as A). 1964, ed. 2. 225. fig. 66, B (err. legend as A). 1972; A. C. Sm. in J. Arnold Arb. 52: 386. 1971.

An often slender tree 3–8 m. high, found in dense forest at elevations of 725–1,050 m. The fruit turns from yellow to red. Flowers have been observed in July and November, fruits between July and February.

TYPEFICTION: The type of *Maba nandarivatensis* is *Gillespie 3848* (BISH HOLOTYPE; ISOTYPES at BISH, UC), collected Nov. 17, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from upland northern Viti Levu. Fosberg's mention of *Diospyros ferrea* var. *nandarivatensis* (in Bull. Torrey Bot. Club 67: 417. 1940) from Yap, Caroline Islands, is incorrect.

LOCAL NAMES: Recorded names are *vaundrai ni singa*, *mbama*, and *mbama the-ndru*.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Slopes and summit of Mt. Ndelaioyö, on escarpment west of Nandarivatu, *Smith 5074*; vicinity of Nandarivatu, *Parks 20602, Gillespie 3764*; Mt. Nanggaranambuluta, east of Nandarivatu, *DA 14447*; Mt. Matomba, near Nandala, *Degener 14434*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau. Matou and Nanga, *Smith 5564*.

Although in 1971 I expressed little confidence in the infraspecific value of this taxon, it now appears to me very reasonably distinct on the basis of obvious foliage characters mentioned in my key, and it is also geographically separated from var. *gillespiei*.

3. *Diospyros phlebodes* (A. C. Sm.) A. C. Sm., comb. et stat. nov. FIGURE 190C & D.

Maba major sensu Seem. in Bonplandia 9: 257. 1861; non Forst. f.

Maba sp. Seem. in Bonplandia 9: 257. 1861.

Maba elliptica sensu Seem. in Bonplandia 10: 296. 1862, Viti, 439, p. p. 1862, Fl. Vit. 152, p. p. 1866; non J. R. & G. Forst.

Maba elliptica var. *glabrescens* Seem. Fl. Vit. 152, nom. provis. 1866; Hiern in Trans. Cambridge Philos. Soc. 12: 118, nom. nud. 1873.

Maba buxifolia sensu A. C. Sm. in Bishop Mus. Bull. 141: 121, p. p. 1936; non Pers.

Diospyros ferrea var. *glabrescens* P. S. Green in Kew Bull. 23: 341, nom. illeg. 1969.

Diospyros ferrea var. *glabrescens* f. *glabrescens* P. S. Green in Kew Bull. 23: 341, nom. illeg. 1969.

Diospyros ferrea var. *phlebodes* A. C. Sm. in J. Arnold Arb. 52: 388. 1971.

A sometimes spreading tree 4–8 m. high, occurring from near sea level to an elevation of 300 m. in dense or dry forest or in beach thickets or on open hillsides. The fruit turns from yellow to pinkish yellow or red. Flowers have been obtained between October and February, fruits between October and July.

TIPIFICATION AND NOMENCLATURE: The type of *Diospyros ferrea* var. *phlebodes* is O. & I. Degener 32224 (BISH HOLOTYPE), collected Feb. 7, 1969, on Nggalito Island, Malolo Group, Mamanuthas (west of Viti Levu). Reasons for considering *Maba elliptica* var. *glabrescens* a provisional name (and its use in combinations as illegitimate) were discussed by me in 1971 (pp. 383–384). Of the four numbers cited by Seemann, Green in 1969 indicated *Storck 898* (BM, GH, K) as the “lectotype” (i. e. source of the name); it was obtained in Fiji without further locality. Of Seemann’s own numbers cited by him, two are correctly placed here and one represents *D. gillespiei* var. *gillespiei*.

DISTRIBUTION: Endemic to Fiji and scattered throughout the archipelago, often found in coastal areas or on smaller islands.

LOCAL NAMES: *Kauloa*, *kaukau loa* (names of general generic application).

AVAILABLE COLLECTIONS: VITI LEVU: M̄BA: North of Lomolomo, *Degener & Ordonez 13634*. RA: Near Penang, *Greenwood 761*; vicinity of Rewasa, near Vaileka, *Degener 15496*. MBENGGGA: Near Lalati, *DA 13725*; Uthuinanggaratu, *DA 2087*; near Ndakuimbengga, *DA 13721*. OVALAU: Waililevu, *DA 17020*. KORO: *Tothill 577b*. VANUA LEVU: MATHUATA: Ndreketi River, *DF 251 (Bola 99)*; vicinity of Nanduri, *Tothill F436*; vicinity of Lambasa, *Greenwood 565*; Mathuata without further locality, *Seemann 297*. THAKAUNDROVE: Maravu, near Salt Lake, *Degener & Ordonez 14196*. TAVEUNI: Vicinity of Somosomo, *Seemann 296*. MATUKU: On rocky shore, *Tothill 577a*; on summit ridge, *Bryan 267*. KANATHEA: *Graeffe 1364*. FIJI without further locality, *U. S. Expl. Exped. (us 653978)*, *Horne 390*.

Unhindered by an outmoded concept of an unwieldy *Diospyros ferrea*, one realizes that *D. phlebodes* is well characterized at the specific level, being distinct from *D. gillespiei* in obvious foliage features as well as in having its calyx in fruit copiously pilose and with strongly reflexed lobes.

4. *Diospyros major* (Forst. f.) Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 429. 1941; A.

C. Sm. in J. Arnold Arb. 52: 390. 1971; St. John & A. C. Sm. in Pacific Sci. 25: 337. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 224. 1972. FIGURE 192.

Maba major Forst. f. Pl. Esc. Ins. Oc. Austr. 54, as *M. maior*. 1786, Fl. Ins. Austr. Prodr. 92, as *M. maior*. 1786; A. DC. in DC. Prodr. 8: 242. 1844; Hiern in Trans. Cambridge Philos. Soc. 12: 125. 1873.

Maba andersonii Seem. Fl. Vit. 152, nom. nud. 1866.

Maba andersoni Solander ex Hiern in Trans. Cambridge Philos. Soc. 12: 124. 1873.

Maba lateriflora Hiern ex Baker in J. Linn. Soc. Bot. 20: 366. 1883; Burkill in op. cit. 35: 45. 1901.

Ebenus andersoni Kuntze, Rev. Gen. Pl. 2: 408. 1891.

Diospyros lateriflora Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 8. 1936; Fosberg in Bull. Torrey Bot. Club 65: 612. 1939, in op. cit. 67: 417. 1940; Yuncker in Bishop Mus. Bull. 220: 213. 1959; J. W. Parham, Pl. Fiji Isl. 160. 1964; Kostermans in Blumea 23: 460. 1977.

Maba globosa sensu A. C. Sm. in Bishop Mus. Bull. 141: 121, p. p. fig. 63. 1936; non sensu typi.

Diospyros ellipticifolia var. *major* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 431. 1941.

Diospyros major var. *andersoni* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 431. 1941.

Diospyros ferrea var. *lateriflora* Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 435, 442. 1941.

Diospyros andersonii P. S. Green in Kew Bull. 23: 339. 1969.

As it occurs in Fiji, *Diospyros major* is an often slender tree 3–15 m. high, occurring from near sea level to an elevation of 1,130 m. in dense, dry, or open forest, sometimes

being cultivated in villages. Its flower buds are white and purple-tinged; its mature corollas are white or cream-colored and sometimes purple-tinged; and its fruit, sometimes as large as 60×30 mm., is fragrant, turning from yellow to brownish. In Fiji flowers have been noted between December and February, but fruits are apparent throughout the year.

TYPIFICATION AND NOMENCLATURE: Although there appears to be no extant type of *Maba major*, Forster's original description may be taken as the type (ICBN, Art. 9.3); that description was based entirely on fruits observed on several Tongan islands and previously discussed by Cook (Voyage to the Pacific Ocean, 393. 1784). The description unmistakably eliminates from consideration the only other two taxa of *Diospyros* known from Tonga (a full discussion is given in my 1971 treatment, pp. 391-394). The holotype of *Maba andersoni* was collected by or for Cook (BM) in Tonga during his third voyage. For *Maba lateriflora*, Baker cited three Horne collections from Fiji: 201 (Ovalau), s. n. (Rambi), and 1013 (Viti Levu, presumably from Nandronga & Navosa Province); in 1971 (pp. 391, 392) I selected *Horne 1013* (κ LECTOTYPE; ISOLECTOTYPE at GH). In describing *Maba globosa* in 1936 I unfortunately illustrated (fig. 63) *Smith*

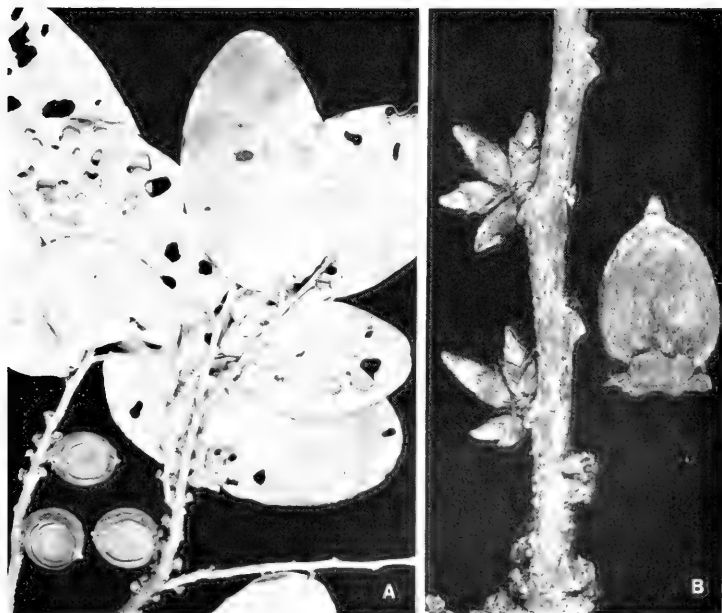


FIGURE 192. *Diospyros major*; A, distal portion of branchlet, with mature infructescences, $\times 1/2$; B, ♀ inflorescences and young fruit, $\times 2$. A from *Smith 7893*, B from *Smith 1045*.

1242, from Kambara, a specimen without nomenclatural significance; the type of *M. globosa* is *Smith 1241*, now referred to *Diospyros vitiensis* var. *longispala*. The three basic epithets involved in an understanding of *D. major* are indubitably synonymous; Bakhuizen's several alternative names are all valid (ICBN, Art. 34.4) because they were published prior to 1 Jan. 1953.

DISTRIBUTION: Indigenous in Fiji, Tonga, and the Horne and Wallis Islands, and sparsely cultivated in Samoa. In Fiji the species is known from several islands, more than 40 collections being at hand.

LOCAL NAMES AND USES: Recorded Fijian names are *kauloa*, *kaukau loa*, *mamba*, *mbama*, *mbamba*, and *mbuka ni singa*. The hard timber is considered valuable and is utilized for house-building. The fruits are used to perfume oil, and the seeds are considered edible.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Vicinity of Nangua, *St. John 18167*. VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1278*; Naloto Range, *DA 14781*; vicinity of Tumbenasolo, valley of Namosi Creek, *Smith 4619*; near summit of Mt. Nanggaranambuluta, *Gillespie 4294*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8724*; vicinity of Nanggarawai, *Gillespie 3203*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15388*. TAILEVU: Waikombulu Creek, *Berry 295* (coll. *Damanu*); Nakalawatha, *DA 2677*. REWA: Delta of Rewa River, *Tothill 373*. KANDAVU: Mt. Mbuke Levu, *Smith 243*; Nambale, Mt. Mbuke Levu, *DA 14919*. OVALAU: Hills above Levuka, *Gillespie 4416*. KORO: Main ridge, *Smith 1045*. NGAU: Shore of Herald Bay, cultivated in Sawaieke, *Smith 7893*. VANUA LEVU: MBUA: Koromba Forest, *DA 15143*. MATHUATA: Mt. Ndelaikoro, *DA 13422*; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6358*. THAKAUNDROVE: Maravu, near Salt Lake, *Degener & Ordonez 14208*. RAMBI: In mountains, *Horne 473*. TAVEUNI: Vicinity of Wairiki, *Gillespie 4751*; slopes of Mt. Manuka, east of Wairiki, *Smith 8170*. KAMBARA: On limestone formation, *Smith 1242*. ONGEA NDRIKI: Interior forested flatland, *Bryan 405*.

5. *Diospyros fasciculosa* (F. v. Muell.) F. v. Muell. Austral. Veg. in Intercolon. Exh. Ess. 1866-67: 35. 1867; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 78. 1938; P. S. Green in Kew Bull. 23: 342. 1969; A. C. Sm. in J. Arnold Arb. 52: 395. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 225. 1972. FIGURE 191B.

Maba fasciculosa F. v. Muell. Fragm. Phyt. Austral. 5: 163. 1866; Benth. Fl. Austral. 4: 290. 1868; Hiern in Trans. Cambridge Philos. Soc. 12: 135. 1873.

Ebenus fasciculosa Kuntze, Rev. Gen. Pl. 2: 408. 1891.

As represented in Fiji, *Diospyros fasciculosa* is a rare tree 12-13 m. high, occurring on the edge of forest near sea level. It is noted as having a white corolla, the only available collection being in flower in January.

TYPIFICATION: In the original publication Mueller listed four Queensland collections: C. Moore, Mueller himself, W. Hill, and Thozet. A lectotypification has not been noted.

DISTRIBUTION: Java, Queensland, and New Caledonia (according to Bakhuizen in 1938); Green (1969) first pointed out its occurrence in Fiji, where it is represented by a single collection.

AVAILABLE COLLECTION: VATULELE: Nawai, *DA 13801*.

The recent collection of a species of sect. *Rhipidostigma* in Fiji was not to be anticipated, but there seems no doubt of the identity of the material, which is entirely unlike any other species of *Diospyros* known in our area. It is possible that the Vatulele plant was introduced, but this seems unlikely; more probably it represents the chance occurrence of a waif from New Caledonia.

6. *Diospyros samoensis* A. Gray in Proc. Amer. Acad. Arts 5: 326. 1862; Hiern in Trans. Cambridge Philos. Soc. 12: 245. 1873; Drake, Ill. Fl. Ins. Mar. Pac. 230.

1892; Burkill in J. Linn. Soc. Bot. 35: 45. 1901; Christophersen in Bishop Mus. Bull. 128: 174. 1935; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 224. 1938, 407. 1941; Fosberg in Bull. Torrey Bot. Club. 67: 417. 1940; Yuncker in Bishop Mus. Bull. 178: 94. 1943, in op. cit. 184: 57. 1945, in op. cit. 220: 214. 1959; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 81. 1970; A. C. Sm. in J. Arnold Arb. 52: 398. 1971; St. John & A. C. Sm. in Pacific Sci. 25: 337. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 225. 1972. FIGURE 193.

As it occurs in Fiji, *Diospyros samoensis* is a tree 3–10 m. high, with a trunk 8–20 cm. in diameter, found from near sea level to an elevation of about 100 m. in forest, usually on limestone and often near the sea. The corolla is white, the fruit turning from yellow to pink and dark brown, and the seeds are dark brown. Flowers have been obtained in February and March, fruits in July and August. In the easterly parts of its range, the species may attain a height of 25 m. and occur at elevations (in Samoa) up to 600 m.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 67253 and 67254 HOLOTYPE; ISOTYPES at K, NY), collected in 1839 or 1841 on "Tutuila and Savaii," Samoa.

DISTRIBUTION: Fiji, Tonga, Niue, the Horne and Wallis Islands, and Samoa. It seems to be frequent in the eastern parts of this range, but in Fiji it reaches its western limit in the Lau Group.

LOCAL NAME AND USE: The Fijian name (more or less generic) is *kaukau loa*, and the hard, black heartwood is valued. Several local names for this well-known species in the easterly groups are listed in my 1971 treatment.

AVAILABLE COLLECTIONS: VANUA MBALAVU: Mboitathe, *D. M. Leslie*, July 6, 1977 (CHR); southern limestone section, Namalata, *Smith 1451*. FULANGA: In ridge forest, *Bryan 448*; on limestone formation, *Smith 1226*. ONGEA LEVU: Interior forest and also near sea, *Bryan 430*.

Although *Diospyros samoensis* and *D. vitiensis* have sometimes been confused, they are sharply distinct in their fruiting calyces and in the degree of openness or congestion of the inflorescences. Their ranges are discrete except for an area of overlap in the Lau Group.

7. *Diospyros vitiensis* Gillespie in Bishop Mus. Bull. 74: 14, fig. 17. 1930; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 457. 1941; A. C. Sm. in J. Arnold Arb. 52: 400. 1971.

DISTRIBUTION: Endemic to Fiji, with two varieties. The infraspecific taxa here recognized seem distinct only in their fruiting calyces, the extreme forms of which are quite marked. Only var. *longisepala* seems to extend eastward into the Lau Group.

KEY TO VARIETIES

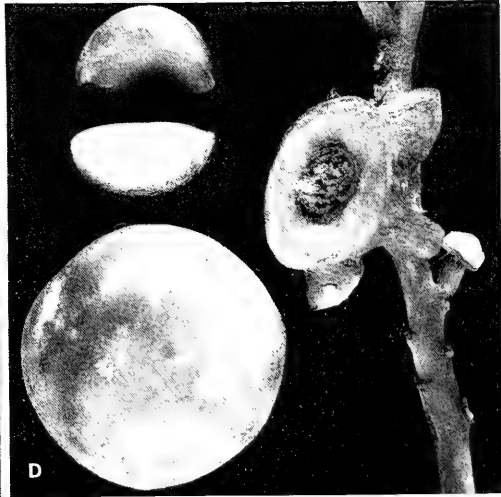
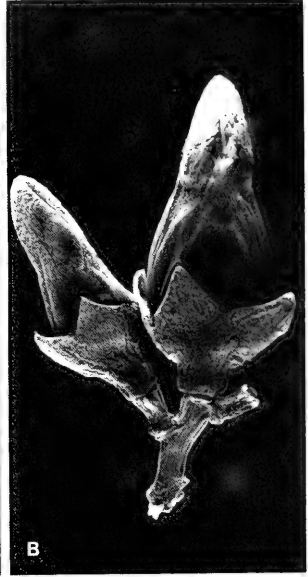
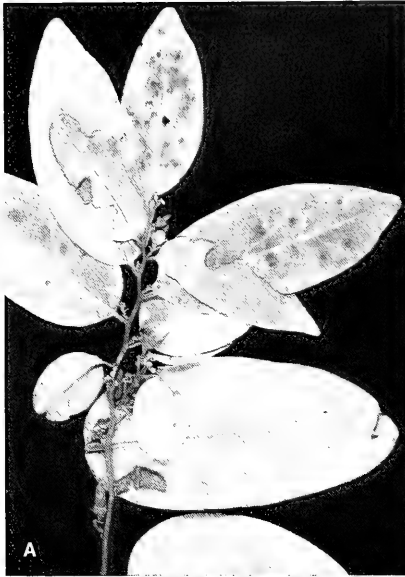
Calyx lobes associated with mature fruits reflexed, deltoid, often about as broad as long, 5–10 (–12) mm. long, 5–12 mm. broad at base. 7a. var. *vitiensis*
 Calyx lobes associated with mature fruits spreading or reflexed, oblong-ligulate or deltoid-oblong, conspicuously longer than broad, 8–18 mm. long, 3–10 mm. broad at base. 7b. var. *longisepala*

7a. *Diospyros vitiensis* var. *vitiensis*; A. C. Sm. in J. Arnold Arb. 52: 401. 1971; J. W. Parham, Pl. Fiji Isl. ed. 2. 225, fig. 66, A (err. legend as B). 1972. FIGURE 194A.

Diospyros vitiensis Gillespie in Bishop Mus. Bull. 74: 14, fig. 17. 1930.

Diospyros samoensis var. *longisepala* sensu J. W. Parham, Pl. Fiji Isl. 161, quoad fig. 61, A (err. legend as B). 1964; non sensu typi.

The typical variety of *Diospyros vitiensis* is an often slender tree 3–15 m. high, occurring at elevations of 100–1,120 m. in dense, dry, or secondary forest. The fruits turn from greenish yellow to brown or yellowish brown. Mature flowers have not been collected, but fruits are seen between May and December.



TYPIFICATION: The type is *Gillespie 3083* (BISH HOLOTYPE; ISOTYPES at BISH, K, NY, UC, US), collected Sept. 27, 1927, at a "place" called Navunitaruilau, on the ridge northwest of Mt. Naitarandamu on watershed between the headwaters of the Waini-koroiluva and Wainimala Rivers, Namosi-Naitasiri boundary, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Vanua Levu.

LOCAL NAMES: Recorded Fijian names are *mbole* (Mba), *mbaumbulu* (Nandronga & Navosa), and *kauloa* and *mbulumate* (Thakaundrove).

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Northern slopes of Mt. Namedre, east of Mt. Koromba, *Smith 4543*; vicinity of Nandarivatu, *Gillespie 4207*, *DF 262* (*Watkins 784*); vicinity of Nandala, *Degener 14835*; hills between Nggaliwana and Nandala Creeks, south of Nauwangga, *Smith 5817*; Mba without further locality, *DA 14468*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5446*. SERUA: Hills between Waininggere and Waisee Creeks, between Ngaloa and Wainiyambia, *Smith 9379*; hills east of Navua River, near Nukusere, *Smith 9086*; near Navua River at Namata rapids, *Gillespie 2950*. NAMOSI: East of Namosi Village, *Gillespie 2829*. VANUA LEVU: THAKAUNDROVE: Nakoroutari, south of Lambasa, *DA 15239*; hills between Vatukawa and Waingingio River, Ndrekeniwai Valley, *Smith 584*; hills west of Korotasere, Natewa Bay region, *Smith 1946*.

7b. *Diospyros vitiensis* var. *longisepala* (Gillespie) A. C. Sm. in J. Arnold Arb. 52: 402. 1971. FIGURE 194B.

Diospyros longisepala Gillespie in Bishop Mus. Bull. 74: 14, fig. 16. 1930.

Maba globosa A. C. Sm. in Bishop Mus. Bull. 141: 121, sensu typi, excl. fig. 63. 1936.

Diospyros globosa Fosberg in Bull. Torrey Bot. Club 65: 612. 1939; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 225. 1972.

Diospyros samoensis var. *longisepala* Fosberg in Bull. Torrey Bot. Club 67: 418. 1940; Bakh. in Bull. Jard. Bot. Buitenzorg III. 15: 407. 1941; J. W. Parham, Pl. Fiji Isl. 162, excl. fig. 61, A. 1964.

A tree 3–10 m. high, with a trunk to 30 cm. in diameter, often slender or spreading, found from near sea level to an elevation of 970 m. in dense or dry forest, sometimes on limestone. The corolla is white and the fruits are yellowish green, as far as recorded. Flowers have been obtained only in March, fruits between March and December.

TYPIFICATION AND NOMENCLATURE: The type of *Diospyros longisepala* is *Gillespie 4360* (BISH HOLOTYPE), collected Dec. 20, 1927, on the slopes of Mt. Nanggaranambuluta, east of Nandarivatu, Mba Province, Viti Levu. *Maba globosa* is typified by *Smith 1241* (BISH HOLOTYPE; many ISOTYPES), obtained March 2, 1934, on limestone formation on Kambara. Although the latter collection bears ♂ flowers, it is referred to var. *longisepala* because of the definite identity of a fruiting collection, *Smith 1272*, also from Kambara.

DISTRIBUTION: Endemic to Fiji and known from several high islands as well as the Lau Group.

LOCAL NAMES: Generally known as *kaukau loa* and more locally as *sawira* (Waya), *mbama* or *kailoa* (Mba), and *mulu* (Kambara).

AVAILABLE COLLECTIONS: YASAWAS: WAYA: North of Yalombi, along Olo Creek, *St. John 18121*. VITI LEVU: MBA: Mt. Evans Range, *Greenwood 444, 954, 1253*; Mt. Mbatilamu, *DA 14810, 14812*; Nandendeleva, *DA 14851*; Savundamatau Creek, west of Nandarivatu, *Webster & Hildreth 14255*; southern slopes of

FIGURE 193. *Diospyros samoensis*; A, distal portion of branchlet, with ♂ inflorescences, × 1/2; B, ♂ inflorescence, × 4; C, longitudinal section of ♂ corolla, showing somewhat agglutinated corolla lobes and dorsal surfaces of stamens, × 4; D, fruiting calyx, showing sharply reflexed limb, with a detached fruit (distal end) and seeds, × 2. A–C from *Smith 1451*, D from *Bryan 448*.

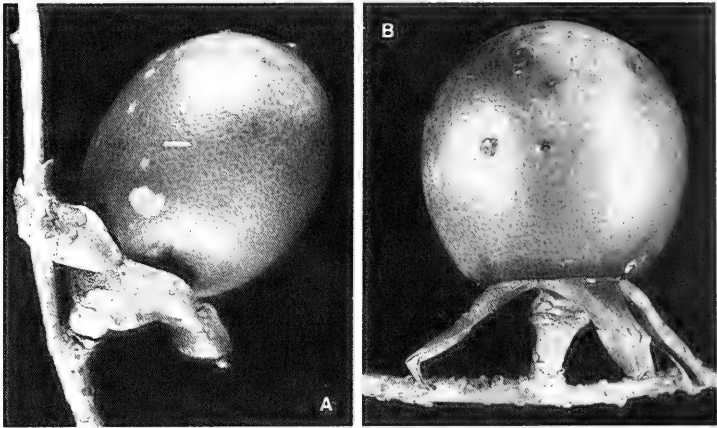


FIGURE 194. A, *Diospyros vitiensis* var. *vitiensis*, mature fruit, $\times 2$. B, *Diospyros vitiensis* var. *longispala*, mature fruit, $\times 2$. A from *Smith 5817*, B from *Smith 7631*.

Mt. Ndelaithovu, on escarpment west of Nandarivatu, *Smith 4943*; hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6200*; Nandala, south of Nandarivatu, *Degener 14741*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 12649 (Melville et al. 7022)*; "in ravine, Navosa," *Horne 904*. NAITASIRI: Nanggarathangihangi, Mendrausuthu Range, *DA 15028*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7631*; Lovoni Valley, *Horne 195, DA 14504*. NGAU: Hills east of Herald Bay, inland from Sawaike, *Smith 7775*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1608*. KAMBARA: On limestone formation, *Smith 1272*.

FAMILY 115. SAPOTACEAE

SAPOTACEAE Juss. Gen. Pl. 151, as *Sapotae*. 1789.

Trees or shrubs with white or yellowish latex, stipulate or with small stipules, often with indument composed of 2-armed hairs; leaves alternate (spirally arranged), often congested toward tips of branchlets (rarely opposite), simple, the blades often coriaceous, entire; inflorescences axillary or often cauligerous, cymose or fasciculate or composed of solitary flowers, bracteate; flowers $\text{\textcircled{f}}$ (infrequently $\text{\textcircled{m}}$ or $\text{\textcircled{f}}$), actinomorphic; calyx gamosepalous, the lobes 5 (4-12) and spirally arranged or in 2 whorls of 2-4 each; corolla gamopetalous, 4-8(-12)-lobed, the lobes often as many as calyx lobes, imbricate, rarely in 2 whorls, sometimes dorsally or laterally appendaged; stamens borne on corolla, more numerous than corolla lobes and in 2 or 3 (or more) whorls (but sometimes the outer whorl(s) staminodial or absent) or the fertile stamens as many as corolla lobes and opposite them, the anthers 2-locular, usually extrorse, dehiscing lengthwise; ovary superior, often 4- or 5-locular (1-18-locular), the ovules solitary in each locule, ascending or pendulous from axile placentas, anatropous, unitegmic, the style simple, often elongate, the stigma small; fruit usually a hard berry, 1-many-locular, the seeds 1-12, with a bony, often shining testa and a dull, ventral to basal scar, the endosperm usually scanty but sometimes copious, the embryo large.

DISTRIBUTION: Pantropical and subtropical, sometimes extending into temperate areas, with 35–75 genera (some of which are not yet clearly delimited) and 600–800 species. The family includes many important economic plants, producing edible fruits, useful timbers, gutta-percha, balata, etc. Seven genera are represented in Fiji, four of them having indigenous species.

USEFUL TREATMENTS OF FAMILY: Baehni, C. Mémoire sur les Sapotacées. I. Système de classification. *Candollea* 7: 394–508. 1938. Lam, H. J. A tentative list of wild Pacific Sapotaceae, except those from New Caledonia. *Blumea* 5: 1–46. 1942. Baehni, C. Mémoire sur les Sapotacées. III. Inventaire des genres. *Boissiera* 11: 1–262. 1965. Aubréville, A. Sapotacées. In: Aubréville, Fl. Nouv.-Caléd. et Dépend. 1: 9–168. 1967.

Botanists who have attempted to understand generic lines in the Sapotaceae will agree with the following remarks by Moore and Stearn (in *Taxon* 16: 393. 1967): “The *Sapotaceae* are a family in which it seems well-nigh impossible to define the genera satisfactorily on a world basis for, although groups which can be treated as genera are fairly easy to distinguish on a regional basis by certain combinations of characters, these characters may occur in different combinations elsewhere and the arrangement as well as the definitions of genera can be varied. . . Certainly no one system can be defended as completely natural or completely logical. . .”

Without here attempting to justify such usage, in the present treatment I maintain the genus *Planchonella* (Lam, 1942, cited above; van Royen, 1957, cited under the genus) as distinct from *Pouteria* (Baehni, 1942, cited under *Planchonella*, although in 1965, cited above, Baehni seemed at least partially to reverse his opinion); the genus *Burckella* (Lam, 1942; Lam & van Royen, 1952, cited under the genus) as distinct from *Croixia* (Baehni, 1965); and the genus *Palaquium* (Lam, 1942; van Royen, 1960, cited under the genus) as distinct from *Madhuca* (Baehni, 1965). For one of the genera cultivated in Fiji I adopt *Calocarpum* (Baehni, 1965) rather than *Pouteria* (Moore & Stearn, 1967). In view of the current uncertain delimitation of sapotaceous genera, a nonspecialist may be forgiven for adopting the usage most frequently preferred in his particular geographic area.

KEY TO GENERA

Calyx lobes spirally arranged, never in 2 distinct alternate whorls.

Lobes of calyx 5 (4–6); seeds usually more than 1, with copious or well-developed endosperm and thin cotyledons.

Staminodes present; ovary 5(4–6)-locular, the ovules attached to upper part of placentas; seeds each with a long, narrow, linear scar; indigenous species. 1. *Planchonella*

Staminodes none; ovary 5(4–12)-locular (7–12-locular in our species), the ovules attached to placentas laterally or basilaterally; seeds each with a large, basilateral (or sometimes lateral) scar; a single cultivated species. 2. *Chrysophyllum*

Lobes of calyx (6–) 9(–12); staminodes present; ovary 5- or 6-locular; seeds usually solitary (sometimes 2), each with a long and broad scar, without endosperm or this scanty, the cotyledons thick; a single cultivated species. 3. *Calocarpum*

Calyx lobes in 2 distinct alternate whorls.

Each whorl of calyx composed of 2 lobes; corolla lobes 8; stamens 9–40; staminodes none; ovary 3–8-locular, the ovules pendulous; seeds usually solitary, each with a long and broad scar, without endosperm or this scanty, the cotyledons fleshy; indigenous and cultivated species. 4. *Burckella*

Each whorl of calyx composed of 3 or 4 lobes.

Calyx lobes 6, in 2 whorls of 3 lobes each; corolla usually 6-lobed.

Staminodes lacking; stamens 12–18 (infrequently 6–36); ovary 6(infrequently 5–11)-locular, the ovules pendulous; seeds 1–3, each usually with a large scar often covering half the surface, without endosperm or this scanty, the cotyledons fleshy; indigenous species. . . 5. *Palaquium*

Staminodes present; stamens 6; ovary 6–14-locular, the ovules ventrally or basiventrally attached to placentas; seeds 1–6 (–12), each usually with a basiventral or subbasal scar, the endosperm

- copious, the cotyledons thin; corolla lobes often with 2 dorsal or lateral segments; indigenous and cultivated species. 6. *Manikara*
- Calyx lobes 8, in 2 whorls of 4 lobes each; corolla 8-lobed, each lobe with 2 dorsal segments subequal to lobe; stamens and staminodes each 8; ovary usually 8-locular, the ovules attached at base of placentas; seeds 1 or 2 (-5), each with a small, circular, basal or basilateral scar, the endosperm copious, the cotyledons thin; a single cultivated species. 7. *Mimusops*

I. *PLANCHONELLA* Pierre, Not. Bot. Sapot. 34. 1890; Lam in *Blumea* 5: 2. 1942; van Royen in op. cit. 8: 236. 1957. Nom. cons.

Trees or shrubs, the young parts closely pilose; leaves scattered or sometimes congested toward apices of branchlets, the blades with secondary nerves anastomosing to form submarginal arches; inflorescences subfasciculate or composed of solitary flowers, axillary or borne on branchlets below leaves or on short spurs (brachyblasts); flowers ♂ (but frequently ♀ in same inflorescences), 5(4-6)-merous; calyx composed of imbricate lobes often free nearly to base, often pilose; corolla usually glabrous, the lobes as long as tube or shorter or longer; stamens inserted on corolla tube, as many as corolla lobes and opposite them (anthers lacking in ♀ flowers); staminodes as many as corolla lobes and alternate with them; ovary 5(4-6)-locular, pilose at anthesis, the ovules epitropous, usually attached to upper part of placentas, the style cylindrical or conical; fruit with a dry or ligneous endocarp, the mesocarp sometimes carnose, the seeds 1-6, usually laterally flattened, each with a long, narrow, linear scar often nearly its whole length, the hilum subapical, the micropyle subbasal, the endosperm copious, the cotyledons thin, foliaceous.

TYPE SPECIES: *Planchonella obovata* (R. Br.) Pierre (*Sersalisia obovata* R. Br.) (vide Blake, Lam, & van Royen in *Taxon* 2: 112. 1953). Typ. cons.

DISTRIBUTION: A predominantly Old World genus extending from southeastern Asia through Malesia to Australia, New Zealand, Polynesia, and Hawaii, with a few species in Africa and South America (cf. Baehni in *Boissiera* 11: 66. 1965). More than 100 species may be referred to *Planchonella*; nine are here recorded as indigenous in Fiji, six being endemic.

