

CONTRIBUTIONS FROM THE GRAY HERBARIUM
OF HARVARD UNIVERSITY—CXLIII. STUDIES OF THE ICACINACEAE IV.¹

(Plates 1-3)

CONSIDERATIONS OF THE NEW WORLD GENERA

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The *Icacinaceae* is a poorly understood family of general tropical distribution. Since Miers separated the *Icacinaceae* from the *Olacaceae* in 1851 the family has had few general studies. Very little attention has been given to the New World genera and the existing treatments of these genera are unsatisfactory. When a general morphological study of this family was begun it was found that the taxonomic treatments then available were not to be trusted. For that reason a systematic revision of the family was started but had to be limited to the New World genera, for the present, because of the unavailability of much of the critical material and many of the type specimens.

There are twelve recognized genera in the Western Hemisphere, all falling into the *Icachineae* as established by Engler in the *Natürlichen Pflanzenfamilien* (1893). These genera do not constitute a coherent or natural division of the family. It is recognized that the group is an artificial one and it is considered in this study only as a matter of convenience for students of the New World floras.

During the course of this study I have seen material from the following herbaria: Arnold Arboretum (A); Brisbane Botanical Gardens, Brisbane, Australia (B); Field Museum (FM); Gray Herbarium (G); New York Botanical Gardens (NY); Singapore Botanical Gardens (S); Instituto Lillo, Univ. Nacional de Tucuman, Argentina (T); University of California (UC);

¹ The preceding papers of the series are: 1. *Preliminary Taxonomic Notes* , Journ. Arnold Arb. **21**: 461-89. 1940; 2. *Humirianthera, Leretia, Mappia* and *Nothapodytes* , *Valid Genera of the Icachineae* , l. c. **23**: 55-78. 1942, and 3. *A Revision of the Genus Emmotum* , to be published in the current volume of Journ. Arnold Arb.

United States National Herbarium (US). I am grateful for the use of this material.

I should like to express my appreciation to Dr. I. M. Johnston, under whose guidance this work progressed, and to Dr. E. D. Merrill and Dr. M. L. Fernald for assistance on many special occasions, as well as for the use of facilities of the Arnold Arboretum and the Gray Herbarium.

HISTORY OF THE FAMILY

The *Ikacinaceae* receives its name from the genus *Ikacina*, which was selected as a type by Bentham (Trans. Linn. Soc. London **18**: (4): 679. 1841). *Ikacina* had been described by A. Jussieu (Mem. Soc. Nat. Hist. Paris **1**: 174. 1823) and was related by him to the order *Olacineae* of Mirbel. Several other genera were referred to this complex by Lindley (Nat. Sys. Bot. 1836) before Bentham (l. c.) made the first comprehensive study of the *Olacineae*. Bentham divided the order into three tribes, the *Olacineae*, the *Opileae* and the *Ikacineae*, recognizing that it might be necessary sometime to consider them all as distinct orders. Bentham placed *Leretia* and *Pogopetalum* in the *Ikacineae* as the first New World genera of that order.

Miers (Ann. Mag. Nat. Hist. II. **8**: 174, 1851, II. **9**: 221, 1852, Contrib. Bot. **1**: 34. 1851-61) raised Bentham's tribes to family status in 1851 and recognized for the first time the actual differences between the *Ikacinaceae* and the *Olacaceae*, as well as their true affinities. This is perhaps the most outstanding bit of work on the family. In 1862 Baillon (Adansonia **3**: 89, 367-70) produced further evidence supporting Miers separation of these two families. However, Baillon believed that *Ikacina*, *Leretia* and *Mappia* were identical genera and since *Mappia*, not *Ikacina*, was the oldest name he proposed that the family be called the *Mappiae*.

In the same year Bentham and Hooker's Genera Plantarum appeared and did not recognize the groups as families but, instead, followed Bentham's previous classification of them as tribes. This prompted Miers (Seem. Jour. Bot. **2**: 257-66. 1864) to restate rather bitterly his distinctions between the *Ikacinaceae* and the *Olacaceae*. In Flora Brasiliensis (**12**: (2): 41-62. 1872)

Engler recognized the *Olacaceae* and *Icacinaceae* as families but he considered them together. Beccari (Malesia 1: 105–134. 1877), Valetton (Crit. Overz. Olac. 1886) and Engler (Nat. Pflanzenfam. 3 (5): 233–257. 1893) followed Miers consideration of the *Icacinaceae* as related to the *Celastrales*. Van Tieghem (Bull. Soc. Bot. Fr. 44: 115. 1897) further subdivided the family, recognizing *Emmotum* and *Pleurisanthes*, New World genera, as the type genera of independent families. More recent authors have not recognized Van Tieghem's divisions, as there seems to be no substantial ground for doing so.

The revision of the family for the second edition of *Natürlichen Pflanzenfamilien* has been prepared by Sleumer (see also *Notizbl.* 15: 228–57. 1940) but it is not available in this country at the present time.

Thus, since Miers established the family in 1854, its independence has been unchallenged.

SYSTEMATIC POSITION OF THE FAMILY

Engler and Diels (Syllabus der Pflanzenfamilien, 11th. Auflage. 1936) place the family in the order *Sapindales* and the suborder *Icacinineae*, on equal status with the *Sapindineae*, *Celastrineae*, *Anacardiineae* and eight others. It is the only member of the *Icacinineae*. The order *Sapindales* is established, in contrast with the *Geraniales*, in the position of the micropyle under the ventral raphe. The *Icacinineae* is quite distinct in this order in having the following characters as listed by Engler and Diels: flowers heterochlamydeous, always actinomorphic, haplostemonous; stamens opposite the calyx-lobes; pistil mostly with one fertile locule; ovules with a single integument; fruit one-seeded.

While the distinctions for orders expressed above may be open to criticism, the most valuable point offered is the equality of the *Icacinineae* with the other suborders. Other workers have not considered it so. Wettstein (Handbuch Systematischen Botanik, 1924) considers the *Icacinaceae* as another family of the *Celastrales*. Hutchinson (Families of Flowering Plants. 1. Dicotyledons. 1926) does the same, placing it in equal rank with the *Aquifoliaceae*, *Celastraceae* etc. Hallier (Arch. Neerl. Sci. Exact. et Natur. ser. 3b: 147–234. 1912) considers the *Icacinaceae* in

the *Santalales* and of close relationship with the *Olacaceae*. In a phylogenetic tree Hallier derives the *Icacinineae* from the *Olacaceae*.

Considering only the wood-structure of the *Icacinaceae*, one could find all stages of phylogenetic specialization. These may be from the most primitive woody form to the highly specialized lianas. Several of the genera of the *Icacinaceae* have a wood-structure far more primitive than the groups from which various authors would derive them. Florally and on the fruit-characters the *Icacinaceae* must be considered as an advanced group. The highly specialized aestivation of the corolla, with its abutting or inrolled edges and inflexed apex, the single row of stamens and the advanced pistil, with but a single locule containing two pendant anatropous uni-integumented ovules, and the fruit with but a single seed, are the characters upon which the previous workers have decided the position of the family. All of these floral characters seem to be specializations of such a nature that it is doubtful if the family could be considered the ancestor of any other group or of any tendency expressed in another group. The *Icacinaceae* seems to represent an end-line when the floral characters are considered. In the anatomical characters, however, one finds that part of the group is basically primitive. Therefore, the most satisfactory treatment of the *Icacinaceae*, phylogenetically or systematically, is to consider it in part a primitive group, with evidences of specializations and modifications and forming an end-line of development. The treatment proposed by Engler and Diels, considering the *Icacinaceae* and *Icacinineae* as a separate monotypic line of equal status with such groups as the *Sapindineae*, *Celastrineae* and the *Anacardiineae*, has the most support from this study and is to be recommended. Whether these are called orders or tribes is not significant but I do believe the *Icacinaceae* should not be considered a family in the *Celastrales*.

GEOGRAPHICAL DISTRIBUTION

The *Icacinaceae* is a pantropical family, with only a few representatives reaching the Southern Temperate zone. In the New World and on the American continent no genus has been

found north of Mexico. The distribution in the Caribbean area is limited to the Greater Antilles. No collections have been reported from El Salvador or Nicaragua, although several genera probably occur there. Representatives have been found in all countries of South America.

The center of distribution in the New World is in the upper Amazon basin of Brazil. *Citronella* and *Emmotum* have the broadest distributions of the various genera. Generic distributions are summarized in the accompanying table.

	MEXICO	CUBA	HAITI	SANTO DOMINGO	JAMAICA	PORTO RICO	COSTA RICA	GUATEMALA	PANAMA	BRIT. HONDURAS	COLOMBIA	VENEZUELA	ECUADOR	BRIT. GUIANA	DUTCH GUIANA	FRENCH GUIANA	BRAZIL	URUGUAY	PARAGUAY	BOLIVIA	ARGENTINA	CHILE	PERU	TOTAL NO. SPECIES
<i>Calatola</i>	✓						✓		✓	✓	✓	✓	✓										✓	7
<i>Citronella</i>							✓										✓	✓	✓	✓	✓	✓	✓	10
<i>Dendrobangia</i>																✓	✓							1
<i>Discophora</i>									✓		✓			✓			✓						✓	3
<i>Emmotum</i>												✓		✓		✓	✓						✓	12
<i>Humirianthera</i>											✓	✓					✓							3
<i>Lereticia</i>														✓			✓						✓	1
<i>Mappia</i>	✓	✓	✓		✓	✓			✓															3
<i>Cecopetalum</i>	✓							✓																3
<i>Ottoschulzia</i>		✓	✓	✓		✓																		3
<i>Pleurisanthes</i>													✓		✓	✓								6
<i>Poraqueiba</i>															✓	✓	✓							3
Total	3	2	2	1	1	2	2	1	3	1	3	3	1	4	1	4	8	1	1	1	1	1	5	

The plants occur in a variety of habitats. They are most commonly found on the edges of clearings in primary forests or on land liable to inundation. The genera *Poraqueiba* and *Humirianthera* are cultivated by the indians of Brazil and may be found in plantations. *Mappia* frequents dry, rocky outcrops in Havana province of Cuba but occurs in dense forests at higher elevations in the province of Santa Clara. *Ottoschulzia cubensis* is a shrub of salt marshes, while *O. domingensis* is limited to limestone outcrops. Species of *Citronella* have been collected on dry, barren soil as well as dense, moist forests. *Calatola* and *Dendrobangia* are commonly found in rain-forests. Altitudinal ranges of genera may vary from sea-level for *Ottoschulzia* to 6,000 feet for *Emmotum* and *Calatola*.

ECONOMIC USES

Three genera of the New World *Icacinaceae* are cultivated as sources of food and members of one are also used as ornamental plants. *Poraqueiba* is cultivated in Brazil, near Pará, for the oil that may be extracted from the sarcocarp and for the copious starchy endosperm of the seed. Fresh fruits are sold in local markets, although their use is not general and a taste must be developed for them. *Humirianthera* has large fleshy tubers which contain a large amount of starch. This genus is cultivated for the tubers or rootstocks and for the starchy seeds (Ducke, Arch. Jard. Bot. Rio **3**: 206. 1922). *Citronella* is also found under cultivation in southern South America. The leaves of *C. Gongonha* are used as a substitute for those of *Ilex paraguayensis* in the preparation of maté. This usage was traced by Lambert (Genus Pinus **2**: app. 7** t. 6. 1824) to the period when Dr. Francis was dictator of Paraguay and declared an embargo on the leaves of *Ilex* . *Citronella Gongonha* was tried as a substitute, probably because of the close similarity in appearance of the two plants. Other species of *Citronella* lack the essential oils necessary for maté and cannot be used. *C. Gongonha* and *C. mucronata* frequently have spinose-margined leaves and for this reason are often used as ornamentals or for hedging. Both are planted as park shade-trees as well as being used as greenhouse or hot-house plants.

The fruits of several species of *Calatola* are edible either raw or roasted and serve as local food-products. No record was found of this plant being under cultivation. The bark, leaves and fruits of *Calatola* all contain a pigment which is used as a blue dye.

Only two genera are reported as toxic to humans. The fruits of *Calatola mollis* , if eaten, cause extreme nausea and often violent stomachic and intestinal pains. The other species of this genus are apparently harmless. The starchy material in the rootstocks and fruits of *Humirianthera* is toxic and must be washed thoroughly before it can be used.

BASIS OF THE PRESENT TREATMENT

Engler divided the *Icacinaceae* into four tribes based primarily on anatomical characters. Bailey and Howard (Journ. Arnold Arb. **22**: 125–32. 1941) have discussed the merits of this division on the basis of anatomical characters, and have shown that two of these tribes cannot be distinguished in all cases by the anatomical criteria Engler suggested. Certain of the *Icacineae* appear transitional in form and structure between the *Icacineae* and the *Iodeae* , *Sarcostigmateae* and *Phytocreneae* . The New World genera have all been placed in the *Icacineae* . Several of the New World genera show either transitions in form and structure to the Old World forms or show closer similarities to the Old World genera than to other New World genera. It is apparent that the New World genera do not comprise a homogeneous or even related unit of the family. Among the genera found in the New World several must be considered as anomalous. Thus the present study is not designed to represent a treatment of a natural unit but is only a consideration of a geographic division of the family for use of students of New World floras.

A total of 12 genera and 70 species are recognized in the New World. One genus is pantropical. Two are monotypic. Three have no New World affinities and are either related to the Old World genera or are considered as anomalous.

Generic and specific characters are found in all parts of the plant and in many organs. Although differences are recognized in the wood-structure, or hair-structure and are used in some keys, no genera are based on these differences alone. The most reliable characters are found in the fruits and the form of the stamens. Excellent floral characters exist in most genera.

Although the generic limits are probably as well marked and readily observable as those of any other family, the limits of the species are difficult to draw. For this reason, as well as the insufficiency of material and the fact that I have not seen the collections in European herbaria, I have recognized few sub-specific entities. That more than are here accepted do exist is not doubted but, until more material can be examined to deter-

mine better the limits of the species themselves, it does not seem wise to propose numerous trinomials for minute variations which may prove to be only in the individual specimen.

ICACINACEAE Miers

Trees, shrubs or lianas; leaves alternate, petiolate, exstipulate, coriaceous or rarely membranaceous, entire or rarely sinuate-dentate, the veins arcuate-anastomosing; inflorescence cymose or paniculate with cymose branches, terminal, axillary, extra-axillary or supra-axillary, bracteate; flowers articulated below the calyx, perfect or polygamous or unisexual by abortion, hypogynous; calyx small, fleshy, the lobes or teeth 5, imbricate; petals 5, rarely 4-6, free or rarely united at the base, valvate, fleshy, the apex inflexed; stamens 5, alternate with the petals, erect, the filaments fleshy, often hairy below the anther, anthers attached basally or dorsally near the base, the anthers with 4, rarely 2, locules, often deeply lobed, the dehiscence introrse or lateral, longitudinal; ovary 1-, rarely 2-3-celled, the ovarian appendage present or absent, the ovules 2, anatropous, pendent from near the apex, collateral or rarely superposed, functional style one, rudiments often present, the stigma capitate; fruit drupaceous, symmetrical or flattened, 1-celled (3- in *Emmotum*), the funicle in a special tubular canal of the putamen or free in the sarcocarp, the seed one, the embryo minute or large, the endosperm copious.

TYPE GENUS: *Icacina* Juss. (Africa).

Distribution in the Western Hemisphere: Antilles, Mexico, Central America, South America.

AN ANALYSIS OF THE NEW WORLD GENERA REFERRED TO THE ICACINACEAE

ASTEROLEPIDION Ducke	equals DENDROBANGIA Rusby
BARRIERIA Juss.	equals PORAEUEIBA Aubl.
BRIQUETINA Macbride	equals CITRONELLA Don
CALATOLA Standley	
CASIMIRELLA Hassler	
CITRONELLA Don	
CLAVAPETALUM Pulle	equals DENDROBANGIA Rusby
DENDROBANGIA Rusby	
DISCOPHORA Miers	
EMMOTUM Desv. ex Hamilton	
HUMIRIANTHERA Huber	probably the same as CASIMIRELLA
KUMMERIA Mart.	equals DISCOPHORA Miers
LASIANATHERA Barb. Rod. not P. Beauv.	equals DISCOPHORA Miers
LERETIA Vellozo	

MAPPIA Jacq.	a conserved name
MARTIA Valetton	equals PLEURISANTHES Baill.
MEISTERIA Gmel.	equals PORAEUEIBA Aublet
METTENIUSSA Karsten	genus excluded from family
OECOPETALUM Greenman & Thompson	
OTTOSCHULZIA Urban	
PARAEUEIBA Scopoli	equals PORAEUEIBA Aublet
PATAGUA Baill.	equals CITRONELLA Don
PLEURISANTHES Baillon	
POGOPETALUM Benthham	equals EMMOTUM Desv.
PORAEUEIBA Aublet	
PORARESIA Gleason	equals POGONOPHORA, <i>Euphorbiaceae</i>
VALETONIA Durand	equals PLEURISANTHES Baill.
VILLARESIA Ruiz & Pavon (in part)	equals CITRONELLA Don.
VILLARESIOPSIS Sleumer	equals CITRONELLA Don.

KEY TO THE GENERA BASED ON FLOWERS

Flowers unisexual.

Staminate inflorescence spicate; flowers 4-parted; pistillate rudiment absent; pistillate inflorescence cymose, few-flowered, the pistil pubescent, without a basal pulvinus.....*Calatola*

Both inflorescences cymose; flowers 5-parted; pistillate rudiment present in staminate flowers; the pistil glabrous, with a basal fleshy pulvinus.....*Discophora*

Flowers perfect.

Ovary 2-3-loculed.....*Emmotum*

Ovary 1-loculed (rarely 2 locules in *Citronella*).

Ovules superposed.

Locule pubescent inside, inflorescence few-flowered or consisting of a single flower.....*Ottoschulzia*

Locule glabrous inside, inflorescence many-flowered....*Oecopetalum*

Ovules collateral.

Petals glabrous inside.

Corolla gamopetalous, petals with clavate appendages; plant stellate-lepidote-pubescent.....*Dendrobangia*

Corolla polypetalous, inflexed petal-apices not clavate.

Lianas; inflorescence-axes frequently flattened; flowers not articulated.....*Pleurisanthes*

Trees or shrubs; inflorescence-axes terete; flowers articulated.....*Citronella*

Petals pubescent inside.

Ovarian disk present.....*Mappia*

Ovarian disk absent.

Ovary glabrous; locule glabrous inside; trees.....*Poraqueiba*

Ovary pubescent; locule pubescent inside; shrubs or lianas.

