

**Flora of Panama. Part IV. Fascicle II**



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# FLORA OF PANAMA

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## Part IV. Fascicle 2\*

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### CHLORANTHACEAE

BY LORIN I. NEVLING, JR.

#### 1. HEDYOSMUM Sw.

HEDYOSMUM Sw. Prod. Fl. Ind. Occ. 84. 1788.

*Tafalla* Ruiz & Pav. Prod. 136. t. 29. 1794.

Dioecious or monoecious aromatic shrubs or small trees. Leaves opposite, generally elliptic to lanceolate, pinnately veined, margin serrate, the petioles connate into a pronounced petiolar sheath enclosing first the apical bud and later the stem, stipules setose to fimbriate. One or two superposed axillary buds may develop from each leaf axil, these buds sometimes becoming exerted from the petiolar sheath by elongation in the nodal region. When the inflorescence is monoecious the terminal bud and the first pair of subtending axillary branches often bear pistillate flowers, while the second and subsequent pairs bear staminate flowers. Staminate catkin of 1 to several cylindrical spikes which greatly elongate at anthesis; flowers naked, ebracteate, sessile or subsessile, each composed of a single bilocular stamen, the connective variously produced, the anthers longitudinally dehiscent. Pistillate inflorescence racemiform, paniculiform or spiciform; flowers monochlamydeous, bracteate, perianth fused into a tri-lobed urceolate cup persistent in fruit; ovary unilocular, uniovulate; style short, deciduous; fruit a small three-angled drupe.

Approximately 50 species. Mexico southward to Peru, Bolivia and Brazil; the Antilles; Asia.

- a. Plants monoecious; pistillate flowers borne singly, the bracts free;  
leaves narrowly lanceolate to elliptic..... 1. *H. BRENESII*  
aa. Plants dioecious; pistillate flowers borne singly or in groups of two or  
more, the bracts connate; leaves elliptic to broadly lanceolate..... 2. *H. CALLOSO-SERRATUM*

#### 1. HEDYOSMUM BRENESII Standl. in Field Mus. Publ. Bot. 18:371. 1937.

Monoecious shrubs 1–2 m. tall, the branchlets terete, smooth to rugose. Leaves narrowly lanceolate to narrowly elliptic, 5–16 cm. long, 1–3 cm. broad, attenuate

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at the apex, cuneate-attenuate to rounded at the base, glabrous to minutely scabrous above and below, margin coarsely serrate except at the smooth base, the primary lateral veins obscure, the petiolar sheath 5–10 mm. long, the petiole 1–6 mm. long; stipules fimbriate or erose. Staminate catkin spiciform, about 5 mm. long, elongating slightly at anthesis, the primary peduncle generally unbranched; staminate flowers with the anthers about 1 mm. long, sessile, the connective apiculate, produced beyond the anthers 0.25 (–0.5) mm. Pistillate inflorescence often falsely dichotomous and then cincinnoid, the primary peduncle often white-spotted; pistillate flowers borne singly, sessile, the perianth urceolate, about 1.5–2.5 mm. long, 1.0–1.5 mm. in diameter, white; the stigma shortly exerted, the bracts free, ovate, to 2.5 mm. long, 1.5 mm. broad; fruit ovoid, 3.0–4.5 mm. long, 2.5–3.5 mm. in diameter, white.

Known only from Costa Rica and Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, Fish Creek Hills, *von Wedel 2362*.

Woodson and Schery have indicated previously (in *Ann. Mo. Bot. Gard.* 29:350. 1942) that this species might be synonymous with *Hedyosmum nutans* Sw. of the Greater Antilles. *Hedyosmum brenesii* differs from *H. nutans* primarily in inflorescence structure and in fruit size and color. In distinguishing between these two species I am indebted to C. E. Wood, Jr., for the use of his unpublished manuscript.

2. HEDYOSMUM CALLOSO-SERRATUM Oerst. in *Vidensk. Meddel. Kjoeb.* 1856:40. 1857.

*Hedyosmum scaberrimum* Standl. in *Field Mus. Nat. Hist.* 4:200–201. 1929.

Dioecious trees to 10 m. tall, the young branchlets generally rugose and somewhat scabrous. Leaves elliptic to broadly lanceolate, 9–18 cm. long, 3–7 cm. broad, narrowly acute to abruptly acuminate at the apex, broadly cuneate to cuneate-attenuate at the base, scabrous above and below, margin serrate but sometimes entire towards the base, the costa and primary lateral veins sometimes with small irregular enations, the petiolar sheath smooth or serrulate-winged, 1.25–2.5 cm. long, the petiole 0.5–2.5 cm. long; stipules setose or fimbriate. Staminate shoot apex and several subtending nodes usually flowering at one time, the inflorescence compound, composed of a terminal spike and generally several lateral spikes, each floriferous peduncle subtended by a lanceolate to elliptic bract, the spikes 3–5 cm. long at anthesis; staminate flowers with the anther 2.0–2.5 mm. long, sessile, the connective apiculate, produced beyond the anther about 0.25 mm. Pistillate inflorescence paniculiform; pistillate flowers borne singly or in groups of 2–5, the perianth urceolate, 2.5–3.0 mm. long, 1.5–1.75 mm. in diameter, white, pedunculate, the stigma and style clavate, about 1 mm. long, exerted, deciduous, the bracts connate, callose at the apex.

Nicaragua, Costa Rica and Panama.

BOCAS DEL TORO: region of Almirante, Buena Vista Camp on Chiriquí Trail, *Cooper 595*; vicinity of Chiriquí Lagoon, Bastimentos "short cut", *von Wedel 2901*; vicinity of Chiriquí Lagoon, Old Bank Island, *von Wedel 1943*. CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, *P. White 28*. COCLÉ: hills north of El Valle, *Allen 2284, 2418*.

Whether *Hedyosmum scaberrimum* and *H. calloso-serratum* should be treated as separate species or a single species is difficult to determine. In Panama it almost appears as though two distinct species are present. The specimens generally can be separated on the basis of whether or not the fruiting branches are enclosed at the base by the petiolar sheath; the relative length of the petiolar sheath in respect to lamina length; presence or absence of serrulate-winging of the petiolar sheath; setose *vs.* fimbriate stipules. However, examination of specimens from Costa Rica and Nicaragua indicates that these characters or combinations thereof intergrade so thoroughly that separation is no longer possible. For this reason I prefer to treat the group as a single species.



Fig. 24. *Hedyosmum brenesii*



## LACISTEMACEAE

BY LORIN I. NEVLING, JR.

Shrubs or trees. Leaves alternate, distichous, simple, pinnately veined, petiolate; stipules caducous. Inflorescences generally fasciculate, axillary, spicate, racemiform or paniculiform; bracteate. Flowers bisexual or unisexual, when unisexual the plants polygamo-andromonoecious, small, 2-bracteolate; naked or monochlamydeous with 6 or fewer perianth segments connate at the base or free, equal or unequal; annular hypogynous disc present; stamen 1, inflexed, longitudinally dehiscent; ovary superior, 3-carpellate, 1-locular, the placentation parietal, the ovules 3-6, anatropous, pendulous, the stigma trifid; fruit a capsule dehiscent by 3 valves; seeds 1-3, testa sometimes fleshy.

Two genera, both represented in Panama.

- a. Inflorescences many-fascicled, spiciform or racemiform; plants bisexual; bracteoles free; pedicel at most  $\frac{1}{4}$  as long as the flower; perianth lobes present or absent, free, often erose, often unequal; anther connective bifurcate distally..... 1. LACISTEMA
- aa. Inflorescences solitary to few-fascicled, racemiform or paniculiform; plants bisexual (in Panama) or polygamo-andromonoecious; bracteoles connate; pedicel at least as long as the flower; perianth lobes present, connate at the base, not erose, equal; anther connective not bifurcate distally..... 2. LOZANIA

## 1. LACISTEMA Sw.

LACISTEMA Sw. Prod. Veg. Ind. Occ. 12. 1788.

*Nematospermum* A. Rich. in Act. Soc. Hist. Nat. Par. 1:105. 1792.  
*Synzyganthera* Ruiz & Pav. Prod. Fl. Per. & Chil. 137, t. 30. 1794.  
*Didymandra* Willd. Sp. Pl. 4:971. 1805.

Shrubs or small trees, the young branches glabrous or rarely pubescent. Leaves membranaceous to coriaceous, margin sometimes distantly serrate; stipule scars sometimes almost encircling the young stem. Inflorescences spicate or rarely racemiform, as many as 35 spikes per axil, generally equal to or exceeding the petiole of the subtending leaf. Flowers bisexual; bracteoles free; perianth present or absent, free, often erose, often unequal, white or cream; anther connective bifurcate distally. Fruit a red globose or subglobose capsule, sessile or on a short gynophore; seeds white.