USEFUL TREATMENTS OF GENUS: Baehni, C. Mémoire sur les Sapotacées. II. Le genre Pouteria. *Candollea* 9: 147-476. 1942. Royen, P. van. Revision of the Sapotaceae of the Malaysian area in a wider sense. VII. *Planchonella* Pierre. *Blumea* 8: 235-445. 1957.

Many students of Melanesian and Polynesian plants have seemed uncomfortable with the broad concept of *Planchonella costata* (Endl.) Pierre ex Lam expressed by Lam (1942, cited above under the family) and van Royen (1957, cited above), who considered the species to extend from Norfolk Island and New Zealand (var. *costata*, in which are also included two montane Fijian collections) to the Austral Islands and Makatea in the Tuamotus (var. *vitiensis*, in which van Royen also included certain New Zealand collections). Van Royen proposed two additional Fijian endemic varieties in *P. costata*; these both appear to me very different from either var. *costata* or var. *vitiensis*, and in the present treatment I discuss them as two distinct species. The problem of the scope of *P. costata* has much interested W. R. Sykes, who has had opportunities to study living plants of the complex in New Zealand, Norfolk Island, Tonga, Niue, and the Cook Islands. Discussions with Sykes have reinforced my opinion that the Melanesian-Polynesian population must be distinguished from the New Zealand-Norfolk Island population at the specific level.

As a first point in this consideration, few angiosperm species demonstrate this distributional pattern (i. e. New Zealand and neighboring areas and also Melanesia-Polynesia), unless they also occur in Malesia or at least in Melanesian islands west of the New Hebrides. Secondly, the absence of the complex from the Kermadec Islands

stimulates speculation; in fact the Sapotaceae are entirely absent from the Kermadecs (Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 219: 39. 1977). Thirdly, the occurrence of var. *vitiensis* in New Zealand and offshore islands is contradicted by New Zealand botanists, who now seem in full agreement that only the "typical" variety grows there; they mostly agree in equating *Planchonella novo-zealandica* (F. v. Muell.) Allan with *P. costata* (type from Norfolk Island). And fourthly, the two montane Fijian collections assigned by Lam to var. *costata* (his var. *austro-montana*, nom. inadmis.) are clearly not closely related to it; below I propose a new species, *P. brevipis*, for this Fijian endemic.

It remains to justify the separation of *Planchonella costata* var. *vitiensis* (in this treatment referred to *P. grayana*) from typical *P. costata*. The following key (including characters of living plants as provided by Sykes) will hopefully demonstrate the clear differences between the taxa:

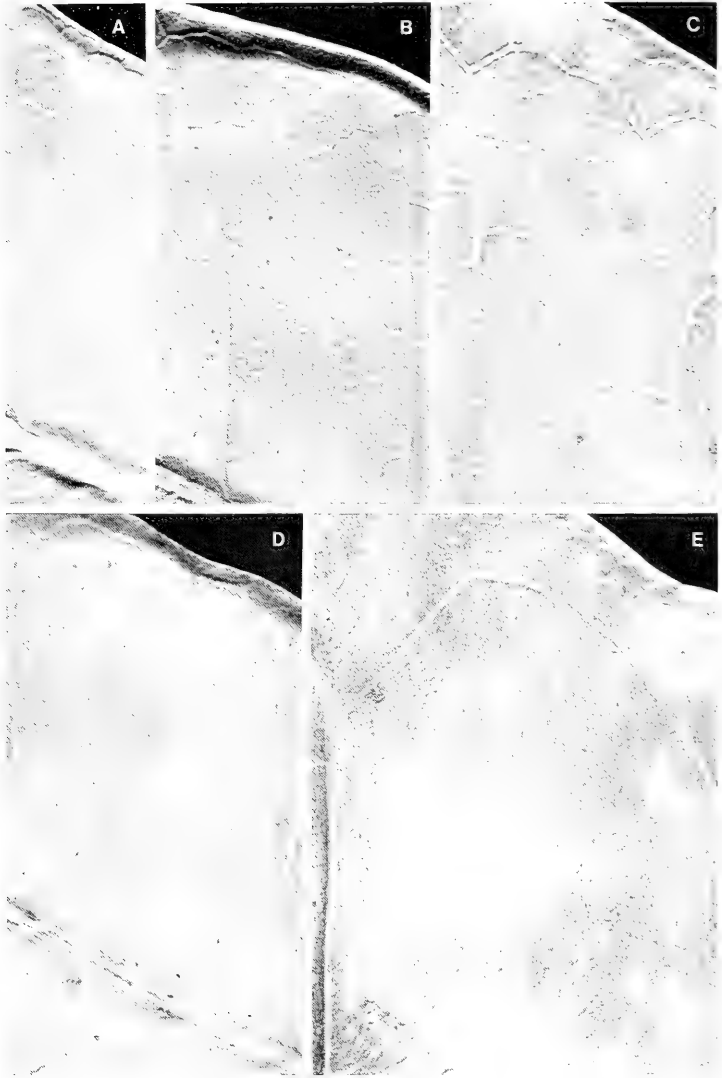
Trunk and branches with rough, fissured bark; juvenile leaf blades about as large as mature leaf blades and nearly similar in texture; mature leaf blades coriaceous, usually glossy on both surfaces, elliptic to obovate, (3-) 4-10 (-15) cm. long, (1.2-) 2-5 (-5.7) cm. broad, the secondary nerves (those that anastomose to form submarginal arches) (8-) 11-26 pairs, sometimes paralleled by essentially straight tertiary nerves that join the submarginal arches at their high points, the tertiaries usually more pronounced than the veinlet reticulation (FIGURE 195A); pedicels at anthesis 6-14 mm. long (FIGURE 197D); fruits ellipsoid to obovoid, at maturity smooth (not wrinkled in drying), 25-35 mm. long, 20-25 mm. broad, dark red (ripe and unripe fruits often occurring simultaneously and giving trees a "rainbow" effect), the mesocarp crustaceous; Norfolk Island and northern New Zealand (and offshore islands).

P. costata

Trunk and branches with comparatively smooth bark; juvenile leaf blades larger (to 35 cm. long) than mature leaf blades and more membranaceous in texture; mature leaf blades chartaceous or thin-coriaceous, glossy above, duller beneath, elliptic (usually broadly so) to oblong- or obovate-elliptic, 8-17 (-25) cm. long, (3-) 4-12 cm. broad, the secondary nerves (those that anastomose to form submarginal arches) 6-12 pairs, the tertiary nerves somewhat flexuose, not straight, often not clearly distinct from the veinlet reticulation (FIGURE 195C); pedicels at anthesis 4-13 mm. long; fruits (FIGURE 200A) subglobose to broadly ellipsoid or broadly obovoid, at maturity green with a white or glaucous bloom, 20-37 mm. in diameter, deeply wrinkled in drying, the mesocarp thick-carnose; Fiji to Austral Islands and Tuamotus. *P. grayana*

To summarize, the distinctions between *Planchonella costata* and *P. grayana* are many and striking (differences in leaf venation and fruits being particularly obvious). In view of this, one must conclude that they are not closely interrelated and that they acquired their present discrete ranges by separate migrations from a Malasian ancestry.

Other interpretations than van Royen's (1957) may be here noted. In my opinion *Planchonella linggensis* (Burck) Pierre does not occur east of the Solomon Islands and perhaps New Caledonia; the specimens from Fiji, Samoa, Tonga, and Niue cited by van Royen seem referable to either *P. garberi* or *P. vitiensis*. The specimens from the New Hebrides referred to *P. linggensis* by van Royen and to *P. oxyedra* by Lam represent the endemic *P. aneityensis* (Guillaumin) Lam. Additionally, I find *P. torricellensis* (K. Schum.) Lam significantly to be absent from the Solomons, New Hebrides, and Fiji; in the eastern archipelagoes of the Fijian Region (Samoa, Horne Islands, Tonga, and Niue) it is replaced by *P. samoensis* Lam ex Christophersen, a well-marked species (rather than a variety) also lacking between Fiji and the Solomons (this interpretation of *P. samoensis* is therefore not strictly germane to the flora of Fiji, but two of its relatives do occur in Fiji).



KEY TO SPECIES

- Tertiary nervation of leaf blades (between secondary nerves) in general parallel to the secondaries, often with 1 or more straight or irregular tertiary nerves more conspicuous than the remaining reticulation and joining the submarginal arches formed by anastomosing secondaries, or such tertiaries obliquely connecting the secondaries; areoles of venation usually longer (on axis parallel to secondaries) than broad, the ultimate obvious areoles 0.8-1.5 (-2) mm. long.
- Leaf blades sessile or essentially so, 3-8 cm. long, 1.5-3.5 cm. broad, obtuse or subcordate at base and often decurrent on branchlets; pedicels at anthesis 2.5-4 mm. long; corolla about 2.5 mm. long; gynoecium at anthesis about 1 mm. long, the style thick-cylindric, 0.5-0.7 mm. long. 1. *P. sessilis*
- Leaf blades obviously petiolate, decurrent on petiole.
- Mature leaf blades 2-3 times longer than broad, elliptic or oblong-elliptic to obovate, often larger than 14 × 6 cm. (smaller in species no. 2), often rounded at apex (but also acute to bluntly cuspidate or short-acuminate), the secondaries and veinlet reticulation often sharply prominulous on both surfaces (but sometimes inconspicuous or nearly plane).
- Petioles narrowly winged above middle; leaf blades coriaceous, obovate, (3-) 4-8.5 cm. long, (1.5-) 2-4 cm. broad, attenuate at base and long-decurrent on petiole, slightly emarginate to obtusely short-cuspidate at apex, sharply recurved at margin; pedicels at anthesis 3-4.5 mm. long; corolla about 2.5 mm. long, the lobes copiously flabellinerved; gynoecium at anthesis 1-1.5 mm. long, the style conical, about 0.5 mm. long. 2. *P. brevipes*
- Petioles often narrowly winged but usually only distally; leaf blades usually larger than 8 × 4 cm. (but smaller ones sometimes occurring among larger ones); pedicels at anthesis 5-15 mm. long; corolla 3 mm. long or more; gynoecium at anthesis 1.5 mm. long or more, the style cylindric or narrowly conical, more than 0.5 mm. long; fruits more than 20 mm. in diameter, with (3 or) 4 or 5 developing seeds, these when mature 25 × 13 × 6 mm. or larger.
- Fruits subglobose to broadly ellipsoid or broadly obovoid, at apparent maturity 20-37 mm. in diameter, glabrous, green with a white or glaucous bloom, deeply wrinkled in drying, the style deciduous, the endocarp woody, 1.5-4 mm. thick, the mesocarp thick-carnose, the seeds dark brown; petioles 1-5 cm. long, comparatively slender, 1-2 mm. in diameter, like the blades glabrous (evanescently pale- or brown-sericeous in early stages); leaf blades chartaceous or thin-coriaceous, elliptic to oblong- or obovate-elliptic, 8-17 (-25) × (3-) 4-12 cm. (juvenile ones to 35 cm. long), pale to bright green or brownish in drying, rounded to slightly emarginate at apex, flattened or very slightly recurved at margin, the secondary nerves 6-12 pairs; pedicels 4-13 mm. long at anthesis, slender (less than 0.8 mm. in diameter), like the calyx closely pale-sericeous; calyx about 2 mm. long; corolla membranaceous, 3-3.5 mm. long; anthers about 0.7 mm. long; staminodes filiform-subulate, about 1 mm. long; gynoecium 1.5-2 mm. long, the ovary minutely pale-sericeous, the style 0.6-1 mm. long; a usually coastal plant, rarely found far inland. 3. *P. grayana*
- Fruits ellipsoid, ovoid, obovoid, or turbinate, at maturity 30-70 × 30-60 mm., with long-persistent indument, appearing brown or reddish, not wrinkled in drying, the endocarp woody, 2-7 mm. thick, the mesocarp crustaceous, the seeds often pale brown; petioles 2-7 cm. long, comparatively stout, 1-3 mm. in diameter; leaf blades coriaceous, often distinctly recurved at margin; pedicels stout (0.7-1.5 mm. in diameter, often thickening to 2 mm. distally), like the calyx copiously brown-sericeous; calyx 3.5-5 mm. long; corolla carnose, 4-4.5 mm. long; anthers 1-1.5 mm. long; staminodes carnose, lanceolate, about 2 mm. long; gynoecium 2.5-3 mm. long, the ovary copiously brown-sericeous, the style 1-1.5 mm. long; forest species.
- Leaves glabrous (brown-sericeous in early stages), the blades dull green, drying brownish, oblong, 8-17 × 4-9 cm., bluntly obtuse or rounded at apex, the secondary nerves 6-13 pairs; pedicels 6-13 mm. long; fruits turbinate, usually abruptly tapering toward base and apex, rarely obovoid or ellipsoid, copiously brown-sericeous but eventually subglabrate and then sometimes with a whitish bloom, broadly conical or umbonate or flattened at apex and tipped by the persistent style. 4. *P. umbonata*

FIGURE 195. *Planchonella*; portions of lower surfaces of leaf blades; each photograph shows 2 secondary nerves, the submarginal arch formed by their anastomosis, and tertiary nervation; all × 4. A, *P. costata*, from Sykes (Norfolk) 491, from Norfolk Island. B, *P. brevipes*, from Smith 705. C, *P. grayana*, from Gillespie 4494. D, *P. umbonata*, from Smith 8807. E, *P. smithii*, from St. John 18204.

Leaves (petioles and lower surfaces of blades) copiously brown- or reddish-sericeous, very tardily subglabrate, the blades greenish or dark brown above, brown or reddish beneath, elliptic or obovate, (12-) 16-65 × (6-) 7-24 cm., subacute to short-acuminate at apex, the secondary nerves 7-27 pairs, sharply prominent beneath; pedicels 10-15 mm. long; fruits ellipsoid or obovoid, sometimes bluntly 5-angled, copiously and persistently brown-sericeous, rounded or obtuse at apex, the style deciduous. 5. *P. smithii*

Mature leaf blades 2.5-4 times longer than broad, lanceolate to narrowly elliptic or narrowly obovate, not exceeding 14 (-17) × 6 (-7) cm. (juvenile leaf blades often larger), obtuse to acute or short-acuminate at apex (rarely rounded), the secondaries and veinlet reticulation usually plane or inconspicuously raised above, sometimes obvious beneath but infrequently sharply prominent; pedicels at anthesis 5-9 mm. long; filaments and anthers each 0.8-1 mm. long at anthesis; ovary golden-hispidulous-sericeous but soon glabrate; mature fruits ellipsoid or globose, glabrous, green or olive-green, becoming dull red to purple or dark brown.

Mature fruits 26-40 mm. long, 22-40 mm. broad, rounded at base and apex, wrinkled in drying, the mesocarp thin-carnose, the style long-persistent, the seeds usually 4 or 5, 22-32 mm. long; leaf blades often lanceolate- or elliptic-obovate, obtusely cuspidate to short-acuminate at apex, usually plane at margin; pedicels and calyx lobes at anthesis copiously golden- or pale brown-sericeous, the calyx indument persisting even in fruit; calyx at anthesis 3.5-4 mm. long; corolla at anthesis about 4 mm. long; style 3.5-4 mm. long, projecting from corolla at anthesis.

6. *P. garberi*

Mature fruits 10-18 mm. long, 8-13 mm. broad, obtuse at base and apex, essentially smooth in drying, the mesocarp crustaceous, the style soon deciduous, the seeds usually 1 or 2, 8-10 mm. long; leaf blades often lanceolate or elliptic, obtuse to subacute at apex, usually slightly recurved at margin; pedicels and calyx buds sericeous with dark brown hairs, these soon caducous, the mature calyx glabrous except for sparse tufts of brown, apical hairs; calyx at anthesis 2-3 mm. long; corolla at anthesis about 2.5 mm. long; style about 1 mm. long, not projecting from corolla at anthesis. 7. *P. vitiensis*

Tertiary nervation of leaf blades (between secondary nerves) transverse or irregularly reticulate, lacking conspicuous tertiary nerves parallel to the secondaries, the more prominent tertiaries transversely and irregularly connecting the secondaries; areoles of venation usually not elongated (on axis parallel to secondaries), the ultimate obvious areoles 0.3-0.7 mm. in diameter; petioles 5-15 mm. long, the leaf blades attenuate at base and long-decurrent on petiole, obtusely cuspidate to short-acuminate at apex, the veinlet reticulation prominulous on both sides; pedicels 3-7 mm. long, like calyx lobes pale-sericeous in young flowers, the inner calyx lobes remaining sparsely sericeous in fruit; fruits wrinkled in drying, up to 40 × 35 mm. when fresh, the mesocarp carnose.

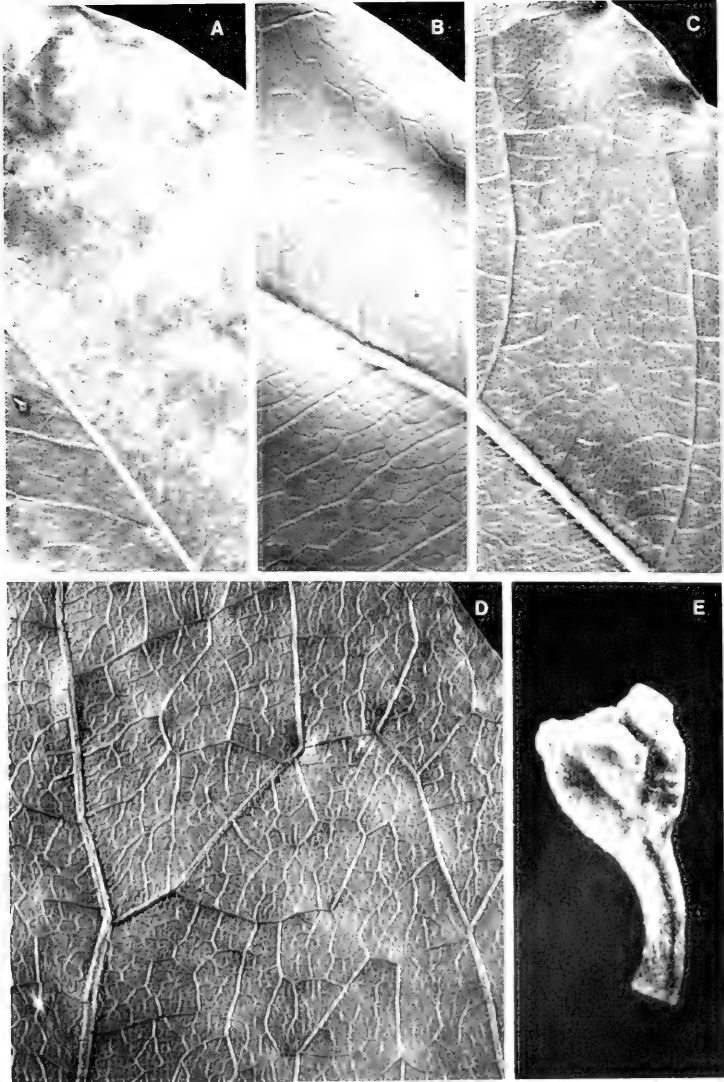
Leaf blades membranaceous, elliptic to lanceolate-obovate, 6-24 cm. long, 2-7.5 cm. broad, glabrous, essentially plane at margin; flowers 1-3 per inflorescence; fruits ellipsoid, often with only 2 (but sometimes with 5) seeds maturing, the style persistent, 1-1.5 mm. long. . . . 8. *P. membranacea*

Leaf blades thick-membranaceous to thin-coriaceous, oblong- to obovate-lanceolate, 6-12.5 cm. long, 2-4.5 cm. broad, sometimes subpersistently brownish-tomentellous on costa beneath (as on petioles), slightly recurved at margin; flowers 2-12 per inflorescence; fruits subglobose or oblate-globose, usually with (3-) 4-6 seeds maturing, the style deciduous. 9. *P. pyrulifera*

1. *Planchonella sessilis* A. C. Sm. & S. Darwin in *Brittonia* 27: 165. fig. 1-6. 1975.

A small tree 3-5 m. high, occurring in wind-swept thickets at an elevation of 400-429 m. Flowers have been obtained in January and July, flower buds in August and November, and young fruits in January.

FIGURE 196. A-D, *Planchonella*; portions of lower surfaces of leaf blades; each photograph shows 2 secondary nerves, the submarginal arch formed by their anastomosis, and tertiary nervation; all × 4. A, *P. garberi*, from Garber 1101, from Samoa. B, *P. vitiensis*, from Gillespie 4546. C, *P. pyrulifera*, from Degener & Ordóñez 13965. D, *P. membranacea*, from Smith 1491. E, *Planchonella brevipes*, flower, × 8, from Smith 683.



TYPIIFICATION: The type is *DA 18093* (coll. *S. Vodonaivalu*) (A HOLOTYPE; ISOTYPES at BISH, K, MASS, NY, SUVA, US), collected in January, 1973, on the summit of Mt. Korombamba, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from the summit and upper slopes of Mt. Korombamba.

AVAILABLE COLLECTIONS: VITI LEVU: REWA: Mt. Korombamba, on and near summit, *Gillespie 2333*, *DA 18094*, *18095*, *18096*, *18155*.

2. *Planchonella brevipes* A. C. Sm., sp. nov. (described at end of genus)

FIGURES 195B, 196E, 197A-C.

Planchonella costata var. *austro-montana* sensu Lam in *Blumea* 5: 6, p. p., quoad spec. vit. 1942; non sensu typi.

Planchonella costata var. *costata* sensu van Royen in *Blumea* 8: 378, p. p., quoad spec. vit. 1957; non sensu typi.

A gnarled shrub 3-4 m. high, occurring in the dense thickets of ridges and crests at an altitude of 1,032 m. Flowers were obtained in November, fruits being still unknown.

TYPIIFICATION: The type is *Smith 683* (BISH HOLOTYPE; many ISOTYPES), collected Nov. 29, 1933, on the summit of Mt. Mbatini, Thakaundrove Province, Vanua Levu.

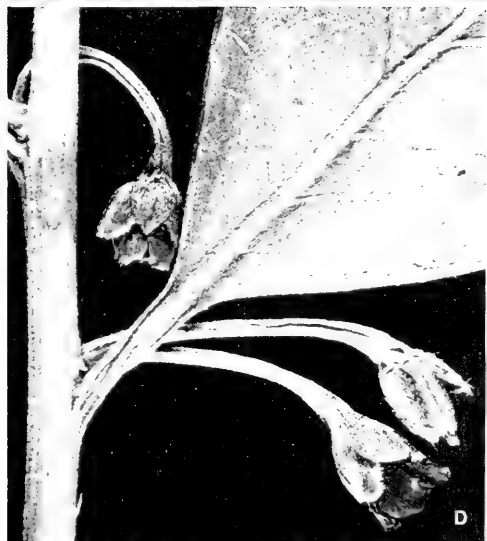
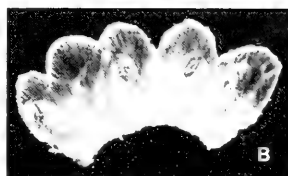
DISTRIBUTION: Endemic to Fiji and thus far known only from the type locality, the highest point of Vanua Levu.

AVAILABLE COLLECTION: VANUA LEVU: THAKAUNDRIVE: Summit of Mt. Mbatini, *Smith 705*.

The two collections representing *Planchonella brevipes* were assigned by Lam in 1942 to his typical variety of *P. costata* (Endl.) Pierre ex Lam. However, *P. brevipes* is only remotely related to *P. costata* (FIGURES 195A, 197D), a comparatively large tree, from which it differs in having leaf blades with fewer secondary nerves (those that form submarginal arches), although these are paralleled by intermediate tertiaries that join the arches between the secondaries. More obvious differences are found in the flowers, which in *P. costata* are always either solitary or paired and have pedicels considerably longer than those of *P. brevipes*. The corollas of *P. costata* are 4-6 mm. long, with lobes that lack the conspicuous fine flabellate nervation of those of *P. brevipes*. The gynoecium of *P. costata* is 5-6 mm. long at anthesis, with an ellipsoid ovary and a slender style 2-3 mm. long. In fact, it cannot be suggested that the two taxa are in any way closely related.

Possibly *Planchonella brevipes* is an outlying derivative of an ancestral form of the widespread and variable *P. obovata* (R. Br.) Pierre. In form and texture the leaf blades of the new species are not precisely suggested in any variants of *P. obovata*, which has the blades thinner and with more numerous secondary nerves, the corollas and stamens substantially larger, and the style much longer. In spite of the pronounced differences in their foliage, *P. brevipes* and *P. sessilis* (the preceding species in the present treatment) are reasonably similar in inflorescence characters; they may indeed represent divergent lines from a common ancestry, each being endemic (as far as now known) to a very limited area on different Fijian islands.

FIGURE 197. A-C, *Planchonella brevipes*; A, inflorescences and leaf bases, $\times 4$; B, opened corolla, with 1 anther removed, $\times 8$; C, gynoecium and pedicel, $\times 8$. D, *Planchonella costata*, inflorescences and leaf base, $\times 4$. E, *Planchonella grayana*, gynoecium and pedicel, $\times 8$. A-C from *Smith 683*, D from *Shakespeare s. n.*, from Little Barrier Island, North Island, New Zealand, E from *O. & I. Degener 32211*.



3. *Planchonella grayana* St. John in Bishop Mus. Bull. 120: 38. 1934; Yuncker in op. cit. 178: 93. 1943. FIGURES 195C, 197E, 198A, 200A.

Sapota vitiensis A. Gray in Proc. Amer. Acad. Arts 5: 328. 1862; Seem. Viti, 439. 1862, Fl. Vit. 151. 1866; non *Planchonella vitiensis* Gillespie (1930).

Sideroxylon vitiense Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 229. 1892; Burkill in J. Linn. Soc. Bot. 35: 44. 1901.

Lucuma vitiensis Gillespie in Bishop Mus. Bull. 74: 12. fig. 14. 1930.

Planchonella costata var. *vitiensis* Lam in Blumea 5: 7, p. p. majore. 1942; van Royen in op. cit. 8: 378, p. p. majore. 1957; Yuncker in Bishop Mus. Bull. 220: 211. 1959; J. W. Parham, Pl. Fiji Isl. 163. 1964, ed. 2. 231. 1972; Sykes in New Zealand Dept. Sci. Indust. Res. Bull. 200: 188. 1970; St. John & A. C. Sm. in Pacific Sci. 25: 337. 1971.

Pouteria costata var. *vitiensis* Baehni in Candollea 9: 305. 1942.

As it occurs in Fiji, *Planchonella grayana* is a tree 6–14 m. high (sometimes stunted and only 1 m. high in exposed coastal areas) found from near sea level to an elevation of about 400 m. along rocky coasts, often on limestone, in coastal thickets, and sometimes inland near the coast along streams or in light or dense forest. Its corolla and filaments are white or greenish white, its anthers yellow, its fruits at maturity green with a white or glaucous bloom, and its seeds dark brown. Flowers have been obtained between January and July, and fruits are to be seen throughout most of the year.

TIPIFICATION AND NOMENCLATURE: The oldest name applicable to the taxon usually known as *Planchonella costata* var. *vitiensis* is *Sapota vitiensis* A. Gray, of which the epithet is not available in *Planchonella* at the specific level because of *P. vitiensis* Gillespie. *Sapota vitiensis* is typified by U. S. Expl. Exped. (US 75134 HOLOTYPE; ISOTYPES AT GH, K, P), a fruiting collection obtained on Ovalau in 1840. All the synonyms listed above are based on this. *Planchonella grayana* is a new name at the species level for Gray's taxon, which was well redescribed by St. John in 1934.

In 1942 Lam placed in the synonymy of his variety *Planchonella tahitensis* (Nadeaud) Pierre ex Dubard, based on *Sideroxylon tahitense* Nadeaud (1897). Nadeaud cites collections from four localities on Tahiti at elevations of 800–1,000 m. Lam stated that the type specimen(s) at P had been lost from the herbarium sheet, leaving a label and annotations by Pierre; he suggested taking as the lectotype a fruiting specimen: *Nadeaud* (P) from Mt. Raairi ("Raavi"). However, this locality is on the island of Moorea, not originally mentioned by Nadeaud, and therefore the specimen cannot be considered a lectotype. In view of the uncertainty, it is probably advisable to consider Nadeaud's description (in J. Bot. (Morot) 11: 111. 1897) as the type, at least for the time being. This taxon was further discussed by Grant, Fosberg, and H. M. Smith in Smithsonian Contr. Bot. 17: 27. 1974. The description is of a plant with white-tomentose branchlets, leaves, and pedicels, often undulate leaf blades, pyriform or obovoid fruits distinctly longer than broad, and gray seeds that are red-spotted. These characters do not conclusively suggest *P. grayana*, which has the branchlets, petioles, and pedicels soon glabrate (with an evanescent, sericeous indument of pale, very short hairs), entire leaf blades, essentially globose fruits, and dark brown seeds. It seems probable that *P. grayana*, a coastal or lowland plant, is replaced

FIGURE 198. A, *Planchonella grayana*, flower, × 8. B & C, *Planchonella umbonata*; B, flower slightly before anthesis, × 8; C, opened corolla bud, × 8. D–F, *Planchonella smithii*; D, flower slightly before anthesis, × 8; E, gynoecium and 2 calyx lobes, × 8; F, opened corolla of ♀ flower, lacking anthers, × 8. A from O. & I. Degener 32211, B & C from Berry 92, D–F from DA 15659.



by a related upland taxon in the Societies, from which I have seen no material of *Planchonella*. However, if Nadeaud's Tahitian material should prove conspecific with *P. grayana*, his name would provide an earlier epithet.

Another name listed in synonymy by Lam in 1942 is *Sideroxylon tannaense* Guillaumin (in J. Arnold Arb. 13: 14. 1932), based on *Kajewski 104* (A HOLOTYPE; ISOTYPES listed by Lam at K, UC), from Tanna, New Hebrides. This taxon has tomentose pedicels and calyx lobes, a densely red-tomentose ovary, and a conical style. The pedicels and calyx lobes of *Planchonella grayana* are merely sericeous, the ovary is sparsely pale-sericeous, and the style is short-cylindric. Neither fruits nor any other collections of *S. tannaense* from the New Hebrides are known to me, and on the basis of the type collection alone I am reluctant to propose the new combination that would be required, should *S. tannaense* and *P. grayana* be considered conspecific.

DISTRIBUTION: Fiji to the Austral Islands and the Tuamotus. Material from east of Fiji has been seen from the Horne Islands, Samoa, Tonga, Niue, the Cook Islands, the Austral Islands (Rurutu and Tubuai), and the Tuamotus (Makatea). In Fiji *Planchonella grayana* is a common component of coastal vegetation (23 collections being at hand), but at higher elevations and inland it seems to be replaced by *P. umbonata* and *P. smithii*, both very distinct forest trees.

In the western part of its range (Fiji to the Cook Islands) *Planchonella grayana* is very uniform, with leaf blades often more than half as broad as long and with fruits globose at maturity, rounded or even slightly impressed at apex. However, in the Austral Islands and on Makatea the leaf blades are inclined to be slightly thicker and sometimes lanceolate-obovate and three times longer than broad, and the fruits may be globose-obovoid and broadly conical-obtuse at apex. The eastern populations of *P. grayana*, when ample material has been assembled, may be found worthy of nomenclatural recognition at some level.

LOCAL NAME: The name *nggalaka* is uniformly used in the Lau Group, but no local name has been noted in western Fiji.

REPRESENTATIVE COLLECTIONS: MAMANUTHAS: NGGALITO Island, Malolo Group, *O. & I. Degener 32211*. KANDAVU: *DA 12441 (DF 86, Watkins 749)*. ONO (northeast of Kandavu): *DA 14946*. OVALAU: *Horne 317a*; slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith 8077*; north of Levuka, *Gillespie 4494, 4559*. WAKAYA: *Wakaya Lailai*, southeastern coast, *DA 17086*. VANUA LEVU: MATHUATA: Islands off coast, *Greenwood 682*. MOALA: North coast, *Smith 1385*. VANUA MBALAVU: Slopes of Korolevu, near Lomaloma, *Garnock-Jones 1030*; Namalata, southern limestone section, *Smith 1453*. LAKEMBA: Near airport, *Garnock-Jones 868*. FULANGA: On limestone formation, *Smith 1208*. ONGEA NDRIKI: Rocky isolated island off northwestern end, *Bryan 398*.

4. *Planchonella umbonata* (van Royen) A. C. Sm., comb. et stat. nov.

FIGURES 195D, 198B & C, 200B.

Planchonella costata var. *umbonata* van Royen in *Blumea* 8: 379, 432. 1957; J. W. Parham, Pl. Fiji Isl. 163. 1964, ed. 2. 231. 1972.

A tree 9–25 m. high with copious white latex, occurring at elevations of 50–800 m. in dense forest, sometimes along creeks. The fruits, borne with leaves or on leafless branchlets, are dull green with a close brown indument and appearing brown, or sometimes when past maturity with a whitish bloom. Flowers have been obtained between August and December, fruits between May and December.

TIPIFICATION: The type is *Smith 8807* (L HOLOTYPE; many ISOTYPES), collected Oct. 1, 1953, in the valley of Wainambua Creek, south of Mt. Naitarandamu, Namosi Province, Viti Levu. Of the three numbers cited by van Royen as representing his var.

umbonata, *Smith 8852* seems to represent the next species, *P. smithii*; many additional collections of both taxa are now at hand.

DISTRIBUTION: Endemic to Fiji and known from the three largest islands, from which 23 collections have now been studied.

LOCAL NAMES AND USE: Names recorded from northern and western Viti Levu are *mbau loa*, *tole ni yavoto*, *mbau sa*, *mbau ravua*, *mbulu mbau nato*, and *ndomoli*. The species is considered by foresters to provide a useful timber.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1273*; vicinity of Nalotawa, eastern base of Mt. Evans Range, *Smith 4440*; vicinity of Nandarivatu, *DA 2329*; vicinity of Navai, *DA 14979*; Yavu Creek, Mba River headwaters, *Berry 92*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13893*; northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5522*. NAMOSI: Hills east of Wainikoroiluva River, near Namuamua, *Smith 9026*. RA: Vicinity of Rewasa, near Vaileka, *Degener 15515*. VANUA LEVU: MBUA: Above Thongea, Wainunu River, *DA 15789*. MATHUATA: Above Nasingasinga, *Berry 46*; Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6906*. THAKAUNDROVE: Nggilo Creek, near Nathula, Sanggani Tikina, *Howard 140*. TAVEUNI: Valley between Mt. Manuka and main ridge of island, east of Wairiki, *Smith 8276*.