Inflorescence axillary; connective linear.....*Leretia*

Inflorescence terminal; connective broadly triangular.....*Humirianthera*

KEY TO THE GENERA BASED ON CHARACTERS IN THE FRUITS

- Fruit 2-3-loculed. *Emmotum*
 Fruit 1-loculed.
 Fruit compressed laterally and bearing a fleshy lateral pulvinus. . . *Discophora*
 Fruit without an appendage.
 Locule subdivided with a radial partition, seed hippocrepi-
 form. *Citronella*
 Locule without partial partition.
 Fruiting calyx about equal to diameter of fruit. *Oecopetalum*
 Fruiting calyx minute.
 Locule pubescent inside.
 Funicle in tubular canal in the putamen; sarcocarp
 thick. *Humirianthera*
 Funicle in groove of putamen and surrounded by
 sarcocarp-tissue.
 Fruit ovoid; putamen woody. *Ottoschulzia*
 Fruit elongate or ellipsoid, slightly flattened; puta-
 men often papery. *Leretia*
 Locule glabrous inside.
 Embryo minute, less than 1/10 the length of the seed.
 Putamen strongly reticulate-crested outside, gla-
 brous, or pubescent with simple hairs. *Calatola*
 Putamen essentially smooth, at most slightly ru-
 gose outside, stellate-pubescent. *Dendrobangia*
 Embryo large, $\frac{1}{2}$ - $\frac{3}{4}$ the length of the seed.
 Fruit seldom 2 cm. long; sarcocarp dry. *Mappia*
 Fruit large, 3-7 cm. long; sarcocarp oily. *Poraqueiba*
- Fruit of *Pleurisanthes* not known.

KEY TO THE GENERA BASED ON STERILE MATERIAL

- Node trilacunar.
 Hairs disarticulating from a papilla-like base.
 Leaves with helically thickened mesophyll-fibers. *Emmotum*
 Leaves without fibers in the mesophyll. *Poraqueiba*
 Hairs not disarticulating.
 Hairs in stellate-lepidote clusters. *Dendrobangia*
 Hairs single, not stellate.
 Mesophyll with large pockets of crystal-sand. *Discophora*
 Mesophyll with druses or rhombic crystals but no crystal
 sand.
 Leaves with domatia in axils of primary veins and the
 midrib or in the bifurcations of the veins. *Citronella*
 Leaves without domatia.
 Mesophyll porous, of stellate cells. *Oecopetalum*
 Mesophyll of rectangular or globular cells.
 Leaves 2-8 cm. long. *Ottoschulzia*
 Leaves 13-30 cm. long. *Calatola*
- Node unilacunar.
 Flowers disarticulating at the base of the calyx; stems and
 petioles without lysigenous canals.
 Trees or shrubs; leaves with pores in axils of veins and midrib. . . . *Mappia*
 Lianas; leaves without axillary pores.
 Hairs in stellate clusters. *Humirianthera*
 Hairs simple, malpighiaceus type. *Leretia*
 Flowers not disarticulating at the base of the calyx; stems and
 petioles with lysigenous canals; stems strap-shaped. *Pleurisanthes*

CALATOLA Standley

Calatola Standley, Contrib. U. S. Nat. Herb. **23**: 688. 1923, Journ. Wash. Acad. Sci. **16**: 413. 1926, Field Mus. Pub. Bot. **22**: 39. 1940; Record, Tropical Woods **53**: 24. 1938; Sleumer, Notizbl. **15**: 248. 1940.

Trees; the leaves papery to coriaceous, turning black on drying, margin entire, revolute, the oblique-arcuate veins slender; flowers minute, dioecious, the staminate arranged in axillary dense pseudo-spikes; calyx of staminate flowers small, 4-lobed; corolla gamopetalous 4-parted, midrib evident inside, villous on the midrib; stamens alternate with the lobes, erect, the filaments short, adnate to the corolla tube, the anthers oblong, basifixed, longitudinally dehiscent; pistillate flowers solitary or in few-flowered axillary racemes; calyx 4-lobed; petals inconspicuous; pistil cylindric, strigose- or hirsute-pubescent, the style not evident; fruit drupaceous, the pericarp fleshy, thick, the putamen bicrestate and irregularly reticulate-dentate-crested or essentially smooth; seed one, large, the embryo minute, the cotyledons ovate, the radicle cylindrical or flattened and rhomboidal in section, the endosperm copious.

TYPE SPECIES: *Calatola mollis* Standley.

DISTRIBUTION: Mexico, Central America, Venezuela, Colombia, Ecuador and Peru.

More material is needed for study before the treatment of the genus *Calatola* will be satisfactory. To the present time six species have been described and another is suggested in this paper.

Standley established the genus with some hesitation, both as to its relationships and as to the possibility of an earlier name, since some specimens had been collected by Liebmann in 1841 and by Gollmer in 1854. The genus has such striking fruits that it seemed likely that someone else had described it but, as yet, no earlier name has been found.

In most of its characters the genus fits into the limits of the *Icacinaceae*; however, the inflorescence is strikingly different from anything else in the family. In addition, the flowers are dioecious and the staminate flowers are subsessile, usually in clusters of three, and in spikes which are very dense when young but are looser at maturity. A bract subtends each flower and the entire inflorescence is pubescent. The flowers are articulated below the calyx, as is typical of the family. The female flowers are few, in more open racemes or cymes.

The flowers are 4-parted, with both the calyx and corolla valvate, at least in the male flowers. No petals have been described for the pistillate flowers but I was able to find several in flowers of *C. costaricensis*. These were lance-oblong, round at the apex, fleshy, essentially glabrous, and alternate with the calyx-lobes. In the staminate flowers the corolla is gamopetalous, short-pubescent outside and it bears long pilose hairs on the midrib. The lobes are about three times the length of the corolla-tube and do not have well developed inflexed apices. No pistillate rudiments were found in the staminate flowers examined.

The pistil is cylindric, without a noticeable style, and with a capitate discoid papillate or pilose stigma. The single locule is eccentrically placed in the ovary, with an abundance of sterile tissue on one side and a normal thin ovarian wall on the other.

The fruits are typical of the family, although they are larger than in most. The size of the fruit is comparable to that of *Poraqueiba* or *Humirianthera*. Only one fruit is developed to the infrutescence and the fruiting pedicel is stout. The drupe has a fleshy non-oily sarcocarp and a woody putamen. The outer surface of the two-ridged putamen is smooth or sharply crested and toothed. The inner surface is smooth or slightly rugose. In one of the ridges there is a canal which, for at least part of its length, houses the funicle. The canal makes an abrupt bend near the apex of the fruit and the funicle enters the locule parallel to the styler canal. Only one of the two pendulous ovules matures. The raphe descends the seed, approximately 90° from the path of the funicle, in the endocarp and terminates in a circular chalaza. Pittier described the fruit of *C. venezuelana* as dehiscent and the isotype I have seen appears to have opened naturally for most of its length before it was broken. In the other species I have found no examples of dehiscence and all the fruits are tightly closed. The seed, differing from previous descriptions, is nearly as large as the locule but is convoluted and shrunken. The embryo is minute, not large, essentially straight, and is apical in position. The cotyledons, in those specimens examined, are ovate, slightly fleshy, prominently one-ribbed, with superposed margins, and are about one-third

the total length of the embryo. The radicle is either cylindric or flattened and rhomboidal in section. This type of embryo is common in the Old World genera but only *Citronella* and *Dendrobangia* possess it in the New World forms. The remainder of the seed is undifferentiated endosperm, which is dark-colored, due to an abundance of pigment present. This pigment can be removed by boiling and is a brilliant blue or purple in dilute solution.

The key to the species as given by Sleumer is essentially satisfactory, although the basic separation of *C. laevigata* and *C. pastazana* from the other species on the size of the leaves must be used with caution. The numerous collections of Schipp from British Honduras which I have cited under *C. laevigata* have much larger leaves than does the type specimen, as the leaves approach 25 cm. in many cases. The characters of ornamentation of the putamen seem more reliable, judging from the fruits available for each species, and I have presented a key based on these. Many more fruits should be studied to determine variability of both shape and ornamentation.

The leaves themselves lack characters to isolate the genus. They turn black on drying, a character which is common in the Old World genera but unusual among the New World forms, although pigmented cells are present in several genera. Apparently this blackening in *Calatola* is due to a dye present in the tissues of the leaves. The dye is also present in the petioles, stem and fruit, and in the endosperm of the seed as well.

The wood is white and hard and used for general construction purposes, frequently for interior work, since it appears to be immune to insect-attacks. The trees are large but usually are rare and scattered in any one locality. The seeds of *C. mollis* and *C. costaricensis* are purgative and vomitive in action, while those of *C. laevigata* are eaten both raw and roasted for food. Their flavor is reported to be that of coconut or grated cheese. The seeds are also a source of a dye.

The relationships of the genus *Calatola* in the *Icacinaceae* are not clear. In flower, fruit and wood-structure it belongs in the family; however, it is an isolated genus and not closely related to other genera of the New World. In the floral struc-

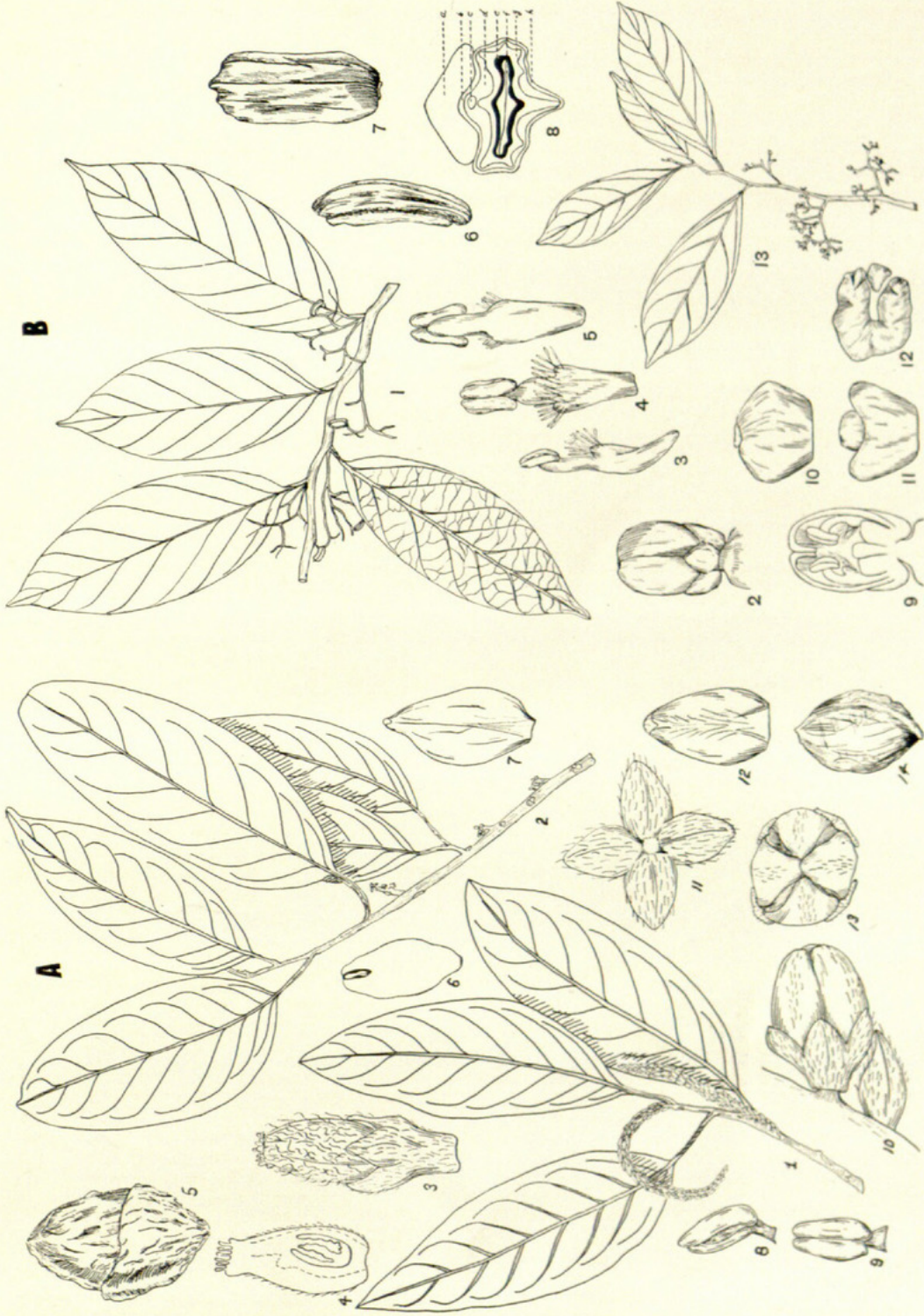
ture the genus is to be considered advanced but in the wood-structure it is unquestionably primitive (Bailey and Howard, Journ. Arnold Arb. **22**: 129, 172-8, 434, 557-8. 1941). Its broad distribution in the New World is surpassed only by that of *Citronella*. *Calatola* is a truly anomalous genus of the *Icacinaeae*.

KEY TO THE SPECIES

- Fruit densely tomentose, with apex and base rounded, 5-5.5 cm. long, 4-4.5 cm. in diameter; leaves densely ferruginous-tomentose below. (Mexico).....*C. mollis*
- Fruit glabrous, base rounded or rostrate; leaves glabrous below or nearly so.
- Fruits manifestly constricted or conical at the base.
- Fruits ellipsoid-oblong, 6 cm. long, 3.5-4 cm. in diameter, apex obtuse. (Western Colombia).....*C. columbiana* ✓
- Fruits almost globose, 4 cm. long, 3 cm. in diameter, apex obtuse. (Eastern Ecuador).....*C. pastazana*
- Fruits obtuse to rounded at the base.
- Putamen deeply reticulate-lacunose, strongly bicrestate, globose to elliptic, rarely subovoid-elliptic, 4.5-6 cm. long, 3.5-4 cm. in diameter. (Venezuela, Peru, Colombia).....*C. venezuelana* ✓
- Putamen not deeply reticulate-lacunose, moderately bicrestate.
- Putamen ellipsoidal, with longitudinal ribs numerous and nearly equalling the prominent lateral crests; leaves barbate in the axils of the veins. (Costa Rica, Panama, Colombia).....*C. costaricensis* ✓
- Putamen elongate-ellipsoid, slightly flattened, only the two lateral ridges prominently developed, the others inconspicuous, or essentially smooth; leaves strictly glabrous. (Mexico, British Honduras).....*C. laevigata*

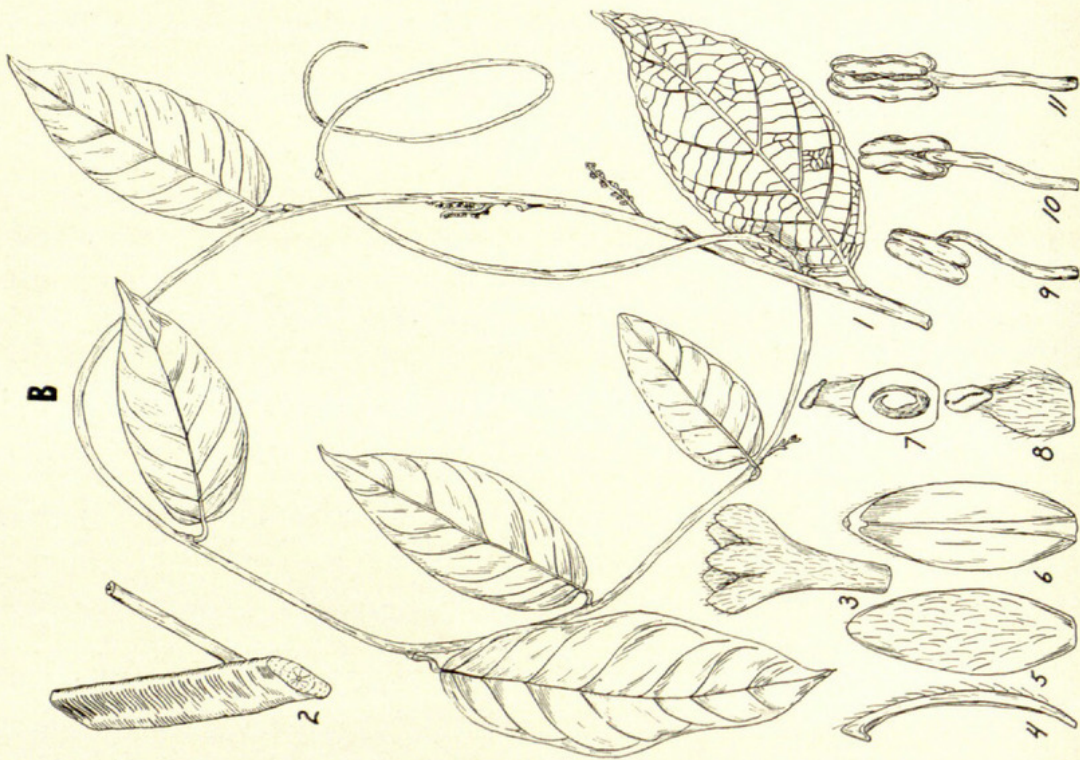
CALATOLA MOLLIS Standley, Contrib. U. S. Nat. Herb. **23**: 689. 1923, Journ. Wash. Acad. Sci. **16**: 414. 1926; Sleumer, Notizbl. **15**: 249. 1940.

Trees; the branches terete, densely yellow-gray-pilose; petioles 3-4.5 cm. long, stout, pilose, the lamina oval-elliptic to oblong-obovate, 21-30 cm. long, 8-14 cm. wide, glabrate except along the nerves, acute to abruptly short-acuminate, the base obtuse or round, the oblique-arcuate and laxly anastomosing veins 7-9 pairs; staminate spike 8-21 cm. long, 6 mm. in diameter, densely flowered, the rhachis short-pilose, the ovate-acuminate bracts small; calyx white-pilose outside, glabrous within, the obtuse lobes oblong-oval, 1.6 mm. long and 1.4 mm. wide; corolla 2-2.4 mm. long, the lobes 1.5-1.7 mm. long; filaments 0.3 mm. long; pistillate flowers solitary, the fruiting pedicel 1.5 cm. long, stout; drupe 5-5.5 cm. long, 4-4.5 cm. in diameter, densely tomentose, the putamen with numerous thin, sharp, irregular crests, the seed 3 cm. long.



A, FIGS. 1-13, CALATOLA LAEVIGATA; FIG. 14, C. SP.