About 35 species in tropical America. Only 1 species represented in Panama.

1. LACISTEMA AGGREGATUM (Berg) Rusby, in Bull. N. Y. Bot. Gard. 4:447 1907.

*Piper aggregatum* Berg, in Act. Helv. 7:131, t. 10. 1772.  
*Lacistema myricoides* Sw. Prod. Veg. Ind. Occ. 12. 1788.  
*Piper fasciculare* Rudge, Pl. Guian. t. 4. 1805.  
*Lacistema oblongum* Spreng. Syst. 1:124. 1825.  
*Lacistema elongatum* Schnizl. in Mart. Fl. Bras. 4<sup>1</sup>:282. 1857.  
*Lacistema myricoides* var.  $\beta$  *stipitatum* DC. in DC. Prod. 16<sup>2</sup>:592. 1868.



Fig. 25. *Lacistema aggregatum*

Shrubs or trees to 18 m., the young branches glabrous or strigose. Leaves lanceolate to obovate-lanceolate, 7–17 cm. long, 2.0–7.5 cm. wide, apex attenuate, cuneate to rounded at the base, membranaceous to subcoriaceous, generally glabrous above, glabrous or sparsely strigose below, the margin entire to distantly and broadly serrate; petiole 5–7 mm. long; stipules 5–9 mm. long. Inflorescence of cylindrical spikes, 4–12 per axil; bracts broader than long, one subtending each flower. Flowers sessile, monochlamydeous; bracteoles at most 1 mm. long; perianth segments 4, about 0.5 mm. long, erose, unequal; disc about 0.75 mm. long, fleshy; stamen almost 1 mm. long, glabrous; stigma exserted; fruit 6–8 mm. long, about 6 mm. in diameter, often on a gynophore to 3 mm. long.

Mexico to Peru, Bolivia, Brazil; Antilles and the West Indies.

BOCAS DEL TORO: Old Bank Island, *von Wedel 1964*. CANAL ZONE: woods along Pavon Road, *Johnston 1777*; Gatún, *Hayes s. n.*; swamp south of mouth of Río Chagres, *Johnston 1697*; Chagres, *Fendler 282*, *Grisebach s. n.* COCLÉ: hills south of El Valle de Antón, alt. about 700 m., *Allen 2476*. PANAMÁ: Cerro Campana, trail from Campana to Chica, alt 600–800 m., *Allen 2646*.

## 2. LOZANIA Mutis

LOZANIA Mutis, in *Contin. Seman. Nouv. Reino de Granada*, 3:20. 1810.

*Monandrodendron* Mansf. in *Notizbl.* 10:861. 1929.

Shrubs or trees, the young branches pubescent or rarely glabrous. Leaves generally pubescent below, membranaceous to subcoriaceous, the margin entire or serrate; stipule scars at most half encircling the young stem. Inflorescences racemiform or paniculiform, solitary or as many as 5 per axil, always much longer than the petiole of the subtending leaf. Flowers bisexual or unisexual, bracteoles connate, the perianth monochlamydeous, connate at the base, equal, white to yellow-green. Fruit a small globose capsule, sessile.

Six species, Central and South America.

- a. Racemes solitary; leaves broadly obovate-elliptic; bracts densely pubescent; staminal filament much longer than broad..... 1. L. PEDICELLATA  
 aa. Racemes solitary or 2-3; leaves elliptic to oblong-elliptic; bracts glabrous; staminal filament as long as broad..... 2. L. MONTANA

1. LOZANIA PEDICELLATA (Standl.) L. B. Smith, in *Phytologia* 1:138. 1927.

*Lacistema pedicellatum* Standl. in *Journ. Wash. Acad. Sci.* 17:8. 1927.

Shrubs or trees to 7.5 m. tall, the young branches strigose. Leaves broadly obovate-elliptic, 8-12 cm. long, 2.5-4.5 cm. broad, obtusely or acutely acuminate, broadly cuneate, membranaceous, glabrous above, the costa, lateral veins and vein axils strigose below, the margin minutely serrate; petiole 3-8 mm. long; stipules 1.5-2.0 mm. long. Inflorescence racemiform, solitary, to 9 cm. long; bracts densely pubescent, about 0.75 mm. long, 0.5 mm. broad. Flowers bisexual; bracteoles about 0.5 mm. long; pedicel 0.75-2.0 mm. long, the perianth lobes broadly rounded, about 0.5 mm. long; disc fleshy; stamen about 0.5 mm. long, exserted, the filament much longer than broad, the anther cells small; ovary globose, about 0.5 mm. long, pubescent, the stigma subsessile; fruit about 4 mm. in diameter, sparsely puberulent, seeds 3.

Panama.

BOCAS DEL TORO: region of Almirante, *Cooper 568*; Old Bank Island, vicinity of Chiriquí Lagoon, *von Wedel 2121*. CANAL ZONE: Barro Colorado Island, *Gross Pt., Aviles 972*. COLÓN: along the Río Culebra, above Santa Isabel, near sea level, *Pittier 4152*.

2. LOZANIA MONTANA Standl. in *Field Mus. Pub. Bot.* 18:722. 1937.

Trees to 40 m. tall, the young branches sparsely strigose. Leaves elliptic to oblong-elliptic, 6-12 cm. long, 1.5-3.5 cm. broad, apex obtusely attenuate-acuminate, base broadly cuneate, subcoriaceous, glabrous above, the costa, lateral veins and vein axils sparsely strigose below, the margin serrate; petiole 9-12 mm. long; stipules about 2 mm. long. Inflorescences racemiform, rarely solitary generally 2 or 3, to 6 cm. long; bracts glabrous, 0.75-1.25 mm. long, 0.5-1.0 mm. broad. Flowers bisexual; bracteoles about 1 mm. long; pedicel 1.5-3.0 mm. long, the perianth lobes broadly rounded, to 1.25 mm. long; disc fleshy; stamen about 0.5 mm. long, exserted, the filament as long as broad, the anther cells small; ovary

globose, about 0.5 mm. long, pubescent, the stigma subsessile; fruit about 3.5 mm. long, 3 mm. in diameter, glabrous or sparsely puberulent.

Costa Rica and Panama.

CHIRIQUÍ: Bajo Mono-Robalo Trail, alt. 5000-7000 ft., western slope of Cerro Horqueta, *Allen 4842*.

## SALICACEAE

Salicaceae, including the poplars (*Populus*) and willows (*Salix*), have not yet been encountered in Panama. *Salix chilensis*, however, is an occasional escape from cultivation in Costa Rica and is to be expected in Chiriquí.



Fig. 26. *Lozania pedicellata*

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## MYRICACEAE

BY LORIN I. NEVLING, JR.

## 1. MYRICA L.

MYRICA L. Sp. Pl. 1024. 1753.

*Gale* Tourn. ex Adans. Fam. 2:345. 1763.*Nageia* Gaertn. Fruct. 1:191. 1788.*Morella* Lour. Fl. Cochinch. 548. 1790.*Cerophora* Raf. Alsog. Am. 11. 1838.*Fayana* Raf. loc. cit. 12. 1838.*Pimecaria* Raf. loc. cit. 64. 1838.*Faya* Webb & Berth. Hist. Nat. Canar. Bot. 2<sup>3</sup>:272, t. 216. 1850.

Monoecious or dioecious shrubs or small trees. Leaves simple, alternate, often glandular below, generally fragrant; estipulate. Inflorescence spicate, axillary. Flowers small, achlamydeous, bracteate, sometimes also bracteolate. Staminate flowers with 2–30 stamens, the filaments free or connate, the anthers longitudinally dehiscent. Pistillate flowers 2-carpellate, the ovary 1-locular, the ovule 1, orthotropous, the stigmas 2, filiform. Fruit a small drupe with a wax-secreting exocarp, often warty; embryo straight, surrounded by a 1-layered oily endosperm, the cotyledons thick, plano-convex.

Only one species represented in Panama.

1. MYRICA MEXICANA Humb. & Bonpl. ex Willd. Enum. Hort. Berol. 2:1011. 1809.

*Myrica xalapensis* Kunth, in HBK Nov. Gen. 2:16. 1817.