It seems probable that *Planchonella umbonata* and *P. smithii* evolved by the inland migration of ancestral forms of the predominantly coastal *P. grayana*. Each of the two inland endemics has acquired comparatively robust flowers and large, distinctive fruits, differing slightly from one another in these respects as indicated in my key. In foliage they have acquired very different aspects. The leaf blades of *P. umbonata* retain essentially the same size, shape, and nervation as those of *P. grayana*, differing in having a more coriaceous texture, recurved margins, and more blunt nervation. The leaf blades of *P. smithii*, however, are very unlike those of *P. umbonata*, being much larger, with a long-persistent indument, and with a subacute to short-acuminate apex. Their secondary nerves are sharply prominent beneath, and there are no obvious tertiary nerves parallel to the secondaries (however irregular and flexuose); instead, the principal tertiaries obliquely connect the secondaries. The two inland endemics, although sometimes more or less sympatric, appear to retain their very distinctive characteristics.

5. *Planchonella smithii* (van Royen) A. C. Sm., comb. et stat. nov.

FIGURES 195E, 198D-F, 199.

Planchonella costata var. *smithii* van Royen in *Blumea* 8: 379, 432. 1957; J. W. Parham, Pl. Fiji Isl. 163. 1964, ed. 2. 230. fig. 68. 1972.

A tree 8–30 m. high with copious white latex and a trunk to 80 cm. in diameter, found at elevations of 30–600 m. in dense, open, or secondary forest, often near rivers and creeks. The fruits, borne on branchlets below leaves, are green to dull greenish brown or brown, with a copious brown indument. Flowers have been noted in February and August, fruits between March and October.

TYPIFICATION: The type is *Smith 6368* (L HOLOTYPE; many ISOTYPES), collected Oct. 27, 1947, on the southern slopes of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from the three largest islands.

LOCAL NAMES AND USES: Local names are not clearly different from those applied to the preceding species; recorded are *mbau loa*, *mbau sa*, *mbau vundi*, *mbau ravua*, *mba*, and *mbawaki*. Foresters consider this species also to be a useful timber tree. The wood is sometimes used for canoe paddles, and children use the latex as chewing gum.



FIGURE 199. *Planchonella smithii*, from *Smith 9049*; a fruiting branchlet held in the forest of Namosi Province, Viti Levu, \times about 1/6.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Navau Creek, upper Navua River, *Howard 6*. SERUA: Nambukelevu, upper Navua River, *DA 15659*; banks of Navua River at Namata rapids, *Gillespie 3379*. NAMOSI: Hills bordering Wainavindrau Creek, vicinity of Wainimakutu, *Smith 8852*; hills east of Wainikoroiuva River, near Namuamua, *Smith 9049*; Nambukavesi Creek, *DF538 (Vaisewa 4)*, 539. NAITASIRI: Wainamo Creek, near Matawailevu, Wainimala River, *St. John 18204*; Waindrandra Creek, *DA 640, 809*; Waimanu River, *DA L.13326 (Berry 37)*, *L.13327*. VANUA LEVU: MBUA: Near Thongea, Wainunu River, *DA 15765*. MATHUATA: Ndongotuki Tikina, *Howard 161*. THAKAUNDROVE: Ndrawa Creek, drainage of Turiwai Creek, *DA 14326*; Ndakunimba, Natewa Peninsula, *Howard 125*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4637*; slopes of Mt. Manuka, east of Wairiki, *Smith 8137*.

6. *Planchonella garberi* Christophersen in *Bishop Mus. Bull.* **128**: 170. *fig. 25*. 1935; Lam in *Blumea* **5**: 9. 1942; Yuncker in *Bishop Mus. Bull.* **184**: 56. 1945.

FIGURES 196A, 200C, 201A & B, 202A.

Pittosporum ritchei sensu Seem. in *Bonplandia* **9**: 254. 1861; A. Gray in *op. cit.* **10**: 35. 1862; non *P. richii* A. Gray (1854).

Pittosporum richii sensu Seem. Viti, 433. 1862; A. Gray in *Proc. Amer. Acad. Arts* **5**: 315. 1862; non A. Gray (1854).

Planchonella oxyedra sensu Lam in *Blumea* **5**: 13, p. p. minore, quoad spec. sam. et tong. 1942; non Dubard.

Pouteria garberi Baehni in *Candollea* **9**: 296. 1942.

Planchonella linggensis var. *linggensis* sensu van Royen in *Blumea* **8**: 385, p. p. minore, quoad spec. sam. et niue. 1957; non Pierre.

Planchonella linggensis var. *garberi* van Royen in *Blumea* **8**: 387. 1957; J. W. Parham, *Pl. Fiji Isl.* 163. 1964, ed. 2. 231. 1972; B. E. V. Parham in *New Zealand Dept. Sci. Indust. Res. Inform. Ser.* **85**: 13. 1972.

Planchonella linggensis sensu St. John & A. C. Sm. in *Pacific Sci.* **25**: 337. 1971; non Pierre.

Planchonella membranacea sensu Sykes in *New Zealand Dept. Sci. Indust. Res. Bull.* **200**: 189. *fig. 18*. 1970; non Lam.

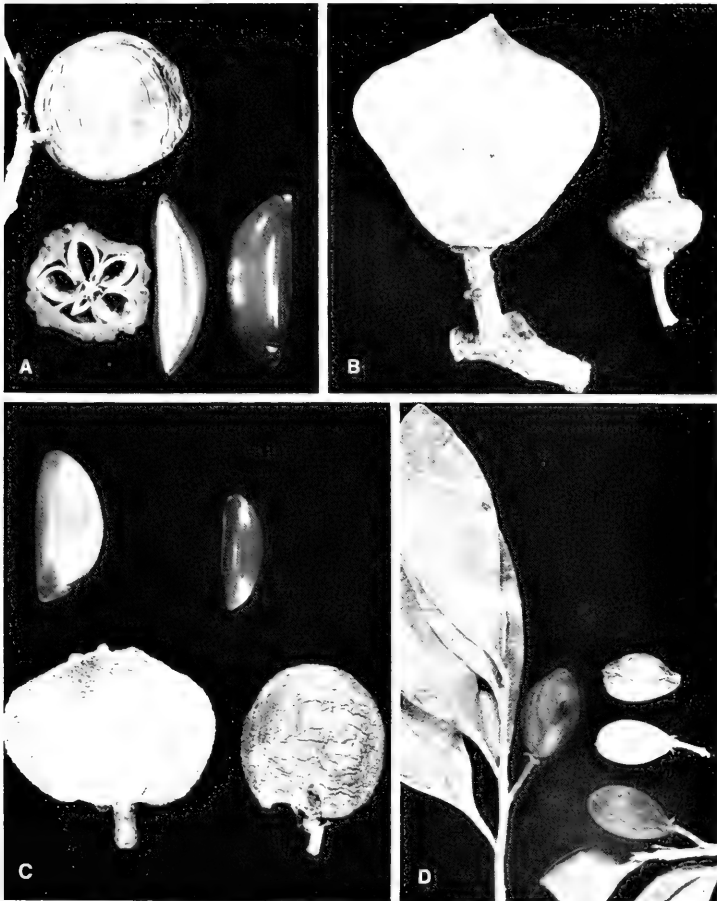


FIGURE 200. A, *Planchonella grayana*, fruits and seeds, $\times 1$. B, *Planchonella umbonata*, mature and young fruit, $\times 1$. C, *Planchonella garberi*, fruits and seeds, $\times 1$. D, *Planchonella vitiensis*, fruits and foliage, $\times 1$. A, essentially mature (dried) attached fruit from DA 17086, cross section of immature fruit from Gillespie 4559, mature seeds from Bryan 398, B, mature fruit from Smith 9026, young fruit from DA 13893, C, larger fruit from DA 16296, larger seed from St. John 18168, smaller fruit and smaller seed from Garber 1101, from Samoa, D, larger branchlet and fruit from Smith 4382, smaller branchlet and fruit from Smith 4990, loose fruits from Gillespie 4546.

As seen in Fiji, *Planchonella garberi* is a tree 6–12 m. high, with a trunk to 30 cm. in diameter, occurring at elevations of 90–450 m. in dense, open, or secondary forest. Its pedicels and calyx are copiously golden- or pale brown-sericeous at anthesis; its fruits are green to purple and up to 40 mm. in diameter at maturity, smooth but becoming wrinkled in drying; and its seeds are dark brown to blackish. Flowers have been obtained in February and April, fruits between February and August.

TYPIFICATION: The type is *Garber 1101* (BISH HOLOTYPE; ISOTYPE at K), collected July 4, 1925, at the top of Nuu Islet, Ofu Island, Samoa. Most of the synonyms cited above are due to misinterpretations, in my opinion.

DISTRIBUTION: In Fiji *Planchonella garberi* is known from several islands but is nowhere very frequent. It seems more abundant in Samoa and it has also been collected in the Horne and Wallis Islands, Tonga, and Niue.

LOCAL NAMES AND USE: Recorded Fijian names are *sarosaro*, *tandiri*, and *thalavia*. The species is considered a useful timber tree, its wood being hard.

AVAILABLE COLLECTIONS: YASAWAS: WAYA: Nangua, *St. John 18168*. VITI LEVU: NAITASIRI: Tholo-i-suva, *Vukicea*, July 11, 1950; Toninaiwau, Tholo-i-suva, *DA 16296*. REWA: Mt. Korombamba, *DA 16503*. KANDAVU: Without further locality, *Seemann 54*. VANUA LEVU: MBUA: Upper Ndama River Valley, *Smith 1604*; Koromba Forest, *DA 15114*. KAMBARA: Central wooded basin, *Bryan 510*.

In my opinion *Planchonella garberi* must be separated from *P. linggensis* (Burck) Pierre at the species level on the basis of its larger corolla, its elongate, projecting style, and its persistently and markedly larger fruits and seeds, four or five of the latter apparently always maturing. In *P. linggensis* the fruits are consistently smaller, ellipsoid or ovoid, infrequently exceeding 20 × 15 cm., and usually with fewer than four seeds maturing.

7. *Planchonella vitiensis* Gillespie in Bishop Mus. Bull. 74: 11, fig. 12. 1930; van Royen in Blumea 8: 380. 1957; J. W. Parham, Pl. Fiji Isl. 164. 1964, ed. 2. 232. 1972.

FIGURES 196B, 200D, 201C–E, 202B.

Pouteria vitiensis Degener, Nat. So. Pac. Exped. Fiji, 294. 1949.

Planchonella linggensis var. *linggensis* sensu van Royen in Blumea 8: 385, p. p. minore, quoad spec. vit. aliquot. 1957; J. W. Parham, Pl. Fiji Isl. 163, p. p. 1964, ed. 2. 231, p. p. 1972; non Pierre.

Planchonella linggensis var. *garberi* sensu van Royen in Blumea 8: 387, p. p. minore, quoad spec. vit. aliquot. 1957; non sensu typi.

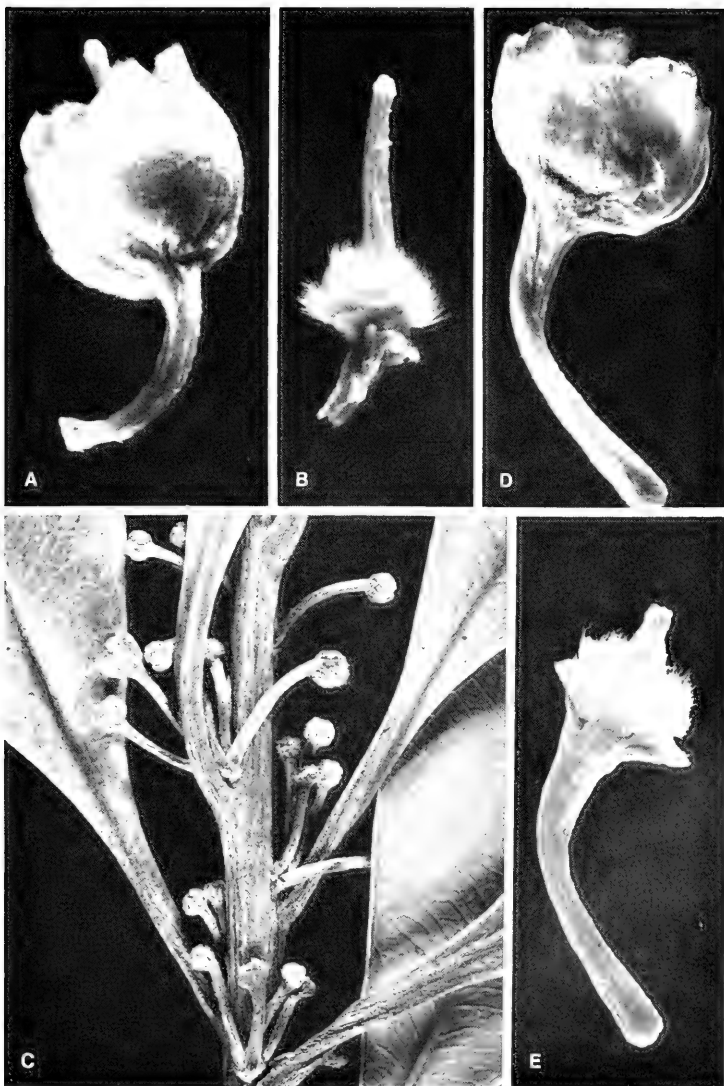
A tree (2-) 5–25 m. high, with abundant white or pale latex and a trunk up to 65 cm. in diameter, found at elevations of 50–1,120 m. in dense or dry forest or in forest and thickets of crests and ridges. The fruits are green when young, becoming dull red to purple or dark brown. Flowers have been obtained between November and May, fruits between January and August.

TYPIFICATION: The type is *Gillespie 4546* (BISH HOLOTYPE; ISOTYPES at BISH, K, US), collected Feb. 1, 1928, in mountains 3 miles northwest of Levuka, Ovalau.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands, from which about 40 collections are available.

LOCAL NAMES AND USES: The most frequently used name is *sarosaro*, others being *mbau mbulu*, *tanga thovi*, *tandiri*, and *songasonga*. The wood is hard and durable, being used in building; it is also said to be used to make combs.

FIGURE 201. A & B, *Planchonella garberi*; A, flower, × 8; B, gynoeceum, × 8. C–E, *Planchonella vitiensis*; C, inflorescences and leaf bases, × 4; D, flower, × 8; E, gynoeceum and pedicel, × 8. A & B from *DA 16296*, C from *Gillespie 4546*, D & E from *Smith 9419*.



REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Northern portion of Mt. Evans Range, between Mt. Vatuyani and Mt. Natondra, *Smith 4382*; Nausori Highlands in Nawaka Tikina 3 miles east of Nausori, *Webster & Hildreth 14298*; ridge between Mt. Nanggarambuluta and Mt. Namama, east of Nandarivatu, *Smith 4990*; slopes of Mt. Tomanivi, *DA 14294*. NANDRONGA & NAVOSA: Nausori Highlands, *DF 786*. SERUA: Inland from Namboutini, *DF 779*; inland from Yarawa, *DF 1065 (S1557/5)*; hills north of Ngaloa, in drainage of Waininggere Creek, *Smith 9419*. NAMOSI: Mt. Voma, *DA 13967*; Nambukavesi Creek, *DF 541*. RA: Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith 5694*. NAITASIRI: Upper Navutuvula Village, Waimanu River, *DA 15693*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7057*. KANDAVU: Without further locality, *DA 11957 (DF 37, Watkins 706)*. OVALAU: Hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7546*; summit of Mt. Tana Lailai and adjacent ridge, *Smith 7700*. VANUA LEVU: MBUA: Above Thongea, Wainunu River, *DA 15798*. MATHUATA: Vicinity of Nasingasinga, *Berry 15*; Naravuka, Ndreketi River, *DF 1029 (S1557/2)*. THAKAUNDROVE: Upper Yanawai River, *DA 15742*; Valeni, Nasavu Creek, *DA 15723*.

The characters that separate *Planchonella vitiensis* from *P. linggensis* were discussed by van Royen in 1957, although, contrary to his comments, the calyx is sericeous when young and becomes glabrous only approaching anthesis. *Planchonella garberi* is readily distinguished from the present species in having its calyx copiously sericeous even in fruit, its comparatively long style projecting from the corolla, and its fruits much larger, essentially globose, and with more numerous maturing seeds.

8. *Planchonella membranacea* Lam in *Blumea* 5: 11. fig. 3. 1942; van Royen in op. cit. 8: 401. 1957; J. W. Parham, *Pl. Fiji Isl.* 164. 1964, ed. 2. 231. 1972.

FIGURES 196D, 202C.

Pouteria membranacea Baehni in *Candollea* 9: 411. 1942.

Planchonella obovoidea sensu van Royen in *Blumea* 8: 390, p. p. minore, oboad spec. vit. 1957; J. W. Parham, *Pl. Fiji Isl.* 164. 1964, ed. 2. 231. 1972; non Lam.

A sometimes slender tree 7–20 m. high, with white latex and a trunk to 40 cm. in diameter, known from near sea level to an elevation of 450 m. in dense or dry forest or hillside thickets. The fruit is noted as dark red but probably becomes purplish to black. Flowers have been collected in December and January, fruits between April and June.

TYPIFICATION: The type is *Smith 1491* (BISH HOLOTYPE; many ISOTYPES), collected April 2, 1934, in the northern limestone section of Vanua Mbalavu.

DISTRIBUTION: Fiji and Tonga; in Fiji it is thus far known from comparatively few collections from the two large islands and Vanua Mbalavu in the Lau Group. In Tonga it seems rare, being known from Vava'u: *Buelow 1603* (BISH, CHR 361336).

LOCAL NAME AND USE: On the large islands the name *sarosaro* is consistently used for this species, said to be a useful timber tree; its trunk doubtless acquires a greater diameter than recorded above.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4609*. SERUA: Nathengathenga Creek, upper Navua River, *DF 1119 (Damanu 217)*; Nambukelevu, upper Navua River, *DA 15660*. NAMOSI: Nambukavesi Creek, *DF 338 (Vaiseva 12)*. NAITASIRI: Upper Navutuvula Village, Waimanu River, *Berry 72*; Waimanu River, *DA L.13318 (Berry 56)*. VANUA LEVU: THAKAUNDROVE: Valeni, Nasavu Creek, *DA 15721*; Navonu Creek, Natewa Peninsula, *Howard 91*.

Planchonella membranacea and *P. pyrulifera*, although closely related to one another, are readily separated on the basis of characters mentioned in my key. They seem well differentiated from other species of the genus in the Fijian Region in having the tertiary nervation of the leaf blades predominantly transverse, in this respect agreeing with *P. samoensis* Lam ex Christophersen (of Samoa, the Horne Islands, Tonga, and Niue); however, the latter species has the leaf blades with comparatively coarse venation, whereas the veinlet reticulation of the two related species is very fine and usually sharply prominulous. *Planchonella samoensis* is characterized by having

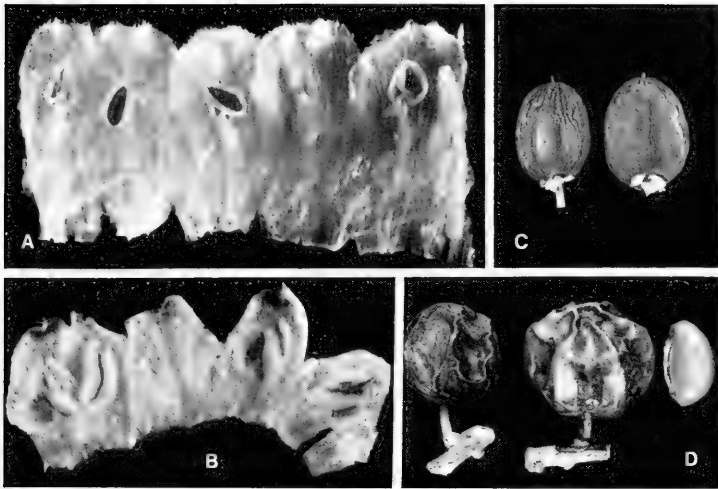


FIGURE 202. A, *Planchonella garberi*, opened corolla, with 1 anther removed, $\times 8$. B, *Planchonella vitensis*, opened corolla, with 1 anther removed, $\times 8$. C, *Planchonella membranacea*, mature fruits, $\times 1$. D, *Planchonella pyrulifera*, mature fruits and a seed, $\times 1$. A from DA 16296, B from Smith 9419, C from Smith 1491, D from Smith 8322.

comparatively long petioles (15–30 mm. long, and much longer on juvenile leaves), flowers very densely aggregated (7–20 per inflorescence) and with pedicels 6–15 mm. long, and ellipsoid fruits about twice as long as broad (up to 35×18 mm.). Since Christophersen (in Bishop Mus. Bull. 154: 35. fig. 10. 1938) did not indicate a type specimen, I herewith select from among his syntypes: *Christophersen 2628* (BISH LECTOTYPE and 2 ISOLECTOTYPES), collected in flower Sept. 18, 1931, between Salailua and Lataitai, Savaii. Prior uses of the epithet *samoensis* by Reinecke and Lam were in nomina nuda.

9. *Planchonella pyrulifera* (A. Gray) Lam ex van Royen in Blumea 8: 381. fig. 40. 1957; J. W. Parham, Pl. Fiji Isl. 164. 1964, ed. 2. 231. 1972. FIGURES 196C, 202D.

Sapota pyrulifera A. Gray in Proc. Amer. Acad. Arts 5: 328. 1862; Seem. Viti, 439. 1862, Fl. Vit. 151. 1866.

Sideroxylon pyruliferum Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Mar. Pac. 229. 1892.

Planchonella oxyedra sensu Lam in Blumea 5: 13, p. p. minore, quoad spec. vit. 1942; non Dubard.

A sometimes buttressed tree (2-) 3–30 m. high, with copious white latex and a trunk up to 1 m. in diameter, found in usually dense forest at elevations of 100–900 m. The calyx is said to be greenish, the corolla pale yellow or white, and the fruits deep purple to black. Flowers and fruits have been obtained between November and August.

TYPEIFICATION: The type is *U. S. Expl. Exped.* (US 61992 HOLOTYPE; ISOTYPE at GH), collected in 1840 on Ovalau.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands. I had identified several other collections deposited only at SUVA as this species, but they are not here cited because I have not re-checked them.

LOCAL NAMES AND USE: Like the preceding, this species is uniformly known as *sarosaro*; Parham has also recorded the name *yawe* (probably taken from one of the above-mentioned collections at SUVA). It is considered a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Vicinity of Mbelo, near Vatukarasa, *Degener 15290*. TAILEVU: Tailevu road, DA 332. VANUA LEVU: THAKAUNDROVE: Savusavu Bay region, *Degener & Ordonez 13965*. TAVEUNI: Borders of lake east of Somosomo, *Smith 920*; slopes of Mt. Manuka, east of Wairiki, *Smith 8169, 8322*. FIJI without further locality, *Gillespie 3492, Howard 118*.

DESCRIPTION OF NEW SPECIES OF PLANCHONELLA

2. *Planchonella brevipes* A. C. Sm., sp. nov.

Frutex 3-4 m. altus, indumento sericeo partium juvenilibus pilis aureo-fuscis 2-armatis 0.2-0.4 mm. longis composito; ramulis juvenilibus obtuse angulatis 2-3 mm. diametro, mox glabratis subteretibus validioribus cinereis sparsim lenticellatis; foliis ramulorum apices versus saepe congestis cito glabratis, petiolis 1-2.5 cm. longis basim versus gracilibus (1-2 mm. diametro) paulo canaliculatis superne incrassatis complanatis coriaceo-alatis; foliorum laminis coriaceis obovatis, (3-) 4-8.5 cm. longis, (1.5-) 2-4 cm. latis, basi gradatim attenuatis et in petiolum longe decurrentibus, apice leviter emarginatis vel rotundatis vel obtuse et breviter cuspidatis, margine recurvatis vel anguste revolutis, costa valida utrinque prominenti, nervis secundariis utrinsecus 6-8 curvatis patentibus utrinque elevatis arcus marginales vadose crenatos 1-2 mm. intra marginem formantibus, nervis tertiariis principalibus manifestis ut rete venularum supra obtuse subtus valde prominulis; inflorescentiis axillaribus fasciculatis (2-) 3-6-floris, bracteis paucis lanceolatis ad 1 mm. longis extus sericeis subtentis; pedicellis teretibus cernuis crassis (0.7-1 mm. diametro superne incrassatis) sub anthesi 3-4.5 mm. longis sericeis; calyce late cupuliformi ad 2 mm. longo et 3 mm. diametro fere ad basim 5-lobato, lobis late ovatis chartaceis superne submembranaceis, extus sericeis et subglabratis, intus glabris, apice rotundatis, margine breviter ciliolatis; corolla glabra submembranacea rotato-cupuliformi circiter 2.5 mm. longa, lobis 5 oblongo-rotundatis tubo longitudine subaequalibus copiose flabellinerviis; staminibus glabris tubi medio insertis, filamentis 0.3-0.5 mm. longis, antheris oblongo-ovoides 0.7-1 mm. longis; staminodiis gracilibus subulatis 0.5-0.7 mm. longis; gynoecio sub anthesi 1-1.5 mm. longo, ovario late ovoideo sparsim aureo-sericeo, stylo conico ad 0.5 mm. longo truncato. HOLOTYPE: FIJI: VANUA LEVU: THAKAUNDROVE: *Smith 683* (BISH).

2. *CHRYSOPHYLLUM* L. Sp. Pl. 192. 1753.

Trees or shrubs, the leaves alternate, the blades with straight or curved secondary nerves, in our species to 20 × 9 cm., persistently reddish- to golden brown-sericeous beneath; inflorescences fasciculate, often many-flowered, axillary or borne on branchlets below leaves; flowers pedicellate to sessile, basically 5-merous; calyx with 5 (4-6) lobes, these spirally arranged, usually glabrous within, in our species closely ferruginous-sericeous without; corolla usually exerted from calyx, the lobes 5 (4-11), equalling or longer than tube (corolla in our species 3-5 mm. long, the lobes rufous-sericeous without except near margins); stamens as many as corolla lobes, inserted in corolla throat; staminodes none; disk usually lacking; ovary pubescent to glabrous, 5(4-12)-locular (7-12-locular in our species); fruit often juicy, subglobose to obovoid, the pericarp thick to very thin, the seeds 1-8, the scar large and basilateral or long, narrow or broad, and lateral, the endosperm well developed, the cotyledons thin.

TYPE SPECIES: *Chrysophyllum cainito* L., the only original species.

DISTRIBUTION: Tropical and subtropical America, tropical West Africa, and south-eastern Asia to Australia and New Caledonia, with about 100 species. One species is occasionally cultivated in Fiji.

USEFUL TREATMENTS OF GENUS: Cronquist, A. Studies in the Sapotaceae—V. The South American species of *Chrysophyllum*. Bull. Torrey Bot. Club 73: 286-311. 1946. Vink, W. Revision of the Sapotaceae of the Malaysian area in a wider sense. XIII. *Chrysophyllum* L. Blumea 9: 21-74. 1958.

1. *Chrysophyllum cainito* L. Sp. Pl. 192. 1753; Christophersen in Bishop Mus. Bull. 128: 171. 1935; J. W. Parham in Agr. J. Dept. Agr. Fiji 19: 102. 1948; Vink in Blumea 9: 26. 1958; Yuncker in Bishop Mus. Bull. 220: 212. 1959; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972; B. E. V. Parham in New Zealand Dept. Sci. Indust. Res. Inform. Ser. 85: 102. 1972.

As seen in Fiji, *Chrysophyllum cainito* is a tree 5–12 m. high, with white latex, occasionally cultivated near sea level; where indigenous the tree attains a height of 30 m. Its corolla is purplish white, its fruit 5–12 cm. in diameter, green to purplish, and its seeds 4–8, embedded in white pulp, brown, obliquely obovoid and flattened, with a broad lateral scar.

TYPIFICATION: Linnaeus based his description on various prior publications.

DISTRIBUTION: Southern Mexico to northern South America and throughout the West Indies. The species is so widely cultivated and naturalized in America that its place of origin is uncertain; it is generally assumed to have originated in the Greater Antilles, but now it is cultivated throughout the tropics.

LOCAL NAMES AND USES: *Star apple* and *cainito* are perhaps the most common among many names applied to the species. The soft, white, sweet pulp of the fruit is edible, and the tree is also quite ornamental.

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Singatoka, DA 9664. NAITASIRE: Nasinu, DA 1558, 3125. REWA: Suva, DA 1587; the species was growing in the Suva Botanical Gardens in 1948 (J. W. Parham, cited above). TAVEUNI: Gillespie 4637.

3. *Calocarpum* Pierre in Urb. Symb. Antill. 5: 97. 1904; Baehni in Candollea 7: 427. 1938, in Boissiera 11: 106. 1965.

Calospermum Pierre, Not. Bot. Sapot. 11. 1890; non *Calospermum* Raf.

Trees, the leaves alternate, clustered toward ends of branchlets, the blades with prominent, straight secondary nerves, in our species oblanceolate, to 30 × 10 cm., attenuate toward base; inflorescences fasciculate, borne on branchlets below leaves, the flowers subsessile; calyx with (6–) 9 (–12) lobes, these spirally arranged, imbricate, the inner ones larger than the outer; corolla with 5 lobes slightly longer than tube; stamens 5, inserted at apex of corolla tube; staminodes 5; ovary conical, 5- or 6-locular; fruit large, ovoid to ellipsoid, the seeds usually solitary (sometimes 2), large, elliptic, the scar long and broad, the endosperm lacking or scanty, the cotyledons thick.

TYPE SPECIES: *Calocarpum mammosum* (L.) Pierre (*Achras mammosa* L., nom. illeg.; *Calospermum mammosum* Pierre) = *Calocarpum sapota* (Jacq.) Merr. (*Sideroxylum sapota* Jacq.).

DISTRIBUTION: America from Mexico to tropical South America, with about five species, one of which is infrequently cultivated in Fiji.

USEFUL (nomenclatural) TREATMENT OF GENUS: Moore, H. E., Jr., & W. T. Stearn. The identity of *Achras zapota* L. and the names for the sapodilla and the sapote. Taxon 16: 382–395. 1967.

1. *Calocarpum sapota* (Jacq.) Merr. Enum. Philipp. Fl. Pl. 3: 284. 1923.

Achras zapota L. Sp. Pl. 1190, p. p., quoad syn. Sloanei et Plukenetii, syn. Plumieri excl. 1753.

Sideroxylum sapota Jacq. Enum. Syst. Pl. Carib. 15. 1760.

Achras zapota major Jacq. Select. Stirp. Amer. 56. t. 182, fig. 19. 1763.

Pouteria sapota H. E. Moore & Stearn in Taxon 16: 383. 1967; J. W. Parham, Pl. Fiji Isl. ed. 2. 232. 1972.

As infrequently cultivated in Fiji, *Calocarpum sapota* has been noted as a tree 5–7 m. high near sea level. Where indigenous it attains a height of 30 m. and has a trunk 60 cm. or more in diameter. The sepals are heavily brownish-pubescent, the corolla white to pale yellow, and the mature fruit to 15 × 10 cm., brown, with shining brown seeds

embedded in reddish pulp. The only available collection from Fiji bore flowers and immature fruits in October.

TYPIFICATION AND NOMENCLATURE: Jacquin in 1760 based his diagnosis of *Sideroxylum sapota* on his own West Indian material, citing Sloane's plate (Voy. Jam. Nat. Hist. 2: t. 218. 1725). His supplementary description of 1763 was detailed and indicated that his 1760 diagnosis referred to the *sapote*. Sloane's plate, reproduced by Moore and Stearn (1967, cited above under the genus, p. 394, fig. 7), may be considered illustrative of *S. sapota* Jacq. (Stearn in Taxon 17: 240. 1968). The complex synonymy and typification of the *sapote* are clarified by Moore and Stearn, who cite many additional synonyms and who prefer to place the species in a comprehensive genus *Pouteria* rather than to maintain *Calocarpum* as a distinct genus as proposed by Pierre, Merrill, and Baehni among many others.

DISTRIBUTION: Probably indigenous in Central America, now widely cultivated throughout the tropics.

LOCAL NAMES AND USE: *Sapote* and *mammee sapote* are perhaps the names in widest use, among many others, for the species. The pulp of the fruit can be eaten raw or used in preserves, etc.

AVAILABLE COLLECTION: VITI LEVU: NANDRONGA & NAVOSA: Agricultural Station, Nathotholevu, DA 17432.

4. BURCKELLA Pierre, Not. Bot. Sapot. 3. 1890; Lam in Blumea 5: 36. 1942; Lam & van Royen in op. cit. 6: 580. 1952.

Trees, often large and with stout branchlets, the stipules subulate or narrowly deltoid, caducous; leaves often congested toward apices of branchlets, the blades chartaceous to coriaceous, usually obovate to obovate-oblong, often with prominent secondary nerves; inflorescences pseudoterminal (composed of flowers congested toward apices of branchlets) and many-flowered or axillary and composed of 1-few flowers, the flowers usually long-pedicellate; calyx with 2 whorls of lobes, each whorl with 2 lobes; corolla exserted from calyx, the tube and lower parts of lobes often pilose, the lobes 8, imbricate, as long as or longer than tube; stamens 9-40, 1-3-seriate in corolla throat, the filaments usually conspicuously strigose, the anthers mucronulate; staminodes none; disk sometimes present, annular, indistinct; ovary glabrous and usually conical, 3-8-locular, the ovules attached at or toward apices of placentas, the style subulate, glabrous, exserted from corolla, truncate or inconspicuously lobed; fruit large, frequently 1-seeded, the style long-persistent, the seed(s) ovoid, with a long and broad scar, the hilum apical, the testa thick, crustaceous, the endosperm lacking or scanty, the cotyledons fleshy.

LECTOTYPE SPECIES: No type species has been indicated in ING (1979). Pierre listed some five species, all from New Guinea; four of these were combined by Lam and van Royen in *Burckella obovata* (Forst. f.) Pierre, which would be the appropriate lectotype species, especially as Pierre's fifth species, *B. may*, seems to be based on a nomen nudum and is questionably referred to *B. macropoda* (Krause) Lam by Lam and van Royen.