B, FIGS. 1-11, DISCOPHORA MONTANA; FIGS. 12 AND 13, D. PANAMENSIS.



B, *PLEURISANTHUS FLAVA*.



A, *OTTOSCHULZIA CUBENSIS*.

TYPE SPECIMEN: *F. Salazar* s. n. (U. S. 43089) collected at Zacatlán, Puebla, Mexico.

ILLUSTRATION: Journ. Wash. Acad. Sci. **16**: 414, fig. 1. 1926.

DISTRIBUTION: Mexico. Reported from Puebla, Tabasco, Chiapas, Vera Cruz, Oaxaca, San Luis Potosi.

SPECIMENS SEEN: Puebla, District of Tepeji, Tlatlanquitepec, collector unknown (US). Huitamalco, *Liebmann* 14923 (FM).

VERNACULAR NAMES: Calatola, Calatolazno, Nueces de Calatola, zapote de mono, Colas de ratas. This last name is applied to the staminate inflorescences.

This species is reported from altitudes of 650–900 m. It flowers in March and April. The seeds are vomitive or purgative in action when eaten. Their chief use is in dyeing. I have not seen fruiting material of this species.

CALATOLA COLUMBIANA Sleumer, Notizbl. **15**: 249. 1940.

Tree 15–20 m. tall, the trunk-diameter 60 cm., the bark rough and brown; petioles 2–3 cm. long, thick, yellow-brown-tomentose; lamina oblong, 16–25 cm. long, 8–13 cm. wide, yellow-tomentose, becoming glabrate except along the nerves, broadly acuminate to subobtuse, the base broadly attenuate, the 8–9 pairs of veins more or less horizontal, the secondary veins obscure; staminate spikes 7–8 cm. long, the abbreviated cymules with numerous subuliform bracts; sepals ovate-oblong, to 0.7 mm. long, obtuse, yellow-pubescent; petals ovate, acuminate, to 1 mm. long; pistillate flowers not known; drupe oblong-elliptic, 6 cm. long, 3.5–4 cm. in diameter, manifestly rostrate at the base, the apex obtuse, the tenuous pericarp black when dry, the endocarp woody, irregularly but not deeply lacunose to obtusely crested.

TYPE SPECIMEN: *Duque* s. n. (Herb. Berlin, not seen) collected at Rio Cali, Dept. Valle, Colombia.

ILLUSTRATION: Notizbl. **15**: 249, figs. 1–2. 1940.

I have not seen any material of this species, which is known only from one collection. It grows at an altitude of 18–2000 m. and flowers and fruits in November. The seeds are reported to taste like coconut but leave an aftertaste.

CALATOLA PASTAZANA Sleumer, Notizbl. **15**: 248. 1940.

Tree to 20 m., the bark gray, the branches subterete; petioles 1–1.5 cm. long, laxly pubescent to glabrous; lamina oblong to broadly oblong, 13–17 cm. long, 5–7.6 cm. broad, glabrous, broadly acuminate to subobtuse, broadly cuneate at base, the subarcuate veins in 6 pairs, the secondary veins obscure; flowers not known; fruiting peduncle 1.2 cm. long, 2 mm. in diameter,

solitary; drupe subglobose, 4 cm. long, 3 cm. in diameter, vertically bicrestate, the endocarp-face indistinctly reticulate, the apex obtuse, the base rostrate.

TYPE SPECIMEN: *Heinrichs* 860 (Herb. Berlin, not seen) collected in Ecuador in the highlands of Ambato, on the right bank of the Pastaza.

ILLUSTRATION: Notizbl. **15**: 249, fig. 5. 1940.

I have not seen this material, which was collected at 1800 m. and in fruit in April.

CALATOLA VENEZUELANA Pittier, Bol. Soc. Venez. Cienc. Nat. **4**: 360. 1938; L. Williams, Tropical Woods, **56**: 6. 1938; Sleumer, l. c. 249; Standley, Field Mus. Pub. Bot. **22**: 39. 1940.

Trees to 17 m. tall, trunk-diameter 40 cm., the branches terete and minutely appressed-puberulous; petioles 1.5 cm. long, terete, almost winged; lamina broadly oval to oblong, 17–20 cm. long, 8–12 cm. broad, glabrous above, sparsely villous below, becoming glabrate except on the 10–12 pairs of veins, abruptly acuminate to rounded, the base acute and commonly unequal; flowers not known; drupe ovoid to subglobose, 4.5–6.5 cm. long, 3.5–4.5 cm. in diameter, the putamen bivalved, the sutures prominent, the valves rugose, the crests prominent and more or less dentate-reticulate.

TYPE COLLECTION: *Williams* 10118, made in the National Park of the State of Aragua in Venezuela.

ILLUSTRATION: Notizbl. **15**: 249, fig. 4 a & b. 1940.

SPECIMENS SEEN: Venezuela. State of Aragua, National Park, *Williams* 10118 (FM isotype). Peru. Huanuco, Shapajilla, *Woythowski* 19 (FM). Colombia. Cincinnati region, *Espina & Giacometto* A-146 (FM).

VERNACULAR NAMES: Orosul, Venenito.

Standley (l. c.) questions if this species is distinct from *C. costaricensis*. From a study of the fruits available for each species there appear to be reliable differences in the ornamentation of the putamen. The fruits cause nausea when eaten raw. They mature in May and September through October. Plants have been collected at altitudes of 950–1500 m. Williams (l. c.) reports that the wood is white when fresh but soon turns blue, although this color may be bleached out. It is suitable for carpentry because it is immune to insect-attack but it is not used locally because of its scarcity.

CALATOLA COSTARICENSIS Standley, Journ. Wash. Acad. Sci. **16**: 416. 1926 (Flora Costa Rica), Field Mus. Pub. Bot. **18**: 636. 1937; Sleumer, Notizbl. **15**: 249. 1940.

Tree 6–15 m. tall, the branches minutely pubescent to glabrate; petioles 2–5 cm. long; lamina oblong to elliptic-oblong, 10–25 cm. long, 4.5–10.5 cm. wide, appressed-pubescent, becoming glabrate except in the axils of the veins, short-acuminate to obtuse, the base acute, the oblique to arcuate veins in 6–8 pairs; staminate spikes 13 cm. long, laxly flowered, the rhachis and calyx hirsute; pistillate flowers not seen; drupe ellipsoid to subglobose, 4–6.5 cm. long, 3.5–4 cm. in diameter, rounded or obtuse at both ends, bicrestate with several sharp longitudinal crests, with less prominent transverse reticulate ridges.

TYPE SPECIMEN: *Standley & Valerio* 50000 (US 1251510) collected at Yerba Buena northeast of San Isidro, Province Heredia, Costa Rica.

ILLUSTRATION: *Notizbl.* **15**: 249, fig. 4. 1940.

SPECIMENS SEEN: Costa Rica. San José, Quebradillas, north of Santa Maria de Dota, *Standley* 42865 (US). Alajuela, Viento Fresco, *Standley & Torres* 47895 (A, US). Province undetermined, El Copey, *Tonduz* 11896 (G, NY, US), Zarcero, *Austin Smith* 4223 (FM). Panama. Bocas del Toro, region of Almirante, *Cooper* 371 (FM, G, NY, US).

VERNACULAR NAMES: Duraznillo, Erepe, palo de papa, papa de palo, palo azul, haguey.

This species is reported from altitudes of 17–2000 m. The trees have wood of good quality, which is used for general construction, and seeds which are roasted and eaten but which cause nausea and produce violent intestinal pains if eaten raw.

Many more complete collections of this species are desired. At present a large amount of variation is admitted in the form and ornamentation of the fruits and eventually it may be necessary to divide this species and establish some of these variations as new entities.

CALATOLA LAEVIGATA *Standley*, *Contrib. U. S. Nat. Herb.* **23**: 689. 1923 (Forest and Flora of British Honduras), *Field Mus. Pub. Bot.* **12**: 230. 1936.

Tree, the branches sparsely appressed-pilose, becoming glabrate; petioles 1.5–2 cm. long; lamina elliptic-lanceolate to narrowly elliptic-oblong, 12–24 cm. long, 4–8 cm. wide, puberulous, becoming glabrate, acute or rarely obtuse, the base acute or rarely obtuse, the slightly arcuate veins in 10 pairs; staminate spikes 4–10 cm. long, the sericeous bracts ovate-acuminate; calyx minutely sericeous, its lobes obtuse; pistillate spikes short, yellow-crispose-pubescent; drupe ellipsoid, 6 cm. long, 3.5–4 cm. in diameter, sparsely short-sericeous, very early becoming gla-

brate, acutely rounded at both ends, not rostrate, strongly bicestate, the seed 4-5 cm. long, the embryo minute and 5 mm. long, the ovate cotyledons 2 mm. long and 1 mm. wide.

TYPE SPECIMEN: *Reko* 3440 (US) collected at Cerro Espino, Cafetal San Carlos, Oaxaca, Mexico.

ILLUSTRATION: PLATE 1-A, FIGS. 1-13.

SPECIMENS SEEN: Mexico. Oaxaca, Cafetal San Carlos, Cerro Espino, *Reko* 3440 (US, TYPE), Calvario, Cerro Espino, *Reko* 3728 (US). British Honduras. Temash river on the Guatemala boundary, *Schipp* 366 (FM), 446 (A, FM, G, NY), 708 (FM, NY), 1366 (A, G, NY).

VERNACULAR NAME: palo tinta.

This species was found on river-banks in dense forests at altitudes of 600-900 m. It flowers in September and has been found fruiting in October. The leaf-blade is asymmetrical. The midrib is arched and the blade is commonly folded when pressed. Schipp states that the large green fruits are used in dyeing.

A collection consisting of three old fruits gathered by *M. Pacheco* (FM 926621) in Guatemala in 1938 seems to represent an additional species. The fruits are subglobose (PLATE 1B, FIG. 14), 4 cm. long and 2.5-3 cm. in diameter. One ridge, housing the funicle, is strongly developed but its counterpart is not more prominently developed than the ridges of the endocarp-faces. These faces have moderate crests, with the reticulated lesser ridges essentially smooth. Both ends of the putamen are rounded and no prominent rostrum is developed. The seed is 3 cm. long, with copious endosperm containing an abundant blue-purple dye which is easily extracted in boiling water. The dye is not stable in aqueous solution. The embryo is minute, about 4 mm. long, with two ovate cotyledons 1.4 mm. long and 1 mm. broad. The radicle is somewhat flattened and angled and appears rhomboidal in cross section. These fruits are similar in size and ornamentation to those described and figured by Sleumer for *C. pastazana* from Ecuador. However, they lack the prominent rostrate base characteristic of *C. pastazana*. Vegetative parts and the flowers are desired before this species is described.

DISCOPHORA Miers

The long controversy over the correct name for this genus has been entirely unnecessary. *Kummeria* of Martius was the first name proposed for it. Unfortunately the original publication contains absolutely no description of the plant but merely a dedication to Dr. Kummer; *Kummeria* is a *nomen nudum*. In 1852 Miers described, under the name *Discophora*, the species Martius had mentioned and Miers' name has been recognized as valid by Bentham and Hooker, Valetton, and Standley. Engler, in both *Flora Brasiliensis* and *Natürlichen Pflanzenfamilien*, and Baillon use the invalid designation *Kummeria*.

Engler mentions two species in *Natürlichen Pflanzenfamilien*, one Brazilian and one Guianan, apparently considering the Miers and Martius specimens distinct. I have examined an isotype of Martius' material, and from the description and plate of Miers' material conclude that they are conspecific. This conclusion is in agreement with that reached by Baillon and Valetton.

Lasianthera amazonica Barbosa Rodrigues must join *Kummeria brasiliensis* in the synonymy of *Discophora guianensis*. Rodrigues apparently had fresh material at his disposal and did not recognize the characters of *Discophora* from dried specimens.

A second valid species of *Discophora* was described by Standley in 1929 on material from Panama. A third species is described in this treatment, based on material from Colombia.

Discophora Miers, Ann. Mag. Nat. Hist. II. 9: 223. 1852, II. 10: 118. 1852.

Kummeria Martius ex Engl. Fl. Bras. 12: (2): 52. 1872, Martius Herb. 1276. 1837, *nomen*.

Trees or shrubs, the branches short-strigose-pubescent or essentially glabrous, the bark smooth; leaves alternate, entire, petiolate; inflorescence axillary, paniculate, with strong branches at the base, the panicle diffuse, rarely strict, elongate and divaricate in fruit, the strigose-pubescent pedicels short, bracteate, the subsessile flowers articulated to the pedicel above the bract; flowers small, polygamous or possibly unisexual, the perianth moderately fleshy; calyx short-campanulate, broadly and frequently unevenly 5-lobed, the lobes deltoid or reduced to mere teeth; petals free, essentially glabrous, the apices inflexed, with short mucros, the midrib prominent adaxially; stamens with fleshy flattened filaments bearing an adaxial swelling or appen-

dage midway its length, the appendage more or less densely pubescent with clavate hairs, the filament abruptly narrowed below the versatile anthers, the ovate anther-sacs diverging at the base and introrsely longitudinally dehiscent, the pollen abundant in the anthers of male flowers, scantily if at all developed in the anthers of functional female flowers; pistil in male flowers abortive, cylindrical or slightly conical, either immersed in a fleshy avascular disk or eccentrically placed in the orifice of a hippocrepiform disk, in functionally female flowers the one-celled ovary cylindrical or angled and slightly compressed and bearing a lateral basal fleshy pulviniform avascular appendage, the style not evident, the fleshy and rugose stigma capitate, and occasionally broader than the ovary; the two anatropous ovules nearly collateral and pendent from the apex of the locule; fruit drupaceous, flattened, slightly arcuate, bearing a large oblong fleshy appendage of a light color on the concave side, the pericarp dark-pigmented, fleshy, the putamen with two pairs of equal primary ribs on the lateral edges of the fruit and one median ridge developed on both the concave and convex sides, intermediate ridges more or less completely and prominently developed on the convex side; seed one, pendent from the apex of the contorted locule, the endosperm copious and conformant with the locule, the embryo minute, the radicle terete.

TYPE SPECIES: *Discophora guianensis* Miers.

DISTRIBUTION: Panama, Colombia, British Guiana, Brazil, Peru.

Valeton described the flowers of *Discophora* as polygamous. Most of those I have examined have been unisexual. Rarely in the flowers with functional pistils I have found anthers containing a few pollen-grains. It is impossible to tell from herbarium specimens if this pollen was viable. The scarcity of the grains and the complete absence of pollen in most flowers indicates that the plants are definitely tending towards a unisexual condition. In the flowers which are functionally staminate the anther-sacs are turgid and well packed with smaller and regular-sized grains. The form of the stamen also distinguishes the two types of flowers. After anthesis the stamens are longer in the male than in the female flowers. The pubescence of the filament is borne adaxially on a swelling or appendage midway the length of the filament and is usually denser in the male flowers. This pubescence, as seen in herbarium specimens, consists of thin-walled hairs which are either clavate or lanceolate. Elongation of the

filament after anthesis occurs primarily in the region between the pubescence and the anther. The filaments are abruptly narrowed immediately below the anthers, which are versatile in both floral types. The anther-sacs are usually ovate-oblong and diverge at the base.

The pistil is very different in each type of flower. This condition has caused the very diverse views, expressed in the literature of this group, as to the nature of the pistil. In the staminate flowers the pistil is reduced. Usually it appears as a small cylindrical mass of undifferentiated tissue; frequently, however, I have found it reduced to a minute globular mass. In all cases this rudiment is associated with another undifferentiated mass of tissue, usually described as a "disk." This "disk" is a large fleshy, glabrous pulviniform mass. In the majority of cases the pistillate rudiment is located in the center of the tissue. Many flowers were observed, however, in which the pulviniform mass was not a complete circle but was hippocrepiform in shape. In these the pistillate rudiment was located in the orifice of the broken "disk." The pistil in functionally female flowers is strikingly different and greatly resembles the condition found in several Old World genera of the family. Here the ovary is cylindrical or angled and slightly compressed. It is unilocular with the locule containing two pendent collateral anatropous ovules. Sections through the ovary reveal two zones of differentiation, a denser tough outer layer, frequently pigmented, and an inner layer of soft tissue. The style is not evident and the sessile capitate stigma may be broader than the body of the ovary. At the base of the ovary is a larger pulviniform mass, which has also been called a "disk." This mass in the functional female flowers, as Valetton points out, never surrounds the ovary but is laterally placed. The glabrous pulvinus is very fleshy and usually approximates the diameter of the ovary. It is confluent with the inner layer of the ovarian wall at its base. The outer layer of the ovarian wall is not represented in the pulvinus. The pulvinus is partially free at the apex and resembles that found in *Lasianthera* and *Gastrolepis* and is unlike that found in *Medusanthera* (Howard, Journ. Arnold Arb. **21**: plates 1-2. 1940).

The fruit is somewhat unusual, yet has a striking resemblance to the fruits of the Old World genera *Lasianthera*, *Gastrolepis*, and *Medusanthera*. Several authors have cited the resemblance of these fruits to the mericarp of the *Umbelliferae*. It should be noted, however, that this resemblance is in shape only. A mericarp is only a portion of a fruit, *i. e.* a carpel, while in *Disco-phora* it is the entire fruit that is arcuate. On the concave side of the fruit there is a large cushion or pad of fleshy tissue. This appears to be undifferentiated and contains no vascular strands, although it is abundantly filled with oil-cells. Pressed and dried herbarium specimens contain much oil, and frequently even the mounting paper is saturated. Rodrigues points out the porcelain-white color of this appendage when fresh. Lawrance also indicates that it is of a glossy white color. In fresh condition this pad is described as broader than the body of the putamen, but in dried specimens it has shrivelled. The putamen is woody and strongly curved. Medianly on both the concave and convex surfaces it has one prominent ridge. On the lateral edges of the flattened fruit the putamen usually has two approximate, equally developed ribs. Between these lateral ridges and the median ridge on the convex surface are one or more less prominent ridges, which may be developed the complete length of the fruit or to varying degrees of completeness. Thus the convex surface of the drupe may appear to bear three or five or even more ribs. The pericarp of the drupe is fleshy, thin, of uniform thickness. Rodrigues mentions the pigmentation of the pericarp, commenting that it is soluble in alcohol. Reports of fresh fruit-color indicate that the pericarp is black or a rich dark brown. When dry all of the fruits are dark. When the pericarp is boiled in alcohol or caustic soda, or after long treatment in hot water, the pigment can be extracted. The resulting solution may be a deep wine-color or brown. The pericarp is unpigmented but readily distinguishable on the concave surface of the fruit where it is covered by the oily pulvinus. Only towards the base is the differentiation slight, indicating that the porcelain-colored pulvinus may have developed from the basal pulvinus of the functional ovary.