Dioecious trees to 8 m. tall, the branches punctate-glandular, hirsute. Leaves oblanceolate, 3.5–12.0 cm. long, 1–3 cm. wide, generally smaller in pistillate plants than in staminate plants, apex acute, attenuate at the base, subcoriaceous, both surfaces glandular-punctate, margin entire to distantly dentate, aromatic; petioles 1–3 mm. long. Flowers subtended by a pair of linear bracteoles and an ovate bract, the bracteoles about 0.75 mm. long, deciduous, the bract about 1.0–1.5 mm. long, 0.75 mm. broad, glandular-punctate on abaxial surface only, margin minutely ciliate at least towards the apex. Staminate flowers (described from Mexican specimens) with 4 (–5) stamens, the filaments about 1.5 mm. long, basally connate. Pistillate flowers with globose ovary about 0.5 mm. tall, 0.5 mm. in diameter, glandular-punctate, strigose apically, the stigmas about 2 mm. long; fruit ovoid, to 4 mm. long, 3 mm. in diameter, warty.

Mexico to Panama. In Panama found along margins of residual patches of forest in dry windswept grasslands.

PANAMÁ: Cerro Campana, *Allen 2084*; Cerro Campana, trail from Campana to Chica, alt. 600–800 m., *Allen 2654*.



Fig. 27. *Myrica mexicana*

## JUGLANDACEAE

BY WAYNE E. MANNING

Trees or rarely shrubs; buds naked or scaly, often several superposed; leaves usually deciduous, alternate, rarely opposite or whorled, estipulate, pinnately compound; leaflets entire or serrate, glandular-dotted beneath; flowers monoecious or rarely dioecious, staminate or pistillate flowers or both in elongate drooping or erect catkins or spikes; staminate and pistillate inflorescences sometimes separate, sometimes combined into an androgynous panicle with central spike wholly or partly pistillate and the lateral branches staminate; separate staminate inflorescence a cluster of 3–8 catkins or a solitary catkin; separate pistillate inflorescence a catkin, a few-flowered spike, or a solitary flower; inflorescences terminal, or lateral on old wood, or the staminate sometimes lateral at the base of the new growth; staminate calyx commonly 4-lobed, or lacking, the subtending entire or 3-lobed bract and 2 bracteoles usually appearing as part of the perianth; petals none; stamens 3–many; pistillate calyx usually 4-lobed, or absent, the subtending 3-lobed or entire bract and 2 or 3 bracteoles fused only with the pedicel and base of the ovary or with the whole ovary, a ring of minute inner bracteoles very rarely present; ovary inferior, 1-celled above, 2- to 4- to 8-celled below, with one erect orthotropous ovule in the center at the top of the primary partial partition; style one, with usually 2 stigmatic branches; fruit a nut enclosed in a husk, or a nut with a thin dry skin, or a nutlet with 2 or 3 wings; seed solitary, large 2–4–8-lobed, without endosperm; cotyledons 4-lobed, oily, at germination remaining in the nut or appearing above ground.

## 1. ALFAROA Standl.

ALFAROA Standley in Journ. Wash. Acad. Sci. 17:78. 1927; Manning, in Bull. Torr. Bot. Club, 76:196–209. 1949; Standley, in Flora of Costa Rica, Field Mus. Publ. Bot. 18:372–374. 1937. Manning, in Standley and Steyermark, Flora of Guatemala, in Fieldiana: Botany, 24: Part III, 353–354. 1952.

Trees or large shrubs; leaves opposite or whorled, pinnately compound, without a terminal leaflet, the leaflets several to many, alternate or frequently opposite, serrate or entire, lepidote beneath at least on the youngest leaves; pith of branchlets solid; flowers monoecious or partially dioecious, the inflorescence terminal, consisting usually of an androgynous open or spike-like panicle, the main portion pistillate, with 30–50 flowers, bearing near the base usually 2–4 lateral short or elongate branches, these staminate, the staminate catkins sometimes forming a separate terminal panicle on different branches or on different trees; bracts of the staminate flowers minute, 3-lobed, beneath the calyx, the 2 bracteoles and 2–4 variable sepals together appearing as an irregular 4–6 lobed calyx, the lobes oblong, obtuse; stamens 6–12, inserted in a single series around a naked center or rarely around a rudimentary ovary, the filaments almost obsolete; anthers 2-celled, glabrous,

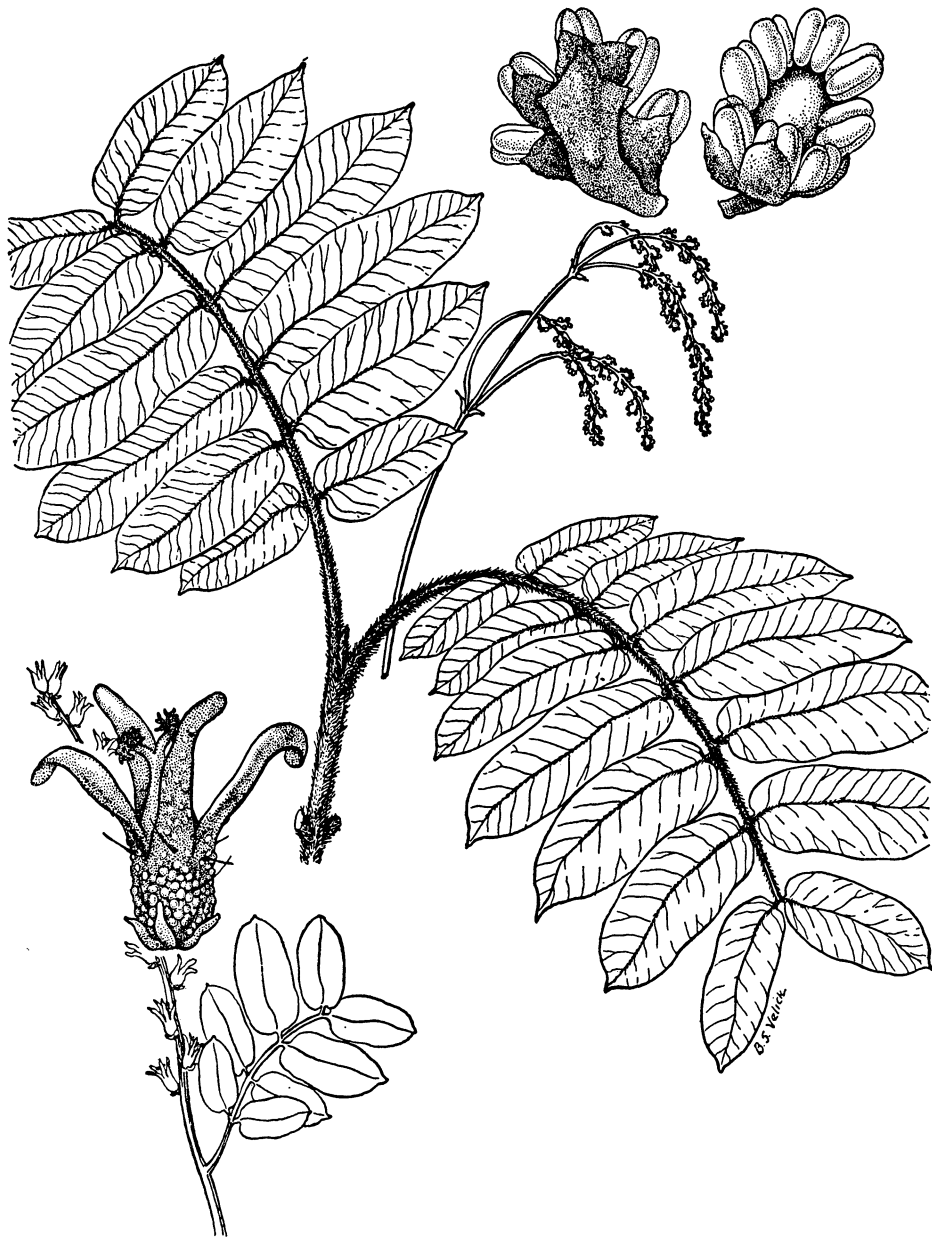


Fig. 28. *Alfaroa costaricensis*



dehiscent by longitudinal slits; pistillate flowers sessile, subtended by a minute 3-lobed bract shorter than the ovary; perianth deeply 4-lobed, the lobes oblong-linear, unequal, obtuse, erect, persistent upon the apex of the fruit; style shorter than the perianth lobes, bifurcate, the stigmas subglobose; fruit oval or obovoid, small, 2-3 cm. long, the skin ("pericarp" or "exocarp") almost dry, thin, indehiscent, adhering closely to the nut proper ("endocarp"); nut thin-walled, loculicidally dehiscent at time of germination of the seed, falsely 8-celled in the lower half, 4-celled above the middle, 1-celled at the very apex, the partitions nearly complete, with lamellae projecting from them into the loculus; seed 8-lobed to the base, each cotyledon 4-lobed.