DISTRIBUTION: Malesia (Moluccas eastward) to Tonga (apparently only cultivated in Samoa), with about twelve species. Five species are believed indigenous in Fiji (four of them endemic), and an additional one is cultivated.

USEFUL TREATMENT OF GENUS: Lam, H. J., & P. van Royen. *Burckella* Pierre. *Blumea* 6: 580-593. 1952.

KEY TO SPECIES

Flowers comparatively small, the pedicels slender (0.5–1 mm. in diameter at anthesis); calyx 3–8 mm. long; corolla 6–15 mm. long; stamens uniseriate, 9–20, the filaments less than 6 mm. long, the anthers less than 4 mm. long; style 8–30 mm. long; comparatively slender plants, the branchlets 2–6 mm. in diameter distally; petioles 5–40 mm. long, 1–3 mm. in diameter; leaf blades 4–25 × 1.5–10 cm., the secondary nerves 6–20 per side.

Leaf blades not more than 12 × 5 cm., acute to bluntly cuspidate at apex; pedicels and calyx copiously strigose, the pedicels 13–42 mm. long; corolla lobes 1–2 times longer than tube, oblong-obovate to oblanceolate or spatulate, but not auriculate nor fimbriate proximally; stamens 11–16; indigenous species.

Flowers solitary or paired in axils of distal leaves or of their scars; calyx 4–5 mm. long, the lobes glabrous within; corolla about 6 mm. long, the lobes about as long as tube; stamens 11–13, comparatively small, the filaments and anthers each about 1 mm. long; style not more than 10 mm. long; petioles 5–25 mm. long; leaf blades oblong, 6–12 × 2–5 cm., abruptly contracted at base, with 10–15 secondary nerves per side. 1. *B. hillii*

Flowers aggregated in lax whorls of 5–20 below terminal bud; calyx 5–8 mm. long, the lobes finely sericeous within; corolla 12–14 mm. long, the lobes about twice as long as tube; stamens about 16, the filaments 3–6 mm. long, the anthers 3–4 mm. long; style 20–30 mm. long; petioles 10–35 mm. long; leaf blades elliptic or lanceolate, 4–9 × 1.5–3 cm., gradually attenuate at base, with 6–12 secondary nerves per side. 2. *B. parvifolia*

Leaf blades usually larger, (5–) 7–25 × (2–) 3.5–10 cm., obtuse to attenuate at base, rounded to bluntly acuminate at apex; pedicels 8–30 mm. long; corolla lobes about twice as long as tube, elliptic-spatulate or obovate, auriculate (or at least abruptly broadened) and fimbriate slightly above base; stamens 9–20; style 12–25 mm. long.

Flowers 8–20 congested near apices of branchlets, the pedicels and calyx glabrous or minutely and evanescently sericeous at anthesis, the pedicels 8–25 mm. long; calyx 5–6 mm. long; corolla 11–15 mm. long, glabrous or essentially so; stamens (12–) 16–20, the filaments (3–) 4–5 mm. long, the anthers 2–3.5 mm. long; leaf blades elliptic to elliptic-obovate, (5–) 7–14 × (2–) 3.5–6 cm., rounded (or slight emarginate to broadly obtuse) at apex, with 6–12 (–14) secondary nerves per side, the petioles 7–40 mm. long; indigenous species. 3. *B. richii*

Flowers 30–45 congested near apices of branchlets, the pedicels and calyx copiously sericeous at anthesis, the pedicels 10–30 mm. long; calyx 3–5 mm. long; corolla 8–14 mm. long, copiously strigose without at least on upper portion of tube and lower portion of lobes; stamens 9–16, the filaments 3–4 mm. long, the anthers 3–4 mm. long; leaf blades obovate, 10–25 × 4.5–10 cm., bluntly cuspidate to bluntly acuminate at apex, with 11–20 secondary nerves per side, the petioles 20–40 mm. long; cultivated only. 4. *B. obovata*

Flowers comparatively large, aggregated in lax whorls of 8–20 toward apices of branchlets, the pedicels 17–35 mm. long, stout (1.5–3 mm. in diameter at anthesis); calyx (8–) 10–13 mm. long; corolla 20–25 mm. long, the lobes about as long as tube; stamens usually 2- or 3-seriate, 25–40, the filaments 7–10 mm. long, copiously pilose, the anthers 4.5–5 mm. long; style 20–42 mm. long; comparatively robust plants, the branchlets 5–15 mm. in diameter distally; petioles 10–80 mm. long, (1.5–) 2–5 mm. in diameter; leaf blades (9–) 12–37 × (4–) 5–15 cm., elliptic or oblong to elliptic-obovate, obtuse to rounded at base, rounded to obtusely cuspidate at apex, the secondary nerves 10–30 per side; indigenous species.

Young vegetative and inflorescence parts closely sericeous, the hairs golden or pale or dark brown, 2-armed, essentially sessile, the hair body 0.1–0.5 mm. long, slender (0.01–0.02 mm. thick), the indument fugacious except on pedicels and calyces (there copious and persistent); petioles (10–) 15–80 mm. long; corolla glabrous without; stamens 25–30; style 35–42 mm. long; fruits ellipsoid, obovoid, or subglobose, 40–80 × 25–80 mm., subacute to obtuse at base, similar or rounded at apex, the style eventually deciduous. 5. *B. fijiensis*

Young vegetative and inflorescence parts tomentose, the hairs ferruginous, 2-armed, stalked (stalk 0.05–0.1 mm. long), the hair body 0.3–1 mm. long, tumid (0.03–0.05 mm. thick), the indument long-persistent on distal branches, petioles, lower leaf blade surfaces, pedicels, and calyces; petioles 10–30 mm. long; corolla pilose without; stamens about 40; style 20–30 mm. long. 6. *B. thurstonii*

1. *Burckella hillii* (Horne ex Baker) Lam in *Blumea* 5: 38. 1942; Lam & van Royen in op. cit. 6: 583, fig. 1. 1952; van Royen in op. cit. 8: 203. 1957; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972.

Payena hillii Horne, A Year in Fiji, 266, nomen nudum. 1881.

Payena hillii Horne ex Baker in J. Linn. Soc. Bot. 20: 368. 1883; Lam in Bull. Jard. Bot. Buitenzorg III. 7: 151. 1925.

A slender tree 10–12 m. high, with sparse white latex, found from near sea level to an elevation of about 200 m. in usually dense forest. This rare species has been collected in flower in March and April.

TIPIFICATION: The type is *Horne 484* (K HOLOTYPE), collected in March, 1878, on the island of Rambi. Mr. Hill (initials unknown) was at that time the proprietor of the island.

DISTRIBUTION: Endemic to Fiji and apparently infrequent, known only from Rambi and from a limited area in eastern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Waindina River, *DA 179*; near Nathokaika, Rewa River, *DA 916*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7187*.

Burckella hillii, well described and illustrated by Lam and van Royen in 1952, is an extremely distinct species, well characterized by its few and very small stamens. This species and the next, *B. parvifolia*, although not really closely allied to one another, must have been isolated in Fiji for such an extended period that their relationship to other Malesian-Pacific *Burckellae* is tenuous.

2. *Burckella parvifolia* A. C. Sm. & S. Darwin in *Brittonia* 27: 170. fig. 11–13. 1975.

An infrequent large tree to 30 m. high, with a trunk to more than 50 cm. in diameter and maroon-colored bark, occurring in usually dense forest at elevations of 120–275 m. Flowers have been obtained in August and December.

TIPIFICATION: The type is *DF 506 (Damanu 145)* (BISH HOLOTYPE; ISOTYPES at K, MASS, SUVA), collected Dec. 13, 1962, inland from Namboutini, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from hills near the coast of southeastern Viti Levu.

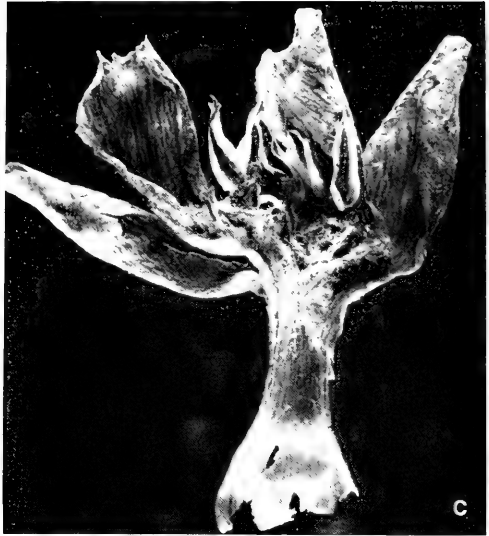
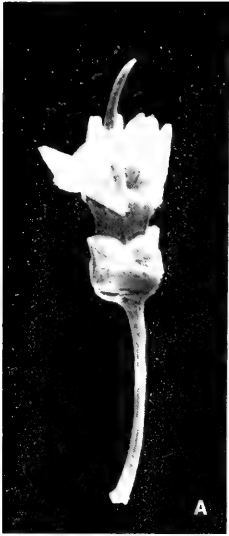
LOCAL NAMES AND USE: The names *mbau sa* and *mbau mika* have been recorded, and the species is a potential timber tree, like most large species of Sapotaceae; however, one collector indicates that the reddish wood is hard and is rejected by saw mills.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Nathengathenga Creek, upper Navua River, *DA L.13317 (Berry 80)*; inland from Namboutini, *DA 12216 (Watkins 734)*. REWA: Slopes of Mt. Korombamba, *DA L.33288*.

The Mt. Korombamba collection, made by S. Vodonaivalu in July, 1980, is sterile but may be referred here with confidence. It extends the known range of this very distinctive species from the coastal hills of Serua Province to those of Rewa Province, a local distribution noted for several rare taxa.

3. *Burckella richii* (A. Gray) Lam in *Blumea* 6: 592. 1952; Yuncker in *Bishop Mus. Bull.* 220: 210. 1959. FIGURE 203A & B.

FIGURE 203. A & B, *Burckella richii*, from *Smith 1474*; A, flower, $\times 2$; B, half of longitudinally sectioned corolla, showing stamens, $\times 4$. C & D, *Burckella fijensis*, from *Gillespie 3430*; C, half of longitudinally sectioned corolla, showing stamens, many with anthers lacking, $\times 4$; D, flower, $\times 2$.



Isonandra richii A. Gray in Proc. Amer. Acad. Arts 5: 327. 1862; Lam in Bull. Jard. Bot. Buitenzorg III. 7: 259. 1925.

Bassia retusa Rich ex A. Gray in Proc. Amer. Acad. Arts 5: 327, pro syn. 1862.

Burckella microphylla Lam & van Olden in Bishop Mus. Bull. 154: 34, pl. 1, B. 1938; Lam in Blumea 5: 39. 1942; Lam & van Royen in op. cit. 6: 586. 1952.

Burckella brachypoda Lam in Blumea 5: 36, fig. 8 (err. *B. macropoda*). 1942; Lam & van Royen in op. cit. 6: 583. 1952; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972.

As known in Fiji, *Burckella richii* is a rare, buttressed tree 25–35 m. high, with white latex, occurring from near sea level to about 200 m. in forest on limestone. In Tonga it has been noted as up to 15 m. high, with a trunk up to 75 cm. in diameter. The corolla and filaments are white, and flowers have been obtained only in April. In Tonga flowers have been collected between January and July; in Samoa flowers were obtained in October and fruits in August.

TIPIFICATION AND NOMENCLATURE: The type of *Isonandra richii* is *U. S. Expl. Exped.* (US 65307 HOLOTYPE), collected in April or May, 1840, on Tongatapu, Tonga; that of *Burckella microphylla* is *Crosby 102* (K HOLOTYPE), collected in January, 1892, on Vava'u, Tonga; and that of *B. brachypoda* is *Smith 1474* (BISH HOLOTYPE; many ISOTYPES), collected April 2, 1934, in the northern limestone section of Vanua Mbalavu. As to the last name, Lam cited the specimens at BISH and L without indicating a holotype; I have noted this as at BISH, which holds the first set of my 1933–1934 collection. With the present availability of good specimens from Tonga, it is readily seen that the three types do not differ from one another to any consequential degree.

DISTRIBUTION: Tonga (ample material is now known from seven islands between Niuatoputapu and 'Eua) and Fiji (known only from Vanua Mbalavu in the Lau Group); apparently known only in cultivation in Samoa (Savaii). The type of *Burckella brachypoda* is the only Fijian collection that I refer to *B. richii*.

LOCAL NAMES: No name was noted in Fiji; in Tonga the species is known as *kau*, in Samoa as *au*.

The description of *Burckella richii* by Lam and van Royen in 1952 is based only on the somewhat depauperate holotype; that of *B. microphylla* by Lam and van Olden in 1938 is more in accord with the many Tongan collections now at hand. In first discussing *B. microphylla*, Lam suggested its relationship to *B. amicorum* (A. Gray) Lam (comb. nov. in op. cit., 1938, p. 35) and implied that it occurred in the New Hebrides and Fiji as well as in Tonga and Samoa. However, he later distinguished the Fijian and New Hebridean material as *B. brachypoda*. *Burckella amicorum* (Lam in 1942, p. 41) is now dismissed as a mixture, with leaves of *Planchonella* and flowers of *Palaquium*. The type collection of *B. brachypoda* was associated by Lam in 1942 with a fruiting specimen from Kandavu, *Smith 82*, which I have no hesitation in referring to *B. fijiensis* because of the copious indument of its stout pedicels and large calyx and its elongate style. The New Hebridean specimen placed in *B. brachypoda* by Lam, *Comins 320*, doubtless represents *B. obovata* (Forst. f.) Pierre. As noted below, the latter species occurs in cultivation in Fiji.

Burckella richii and *B. obovata* are doubtless closely related, but they may be separated as noted in my key, with particular reference to the average size, apex, and number of secondaries of leaf blades, the number of flowers per inflorescence, the indument of pedicel and calyx and the size of the latter, and other minor points; none of these differences are very striking, but taken together they point to an eastward attenuation of diversity which seems well recognized at the specific level.

4. *Burckella obovata* (Forst. f.) Pierre, Not. Bot. Sapot. 4. 1890; Lam in Blumea 5: 40. 1942; Lam & van Royen in op. cit. 6: 588. 1952.

Bassia obovata Forst. f. Fl. Ins. Austr. Prodr. 35. 1786; Guillaumin in J. Arnold Arb. 13: 16. 1932.

Burckella obovata is known in Fiji only as a rarely cultivated tree; flowers have been noted in January.

TIPIFICATION AND NOMENCLATURE: The type of *Bassia obovata* is *J. R. & G. Forster* (K LECTOTYPE, cited as type specimen by Lam and van Royen in 1952), collected during Cook's second voyage on Tanna, New Hebrides. An extended synonymy and discussion of the species are provided by Lam and van Royen.

DISTRIBUTION: Moluccas, New Guinea, Solomon Islands, and New Hebrides; one collection of a cultivated plant is known from Fiji.

USE: Presumably introduced as an ornamental tree.

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva, in private garden, DA 16084.

The only recorded collection of *Burckella obovata* in Fiji was made in January, 1969, in the garden of the second Sir Maynard Hedstrom on the outskirts of Suva. It may be noted that this garden was developed as "Thornbury" by J. B. Thurston toward the end of the nineteenth century. Where native, *B. obovata* is a large forest tree with abundant white or cream-colored flowers. Since the SUVA specimen is now a fairly mature tree, it may have been introduced by Thurston, although no Sapotaceae are listed in his *Catalogue* (cf. Vol. 1 of this *Flora*, pp. 47, 87).

5. *Burckella fijiensis* (Hemsl.) A. C. Sm. & S. Darwin in Brittonia 27: 169. 1975.

FIGURE 203C & D.

Chelonespermum fijienae Hemsl. in Ann. Bot. 6: 207. pl. 13, fig. 6-9. 1892; van Royen in Nova Guinea n. s. 10: 139. fig. 3, c-e. 1959; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972.

Burckella thurstonii sensu Gillespie in Bishop Mus. Bull. 74: 12, quoad spec. cit. et fig. 13. 1930; J. W. Parham, Pl. Fiji Isl. 162. fig. 61, C. 1964, ed. 2. 227. fig. 66, C. 1972; non Lam.

Burckella macrantha Lam in Blumea 5: 39. fig. 9. 1942.

Burckella macropoda var. *macrantha* Lam & van Royen in Blumea 6: 586. 1952; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972.

Burckella multinervis Lam in Lam & van Royen in Blumea 6: 586. fig. 2. 1952; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 227. 1972.

A tree with abundant white latex, attaining a height of at least 25 m. and with a trunk to 30 cm. (and doubtless more) in diameter, occurring from near sea level to an elevation of 825 m. in dense forest and on its edges, and also introduced into cultivation locally. The corolla is white, and the brown fruits attain a diameter of 6-8 cm. when mature. Flowers and fruits have been collected between June and January.

TIPIFICATION AND NOMENCLATURE: The type of *Chelonespermum fijienae* is *Horne 1140* (K HOLOTYPE), collected in September, 1878, near Salialailai, on the southeastern coast of Taveuni; that of *Burckella macrantha* is *Smith 1980* (BISH HOLOTYPE; many ISOTYPES; BISH and L specimens were cited by Lam but the first is here indicated because it is in the first set of this series), obtained June 15, 1934, on Mt. Uluingala, Natewa Peninsula, Thakaundrove Province, Vanua Levu; and that of *B. multinervis* is *Smith 5631* (L HOLOTYPE; many ISOTYPES; L and US specimens were cited by Lam but the first set of this series is at A), collected Aug. 11, 1947, on the northern portion of the Rairaimatuku Plateau, between Nandrau and Rewasau, Nandrunga & Navosa Province, Viti Levu. The three types concerned are scarcely distinguishable, although that of *B. macrantha* has fewer secondaries than the others, but it falls well within the extremes of the species in this respect.

DISTRIBUTION: Endemic to Fiji and the most frequently collected *Burckella* there, known from 25 collections on five of the high islands.

LOCAL NAMES AND USES: This well-known species is recorded on Viti Levu as *mbau ndina*, *mbau loa*, *mbau sa*, *mbau somi*, *mbau vundi*, and *mbawaki*. On Kandavu I noted the name *mbulu*. It is considered a useful timber tree, and the wood is sometimes used for spears.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Naloto Range, Mangondro Tikina, *DA 14757*. NANDRONGA & NAVOSA: Navau Creek, upper Navua River, *Howard 7*. SERUA: Nathengathenga Creek, upper Navua River, *DF 1106*. NAMOSI: Between Lombau River and Nambukavesi Creek, *DF 554*. NAITASIRI: South of Matawailevu, Wainimala River, *St. John 18242*; Waimanu River, *DA L.12667 (Berry 34)*; vicinity of Nasinu, *Gillespie 3430*. REWA: Suva, in private garden, brought in from wild, *DA 10815*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 82*. OVALAU: Lovoni Valley, *DA 13296*; hills above Levuka, *Gillespie 4516* (err. cit. Gillespie, 1930, as 4515). VANUA LEVU: MATHUATA: Mountains along coast, *Greenwood 655*. THAKAUNDROVE: Inland from Ndakunimba, Natewa Peninsula, *Howard 117*.

Burckella fijiensis and *B. thurstonii* are at once distinguished from other Fijian species of the genus by their robust facies, large leaves with more numerous secondary nerves (although leaf nervation is too variable a character in *Burckella* to be trusted), much larger flowers, and more numerous stamens. The two species are readily distinguished from one another, even when sterile, by their different indument. In the 1952 treatment of Lam and van Royen, too much weight seems to be given to the number of secondary nerves, a character that artificially separates *B. multinervis* and *B. macropoda* var. *macrantha* (both here referred to *B. fijiensis*). The relationship of *B. fijiensis* may indeed be distantly with *B. macropoda* (Krause) Lam, of New Guinea, but that species differs conspicuously in its slender, glabrous pedicels and glabrous calyx, much smaller corolla, and smaller, fewer stamens. *Burckella fijiensis* and *B. thurstonii* seem to constitute a fairly isolated pair of species within the genus. Lam and van Royen did not see developed corollas of *B. macrantha* and hence did not realize how strikingly it differs from *B. macropoda*.

6. *Burckella thurstonii* (Hemsl.) Lam in Bull. Jard. Bot. Buitenzorg III. 7: 259. 1925, in op. cit. 8: 423. 1927, in *Blumea* 5: 41. 1942; Lam & van Royen in op. cit. 6: 592. 1952; van Royen in *Nova Guinea* n. s. 10: 131. 1959; J. W. Parham, *Pl. Fiji Isl.* 162, *solum quoad nomen*. 1964, ed. 2. 227, *solum quoad nomen*. 1972.

Bassia thurstonii Hemsl. in Hook. Icon. Pl. 26: pl. 2569. 1898.

A tree to 15 m. high (as recorded, but doubtless larger), found in forest at elevations of 150–300 m. The brown fruit attains a diameter of at least 5 cm. and has been collected in April.

TIPIFICATION: The type is *Thurston* (K HOLOTYPE), collected in August, 1894, in Fiji without further data. The holotype, in flower, consists of two good specimens; Hemsl. opined that it was "probably from the island of Suva," also suggesting that the accompanying testa of a seed (not now located) represented a species of *Chelonespermum*, probably *C. unguiculatum* Hemsl. However, Thurston was doubtless correct in associating the seed fragment with his material.

DISTRIBUTION: Endemic to Fiji and thus far known with certainty only from southeastern Viti Levu.

LOCAL NAMES AND USE: Fijian collectors have recorded the names *mbau vundi*, *mbau ka*, and *mbawaki*, indicating the species as a timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Below Naroyalewa Village, *DA 2402*; Tholo-i-suva, *DA 1469*, *Vukicea*, July 6, 1950.

5. *PALAQUIUM* Blanco, Fl. Filip. 403. 1837; Lam in *Blumea* 5: 31. 1942; van Royen in op. cit. 10: 433. 1960.

Trees, the stipules small or infrequently large, usually caducous, rarely lacking; leaves scattered along branchlets or congested toward their apices (as in our species), the blades often obovate, with prominent or inconspicuous secondary nerves (these 7-15 per side in our species), the tertiary nervation transverse or subparallel to secondaries, obscure or prominulous; inflorescences axillary or borne on branchlets below leaves, fasciculate or composed of solitary flowers (in our species flowers 1-10 together), sometimes pseudoterminal, bracteate, the flowers usually (always in our species) 3-merous; calyx with 2 whorls of lobes, each whorl with 3 (very rarely 2, but not in Fiji) lobes (or lobes very rarely 5 or 7, spirally arranged, and imbricate); corolla tube shorter than calyx, the limb (4- or 5)6-lobed, the lobes imbricate, often contorted; stamens 12-18 (in all our species, but elsewhere infrequently 6-36), 1-3-seriate in corolla throat, the anthers with a prolonged connective; staminodes none; ovary 6 (infrequently 5-11)-locular, the ovules pendulous, the style subulate; fruit with the pericarp carnosous or woody, the seeds 1-3, the scar large (often covering half the surface), very rarely narrow, the hilum apical, the testa crustaceous to coriaceous, the endosperm lacking or scanty, the cotyledons thick, fleshy.

LECTOTYPE SPECIES: *Palaquium lanceolatum* Blanco (vide Merrill in Publ. Bur. Sci. Gov. Lab. 6: 15. 1904).

DISTRIBUTION: India, Formosa, and southeastern Asia through Malesia and eastward in the Pacific to Samoa, with about 115 species. Four species are known from Fiji, all endemic. The species recorded from Tahiti (cf. Grant, Fosberg, and H. M. Smith in Smithsonian Contr. Bot. 17: 25. 1974) is referable to *Nesoluma nadeaudii* (Drake) Pierre ex Lam.

USEFUL TREATMENT OF GENUS: Royen, P. van. Revision of the Sapotaceae of the Malaysian area in a wider sense. XXIII. *Palaquium* Blanco. *Blumea* 10: 432-606. 1960.

The Fijian species do not seem very closely related to those of neighboring areas, nor to each other (except for *Palaquium hornei* and *P. porphyreum*), suggesting a long period of archipelagic isolation for this genus in the area between the New Hebrides and Samoa.

KEY TO SPECIES

Pedicels and calyx glabrous or soon glabrate (sometimes closely strigose or sericeous at anthesis); young branchlets and petioles glabrous or soon glabrate (sometimes puberulent or sericeous in young stages); leaf blades glabrous (or, if sericeous when young, soon glabrate).

Comparatively slender plants, the branchlets 1.5-5 mm. in diameter toward apex; petioles 3-15 mm. long, slender, 1-2 mm. in diameter; leaf blades thin-coriaceous, 6-13 × 2-5 cm., drying dark brown on both sides, cuneate at base and decurrent on petiole, rounded or faintly emarginate to obtusely short-acuminate at apex, the secondary nerves inconspicuous or prominulous beneath; pedicels 5-14 mm. long; calyx 3-4 mm. long; corolla 6-7 mm. long; ovary sericeous at anthesis, the style 6-8 mm. long; fruit apparently not much exceeding 20 × 15 mm. 1. *P. fidiense*

Comparatively robust plants, the branchlets 3-10 mm. in diameter toward apex; petioles (10-) 15-40 mm. long, stout, 1.5-4 mm. in diameter; leaf blades coriaceous, 8-23 × 2.5-10 cm., obtuse to attenuate at base and long-decurrent on petiole, the secondary nerves prominent beneath; pedicels 10-30 mm. long; calyx 5-7 mm. long; corolla 8-12 mm. long; fruit 40-60 × 18-40 mm.

Leaf blades elliptic to oblong-lanceolate or obovate, drying dull or pale brown on both sides, rounded to obtusely short-acuminate (acumen to 7 mm. long) at apex, usually sharply recurved at margin; pedicels (often recurved) and calyx glabrous; anthers glabrous, the filaments about 6 mm. long; ovary glabrous, the style about 5 mm. long. 2. *P. hornei*

Leaf blades obovate, drying dark brown above and usually reddish or castaneous beneath, rounded or emarginate at apex, usually flat at margin; pedicels and calyx minutely sericeous, usually obviously so at anthesis; anthers strigose on both sides, the filaments 2-3 mm. long; ovary copiously strigose at anthesis, the style 13-18 mm. long. 3. *P. porphyreum*

Pedicels and outer surfaces of calyx persistently ferruginous-tomentose, the pedicels 15–35 mm. long; calyx 4–7 mm. long; corolla 7–8 mm. long; anthers sericeous on both sides, the filaments 3–5 mm. long; ovary spreading-pilose at anthesis, the style 10–15 mm. long; young branchlets (robust, 3–7 mm. in diameter toward apex) and petioles (8–30 mm. long, stout, 2–3.5 mm. in diameter) persistently ferruginous-tomentose, the leaf blades with similar indument beneath, this usually long-persistent at least on costa; leaf blades chartaceous or thin-coriaceous, elliptic to obovate, (7–) 10–20 × (3–) 4–10 cm., rounded to subacute at base, obtuse to rounded or slightly emarginate at apex. 4. *P. vitilevuense*

1. *Palaquium fidjiense* Pierre ex Dubard in Bull. Soc. Bot. France **56**: Mém. **16**: 10. 1909; Lam in Bull. Jard. Bot. Buitenzorg III. **7**: 107. 1925, in op. cit. **8**: 414. 1927, in *Blumea* **5**: 33. 1942; van Royen in op. cit. **10**: 471. 1960; J. W. Parham, Pl. Fiji Isl. **163**. 1964, ed. 2. 228. 1972.

A tree 5–30 m. high, sometimes densely foliaged, with abundant white latex and a trunk up to 90 cm. in diameter, occurring at elevations of 180–1,120 m. in dense forest or in the dense thickets of crests and ridges. The calyx is purple-tinged, the corolla pale greenish to yellow or greenish white, the filaments and style pale green to greenish white, and the fruit as noted green but probably not fully mature. Flowers have been obtained between April and September, fruits between September and May.

TIPIFICATION: The type is *Horne 1117* (K HOLOTYPE), collected in September, 1878, in Mbua Province (without further locality), Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known from four of the high islands; 26 collections have been examined.

LOCAL NAMES AND USE: Commonly used Fijian names are *mbau* and *mbau vundi*; the name *souwalu* was noted once in Mba Province. Many foresters consider the species to be a good timber tree.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4165*; vicinity of Nandarivatu, *Greenwood 842*; ridge between Mt. Nanggaranambuluta and Mt. Namama, east of Nandarivatu, *Smith 4995*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13328*. SERUA: Korovisilou Creek, *DF 696*. KANDAVU: Naikorokoro, *Damanu KU-13*. OVALAU: Hills west of Lovoni Valley, on ridge of Mt. Korolevu, *Smith 7543*; summit of Mt. Tana Lailai and adjacent ridge, *Smith 7689*. VANUA LEVU: MATHUATA: Ndreketi River area, *Berry 32*; Sarava, Lambasa, *DF 694 (S1411/1)*. THAKAUNDOVE: Mt. Kasi, Yanawai River region, *Smith 1805*.

Among the species with which van Royen in 1960 allies it, *Palaquium fidjiense* is perhaps closest to *P. erythrospermum* Lam, of the Solomon Islands, from which the Fijian species is at once distinguished by its smaller, short-petiolate leaves, its smaller calyx with closer and more evanescent indument, its shorter styles, and its smaller fruits. The corollas of *P. erythrospermum* are not known.

2. *Palaquium hornei* (Hartog ex Baker) Dubard in Bull. Soc. Bot. France **56**: Mém. **16**: 10. 1909; Lam in Bull. Jard. Bot. Buitenzorg III. **7**: 107. 1925, in op. cit. **8**: 414. 1927, in *Blumea* **5**: 33. 1942; van Royen in op. cit. **10**: 547. *fig. 19*. 1960; J. W. Parham, Pl. Fiji Isl. **163**. 1964, ed. 2. 228. 1972.

Dichopsis hornei Hartog ex Baker in J. Linn. Soc. Bot. **20**: 367. 1883.

Croixia hornei Baehni in Boissiera **11**: 109. 1965.

A tree 6–24 m. high, with white latex and a trunk to 60 cm. (or probably more) in diameter, found in usually dense forest at elevations between 100 and 610 m. The flowers are often very densely congested on branchlets below leaves and characteristically have recurved pedicels; the corolla and stamens are white. Flowers have been collected between January and June, fruits between August and December.

TIPIFICATION: The type is *Horne 717* (K HOLOTYPE; ISOTYPE at BO cited by van Royen), collected in June, 1878, at Na Vasi ("Navesi"), east of Naikorokoro Creek, Namuka Harbour, Rewa Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and now known from three of the high islands, 30 collections being available.

LOCAL NAMES AND USE: *Sathau* is the name usually referred to this now well-known forest tree; *sathali* is recorded from Naitasiri, and *mbulu* from Thakaundrove. The species is considered a good timber tree.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Nausori Highlands, *DA 15628*. SERUA: Inland from Navutulevu, *DF 668 (S1417/4, Damanu NL-11)*; inland from Namboutini, *DF 960 (Damanu R-5)*; inland from Ngaloa, *DA 15674*; Kandawa Mt., east of Navua River, *Nasoqiri 1*. NAMOSI: Nambukavesi Creek, *DF 517 (Damanu 151)*. NAITASIRI: Vicinity of Viria, *DA 231*; Waimanu River, *DA L 13319 (Berry 33)*; Tholo-i-suva, *DF 543 (Bola 142)*. REWA: Slopes of Mt. Korombamba, *Gillespie 2247*. KANDAVU: Naikorokoro, *DF S1417/2 (Damanu KU-17)*. VANUA LEVU: MBUA: Nuku Creek, upper Wainunu River, *DA 15762*. THAKAUNDRIVE: Mt. Kasi, Yanawai River region, *Smith 1793*; Mbutha Bay area, Natewa Peninsula, *Howard 236*.

Palaquium hornei seems most closely related to *P. karrak* Kanehira, of the Caroline Islands, from which it differs in its proportionately narrower leaf blades, its usually more densely clustered flowers with shorter pedicels, and its glabrous calyx. The Fijian species further differs in having stamens with slightly longer filaments, a glabrous ovary, and a longer style.

3. *Palaquium porphyreum* A. C. Sm. & S. Darwin in *Brittonia* 27: 167. fig. 7-10. 1975.

Palaquium stehlinii sensu van Royen in *Blumea* 10: 456, p. p. minore, quoad spec. vit. 1960; J. W. Parham, *Pl. Fiji Isl.* 163. 1964, ed. 2. 229. fig. 67. 1972; non Christophersen.

A tree 4-25 m. high, with white latex and a trunk up to 40 cm. (and doubtless more) in diameter, occurring at elevations of 40-1,100 m. in dense forest, often on ridges and slopes. The corolla has been recorded as yellow, but presumably it is pale or whitish. Flowers have been obtained in most months between December and September, fruits only in October and November.

TYPEFICTION: The type is *DA 15769* (coll. *N. Tulewa*) (BISH HOLOTYPE; ISOTYPES at MASS, SUVA), collected July 29, 1968, on a ridge east of Thongea, Wainunu River, Mbua Province, Vanua Levu.

DISTRIBUTION: Endemic to Fiji and known only from the two large islands, from which I have examined 34 collections.

LOCAL NAMES AND USE: This is one of the several sapotaceous trees commonly known as *mbau vundi*; other recorded names are *mbau* (Naitasiri and Mbua), and *mbau loa* and *mbau mei rakaka* (Namosi). The species has become well known as a good timber tree.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBUA: Mbukuya, Mangondro Tikina, *DF 1266*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15637*. SERUA: Inland from Namboutini, *DF 823*. NAMOSI: Below summit of Mt. Naitarandamu, *Gillespie 3148*; between Wairoro and Nambukavesi Creeks, *DF 690 (Bola NF-10)*. NAITASIRI: Vasila, Waindina River, *DA 662*; upper Navutuvula Village, Waimanu River, *DA 15682*; Tholo-i-suva, *DA 16940*. TAILEVU: Inland from Nataleira, *Berry 206*. NAITASIRI-REWA boundary: Mt. Kombalevu, *Parks 20312*. VANUA LEVU: MBUA: Koroma Creek, Mbua River headwaters, *Berry 139*; Nambuna, Wainunu River, *DA 15757*. MATHUATA: South of Ndreketi River, *Mead 2007*; summit ridge of Mt. Numbuloa, east of Lambasa, *Smith 6508*.