The single locule of the putamen conforms in shape to the

exterior sculpturing since the wall of the putamen is nearly of uniform thickness. The albumen of the seed conforms with the irregular shape of the locule and the cotyledons in all specimens examined are minute.

The path of the funicle through the ovarian wall and in the fruit has received considerable attention in other genera of the family. Here the funicle is sturdy and not definitely flattened. Its path is outside the putamen and it usually lies on top of the median rib on the concave side of the fruit. After entering the locule at the styler end it becomes flattened and descends the side of the seed 90° from its course on the outside. The funicle in its course on the concave side of the fruit is covered by unpigmented pericarp-tissue which is, in turn, covered by the fleshy oily paid previously described.

The genus *Discophora* cannot be closely related to any of the present known New World genera of the *Icacinaceae*. In all the characters of its fruit, flowers or wood it stands distinct. Comparison of these same characters with those of several genera of the Asiatic region show close relationships. The similarities and differences in wood structures of *Discophora*, *Lasianthera*, *Gastrolepia*, *Medusanthera* and *Grisollea* have been pointed out by Bailey and Howard (Journ. Arnold Arb. **22**: 178–180. 1941). Similarity in the flowers and particularly in the fruits of these genera is striking (Howard l. c.).

KEY TO THE SPECIES

- Leaves obovate-oblong; acumen short, 7–10 mm. long. *D. panamensis*
 Leaves oblong-lanceolate to elliptic; acumen 1.5–4 cm. long.
 Drupe 2 cm. long, 1 cm. wide, 0.9 cm. thick; leaves oblong-lanceolate to elliptic-oblong, acumen 1–4 cm. long. *D. guianensis*
 Drupe small, 1 cm. long, 0.4 cm. wide, 0.3 cm. thick; leaves elliptic, acumen to 2 cm. long. *D. montana*

DISCOPHORA PANAMENSIS Standley, Field Mus. Pub. Bot. **4**: 222. 1929.

Trees to 10 m. tall; the trunk 10 cm. in diameter, the branchlets terete, minutely puberulous; petioles 1–1.5 cm. long, narrowly and deeply canaliculate, densely and minutely puberulous; lamina obovate-oblong, 13–17 cm. long, 4–5.5 cm. wide, flat or minutely revolute, membranaceous, light green above, glabrous, abruptly short-acuminate, the obtuse to acute acumen 7–10 mm. long, the base acute to rarely obtuse, the midrib and veins

slightly impressed, sparsely short-puberulous below, the ascending and only slightly arcuate veins 7-8 pairs, conspicuous, the veinlets inconspicuous; cymes many-flowered, 2-3 cm. long and broad, the branchlets puberulous; staminate flowers with calyx subentire, 0.7 mm. high, glabrous except for small clusters of hairs at the tips of the teeth; petals ovate-oblong 1.5-3.0 mm. long, subglabrous or papillate on the inflexed apex, stamens as long as the petals, after anthesis slightly exerted, densely white-barbate, the anthers ovate, 0.6 mm. long; pistil abortive and undifferentiated, centric or eccentric to a large fleshy pulviniform disk; female flowers and fruits not known.

TYPE SPECIMEN: *Cooper 613* (FM), collected in the region of Almirante, province of Bocas del Toro in Panama.

ILLUSTRATION: PLATE 1B, FIGS. 12-13.

SPECIMENS SEEN: Panama, Bocas del Toro, region of Almirante, *Cooper 613* (FM TYPE, G, US).

This species is represented only by staminate material. As Standley has indicated, it differs from *D. guianensis* in having smaller, less coriaceous leaves and more slender branches to the inflorescence. The secondary venation of the leaves is not so conspicuous nor so highly reticulate as in *D. guianensis*. The specimens known are all tips of young shoots. Nevertheless the smaller size of the mature leaves is forecast by the small buds and leaf-primordia on these shoots. In comparison with those of *D. guianensis* the size is about one-third to one-half. The leaves of the present species are obovate-oblong, several times longer than wide, and broader near the apex than at the base, and the acumen is tapering to an acute apex. In contrast the leaves of *D. guianensis* of a comparable size are oblong-ovate and broader at the base, while the acumen is of uniform width for a good proportion of its length before it reaches an obtuse apex.

In the original description little mention was made of the unisexuality of the flowers of this plant. The anthers are fertile and the pistil is abortive, small and cylindrical or even further reduced to a globular mass. Sections of several of these rudiments revealed no structure other than a few weakly developed vascular strands very near the base. This rudiment is found either in the middle of a circular fleshy disk or at the orifice of a hippocrepiform fleshy mass. Female flowers and fruits are much desired.

DISCOPHORA GUIANENSIS Miers, Ann. Mag. Nat. Hist. II. **10**: 118. 1852, Contrib. Bot. **1**: 105. 1851–61; Bentham and Hooker, Gen. Pl. **1**: 352. 1862; Valetton, Crit. Overz. Olac. 241. 1886.

Kummeria brasiliensis Martius Herb. 1276. 1837, *nomen*: Martius ex Engler, Fl. Bras. **12**: (2): 52. 1872; Baillon, Adansonias **11**: 194. 1873 and Hist. Pl. **5**: 330. 1874; Engler, Nat. Pflanzenfam. **3** (5): 249. 1893.

Lasianthera amazonica Barbosa Rodrigues, Vellozia **1**: 12. 1891, second edition.

Trees or shrubs to 13 m. tall, the trunk to 10 cm. diameter, the branches lightly golden-strigose; petioles 10–25 mm. long, stout, canaliculate, strigose to glabrate; lamina oblong-lanceolate to elliptic-oblong, 15–30 cm. long, 7–13 cm. wide, coriaceous, olive-brown, silvery- or golden-sericeous or pilose when young, glabrate, acute or acuminate, the acumen to 4 cm. long but usually 2 cm. long, with the ultimate apex rounded, the base acute, rarely rounded, the margin revolute, the midrib prominent and strigose below, sulcate below, the arcuate or ascending veins 7–10 pairs, the veinlets conspicuously reticulated and sharply prominent on both surfaces; inflorescence paniculate, strongly branched from the base, rarely strict, densely golden-strigose, becoming glabrate and stout in fruit, the pedicels short, the densely pubescent bracts lance-ovate or ovate; calyx campanulate, glabrous except for the tips of the teeth; petals obovate to elliptic, 2–3 mm. long, glabrous except for minute pubescence on inside of inflexed acumen; stamens of male flowers 3.5–4 mm. long, the broadly ovate anther 0.7 mm. high, stamens of the female flowers shorter; functional pistil cylindrical or slightly angular and arcuate, 3 mm. high, basal lateral fleshy pulvinus to 1 mm. high and surrounding about one-half of the ovary, the capitate stigma strongly rugose; the pistil of the male flowers abortive, club-shaped or cylindrical, minute, rarely to 1 mm. high, completely surrounded by a fleshy disk, less frequently eccentrically placed; drupe 2 cm. long, 1 cm. wide, 0.9 cm. thick, the putamen strongly five-ribbed on the convex surface.

TYPE SPECIMEN: *Parker* in the Hooker herbarium (not seen), collected on the Demerare river in British Guiana.

ILLUSTRATIONS: *Miers*, Contrib. Bot. **1**: pl. 20. 1851–61; Engler, Fl. Bras. **12** (2): pl. 12. 1872; Valetton, Crit. Overz. Olac. pl. 5, fig. 24 a-d. 1886; Barbosa Rodrigues, Vellozia **3**: pl. 7. 1891, second edition, as *Lasianthera amazonica*; Engler, Nat. Pflanzenfam. **3** (5): fig. 139. a-c. 1893.

SPECIMENS SEEN: Brazil. Amazonas: Para, *Huber* 93 (FM); Humayta, near Livramento on Rio Livramento, *Krukoff* 6789 (A, FM, NY, US); Humayta between Rio Livramento and Rio

Ipixuna, Cipoal, *Krukoff* 7227 (A, FM, NY, US); São Paulo de Olivença, *Krukoff* 8699 (A, FM, NY); Amazon region, *Ducke* 317 (NY). Bahia: Ilheos, *Martius* 1276 (NY isotype of *Kummeria brasiliensis*, TYPE photo FM); Esperance, *Riedel* 793 (NY). Peru: Loreto: Balsopuerto, *Klug* 3017 (A, FM, G, NY, US); Mishayacu near Iquitos, *Klug* 478 (FM, NY, US), 986 (FM, NY, US), 452 (FM, NY, US), 942 (FM, NY, US). British Guiana. Barima River, *La Cruz* 3419 (FM, G, NY, US); Kama-kusa upper Mazaruni river, *La Cruz* 4233 (FM, G, NY, US); Coverden, *Persaud* 135 (FM, NY). Without locality: *Melinon* 242 (FM) this specimen was originally from the Herb. Mus. Paris.

In spite of a wide separation geographically I believe the specimens upon which Martius and Miers established *Kummeria* and *Discophora* are conspecific. Martius' plant was from Bahia, that seen by Miers from British Guiana. I have not seen the specimen cited by Miers but more recent collections from the same region are indistinguishable from Martius' plant, which also is in agreement with the description and plate published by Miers.

Only slight variation appears in the specimens from Peru. In these the entire plant, calyx, inflorescence, leaves and branches are more pubescent, with the hairs longer and more persistent. No other differences worthy of distinction were to be found. The range of the present species, therefore, is from British Guiana through Brazil, from Para to Bahia, and up the Amazon river to Loreto, Peru.

Rodrigues mentions a lack of a fleshy pad on one side of the fruit in *Kummeria* and through this he distinguished the plant he described. Obviously he was in error for, although this fleshy mass is not indicated in Engler's diagnosis of the species, it is clearly visible in a photograph of the type specimen.

Illustrations of this species are variable in their accuracy. Those of Rodrigues are especially good and show well the habit, fruits and flowers. The sections of fruit as illustrated are also good. The stamens which Rodrigues illustrates are all from functionally female flowers. The adaxial appendage midway the length of the filament is accurate and the pubescence is correctly placed. The elongation of the filament after anthesis is

primarily above the appendage and, as illustrated, its pubescence, and thereby quite different from the condition found in either *Lasianthera* or *Gastrolepis*. Engler's drawings in Fl. Bras. and Nat. Pflanzenfam. are inaccurate and should not be considered beyond the habit-sketch.

DISCOPHORA montana sp. nov.

Arbor 6-metralis; ramulis teretibus, minute puberulis, internodiis 3–5 cm. longis; petiolis 13–18 mm. longis minute puberulis, anguste et profunde sulcatis; laminis foliorum ellipticis 16–24 cm. longis 6–9 cm. latis coriaceis supra olivaceis et glabris apice acuto vel acuminato (acumine ad 2 cm. longo obtuso) basi acuto, cum costa et nervis impressis notatis, subtus pallidioribus sparse strigosis puberulis; nervis foliorum lateralibus utroque 7–9 adscendentibus, ad apicem arcuatis et juxta marginem conjunctis; cymis divaricatis laxae multifloris 3–4 cm. longis et 3–6 cm. latis ramulis sericeis puberulis bracteis ovatis 0.5–1.5 mm. longis; calycis florum masculorum 0.5 mm. longis lobis ad 0.2 mm. longis; petalis ovato-oblongis 1.5–2.0 mm. longis, obtusis; staminibus quam petalis laeviter longioribus filamentis crassis ad mediam dense albo-barbatis antheris ovatis 0.3–0.4 mm. longis; pistillo florum masculorum abortivo rudimento pistilli glabro in discum carnosum annularem inserto; floribus femineis ignotis; fructu maturo drupaceo leviter arcuato 9–11 mm. longo 3–4 mm. lato 3 mm. crasso in latere concavo pulvinum subcarnosum gerente; putamine longitudinaliter sulcato costis lateralibus costaque dorsali caeteris crassiore.

ILLUSTRATION: PLATE 1B, FIGS. 1–11.

SPECIMENS SEEN: Colombia. El Umbo region of Mt. Chapon, extreme western part of Dept. Boyaca, 130 miles N. of Bogota, *Lawrance* 522 (A TYPE, FM, G, NY isotypes), 535 (A, FM, G, NY).

VERNACULAR NAME: Senceso.

This species is represented by two collections of *A. E. Lawrance* from Colombia. One collection in full flower is entirely staminate, with abundant pollen in the anthers and a rudimentary pistil completely immersed in the center of a fleshy cushion or disk. This collection was made at an altitude of 3200 feet. The flowers are reported as tiny, creamy-white and odorous. The second collection consists of older material with a few fruits remaining attached to the cymose inflorescence. Diligent search failed to reveal any old flowers or floral parts, so a description of the functional pistil is lacking. The drupe is typical of the

genus, slightly arcuate, with a long fleshy cushion attached to the concave side. It is conspicuously smaller than the fruits known for *D. guianensis*. This collection was made at an altitude of 4000 feet, in a high thick forest. In attached field-notes the fruits are described as bean-shaped, half black and half white. The altitudinal range of this species is much higher than those of the others. The specimens of *D. panamensis* were collected at less than 1250 feet and those of *D. guianensis* from coastal forests at altitudes up to 500 feet.

Several morphological features of this species are worthy of further mention. The strict silvery strigose pubescence of the inflorescence is continuous to the articulation of the flower at the base of the calyx. The fleshy calyx is minutely papillate and the tissue contains numerous large crystal-bearing cells. The calyx-teeth are better developed than in the other species of the genus. The inflexed apex of the corolla is papillate above and the inner surface of this apex bears numerous moderately long lanceolate hairs. The midrib of the petal is fleshy and prominent and broadens at the base. Auriculate lobes are well developed laterally in the middle of the filament on most of the stamens examined. The pubescence on these lobes is dense, with lanceolate rather than clavate hairs.

Discophora montana is distinct from the other species of this genus on its smaller fruits, elliptic leaves and delicate, much branched cymose inflorescences.

EMMOTUM Desv. ex Hamilt.

A complete revision of this genus will be published in one of the later numbers of the current volume of the Journal of the Arnold Arboretum.

OTTOSCHULZIA Urban

Ottoschulzia Urban Symb. Antill. 7: 272. 1912.

Trees or shrubs, the terete branches strigose or glabrate; leaves coriaceous, entire, pinnately veined, the veins not arcuate; flowers small, in few-flowered racemes, or solitary in the axils of the leaves, articulated at the base of the elongated calyx, perfect; sepals ovate, obtuse or rounded; petals fleshy, with a prominent midrib, glabrous inside; stamens glabrous, the broad fleshy

filaments slightly concave internally, the basifixed ovate anthers erect, connective extended to a slightly incurved apex, the anthersacs laterally dehiscent along the connective; disk absent; ovary globose, glabrous, the short style terminal, the locule solitary, the two ovules superposed; drupe ovoid, mesocarp slightly fleshy and with a fibrous layer, the thin putamen smooth outside and pilose inside, the seed solitary, the embryo straight, the oblong cotyledons foliaceous, the radicle terete and shorter than the cotyledons, the endosperm copious.

TYPE SPECIES: *Ottoschulzia cubensis* (Wright) Urban.

DISTRIBUTION: Cuba, Porto Rico, Santo Domingo, Haiti.

Urban established *Ottoschulzia* by splitting the genus *Poraqueiba*. The genus is named in honor of Otto E. Schulz, a monographer of the Antillean flora.

The plants are either trees or shrubs. On a specimen of *O. cubensis* (Wright 2639) there is a pencilled label reporting the plant to be a large bush of saline thickets ("salt marsh") and another label on the same collection described it as a small tree 25 feet. The other two species are trees.

The leaves of *Ottoschulzia* are much smaller than in most of the New World genera. They bear a malpighiaceae pubescence on the lower surface when young. The arms of the hairs may be equal or quite unequal and they break off early. Frequently in *O. cubensis* and regularly in *O. rhodoxylon* and *O. domingensis* the leaves and older twigs are grey in color, due to a free layer of empty cells on each surface. The veins are not arcuate as in most genera of the family but are strictly pinnate and parallel. They branch near the margin, with the divisions curving and weakly anastomosing close to the edge of the lamina. This is somewhat similar to the condition found in *Emmotum*.

The inflorescence of *O. cubensis* is commonly racemose and scarcely equals the length of the petiole. The number of flowers may be reduced to two; or frequently only a single flower is to be found in the axil of a leaf. The bracteate calyx may be articulated either to the main axis in the case of the true inflorescence or to a very short axillary stalk when only one or two flowers are present. The calyx is densely strigose-pubescent with thick-walled chestnut-brown hairs. Urban described the corolla as gamopetalous but, although I have carefully studied

flowers of *O. cubensis*, I can find no examples of this. The petals and filaments are fleshy and are usually agglutinated in drying, but boiling and careful dissection reveals that all parts are free. In fact, the petal-bases are rounded and actually quite separated. The petals are densely strigose outside except at the base, where the tight investment of the calyx prevents the development of hairs. The petals are glabrous inside and bear two longitudinal furrows and a prominent midrib, which is not sulcate as in *Poraqueiba*.

The glabrous stamens are similar in form to those found in *Poraqueiba* but differ in the presence of pigmented cells throughout the tissue. When viewed from the side the anthers are ovate in contrast to the triangular shape in *Poraqueiba*, and at the ends the anther-sacs are approximate. The apex of the connective is inflexed and the dehiscence of the anther is along the junction with the connective.

Urban described the ovary as having three locules, two of which aborted. I have been unable to find any indication of two extra locules at any stage of development. The single locule has two superposed ovules, the lower one usually shrunken and abortive.

Fruits are known only for *O. cubensis*. The drupe is ovoid, with a thin pericarp in which there are no oil cells such as were found in *Poraqueiba*. The thin woody putamen is pubescent on the inner surface, also different from *Poraqueiba*. These hairs are longer than those found elsewhere on the plant. They are usually thin-walled and have a restricted lumen and slightly enlarged base.

A dark pigment is found in the tissues of this plant which is comparable to that found in the tissues of *Emmotum* and *Poraqueiba*. The leaves have pigmented cells in the mesophyll and the pigment is also found in the bark, the ray-parenchyma and the pith. The pigment is present in the calyx but is masked by a thick-walled epidermis. It is also present in the connective tissues, the filaments and the ovarian wall.

Habitat-notes for this genus are few. Wright's material bears pencilled notes referring to a salt marsh, which may account for the reduced characters of leaf-size and inflorescence. *O. rho-*

doxylon is reported from woods, and Ekman gives limestone rocks as its habitat in Haiti.