1. ALFAROA COSTARICENSIS Standl. in Jour. Wash. Acad. Sci. 17:78. 1927.

A large shrub or a tree, the bark almost smooth, pale brownish; branchlets and leaf rachises usually densely hirsute with long stiff spreading hairs, sometimes merely hirtellous or in age glabrate; leaves almost all opposite, those of a pair often unequal, or one of the leaves sometimes suppressed; petiole 1-2 (-3) cm. long; leaflets mostly 10-20, highly variable, often almost all opposite, oblong to narrowly lance-oblong, mostly 10-18 cm. long and 1.5-4 cm. wide, the lowest leaflets generally much reduced, acute to long-acuminate or rarely obtuse, sessile or nearly so, obtuse to truncate at the base and usually very oblique, conspicuously appressed-serrate or almost entire, membranaceous or thicker, glabrous or nearly so along the costa, usually glaucous or glaucescent beneath, usually hirtellous or hirsute along the nerves but sometimes glabrate, inconspicuously lepidote; flower spikes stout, 3-5 cm. long, short-pedunculate, the rachis densely hirtellous and glandular; staminate flowers 4 mm. broad, the perianth glandular; pistillate flowers green, 5-6 mm. long; ovary sparsely hirtellous and densely covered with golden glands; stigmas red; fruiting spikes 12-18 cm. long or more, each bearing numerous oval or obovoid fruits, about 2.5 cm. long and 2 cm. thick, densely velutinous-hirsute and covered with sessile glands; nut not ridged, broadly rounded at base and apex, the wall ("endocarp") less than 1 mm. thick.

Mountains of Guatemala, Costa Rica, and Panama.

CHIRIQUÍ: Boquete region, Cerro Horqueta-cloud forest, 6500 ft., *Von Hagen & Von Hagen 2096, 2179*.

These specimens are from young, non-fruiting trees, with the twigs and rachises strongly hairy.

*Alfaroa manningii* Leon, described by Jorge Leon from Costa Rica in *Ceiba* 42:46, 1953, and recently collected in Colombia, undoubtedly occurs in Panama. In this species the leaf has 8-12 leaflets, strongly lepidote beneath, the lower leaflets not much reduced, the petiole is 4-7 cm. long, and the fruit is glabrous, ridged.

*Engelhardtia* and *Juglans* may occur in Panama. The former occurs in Mexico, Guatemala, and Costa Rica. *Juglans* occurs in U. S., Mexico, Honduras, Guatemala, in seven South American countries, and in the West Indies.

## CORYLACEAE

By LORIN I. NEVLING, JR.

Monoecious trees or shrubs. Leaves alternate, simple, serrately margined, petiolate; stipulate. Inflorescences unisexual, compound, composed of spirally arranged, condensed and sometimes reduced cymules, catkin-like, bracteate, the staminate pendent, the pistillate pendent or erect. Staminate inflorescence composed of 3-flowered cymules (reduced in distal portion of catkin); primary bract 1, secondary bracts 0 or 2, tertiary bracts 0, 2, (3 or 4); perianth present or absent, tepaloid; stamens 2–20 per cymule, the filaments short, free or basally connate, generally adnate in part with the tepals, the anthers 2-celled, cells separate or connate, dehiscing longitudinally. Pistillate inflorescence composed of 2- or 3-flowered cymules; primary bract 1, secondary bracts 0 or 2, tertiary bracts 0, 2, or 4; perianth present or absent, generally tepaloid though sometimes reduced to small glands; pistil 1, the ovary 2- or 3-carpellate, inferior or nude, 2- or 3-locular below, 1-locular above, each locule functionally 1-ovulate, the placentation basically axile, the ovules with 1 integument, the styles 2; fruit a small nut or samara, indehiscent, the embryo straight, exendospermous, cotyledons oil-bearing.

Six genera, approximately 100 species. Represented in Panama by a single genus.

## 1. ALNUS Gaertn.

ALNUS Gaertn. Fruct. & Sem. 2:54. 1791.

*Alnaster* Spach, in Ann. Sc. Nat. Ser. II. 15:200. 1841.

*Clethropsis* Spach, loc. cit. 201. 1841.

*Semidopsis* Zumaglini, Fl. Pedem. 1:249. 1849.

*Duschekia* Opiz, Seznam. 38. 1852.

*Alnobetula* Schur, in Verh. Siebenb. Ver. Naturw. 4:68. 1858.

Terminal buds present; stipules caducous. Staminate catkins borne at the end of last year's leaf shoot; cymules 3-flowered (often reduced at distal portion of catkin), subtended by a primary bract, 2 secondary bracts and each lateral flower by a single abaxial bract (rarely an adaxial bract develops); tepals 0–6; stamens 4(–6), adnate to the tepals. Pistillate catkins borne on few-leaved dwarf-shoots or borne in a leaf axil subtending the staminate catkin, often several lateral catkins develop to form a raceme, each cymule composed of 2 lateral flowers, the bracts as in staminate cymules; perianth reduced to small glands which are sometimes adnate to the ovary; the catkin at maturity resembling a small cone; ovary 2- or 3-carpellate. Fruit a nut more or less winged. The presence of polymerous flowers in the same cymule is not unusual. Hermaphroditic flowers are sometimes found toward the base of the catkin (either staminate or pistillate).

Species approximately 20, only 1 in Panama.

1. *ALNUS FERRUGINEA* HBK. Nov. Gen. & Sp. 2:17. 1817.

*Alnus acuminata* var. *ferruginea* (HBK) Regel, in Mém. Soc. Nat. Moscow 8:148. 1861.

*Alnus jorullensis* var.  $\gamma$  *ferruginea* (HBK) O. Ktze. Rev. Gen. 3<sup>2</sup>:295. 1898.

Trees to 25 m. tall, the branches terete, more or less glabrous, the buds sparsely ferruginous-velutinous. Leaves ovate to ovate-lanceolate, 5–17 cm. long, 3–7 cm. broad, acute to acuminate at the apex, obtuse to rounded at the base, margin serrate, peltate glandular above when young, peltate glandular and ferruginous-velutinous below; petiole 0.6–1.7 cm. long, densely velutinous to almost glabrous. Staminate catkin (immature) to 2.5 cm. long, about 4 mm. in diameter, shortly stalked to sessile. Staminate flowers small; tepals 4, more or less oblong, incised, to 1.25 mm. long, 0.5 mm. broad; stamens 4, opposite the tepals, the filaments short, adnate at their bases to the tepals, the anthers oblong, to 1 mm. long, 0.5 mm. broad. Pistillate catkin at maturity an ovoid cone, 1–2 cm. long, 0.7–1.2 cm. in diameter. Pistillate flowers small; pistil less than 0.5 mm. long, the styles 2, spreading; fruit samaroid, obcordate, 2.5–3.5 mm. long, 1.5–2.5 mm. broad.

A common tree in the Chiriquí Volcano region where it forms almost pure stands or sometimes intermixes with oaks. Occupies about 20% of the forest stand in the 8,000–10,000 ft. zone.

The status of this group is not definite. It has been assigned specific rank and also varietal rank in two species. The most practical position is to retain it as a species until further evidence indicates a change of status to be necessary.

CHIRIQUÍ: Finca Lérida to Peña Blanca, alt. 1750–2000 m., Woodson & Schery 317; valley of the upper Río Chiriquí Viejo, White & White 57, P. White 319; Volcán de Chiriquí, Davidson 997; Llano del Volcán, alt. 1500–1600 m., Allen & Fairchild 3468; Bajo Chorro, Boquete District, Davidson 173; summit and SW face of Cerro Copete, alt., 9000 ft., Allen 4895.