Palaquium porphyreum is not closely related to the Samoan *P. stehlinii* Christophersen, as which it has unfortunately become known in Fiji, nor is it very close to *P. neo-ebudicum* Guillaumin as suggested in the original protologue. Its closest relative would seem to be *P. hornei*, but the two Fijian species are readily distinguished from one another as noted in the above key.

4. *Palaquium vitilevuense* Gilly ex van Royen in *Blumea* 10: 552, 606. 1960; J. W. Parham, *Pl. Fiji Isl.* 163. 1964, ed. 2. 229. 1972.

A tree 6–24 m. high, with copious white latex, found at elevations of 30–610 m. in dense or open forest or along creeks in dry, hilly areas. The copious indument of vegetative and inflorescence parts, ferruginous to pale yellowish or brown, characterizes the species. Flowers have been collected between February and July, fruits only in May and September.

TIPOLOGIA: The type is *Greenwood 914* (NY HOLOTYPE; ISOTYPES at A, BISH, K), collected May 1, 1942, in mountains near Lautoka, Mba Province, Viti Levu.

DISTRIBUZIONE: Endemic to Fiji and as now known to Viti Levu; 20 collections have been studied.

LOCALI NOME E USI: The names *mbau* and *mbau vundi* have been applied to the species, which provides a useful timber. In Serua Province use of the latex as chewing gum has been noted.

COLLEZIONI RAPPRESENTATIVE: VITI LEVU: Mba: Mbukuya, Mangondro Tikina, *DF 1270*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 15611*; vicinity of Mbalo, near Vatukarasa, *Degener 15310a*. SERUA: Inland from Namboutini, *DA 13229*, *DF 583* or *807* (*S1411/7*, *Damanu R.35*); inland from Yarawa, *DF 272* (*Bulai 8*); inland from Ngaloa, *DF 584* or *808* (*S1411/6*, *Kashap G.15*); Taunovo River, *DF 598*. NAMOSI: Nambukavesi Creek, *DF 549*. NAITASIRI: Upper Navutuva Village, Waimanu River, *DA 15683*; N. T. C. Farm, *DA 8016*.

Van Royen allies his new species with *Palaquium confertum* Lam (Malaya and Sumatra), *P. koratense* Fletcher (Thailand), and *P. elongatum* Merr. (Philippines). Among geographically closer species, *P. vitilevuense* suggests *P. neo-ebudicum* Guillaumin in its copiously tomentose young parts, pedicels, and calyx, but the indument of the Fijian species is coarser and extends to the leaf blades, which in general are larger and with more numerous secondaries. *Palaquium neo-ebudicum* has the calyx lobes within tomentose rather than glabrous, and its style is as much as 20 mm. long.

A degree of local variation is noted in *Palaquium vitilevuense*. Specimens from northwestern and western Viti Levu (including the type) and some from Naitasiri have the leaf blades comparatively narrow, obovate, and acute at base; these specimens tend to have the leaf blades glabrate and may come from exposed situations. Other collections, mostly from Serua and Namosi (but also from the Waimanu area, Naitasiri), have the leaf blades comparatively broadly elliptic and rounded to obtuse at base; these specimens have the indument of lower leaf blade surfaces more persistent, and they seem to be from the more heavily forested areas. No differences are noted in inflorescence characters, and there are a few intermediates in leaf shape and indument.

6. MANILKARA Adanson, *Fam. Pl.* 2: 166. 1763; Lam in *Blumea* 4: 323. 1941, in op. cit. 5: 41. 1942; van Royen in op. cit. 7: 401. 1953. Nom. cons. vs. *Achras*.

Achras L. Sp. Pl. 1190. 1753; Baehni in *Candollea* 7: 416. 1938, in *Boissiera* 11: 79. 1965.

Trees, the stipules fugacious or none; leaves alternate, often congested toward apices of branchlets, the blades usually coriaceous, often obovate and rounded at apex, the secondary nerves not much more prominent than the parallel tertiary nerves, the veinlet reticulation often inconspicuous; inflorescences axillary or in subterminal clusters, 1–many-flowered; flowers 3-merous; calyx with 2 whorls of lobes, each whorl with 3 lobes, these often sharply reflexed in fruit; corolla lobes 6, equal to or longer than tube, each with 2 dorsal or lateral segments or these lacking or greatly reduced and the lobes inconspicuously tridentate; stamens 6, inserted at apex of corolla tube, the filaments filiform or lanceolate, the anthers extrorsely dehiscent, often mucronate; staminodes 6, petaloid or small, sometimes dentate or lobed; disk none or inconspicu-

ous; ovary pilose, 6-14-locular, the ovules ventrally or basiventrally attached to placentas, the style subulate; fruit 1-6(-12)-seeded, the seeds usually laterally compressed, the scar basiventral or subbasal, the testa crustaceous, the endosperm copious, the cotyledons thin, foliaceous.

TYPE SPECIES: The type species of *Manilkara* is *M. kauki* (L.) Dubard (*Mimusops kauki* L.), typ. cons.; that of *Achras* is *A. zapota* L., the only original species.

DISTRIBUTION: Pantropical; in the Indo-Pacific area from India and southern China through Malesia to northern Australia and eastward in the Pacific to Samoa and Tonga. The genus includes about 75 species, three of which are indigenous in Fiji (two of them endemic); two other species have been recorded in cultivation in Fiji.

USEFUL TREATMENTS OF GENUS: Lam, H. J. (with B. J. D. Meeuse & R. A. Maas Geesteranus). Note on the Sapotaceae-Mimusopoideae in general and on the far-eastern *Manilkara*-allies in particular. *Blumea* 4: 323-358. 1941. Royen, P. van. Revision of the Sapotaceae of the Malayans area in a wider sense. V. *Manilkara* Adanson em. Gilly in the Far East. *Blumea* 7: 401-412. 1953. Moore, H. E., Jr., & W. T. Stearn. The identity of *Achras zapota* L. and the names for the sapodilla and the sapote. *Taxon* 16: 382-395. 1967.

Although *Achras* is sometimes maintained as a distinct genus from *Manilkara*, their separation does not seem warranted. The geographical occurrence of the species composing *Achras* strengthens a concept that the genus is unnatural and that its components have independently evolved from *Manilkara* or a fairly recent common ancestor. A justification for combining the two is given by van Royen (1953, cited above).

It is a strange coincidence that the two endemic Fijian species of *Manilkara* were both collected on the same day in 1934 and at essentially the same locality, on southern Vanua Mbalavu and its adjacent islet Namalata; nevertheless, the two species are remarkably distinct from one another. The only prior collection of the genus in Fiji was a sterile specimen obtained by Graeffe, probably in 1864, on Susui, an islet adjacent to Namalata. Until 1963 no further material of *Manilkara* was collected in Fiji, and it seemed that the genus in the archipelago was limited to the Exploring Islands. Since that time, however, both endemic species have been recollected and *M. dissecta* has also been obtained. The latter species previously had a known distribution of New Caledonia, the New Hebrides, Tonga, and Samoa, and so its absence from Fiji had been puzzling. Although *Manilkara* remains an infrequently collected genus in Fiji, it is now known from Viti Levu and the nearby Mamanuthas, Vanua Levu, and the Lau Group.

KEY TO SPECIES

Indigenous species.

Flowers comparatively small, 1-3 in axils of leaves congested toward apex of branchlets; pedicels 12-25 mm. long (to 35 mm. in fruit), glabrous or soon glabrate; calyx 4-7 mm. long, the outer lobes pilose distally and on margins, the inner lobes copiously sericeous; corolla 5-7 mm. long, the dorsal appendages nearly as long as lobes; stamens with filaments and anthers each 2-3 mm. long; staminodes subdeltoïd, 1-2 mm. long, dentate at margin; ovary 6-locular, closely sericeous, the style 5-8 mm. long, glabrous; fruit 1-seeded, ellipsoid or ovoid, 8-10 × 5-7 mm., early glabrous, the seeds about 7 × 5 × 4 mm., with a basiventral scar about 3 × 2 mm.; comparatively slender plants, the petioles 10-20 mm. long, about 1 mm. in diameter; leaf blades essentially concolorous and drying dull brown, glabrous or soon glabrate (sometimes when young copiously pale-sericeous beneath), obovate, 2.5-7.5 × 1.5-3.5 cm., acute to attenuate at base, rounded or emarginate at apex, the secondary nerves 12-18 per side, the ultimate veinlet areoles longitudinally oriented (parallel to secondaries).

1. *M. dissecta*

Flowers comparatively large, in subterminal clusters of 8-15 or axillary to persistent, congested leaves; pedicels 7-25 mm. long, like outer surface of calyx copiously sericeous with pale or golden brown hairs (these 2- or several-armed, less than 0.1 mm. long, and sometimes agglutinated into a waxy layer); calyx 7-12 mm. long; corolla 11-13 mm. long, the dorsal appendages not more than 2/3 length

of lobes; stamens with filaments 4–5 mm. long and anthers 3–5 mm. long; staminodes at least 2 mm. long; ovary closely sericeous, the style 8–13 mm. long, glabrous; fruit 25–35 mm. long; comparatively robust plants, the petioles (8–) 12–55 mm. long, 1–4 mm. in diameter; leaf blades usually 5–21 × 2.5–10.5 cm., rounded to broadly acute at base, rounded or emarginate at apex.

Leaf blades drying pale to dark brown above, paler or greenish or whitish (rarely pale brown) beneath, persistently sericeous beneath with appressed hairs less than 0.1 mm. long somewhat agglutinated into a completely covering layer, elliptic-obovate, (5–) 7–21 × (3–) 3.5–10.5 cm., the secondary nerves 15–30 per side, the ultimate veinlet areoles longitudinally oriented (parallel to secondaries); corolla tube about 3 mm. long, the lobes about 9 mm. long, with conspicuous, lanceolate dorsal appendages about 2/3 their length; stamens with anthers 4–5 mm. long; staminodes about half as long as corolla lobes, oblong-ovate, fimbriate; ovary 7–9-locular; fruit (perhaps not fully mature) obovoid, 25–30 × 12–15 mm., persistently and minutely pale-sericeous. 2. *M. smithiana*

Leaf blades essentially concolorous (or drying greenish brown above and darker brown beneath), glabrous (or with a few scattered, minute hairs beneath), elliptic-oblong or -obovate, (3–) 5–12 × (1.5–) 2.5–6 cm., the secondary nerves 10–15 per side, the ultimate veinlet areoles irregular, not longitudinally oriented; corolla tube 1–2 mm. long, the lobes 10–12 mm. long, with inconspicuous, ovate-deltoid dorsal appendages (1.5–3 mm. long) 1/4–1/5 their length; stamens with anthers about 3 mm. long; staminodes inconspicuous, suborbicular, denticulate, 1/5–1/6 the length of corolla lobes, sometimes lacking; ovary 6-locular; fruit ellipsoid, 25–35 × 20–25 mm., glabrous, the seeds 2–4, oblong-ellipsoid, about 20 × 12 × 8 mm., with a basiventral scar about 10 × 5 mm.

3. *M. vitiensis*

Cultivated species.

Corolla lobes without appendages (but sometimes tridentate at apex); ovary (6–) 10–12-locular; flowers solitary in leaf axils; fruit brown, ovoid to subglobose, 5–10 cm. in diameter, with 1–12 shining, blackish brown seeds embedded in yellowish to reddish brown pulp; petioles 1–3.5 cm. long; leaf blades elliptic to obovate or oblong-lanceolate, 3.5–15 × 1.5–7 cm., obtuse to acute at apex, shining dark green above, dull green beneath and brown-sericeous when young but soon glabrate, drying dull brown on both surfaces. 4. *M. zapota*

Corolla lobes with obvious appendages about the same length; ovary 6–8-locular; flowers 1–3 in leaf axils; fruit reddish brown, ovoid-ellipsoid, 3–4 × 2–3.5 cm., with 1–6 seeds; petioles 2–5.5 cm. long; leaf blades broadly obovate, 5–13 × 3.5–8.5 cm., broadly obtuse to emarginate at apex, shining dark green above, sericeous and silvery beneath, eventually glabrate and grayish. 5. *M. kauki*

1. ***Manilkara dissecta*** (L. f.) Dubard in Ann. Mus. Colon. Marseille III. 3: 13. 1915; Guillaumin in J. Arnold Arb. 13: 15. 1932; Lam in Blumea 4: 325, fig. 1. 1941, in op. cit. 5: 42. 1942; van Royen in op. cit. 7: 405. 1953; Yuncker in Bishop Mus. Bull. 220: 212. 1959.

Achras dissecta L. f. Suppl. Pl. 210. 1781; Forst. f. Fl. Ins. Austr. Prodr. 25, p. p., quoad typum. 1786.

Manilkara dissecta var. *typica* Maas Geester. in Blumea 4: 327, nom. inadmis. 1941; Lam in op. cit. 5: 42. 1942.

Manilkara dissecta var. *dissecta*; van Royen in Blumea 7: 405. 1953; J. W. Parham, Pl. Fiji Isl. ed. 2. 228. 1972.

As seen in Fiji, *Manilkara dissecta* is a tree to 15 m. high, with a trunk to 50 cm. in diameter, occurring in forest near the shore and in coastal thickets. The corolla is white; flowers have been obtained in August and November.

TIPIFICATION: The type is *J. R. & G. Forster* (K LECTOTYPE), collected on Cook's second voyage on Tongatapu, Tonga. Lam in 1941 and van Royen in 1953 indicated the type specimen as being at K, and there are said to be duplicates at B and S. I was unable to locate a Forster specimen of the species at BM.

DISTRIBUTION: New Caledonia and the New Hebrides to Tonga and Samoa.

LOCAL NAME: *Mbau sanggali* (Howard 158).

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Waimate Beach, near Taunovo River, DA 17130, 17131. VANUA LEVU: MATHUATA: Ndongotuki Tikina, Howard 158.

The species seems suprisingly infrequent in Fiji, in view of the fact that it occurs near beaches. One may doubt the desirability of dividing *Manilkara dissecta* into var. *dissecta* (New Hebrides to Tonga and Samoa) and var. *pancheri* (Baill.) Maas Geester.

(in *Blumea* 4: 327. 1941; New Caledonia; for a full description cf. Aubréville, Fl. Nouv.-Caléd. et Dépend. 1: 32. pl. IV, 1-4. 1967). For instance the Fijian collection *Howard 158* has the young leaf blades copiously whitish-sericeous beneath (the indument forming a solid layer as on the young leaves of var. *pancheri*), but it definitely represents var. *dissecta*, with very early glabrate leaf blades.

2. ***Manilkara smithiana*** Lam & Maas Geester. in *Blumea* 4: 328. fig. 2. 1941; Lam in op. cit. 5: 42. 1942; van Royen in op. cit. 7: 405. 1953; J. W. Parham, Pl. Fiji Isl. 162. 1964, ed. 2. 228. 1972.

A tree 7-30 m. high, with copious white latex, found in sometimes high and dense forest from near sea level to about 825 m. The corolla, filaments, and staminodes are white. Flowers have been obtained in March and June, fruits (probably immature) only in June.

TYPIFICATION: The type is *Smith 1450* (BISH HOLOTYPE; many ISOTYPES), collected March 29, 1934, on Namalata, an islet immediately adjacent to the southern limestone section of Vanua Mbalavu. Lam and Maas Geesteranus listed the type specimen as being at BISH and L; I indicate the BISH specimen as holotype because it is part of the first set of my 1933-1934 collection.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Vanua Levu, and the Exploring Islands in Lau.

LOCAL NAMES AND USE: Recorded Fijian names are *mbau mbulu* (Mba), *mbau sa* (Serua), and *mbau* (Serua and Namalata). Collectors who obtained the species on the two large islands report it as a useful timber tree.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Vicinity of Nandarivatu, *DF 552* (coll. J. Vetawa). SERUA: Inland from Navutulevu, *Howard 40*. VANUA LEVU: THAKAUNDROVE: Tunuloa Tikina, inland from Koroivono, *Howard 88*. SUSUI (south of Vanua Mbalavu): *Graeffe 1401*.

The known distribution of *Manilkara smithiana* is surprising in its altitudinal range. The Mba collection is the only one from upland forest; it is the only available fruiting collection, but the persistent indument even on old foliage permits no doubt of its identity. The fact that the tree is known to sawmill operators suggests that it is more frequent than indicated by presently available collections. I believe the species to be less closely related to *M. dissecta*, with which it has been keyed by prior students, than to *M. vitiensis*, the other Fijian endemic, although the two are unmistakably distinct.

3. ***Manilkara vitiensis*** (Lam & van Olden) Meeuse in *Blumea* 4: 339. fig. 11. 1941; Lam in op. cit. 5: 42. 1942; van Royen in op. cit. 7: 410. 1953, in op. cit. 8: 206. 1957; J. W. Parham, Pl. Fiji Isl. 163. 1964, ed. 2. 228. 1972.

Northia vitiensis Lam & van Olden in Bishop Mus. Bull. 141: 163. fig. 83, a-c. 1936.

A sometimes gnarled tree to 7 m. high, occurring at elevations from near sea level to about 100 m. in coastal forest or woods or on limestone cliffs near the sea. The corolla, filaments, and staminodes are white. Flowers have been collected in February and March, fruits only in February.

TYPIFICATION: The type is *Smith 1461* (BISH HOLOTYPE; many ISOTYPES), collected March 29, 1934, in the southern limestone section of Vanua Mbalavu. In the original protologue Lam did not mention a depository for the type, but the introduction to the paper in which his species was published (p. 3) states that all types, unless otherwise mentioned, are deposited at BISH. Therefore in this case I regard the BISH specimen as

the holotype, although Meeuse, in making his new combination in 1941, indicated the type specimen as being at L.

DISTRIBUTION: Endemic to Fiji and thus far known only from two widely separated islands, one in the Mamanuthas and one in the northern Lau Group.

LOCAL NAME: *Mbotha* (from type collection).

AVAILABLE COLLECTIONS: MAMANUTHAS: NGGALITO Island, Malolo Group, *O. & I. Degener* 32210, 32216, 32244. VANUA MBALAVU: Ndalithoni, *DA* 2740.

The known distribution of *Manilkara vitiensis*, although as scattered as that of *M. smithiana*, is more to be expected, all the cited localities being near the sea and perhaps all from limestone areas. The alliance of *M. vitiensis* is to the Samoan endemic *M. samoensis* Lam & Meeuse (in *Blumea* 4: 338. *fig. 10.* 1941).

4. ***Manilkara zapota* (L.) van Royen** in *Blumea* 7: 410. *fig. 1, l-q.* 1953; Moore & Stearn in *Taxon* 16: 383. 1967; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 228. 1972.

Achras zapota L. *Sp. Pl.* 1190, quoad typum, syn. Sloanei et Plukenetii excl. 1753; J. W. Parham, *Pl. Fiji Isl.* 162, as *A. sapota*. 1964.

Achras mammosa L. *Sp. Pl.* ed. 2. 1: 469, nom. illeg. 1762.

As seen in Fiji, *Manilkara zapota* is a cultivated (and possibly also very sparingly naturalized) tree 3-4 m. high near sea level, with white latex. Where indigenous the species attains a height of 30 m. The calyx lobes are brown-pilose, and the corolla is white or pale green, turning brown. Fijian collections bore flowers in January and October and immature fruits in January.

TIPIFICATION AND NOMENCLATURE: As clarified by Moore and Stearn in 1967 (cited above), *Achras zapota* was based on a mixture, and its lectotype must be the element on which Plumier (*Nov. Gen.* 43. *t. 4.* 1703) based his genus *Sapota*; this is referable to the *sapodilla* and not to the *sapote*. Plumier's illustration is reproduced by Moore and Stearn (p. 385, *fig. 2*). In attempting to separate the two elements in 1762, Linnaeus intended to describe the *sapote* as *Achras mammosa*, but this name is illegitimate because a reference to Plumier's publication was included. The complex nomenclature is well discussed by Moore and Stearn, who give many additional references and synonyms.

DISTRIBUTION: Indigenous in Mexico and Central America, now widely grown throughout the tropics.

LOCAL NAME AND USES: *Sapodilla* is a more or less standard name for the species, but there are many others. The pulp of the ripe fruit is edible, and the tree produces latex that is an important source of *chicle*, used in the manufacture of chewing gum. An interesting account of the species is found in Burkill, *Dict. Econ. Prod. Malay Penins.* ed. 2. 29-32. 1966.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Nasinu, *DA* 5512. REWA: Namboro, *DA* 5628; Suva, in private garden, *DA* 16237.

5. ***Manilkara kauki* (L.) Dubard** in *Ann. Mus. Colon. Marseille* III. 3: 9. *fig. 1, 2.* 1915; Lam in *Blumea* 4: 329. *fig. 3.* 1941; van Royen in *op. cit.* 7: 405. 1953.

Mimusops kauki L. *Sp. Pl.* 349. 1753.

Mimusops browniana Benth. *Fl. Austral.* 4: 285. 1868; B. E. V. Parham in *Agr. J. Dept. Agr. Fiji* 10: 115. 1939.

Where it is indigenous, *Manilkara kauki* is a tree to 20 m. high, often growing near beaches and on limestone; it has a yellowish white corolla slightly projecting from the calyx and a reddish brown fruit up to about 4 cm. long.

TYPIIFICATION AND NOMENCLATURE: The only reference of Linnaeus in 1753 was to his *Fl. Zeyl.* 137. 1747. The holotype therefore is *Hermann 137* (BM), from Ceylon, presumably from a cultivated plant. Van Royen in 1953 discussed problems of the typification of the Linnaean species *Mimusops kauki* and *M. elengi*. *Mimusops browniana* is based on *M. kauki* sensu R. Br. (*Prodr. Fl. Nov. Holl.* 531. 1810), non L., and the holotype is a Brown specimen (BM) from "islands off Cape Fear," Australia. Van Royen in 1953 did not question the combination of the two taxa.

DISTRIBUTION: Southeastern Asia to New Guinea and northern Australia; sometimes cultivated elsewhere as a fruit tree or an ornamental.

No Fijian voucher supports this record, the species having been discussed by B. E. V. Parham as *Mimusops browniana*, as noted above. Parham indicates that in 1939 the tree, which he noted as *Queensland ebony*, was flourishing and fruiting on the property of W. L. Wallace, Tovu Island, Ra Province, Viti Levu. The record is probably correct, whether or not the species still persists in Fiji.

7. *MIMUSOPS* L. Sp. Pl. 349. 1753; van Royen in *Blumea* 6: 594. 1952.

Trees, the stipules fugacious; leaves alternate, sometimes congested toward apices of branchlets (but in our species not closely approximate), the blades with lax and irregular tertiary nervation; inflorescences axillary or borne on branchlets below leaves, fasciculate (sometimes many-flowered) or composed of solitary flowers (flowers usually 1-4 in our species); flowers 4-merous, the calyx with 2 whorls of lobes, each whorl with 4 lobes; corolla tube short, the lobes 8, each with 2 dorsal segments subequal to lobe; stamens 8, borne in corolla throat; staminodes 8, shorter than corolla lobes; ovary usually 8-locular, the ovules attached at bases of placentas, the style subulate; fruit 1- or 2(-5)-seeded, the seeds with a small, circular, basal or basilateral scar, the hilum and micropyle close to one another, the endosperm copious, the cotyledons thin, foliaceous.

LECTOTYPE SPECIES: *Mimusops elengi* L. (vide Britton & Millspaugh, *Bahama Fl.* 324. 1920), one of Linnaeus's two original species.

DISTRIBUTION: Tropics of the Old World, with about 50 species in Africa and Madagascar and one extending from India to the New Hebrides. The latter species has been cultivated in Fiji.

1. *Mimusops elengi* L. Sp. Pl. 349. 1753; van Royen in *Blumea* 6: 594. 1952; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 228. 1972.

As seen in Fiji, *Mimusops elengi* is a tree to 12 m. high sparingly cultivated near sea level. The corolla is white, becoming brownish, and the fruit (not seen in Fiji) is ovoid, about 3 cm. long, yellow to orange, and with dark brown seeds. The only collection noted was in flower in March.

TYPIIFICATION: The specimen mentioned in *L. Fl. Zeyl.* (1747), *Hermann 138* (BM), from Ceylon, is to be taken as the lectotype, as discussed by van Royen (in *Blumea* 7: 406. 1953).

DISTRIBUTION: India through Malesia to Australia, New Caledonia, and the New Hebrides; cultivated elsewhere.

USE: An ornamental tree, also much used medicinally in southeastern Asia (cf. Burkill, *Dict. Econ. Prod. Malay Penins.* ed. 2. 1500-1502. 1966).

AVAILABLE COLLECTION: VITI LEVU: REWA: Suva Botanical Gardens, *DA 12361*.

The single Fijian collection seems to represent a somewhat typical or intermediate form of the species; it has leaf blades about 12 × 7 cm. and therefore probably did not

come from the eastern part of the range, where var. *parvifolia* (R. Br.) Lam is indigenous (cf. Lam in Bull. Jard. Bot. Buitenzorg III. 7: 236. 1925, in Blumea 5: 43. 1942; Aubréville, Fl. Nouv.-Caléd. et Dépend. 1: 34. pl. IV, 5-9. 1967), based on *Mimusops parvifolia* R. Br. (Prodr. Fl. Nov. Holl. 531. 1810; Guillaumin in J. Arnold Arb. 13: 14. 1932). Van Royen (1952, cited above) considers the recognition of infraspecific taxa undesirable.

ORDER PRIMULALES

An order Primulales, consisting of three families, is considered by many recent phylogenists (e. g. Melchior, 1964; Cronquist, 1968; Takhtajan, 1969) to be closely related to the Ebenales, both orders presumably derived from an ancestral thealean stock. Thorne (1976) and Dahlgren (1980) include the Plumbaginaceae in the Primulales, but that family is as frequently considered allied to the Caryophyllales. Hutchinson (1973) considers his orders Myrsinales and Primulales to be only superficially similar. The largest family of this complex, however interpreted, is the Myrsinaceae, which practically all modern systems ally to the Ebenales.

FAMILY 116. MYRSINACEAE

MYRSINACEAE R. Br. Prodr. Fl. Nov. Holl. 532, as *Myrsineae*. 1810.

Trees or shrubs, sometimes lianas, estipulate, usually with ♂ flowers, sometimes dioecious, polygamodioecious, or monoecious; leaves alternate (spirally arranged or distichous), often congested toward apices of branchlets, rarely subopposite or subverticillate, simple, the blades often coriaceous, usually glandular-punctate or with secretory canals, entire to shallowly serrate; inflorescences terminal, axillary, or borne on branchlets below leaves, racemose or paniculate to fasciculate or glomerulate; flowers actinomorphic, ♂, sometimes unisexual or functionally so, usually small, 4- or 5-merous (rarely 3-, 6-, or 7-merous), sometimes with bracteoles (prophylls) immediately below calyx; calyx usually deeply lobed, persistent, the lobes valvate, imbricate, or contorted, often glandular; corolla rotate to hypocrateriform, often deeply lobed and sometimes choripetalous, caducous, the lobes (or petals) imbricate, contorted, or rarely valvate; stamens opposite to and as many as corolla lobes, the filaments usually adnate to corolla and with short (or no) free portions, rarely elongate or free, the anthers dorsifixed or rarely basifixed, introrse, dehiscent by longitudinal or subapical slits or by apical pores; ovary superior or semisuperior, unilocular, the ovules few-numerous, anatropous to campylotropous, 1-many-seriate on a free-central placenta, sometimes immersed in placental tissue, the style simple, elongate or short, sometimes lacking, the stigma various, punctiform to peltate, capitate, conical, angled, or farciminiform; fruit a berry or a 1-seeded drupe, rarely irregularly dehiscent, the seeds with smooth or rarely ruminate endosperm, the embryo straight or slightly curved.

DISTRIBUTION: Pantropical and subtropical, sometimes extending to warm-temperate areas, with 32-35 genera and about 1,000 or more species. The family is not economically important but includes a few ornamentals. Six genera have species indigenous in Fiji.

USEFUL TREATMENTS OF FAMILY: Mez, C. Myrsinaceae. Pflanzenr. 9 (IV. 236): 1-437. 1902. Smith, A. C. Studies of Pacific Island plants, XXV. The Myrsinaceae of the Fijian Region. J. Arnold Arb. 54: 1-41, 228-292. 1973.

The present treatment is abstracted from my 1973 review. Since that includes illustrations of diagnostic characters of genera, only a few photographs are here offered.

KEY TO GENERA

- Ovary semisuperior, the ovules in our species bi- or several-seriate; pedicels with a pair of persistent distal bracteoles (prophylls); fruit essentially inferior, many-seeded, the seeds angled-obovoid, convex at apex, the style and calyx persistent. 1. *Maesa*
- Ovary superior; pedicels without prophylls; fruit superior and eventually falling from calyx, 1-seeded, the seed more or less subglobose.
- Ovules mostly several-seriate but in our indigenous species 6-10 and irregularly uniseriate; style elongate, very slender and subulate to a minutely punctiform stigma; inflorescences in our indigenous species compact, irregularly fasciculiform or short-racemose or rarely short-paniculate, the rachis rarely more than 3 mm. long at anthesis. 2. *Ardisia*
- Ovules uniseriate, in our species 2-5; style sometimes cylindrical and slender but not subulate, the stigma discoid or subcapitate or peltate or (in genus no. 6) diverse.
- Inflorescences paniculate, usually obviously pedunculate, often freely branched, in our species rarely less than 2 cm. long at anthesis and usually much longer; style apparent.
- Corolla sympetalous, the lobes obviously dextrorsely contorted in bud; flowers in our species ♂.
- Anthers dorsifixed, the filaments distally free and ligulate; pedicels sometimes swollen distally into a clavate or cupuliform calyx tube, but sometimes as in *Discocalyx*; style as long as or longer than ovary, in our species 0.6-5 mm. long at anthesis. 3. *Tapeinosperma*
- Anthers broadly basifixed, the filament tube adnate to corolla tube for its entire length and not distally divided into free parts; pedicels slenderly terete, the calyx subtrotate from base; style often shorter than ovary, in our species (0.1-) 0.2-0.7 mm. long at anthesis. 4. *Discocalyx*
- Corolla in our species choripetalous, the petals narrowly imbricate in bud; flowers functionally unisexual. 5. *Embelia*
- Inflorescences in our species glomerulate or verruciform, essentially epedunculate, the axis not exceeding 7 mm. in length; style lacking. 6. *Rapanea*

1. MAESA Forssk. Fl. Aegypt.-Arab. 66. Oct. 1775; Seem. Fl. Vit. 147. 1866; Mez in Pflanzenr. 9 (IV. 236): 15. 1902; St. John in Naturaliste Canad. 98: 571, 573. 1971; A. C. Sm. in J. Arnold Arb. 54: 3. 1973.

Baeobotrys J. R. & G. Forst. Char. Gen. Pl. 11. Nov. or Dec. 1775, ed. 2. 21. 1776.

Small trees or shrubs, sometimes subsucculent, the indument composed of simple hairs and/or minute scales; leaves alternate, the blades entire to serrate, with (sometimes obscure) secretory canals immersed in the mesophyll; inflorescences axillary or rarely terminal, racemose or paniculate, bracteate; flowers (in all our species) ♂, sometimes functionally unisexual, small, usually 5-merous (occasionally 4- or 6-merous), the pedicels with 2 persistent distal bracteoles (prophylls), these free or connate into a cymbiform receptacle; calyx partly adnate to ovary, the lobes (usually quincuncially) imbricate in bud; corolla usually campanulate and submembranous, the lobes often about as long as tube, imbricate in bud, often lineolate-glandular; stamens affixed near middle of corolla tube, the filaments elongate or short, the anthers short, usually dorsifixed near middle, longitudinally dehiscent, usually emarginate at apex; ovary adnate to calyx, semisuperior to nearly entirely inferior, the placenta stipitate, with 1-several-seriate ovules, the style short, persistent, the stigma obtuse to discoid or lobed; fruit a small, dry or fleshy, indehiscent, many-seeded berry, the mesocarp carnosous, glandular-lineolate, the endocarp spongy or brittle, the prophylls, calyx, and style persistent, the seeds few to many, angled-obovoid, castaneous or blackish.

TYPE SPECIES: The type species of *Maesa* is *M. lanceolata* Forssk.; that of *Baeobotrys* is *B. nemoralis* J. R. & G. Forst. (= *Maesa nemoralis* (J. R. & G. Forst.) A. DC.).

DISTRIBUTION: Africa and Madagascar to southeastern Asia and Japan, eastward through Malesia to Queensland and into the Pacific to Tonga and Samoa, with 150-200 species. Seven species (five of them endemic) occur in Fiji.

KEY TO SPECIES

- Indument (of young parts, branchlets, petioles, and at least the proximal parts of leaf costas) composed of spreading simple hairs as well as of minute scales, the hairs usually obvious but sometimes inconspicuous, rarely as short as 0.1 mm.

Spreading hairs usually obvious on some inflorescence parts, occasionally limited to calyx lobes.

Leaf blades ovate, about twice as long as broad, usually 6–13 × 3.5–8.5 cm., copiously and persistently soft-pilose on both surfaces (or rarely eventually glabrate above), cordate at base (infrequently merely rounded and rarely broadly obtuse), usually conspicuously crenulate-dentate at margin, the secondary nerves 5–7 per side; inflorescences broadly paniculate, often bipinnately so (sporadically simply racemose). 1. *M. corylifolia*

Leaf blades prevailing lanceolate or oblong-lanceolate and about 3 times as long as broad, usually 6–13.5 × 2–4.5 cm., usually glabrous on both surfaces except for scattered hairs on the principal venation (but sometimes copiously pilose beneath), prevailing acute to obtuse at base, infrequently narrowly subcordate, usually subtire or undulate at margin but occasionally obviously crenulate, the secondary nerves 6–11 per side; inflorescences simply racemose, only rarely paniculate with as many as 10 branches. 2. *M. pickeringii*

Spreading hairs lacking on inflorescence parts, these merely furfuraceous; leaf blades glabrous beneath except for sparse indument on proximal parts of costa and secondaries (or occasionally soft-pilose on lower surface in species no. 3).