The closest affinities of the genus are with *Poraqueiba*. Similar fleshy petals, filaments and broad connectives are also found in *Oecopetalum*, *Poraqueiba* and *Emmotum*. The position of the ovules is similar to that in *Oecopetalum*. Further agreement of these genera is found in the wood-structure.

The genus is readily distinguished from *Poraqueiba* by the much smaller leaves, reduced inflorescence, lack of subtending bracts to the flowers, elongate calyx-bases, glabrous inner surface of the petals, superposed ovules, and the pubescent inner surface of the putamen.

I have seen isotypes of *O. cubensis* and leaf-fragments of the other two species. *O. rhodoxylon* is known only in sterile condition but, according to Urban, Prof. Volkens reports it has a wood-structure comparable to that of *O. cubensis*. *O. domingensis* is known in flowering condition but I have not seen material of it.

KEY TO THE SPECIES

- Young stems ferruginous tomentose; leaves ovate 2.5–5 cm. long, 1.5–3 cm. wide, the base rounded, brown strigose pubescent. *O. cubensis*
- Youngest stems glabrous.
- Leaves ovate to broadly elliptic, 6.5–8 cm. long, 4.5–6 cm. wide, the base rounded to truncate. *O. rhodoxylon*
- Leaves obovate, 3–3.5 cm. long, 1.3–3 cm. wide, the base narrowed or cuneate. *O. domingensis*

OTTOSCHULZIA CUBENSIS (Wright) Urban, Symb. Antill. 7: 273. 1912.

Poraqueiba cubensis Wr. ex. Griseb. Cat. 119. 1866; Wr. et Sauv. Flor. Cub. 21: 1863 *nomen*; Urban Symb. Antill. 5: 405. 1908.

Large bush or small tree to 25 feet, the branches terete, the youngest branchlets red-brown and strigose or tomentose to glabrate; petiole 5–8 mm. long, canaliculate, densely ferruginous-tomentose; lamina ovate or rarely oblong, 2.5–5 cm. long, 1.5–3 cm. wide, coriaceous, pubescent when young with malpighiaceae hairs, usually glabrous above, short-acuminate or rounded, the base rounded, the strigose-pubescent midrib prominent below, the veins inconspicuous; inflorescence axillary, racemose or reduced to 1–2 flowers, scarcely as long as the petiole, rhachis sparsely strigose; calyx-lobes ovate, rounded or acute, 0.5 mm.

high; petals ovate, 2.5–2.9 mm. long, 1 mm. wide; stamens 2.2 mm. long, the filaments 0.5 mm. wide, the connective-apex 0.2 mm. long, the anther-sacs 0.9–1.1 mm. long; pistil 1 mm. long; drupe 2–2.5 cm. long, 1.6 cm. in diameter, the putamen 0.5 mm. thick.

TYPE COLLECTION: *Wright* 2639, from the Oriente province of Cuba.

ILLUSTRATION: PLATE 2A.

SPECIMENS SEEN: Cuba. Oriente: Manglaus, Toscano, *Wright* 2639 (G, NY, US isotypes); Sierra Maestra, *Leon* 10799 (NY). Isle of Pines: Hato Nuevo, Punta del Este, *Roig & Cremata* 1793 (NY).

OTTOSCHULZIA RHODOXYLON (Urban) Urban Symb. Antill. 7: 274. 1912.

Poraqueiba rhodoxylon Urban, l. c. 5: 405. 1908.

Stems angular, striate, glabrous; petioles 6–8 mm. long; lamina orbicular-ovate to oval, 6.5–8 cm. long, 4.5–6 cm. wide, coriaceous, olive, shining above, pale brown below, the apex rounded to obtuse, the base round to almost truncate, the prominently reticulate-anastomosing veins 6–7 pairs, lightly impressed above and oblique; flowers and fruits unknown.

TYPE COLLECTION: *Krug* 1442, from Mayaguez, Porto Rico.

SPECIMENS SEEN: Porto Rico. Near Mayaguez, *Krug* 1442 (NY leaf fragment of TYPE). Haiti. Inseln Grande-Caimite near Les Abricots, *Ekman* 8933 (US), Massif du Nord, Port Margot, Bayeux, *Ekman* 2586 (US). Both of Ekman's collections are sterile.

VERNACULAR NAME: Palo de rosa.

OTTOSCHULZIA DOMINGENSIS Urban, Symb. Antill. 7: 274. 1912.

Stems brown or gray; petioles 4–7 mm. long, 0.6–1 mm. thick, deeply sulcate, appressed-brown-pilose; lamina obovate to elliptic, 3–5.5 cm. long, 1.3–5 cm. wide, shining above, glabrous, short-brown-pilose below, the apex round or obtuse to short-acuminate, the base narrowed, the 5–7 pairs of veins slightly prominent on both surfaces; flowers solitary in the leaf-axils, the pedicels 1 mm. long and thick; calyx-lobes suborbicular, 1 mm. long, pilose outside, the apex round or obtuse; petals narrowly ovate, 3 mm. long, 1.3 mm. wide, acute, appressed-pubescent with brown malpighiaceous hairs; filaments 1.5 mm. long, 0.4 mm. wide, the anthers not known; ovary ovate, 0.7 mm. long, 0.6 mm. in diameter, the style cylindric; fruit unknown.

TYPE COLLECTION: *Fuertes* s. n., collected in Barahona province of Santo Domingo.

I have seen a fragment of a leaf from the type specimen (NY). Only one flower is known for this species.

In Urban's descriptions the only characters distinguishing between *O. domingensis* and *O. rhodoxylon* are leaf-size and, especially, the shape of the base of the lamina. Ekman (Arkiv. Bot. **17** (7): 40. 1921) includes in his description of a Haitian plant the characters of both these species. He suggests that they are conspecific. Using Urban's descriptions I have changed the identification of Ekman's material from *O. domingensis* to *O. rhodoxylon*. I cannot decide the question of conspecificity of these plants without seeing more material and, therefore, I accept the three species as defined by Urban. If *O. domingensis* and *O. rhodoxylon* should prove to be conspecific, as Ekman suggests, the name *rhodoxylon*, not *domingensis*, will have to be retained.

OECOPETALUM Greenman & Thompson

Oecopetalum Greenman & Thompson, Ann. Miss. Bot. Gard. **1**: 408. 1914.

Trees; leaves alternate, subcoriaceous, the veins arcuate and anastomosing, the margin entire; inflorescence axillary, pedunculate, much branched, the cymes densely flowered; flowers perfect; calyx fleshy, sericeous, accrescent in fruit; petals fleshy, the midrib prominent, the margins incurved; stamens with elongate anthers, erect, dehiscence lateral along junction with the connective, connective fleshy; disk none; ovary globose, glabrous or sparingly pilose, the ovules superposed, the style stout or filiform, the stigma obtuse and bilobed; fruit drupaceous, globose, 2-ridged, dehiscent with the calyx, the rugose and glabrous putamen woody, the single seed with a curved embryo, the ovate cotyledons not superposed, the radicle terete and equal in length to the cotyledons, the endosperm copious.

TYPE SPECIES: *Oecopetalum mexicanum* Greenm. & Thomps.

DISTRIBUTION: Mexico and Guatemala.

In the original description and in several subsequent reports of the genus the ovary has been described as unilocular and uniovulate. In fact, however, there are two pendant anatropous ovules present. Unlike most of the genera of the family, *Oecopetalum* has the two ovules superposed. One ovule has a short funicle and is situated directly above the second ovule with a longer funicle. Both ovules are turgid and tightly compressed against each other and against the locular walls. For this

reason they could easily be mistaken as one, but careful dissection shows that two are present.

Baehni (Candollea 7: 171. 1936) suggests that *Oecopetalum* is synonymous with *Poraqueiba* but this is not the case. *Oecopetalum* cannot be confused with any other genus of the New World. The much-branched inflorescence, accrescent calyx, fleshy, essentially glabrous petals, elongate anthers with very thick connectives, and the superposed ovules allow ready identification of the genus.

Greenman and Thompson suggested the characters which *Oecopetalum* has in common with *Mappia*, *Discophora* and *Poraqueiba*; however, the relationships of these genera are vague except that with *Poraqueiba*. The closest relationship of *Oecopetalum* is with *Ottoschulzia*, on the basis of floral structure, and with *Platea* through certain similarities in the wood.

The three species recognized in this genus are very similar. Study of more material may not allow all to be retained.

KEY TO THE SPECIES

- Veins of the leaves 8-10 pairs; stamens only 5 mm. long, filaments 0.5-1.2 mm. long; ovary sparsely pilose at the base of the style.....*O. Greenmanii*
- Veins of the leaves 4-6 pairs; stamens 6-8 mm. long, the filaments 2-2.5 mm. long; ovary glabrous.
- Leaves broadest below the middle, the base narrowed or rounded; anthers oblong, not narrowed at the base; petals pubescent outside.....*O. guatemalense*
- Leaves broadest above the middle, the base cuneate; anthers narrowed and the anther-sacs approximate at the apex; petals glabrate or very sparsely pubescent outside.....*O. mexicanum*

OECOPETALUM GREENMANII Standley & Steyermark, Field Mus. Pub. Bot. 22: 154. 1940.

Tree, the green and glabrous branches terete; petioles 0.8-1.5 cm. long, canaliculate, glabrate or sparsely sericeous; lamina oblong or elliptic-oblong to lance-oblong, 14-20 cm. long, 3.5-8 cm. broad, glabrous, shining above, acute to subacuminate, the base obtuse, the midrib slightly prominent, the arcuate veins 8-10 pairs, the veinlets reticulate; cyme 5 cm. wide, 6 cm. long, repeatedly branched, densely flowered, to 9 cm. long in fruit, the rhachis sparsely to densely sericeous; flowers aggregated, the minute bracts subulate or lanceolate; calyx 1.5-2 mm. long, the ovate, acute and sericeous lobes persistent and accrescent in fruit, the lobes then 5.5-6.5 mm. long and 3 mm. wide; petals

5–5.5 mm. long, 1.5–1.6 mm. wide, minutely sericeous outside, slightly pilose on the keel inside; anthers 4 mm. long, 1 mm. wide, the filaments 0.5–1.2 mm. long and 0.5 mm. wide; ovary 1 mm. long, 0.75 mm. wide, sparsely pilose at the base of the style, the glabrous style 3.5 mm. long; drupe depressed-ovoid or globose, obliquely 2-ridged, 1.5 cm. in diameter, the apex broadly rounded and short-rostrate, the rostrum 1.5 mm. long.

TYPE SPECIMEN: *Steyermark* 39516 (FM), collected in Guatemala, Dept. Izabal, Rio Dulce, west of Livingston.

SPECIMENS SEEN: *Steyermark* 39516 (FM, TYPE).

After examining the type specimen I find it necessary to emend the original description with the following details. The ovary is sparsely pilose at the base of the style and is uniloculate, with two superposed pendant, anatropous ovules.

OECOPETALUM GUATEMALENSE Howard, Journ. Arnold Arb. **21**: 483. 1940.

Tree to 20 m. tall, the trunk-diameter 30 cm., the branches sparsely sericeous to glabrate; petioles 0.7–1 cm. long, canaliculate, glabrate; lamina elliptic to elliptic-oblong, 10–14 cm. long, 3.5–6 cm. wide, broadest below the middle, glabrous above, green, paler below and sparsely appressed-pubescent with malpighiaceus hairs, acute, the base rounded, the midrib and veins prominent, the arcuate veins 4–6 pairs; cymes with peduncles to 2.5 cm. long, the rhachis appressed pubescent; calyx campanulate, 2.1 mm. in diameter, enlarging in fruit to 1.5 cm. in diameter, the lobes 6–7 mm. high; petals oblong-lanceolate, 8 mm. long, 1.7–2 mm. wide, sparsely sericeous-pubescent outside, glabrous inside; stamens 5–7 mm. long, the oblong anthers 5–5.3 mm. long and 1.3–1.5 mm. wide, the connective red-brown; ovary and style glabrous; drupe globose, 1.8–2 cm. in diameter.

TYPE SPECIMEN: *Skutch* 2080 (A), collected in Guatemala, Finca Moca, Dept. Suchitepequez.

ILLUSTRATION: Journ. Arnold Arb. **21**: pl. 3. 1940.

SPECIMENS SEEN: Guatemala. *Skutch* 2080 (A, TYPE); Volcan Zunil, Dept. Quezaltenango, *Skutch* 954 (A, NY). Mexico. Finca Irlanda, Chiapas, *Purpus* 7609 (A, G, NY, US).

OECOPETALUM MEXICANUM Greenm & Thoms. Ann. Miss. Bot. Gard. **1**: 408. 1914.

Trees, the branches sericeous to glabrate; petioles 0.7–1.5 cm. long, canaliculate; lamina elliptic to lanceolate, 10–25 cm. long, 3.5–10 cm. wide, glabrous, the apex short-acuminate to obtuse, the base cuneate or narrowly acute, the midrib and veins slightly sulcate above, prominent and sparsely appressed-pubescent below, the arcuate veins 5–7 pairs; cymes densely flowered, the

rhachis densely appressed-puberulous; calyx 2 mm. in diameter, the obtuse and densely sericeous lobes ovate and 1 mm. long; petals oblong-lanceolate, 8–8.3 mm. long, 2 mm. wide, sparsely sericeous outside or glabrate, glabrous inside; stamens 7 mm. long, the anthers ovate-lanceolate, the anther-sacs approximate at the apex; ovary glabrous, the two ovules superposed, the style glabrous; fruit unknown.

TYPE SPECIMEN: *Purpus* 6159 (Mo. Bot. Gard. Herb. not seen), collected in Mexico, Vera Cruz, Sierra Madre near Miscantla.

ILLUSTRATIONS: Ann. Miss. Bot. Gard. **1**: pl. 25. 1914.

SPECIMENS SEEN: Mexico. Vera Cruz: Sierra Madre near Miscantla, *Purpus* 6159 (FM, G, US isotypes). Chiapas: Mt. Tacana, *Matuda* 2437 (FM, G, NY).

DENDROBANGIA Rusby

Dendrobangia Rusby, Mem. Torrey Bot. Club **6**: 19. 1896, Bull. Torrey Bot. Club **24**: 79. 1897; Smith, Lloydia **2**: 193. 1939.

Clavapetalum Pulle, Rec. Trav. Bot. Neerl. **9**: 148. 1912.

Asterolepidion Ducke, Arch. Jard. Bot. Rio **3**: 207. 1922.

Tree, the lepidote-strigose to glabrate branches terete; leaves alternate, entire; inflorescence axillary, paniculate, diffuse, densely pubescent, bracteate; flowers sessile in glomerules of 3–5, articulated below the calyx, perfect; calyx 5-parted, fleshy, the stellate-pubescent segments coherent at the base and imbricated; corolla gamopetalous, 5-lobed, valvate, glabrous or rarely papillate, the inflexed apices with long clavate appendages; stamens 5, the glabrous filaments dilated at the base and adnate to the corolla-tube at the sinuses, the long anther-sacs diverging at the base, longitudinally dehiscent and introrse; disk none; ovary dorso-ventrally compressed, uniloculate, collateral ovules two; style stout, capitate stigma minute; fruit drupaceous, oblong, mesocarp thin and fleshy, endocarp thin and woody, the seed solitary, the embryo minute, the endosperm copious.

TYPE SPECIES: *Dendrobangia boliviana* Rusby.

DISTRIBUTION: French Guiana, Brazil.

DENDROBANGIA BOLIVIANA Rusby, Mem. Torrey Bot. Club **6**: 19. 1896, Bull. Torrey Bot. Club **24**: 79. 1897.

Clavapetalum surinamense Pulle, Rec. Trav. Bot. Neerl. **9**: 148. 1912.

Asterolepidion elatum Ducke, Arch. Jard. Bot. Rio **3**: 207. 1922.

Clavapetalum elatum Ducke, Arch. Jard. Bot. Rio **4**: 116. 1925.

Tree to 40 m. tall, the brownish-gray bark smooth, the stout branches ferruginous-tomentose or stellate-pubescent, becoming glabrate; petioles 1–1.5 cm. long, narrowly canaliculate, stellate-

pubescent; lamina lance-oblong to obovate, 8–14 cm. long, 3–5 cm. wide, coriaceous, dark green when fresh, turning black on drying, glabrate above, persistently ferruginous-stellate-pubescent below, the apex obtusely acuminate with curved acumen or acutish, the base acute to rounded, the midrib sulcate above but prominent below, the irregularly falcate-ascending and inconspicuous veins 6–8 pairs, slightly anastomosing near the margin; inflorescence axillary, much branched, the panicle 3–4 cm. long, with branches scurfy with stellate pubescence, the lance-ovate and fleshy bracts densely pubescent and ciliate; sepals 1–2 mm. long, stellate-pubescent, ciliate; corolla white, 3 mm. long, the broadly triangular lobes inflexed in bud and bearing clavate or oblanceolate appendages, the lobes reflexed on maturity; anthers 0.4 mm. long; ovary 0.4 mm. high and 0.6 mm. in diameter, bearing large stellate hair-clusters, the style minute but evident, the capitate stigma minute; drupe compressed, triangular in section, 1.5–2 cm. long, 1 cm. wide, 0.5 cm. thick, sparsely stellate-pubescent, the putamen thin and essentially smooth on both surfaces, the seed one, the endosperm copious, the embryo minute, the cotyledons minute and triangular.

TYPE SPECIMEN: *Rusby 1694* (NY), collected in British Guiana between Tipuani and Guanai.

ILLUSTRATIONS: Bull. Torr. Bot. Club **24**: pl. 294. 1897; Rec. Trav. Bot. Neerl. **19**: pl. 2. 1912 as *Clavapetalum surinamense*.

SPECIMENS SEEN: British Guiana. *Rusby 1694* (NY type, A. FM, G, US isotypes); Malali, Demerara river, *La Cruz 2717* (G, NY, US); Kamakusa, upper Mazaruni river, *La Cruz 2856* (G, NY, US); Wismar, *Persaud 113* (NY); basin of the Essequibo river near the mouth of the Onoro creek, *Smith 2726* (FM, G, NY). Brazil. Amazonas: Borba, *Ducke 10153* (US); Belem de Pará, *Ducke 17855* (US), 15534 (NY, US).

VERNACULAR NAMES: Piritjalopo, Apiritjalopo.

A. C. Smith recognized the identity of the three monotypic genera here cited and combined them under the oldest name, *Dendrobania*. Only slight variation in the leaf-shape exists among the specimens and Ducke's claim of two species seems best disregarded.