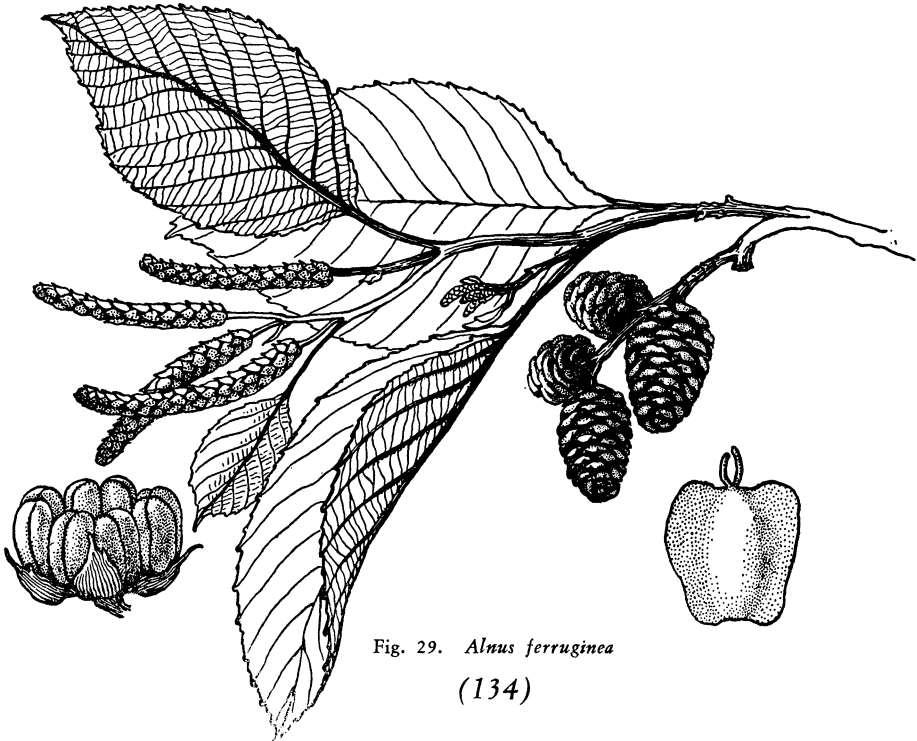


Fig. 29. *Alnus ferruginea*

(134)

## FAGACEAE

By C. H. MULLER

## 1. QUERCUS L.

QUERCUS L. Gen. Pl. ed. 5. 431. 1754.

*Erythrobalanus* Schwarz, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 13:8. 1936.*Macrobalanus* Schwarz, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 13:8. 1936.

Trees or shrubs; leaves alternate, simple, petiolate, blades entire, toothed, or lobed, persistent or deciduous, stipules associated with the buds, ligulate, often caducous; flowers monoecious; staminate flowers in flaccid pendulous aments, the perianth about 5-lobed, stamens 5 to 10, free; pistillate flowers solitary or clustered, sessile or peduncled, enclosed in an involucre of numerous flat scales, the perianth 6-lobed, ovary 3-carpellate, 1-celled, ovules 6 (5 abortive), styles 3, short; fruit a nut (acorn), 1-seeded, partly enveloped by an involucre (cup) of flat or basally thickened scales, maturing in 1 or 2 seasons.

The oaks comprise a more or less temperate zone group and are therefore, with few exceptions, confined in Panama to the high mountains near the Costa Rican boundary, apparently no species occurring below an elevation of 1200 m. In addition to the ten species definitely known to exist in Panama, it is very likely that several of the closely adjacent Costa Rican species may also occur across the boundary in the higher mountains of upper Panama. Future more detailed collections in this area will possibly reveal these as well as a few additional undiscovered endemics.

- a. Bark rather soft gray and scaly, leaves if toothed only mucronately tipped or rounded, never spinose- or aristate-tipped, stigmas abruptly dilated on short styles, fruit annual, cup scales usually prominently thickened basally and loosely appressed apically, acorns with the shell glabrous on the inner surface, abortive ovules basal.....subgenus LEPIDOBALANUS. White oaks.
- b. Twigs of the season persistently and densely fulvous-tomentose.
- c. Leaves obovate to elliptic-oblancoelate, not tapering, the base rather broad, cuneate to cordate, subentire or low-toothed, petioles over 6 (usually over 10) mm. long.
- d. Leaves deeply broad-cordate..... 1. *Q. SEIBERTII*
- dd. Leaves cuneate to truncate at base..... 2. *Q. DAVIDSONIAE*
- cc. Leaves oblanceolate, tapering to a cuneate or narrowly rounded base, coarsely toothed above the middle, petioles 3 to 5 mm. long. 3. *Q. OOCARPA*
- bb. Twigs of the season glabrate or sparingly pubescent or gray-tomentose.
- e. Leaves completely glabrate.
- f. Leaves long-acuminate, entire, fruit very small, cup scales tomentose at base only, the apices glabrous, thin, and loosely appressed..... 5. *Q. PANAMANDINAEA*
- ff. Leaves not acuminate, or if so then coarsely toothed, fruit very large, cup scales pubescent all over..... 4. *Q. CORRUGATA*
- ee. Leaves villous or tomentose beneath or at least the midrib strigose or stellate-tomentose.
- f. Leaves rarely over 6 (8) cm. long, acorns scarcely more than 1 cm. in diameter..... 6. *Q. COPEYENSIS*
- ff. Leaves rarely less than 10 cm. long, acorns 2.5 cm. broad or broader.
- g. Leaves obovate to elliptic-oblancoelate, not markedly tapering, the base rather broad, cuneate to cordate, obscurely low-toothed, petioles 6 to usually 10 or 12 mm. long..... 2. *Q. DAVIDSONIAE*

- gg. Leaves oblanceolate, tapering to the cuneate or narrowly rounded base, coarsely toothed above the middle, petioles 3 to 5 mm. long..... 3. *Q. OOCARPA*
- aa. Bark rather hard, black and furrowed but scarcely scaly, leaves if toothed aristate-tipped, never round-lobed or mucronate, stigmas gradually (or rather abruptly) dilated, on long styles, fruit biennial or annual, cup scales scarcely thickened basally (in Panama) and usually tightly appressed apically, acorns with the shell tomentose on the inner surface, abortive ovules apical or basal.....subgenus *ERYTHROBALANUS*. Black oaks
- h. Cup scales very loosely appressed..... 7. *Q. HUMBOLDTII*
- hh. Cup scales rather closely appressed.
- i. Leaves small, averaging under 8 cm. long, glabrate except for discrete tufts in the axils of the principal veins beneath..... 8. *Q. SEEMANNII*
- ii. Leaves large, averaging over 12 cm. long, distinctly pubescent about the midrib beneath
- j. Petioles very short, 2-6 mm. long, blades very thin..... 9. *Q. GULIELMI-TRELEASEI*
- jj. Petioles elongate, 12-23 mm. long, blades thick and coriaceous...10. *Q. BARUENSIS*

1. *QUERCUS SEIBERTII* C. H. Mull., U.S.D.A. Misc. Pub. 477:19. pls. 6 & 7. 1942.