Leaf blades elliptic or ovate to obovate-elliptic, usually 8–26 × 5–15 cm., comparatively broad, usually about twice as long as broad; petioles 15–45 mm. long. 3. *M. tabacifolia*

Leaf blades prevailing lanceolate to oblong-elliptic, usually 4–13 × 1.5–5 cm. and about 3 times as long as broad; petioles 5–27 mm. long. 6. *M. persicifolia*

Indument composed of minute scales only, without hairs (or, if hairs rarely present and visible on branchlets, then forming an obscure puberulence and less than 0.1 mm. long).

Leaf blades usually 5–23 × 4.5–11.5 cm., comparatively broad, often about twice as long as broad; petioles 12–50 mm. long.

Inflorescences paniculate (occasionally bipinnately so), with 5–15 (–20) spreading branches, the inflorescence parts (rachis, bracts, pedicels, and calyx) copiously furfuraceous, tardily subglabrate, the pedicels 0.3–2 mm. long in flower and fruit; leaf blades ovate-oblong to elliptic-lanceolate, usually 8–23 (–28) × 3.5–9.5 (–18) cm., acute to attenuate (rarely rounded) at base, gradually acuminate to cuspidate at apex, inconspicuously undulate-crenulate at margin, the secretory canals inconspicuous or not apparent. 4. *M. insularis*

Inflorescences often simply racemose but sometimes paniculate and with 1–4 (rarely –15) spreading branches, the inflorescence parts (rachis, bracts, pedicels, and calyx) essentially glabrous, the pedicels 1–3 mm. long in flower (–4 mm. long in fruit); leaf blades ovate to suborbicular, sometimes broadly elliptic, usually 5–14 × 4.5–11.5 cm., rounded to broadly obtuse at base, rounded (less often broadly obtuse or obtusely cuspidate) at apex, conspicuously crenulate at margin, the secretory canals sinuous and obvious on lower surface. 5. *M. tongensis*

Leaf blades usually 4–13 × 1.5–5 cm., comparatively narrow, usually about 3 times as long as broad; petioles 5–35 mm. long.

Indument scales often subpersistent on inflorescence parts; petioles narrowly winged distally; leaf blades usually rounded to obtuse at base and abruptly short-decurrent on petiole, the secondary nerves spreading, the lower surfaces without visible secretory canals or these immersed and not apparent, rarely faintly discernible; inflorescences usually paniculate, sometimes bipinnately so, with spreading branches, infrequently simply racemose, the pedicels often negligible but sometimes to 2.5 mm. long at anthesis and to 3 mm. long in fruit, the corolla lobes inconspicuously glandular-lineolate. 6. *M. persicifolia*

Indument scales evanescent, rarely persistent to anthesis on inflorescence parts; petioles narrowly winged or cartilaginous-angled often nearly to base; leaf blades attenuate to obtuse at base and long-decurrent on petiole, the secondary nerves curved-ascending, the lower surfaces usually with conspicuous secretory canals but these sometimes immersed and not obvious; inflorescences often simply racemose but frequently paniculate and then usually with comparatively short and ascending branches, the pedicels obvious, usually 1.5–2.5 mm. (but sometimes only 0.5 mm.) long at anthesis and often to 3.5 mm. long in fruit, the corolla lobes obviously and conspicuously glandular-lineolate. 7. *M. vitiensis*

1. *Maesa corylifolia* A. Gray in Proc. Amer. Acad. Arts 5: 330. 1862; Seem. Viti, 438. 1862, Fl. Vit. 148. 1866; Horne, A Year in Fiji, 264. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 226. 1892; Mez in Pflanzenz. 9 (IV. 236): 37. 1902; Gibbs in J. Linn. Soc. Bot. 39: 155, p. p. 1909; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972; A. C. Sm. in J. Arnold Arb. 54: 8. fig. 11. 1973. FIGURE 84 (upper left).

Maesa macrophylla sensu Seem. in Bonplandia 9: 257. 1861; non Wall.

Maesa corylifolia var. n. Horne, A Year in Fiji, 264. 1881.

A liana, or sometimes a scrambling or scandent shrub 1-5 m. high, found at elevations from near sea level to 1,150 m. in dense or open forest, in hillside and grassland thickets, and on open hillsides. The corolla is white to pale greenish yellow, with brown glandular lines; the stamens have greenish yellow filaments and yellow anthers; the ovary is orange-red and the stigma is green; and the fruit is dull waxy white. Flowers have been obtained between June and November, fruits between August and December.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 73887 HOLOTYPE; ISOTYPES at GH, K), collected in 1840 in Mathuata Province ("in mountains"), Vanua Levu. *Seemann* 288, a fruiting specimen, was also cited, but the title of Gray's paper makes lectotypification unnecessary.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands; about 40 collections are at hand.

LOCAL NAMES AND USE: The commonly used names, more or less generic in connotation, are *kutumirase* (Viti Levu) and *kolo ni mbeka* (Vanua Levu). Also recorded are *wa watu* (Mba), *wa sinu* (Nandronga & Navosa), *ngingi* (Namosi), *vere* (Mathuata), and *kala mbu ndi wawa* (Thakaundrove). The leaves are said to be used medicinally, a usage vaguely attributed to most *Maesae* in Fiji.

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Mountains near Lautoka, *Greenwood* 896; Savundamata Creek, west of Nandarivatu, *Webster & Hildreth* 14252; slopes of escarpment north of Nandarivatu, *Smith* 6031; vicinity of Nandarivatu, *Gibbs* 557; slopes of Mt. Nanggaranambuluta, *Gillespie* 3679; slopes of Mt. Tomanivi, *Smith* 5219. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith* 5428. NAMOSI: Slopes of Mt. Voma, *DA* 945; vicinity of Namuamua, *Gillespie* 2959. REWA: Suva, *Tohill* 555. OVALAU: Slopes of Mt. Koronimoko, vicinity of Thawathi, *Smith* 8073; north of Levuka, *Gillespie* 3474. NGAU: *Milne* 222. VANUA LEVU: MATHUATA: *Seemann* 288; vicinity of Natua, Seangangga Plateau, *DA* 15199; southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith* 6347. THAKAUNDOVE: Savusavu Bay region, between Urata and Valeti, *Degener & Ordonez* 13824.

The relationships of *Maesa corylifolia*, usually a distinct and unmistakable species, to other species from Fiji and the New Hebrides were discussed in my 1973 review. A few specimens suggest introgression with *M. pickeringii* and *M. tabacifolia*, but in general the three species are readily separated from one another.

2. ***Maesa pickeringii*** A. Gray in Proc. Amer. Acad. Arts 5: 329. 1862; Seem. Viti, 438. 1862, Fl. Vit. 148. 1866; Horne, A Year in Fiji, 264. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 226. 1892; Mez in Pflanzenz. 9 (IV. 236): 37. 1902; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. 54: 13. fig. 12. 1973.

FIGURE 84 (upper right).

Maesa corylifolia sensu Gibbs in J. Linn. Soc. Bot. 39: 155, p. p. 1909; non A. Gray.

A shrub or small tree to 10 m. high, or a scrambling liana, occurring at elevations from near sea level to 850 m. in dense or open forest, in thickets, or on open or grassy slopes. The corolla is white; both flowers and fruits have been noted between June and January.

TYPIFICATION: The type is *U. S. Expl. Exped.* (US 49420, p. p., HOLOTYPE; ISOTYPES at GH, NY, K, P cited by Mez), collected in 1840 on Viti Levu without further locality. The holotype is mixed with a fragment of *Maesa persicifolia*; the GH and NY sheets entirely represent *M. pickeringii*; I have not examined the K and P sheets with this in mind.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and two small islands in Loma-i-Viti. Eighteen collections have been examined.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Hills near Lautoka, *Greenwood 1071*; Sambeto Range, *Vaughan 3208*; Naloto Range, *DA 14763*; vicinity of Nandarivatu, *Gibbs 556*; Mt. Nanggaranambula, east of Nandarivatu, *DA 2336*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5587a*. RA: Yanggara, *Greenwood 767A*; Ndombuilevu, *DA 1225*. MAKONGAI: *Tothill 363*. WAKAYA: *Tothill 357*.

3. *Maesa tabacifolia* Mez in *Pflanzenr.* 9 (IV. 236): 51. 1902; Rechner in *Denkschr. Akad. Wiss. Wein* 85: 326. 1910; J. W. Parham, *Pl. Fiji Isl.* 158. 1964, ed. 2. 223. 1972; A. C. Sm. in *J. Arnold Arb.* 54: 15. *fig. 10, 13*. 1973. FIGURE 84 (lower left).

Maesa indica sensu Seem. in *Bonplandia* 9: 257. 1861; A. Gray in op. cit. 10: 36. 1862; non auct. mult. *Maesa nemoralis* sensu Seem. Viti, 438. 1862, in *J. Bot.* 2: 72. 1864, *Fl. Vit.* 148. 1866, op. cit. 430. 1873;

Horne, *A Year in Fiji*, 264. 1881; Drake, *Ill. Fl. Ins. Mar. Pac.* 226. 1892; non A. DC.

Maesa grandis Gillespie in *Bishop Mus. Bull.* 74: 5. *fig. 2*. 1930; J. W. Parham, *Pl. Fiji Isl.* 156. 1964, ed. 2. 222. 1972.

Maesa samoana sensu St. John & A. C. Sm. in *Pacific Sci.* 25: 336. 1971; non Mez.

As it occurs in Fiji, *Maesa tabacifolia* is a shrub or slender tree 1–7 m. high, sometimes becoming scandent, or a liana, found between sea level and about 600 m. in dense or open forest or on its edges, in thickets, and on open hillsides. The corolla is white to pale yellow with faint purplish glandular lines; the stamens have white filaments and yellow anthers, and the gynoecium is dull pink. Flowers have been observed between July and October, fruits between July and February.

LECTOTYPIFICATION AND NOMENCLATURE: As Mez originally cited four collections without designating a type, in 1973 I proposed *Seemann 286*, p. p. (K LECTOTYPE; ISOLECTOTYPES at BM, GH), obtained at two localities: southeastern Viti Levu (July, 1860) and the vicinity of Somosomo, Taveuni (May, 1860). The portions of the specimens cannot now be separated in respect to these localities; the K and GH sheets also bear fragmentary portions of *Maesa persicifolia*. *Maesa grandis* is typified by *Gillespie 2503* (BISH HOLOTYPE; ISOTYPES at BISH, K, NY, UC), collected Sept. 3, 1927, on Mt. Voma, Namosi Province, Viti Levu. A justification of the reduction is given in my 1973 treatment.

DISTRIBUTION: Fiji, Samoa, and the Horne and Wallis Islands. In Fiji about 25 collections have been studied; the species seems less common in the more eastern archipelagoes.

LOCAL NAMES AND USE: Recorded names in Fiji are *ngginggi* (Namosi), *ndawandawa i rakalavo* (Naitasiri), *matamerangginggi* (Tailevu), *kolo ni mbeka* (Thakaudrove), and *vini* (Taveuni). Like other species of *Maesa*, it is often indicated to have "medicinal" uses.

REPRESENTATIVE COLLECTIONS: VITI LEVU: NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8773*. NAITASIRI: Waimano Creek, near Matawailevu, Wainimala River, *St. John 18180*. TAILEVU: Viwa Island, *Harvey*, Nov. 1855. REWA: Vicinity of Rewa Village, *Horne s. n.* KANDAVU: Lutumatavoro, *DA 14928*. NAIRAI: *Milne 184*. VANUA LEVU: MBUA: Thongea, Wainunu River, *DA 2275*, p. p. MATHUATA: Ndreketi Plantation, *DA 16965*. THAKAUDROVE: Hills west of Mbutha Bay, Natewa Peninsula, *Smith 812*. TAVEUNI: Vicinity of Waiyevo, *Gillespie 4632*; slopes of Mt. Manuka, east of Wairiki, *Smith 8181*. MOALA: *Milne 129*. MATUKU: *Moseley s. n.* LAKEMBA: Tumbou, *DA 1381*.

4. *Maesa insularis* Gillespie in *Bishop Mus. Bull.* 74: 6. *fig. 3*. 1930; A. C. Sm. in *J. Arnold Arb.* 54: 24. *fig. 1, 2, 16*. 1973.

Maesa samoana sensu A. C. Sm. in *Bishop Mus. Bull.* 141: 120. 1936; J. W. Parham, *Pl. Fiji Isl.* 158. 1964, ed. 2. 223. 1972; non Mez.

A liana, or a shrub or tree to 10 m. high sometimes with subscandent branches, occurring at elevations from near sea level to 1,000 m. in dense or open forest, ridge forest, and thickets along streams, and sometimes in beach thickets and among reeds in

open country. The corolla is white to greenish yellow, with deep pink or faint purple or brownish glandular lines; the stamens have white filaments and yellow anthers; the ovary is deep red or rich pink, and the fruits are brown to white. Flowers and fruits seem to occur throughout the year.

TYPEFICTION: The type is *Gillespie 3479* (BISH HOLOTYPE; ISOTYPES at BISH, NY, UC), collected Oct. 23, 1927, in the vicinity of Nasinu, Naitasiri Province, Viti Levu. Differences between this species and the closely related *Maesa samoana* Mez are discussed in my 1973 review.

DISTRIBUTION: Endemic to Fiji and known from several islands; about 50 collections are available.

LOCAL NAMES AND USE: Recorded names (some generic in nature) are *kutumirase* (Yasawas and Mba), *vorovorokuro* (Mbengga and Kandavu), *kolo ni mbeka* (Mathuata), and *vini* (Nggamea). Bark and leaf concoctions are said to be useful for "internal illnesses."

REPRESENTATIVE COLLECTIONS: YASAWAS: NATHULA: Nathula Village, *Weiner 244*. VITI LEVU: MBA: Vicinity of Tumbenasolo, valley of Namosi Creek, *Smith 4614*; valley of Nggaliwana Creek, north of Navai, *Smith 5343*. NAMOSI: Mt. Naitarandamu, *Gillespie 3116*; east of Wainikoroiuva River, near Namuamua, *Smith 9060*; vicinity of Mau, *DA 12903*. SERUA: West of Waivunu Creek, between Ngaloa and Korovou, *Smith 9250*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6101*; Viria, *Meebold 16517*; Tholo-i-suva, *DF 439 (Bola 134)*. MBENGGGA: Savusavukalou, *Weiner 188*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 118*. ONO (northeast of Kandavu): *DA 14953*. OVALAU: Near summit of main range west of Levuka, *Gillespie 4434*. VANUA LEVU: MATHUATA: Near Mbatiri, Ndreketi River, *DA 13092*, p. p.; summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6448*. THAKAUNDRIVE: East of Nandua, Yanawai River basin, *Degener & Ordonez 14102*; Mt. Nasorolevu, *DA 17155*. TAVEUNI: Summit ridge east of Somosomo, *Gillespie 4823*. NGGAMEA: Naiiviivi Village, *Weiner 71-7-37*. NAITAMBA: *Tohill 351*.

5. *Maesa tongensis* Mez in *Pflanzenr.* 9 (IV. 236): 54. 1902; Yuncker in Bishop Mus. Bull. 220: 209. 1959; A. C. Sm. in *J. Arnold Arb.* 54: 29. fig. 17. 1973.

FIGURE 204A & B.

Maesa nemoralis sensu A. Gray in *Proc. Amer. Acad. Arts* 5: 329. 1862; Hemsl. in *J. Linn. Soc. Bot.* 30: 183. 1894; Burkill in *op. cit.* 35: 44. 1901; non A. DC.

Maesa vitiensis sensu Hemsl. in *J. Linn. Soc. Bot.* 30: 183. 1894; non Seem.

Maesa samoana sensu Setchell in *Carnegie Inst. Wash. Publ.* 341: 60. 1924; Christophersen in Bishop Mus. Bull. 128: 166, p. p. 1935; Yuncker in *op. cit.* 184: 56. 1945; non Mez.

A shrub or small tree with scandent branches and 1-4 m. high, found in Fiji only near sea level on limestone formation. The corolla (in Tonga) has been noted as pale pink to greenish white, and the fruits as white. In various parts of its range the species bears flowers between May and December and fruits throughout the year.

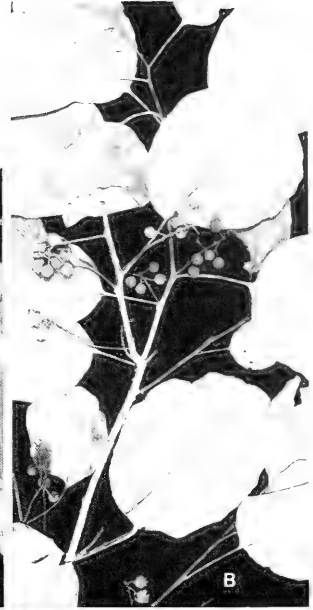
LECTOTYPIFICATION: As Mez cited three Tongan collections, in 1973 I proposed to typify the species by *Crosby 228* (K LECTOTYPE), collected in June, 1891, on Vava'u, Tonga.

DISTRIBUTION: Fiji, Samoa, and Tonga. In Tonga and on at least the eastern islands of Samoa the species seems quite frequent, but in Fiji it has been seen only on Fulanga, in southern Lau. It is a well-marked species, only distantly related to *Maesa samoana* Mez and *M. insularis* Gillespie.

LOCAL NAME: The only name recorded in Fiji was *yaro* (very questionable).

AVAILABLE COLLECTIONS: FULANGA: *Tohill 349*; on limestone formation, *Smith 1160*.

6. *Maesa persicifolia* A. Gray in *Proc. Amer. Acad. Arts* 5: 330, as *M. persicaefolia*. 1862; Mez in *Pflanzenr.* 9 (IV. 236): 48. 1902; J. W. Parham, *Pl. Fiji Isl.* 158. 1964, ed. 2. 223. 1972; A. C. Sm. in *J. Arnold Arb.* 54: 30. fig. 5, 6, 18. 1973.



Maesa nemoralis sensu A. Gray in Proc. Amer. Acad. Arts 5: 330. 1862; non A. DC.

Maesa persicaefolia A. Gray ex Seem. Fl. Vit. 148. 1866, op. cit. 430. 1873; Horne, A Year in Fiji, 264. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 226. 1892.

Maesa densiflora Gillespie in Bishop Mus. Bull. 74: 5. fig. 1. 1930; J. W. Parham, Pl. Fiji Isl. 156. fig. 59. B. 1964, ed. 2. 222. fig. 65. B. 1972.

Maesa parksii Gillespie in Bishop Mus. Bull. 74: 8. fig. 6. 1930; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 222. 1972.

A slender or compact tree or shrub 1–10 m. high, often becoming scandent, or a liana, occurring in dense, open, or dry forest or on open hillsides at elevations from near sea level to 1,200 m. The corolla is pale yellow to cream-colored or white, with faint purple glandular lines; the stamens have pale yellow filaments and anthers; and the fruits are waxy white to dull yellow or purplish. This abundant species has been found in flower and fruit in practically every month.

TYPEFIICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (us 49408 HOLOTYPE; ISOTYPE at GH), collected in 1840 at Mbua Bay, Mbua Province, Vanua Levu. Gray also mentioned *Seemann 287*, subsequently described as *Maesa vitiensis*, as "perhaps a form of this species." *Maesa densiflora* is typified by *Parks 20512* (BISH HOLOTYPE; ISOTYPES at SUVA, UC, US), collected July 2, 1927, near Nandarivatu, Mba Province, Viti Levu. The type of *M. parksii* is *Parks 20509* (BISH HOLOTYPE; ISOTYPES at SUVA, UC, US), collected in July, 1927, also near Nandarivatu. A justification of these reductions is given in my 1973 treatment.

DISTRIBUTION: Endemic to Fiji and known with certainty only from the two large islands and the Yasawas, from which about 50 collections are at hand.

LOCAL NAMES AND USES: Recorded Fijian names are *mbutambuta* (Yasawas), *kutumirase* (Mba), *kutu* (Nandronga & Navosa), *mbumbu marasea* (Ra), *merikula* (Mbua), and *mbumbu* (Thakaundrove). Medicinal uses are ascribed to the species, somewhat more specifically than usual, such as in treating cold sores and (fruits) for relieving bladder stones; children seem to consider the fruits edible.

REPRESENTATIVE COLLECTIONS: YASAWAS: YASAWA: Tethi Village, *DA 13657*. WAYA: Ridge back of Yalombi, *St. John 18010*. VITI LEVU: MBUA: Between Lautoka and Natalau, *Degener 15004*; eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4130*; Nukunuku Creek, west of Nandarivatu, *Vaughan 3398*; Mt. Nangaranambuluta, east of Nandarivatu, *Gillespie 3787*; Nandala, south of Nandarivatu, *Degener 14375*; Mt. Tomanivi, *DA 13068*. NANDRONGA & NAVOSA: Nausori Village, *DA 13333*; Mbulu, near Sovi Bay, *Degener 15037*. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith 9217*. RA: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15340*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 5786*. TAILEVU: Matavatathou, *DA 9234* (*McKee 2799*). REWA: Vicinity of Suva, *H. B. R. Parham 383*. "VITI LEVU or TAVEUNI": *Seemann 286*, p. p. VANUA LEVU: MBUA: Mt. Seatura, *DA 14895*; vicinity of Nandi, *Milne s. n.* THAKAUNDOVE: Mt. Kasi, Yanawai River region, *Smith 1783*.

7. *Maesa vitiensis* Seem. Fl. Vit. 148. 1866; Horne, A Year in Fiji, 264. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 227, p. p. 1892; A. C. Sm. in J. Arnold Arb. 54: 33. fig. 7–9, 19. 1973. FIGURES 84 (lower right), 204C & D.

FIGURE 204. A & B, *Maesa tongensis*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$; B, same, with infructescences, $\times 1/2$. C & D, *Maesa vitiensis*; C, distal portion of branchlet, with foliage and infructescences, $\times 1/2$; D, same, with infructescences, $\times 1/2$. A from *Tothill 349*, B from *Smith 1160*, C from *DA 15890*, D from *DA 14575*.

Maesa indica var. sensu Seem. in Bonplandia 9: 257. 1861; A. Gray in op. cit. 10: 36. 1862; non auct. mult.

Maesa persicaefolia sensu Seem. Viti, 438. 1862; non A. Gray.

Maesa lenticellata Gillespie in Bishop Mus. Bull. 74: 6. fig. 4. 1930; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972.

Maesa neriifolia Gillespie in Bishop Mus. Bull. 74: 7. fig. 5. 1930; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 222. 1972.

Maesa stenophylla A. C. Sm. in J. Arnold Arb. 33: 106. 1952; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972.

A shrub or a slender or compact tree 2–5 m. high or a liana, found at elevations from near sea level to 1,150 m. in dense or open forest or in thickets on crests or hill-sides. The corolla is pale yellow to cream-colored or white with faint brownish or salmon-pink glandular lines, the filaments are pale green, and the anthers are yellow. Flowers have been collected between July and January, fruits between October and March.

LECTOTYPIFICATION AND NOMENCLATURE: Of the two specimens originally cited by Seemann, in 1973 I typified the species by *Seemann 287* (K LECTOTYPE; ISOLECTOTYPES at BM, GH), collected in October, 1860, on Ovalau. A Harvey specimen cited by Seemann is referable to *Maesa persicifolia*. The type of *M. lenticellata* is *Gillespie 3149* (BISH HOLOTYPE; ISOTYPES at BISH, UC), collected Sept. 28, 1927, on the summit ridge of Mt. Naitarandamu, on the boundary between Namosi and Naitasiri Provinces, Viti Levu; that of *M. neriifolia* is *Gillespie 2390* (BISH HOLOTYPE; ISOTYPES at BISH, K, NY, UC), obtained Aug. 23, 1927, on the summit of Mt. Korombamba, Rewa Province, Viti Levu; and that of *M. stenophylla* is *Smith 6490* (A HOLOTYPE; many ISOTYPES), collected Nov. 6, 1947, on the northwestern slopes of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu. Although there is considerable variation among these types and other populations, the species as here outlined seems reasonable and is so justified in my 1973 review, where its differences from *M. persicifolia* are also discussed.

DISTRIBUTION: Endemic to Fiji and thus far known from three of the high islands, from which about 30 collections are available.

LOCAL NAMES: Recorded names are *rongo* and *tui ni nduna* (Mbua) and *kolo ni mbeka* (Mathuata).

REPRESENTATIVE COLLECTIONS: VITI LEVU: SERUA: Mt. Tikituru, summit, on boundary with Nandronga & Navosa and Namosi Provinces, *DA 14498*. NAMOSI: Track to Mt. Nandombe, Korombasambasanga Range, *DA 14575*; summit of Mt. Vakarongasiu, *Gillespie 3287*. NAITASIRI: Central Road, *Tothill 486*. REWA: Summit of Mt. Korombamba, *Webster & Hildreth 14093*. VANUA LEVU: MBUA: Rukuruku Bay, *H. B. R. Parham 6*. MATHUATA: Vicinity of Lambasa, *Greenwood 487*; Undu Point, *Tothill 358*. THAKAUNDRÖVE: Maravu, near Salt Lake, *Degener & Ordóñez 14153*; Nandongo, Sanggani Tikina, *Horne 674*. TAVEUNI: Rairai Ndreketi, *DA 15890*; Mt. Manuka, inland from Wairiki, *Smith 778*.

2. *ARDISIA* Sw. Nov. Gen. & Sp. Prodr. 3, 48. 1788; Seem. Fl. Vit. 149, p. p. 1866; Mez in Pflanzenr. 9 (IV. 236): 57. 1902; A. C. Sm. in J. Arnold Arb. 54: 36. 1973. Nom. cons.

Small trees or shrubs, rarely scandent; leaves alternate or subverticillate, petiolate or rarely sessile, the blades entire to serrate, with (sometimes obscure) punctate glands or secretory canals; inflorescences terminal or axillary, paniculate, racemose, umbelliform, or fasciculiform; flowers ♂ (rarely functionally unisexual), 5-merous; calyx cupuliform to rotate, usually deeply lobed, the lobes dextrorsely imbricate in bud; corolla deeply lobed, the lobes dextrorsely and narrowly imbricate; stamens free or affixed to corolla near base, the filaments short, the anthers dorsifixed, longitudinally dehiscent, erect, sagittate at base; ovary superior, often ovoid, the style filiform or subulate, the stigma minute, punctiform, the ovules usually several-seriate on placenta but sometimes (as in our indigenous species) irregularly uniseriate; fruit a 1-seeded

drupe, often subglobose, the style base persistent or caducous, the seed subglobose, usually not excavate at base.

TYPE SPECIES: *Ardisia tinifolia* Sw. Typ. cons.

DISTRIBUTION: Tropical America and tropical Asia (northward to warm temperate Asia), extending eastward through Malesia to Australia and the Solomon Islands, and with one endemic species terminating the generic range in Fiji. The genus includes 300 or more species, including several attractive ornamentals, one of which is cultivated in Fiji. *Ardisia* was inadvertently omitted from my discussion of genera with distributions terminating in Fiji (in J. Arnold Arb. 36: 273-292. 1955).

KEY TO SPECIES

Indigenous species; leaf blades elliptic to oblong-lanceolate, 4-13 × 1.5-3.5 cm., irregularly and inconspicuously crenate but not glandular at margin, the secondary nerves 12-25 per side; inflorescences irregularly fasciculiform or short-racemose (rarely short-paniculate), the rachis to 3 mm. long (rarely to 15 mm. long in fruit), the flowers 1-7, the pedicels 4-11 mm. long at anthesis. . . . 1. *A. brackenridgei*
Cultivated species; leaf blades 6-18 × 1.5-6 cm., undulate to crenate at margin and with resinous glands in sinuses, the secondary nerves about 8 per side; inflorescences subumbelliform, usually borne at apices of pedunclelike branchlets 1-7 cm. long, the flowers 2-12, the pedicels 7-15 mm. long at anthesis.

2. *A. crispata*

1. ***Ardisia brackenridgei*** (A. Gray) Mez in Pflanz. 9 (IV. 236): 127. 1902; Turrill in J. Linn. Soc. Bot. 43: 30. 1915; J. W. Parham, Pl. Fiji Isl. 155. 1964, ed. 2. 220. 1972; A. C. Sm. in J. Arnold Arb. 54: 36. fig. 20-23. 1973. FIGURE 205.

Ardisia sp. Seem. in Bonplandia 9: 257. 1861; A. Gray in op. cit. 10: 37. 1862; Seem. in op. cit. 10: 296. 1862, Viti, 439. 1862.

Myrsine brackenridgei A. Gray in Proc. Amer. Acad. Arts 5: 330. 1862; Seem. Viti, 438. 1862, Fl. Vit. 149. 1866; Horne, A Year in Fiji, 265. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 228. 1892.

Ardisia vitiensis Seem. Fl. Vit. 150. 1866; Horne, A Year in Fiji, 257. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 228. 1892.

Ardisia storckii Seem. Fl. Vit. 150. 1866; Horne, A Year in Fiji, 257. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 228. 1892; Mez in Pflanz. 9 (IV. 236): 126. 1902; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 220. 1972.

Myrsine sp. n. Horne, A Year in Fiji, 265. 1881.

Tinus storckii Kuntze, Rev. Gen. Pl. 2: 975. 1891.

A slender shrub or small tree 0.5-5 m. high, often simple-stemmed and dense-foliaged, occurring at elevations of 150-915 m. in dense forest or thickets or in the forest-grassland transition. The leaves sometimes have reddish petioles; the flower buds are pale pink to red and the mature corolla is pink; and the fruits are dull white, pink- or purple-tinged, and at length red. Flowers have been obtained between September and March, fruits more or less throughout the year.

TYPE AND NOMENCLATURE: The type of *Myrsine brackenridgei* is U. S. Expl. Exped. (US 63445 HOLOTYPE; ISOTYPES at GH, NY), collected in 1840 in the mountains of Ovalau. *Ardisia vitiensis* is typified by Seemann 291 (K HOLOTYPE; ISOTYPES at BM, GH), obtained on Viti Levu in July, 1860; at that time Seemann visited coastal southeastern areas between the present Provinces of Serua and Tailevu. Of the two collections cited by Seemann for *A. storckii*, in 1973 I selected Storck 897 (K LECTOTYPE; ISOLECTOTYPES at BM, GH), collected in 1860 or 1861 on either Viti Levu or Ovalau. Although the species is a very distinct one, differences among the three type collections are inconsequential, as noted in my 1973 review.

DISTRIBUTION: Endemic to Fiji and known from several of the high islands. As the known localities are scattered, it seems advisable to cite all available material here.

LOCAL NAME: The only recorded Fijian name is *thondo* (from Smith 551, Vanua Levu).

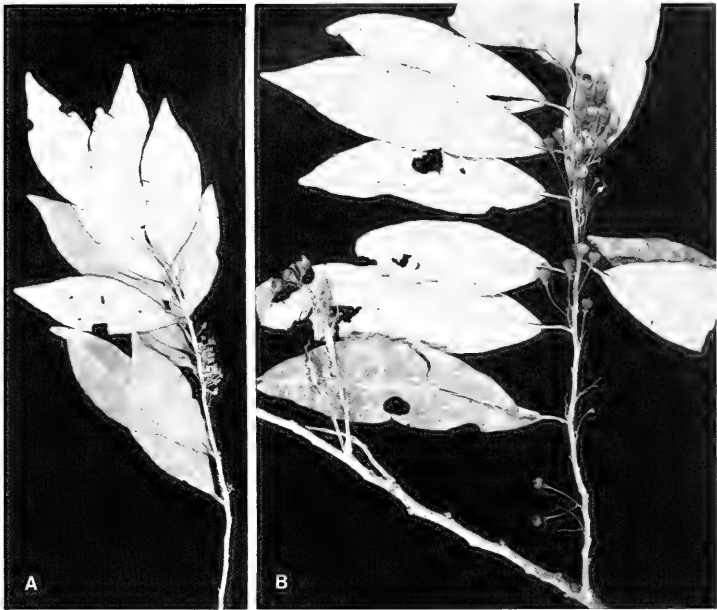


FIGURE 205. *Ardisia brackenridgei*; A, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$; B, same, with infructescences, $\times 1/2$. A from DA 14131, B from DA 14507.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 447*; Mt. Mbatilamu, DA 14131; south of Nandarivatu, *in Thurn 282*; between Nggaliwana and Tumbeindreketi Creeks, east of Navai, *Smith 6017*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5527*; between Koronayalewa and Mt. Vonolevu, DA 1392. SERUA: Upper Navua River, DA 15518. VITI LEVU without further locality, *Graeffe 22*. VITI LEVU or OVALAU: *Seemann 292*. OVALAU: *Horne 262, 291, 355*; Mt. Korotolutolu, west of Thawathi, *Smith 8031*; south of Mt. Korolevu, west of Lovoni Valley, *Smith 7537*; Wainisavulevu, Lovoni Valley, DA 14507. KORO: Eastern slope of main ridge, *Smith 977*. VANUA LEVU: MBUA: Navotuvotu, summit of Mt. Seatura, *Smith 1656*. MATHUATA-THAKAUNDROVE boundary: Crest of Korotini Range, *Smith 551*. TAVEUNI: Mt. Manuka, east of Wairiki, *Smith 774*. MOALA: Above Maloku, *Smith 1345*. FIJI without further locality, *Yeoward 25*.

2. *Ardisia crispa* (Thunb.) A. DC. in *Trans. Linn. Soc.* 17: 124. 1834, in DC. *Prodr.* 8: 134. 1844; *Mez in Pflanzendr.* 9 (IV. 236): 144. *fig. 22*. 1902; J. W. Parham, *Pl. Fiji Isl.* ed. 2. 220. 1972; A. C. Sm. in *J. Arnold Arb.* 54: 40. 1973.

Bladhia crispa Thunb. *Fl. Jap.* 97. 1784.

Tinus crispa Kuntze, *Rev. Gen. Pl.* 2: 415. 1891.

As it occurs in Fiji, this attractive species is cultivated at elevations not much above sea level as a shrub 0.5–3 m. high. Its corolla is white to pink and its fruits are red.

Flowers have been noted in December and January, fruits in April, September, and December.

TYPEIFICATION: The type, from Japan, was presumably collected by Kaempfer.

DISTRIBUTION: Eastern Asia from Sikkim through upper India and China to Hainan, Formosa, and the Ryū Kyūs to Japan, and southward to the Philippines, Sumatra, Java, and Borneo; widely cultivated elsewhere.