Collectors report the trees in deep forests on high lands and 30–40 m. tall, making them among the tallest of the New World *Icacinaceae*. Only *Poraqueiba* is reported to comparable heights. Ducke says the bark is smooth and, when fresh, has an odor of "cubiu," a Solanaceous genus cultivated in the Amazon basin. The wood is hard and durable and is exported from the region of Breves under the name "pau de cubiu."

The leaves are somewhat variable in shape but examination of sufficient material of single collections shows the variations reported in each of the previous descriptions. The under side of the lamina and the midrib and veins bear ferruginous stellate hair-clusters. These clusters have frequently been described as lepidote, since the basal regions of the hairs are often fused and flattened. The outer extremities of the hair are crispate and free. The occurrence of stellate hairs in this genus is significant, since this type of indument is somewhat rare in the family. Among the other New World genera only the species of *Humirianthera* regularly have stellate clusters of hairs. Several Old World genera of the other subfamilies have clustered hairs but of different types. *Platea* has hairs which approach closely those of *Dendrobangia*, since the lower portions of the individual hairs are also fused.

The axillary inflorescence of *Dendrobangia* consists of one or two strongly branched panicles, which generally have the basal branches as well developed as the principal axis. The inflorescence usually is about the length of the leaf, or 2-3 cm. long. Pulle reports and figures the inflorescence of his material to be 4-8 cm. long, which is the only noteworthy character in his new genus. Both bracts and bracteoles of the inflorescence are fleshy and usually have a ciliate margin. The rest of the inflorescence and the calyx is stellate-pubescent. Terminating the branches are glomerules of 3-5 flowers which lack distinct pedicels and are articulated immediately below the calyx to the main axis. The valvate corolla is glabrous but there may be papillae developed on the margin of the lobe but no well developed indument, as described by Rusby, was seen. Upon anthesis the lobes recurve and frequently elongate. The genus *Dendrobangia* is the sole member of the New World *Icacinaceae* to possess a gamopetalous corolla and to have the stamens attached to the corolla-tube.

A complete description of the fruit has been lacking. It is a drupe, oblong in side-view and triangular in section, but laterally compressed, so that the shorter side is concave. The pericarp is thin, fleshy, and bears stellate hair-clusters. Ducke reports the fresh fruit to be yellow at maturity, with a sweet, slightly

biting taste. The putamen is thin, uniform in thickness, and essentially smooth. The one locule bears a single anatropous seed pendent from the apex. The funicle which travels up the fruit in the pericarp-tissue is located in the concave groove or the narrower side of the fruit. Near the apex it makes an abrupt bend to enter the putamen below the stylar point. The raphe is strap-shaped and travels down the edge of the triangular-shaped albumen to the base, where it flattens out to form a circular chalaza. The change in the course of the funicle and raphe after entering the locule is not as great as in other genera, since it is less than 90° in all specimens examined. The seed itself fills the locule. The embryo is minute, apically placed, and varies from 1–1.6 mm. long, while the seed itself is 12–20 mm. long. Most of the cylindrical embryo consists of the radicle, the two minute ovate or triangular fleshy cotyledons being only 0.3 mm. long in the largest specimen.

Rusby considered in some detail the possible relationships of *Dendrobangia*. It is unique among the New World genera and has only a superficial resemblance to the others. Considering all characters, it is most similar to *Platea*, a Malaysian genus, in the structure of the wood, the type of inflorescence, the possession of stellate hairs and the gamopetalous corolla.

PLEURISANTHES Baillon

Pleurisanthes Baillon, *Adansonia* **11**: 201. 1874; Valetton, *Crit. Overz. Olac.* 258. 1886; Engler, *Nat. Pflanzenfam.* **3** (5): 252. 1893; Van Tieghem, *Bull. Soc. Bot. France* **44**: 117. 1897; Sleumer, *Notizbl.* **15**: 256. 1940.

Martia Valetton, *Crit. Overz. Olac.* 259. 1886, not Bentham.

Valetonia Durand, *Index Gen. Phanerogam.* 64. 1888; Engler, *l. c.* 460. 1896.

Vines or scandent shrubs; youngest stems terete, the older branches strap-shaped; leaves alternate, petiolate, pinnately arcuately veined, the secondary veins prominent and reticulate; inflorescence axillary, supra-axillary or terminal, paniculate or spiciform-racemose, the rachis commonly flattened, the glomerate and nonarticulated few flowers sessile or pedicelled in bracteate clusters, the glomerules usually arranged on only one face of the flattened rhachis, the flowers perfect; calyx campanulate, 5-lobed, the lobes triangular and acute; corolla polypetalous, the fleshy petals strigose outside and glabrous inside, the midrib

frequently prominently developed; stamens 5, free, the glabrous filaments filiform, the longitudinally dehiscent introrse anthers oblong; ovary conical, hirsute, unilocular, the two ovules collateral, the style minute or well developed, the capitate stigma frequently papillate; fruit unknown.

TYPE SPECIES: *Pleurisanthes Artocarp* Baillon.

DISTRIBUTION: French and British Guiana, Brazil.

The genus *Pleurisanthes*, described by Baillon, was based on a plant collected in French Guiana. Later Valeton studied Baillon's description of *Pleurisanthes* and described a genus very similar to it, which he dedicated to Martius and called *Martia*. However, this name proved invalid since Bentham had previously used it for a genus of the *Leguminosae*. Durand renamed the genus for Valeton, calling it *Valetonia*. When Van Tieghem examined the type material of *Pleurisanthes* he found that Baillon's description of *Martia* was simply a correct diagnosis of *Pleurisanthes*.

Van Tieghem made a thorough study of the group, since he believed that it should be the type genus of a distinct family. The original description of the plants as trees having polygamous flowers, with the male flowers in a separated inflorescence, was rejected by Van Tieghem, who also studied the wood and reported that the species are lianas having perfect flowers. Further study also indicated a polypetalous or agglutinated corolla, rather than a gamopetalous one, and an ovary without the basal disk which Baillon had claimed for it. I have not seen the original material on which these two diverse opinions were based, but, judging from the species later described, I believe Van Tieghem's corrections to be valid.

Thus the plants of this genus are lianas or scandent shrubs. The young stems and branches are terete, tendril-like in appearance and have a normal wood-structure. The older branches are strap-shaped, with the secondary xylem laid down principally on opposite sides of the stem between the orthostiches. The leaf-scars are elevated, as is frequent in vines, and are circular. On the stems and on petioles there may be two kinds of hairs developed, strict thick-walled rugose hairs and relatively thin-walled arching hairs. The lower leaf-surface of *P. Arto-*

carpi is reported as glabrous but those of other species all bear a pubescence. *P. parviflora* is most distinct, having a dense stellate-tomentose pubescence on the under side of the leaf. The primary veins are arcuate and anastomosing near the margin. The secondary veins are frequently parallel and the veinlets are strongly reticulate. Near the margin the vascular strands of the leaf often protrude, forming irregular spines or teeth. If the margin is recurved these teeth are not noticeable, but, when flat, the leaf-margin has been described as spinose-dentate.

The inflorescence is anomalous in the family, even among the lianoid tribes. It may be terminal, axillary, or in extreme cases supraaxillary midway between the nodes. The inflorescence may be a sparsely branched panicle, as reported in *P. brasiliensis* and *P. parviflora*, or, more commonly, it consists of a single raceme or a cluster of spiciform racemes with flattened axes. Baillon referred to these axes as cladode-like. These may be branched near the base but are, more commonly, strict and single. The flowers are only on one face of this axis. Van Tieghem and Sandwith point out that the axis may be strongly flattened when young but that it does round off slightly in maturity.

The flowers are sessile, pedicelled, or sessile when young and later developing short pedicels. Rarely are they found singly but more often in groups of 3–5 flowers, each group being subtended by a series of bracts. The glomerules may be placed close together on the axis or they may be widely spaced and alternate or zig-zag on the axis. The flowers are not articulated immediately below the calyx. The importance of this will be indicated later. Van Tieghem has mentioned that the valvate corolla is not gamopetalous, as Baillon described it, but consists of separate petals. These may be agglutinated near the base and dehisce as a unit or they may be entirely free and fall independently.

The pistil has been described either as lacking a style or having a style as long as the ovary. I have examined several sheets of *P. parviflora* and find, in that species, that the style elongates rapidly with the expansion of the bud. The stigma is capitate, rugose, or with papillae developed. Baillon reports a pubescence on the stigma of *P. Artocarpus*. The one locule has two

nearly collateral anatropous ovules pendent from near the apex. Usually one, the upper one, is smaller and more shrunken than the lower. Probably only one developed. No fruits are known for this genus.

Recently Sleumer has proposed two sections, *Eupleurisanthes*, with the flowers sessile, arranged in interrupted spikes and having the axis of the inflorescence more or less flattened, and *Haplobotrys*, having the flowers shortly pedicellate and arranged in simple racemes on a terete axis. The first section was to contain all the species except *P. simpliciflora*, which was the sole member of the second section. Actually none of the characters of the sections seem constant. The flowers are short-pedicelled in *P. emarginata*, *P. brasiliensis* and *P. flava*, as well as *P. simpliciflora*. As mentioned earlier, the flattened nature of the inflorescence-rhachis seems to be a developmental feature. Thus, I do not believe a division of the genus as proposed is possible or necessary.

Van Tieghem removed the genus *Pleurisanthes* from the *Icacinaceae* and proposed that it become the type of a new family. His *Pleurisanthaceae* was separated from the *Icacinaceae* by the following characters: the presences of secretive canals in the primary tissues of the plant body; the progressive inclusion of the secondary wood; the hermaphroditic flowers, and the dialypetalous corolla. The canals mentioned by Van Tieghem run in the primary tissues through the petioles of the leaves and into the lamina. Unfortunately, these cannot be properly studied from dried material, so their exact nature must await better material for further study. On this character *Pleurisanthes* is anomalous in the family. Van Tieghem's additional criteria for separating the families are less distinctive and may be found in many genera of the *Icacinaceae* as well as in his *Pleurisanthaceae*.

Another anomalous character found in *Pleurisanthes*, which is not found in the *Icacinaceae* as a whole, is the absence of any kind of floral articulation either immediately below the calyx, as is the common expression, or at the base of the pedicel. Since this is present in the other genera of the *Icacineae* its absence in *Pleurisanthes* might suggest affinities with some other groups of the *Icacinaceae*.

Engler divided the *ICACINACEAE* into four tribes, principally on anatomical characters. The *Sarcostigmateae* and the *Phytocreneae* are quite distinct but the *Iodeae* and *ICACINEAE* are more difficult to separate. Engler separated these last two essentially as follows: *ICACINEAE*: trees or shrubs, seldom climbing, mostly with perfect flowers; embryo small, seldom as long as the endosperm; vessels with scalariform perforations, interxylary phloem absent. *IODEAE*: climbing plants, with dioecious flowers; embryo as long as the endosperm; vessels with simple perforations, xylem more prominently developed between the orthostiches of the stem. Bailey and Howard (Journ. Arnold Arb. **22**: 125–30, 171–84. 1941) have discussed the merits of the anatomical characters used by Engler in dividing the family. They have shown that the *Iodeae* and the *ICACINEAE* could not be distinguished, in all cases, on the characters given by Engler. Such genera of the *ICACINEAE* as *Mappia* and *Leretia* have porous perforations to the vessel-segments, not the scalariform perforations prescribed. *Leretia* may have the xylem more prominently developed on two sides of the stem. Howard (Journ. Arnold Arb. **21**: 461–86. 1940) has pointed out that some genera of the *ICACINEAE* likewise may be dioecious and that several genera of this tribe have embryos approaching the length of the endosperm. *Pleurisanthes* is a liana with simple perforation-plates to the vessel-segments, unequal development of the stem, and perfect flowers, thereby tending to bridge the two tribes as established by Engler. However, in most of its characters *Pleurisanthes* is similar to the genera of the *ICACINEAE*. For this reason I consider the genus in the *ICACINEAE*, as Engler did, and reserve final decision as to its precise relationships until the fruits are known and have been studied. Among the New World genera *Pleurisanthes* is distinct and lacks close relationship with any of the known genera. Its similarities are strongest with the Old World genera.

KEY TO THE SPECIES

Inflorescence terminal or its lowermost branches axillary, profusely branched from the base, rhachis dorso-ventrally flattened.

Leaves ovate, broadest at the base, the apex rounded but apiculate, glabrous; flowers sessile or very short-pedicelled,

5-parted *P. Artocarpi*

- Leaves elliptic to obovate-elliptic, broadest above the middle, the apex emarginate, densely pubescent; flowers glomerate, short-pedicelled, 4-parted. *P. emarginata*
- Inflorescence axillary or supra-axillary (rarely terminal in *P. brasiliensis*), sparingly if at all branched at the base.
- Inflorescence paniculate.
- Leaves elliptic, 7 cm. long, 2.5 cm. wide, glabrous, the margins spinose-denticulate, flat, the apex acute; inflorescence to 12 cm. long. *P. brasiliensis*
- Leaves lance-oblong to elliptic-oblong, 9–13 cm. long, 4–6 cm. wide, pilose above, densely stellate-tomentose below, the margins revolute, the apex acuminate, the acumen to 1.2 cm. long; inflorescence sparingly branched, shorter than the leaves. *P. parviflora*
- Inflorescence racemose, single, rarely of 2-spiciform racemes.
- Leaves broadly elliptic-oblong, the apex rounded or obtuse. *P. simpliciflora*
- Leaves lance-oblong to elliptic-oblong, the apex acute, ultimately cuspidate. *P. flava*

PLEURISANTHES ARTOCARPI Baillon, *Adansonia* **11**: 201. 1874.

Vines or climbing shrubs; the stems compressed or subterete, the bark gray and striated; petioles 1.5 cm. long; lamina ovate, 12 cm. long, 7 cm. wide when young, becoming much larger, thinly coriaceous, glossy below, crenulate to denticulate, short-acuminate, the base rounded, the veins 7–9 pairs; inflorescence terminal or the basal portions axillary, the spikes to 7 cm. long, the flowers sessile in two rows, arranged in small glomerules; calyx cupular, puberulous outside; petals 5; stamens shorter than the petals, the filaments subulate; pistil short-conical, hirsute, the apex papillate- or pilose-stigmatic; fruit unknown.

TYPE SPECIMEN: Collected by *Melinon* in French Guiana in 1863. Specimen in the Herb. Mus. Paris, not seen. I have seen a photograph of the type (FM).

Van Tieghem reexamined the type specimen and concluded that the original description was inaccurate. No complete diagnosis of this species is known to me and the description above has been compiled from Van Tieghem's correction of Baillon's work.

PLEURISANTHES EMARGINATA Van Tieghem, *Bull. Soc. Bot. France* **44**: 117. 1897.

Vine; petioles to 1 cm. long; lamina elliptic to obovate-elliptic, broadest above the middle, 8–12 cm. long, 4–7 cm. broad, tomentose below, the base narrowed and round or cordate, the apex truncate or emarginate, the margin revolute, the veins 6–7 pairs; inflorescence terminal, composed of numerous branched spiciform racemes to 3 cm. long, the axes flattened, the flowers short-pedicelled and clustered, tetramerous; fruits unknown.

TYPE SPECIMEN: *Le Prieur* 275, collected in Guyane. I have seen a photograph of the type (FM) which is in the Herb. Mus. Paris.

PLEURISANTHES BRASILIENSIS (Valeton) Van Tieghem, Bull. Soc. Bot. France **44**: 117. 1897.

Martia brasiliensis Valeton, Crit. Overz. Olac. 261. 1886.

Valetonia brasiliensis Durand, Index Gen. Phanerogam. 64. 1888; Engler, Nat. Pflanzenfam. **3** (5): 460. 1896.

Climbing shrub; petioles to 1.5 cm. long; lamina elliptic, 7 cm. long, 2.5 cm. wide, glabrous, the base rounded, the apex acute to mucronate, the margin irregularly obtusely spinose-denticulate, the veins 7–9 pairs; inflorescence terminal, a panicle to 12 cm. long, or if axillary longer than the leaves, the flowers glomerate, 3–5 to a cluster, the pedicels 2–4 mm. long, the buds subglobose; calyx deeply five-parted; petals appressed-pubescent outside; fruit unknown.

TYPE SPECIMEN: *Neuwied* s. n., collected in Brazil. Valeton reports seeing this specimen in the Herb. of the Museum of Brussels.

ILLUSTRATION: Valeton, Crit. Overz. Olac. pl. 6, fig. 45. 1886.

I have not seen this material. Van Tieghem reports that the species is clearly distinct on the size of its leaves.

PLEURISANTHES PARVIFLORA (Ducke) Howard, Journ. Arnold Arb. **21**: 482. 1940.

Leretia parviflora Ducke, Arch. Jard. Bot. Rio. **4**: 119. 1925.

Mappia parviflora Baehni, Candollea **7**: 174. 1936.

Leretia glabrata Sleumer, Notizbl. **15**: 245. 1940. (?)

Climbing shrub; the stems angular to subterete, canous-tomentose or glabrate; petioles to 1 cm. long, densely subvillous or tomentose; lamina elliptic-lanceolate to lance-oblong, 10–16 cm. long, 5–6 cm. wide, thinly coriaceous, glabrous, shining above, stellate-tomentose below, the base slightly cordate, the apex short-acute to acuminate, the margin entire or slightly revolute, the veins 8–9 pairs; panicle axillary, 3–9 cm. long, the branches few, appressed-gray-pubescent, the bracts small, the pedicels 2–3 mm. long; calyx-teeth triangular-acute, 1 mm. wide; petals 2.5 mm. long, 0.6–1 mm. broad, linear-oblong to oblanceolate, sericeous-pubescent outside and on the margins; anthers oblong, 1 mm. long; pistil to 1.5 mm. high at anthesis, the ovary yellow-hirsute, the style glabrous, as long as the ovary; fruit unknown.

TYPE COLLECTION: *Ducke* Herb. Jard. Bot. Rio. 17856, collected at Mosqueiro near Para river in Para, Brazil.

ILLUSTRATION: PLATE 3A.

SPECIMENS SEEN: *Brazil*. Amazonas: Municipality Humayta, near Livramento on the Rio Livramento, *Krukoff* 6954 (A, FM, NY, US).

I have indicated in a previous paper (Howard, Journ. Arnold Arb. **23**: 60. 1942) that I am unable to distinguish between *P. parviflora* and *Leretia glabrata* Sleumer from the description of the later. Until I can examine the type-material I tentatively refer *L. glabrata* to the synonymy of *P. parviflora*. Sleumer's points of distinction do not allow separation of these two species without direct comparison of the specimens.