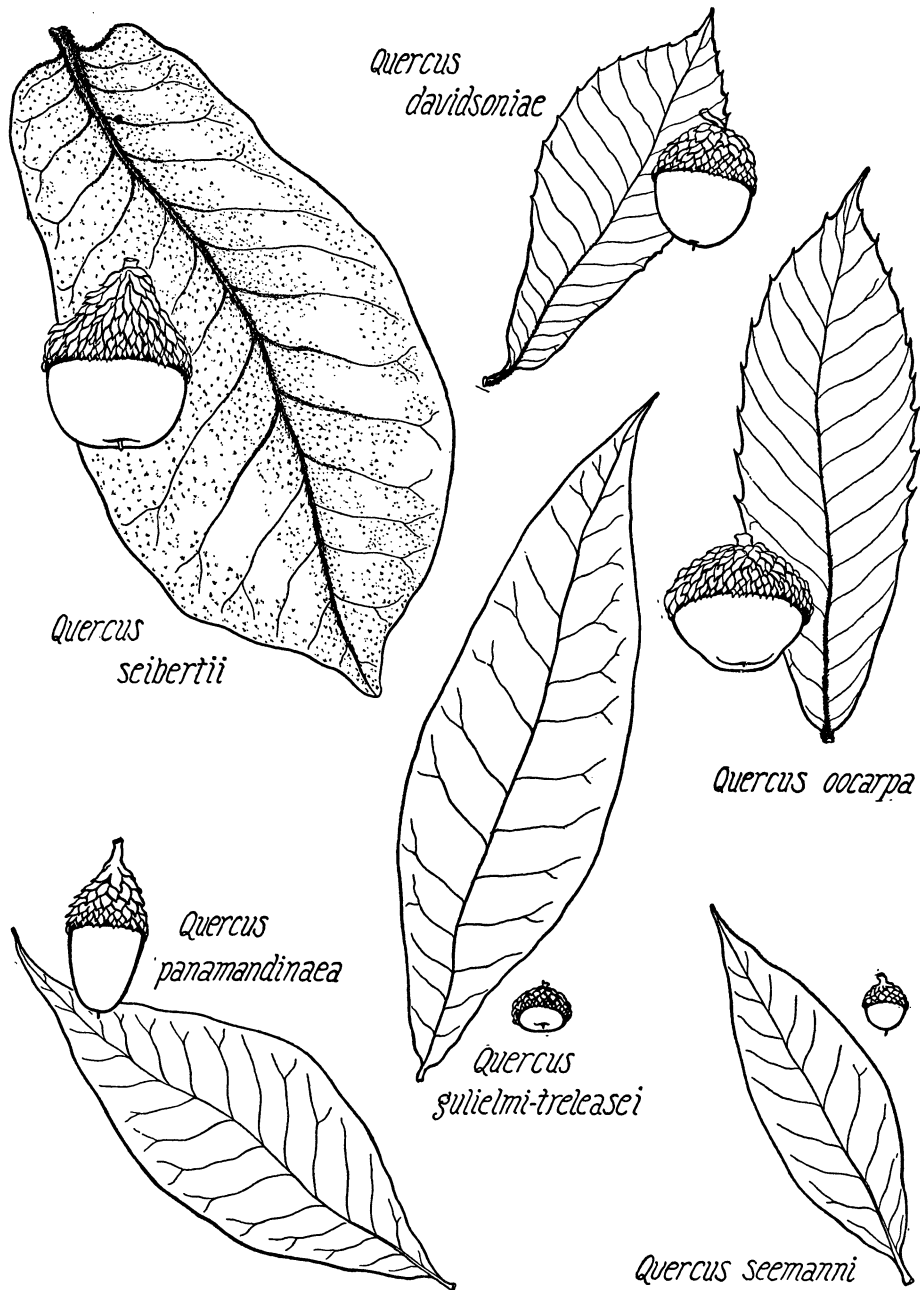
Large tree to 25 m. tall. Twigs very coarse (4 to 7 mm.), markedly fluted, densely fulvous-tomentose, glabrate and gray the second year with conspicuous white lenticels. Buds glabrate, for a time surrounded by ligulate stipulelike scales; the stipules persistent for a time, 10 to 12 mm. long, ligulate, dorsally appressed-pubescent. Leaves deciduous, thin but firm, large (12 to 20 cm. long, 5 to 11 cm. broad), elliptic or broader above the middle, apically acute or broadly rounded, broadly and markedly cordate, entire, margins minutely revolute, upper surface somewhat shining, glabrous or glabrate from sparsely stellate-puberulent, midrib densely and conspicuously fulvous-tomentose, lower surface dull, minutely stellate-puberulent, the veins and midrib villous; veins about 13 to 15 on each side, much branched and obviously anastomosing near the margin, scarcely raised or even impressed above and very prominent (even to the reticulum) beneath; petioles 12 to 18 mm. long, 1.5 to 3 mm. thick, densely fulvous-tomentose. Pistillate catkins 3 to 9 cm. long, 3 to 6 flowers scattered on the pubescent peduncle, all except the basal 1 or 2 flowers aborting. Fruit annual, large; cups 3 to 4 cm. in diameter, openly shallow-goblet-shaped, the scales elongate-oblong, somewhat spreading or loosely appressed, finely pubescent, the lower ones dorsally thickened. Mature acorns unknown.

*Quercus seibertii* is most closely related to *Q. insignis* Mart. & Gal. of Mexico from which its long peduncles and entire cordate leaves with fewer veins amply distinguish it. These characters distinguish it equally well from *Q. davidsoniae*, to which it is less closely related. The species is known only from Panama.

CHIRIQUÍ: Upper valley of Río Chiriquí Viejo, vicinity of Monte Lirio, *Seibert 225* (type), *Allen 1506*.

2. *QUERCUS DAVIDSONIAE* Standl., Field Mus. Bot. Ser. 22:14. 1940.

"Very tall" tree or reaching only 8 m. Twigs moderately coarse (2 to 5 mm. thick), fluted, from sparsely fulvous-tomentose glabrate and gray or brown with evident light lenticels. Buds round, glabrate; stipules caducous, about 10 mm.

Fig. 30. Panamanian species of *Quercus*

long, ligulate, dorsally tomentose. Leaves deciduous (?), thin but firm, 9 to usually 15 cm. long, 4 to 8 cm. broad, oblanceolate-oblong to oblong-elliptic, attenuately acute or merely acute at apex, cuneate or rounded or truncate at base, scarcely cordate, mucronately or rarely crenately toothed especially above, the teeth coincident with the veins, margins minutely revolute, upper surface somewhat shining, from very sparsely puberulent glabrate, lower surface somewhat shining, from puberulent glabrate or the veins pubescent; veins about 13 to 18 on each side, much branched and obviously anastomosing but ultimately passing into the teeth where those are present, scarcely raised above but quite prominent (including the reticulum) beneath; petioles 6 to 12 mm. long, about 1.5 mm. thick, from puberulent or tomentose becoming glabrous. Catkins? Fruit annual, solitary on a peduncle about 1.5 cm. long; cups 3.5 cm. broad, hemispheric, scales deltoid-ovate to oblong, attenuately narrowed but finally obtuse, thickened basally, loosely appressed, densely sericeous-tomentose; acorns (immature) subglobose, about 2.5 cm. long and 3 cm. broad, from buff-sericeous becoming glabrate.

*Quercus davidsoniae* is a polymorphic species, and it is therefore sometimes difficult to distinguish. Its specific relationship is not clear, but its toothed leaves and glabrescent twigs readily distinguish it from similar species. The species occurs also in Costa Rica.

CHIRIQUÍ: Distr. de Boquete, Boquete, *Davidson 864* (type).

3. *QUERCUS OOCARPA* Liebm., Overs. Danske Vidensk. Selsk. Forhandl. 1854:184. 1854.

Small or large tree (6 to 25 m.). Twigs rather coarse (3 to 5 mm.), fluted, from densely fulvous-tomentose becoming glabrate and gray or light brown with a few scarcely evident lenticels. Buds oblong, acute, about 4 mm. long, glabrous, with ligulate villous stipules 10 to 13 mm. long and persistent. Leaves apparently evergreen, thin and papery or rather firm, 10 to 25 or rarely 30 cm. long, 3 to 10 or even 14 cm. broad, oblanceolate to obovate or narrowly elliptic, attenuately acute at apex, narrowly rounded or cuneate at base, undulately or sharply low-dentate except the entire base, margins very minutely somewhat revolute, upper surface somewhat shining, glabrous or usually glabrescent from minutely puberulent, the midrib often persistently fulvous-tomentose, lower surface dull, persistently and sparsely villous especially on the veins and reticulum; veins about 14 to 22 on each side, much branched and obviously anastomosing near the margin but eventually passing into the teeth where those are present, slightly impressed above and very prominent (including the reticulum) beneath; petioles very short (3 to 5 mm. long), densely or sparsely fulvous-tomentose. Catkins? Fruit annual, rather large, solitary or paired on a peduncle 5 to 18 mm. long and 5 to 7 mm. thick; cups 3 to 4 cm. broad, openly goblet-shaped or cup-shaped, the scales triangular-ovate to oblong and narrowly obtuse, densely short-pubescent, loosely appressed; acorns depressed-subglobose or elliptic, 2.5 cm. long and 3 cm. broad or (in Panama material) 4 cm. long and 2.5 cm. broad, one-half or only one-fourth included.

*Quercus oocarpha* is not closely related to any other species in Panama. It is characterized by its large fruit and by its oblanceolate, toothed, attenuately acute leaves with markedly short and inconspicuous petioles. The species ranges north to Mexico.

CHIRIQUÍ: valley of upper Río Chiriquí Viejo, vicinity of Monte Lirio, *Seibert* 317; Distr. de Boquete, Bajo Mono, *Davidson* 497; Boquete to Finca Lérica, *Allen* 303; Finca Lérica to Peña Blanca, *Woodson* and *Schery* 286.

4. *QUERCUS CORRUGATA* Hook., *Icones Plant.* 5: *pl.* 403, 404. 1842.