LOCAL NAMES AND USE: In Fiji the names *holly*, *Australian holly*, and *crispa* have been noted; a desirable ornamental for use in gardens and hedges.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Plant Introduction and Quarantine Station, Nandurulou, DA 9811; Mbatiki (Arboretum), DA 11745. REWA: Lami, in private garden, DA 11570; Vunikawai, DA 6065; Suva, in private garden, DA 16090.

3. *TAPEINOSPERMA* Hook. f. in Benth. & Hook. f. Gen. Pl. 2: 647. 1876; Mez in Pflanzenr. 9 (IV. 236): 162. 1902; Gillespie in Bishop Mus. Bull. 74: 8. 1930; A. C. Sm. in J. Arnold Arb. 36: 286. 1955, in op. cit. 54: 228. 1973.

Ardisia sensu Seem. Fl. Vit. 149, p. p. 1866.

Trees or shrubs, sometimes subscandent, rarely lianas, the vegetative and inflorescence parts often ornamented with conspicuous punctate or lineolate glands; leaves often congested toward apices of branchlets, sometimes large, petiolate or sessile, the blades entire; inflorescences axillary, supra-axillary, or subtended by caducous scales rather than by leaves, paniculate or rarely congested and appearing subcapitate, the panicles composed of racemes or umbelliform corymbs; flowers ♂, (3-) 5(-7)-merous, pedicellate, the pedicels often distally swollen but sometimes slenderly terete; calyx clavate to cupuliform or subtrotate, the lobes narrowly or broadly dextrorsely imbricate in bud, spreading at anthesis, often inequilaterally emarginate or retuse; corolla conical to subglobose in bud, becoming campanulate to rotate, the lobes strongly dextrorsely contorted in bud, erect or spreading at anthesis and often inequilaterally emarginate or retuse; stamens usually shorter than corolla, the filaments proximally connate into a membranous tube lining and adnate to corolla tube, distally free and ligulate, the anthers dorsifixed near base, often oblong-deltoid and dorsally glandular-punctate, longitudinally dehiscent; ovary superior, usually ovoid, attenuate into an obvious style, the placenta ovoid, acute, the ovules 2-12 (in our species 2-5 in shallow, lateral or somewhat distal foveolae), the style cylindrical, as long as or longer than ovary at anthesis, the stigma inconspicuously discoid or subcapitate; fruit a 1-seeded drupe, subglobose to oblate or turbinate, carnosic when fresh, drying hard and coriaceous, usually rounded at base and umbonate at apex, the exocarp usually glandular, the mesocarp thick and succulent, fibrous in drying, the endocarp bony, smooth or ornamented, the seed subglobose to oblate, shallowly excavate at base.

TYPE SPECIES: The genus has not yet been lectotypified (ING, 1979); Hooker based it on two new New Caledonian species, *Tapeinosperma vieillardii* and *T. lenormandii*, either of which could serve as the lectotype species, although the former seems better represented in herbaria.

DISTRIBUTION: Eastern Malesia (Borneo and New Guinea) to Australia, New Caledonia, the New Hebrides, and Fiji, where twelve endemic species terminate the generic range. The genus includes 60 or more species.

KEY TO SPECIES

Inflorescences subcapitate or congested-racemose or congested-pinnate-paniculate, the flower-subtending bracts large, 15-18 × 12-18 mm., subpersistent; flowers large, the calyx lobes 6-10 mm. long, accrescent in fruit, the corolla 7-12 mm. long, with lobes 6-8 mm. long; fruits large, 20-35 mm. in diameter, the endocarp forming a bony putamen 15-25 mm. in diameter, conspicuously and irregularly 5-angled; leaf blades prevalently obovate, large, usually 20-58 × 6-16 cm., attenuate to a stout petiole, this variable in length from essentially none to 30 mm. 1. *T. capitatum*

Inflorescences paniculate, not congested or subcapitate, the flower-subtending bracts not exceeding 3 mm. in length, caducous; flowers smaller, the calyx lobes not exceeding 6 mm. in length, the corolla not more than 6 mm. long, with lobes not exceeding 5 mm. in length; fruits not more than 15 mm. in diameter, the endocarp essentially smooth on outer surface.

Leaf blades narrowly cordate, rounded, or obtuse at base, very rarely acute, not decurrent or only short-decurrent on petiole, this terete or semiterete proximally.

Inflorescences 15–35 cm. long, the flowers large, the corolla 8–10 mm. in apical diameter, with lobes 4–5 × 3–4 mm.; leaf blades very robust, narrowly oblong, 55–90 cm. long, 12–20 cm. broad, the petiole stout, 3–20 mm. long. 2. *T. megaphyllum*

Inflorescences smaller, rarely as long as 20 cm., the flowers comparatively small, the corolla 3–6 mm. in apical diameter, with lobes 1.8–3 × 1.3–2.8 mm.; leaf blades not exceeding 40 × 15 cm.

Leaf blades oblong to oblong-elliptic or oblong-lanceolate, usually 3 or 4 times as long as broad, the petiole obvious, at least 10 mm. long.

Petioles (15–) 20–70 mm. long, the leaf blades variable but comparatively ample, usually 15–37 × 4–15 cm.; inflorescences bipinnately paniculate, 3–20 cm. long. 3. *T. hornei*

Petioles 10–35 mm. long, the leaf blades smaller, 4–14 × 1–3.5 cm.; inflorescences pinnately paniculate, 2.5–5 cm. long. 4. *T. divaricatum*

Leaf blades elongate-ligulate, many times longer than broad, 15–40 × 1–2.3 cm., the petiole inconspicuous, 1–10 mm. long; inflorescences often bi- or tripinnately paniculate, 4–12 cm. long.

5. *T. ligulifolium*

Leaf blades attenuate or gradually narrowed toward base and long-decurrent on petiole, this often narrowly winged or angled nearly to base.

Calyx at anthesis cupuliform to turbinate or clavate, the tube obvious, the pedicel swollen distally, the calyx limb eventually, at least in fruit, becoming rotate.

Leaf blades comparatively large, usually 8–20 cm. long and 3–8.5 cm. broad; corolla 4–7 mm. in apical diameter; gynoecium about 3 mm. long at anthesis.

Calyx clavate or narrowly cupuliform, the lobes at anthesis 0.8–1.5 × 1.5–2.3 mm.; corolla lobes 2–3 × 1.5–2.5 mm. 6. *T. clavatum*

Calyx broadly cupuliform, the lobes at anthesis 1.5–3 × 2–4 mm.; corolla lobes 3–5 × 2–4 mm.

Inflorescences (peduncle, rachis, branches, pedicels, and calyces) copiously puberulent or pilose (hairs 0.05–0.4 mm. long, glandular), soon glabrate; corolla lobes ovate, 3–4 mm. long and broad, glabrous; anthers 1.5–1.8 mm. long. 7. *T. ampliflorum*

Inflorescences copiously tomentellous (hairs 0.2–0.4 mm. long, multicellular, often irregularly branching, eglandular), the indument long-persistent; corolla lobes ovate or oblong, 4–5 × 2–3 mm., dorsally slightly pilose at least in bud; anthers about 1.2 mm. long.

8. *T. chloranthum*

Leaf blades comparatively small, usually 5–13 cm. long and 2–5 cm. broad; calyx 2–3.5 mm. in apical diameter, the lobes 0.6–1.3 × 1–2.5 mm.; corolla 3–5 mm. in apical diameter, the lobes 2–3.5 × 1.5–2.5 mm.; gynoecium 1.5–2 mm. long at anthesis; inflorescences (peduncle, rachis, branches, pedicels, and calyx) minutely furfuraceous or capitate-glandular or copiously pilose with several- or many-celled hairs to 0.4 mm. long. 9. *T. multiflorum*

Calyx at anthesis rotate or subrotate, the tube very short and inconspicuous, not turbinate or clavate, the pedicel not swollen distally or very inconspicuously so.

Petioles usually 15 mm. or more long (rarely only 5 mm.); leaf blades oblong-lanceolate, usually about 5 times as long as broad, 20–55 × 4–12 cm.

Calyx 3–4.5 mm. in diameter at anthesis, to 5 mm. in fruit, the lobes ovate-deltoid, 1–1.5 × 1–2 mm. at anthesis, not exceeding 2 × 2.5 mm. in fruit; leaf blades 30–55 cm. long and 4–12 cm. broad.

10. *T. grande*

Calyx 7–10 mm. in diameter in fruit, the lobes oblong-ligulate, 3.5–6 × 1.5–2 mm. and strongly reflexed; leaf blades 20–25 cm. long and 4–5.5 cm. broad. 11. *T. babucense*

Petioles 5–10 mm. long; leaf blades elliptic-oblong or obovate, 2–3 times as long as broad, 10–21 × 4–8 cm.; inflorescences tri- or quadripinnately paniculate, 10–20 cm. long, the peduncle, rachis, branches, pedicels, and calyces glandular-puberulent, often copiously so, the pedicels 1–2.5 mm. long at anthesis; calyx 2–2.5 mm. in diameter at anthesis, to 4 mm. in fruit, the lobes broadly ovate, 0.8–1 × 1–1.3 mm. at anthesis. 12. *T. greenwoodii*

1. ***Tapeinosperma capitatum*** (A. Gray) Mez in Pflanzenr. 9 (IV. 236): 165, quoad basionymum, excl. descr. et spec. cit. 1902; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. 54: 232. fig. 24–28. 1973.

FIGURE 206A.

Ardisia capitata A. Gray in Proc. Amer. Acad. Arts 5: 331. 1862; Seem. Viti, 438. 1862, Fl. Vit. 150. 1866; Horne, A Year in Fiji, 257. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 228. 1892.

Tapeinosperma cephalophorum Gillespie in Bishop Mus. Bull. 74: 8. fig. 7. 1930; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 224. 1972.

Tapeinosperma punctatum Gillespie in Bishop Mus. Bull. 74: 10. fig. 9. 1930; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 224. 1972.

A shrub or tree 2–10 m. high, often slender and few-branched, with a trunk up to 40 cm. in diameter, occurring from near sea level to an elevation of 1,100 m. in usually dense forest. This striking species has the peduncles and bracts often rich purple, the calyx being dark red to dull pink (sometimes dull yellow or green), with pale or dark reddish or purple glands. The corolla is waxy-pink or white with purplish glands, the anthers are yellow with brown connectives, and the fruits are greenish yellow, turning to red, scarlet, or maroon at maturity. Flowers and fruits (which are sought by birds) occur throughout the year.

TYPIIFICATION AND NOMENCLATURE: The type is *U. S. Expl. Exped.* (us 49388 HOLOTYPE), collected in 1840 on Ovalau. The collection seems to be a unicate and was not seen by Mez, whose interpretation was based on two other quite different collections that are referable to *Tapeinosperma ligulifolium*; nevertheless, Mez's combination is nomenclaturally correct. *Tapeinosperma cephalophorum* is based on *Gillespie 4441* (BISH HOLOTYPE; ISOTYPES at BISH, K, NY, UC), obtained Jan. 26, 1928, near the summit of the main range west of Levuka, Ovalau. This collection in all respects seems identical with Gray's type, suggesting that Gillespie was misled by Mez's erroneous description. The type of *T. punctatum* is *Gillespie 3919* (BISH HOLOTYPE; ISOTYPE at UC), collected Nov. 21, 1927, on the lower slopes of Mt. Nanggaranambuluta, near Nandarivatu, Mba Province, Viti Levu. In view of the variation in the taxon now apparent, no significant characters set apart this collection.

DISTRIBUTION: Endemic to Fiji and now known from several high islands, some 50 collections being at hand.

LOCAL NAMES: Recorded Fijian names on Viti Levu are *kandanu levu*, *masawe*, *lere ndamu*, *utu vei ni kai*, and *kuluva ni tonda*, each noted only once or twice in spite of the conspicuous appearance of this abundant species.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Slopes of Mt. Mbatilamu, *DA 14803*; Savundamataua Creek, west of Nandarivatu, *Webster & Hildreth 14247*; Mt. Nanggaranambuluta, *Smith 6307*; Nauwangga, *Degener 14535*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 12647* (*Melville et al. 7020*); ridge near Mt. Vonolevu, *DA 1393*. SERUA: Nathengathenga Creek, upper Navua River, *DF 977* (*Vakarewa 5*); Vatuvilakia, vicinity of Ngaloa, *Degener 15132*. NAMOSI: Veinungga Creek, *Horne 829*; Mt. Naitarandamu, *Gillespie 3247*; northern base of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8635*; track to Mt. Nambui, Korombasambasanga Range, *DA 14536*. NAITASIRI: Wainisavulevu–Numbulolo divide (southern portion of Rairaimatuku Plateau), *St. John 18315*; Mendrausuthu Range, *DA 15485*; Waimanu River, *DA 665*; Tamavua, *Yeoward*, Feb. 22, 1897. REWA: Mt. Korombamba, *Gillespie 2384*. KANDAVU: Mt. Mbuke Levu, *Smith 276*; Lutumatavoro, *DA 14921*. OVALAU: Summit of Mt. Ndelaiovalau and adjacent ridge, *Smith 7589*. VANUA LEVU: MBUA: Vicinity of Navave, *DA 16048*. MATHUAATA-THAKAUNDROVE boundary: Crest of Korotini Range, *Smith 538*. THAKAUNDROVE: Southwestern slope of Mt. Mbatini, *Smith 610*. TAVEUNI: Western slope between Somosomo and Wairiki, *Smith 749*; valley between Mt. Manuka and main ridge of island, *Smith 8305*.

In its congested, large-bracteate, large-flowered inflorescences and the ornamented endocarps of its large fruits, *Tapeinosperma capitatum* is entirely distinct from other Fijian and New Hebridean species of the genus, but its fruits suggest those of the two original New Caledonian species of *Tapeinosperma*.

2. *Tapeinosperma megaphyllum* (Hemsl.) Mez in Pflanzentz. 9 (IV. 236): 165. 1902; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 235. fig. 29–31. 1973.

FIGURE 206B.

Ardisia sp. n. Horne, A Year in Fiji, 257. 1881.

Ardisia megaphylla Hemsl. in Kew Bull. 1894: 6. Jan. 1894; Oliver in Hook. Icon. Pl. 24: pl. 2316. May, 1894.

A small tree or slender, simple-stemmed shrub 2–4 m. high, apparently infrequent from near sea level to an elevation of 590 m. in dense, shady forest. The huge leaf blades of this remarkable species are purplish or dark metallic green, and its large inflorescence has pinkish branches. The calyx is rich pink, the corolla pale yellow or nearly white and faintly pink-tinged or sometimes deeper pink, and the anthers are pale yellow. Flowers have been obtained between October and March, fruits only in October.

LECTOTYPIFICATION: Of the two collections listed by both Hemsley and Oliver, for reasons stated in 1973 I chose *Horne 429* (K LECTOTYPE; ISOLECTOTYPE at GH), collected in March, 1878, on the island of Rambi.

DISTRIBUTION: Endemic to Fiji and known from only a few collections from Viti Levu, Vanua Levu, and Rambi.

LOCAL NAME: Yeoward, for his specimen cited below, recorded the name *ndathea*, probably to be corrected to *ndasia*, known for other species of the genus.

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Hills west of Waivunu Creek, between Ngaloa and Koroavu, *Smith 9232*. NAMOSI or REWA: Along Queen's Road between Wainamboro Creek and Wainandoi River, *Vaughan 3339*. NAITASIRI: Vicinity of Tamavua River, *Gillespie 2462*. NAITASIRI or REWA: Valley of Tamavua River, *Yeoward l.* VANUA LEVU: MATHUATA: Mt. Numbuiloa, east of Lambasa, *Smith 6459*.

3. *Tapeinosperma hornei* Mez in Pflanzentr. 9 (IV. 236): 164. 1902; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 239. fig. 32–36. 1973.

Ardisia sp. n. Horne, A Year in Fiji, 257. 1881.

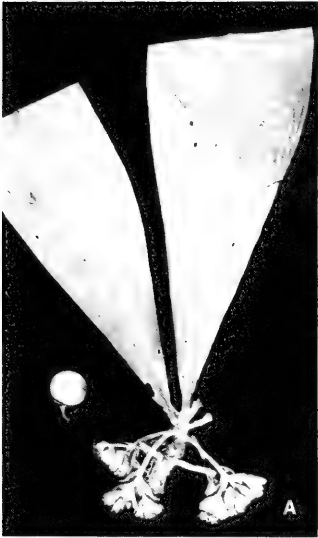
A simple-stemmed shrub or a slender tree 2–9 m. high, with the foliage and inflorescences often borne on separate branchlets, found at elevations of 40–1,150 m. in dense, often deeply shady forest. The inflorescence branches, pedicels, and calyces are rich pink to purple; the corolla varies from dull yellowish green or white to pink and is marked by yellowish or brownish glands; the anthers are yellow; and the fruits turn from green to red or scarlet, with purple glands. Flowers and fruits have been obtained in most months.

LECTOTYPIFICATION: Only one collection was cited by Mez, who failed to indicate a depository: *Horne 883* (K LECTOTYPE, cf. Smith, 1973; ISOTYPES at GH, LE also listed by Mez), collected in July, 1878, along Veinunga Creek, Namosi Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known to occur on Viti Levu with reasonable abundance, but otherwise represented only by single collections from Ovalau and Vanua Mbalavu. Thirty-nine collections have been examined.

LOCAL NAMES: Fijian names recorded on Viti Levu are *sila*, *sila ni veikau*, and *mokoelu* (Mba), *samoloa* (Serua), and *ndasia* (Tailevu).

FIGURE 206. A, *Tapeinosperma capitatum*, distal portion of branchlet, with foliage and inflorescences, and a detached fruit, $\times 1/4$. B, *Tapeinosperma megaphyllum*, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$. C, *Tapeinosperma divaricatum*, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$. D, *Tapeinosperma ampliflorum*, distal portion of branchlet, with an inflorescence, $\times 1/3$. A from *Smith 749*, the detached fruit from *DA 14536*, B from *Smith 9232*, C from *DA 12384*, D from *DA 14126*.



REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Mt. Ndelaiyoö, on escarpment west of Nandarivatu, *Smith 5069*; vicinity of Nandarivatu, *Gillespie 4365*; Mt. Nanggaranambuluta, *Tothill 361*; Nauwanga, *Degener 14560*; Mt. Tomanivi, *DA 12694 (Melville et al. 7082)*. NANDRONGA & NAVOSA: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5606*; Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15622*. SERUA: Vunambua Creek, upper Navua River, *DA 14871*; hills east of Navua River, near Nukusere, *Smith 9139*; inland from Namboutini, *DF 205 (Bola 64)*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8447*; track to Mt. Vakarongasi, *DA 16114*. NAITASIRI: Waimanu River, *DA 15574*; vicinity of Nasinu, *Gillespie 3482*. TAILEVU: Hills east of Wainimbuka River, vicinity of Ndakuivuna, *Smith 7100*. REWA: Wainamboro Creek, *DA 5918*; Mt. Korombamba, *DA 16543*. OVALAU: Hills southeast of valley of Mbureta River, *Smith 7463*. VANUA MBALAVU: Northern end of island, on limestone, *Bryan 577*.

4. *Tapeinosperma divaricatum* (Gillespie) A. C. Sm. in J. Arnold Arb. **54**: 241. fig. 37–41. 1973. FIGURE 206C.

Discocalyx divaricata Gillespie in Bishop Mus. Bull. **74**: 10. fig. 10. 1930; J. W. Parham, Pl. Fiji Isl. **156**. fig. 59, A. 1964, ed. 2. 220. fig. 65, A. 1972.

A shrub or tree 1–4 m. high, sometimes with horizontal branches and subscandent, or a liana, occurring at elevations of 700–1,100 m. in usually dense forest. The pedicels, inflorescence branches, and calyx are pink; the corolla is pink to maroon or rich purple; the filaments are pale pink; and the fruits turn from green to bright red or scarlet and are marked with red glands. Flowers have been collected between May and August, fruits in months scattered throughout the year.

TIPIFICATION: The type is *Parks 20592* (BISH HOLOTYPE; ISOTYPE at UC), collected in July, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from upland areas in the northern and western parts of Viti Levu.

LOCAL NAME: The only recorded Fijian name is *mbulumbulu* (*Gillespie 3843*).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Mt. Mbatilamu, *DA 14809*; Mt. Evans Range, *Greenwood 1162*; eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4250*; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith 4526*; vicinity of Nandarivatu, *Tothill 203*, *Parks 20534*, *Gillespie 3843*, *DA 12384*, O. & I. *Degener 32049*; Mt. Nanggaranambuluta, *Gillespie 4069.1*, *Smith 4823*; hills east of Nandala Creek, *Smith 6216*; Mt. Matomba, Nandala, *Degener 14449*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13396*.

5. *Tapeinosperma ligulifolium* A. C. Sm. in J. Arnold Arb. **33**: 107. 1952; J. W. Parham, Pl. Fiji Isl. **160**. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. **54**: 243. fig. 42–44. 1973.

Tapeinosperma capitatum sensu Mez in Pflanzenz. **9** (IV. 236): 165, quoad descr. et spec. cit., non sensu typi. 1902.

A shrub 1.5–2 m. high, rare and strikingly distinct, found (as far as recorded) at elevations of 200–590 m. in dense ridge forest. The inflorescence branches, calyx, and corolla are rich pink. Flowers have been obtained in November and December, fruits only in August.

TIPIFICATION: The type, a unicate specimen, is *Smith 6522* (A HOLOTYPE), collected Nov. 6, 1947, on the summit ridge of Mt. Numbuiloa, east of Lambasa, Mathuata Province, Vanua Levu. The two numbers cited by Mez as *Tapeinosperma capitatum* have no type status in either species.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Vanua Levu. The part of *Seemann 293* cited by Mez is not necessarily from Kandavu, the locality of the part of that number that is the type of *Tapeinosperma grande*.

AVAILABLE COLLECTIONS: VITI LEVU: NAITASIRI: Tholo-i-suva, *im Thurn 359*, p. p. VANUA LEVU: MATHUATA: Mt. Numbuiloa, *DA 14625*. FIJI without further locality, *Seemann 293*, p. p. (K) (possibly from Ovalau; cf. *Smith* in 1973, p. 256), *Horne 1076*.

The superficial resemblance of this species to *Ixora bullata* Turrill (Rubiaceae) led im Thurn to combine his material of the two species, which he obtained at the same locality but on different dates, under his number 359.

6. ***Tapeinosperma clavatum*** Mez in Pflanzenz. 9 (IV. 236): 164. 1902; Gillespie in Bishop Mus. Bull. 74: 9. fig. 8. 1930; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 246. fig. 45-47. 1973.

Ardisia humilis sensu A. Gray in Bonplandia 10: 37. 1862; non auct. mult.

Ardisia sp. n. Horne, A Year in Fiji, 257. 1881.

An often slender tree or shrub 1.5-10 m. high, occurring at elevations of 400-1,120 m. in dense forest or in the dense thickets of crests and ridges. The corolla is greenish or white, with purple glands, and the fruits mature to a bright or deep red. Flowers and fruits have been observed between May and January.

LECTOTYPIFICATION: Of the two Horne numbers cited by Mez, in 1973 I selected *Horne 180* (K LECTOTYPE; ISOLECTOTYPE at GH), collected in January, 1878, in the mountains surrounding Lovoni Valley, Ovalau.

DISTRIBUTION: Endemic to Fiji and thus far known from Viti Levu, Kandavu, and Ovalau. Twenty-seven collections have been studied.

LOCAL NAMES: Recorded names on Viti Levu are *sila* and *ndasia*.

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Upper slopes of Mt. Koromba, *Smith 4665*; Savundamatau Creek, west of Nandarivatu, *Webster & Hildreth 14243*; vicinity of Nandarivatu, *Gillespie 4037*; ridge between Mt. Nanggaranambuluta and Mt. Namama, east of Nandarivatu, *Smith 4981a*. NANDRONGA & NAVOSA: Ridge above Koronayalewa, *DA 2481*. SERUA: Track to Mt. Tikituru, *DA 14484*. NAMOSI: Mt. Voma, *Gillespie 2674*, *DA 11663*. NAITASIRI: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6110*. KANDAVU: Mt. Mbuke Levu, *Smith 270*. OVALAU: "Tops of mountains," *Horne 52*; summit and adjacent slopes of Mt. Korotolotolu, west of Thawathi, *Smith 8037*; hills west of Lovoni Valley, on ridge south of Mt. Korolevu, *Smith 7532*; summit of Mt. Tana Lailai and adjacent ridge, *Smith 7693*; along stream above Levuka, *Gillespie 4513*. FIJI without further locality, *U. S. Expl. Exped.* (det. A. Gray as *Ardisia humilis*).

7. ***Tapeinosperma ampliflorum*** A. C. Sm. in Contr. U. S. Nat. Herb. 37: 88. 1967; J. W. Parham, Pl. Fiji Isl. ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. 54: 248. fig. 48-50. 1973. FIGURE 206D.

An often slender tree 4-10 m. high, found sparingly from near sea level to an elevation of about 900 m. in dense forest or in forest on ridges. The bracts, flower buds, calyx, and corolla are pink or dull pink, and the mature fruits are dull brown to purple. Flowers have been obtained between September and January, fruits between April and November.

TYPIFICATION: The type is *Smith 9102* (US 2192113 HOLOTYPE; many ISOTYPES), collected Oct. 29, 1953, in hills east of Navua River, near Nukusere, Serua Province, Viti Levu. (The village of Nukusere and a small adjacent area form an enclave of Namosi Province, but the surrounding hills are part of Serua.)

DISTRIBUTION: Endemic to Fiji and known from scattered localities on Viti Levu, with one collection from Kandavu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Mbatilamu, *DA 14126*. SERUA: Vatutavathe, vicinity of Ngaloa, *Degener 15176*. NAMOSI: Northern slopes of Korombasambasanga Range, in drainage of Wainavindrau Creek, *Smith 8743*. NAITASIRI (?): "Suva," *Tohill 525*. REWA: Mt. Korombamba, *Meebold 17041*. KANDAVU: Mt. Mbuke Levu, *DA 14932*.

8. ***Tapeinosperma chloranthum*** A. C. Sm. in J. Arnold Arb. 33: 106. 1952; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 251. fig. 51. 1973.

A tree 7–12 m. high, with a trunk to 35 cm. in diameter, recorded from elevations of 700–1,050 m. in dense or secondary forest. The calyx and other inflorescence parts are copiously brown-pilose with multicellular, eglandular hairs; the corolla is dull green, with purplish glands; and the fruits are red at maturity. Flowers have been obtained in August and December (bud), fruits in April and August.

TYPIFICATION: The type is *Smith 5820* (A HOLOTYPE; many ISOTYPES), collected Aug. 26, 1947, in hills between Nggaliwana and Nandala Creeks, south of Nauwangga, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from upland forest in northern and northwestern Viti Levu.

LOCAL NAME: *Kutumirase* (*Smith 4023*, doubtful, usually applied to *Maesa*).

AVAILABLE COLLECTIONS: VITI LEVU: Mba: Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, *Smith 4023*; vicinity of Nandarivatu, *DA 13100*; vicinity of Navai, *O. & I. Degener 32114*. NANDRONGA & NAVOSA: Yavu Creek (tributary of Ndura Creek, Mba River headwaters), *DF 1091 (Damanu 205)*.

9. *Tapeinosperma multiflorum* (Gillespie) A. C. Sm. in J. Arnold Arb. 54: 252. fig. 52, 53. 1973.

Discocalyx multiflora Gillespie in Bishop Mus. Bull. 74: 11. fig. 11. 1930; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972.

Discocalyx obtecta A. C. Sm. in J. Arnold Arb. 33: 108. 1952; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972.

An often slender tree (with a trunk to 20 cm. in diameter) or a simple-stemmed shrub 1.5–9 m. high, found in dense forest or in the thickets and mossy forest of ridges and crests, often in shady places, at elevations of 725–1,323 m. The calyx is green, with reddish glands and a brown indument; the corolla is waxy-white, with dark red glands; the anthers are deep red dorsally; and the fruits turn from red to purple at maturity. Flowers have been noted between August and December, fruits only in June and July.

TYPIFICATION AND NOMENCLATURE: *Discocalyx multiflora* is typified by *Gillespie 5113* (BISH HOLOTYPE; ISOTYPE at UC), collected Sept. 28, 1927, near the summit of Mt. Naitarandamu, on the slope in Namosi Province, Viti Levu; the type of *D. obtecta* is *Smith 6217* (A HOLOTYPE; many ISOTYPES), obtained Sept. 25, 1947, in hills east of Nandala Creek, south of Nandarivatu, Mba Province, Viti Levu. A justification of combining the two concepts and transferring the taxon to *Tapeinosperma*, where it is related to the three preceding species, was given in my 1973 review.

DISTRIBUTION: Endemic to Fiji and thus far known only from northern and central Viti Levu, with a single montane collection from Vanua Levu; 15 collections have been examined.

LOCAL NAMES: Recorded Fijian names are *sila* and *sendua* (both from Viti Levu).

REPRESENTATIVE COLLECTIONS: VITI LEVU: Mba: Mt. Evans Range, *Greenwood 1149*; southern slopes of Mt. Ndelainathovu, on escarpment west of Nandarivatu, *Smith 4921*; Mt. Nanggaranambuluta, east of Nandarivatu, *Gillespie 3791*; vicinity of Navai, *DA 14452*; hills between Nggaliwana and Tumbeindreketi Creeks, east of Navai, *Smith 6007*; summit of Mt. Tomanivi, *Smith 5912*. NAMOSI: Near summit of Mt. Naitarandamu, *Gillespie 3296*. NAITASIRE: Wainisavulevu–Numbulolo divide (southern portion of Rairaimatuku Plateau), *St. John 18323*. VANUA LEVU: THAKAUNDOVE: Summit of Mt. Mbatini, *Smith 709*.

10. *Tapeinosperma grande* (Seem.) Mez in Pflanzenz. 9 (IV. 236): 164. 1902; J. W. Parham, Pl. Fiji Isl. 159. fig. 60. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 255. 1973.

Ardisia grandis Seem. in Bonplandia 9: 257, nom. nud. 1861, Viti, 439, nom. nud. 1862; A. Gray in Proc. Amer. Acad. Arts 5: 331, nom. nud. 1862, in Bonplandia 10: 37, nom. nud. 1862; Seem. Fl. Vit. 150. t. 29. 1866; Horne, A Year in Fiji, 257. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 228. 1892.

An often slender tree or simple-stemmed shrub 2–6 m. high, known from near sea level to an elevation of about 850 m. in dense forest. No notes indicate flower colors; the mature fruits are red. The only satisfactory flowers are those of the type, presumably collected in August or September; fruits have been obtained between June and January.

TIPIFICATION: The type is *Seemann 293*, p. p. (K HOLOTYPE; ISOTYPES at BM, GH), collected in 1860 on Kandavu. Some confusion is attached to this collection, which was first described and well illustrated in 1866, the name having been previously mentioned only in lists. Seemann in 1866 notes the locality as Ovalau, but his field label on the holotype clearly states "Kadavu." The second K sheet labeled as *Seemann 293* is clearly referable to *T. ligulifolium* (q. v.), but it bears no locality data and may possibly have been obtained on Ovalau.

DISTRIBUTION: Endemic to Fiji and thus far known from four of the high islands.

LOCAL NAMES: Recorded names are *kaikaro* (Nandronga & Navosa) and *ndasia* (Naitasiri).

AVAILABLE COLLECTIONS: VITI LEVU: NANDRONGA & NAVOSA: Mbalo, near Vatukarasa, *Tabualewa 1303*. NAITASIRE: Vasila, Waindina River, *DA 660*; vicinity of Tamavua, *Gillespie 2024*. KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 163*; vicinity of Naikororo, *DF 361*, p. p. (*Damanu 50*); without further locality, *DA 11951 (DF 31, Watkins 700)*. NGAU: Slopes of Mt. Ndelaitho, on northern spur toward Navukailangi, *Smith 7880*. VANUA LEVU: MATHUATA: Vunimoli, upper Lambasa River, *DA 15393*. THAKAUNDROVE: Eastern drainage of Yanawai River, *Degener & Ordenez 14095*, p. p.; Mt. Mariko, *Smith 446*.

This striking species, although closely related only to the next, may suggest in foliage *Tapeinosperma hornei*, for a comparison with which see my 1973 review, p. 256.

11. *Tapeinosperma babucense* Mez in Pflanzenz. 9 (IV. 236): 164. 1902; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. 54: 257. 1973. *Ardisia* sp. n. Horne, A Year in Fiji, 257. 1881.

A shrub (or small tree?) about 3 m. high, apparently rare, known only from an approximate elevation of 300–600 m. and presumably in dense forest. Only fruiting material is known, collected in August.

TIPIFICATION: A single specimen is known: *Horne 946* (K HOLOTYPE), collected in August, 1878, in mountains near Namboumbutho Creek (northwestern headwaters of Wainimala River), Naitasiri Province, Viti Levu. Horne's spelling for Namboumbutho was "Babuca," in reference to a village and a "small district" situated where the creek joins the Wailoa River; one may assume that "Babuca" is the present-day village of Nanggelewai.

DISTRIBUTION: Endemic to Fiji and known only from the type specimen.

This inadequately known species is clearly related to *Tapeinosperma grande*, from which it is just as clearly separable on the basis of its large, long-lobed calyces and less robust facies.

12. *Tapeinosperma greenwoodii* A. C. Sm. in J. Arnold Arb. 26: 103. 1945; J. W. Parham, Pl. Fiji Isl. 160. 1964, ed. 2. 224. 1972; A. C. Sm. in J. Arnold Arb. 54: 258. fig. 54. 1973.

A tree 3–10 m. high, known from dense, low forest at elevations of 880–1,050 m. The corolla is noted as pure white, the fruits as green, but doubtless these turn red at

maturity. Flowers have been obtained in September and October, fruits in January and May.

TYPIIFICATION: The type is *Greenwood 994*, p. p. (A HOLOTYPE; ISOTYPES at BISH, K, NY), collected Oct. 25, 1942, in the Mt. Evans Range, Mba Province, Viti Levu. Revisiting the same tree on Sept. 24, 1944, Greenwood collected somewhat more mature flowers and also numbered the material 994 (A, UC, US), but the 1944 specimens cannot be considered isotypes (ICBN, Art. 7.6).