Through the paniculate inflorescence and the dense stellate-tomentose pubescence of the leaves one can readily identify this species. As in *P. flava*, the style is well developed but here it is glabrous. Also in common with *P. flava* is the pronounced development of the lower portion of the prominent midrib of the petal. Frequently this protuberance is gland-like in appearance.

PLEURISANTHES SIMPLICIFLORA Sleumer, Notizbl. **15**: 256. 1940.

Scandent shrub; the stems terete; petioles 1–1.5 cm. long, 2 mm. thick, densely tomentose; lamina broadly elliptic-oblong, 8–14 cm. long, 5–9 cm. broad, widest at the middle, membranaceous, lightly pilose above, ferruginous-tomentose below, the base cordate, the apex round or obtuse to subacuminate, the margins undulate, the veins protruding beyond the margin; inflorescence axillary, consisting of a single spiciform raceme 3–4 cm. long, yellow-ferruginous-pubescent, the minute bracts subulate, the short-pedicelled flowers in fascicles of 2–3; sepals deltoid, to 1 mm. long; petals narrowly oblong, 2.5 mm. long after anthesis; filaments subulate, 2 mm. long, the minute anthers elliptic; ovary ovoid, the glabrous stigma subcapitate; fruit unknown.

TYPE SPECIMEN: *Ducke* ex Herb. Jard. Bot. Rio 37637 in the herbarium at Berlin. Collected at Camanaos on the Rio Negro, Brazil.

SPECIMEN SEEN: Brazil. Amazonas: São Paulo de Olivença, *Krukoff* 8773 (NY).

I have not seen authentic material of this recently described species; however, it seems distinct on the single supra-axillary bracteate inflorescence and the elliptic-oblong leaves with rounded apices. The specimen cited is very immature.

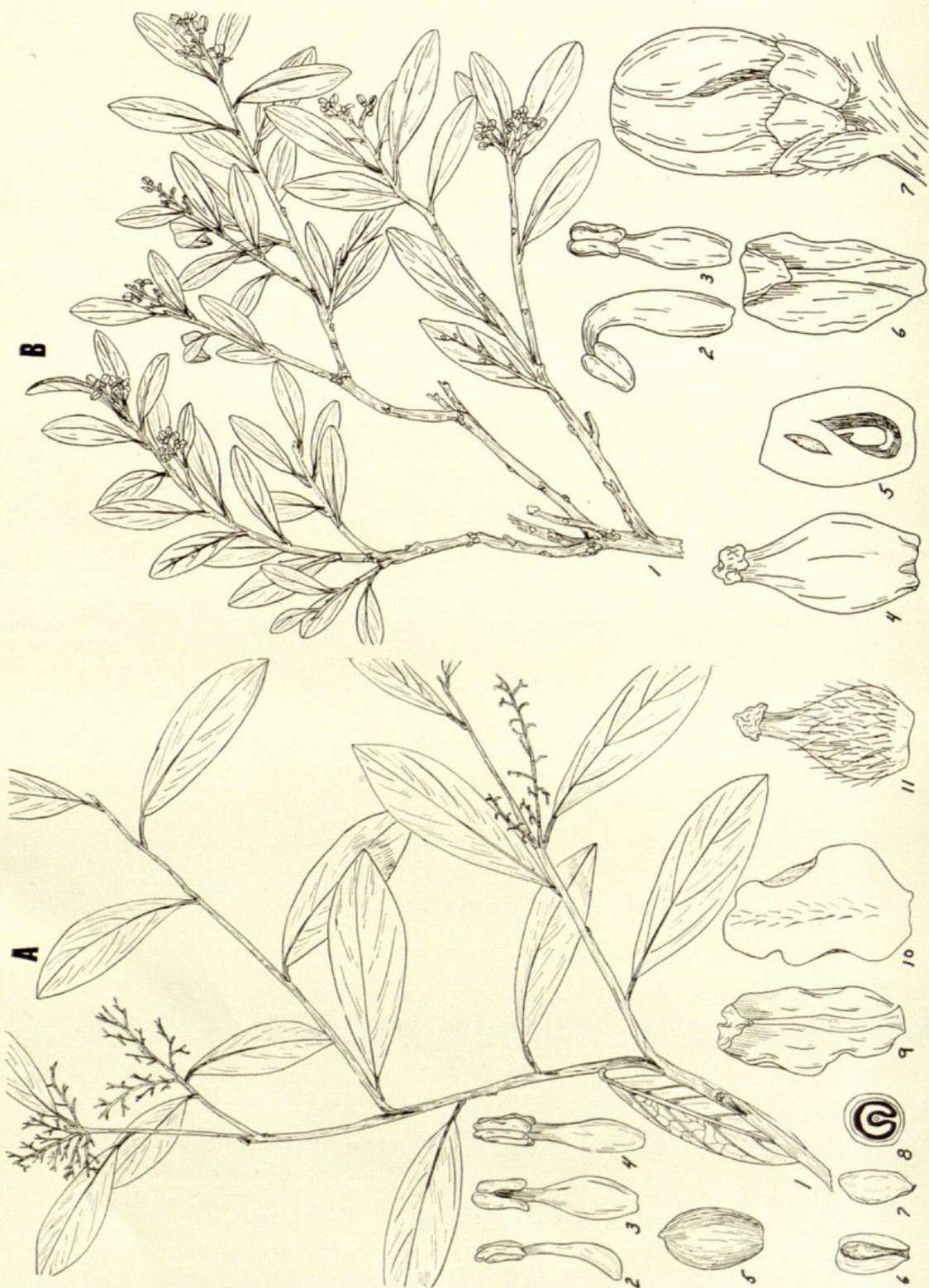
PLEURISANTHES FLAVA Sandwith, Kew Bull. 467. 1931.

Scandent shrub; the young stems terete, yellow-gray-pilose or appressed-tomentose; petioles flexuous, densely yellow-gray-tomentose, to 1.8 cm. long; lamina ovate to elliptic-oblong, 6–14 cm. long, 3–7 cm. wide, membranaceous, shining above, sparsely pubescent and paler below, tomentose on the veins, the base



A, *PLEURISANTHES PARVIFLORA*.

B, *PORAQUEIBA PARAENSIS*.



A, CITRONELLA PANICULATA.

B, CITRONELLA ENGLERIANA.

rounded to slightly cordate, the apex acute-acuminate to subcuspidate, the acumen broadly obtuse to abruptly mucronate, the margin entire, the veins 7–9 pairs; inflorescence axillary, simple racemes to 5.5 cm. long, the flowers two ranked, the tomentose and flattened branches bracteate, the glomerate to umbellate flowers in clusters of 3–5 flowers, short-pedicelled to sessile, the buds ovoid-ellipsoid; calyx cupular, 1.75 mm. in diameter, 0.8 mm. high, pubescent outside, the acute teeth deltoid, 0.4 mm. long and 0.7 mm. wide, with sinuses obtuse; petals elliptic, 2.5 mm. long, 0.8–1.1 mm. wide, cinereous-tomentose outside; stamens 1.8–2.2 mm. long, the filaments 1.5 mm. long, the oblong anthers 0.8 mm. long; ovary ovoid, densely pilose, 1 mm. long, 0.7 mm. diameter, the style 0.5 mm. long, the glabrous stigma discoid; fruit unknown.

TYPE COLLECTION: Sandwith 590, made in British Guiana.

ILLUSTRATION: PLATE 2B.

SPECIMENS SEEN: British Guiana. Moraballi Creek, on the Essequibo river, *Sandwith* 590 (isotype NY). Brazil. Amazonas, São Paulo de Olivença, *Krukoff* 8683 (NY).

Older stems on the Krukoff specimen reveal a strap-shaped stem 12 mm. wide and 5 mm. thick. The plant is described as a vine of the high forest. Sandwith reported the type collection as a "bush-rope," since the terminal shoot was tendril-like and terete. A section of this tendril-like portion showed that a tendency to subsequent unilateral growth was already initiated in a one-year-old stem.

CITRONELLA D. Don

A revision of this genus is presented as a separate paper (Studies, V) following this, since the Old World species of it are also treated.

MAPPIA Jacquin

The genus *Mappia* was treated in a study of the "*Mappia* Complex," published in the Journal Arnold Arboretum **23**: 56–78. 1942.

PORAQUEIBA Aublet

Poraqueiba Aublet, Fl. Guian. **1**: 123, t. 47. 1775; Poiret in Lamarck, Encycl. Meth. **5**: 569, pl. 134. 1804; Tulasne, Ann. Sc. Nat. III. **11**: 169. 1849; Walpers, Ann. Bot. **2**: 179. 1851; Miers, Ann. Mag. Nat. Hist. II. **9**: 481. 1852, Contrib. Bot. **1**: 69.

1851-61; Bentham and Hooker, Gen. Pl. **1**: 352. 1862; Engler, Fl. Bras. **12** (2): 47, pl. 10. 1872, Nat. Pflanzenfam. **3** (5): 252. 1893; Huber, Bol. Mus. Goeldi **4**: 396. 1904; Le Cointe, Arvores e Plantas Uteis. 1934.

Paraqueiba Scop., Introd. 182, No. 767. 1777.

Barreria Scop., Introd. 182, No. 767. 1777, not *Barreria* L.

Bareria Juss., Dict. Sc. Nat. **4**: 61. 1816.

Meisteria Gmel., Sys. Veg. **1**: 391. 1796, ex Steudel, Nom. Bot. 1821, not Scop., Introd. 124. 1777.

Trees; leaves alternate, petiolate, coriaceous, entire, the veins arcuate and weakly if at all anastomosing near the margin; inflorescence axillary, paniculate, strongly branched from the base, the flowers subtended by three imbricated pubescent bracts and articulated at the base of the calyx, the buds globose; calyxlobes 5, fleshy, lightly imbricated; petals valvate, fleshy, the edges incurved, the midrib prominent, longitudinally furrowed inside, more or less white-silky pubescent on the lateral and median ridges, the apices inflexed; stamens with fleshy and flattened filaments usually concave at the base, glabrous, the basifixed anthers erect, the connective broadened and extended to an attenuate inflexed apex, in side-view the anthers appearing triangular, the anther-sacs lateral on the lobes of the connective, dehiscence lateral at the junction with the connective; disk none; ovary globose, glabrous, unilocular, the style terminal and shorter than the ovary, the minute stigma capitate; drupe ovoid to oblong, more or less oblique, the mesocarp fleshy, the woody and smooth endocarp with a longitudinal ridge around the fruit, the embryo curved or nearly straight, the cotyledons foliaceous, the radicle short cylindrical.

TYPE SPECIES: *Poraqueiba guianensis* Aublet.

DISTRIBUTION: Dutch Guiana, Brazil, Peru.

The trees of this genus are among the tallest of the American *Icacinaceae*. Aublet described *P. guianensis* as 50 feet tall and recent collections of *P. sericea* by Ducke and Krukoff are reported to 90 feet, with a trunk-diameter of 2.5 feet.

The leaves possess a short, white sericeous pubescence but soon become glabrate. The hair-bases persist as conspicuous projections (under a microscope) and are usually lighter in color than the rest of the leaf. Several authors have mistaken them for glands. The hair-bases are extremely abundant on leaves of *P. sericea* and rather sparse in *P. paraensis*.

There is a dark-colored material throughout the tissues of

these plants. Ducke likens the color to that of *Emmotum*. It is readily removed in caustic soda or even by continued boiling in water. In aqueous solution it is a rich chestnut or brown to a wine-color. The tissues of the leaf have this pigment in the cells and the dark color of the petiole is due to its abundance there. It is likewise present in the cortex, bark, and frequently in the wood, particularly in the wood-parenchyma and in the ray-cells. It is also present in the fleshy connectives, and the variegated pigmentation of the ovarian wall results from the irregular masking of the cells containing this material by thick-walled cells of the outer tissues of the wall. In *P. guianensis* this colorless layer ends a short distance from the base of the ovary and the pigmented cells of the inner layer form a basal dark-colored ring.

The inflorescence is an axillary panicle, scarcely as long as the petiole in *P. paraensis*, but frequently twice as long as the petiole in both *P. sericea* and *P. guianensis*. It is much branched from the base, with the branches approaching the length of the main axis. The flowers are sessile on the branches in *P. sericea* and *P. paraensis* but are slightly stalked in *P. guianensis*. This last condition is frequently described as racemose and was illustrated as such by Miers. The flowers are all subtended by three imbricated bracts, the bract directed downward on the axis being lowermost, the lateral ones opposing each other. These are densely white-sericeous in all species.

The petals develop two internal longitudinal furrows separated by a usually well developed median ridge. The lateral margins of the petals are incurved. The form of the median ridge of the petal varies within the genus but appears to be relatively constant within the species. The value of this as a specific character must be tested by examination of more material. The median ridge is usually sulcate or canaliculate, with its lateral margins variously developed. In *P. sericea* the median ridge is divided at the middle. The lower portion is expanded into ovate, rounded lateral lobes and the upper portion is oblong-lanceolate and broadest at the middle. These flanges are densely white-sericeous with moderately long hairs. The lateral rims of the petals are also white-sericeous but the hairs are shorter.

The stamen is intimately associated with these flaps, both in bud-condition and until the petals fall away. The ear-like lobes of the lower portion of the median ridge-flaps of adjacent petals completely obscure the filament, with the anthers alone visible. In *P. guianensis* the median ridge is scarcely developed and only slightly sulcate above, but shallowly and very broadly sulcate below the middle. This results in two furrows in the upper half of the petal and essentially three in the lower portion. The upper and lower regions are separated by a definite transverse ridge of tissue which is lacking in the other two species of the genus. The pubescence of the petals of *P. guianensis* is greatly reduced. A few hairs occur on the lateral rim at the point of junction with the transverse ridge. Longer and more abundant hairs forming a fringe are found on the margins of the broadly sulcate median ridge in the lower half of the petal. The flaps of this lower portion do not cover the filaments in the younger stages of floral development. The internal form of the petals of *P. paraensis* is quite similar to that just described for *P. guianensis* but differs noticeably in the absence of a transverse ridge at the middle of the petal. Thus the two longitudinal furrows extend the full length of the petals. Both the lateral and median ridges are densely sericeous. The hairs resemble chains of beads when dry, due to the regular constriction along their length. The hairs may not collapse in others.

Externally the petals of *P. sericea* and *P. guianensis* are densely white-sericeous. In *P. paraensis*, however, the petals are only minutely and sparsely pubescent in the upper third when young and usually become completely glabrate at the time of aestivation.

The stamens of *Poraqueiba* are distinctive. The filaments are broad, frequently oblong-ovate in bud but expanding after anthesis. They are thick and slightly concave internally and lack the dark pigment so contrastingly present in the connective-tissue. The anthers are flattened laterally and are triangular in side-view, with the connective tapering to an apical mucro which is tightly inflexed against the adaxial margin of the anther. The four sides of the anther are sulcate; thus in transverse section the anther has a form of a flattened cross. The anther-

sacs on the adaxial margin are usually shorter than those on the abaxial margin. In *P. sericea* the adaxial sacs commonly extend along the lower side of the anther. Their dehiscence is by means of a longitudinal slit along the junction with the connective. The white or yellow anther-sacs form a color-contrast with the chestnut-brown connective tissue.

Contrary to Miers report there is no disk in *Poraqueiba*. The ovary in *P. guianensis* commonly has a dark colored ring at its base. The ovarian wall in *P. paraensis* has only patches of dark colored tissue on the surface and in *P. sericea* no pigmented tissue is visible. Engler (Fl. Bras. 12 (2): 48. 1872) reports a specimen of Martius (No. 2689) as having three locules, two of which early abort. I have never seen such a condition in the material available to me.

Poraqueiba sericea has one of the largest fruits yet described in the family. One specimen is 8 cm. long and 5.5 cm. in diameter. The drupe is described as yellow-green or black. Dried specimens are either black or dark brown. The outer layers of the pericarp are completely permeated by pigmented cells. In the major portion the pigmented cells form a network with the colorless cells comprising the bulk of the tissue. Le Cointe reports that this pulp contains 12% of its weight in chestnut-yellow oil. The endocarp is smooth inside and out. There is a longitudinal ridge running around the putamen. A portion of this is hollow and contains the funicle. At the apex of the putamen is a slightly flattened conical styler canal.

The fruits of *P. guianensis* are small, green and inedible. Those of *P. sericea* and *P. paraensis* are larger and the mesocarp and seeds are quite edible. Huber discusses at length their usefulness as food. He points out that the taste is not agreeable to all palates and, although they are sold on the market, their use is not widespread. *P. paraensis* and *P. sericea* have both been cultivated by the Indians on the lower Amazon. In the wild state *P. sericea* is known only from the upper Amazon and Peru, with *P. paraensis* only in the region around Belem de Pará. The wood of *P. guianensis* and of *P. sericea* is dark, hard, compact, and is used by the natives for general carpentry and fuel.

The vernacular name of "mary" has been applied to all species of this genus. "Umary" and "Mary Gordo" have been applied to *P. paraensis* (Le Cointe). "Mary negro," "umari roco," "umari negro," "Umari amarillo," "Mari preto," "Umari" and "Umary" apply to *P. sericea*. Common names for *P. guianensis* include "Umari bravo" and "Umari sauvage." For a discussion of further applications of the name "Mari" see the footnote by Ducke in Arch. Jard. Bot. Rio 4: 117. 1925.

The genus *Poraqueiba* was described by Aublet in 1775. The generic name is an adaptation of the vernacular Carib name and, presumably for this reason, was not accepted by later botanists. Scopoli replaced it with *Barreria* but this name cannot be accepted since Linneaus had previously used it for a different plant. Dalla Torre and Harms consider *Barreria* L. in their list of *Genera incertae sedis* (No. 9645). *Barreria* Scopoli, however, refers to the Icacinaceous plant. In an attempt to save this name Jussieu changed the spelling to *Bareria*.

Scopoli, in placing *Poraqueiba* in the synonymy of *Barreria*, misspelled it and his spelling, *Paraqueiba*, has been carried in the literature by several authors.

According to Steudel (Nom. Bot. 515. 1821) the name *Meisteria* also belongs in the synonymy of *Poraqueiba* Aublet. *Meisteria* was a name substituted by Scopoli for *Pacourina* Aubl., a genus of the *Compositae*. Gmelin in 1796 (Veg. Sys. 1: 391) used *Meisteria* for an entirely different plant and attributes the name to Scopoli, Introd. No. 868. 1777. This reference is erroneous and cannot be checked. Steudel (l. c.) placed *Meisteria* Gmelin in the synonymy of *Barreria*, a genus which Willdenow states to be synonymous with *Poraqueiba* Aubl. Thus the name *Meisteria* is invalid in any sense. It is an invalid substitution for a valid name of a genus of the *Compositae* and its second use is, at best, a doubtful later synonym of *Poraqueiba* Aublet.