Small or large tree, 6 to 20 m. tall. Twigs slender or coarse (often on the same branch), 1.5 to 5 mm. thick, fluted, glabrous or from sparingly strigose soon glabrescent, brown but soon becoming gray with rather large pale lenticels. Buds about 3 mm. long, round-ovoid, glabrous, grayish brown, the stipules caducous, about 10 mm. long, ligulate, dorsally pubescent. Leaves deciduous, thick and rather hard, 5 to usually 15 or even 25 cm. long, 2 to 5 or even 7 cm. broad, lanceolate to oblanceolate or a broader form elliptic to obovate, acute to attenuately acuminate and the ultimate apex narrowly rounded or acute, basally cuneate to rounded, coarsely toothed with the teeth abruptly directed forward and mucronate-tipped, entire toward the base, margins minutely revolute or flat, both surfaces somewhat shining, glabrous, old leaves somewhat bullate-granular above or smooth; veins 12 to 14 or even 18 on each side, branching and more or less obviously anastomosing but ultimately passing into the teeth where those are present, minutely raised (including the reticulum) above, more prominent beneath; petioles 15 to 40 mm. long or rarely shorter, glabrous or puberulent. Staminate catkins 5 to 6 cm. long, sparsely villous, loosely flowered, the anthers much exerted. Pistillate catkins about 5 mm. long, 1- or 2-flowered. Fruit annual, solitary on a peduncle 5 to 10 mm. long, rather large; cups 3 to 4 or even 6 cm. broad, shallowly cup-shaped or hemispheric (or discoid in some Mexican forms), very thick, the scales broadly ovate with narrowed apices, much thickened basally, appressed, closely tomentose; acorns subglobose or ovate to oblong, 3 to 5 cm. in diameter, typically longitudinally corrugated but often smooth, dark brown, from sparsely villous glabrate, about one-half included.

*Quercus corrugata* is readily distinguished from all other species of *LEPIDO-BALANUS* in our range by its usually narrow leaves with quite glabrate blades and its very large fruit. The species ranges from Mexico to Costa Rica and is very sparse in Panama.

CHIRIQUÍ: north of El Hato, Volcán Baru, *Stern* and *Chambers* 47.

5. *QUERCUS PANAMANDINAE* C. H. Mull., U.S.D.A. Misc. Pub. 477:29. *pls.* 21 & 22. 1942.

Large tree to 25 m. tall. Twigs 1 to scarcely 2 mm. thick, fluted, from stellate-pubescent glabrate and brown with few rather inconspicuous light lenticels. Buds 2 to 2.5 mm. long, ovoid, subacute, glabrous, straw-colored; stipules caducous. Leaves evergreen, thin and hard, 10 to 15 cm. long, 4 to 6 cm. broad, broadly



lanceolate to oblanceolate, long-acuminate, the bases cuneate to rounded or apparently truncate and then minutely cuneate, entire or the margins slightly wavy but scarcely toothed, somewhat crisped, minutely revolute, both surfaces glabrous or sparsely stellate-pubescent at the base of the midrib above, dully shining; veins 12 to usually 15 or 18 on each side with evanescent intermediates, branching (often doubly) and anastomosing toward the margin, impressed above but slightly raised (as is the reticulum) within the grooves, quite prominent beneath, the reticulum less so; petioles about 4 mm. long (excluding the decurrent lamina), 1.5 to 3 mm. thick, glabrous or sparingly stellate-pubescent, dark reddish-brown. Staminate catkins? Pistillate catkins up to 1.5 cm. long, 2- or 3-flowered, the peduncle glabrous. Fruit annual, solitary, in twos, or in threes, peduncles about 1 cm. long, glabrous; cups about 25 mm. broad, 15 mm. high, cup-shaped, the scales ovate to ovate-lanceolate, basally thickened and densely gray-tomentose, the thin loose apices glabrous and reddish-brown; acorns about 25 mm. long, 16 to 18 mm. broad, ovoid, glabrous and light brown, the cotyledons decidedly unequal with the radicle lateral or equal with the radicle apical.

*Quercus panamandinaea* (named for Panama and *Andinae*, a series of black oaks which it superficially resembles quite closely) is a remarkable endemic species. It has no close relatives in Panama and is readily distinguished by the character of its cup scales and by its large, entire, long-acuminate, short-petioled leaves.

CHIRIQUÍ: Casita Alta to Copete, *Woodson* and *Schery* 360 (type).

6. *QUERCUS COPEYENSIS* C. H. Mull., U.S.D.A. Misc. Pub. 477:30. *pls.* 31 & 32. 1942.

Large tree to 15 m. in height or taller. Twigs moderate (2 to 3 mm.), somewhat fluted, strikingly yellowish-white, glabrous. Buds round-ovoid, about 3 mm. long, glabrous, brown, the stipules persistent for a time, about 7 mm. long, ligulate, glabrous. Leaves deciduous, thick and very firm, 4 to 6 or rarely 8 cm. long, 2.5 to 4 cm. broad, ovate to obovate or broadly elliptic, the apex broadly rounded or merely obtuse, base subcuneate to cordulate but usually rounded, entire, the margins minutely revolute or flat, upper surfaces shiny, glabrous, lower surface dull, glabrous except occasional fulvous-stellate tomentum along the midrib toward the base; veins 6 or 7 or rarely 9 on each side, very irregular, much branched and obviously anastomosing, very slightly raised above with the reticulum not evident, more prominent beneath, the reticulum somewhat raised or not; petioles 4 to 7 mm. long, dark brown, glabrous. Staminate catkin 3 or 4 cm. long, the rachis sparsely pubescent or glabrous, loosely flowered or rather densely so toward the apex, the anthers little exerted. Pistillate catkins 2 or 3 cm. long, several-flowered toward the apex, the styles short, stigmas abruptly dilated if at all. Fruit annual, several distally grouped on a glabrous peduncle about 3 cm. long and 2 mm. thick; cups about 10 or 12 mm. broad, cup-shaped, the scales narrowly ovate, apically narrowed but obtuse, somewhat thickened basally, the thin apices closely appressed, gray-puberulent only at the base, otherwise glabrous and reddish-brown; acorns (immature) about 1 cm. in diameter, round, one-half included.

*Quercus copeyensis* is not closely related to any other species in Panama. It is readily distinguished from the other species of *LEPIDOBALANUS* by its small, relatively broad leaves. The species occurs also in central Costa Rica where it attains immense size.

CHIRIQUÍ: Volcán Chiriquí, between Potrero Muleto and the summit, *Woodson and Schery* 383.

7. *QUERCUS HUMBOLDTII* Bonpl. in Humb. & Bonpl., Pl. Aequinoct. 2:155. *pl.* 130. 1809.

*Erythrobalanus humboldtii* Schwarz, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 13:496. 1937.

Medium-sized or large tree. Twigs 2 to 4 or rarely 7 mm. thick, fluted or subterete, from loosely fulvous-tomentose quickly or tardily becoming glabrate, the numerous light lenticels raised and very prominent. Buds about 5 mm. long, ovoid or elongating and acute, from loosely tomentose becoming glabrate and dull brown but the scales ciliate; the ligulate stipules rather early caducous. Leaves subevergreen or clearly evergreen, rather thin but hard and coriaceous, 10 to 20 cm. long, 3 to 7 cm. broad, lanceolate to elliptic or oblanceolate, acute or long-acuminate at apex, cuneate to rounded at base, entire or rarely coarsely few-toothed near the apex, margins minutely cartilaginous-revolute, flat or minutely crisped, upper surface glabrous and somewhat shining or the base of the midrib persistently tomentose, lower surface glabrate or rather persistently floccose especially along the midrib, opaque or somewhat shining, not bullate; veins about 12 to 16 on each side, branching and very obviously anastomosing near the margin, impressed above but slightly raised within the grooves, very prominent beneath, the reticulum rather inconspicuously raised beneath, less so above; petioles 4 to 10 or 15 mm. long, glabrate or persistently tomentose. Staminate catkins 8 to 15 cm. long, rather loosely flowered, the rachis sparsely villous, the obtuse anthers well exerted from the villous perianth. Pistillate catkins about 1 cm. long, 1- to 2-flowered. Fruit annual, solitary or paired on a peduncle 3 to 10 mm. long and 3 to 6 mm. thick with prominent lenticels; cups 2 to 3 cm. broad, deeply or shallowly cup-shaped, the margins inrolled or not, the scales narrowly ovate, obtuse, rather loosely appressed, short-fulvous-tomentose; acorns 2 to 3 cm. long, 1.5 to 2 cm. broad, round or ovoid, from loosely silky-tomentose becoming glabrate and brown, one-half or usually one-third included.

*Quercus humboldtii* is readily distinguished from the other species in Panama by its rather large entire lanceolate leaves and its large cups with loosely appressed thin scales. It is not closely related to any other species in Panama; its center is in the Andes of Colombia, where it is the only South American species of the genus. Its existence in Panama is attested by a single specimen in the New York Botanical Garden Herbarium labeled merely "Panama, 1859-1860." It is very likely that this specimen was taken in lower Panama near Colombia since no others of this species have turned up in the recent extensive explorations of the Chiriquí region.

DARIÉN (?): without specific locality data, *Hayes* 830.