DISTRIBUTION: Endemic to Fiji and thus far known only from the Mt. Evans Range and adjacent hills, in northwestern Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: MBA: Mt. Mbatilamu, *DA 14120*; eastern slopes of Mt. Koroyanitu, Mt. Evans Range, *Smith 4133*.

Tapeinosperma greenwoodii seems to be the only Fijian species of the genus that bears any significant relationship to a non-Fijian taxon, the New Hebridean *T. scrobiculatum* (Seem.) Mez. From this *T. greenwoodii* differs in the more complex branching of its inflorescences and their copious, glandular-puberulent indument, its shorter pedicels, its smaller calyces, and its much smaller fruits (even if mature fruits of the Fijian taxon are still wanting, it is obvious that the mature size will not approach 15 mm. in diameter, noted for *T. scrobiculatum*).

4. DISCOCALYX Mez in Pflanzenr. 9 (IV. 236): 211. 1902; A. C. Sm. in J. Arnold Arb. 54: 263. 1973.

Badula sect. *Discocalyx* A. DC. in DC. Prodr. 8: 107. 1844.

A genus closely related to *Tapeinosperma* and with the same basic characters, but with the filaments firmly connate for their entire length into a tube adnate to corolla tube and not distally free, the anthers broadly basifixed on filament tube and appearing sessile in corolla throat; style commonly shorter than ovary at anthesis; flowers perhaps sometimes functionally unisexual (but always ♂ in our species); pedicels slenderly terete; calyx subrotate from base; ovary with 2-5 ovules; fruits usually comparatively small and with a smooth endocarp.

TYPE SPECIES: *Discocalyx cybianthoides* (A. DC.) Mez (*Badula cybianthoides* A. DC.).

DISTRIBUTION: Malesia, with many species in the Philippines, eastward to Micronesia, Fiji, and Tonga, with 50 or more species. Three species are endemic in Fiji and one in Tonga.

KEY TO SPECIES

- Petioles 5-17 mm. long, narrowly winged distally and usually nearly to base; leaf blades comparatively small, elliptic to oblong- or obovate-elliptic, (2-) 4-11 (-18) × (1-) 2-6 cm., attenuate at base and long-decurrent on petiole; inflorescences at anthesis and in fruit 2-9 × 1-4 cm.; calyx 1.5-3 mm. in apical diameter; corolla 3.5-6 mm. in apical diameter; mature fruits 4-7 mm. in diameter; vegetative and inflorescence indument composed of minute scales or short hairs, evanescent. 1. *D. fusca*
- Petioles 30-110 mm. long, narrowly winged distally, subterete or semiterete proximally; leaf blades comparatively ample, elliptic to obovate- or lanceolate-elliptic, (12-) 17-44 × 6.5-22 cm., narrowly cordate to broadly obtuse at base and only short-decurrent on petiole.
- Indument of young parts inconspicuous, the hairs glandular or eglandular, 0.1-0.3 mm. long, evanescent, the inflorescences 9-22 × 5-15 cm., on rachis (etc.) glandular-puberulent with hairs not more than 0.1 mm. long; petioles usually 50-110 mm. long, the leaf blades usually about twice as long as broad. 2. *D. amplifolia*
- Indument persistent on foliage and inflorescences, the hairs 0.2-1.5 mm. long, several- to many-celled, eglandular; inflorescences 4-11 × 2-5 cm.; petioles 30-70 mm. long, the leaf blades often about 3 times longer than broad. 3. *D. crinita*

1. **Discocalyx fusca** Gibbs in J. Linn. Soc. Bot. 39: 155. *pl. 13, fig. 5-10*. 1909; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 220. 1972; A. C. Sm. in J. Arnold Arb. 54: 265. *fig. 57-60*. 1973. FIGURE 207A.

Discocalyx sylvestris A. C. Sm. in Bull. Torrey Bot. Club 70: 547. 1943; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972; non *D. sylvestris* Holth. (1942).

Discocalyx gillespieana A. C. Sm. in J. Arnold Arb. 33: 109. 1952; J. W. Parham, Pl. Fiji Isl. 156. 1964, ed. 2. 222. 1972.

An often slender tree (with a trunk to 10 cm. in diameter or perhaps more) or a shrub 2-15 m. high, occurring in dense or open forest, dense low forest, or in crest thickets at elevations of 50-1,120 m. The young inflorescence parts are purplish; the calyx and corolla are rich pink to deep purplish red, the corolla lobes often being paler; the anthers and stigmas are pale or dull yellow, the anthers with dark purple glands; and the fruits turn from red to purple at maturity. Flowers and fruits have been noted throughout the year.

TYPIFICATION AND NOMENCLATURE: The type of *Discocalyx fusca* is Gibbs 723 (BM HOLOTYPE; ISOTYPE at K), collected in September, 1907, on a wooded ridge near Nandarivatu, Mba Province, Viti Levu; that of *D. sylvestris* is MacDaniels 1134 (A HOLOTYPE; ISOTYPE at BISH), collected April 13, 1927, along "Central Road," Naitasiri Province, Viti Levu; and that of *D. gillespieana* is Smith 5546 (A HOLOTYPE; many ISOTYPES), collected Aug. 7, 1947, on the northern portion of the Rairaimatuku Plateau, between Nandrau and Nanga, Nandronga & Navosa Province, Viti Levu. The two taxa described by me, seemingly distinct at the time, are now seen to differ from *D. fusca* in only minor respects, in view of the ample material that has subsequently become available (cf. my 1973 review, pp. 267, 268).

DISTRIBUTION: Endemic to Fiji and thus far known only from the two largest islands, from which about 30 collections have been studied.

LOCAL NAMES: Recorded names are *vutuvutu* (Nandronga & Navosa) and *mbumbu* (Thakaundrove).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Eastern slopes of Mt. Koroyanitu, Mt. Evans Range, Smith 4119; Koro-O, west of Nandarivatu, DA 13733 (DF 175, Watkins 770); vicinity of Nandarivatu, Parks 20720; ridge between Mt. Nanggaranambuluta and Mt. Namama, east of Nandarivatu, Smith 4981; vicinity of Nandala, south of Nandarivatu, Degener 14376. NANDRONGA & NAVOSA: Nausori Highlands, DA 13882; Nandevondevo, vicinity of Vanualevu (western slope of Rairaimatuku Plateau), DF 1184. SERUA: Hills west of Waivunu Creek, between Ngaloa and Korovou, Smith 9237. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, Smith 8477. NAITASIRI: "Central Road," Tothill 360, April, 1927 (BISH, K), probably from type tree of *Discocalyx sylvestris*; vicinity of Tamavua, Gillespie 2096; vicinity of Nasinu, Gillespie 3451. NAITASIRI-REWA boundary: Mt. Kombalevu, Parks 20898. REWA: Mt. Korombamba, Gillespie 2289. VANUA LEVU: MBUA: Navotuvotu, summit of Mt. Seatura, Smith 1659. THAKAUNDRÖVE: Southern slopes of Korotini Range, below Navitho Pass, Smith 498.

Discocalyx fusca is readily distinguished from the Tongan *D. listeri* (Stapf) Mez & Stapf in its shorter-petiolate and smaller leaves and its small flowers and fruits.

2. **Discocalyx amplifolia** A. C. Sm. in J. Arnold Arb. 54: 269. *fig. 66, 67*. 1973.

A shrub or a compact or slender tree 2-5 m. high, found in dense or secondary forest at elevations from near sea level to 450 m. The young inflorescences are red, the branches and pedicels becoming dull purple, and the calyx is also dull purple; known fruits are green but doubtless become red at maturity. Flowers have been obtained in April (buds) and July, fruits between September and February.

TYPIFICATION: The type is DA 15444 (coll. I. T. Kuruvoli) (BISH HOLOTYPE; ISOTYPES at MASS, SUVA), collected July 10, 1967, in the Waimanu River region ("S. E. Nasele," a locality not found by me), Naitasiri Province, Viti Levu.

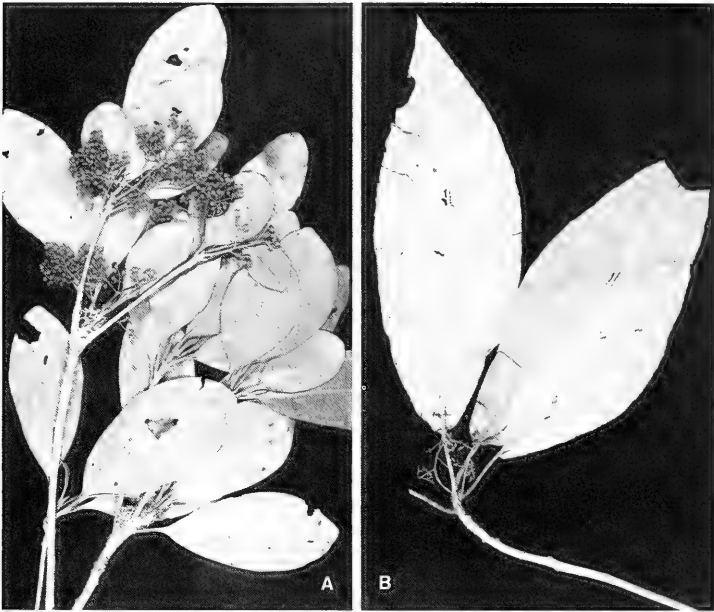


FIGURE 207. A, *Discocalyx fusca*, distal portion of branchlet, with foliage and inflorescences, $\times 1/2$. B, *Discocalyx crinita*, distal portion of branchlet, with foliage and inflorescences, $\times 1/4$. A from *Smith 4981*, B from *DA 15524*.

DISTRIBUTION: Endemic to Fiji and apparently rare, known only from southeastern Viti Levu and from a single Vanua Levu collection.

AVAILABLE COLLECTIONS: VITI LEVU: NAMOSI: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith 8798*; hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8474*. REWA: Near Botanical Station (i. e. present Suva Botanical Gardens), *Yeoward*, Feb. 22, 1897. VANUA LEVU: THAKAUNDRIVE: Nggilokalou (locality not found by me), *DA 16052*.

Discocalyx amplifolia and *D. crinita* seem to have no very close relatives; the first in a general way suggests *Tapeinosperma hornei* Mez, from which it is now seen to differ superficially as well as in generic characters (cf. my 1973 treatment, p. 272). In details of indument and foliage the two recently described species are strikingly different.

3. *Discocalyx crinita* A. C. Sm. in *J. Arnold Arb.* 54: 272. fig. 68-70. 1973.

FIGURE 207B.

A tree 6-9 m. high, found at elevations of 140-600 m. in dense forest, often on slopes. The inflorescence branches, calyx, and gynoecium are reddish, the young fruits

purple. Flowers (all slightly past anthesis) and fruits (all immature) have been obtained in June and July.

TYPIFICATION: The type is *DA 15524* (coll. *D. Koroiveibau & S. Vodonaivalu*) (BISH HOLOTYPE; ISOTYPE at SUVA), collected July 24, 1967, near the upper Navua River, Serua Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and apparently rare, known only from Serua Province on Viti Levu.

AVAILABLE COLLECTIONS: VITI LEVU: Inland from Namboutini, *DA 14269*; Tawavulu Creek, north of Ngaloa, *Webster & Hildreth 14325*.

5. *EMBELIA* Burm. f. *Fl. Ind.* 62. 1768; Mez in *Pflanzenr.* 9 (IV. 236): 295. 1902; A. C. Sm. in *J. Arnold Arb.* 54: 274. 1973. Nom. cons.

Dioecious scandent shrubs or lianas; leaves alternate, petiolate, the blades entire to crenate, often conspicuously glandular-punctate or -lineolate; inflorescences terminal (sometimes on short lateral branchlets) or axillary, paniculate, racemose, or fasciculate; flowers unisexual, pedicellate, small, 4- or 5(-6)-merous (4-merous in our species); calyx subrotate, deeply lobed, the lobes imbricate; petals free (or minutely coherent at base), narrowly imbricate in bud; stamens affixed near base of petals, the filaments usually obvious, the anthers dehiscing longitudinally, sometimes appearing developed in ♀ flowers but actually sterile; gynoecium in ♂ flowers rudimentary; ovary in ♀ flowers superior, ovoid or subglobose, the ovules few, uniseriate on placenta, the style usually short, the stigma bilobed to capitate or disciform; fruit a 1-seeded drupe, subglobose, the endocarp crustaceous, the style eventually deciduous, the seed subglobose, often excavate at base.

TYPE SPECIES: *Embelia ribes* Burm. f.

DISTRIBUTION: Old World tropics from Africa to southeastern Asia and eastward through Malesia to Australia and the Caroline Islands, with two outlying species in Fiji, Samoa, and Tonga; also indigenous in Hawaii. The single species in Fiji is endemic. The genus includes 100-130 species.

1. *Embelia gracilis* Turrill in *J. Linn. Soc. Bot.* 43: 30. 1915; A. C. Sm. in *Sargentia* 1: 96. 1942; J. W. Parham, *Pl. Fiji Isl.* 156. 1964, ed. 2. 222. 1972; A. C. Sm. in *J. Arnold Arb.* 54: 274. *fig. 71-74.* 1973.

A scrambling subsucculent shrub to 3 m. high or a liana, occurring from near sea level to an elevation of 1,180 m. in dense forest or sometimes in open, sunny forest. The petals and filaments are white, the mature fruit red or scarlet. Flowers have been noted between March and June, fruits between May and January.

TYPIFICATION: The type is *im Thurn 200* (K HOLOTYPE; ISOTYPE at BM), collected March 28, 1906, in the vicinity of Navai, south of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Taveuni (hence to be expected at least from Vanua Levu); 20 collections are now available.

LOCAL NAMES: Recorded Fijian names are *wa kumarea* and *wa ni mbai* (Mba), *wakai* (Nandronga & Navosa), *wa tuva* (Namosi), and *wa ndrenga* (Ra).

REPRESENTATIVE COLLECTIONS: VITI LEVU: MBA: Mt. Evans Range, *Greenwood 1148*; southern slopes of Mt. Ndelaithovu, on escarpment west of Nandarivatu, *Smith 4920*; Sovutawambu, near Nandarivatu, *Degener 14662*; valley of Nggaliwana Creek, near Navai, *Webster & Hildreth 14119*; western and southern slopes of Mt. Tomani, *Smith 5243*. NANDRONGA & NAVOSA: Nausori Highlands, *DA 13308*; northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5416*; Yawe, vicinity of Mbalo, near Vatukarasa, *Degener 15268*. SERUA: Vatuvilakia, vicinity of Ngaloa, *Degener 15163*. NAMOSI: Waina-

ndoi River, DA 10800. RA: Vatundamusewa, vicinity of Rewasa, near Vaileka, *Degener 15453*. TAVEUNI: Summit and adjacent slopes of Mt. Manuka, east of Wairiki, *Smith 8228*.

Embelia gracilis is distinguished from the only species in nearby areas, *E. vaupelii* Mez, of Samoa and Tonga, by having its leaf blades with copious and conspicuous, punctate or short-lineolate, translucent glands and a comparatively small fruit; the leaf blades of *E. vaupelii* have large, black, opaque, round or oval glands, these being copious toward margin. The calyx lobes of the Fijian species are sparsely pellucid-glandular; those of the more easterly species have the glands copious, opaque, and black. W. R. Sykes (in litt.) suggests that *E. vaupelii* may prove limited to Samoa; he has recently obtained flowering material from 'Eua in which the anthers are obviously borne on elongate filaments rather than being sessile. The only other known material from Tonga (cf. my 1973 review, pp. 277, 278) is sterile and has atypically large leaves; it is therefore quite possible that the Tongan collections should be separated from *E. vaupelii*.

6. RAPANEA Aubl. Hist. Pl. Guiane Fr. 121. 1775; Mez in Pflanzentr. 9 (IV. 236): 342. 1902; A. C. Sm. in J. Arnold Arb. 54: 278. 1973.

Trees or shrubs, monoecious or dioecious or with ♂ flowers; leaves alternate, the blades entire or rarely dentate, with (sometimes obscure) punctate or lineolate glands; inflorescences axillary or borne on branchlets below leaves, fasciculate or glomerulate or verruciform, sessile or short-pedunculate, few-many-flowered; flowers ♂ or (as in our species) functionally unisexual (♂ and ♀ flowers sometimes borne in the same inflorescence), small, 4- or 5-merous (infrequently 6- or 7-merous); calyx cupuliform to rotate, usually deeply lobed, the lobes imbricate or valvate, symmetrical, commonly ciliolate and glandular-punctate or -lineolate; corolla cupuliform to rotate, the lobes imbricate in bud, usually glandular-punctate or -lineolate; stamens affixed to corolla throat, the filaments completely fused with corolla tube (not forming a tube and distally produced as in *Myrsine*), the anthers sessile, sometimes partially dorsally connate to corolla and appearing sessile on it, longitudinally dehiscent, reduced and sterile in ♀ flowers (in our species); gynoeceum reduced and sterile or lacking in ♂ flowers; ovary in ♀ flowers subglobose to ovoid, the ovules few, the style none (not obvious as in *Myrsine*), the stigma sessile, conspicuous, various (linear-conical to capitate-angled or farciminiform); fruit a 1-seeded drupe, subglobose, the endocarp crustaceous to coriaceous or woody, the stigma marcescent and caducous, the seed subglobose, excavate at base.

TYPE SPECIES: *Rapanea guianensis* Aubl.

DISTRIBUTION: Pantropical and subtropical, throughout much of the Pacific including Hawaii, with 150-200 species. Four species (three of them endemic) occur in Fiji.

Fosberg and Sachet (in Smithsonian Contr. Bot. 21: 3. 1975) refer the eastern Polynesian species of this relationship to *Myrsine*. Maintenance of a single genus in this complex requires acceptance of substantial diversity in staminal and gynoeceal characters. Users of Pacific Floras may find this disagreement unsettling, as many taxa lack appropriate binomials in one or the other genus.

KEY TO SPECIES

Leaf blades attenuate at base and long-decurrent on petiole, this 2-15 mm. long and narrowly winged nearly to base, leaving a transversely semielliptic scar; leaves evenly spaced along branchlets, not whorled or congested, the blades obovate to lanceolate or obovate- or elliptic-lanceolate, usually 3-11 × 1-3.5 cm.; branchlets slender, 1-3.5 mm. in diameter toward apex; flowers and fruits sessile or borne on pedicels to 2 (rarely 4) mm. long; stigma conspicuous, capitate-subquadrangular with subulate angles,

to 1.5 × 2 mm.; fruits globose or slightly obovate, 3–7 mm. in diameter, the endocarp 0.3–0.5 mm. thick.

1. *R. myricifolia*

Leaf blades obtuse or narrowly rounded at base and not appreciably decurrent on petiole, this not winged, terete or subterete proximally, leaving a scar nearly as high as broad; leaves congested toward apices of branchlets or in irregular whorls, the blades comparatively large, rarely less than 9 × 3.5 cm.; flowers and fruits pedicellate.

Branchlets comparatively stout, usually 3–10 mm. in diameter toward apex; plants glabrous throughout.

Petioles 12–22 mm. long, the leaf blades obovate, 11–15 × 4.5–7 cm.; inflorescences bearing 2–4 flowers at apex of an axis up to 7 × 4 mm., the pedicels 4–6 mm. long, the flowers 5–7-merous; branchlets 5–10 mm. in diameter toward apex. 2. *R. crassiramea*

Petioles 3–5 mm. long, the leaf blades narrowly elliptic, (7–) 9–13 × (2–) 3.5–5 cm.; inflorescences bearing 13–25 flowers at apex of an axis about 2 × 3 mm., the pedicels about 3 mm. long, the flowers 5-merous (or perhaps sometimes 4-merous); branchlets less robust, usually 3–4 mm. in diameter toward apex. 3. *R. polyantha*

Branchlets comparatively slender, 1.5–2.5 mm. in diameter toward apex; young parts pilose with minute glandular hairs, the indument sometimes very sparse and inconspicuous, but sometimes subsistent on petioles and pedicels; petioles 3–10 mm. long, the leaf blades lanceolate-obovate or elliptic, (7–) 10–16 × (2.5–) 3.5–6.5 cm.; fruits 7–10 mm. in diameter, 1–4 maturing per inflorescence, the endocarp to 0.2 mm. thick, the fruiting pedicels 1.5–4 mm. long. 4. *R. hadrocarpa*

1. *Rapanea myricifolia* (A. Gray) Mez in Pflanzenr. 9 (IV. 236): 366. 1902; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. 54: 282. fig. 76–83. 1973.

Myrsine capitellata sensu Seem. in Bonplandia 9: 257. 1861, Viti, 438. 1862; Seem. ex Mez in Pflanzenr. 9 (IV. 236): 366, pro syn. 1902; non auct. mult.

Ardisia sp. aff. *A. korthalsii* sensu Seem. in Bonplandia 9: 257. 1861; non *A. korthalsiana* Scheff. (1867).

Myrsine myricaefolia A. Gray in Proc. Amer. Acad. Arts 5: 330. Jan. 1862, in Bonplandia 10: 37. Feb. 1862; Seem. Viti, 438. 1862, Fl. Vit. 149. 1866; Horne, A Year in Fiji, 265. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 227. 1892.

Myrsine crassifolia sensu A. Gray in Bonplandia 10: 37. 1862; Seem. Fl. Vit. 149. 1866; Horne, A Year in Fiji, 265. 1881; Drake, Ill. Fl. Ins. Mar. Pac. 227. 1892; non R. Br.

Myrsine sp. n. Horne, A Year in Fiji, 265. 1881.

Rapanea samoensis Lauterb. in Bot. Jahrb. 41: 232. 1908; Reching in Denkschr. Akad. Wiss. Wien 85: 326. 1910; Setchell in Carnegie Inst. Wash. Publ. 341: 61. 1924; Christophersen in Bishop Mus. Bull. 128: 167. 1935; A. C. Sm. in op. cit. 141: 119, p. p. 1936; J. W. Parham, Pl. Fiji Isl. 158. p. p. 1964, ed. 2. 223, p. p. 1972.

As it is found in Fiji, *Rapanea myricifolia* is a frequent tree or shrub 1–15 m. high, sometimes freely branched and sometimes compact, occurring from near sea level to the highest elevation, 1,323 m., in thin or dry forest, thickets in grassland, crest and ridge forest, and sometimes in beach thickets or on limestone. The calyx has brownish or purplish glands; the corolla is white to yellowish green, with pink or red to purple or brownish glands; the anthers are greenish white; and the fruit matures from pinkish to purplish black. Flowers and fruits may be found throughout the year.

TYPEFIICATION AND NOMENCLATURE: The type of *Myrsine myricaefolia* is *U. S. Expl. Exped.* (US 63446 HOLOTYPE; ISOTYPES at GH, K, NY), collected in 1840 in Mathuata Province, Vanua Levu. One of the three NY isotypes is labelled "Eimeo, Society I.," a locality repeated by Gray; this specimen seems identical to other type material and may be assumed to be mislabelled. The type of *Rapanea samoensis* is *Vaupel 173* (κ LECTOTYPE designated by Smith, 1973; ISOLECTOTYPES at BISH, US), collected April 4, 1906, on Savaii, Samoa. A lectotype is indicated because the holotype, deposited at B, has presumably been destroyed. *Rapanea samoensis* has often been retained as a taxon distinct from *R. myricifolia*, and on first examination there do appear to be slight differences between them. However (cf. my 1973 treatment, pp. 286, 287), no real differences correlate with geography.

DISTRIBUTION: Fiji and Samoa; in the former archipelago the species is to be found at all elevations and probably on many islands, some 60 collections being at hand.

LOCAL NAMES AND USES: Recorded Fijian names are *mbethembethe* (Yasawas), *sinu*, *ndoi ni vosa*, and *mbu na kau ni mbure* (Mba), *se mbala* (Nandronga & Navosa), *sinu nganga* (Serua), and *sanggali ni sakea* and *ndasia* (Mathuata). The timber provides useful poles, and unspecified parts of the plant are used medicinally for eye treatment in the Yasawas.

REPRESENTATIVE COLLECTIONS: YASAWAS: WAYA: Nangua, rocky summit, *St. John 18159*. VITI LEVU: MBA: Vicinity of Nandarivatu, *Parks 20675*, *Degener 14269*; Mt. Nanggaranambuluta, *Gillespie 4063*; vicinity of Nandala, *O. & I. Degener 32133*; summit of Mt. Tomanivi, *Smith 5191*. NANDRONGA & NAVOSA: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4602*; northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith 5435*. SERUA: Vicinity of Namboutini, *DA 14009*; inland from Ngaloa, *DF 899 (Tiko 11)*; Ndeumba Beach, *DA 13217*. NAMOSI: Hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith 8446*; slopes of Mt. Voma, *Gillespie 2899*; Wainandoi River, *Mead 1967*. RA: Hills near Penang, *Greenwood 760*. TAILVU: Vicinity of Nggelekuro, *DA 13604*. REWA: Lami Quarry, *DA 940*. "VITI LEVU and VANUA LEVU." *Seemann 289*. MBENGGGA: Vicinity of Lalati, *DA 13727*. KANDAVU: Without further locality, *Seemann 290*. OVALAU: Summit of Mt. Tana Lailai and adjacent ridge, *Smith 7709*. VANUA LEVU: MATHUATA: Southern base of Mathuata Range, north of Natua, *Smith 6806*; Mt. Numbuloa, east of Lambasa, *DA 14640*. MATHUATA-THAKAUNDROVE boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 567*. RAMBI: *Horne 455*. TAVEUNI: Hills east of Somosomo, west of old crater occupied by small swamp and lake, *Smith 8354*. FULANGA: On limestone formation, *Smith 1218*. ONGEA NDRIKI: On rocky beach, *Bryan 420*.

The closest relative of *Rapanea myricifolia* in our area is *R. modesta* Mez, of New Caledonia and the New Hebrides, which superficially is not readily separable; however, *R. modesta* has a farciminiform, terete stigma, much longer than broad. Mez did not adequately observe the stigma of *R. myricifolia*, which in this important character is doubtless more closely related to some of the eastern Polynesian species.

2. *Rapanea crassiramea* A. C. Sm. in Bull. Torrey Bot. Club **70**: 547. 1943; J. W. Parham, Pl. Fiji Isl. 158. 1964, ed. 2. 223. 1972; A. C. Sm. in J. Arnold Arb. **54**: 288. 1973.

A glabrous tree with robust branchlets, apparently rare and known only from the type specimen, obtained on wooded slopes at an altitude of about 900 m. Flowers, slightly past anthesis and lacking corollas, were collected in December.

TYPIFICATION: The type is *Gillespie 4374* (BISH HOLOTYPE; fragment at A), collected Dec. 16, 1927, in the vicinity of Nandarivatu, Mba Province, Viti Levu.

DISTRIBUTION: Endemic and known only from the type. Although the preceding species, *Rapanea myricifolia*, is common near Nandarivatu, the two species are not closely related, *R. crassiramea* being more suggestive of the following endemic from the same general Viti Levu area.

Rapanea crassiramea and the two following Fijian endemics seem morphologically isolated from other Melanesian and Polynesian species of the genus, being at once distinguishable by their robust habit, congested or irregularly whorled leaves, and terete or semiterete petioles (at least proximally) that leave essentially isometric scars. None of the three endemics is frequent or completely known, but differences among them are sharp and unmistakable.

3. *Rapanea polyantha* A. C. Sm. in J. Arnold Arb. **54**: 289. *fig. 84, 85*. 1973.

FIGURE 208A.



FIGURE 208. A, *Rapanea polyantha*, distal portion of branchlet, with foliage and ♂ inflorescences, $\times 1/3$. B, *Rapanea hadrocarpa*, distal portion of branchlet, with foliage and fruits, $\times 1/3$. A from DA 12681, B from Smith 1245.

A tree about 4–5 m. high, with a rounded or flat, wind-clipped crown, apparently rare at elevations of 1,127 to about 1,220 m. in montane ridge forest. Only ♂ flowers, at anthesis in May, are known; these have white corollas.

TYPIFICATION: The type is DA 12681 (*R. & E. F. Melville & J. W. Parham 7059*) (K HOLOTYPE; ISOTYPES at A, BISH, SUVA), collected May 4, 1962, on the summit ridge of Mt. Tomanivi, Mba Province, Viti Levu.

DISTRIBUTION: Endemic to Fiji and known only from high ridges in north-central Viti Levu. The second known collection, cited below, is sterile but obviously conspecific with the type collection.

LOCAL NAME: *Kau ni marase* (*Gillespie 3795*).

AVAILABLE COLLECTION: VITI LEVU: Mba: Summit of Mt. Nanggaranambuluta, *Gillespie 3795* (A, BISH).

4. *Rapanea hadrocarpa* A. C. Sm. in J. Arnold Arb. **54**: 290. 1973. FIGURE 208B.

Rapanea samoensis sensu A. C. Sm. in Bishop Mus. Bull. **141**: 119, p. p. 1936; J. W. Parham, Pl. Fiji Isl. 158, p. p. 1964, ed. 2. 223, p. p. 1972; non Lauterb.

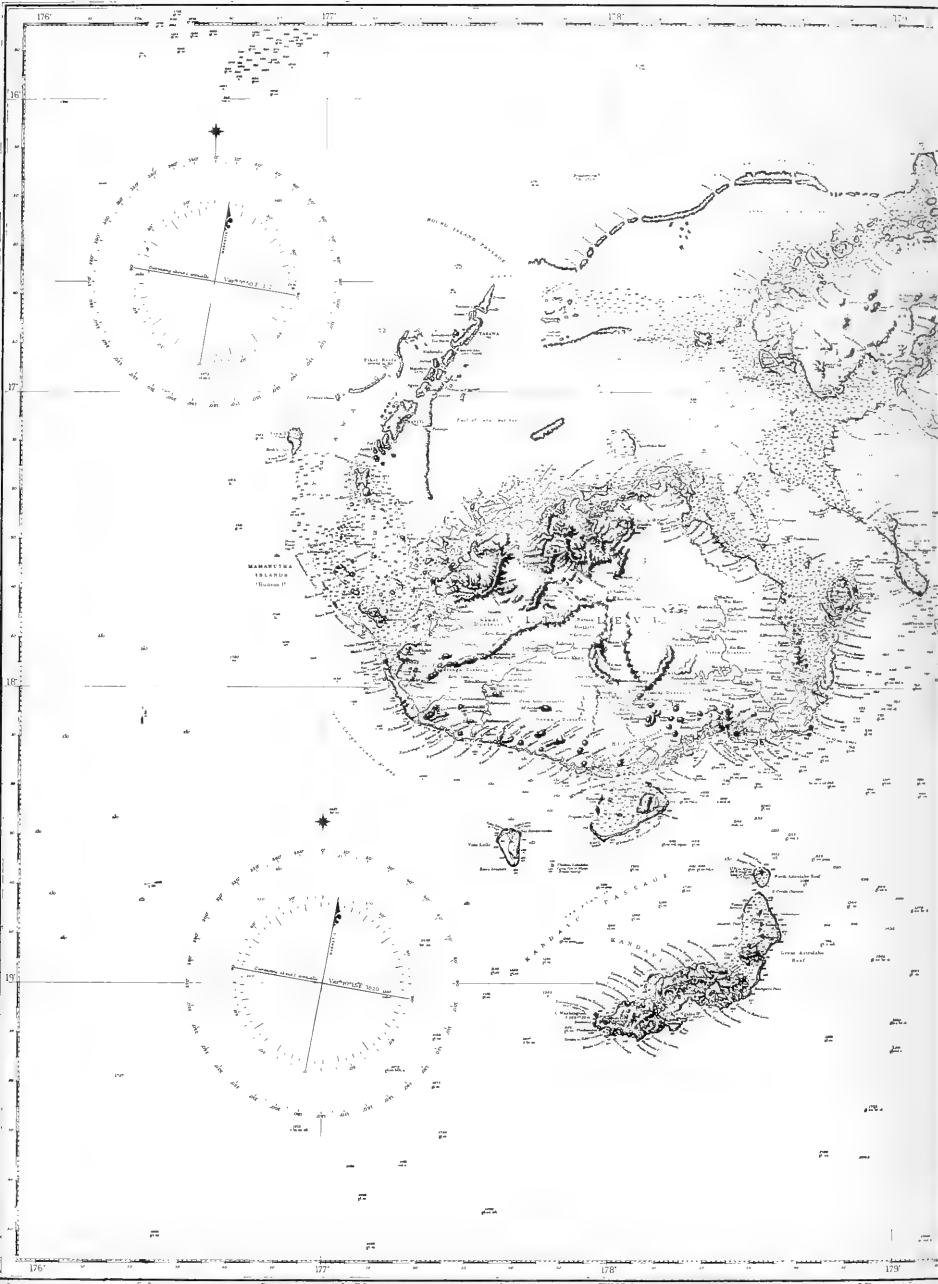
A tree 4–8 m. high, sometimes noted as slender, with a trunk 6–8 cm. in diameter, occurring in sometimes dense forest and sometimes on limestone, from near sea level to an elevation of about 300 m. Only fruiting material, collected in March, April, and September, is known; the fruits turn from green to dull white or red and are marked with purplish glands.

TYPIFICATION: The type is *Smith 1245* (BISH HOLOTYPE; many ISOTYPES), collected March 2, 1934, in forest on limestone formation on the island of Kambara.

DISTRIBUTION: Endemic to Fiji and known only from southern Viti Levu and two islands in the Lau Group.

LOCAL NAME: *Utu ni tandruku* (from type collection).

AVAILABLE COLLECTIONS: VITI LEVU: SERUA: Inland from Namboutini, *DF 459 (Damanu 108)*. REWA: Mt. Korombamba, *DA 16517*. TUVUTHA: In central forest, *Bryan 549*.



HAWAIIAN ISLANDS
"Hawaii"

MAUI
"Maui"

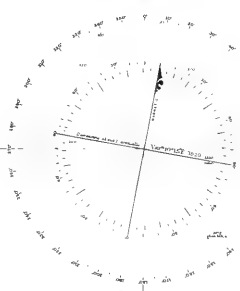
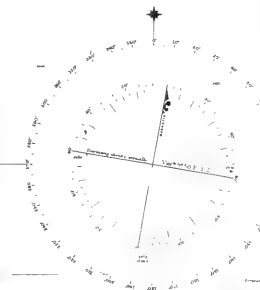
OAHU
"Oahu"

MOLOKAI
"Molokai"

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v. 2 Flora Vitiensis nova