On the basis of the broad connective, the petal-form and the type of fruit and seed it appears that *Poraqueiba*, *Ottoschulzia*, *Emmotum*, and probably *Oecopetalum*, are closely related. There are similarities of wood which also support this relationship.

KEY TO THE SPECIES

- Corolla glabrous outside; calyx glabrous or ciliate on the margins; inflorescence scarcely as long as the petiole; leaves elliptic to orbicular, 10–17 cm. long; petioles slender. *P. paraensis*
- Corolla and calyx densely short-white-sericeous outside; inflorescence twice as long as the petiole.
- Leaves narrowly oblong, 15–25 cm. long, 6–8 cm. wide, the base acute or rarely obtuse; petals with a transverse ridge across the middle, glabrate above the middle, sparsely pubescent below the middle inside; fruit small, 2.5 cm. long and 1.3–1.5 cm. in diameter, green. *P. guianensis*
- Leaves broadly elliptic-ovate, 17–25 cm. long, 8–15 cm. wide, the base rounded to subcordate; petals densely villous on the ridges inside, transverse ridge absent; fruit large, 6–8 cm. long, 4.5–6 cm. in diameter, yellow-brown to dark brown or black. *P. sericea*

PORAQUEIBA PARAENSIS Ducke, Arch. Jard. Bot. Rio 4: 116. 1925, 5: 90. 1930.

Tree 60–75 feet tall; the branches terete, brown-puberulent to glabrate; petiole 1.5–2.5 cm. long, sericeous-pubescent, becoming glabrate, deeply canaliculate above; lamina elliptic to orbicular, rarely ovate, 10–18 cm. long, 6–10 cm. broad, glabrous above except on the sulcate midrib, short-sericeous below, short acuminate, the acumen to 1 cm. long, the base obtuse to rounded, the midrib and veins prominent, the 4–6 pairs of arcuate veins free at the ends or slightly anastomosing; inflorescence scarcely equaling the petiole, sparsely white-sericeous, becoming glabrate; calyx 2 mm. in diameter, the oblong to ovate ciliate lobes 0.6 mm. long and 1.0 mm. broad; petals ovate to oblong, 3–3.5 mm. long, 1–1.4 mm. broad, sericeous outside, the margins in-rolled, weakly sericeous, the fleshy sericeous midrib prominent and broadly but shallowly sulcate below the middle, the furrows glabrous; stamens 2.5 mm. long, the anthers 1.1–1.2 mm. long, the theca not extending adaxially on the basal portion of the strongly developed connective; ovary globose, the style short; drupe ovate-oblong, oblique or compressed, 7 cm. long, 3.5–4.5 cm. in diameter (ex Ducke), glabrous, shining at maturity, yellow or red, the mesocarp strongly odorous and containing a yellow oil.

TYPE COLLECTION: Ducke, Herb. Jard. Bot. Rio 11368, collected near Pará, Brazil (not seen).

ILLUSTRATION: PLATE 3B.

SPECIMENS SEEN: Brazil. Pará: Bélem de Pará, Quinta Carmita, Ducke 17850 (NY); vicinity of Pará, Burchell 9590 (G, NY).

According to Ducke this tree is cultivated for the edible oily mesocarp and the starchy endosperm of the seed. It is also sub-

spontaneous in the estuaries of the Amazon-Tocantino. It is usually found in secondary humid and rich forests. The flowers are white.

PORAQUEIBA GUIANENSIS Aublet, Fl. Guian. **1**: 123, Ic. 47. 1775.

Poraqueiba surinamensis Miers, Ann. Mag. Nat. Hist. II. **9**: 483. 1852, Contrib. Bot. **1**: 72. 1851-61.

Barreria theobromaefolia Willd., Sp. Pl. **1**: 1145. 1798.

Meisteria anonyma Scopoli ex Gmel. Veg. Syst. **1**: 391. 1796.

Trees to 60 feet; the bark ash-gray; petioles 1.2-1.5 cm. long, canaliculate, commonly twisted; lamina oblong, 15-25 cm. long, 6-8 cm. broad, thinly coriaceous, lightly sericeous, becoming glabrate, long attenuate or frequently acuminate, the base acute or rarely obtuse, the midrib sulcate above and prominent below, sparsely crispate pubescent at maturity, the 7-8 pairs of veins prominent below; calyx pilose outside, the obtuse ovate lobes 1 mm. long and 1 mm. broad; petals ovate, becoming lance-ovate, 3.1-3.4 mm. long, 1.1-1.2 mm. broad, fleshy, pilose outside bearing two grooves in the upper half and three below, which are separated by a strigose or pilose transverse ridge; stamens 2.7-2.8 mm. long, the anther-sacs limited to the margins and not confluent; ovary globose, 1.2-1.5 mm. in diameter, the short style 0.2-0.5 mm. long; drupe 2.5 cm. long, 1.3-1.6 cm. in diameter, the outer fleshy layer of the pericarp with oil-bearing cells.

TYPE COLLECTION was made in French Guiana.

ILLUSTRATIONS: Aubl. Hist. Pl. Guiane Franc. **3**: t. 47. 1775; Lamarck, Ill. **1**: t. 134. 1797; Engler, Fl. Bras. **12** (2): t. 10. 1872, Nat. Pflanzenfam. **3** (5): fig. 139, P-T. 1893; Miers, Contrib. Bot. **1**: t. 10, as *P. surinamensis* 1851-61.

SPECIMENS SEEN: Brazil. Belem de Pará, Huber 1288 (US). Dutch Guiana: Batava, Hostman 1209 (FM).

The mature fruit is small, green and not edible. The figure given by Engler shows the fruit to be warty. There is no mention of this in the literature and I have not seen such a condition. The calyx as figured under No. 12 of the same plate is typical of *P. paraensis*, not *P. guianensis*, if it is correctly drawn. The figure labelled *P. sericea* in Nat. Pflanzenfam. **3** (5): fig. 139, P-T should be *P. guianensis*. Miers gives a good plate and accurate diagnosis of this species under the name *P. surinamensis*.

PORAQUEIBA SERICEA Tulasne, Ann. Sc. Nat. III. **11**: 172. 1849; Williams (Woods of Northeastern Peru) Field Mus. Pub. Bot. **15**: 291. 1936.

Poraqueiba acuminata Miers, Ann. Mag. Nat. Hist. III. **4**: 365. 1859, Contrib. Bot. **1**: 229. 1851-61.

Trees 45–65 feet tall, the crown spreading, the trunk straight and 10–20 inches in diameter; bark purplish or dark brown, the terete and frequently striate branches densely sericeous to glabrate; petiole stout, 2–4 cm. long, strongly canaliculate above, rarely twisted, subterete to frequently manifestly four-angled; lamina broadly elliptical-ovate, 17–25 cm. long, 8–15 cm. broad, membranaceous when young, becoming strongly coriaceous, glabrous above, frequently shining when dry, densely sericeous when young, becoming glabrate below, acuminate, the acumen 10–22 mm. long, 2–4 mm. wide, with the apex obtuse, rounded, emarginate or bifid (due to injury), the base rounded, the midrib strongly sulcate above, the veins 7–9 pairs; inflorescence 5–10 cm. long, sericeous; calyx densely sericeous, 2.3 mm. in diameter, 1.7 mm. high, the acute or obtuse ovate lobes 1 mm. long and 1 mm. wide; petals ovate-lanceolate, 3–4 mm. long, 1.8–2 mm. wide, densely sericeous outside, tapering to the inflexed papillate apex, the base rounded, the lateral rims strongly inrolled, the deeply sulcate midrib with its edges cleft to the base at the middle of the petal, the lower portions strongly developed into rounded triangular lobes, the midrib with long white pilose hairs, their inrolled margins with shorter hairs, the furrows glabrous; stamens 2.5–3.2 mm. long, the anthers 1.5 mm. long, the theca small and marginal, the adaxial sacs extended at the base of the anther, the abaxial sacs reduced in length, the filament 1 mm. broad; pistil 2 mm. high, the style stout, the stigma capitate; drupe ovate-oblong, slightly compressed, 6.5–7.6 cm. long, 3.5–4.5 cm. in diameter, the fleshy mesocarp bearing oil cells, shiny, the putamen 3–4 mm. thick.

TYPE COLLECTION: *Poeppig* 2597, from Amazonas, Brazil.

SPECIMENS SEEN: *Brazil*. Amazonas: *Poeppig* 2597 (FM, isotype); *Manaos*, *Ducke* 25 (A, FM, NY, US), 109 (FM); Municipality of Humayta, Basin Rio Madiera on plateau between Rio Livramento and Rio Ipixuna, fruit yellow, *Krukoff* 7064 (A, FM, NY, US), fruit black, *Krukoff* 7281 (A, FM, NY, US); Municipality São Paulo de Olivença, near Palmeres planted by Indians, *Krukoff* 8569 (A, FM, NY); Rio Negro, *Riedel* 1462 (NY); Panure near Rio Uaupes, *Spruce* 1748 (FM, G). Peru. Loreto; Iquitos, *Killip & Smith* 29837 (FM, NY, US); Iquitos, *Williams* 8078 (FM), 8080 (FM, US); Caballo cocha on the Amazon, *Williams* 2099 (A, FM, G, NY, US).

The color of the fruit is apparently variable in this species. It is commonly reported as black but also is said to be brown or yellow. *Krukoff* indicates on his collection-labels that some trees bear yellow fruits and others black. Careful examina-

tion of these collections has failed to reveal any characters to allow specific segregation. Huber early recognized this discrepancy and left its solution to later workers. It seems advisable to consider all the color-variations of these fruits as being within one species.

Williams reports this to be a common tree in dry loamy soils among shrubs and small trees of secondary growth or on margins of forests.

The figure given by Engler (Nat. Pflanzenfam. **3** (5): fig. 139, P-T), cited as *P. sericea*, is actually of *P. guianensis*.

SPECIES TO BE EXCLUDED

Poraqueiba cubensis Wright ex Griseb. Cat. Pl. Cub. 119. 1866, equals *Ottoschulzia cubensis* (Wr. ex Griseb.) Urban.

Poraqueiba rhodoxylon Urb. Sym. Antill. **5**: 405. 1908, equals *Ottoschulzia rhodoxylon* (Urb.) Urb.

LERETIA Vellozo

This genus was considered in a separate paper published in the Journal of the Arnold Arboretum **23**: 55-78. 1942.

HUMIRIANTHERA Huber

Humirianthera was also treated as part of the "Mappia Complex" in the Journal of the Arnold Arboretum **23**: 55-78. 1942.

CASIMIRELLA Hassler

The genus *Casimirella* (Fedde Repert Nov. Sp. **12**: 249. 1913) has escaped notice as a member of the "*Mappia* Complex." It is probably identical with *Humirianthera* Huber and will replace the latter name since it antedates Huber's name by one year. Besides a break in geographic distribution there are several technical points which remain vague, in spite of a fairly good generic diagnosis. For this reason I do not make the transfer at this time but will wait, and hope sometime to examine the type material.

The type species, *Casimirella guaranitica*, is found in Paraguay, while those known of *Humirianthera* are found in the Brazilian Amazon. The rhizome of *C. guaranitica* is smaller than that of the species of *Humirianthera*, being only 4-5 cm.

in diameter. It bears several short shoots, which are probably first-year shoots and will probably become vine-like in habit in subsequent growth. The plant is described as being densely pubescent, with the hairs presumably simple, not in stellate clusters. The fruit, described by Hassler, was immature, yet the thick pericarp and the tomentose inner surface of the putamen were recognized. The genus is probably similar to *Leretia* as well as to *Humirianthera*.

EXPLANATION OF THE PLATES

PLATE 1A. FIGS. 1-13 *CALATOLA LAEVIGATA* Standley. FIG. 14 *CALATOLA* SP. FIG. 1, habit of the staminate plant of *C. LAEVIGATA* (Reko 3440, US 989705 TYPE) $\times \frac{1}{3}$; FIG. 2, habit of the pistillate plant of *C. LAEVIGATA* (Reko 3728); FIG. 3, pistillate flower showing the papillate stigmatic disk and the calyx-articulation, $\times 6$; FIG. 4, diagrammatic section of a pistil, showing the eccentric locule; FIG. 5, drupe, with a portion of the sarcocarp removed (*Schipp* 446), $\times \frac{1}{3}$; FIG. 6, longitudinal section of the seed, showing the minute embryo, $\times \frac{1}{3}$; FIG. 7, petal from a female flower, $\times 8$; FIGS. 8-9, lateral and adaxial views of a stamen, $\times 7$; FIG. 10, bud from a staminate spike, showing the position of bract and floral-articulation, $\times 12$; FIG. 11, basal view of the expanded calyx, $\times 6$; FIG. 12, adaxial surface of a single petal, $\times 7$; FIG. 13, top-view of a staminate flower, $\times 14$; FIG. 14, fruit of *CALATOLA* SP., $\times \frac{1}{3}$.

PLATE 1B. FIGS. 1-11 *DISCOPHORA MONTANA*, sp. nov. (Lawrence 522, TYPE). FIGS. 12 and 13 *DISCOPHORA PANAMENSIS* Standley (Cooper 613). FIG. 1, habit of *D. MONTANA*, $\times \frac{1}{3}$; FIG. 2, bud of staminate flower, showing the floral articulation; FIGS. 3-5, fertile stamens in lateral, abaxial and adaxial views, $\times 11$; FIG. 6, lateral view of the mature fruit, $\times 2$; FIG. 7, view of concave surface of the drupe, $\times 2$; FIG. 8, diagrammatic cross-section of the fruit, *a.* fleshy pad on the concave surface, *b.* uncolored exocarp, *c.* vascular trace, *d.* uncolored mesocarp, *e.* locule, *f.* seed, showing the bipartite albumen, *g.* endocarp or putamen, *h.* partly pigmented region of the exocarp; FIG. 9, diagrammatic longitudinal section of a staminate flower, showing the pubescent incurved apex of the petals, the pubescent abaxial swelling of the filament, the fleshy undifferentiated pulvinus, the sterile pistillate rudiment and the articulation of the calyx to the pedicel; FIGS. 10-11, types of disks and pistillate rudiments commonly found in the male flowers; FIG. 12, hippocrepiform disk and the eccentric rudiment of the pistil found in *D. PANAMENSIS*, $\times 7$; FIG. 13, habit of *D. PANAMENSIS*, $\times \frac{1}{6}$.

PLATE 2A. OTTOSCHULZIA CUBENSIS (Wright) Urban (Wright 2639, isotype). FIG. 1, habit, $\times \frac{1}{3}$; FIG. 2, bud, $\times 6$; FIG. 3, pistil, $\times 14$; FIGS. 4-6, lateral, adaxial and abaxial views of a petal, $\times 9$; FIG. 7, fruit, $\times \frac{1}{3}$; FIG. 8, diagrammatic cross-section of the ovary; FIG. 9, diagrammatic parasagittal section of the ovary; FIGS. 10-12, lateral, adaxial and abaxial views of a stamen, $\times 10$.

PLATE 2B. *PLEURISANTHES FLAVA* Sandwith (*Sandwith* 590). FIG. 1, habit, $\times \frac{1}{3}$; FIG. 2, flattened branch, $\times \frac{1}{3}$; FIG. 3, calyx, $\times 3$; FIGS. 4-6, lateral, adaxial and abaxial views of a petal, $\times 8$; FIG. 7, parasagittal section of the pistil; FIG. 8, pistil, $\times 8$; FIGS. 9-11, lateral, adaxial and abaxial views of a stamen, $\times 9$. (Drucke) Howard (*Krukoff* 6954).

PLATE 3A. *PLEURISANTHES PARVIFLORA* (Ducke) Howard (*Krukoff* 6954).
FIG. 1, habit, $\times \frac{1}{3}$; FIG. 2, adaxial view of a stamen, $\times 12$; FIG. 3, abaxial
view of a petal, $\times 9$; FIG. 4, diagrammatic parasagittal section of the ovary;
FIG. 5, pistil, $\times 15$.

PLATE 3B. *PORAQUEIBA PARAENSIS* Ducke (*Burchell* 9590). FIG. 1, habit, $\times \frac{1}{3}$; FIG. 2, bud, $\times 8$; FIG. 3, adaxial surface of a petal, $\times 9$; FIG. 4, pistil, $\times 10$; FIG. 5, diagrammatic section of the pistil; FIG. 6, dorsal view of the three bracts subtending the flowers, showing the point of articulation, $\times 6$; FIGS. 7-9, lateral, abaxial and adaxial views of the stamens, $\times 10$.

II. STUDIES OF THE ICACINACEAE V.

A REVISION OF THE GENUS CITRONELLA D. DON

(Plates 4-6)

RICHARD A. HOWARD

Ruiz and Pavon presented two very different concepts in their successive treatments of the genus *Villaresia*. The plant they described in the *Prodromus Flora Peru and Chile* (1793) is a member of the *Celastraceae*. That described in the third volume of the same work (1803) is the *Ikacinaceous* genus considered here. This discrepancy was mentioned by Jussieu in 1825 and by Don in 1832, yet all subsequent workers have persisted in accepting for the genus of the *Ikacinaceae* their second and invalid epithet *Villaresia*. Since *Villaresia* was a later homonym Don substituted the name *Citronella* for the second genus which Ruiz and Pavon had described.

In 1850 Blume described a plant from Java under the name *Pleuropetalon*. Asa Gray described a second species in 1854 and mentioned the affinities of this genus with *Villaresia*. However, *Pleuropetalon* is also an invalid name, being antedated by *Pleuropetalum* Hook f. of the *Portulacaceae*, established in 1845, and for this reason Miquel (1855) substituted *Chariessa* as the generic name. Benthams and Mueller combined *Villaresia* and *Chariessa* and this treatment has been followed by Valetton, Merrill, Domin, and Howard. Beccari, Engler, and Sleumer maintain them as distinct genera.

Macbride proposed the genus *Briquetina* in 1926 and compared it with several New World genera but not with *Villaresia*. I cannot distinguish between *Briquetina* and *Villaresia* and have combined them. Likewise, it is not possible satisfactorily to distinguish between *Villaresia* and Baillon's genus *Sarcanthidion*, which was apparently separated because of its climbing habit.

BV 0034091
names, types, syn
dist. of
Mesoamerican
sp.



Howard, Richard A. 1942. "Studies of the Icacinaceae IV. Considerations of the New World genera." *Contributions from the Gray Herbarium of Harvard University* (142), 3–60. <https://doi.org/10.5962/p.336265>.

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