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8. QUERCUS SEEMANNII Liebm., Overs. Danske Vidensk. Selsk. Forhandl. 1854: 188. 1854.

*Quercus boquetensis* Standl., Field Mus. Bot. Ser. 22:13. 1940.

*Q. chiriquiensis* Trel. ex C. H. Mull., U.S.D.A. Misc. Pub. 477:57. 1942. (as synonym).

Small or moderately large tree. Twigs 1 to 2.5 mm. thick, fluted, from sparsely pubescent soon glabrate and dark reddish-brown with prominent light lenticels. Buds 2 to 4 mm. long, ovoid or elongating, acute, glabrous, light brown; the ligulate stipules soon caducous. Leaves subevergreen, thin but rather hard, 4 to usually 8 or even 16 cm. long, 1 to usually 3 or 4 cm. broad, lanceolate or occasionally linear-lanceolate or ovate lanceolate or elliptic, apex long- or short-acuminate, base rounded to usually cuneate or attenuately acute, entire, margins minutely revolute, usually finely crisped, upper surface glabrate and shiny, lower surface glabrate or persistently tomentose along the midrib, dull; veins 8 to usually 10 or 12 on each side, repeatedly branching but obscurely anastomosing near the margin, very slightly or rather clearly raised above, or slightly impressed, somewhat more prominent beneath, the reticulum slightly raised on both surfaces; petioles 5 to usually 10 or rarely even 17 mm. long, rather prominently winged, glabrate. Staminate catkins 4 or 5 cm. long, rather loosely flowered, sparsely crisped-villous, the apiculate anthers slightly exerted. Pistillate catkins about 1 cm. long, 2- to 4-flowered along a slender glabrate peduncle. Fruit annual, rather small, solitary or paired on a peduncle 2 to 10 mm. long and as much as 3 mm. thick; cups goblet-shaped or deeper, 12 to 14 mm. broad, about 5 to 10 mm. high, the scales triangular-ovate, apices rounded, appressed, minutely sericeous-puberulent but the apices and margins glabrate and glossy brown; acorns about 12 to 15 mm. long, 11 or 12 mm. broad, subrotund to ovoid, loosely buff-puberulent, light brown where abraded, about one-fourth or one-third included; abortive ovules basal or lateral to subapical.

*Quercus seemannii* is rather similar to *Q. baruensis*; it is distinguished from that species by its thin blades, small leaves, and generally smaller fruit. *Q. seemannii* occurs commonly in Costa Rica.

CHIRIQUÍ: labeled "Veraguas" and without further locality, *Seeman s. n.* (type); Cerro Vaca, eastern Chiriquí, *Pittier 5305*; Distr. de Boquete, Volcán Chiriquí, *Davidson 909*; vicinity of Casita Alta, Volcán Chiriquí, *Woodson, Allen, and Seibert 796* and *868*; Camiseta, Volcán Chiriquí, *Terry 1337*; Boquete, *Davidson 677* and *780* (type of *Q. boquetensis*); Salto Boquete, *Terry 1258*; Bajo Chorro, *Davidson 437* and *721*; upper valley of Río Chiriquí Viejo, between Paso Ancho and Monte Lirio, *Allen 1595*; between Finca Lérica and Peña Blanca, *Woodson and Schery 318*.

9. QUERCUS GULIELMI-TRELESEI C. H. Mull., U.S.D.A. Misc. Pub. 477:58. *pls.* 79 & 80. 1942.

*Quercus chiriquina* Trel. ex C. H. Mull., U.S.D.A. Misc. Pub. 477:58. 1942. (as synonym).

Large tree. Twigs 1.5 to 3 mm. thick, fluted, from fulvous-stellate-tomentose becoming glabrate or sparsely floccose, reddish-brown with rather prominent pale lenticels, becoming gray. Buds about 2 mm. long, round to narrowly ovate, obtuse, straw-colored, glabrous or the scales minutely ciliate, the ligulate stipules

early caducous. Leaves deciduous (?), thin but firm and coriaceous, 8 to usually 18 or even 25 cm. long, 2 to usually 5 or sometimes 7 cm. broad, narrowly or broadly lanceolate to oblanceolate, apex narrowly acute to long-acuminate, not strikingly aristate-tipped, base cuneate to very narrowly rounded, entire, margins minutely revolute and very finely crisped, upper surface glabrous and shiny, lower surface glabrous or usually sparsely stellate-pubescent along the midrib toward the base, somewhat shining; veins about 15 to 18 or 20 on each side with evanescent intermediates, repeatedly branching and inconspicuously anastomosing near the margin, very slightly impressed above but somewhat raised within the grooves, rather prominent beneath, the fine reticulum somewhat raised on both surfaces; petioles 2 to 4 mm. long, as much as 2 mm. thick, winged, glabrate or pubescent like the twigs, dark reddish-brown at the swollen base. Catkins? Fruit probably annual, solitary or paired or several scattered on a peduncle 1 to 2 or 4 cm. long, 1.5 to 3 mm. thick, often irregularly bent in a zigzag at the points of attachment of the cups, glabrate, reddish-brown with conspicuous lenticels; cups 13 to 18 mm. broad, 5 to 10 mm. high, deeply saucer-shaped to goblet-shaped, often somewhat constricted at the base, the scales broadly triangular-ovate, rounded at apex, thin and very closely appressed, the base sometimes appearing thickened but merely protruded by the bud in its axil, finely buff-sericeous but the apices and margins glabrate; acorns 7 to 15 mm. long, 11 to 15 mm. broad, hemispheric to broadly ovate, apex nearly flat or rounded, from minutely sericeous-puberulent tardily glabrate, one-fifth included to completely covered (in equally mature material, varying with the form of the acorn); abortive ovules basal.

*Quercus gulielmi-treleasei* is not very closely related to *Q. seemanii*, its closest ally, but aside from the larger leaves, very short petioles, and rather longer-stalked, smaller fruit of the former, distinguishing characters are difficult to ascertain. Such a paucity of distinctions characterizes the whole group of entire-leaved black oaks of the tropics and subtropics, especially if fruiting material is not available. *Q. gulielmi-treleasei* occurs also in Costa Rica.

CHIRIQUÍ: valley of upper Río Chiriquí Viejo, vicinity of Monte Lirio, *Seibert 226* (type); between Boquete and Finca Lérída, *Allen 302*.

10. *QUERCUS BARUENSIS* C. H. Mull., *Trop. Woods* 108:75. 1958.

Tree to 30 m. tall, the trunk to 1.8 m. in diameter. Twigs 2 to 3 mm. in diameter, nearly glabrous or densely stellate-tomentulose, soon or tardily glabrate with inconspicuous light lenticels, gray the second year and the lenticels numerous and more prominent (this variation occurring as polymorphism of individual trees). Buds 2 to 3 mm. long, ovoid, apically rounded, dull straw-colored, the scales markedly ciliate or glabrate; stipules quickly caducous (not seen). Leaves deciduous (?), firm and coriaceous, 10 to 15 cm. long, 2.5 to 6 cm. broad, entire, lanceolate or ovate-lanceolate, acuminate, the ultimate apex not aristate, cuneate to obtuse at base, blades dull green and glabrate above or sparingly stellate pubescent along the base of the midrib, very dull beneath, the midrib and veins persist-

ently stellate-tomentose, especially in the axils, margins nearly flat, minutely cartilaginous; veins about 8 to 10 on each side, obviously branching and anastomosing toward the margin, minutely raised on the upper surface, rather prominently raised on the lower surface; petioles 8 to 18 mm. long, winged by the decurrent blade, the upper surface flattened, pubescent or glabrate like the twigs. Flowers not seen. Fruit annual, solitary (from short multiflowered catkins) on short, thick peduncles 3 to 10 mm. long and 3 to 5 mm. thick; cups 13 to 17 mm. broad, 8 to 10 mm. deep, cup-shaped, the bases rounded, the margins not inrolled, the scales tightly appressed, prominently tan-puberulent all over; acorns about 10 mm. long and 15 mm. broad, densely puberulent, about two-thirds included.

*Quercus baruensis* is distinguished from *Q. guillemi-treleasei* by its long petioles and thick leaf blades and from *Q. seemanii* by its much larger leaves and fruit. Although the species may occur in Costa Rica, it is thus far known only in Panama.

CHIRIQUÍ: north of El Hato, Volcán Baru, *Stern and Chambers* 55 (type); Cerro Punta, *Stern and Chambers* 76; *Allen* 3496 and 3523; Llano del Volcán, *Allen and Fairchild* 3464 and 3467.

## ULMACEAE

By LORIN I. NEVLING, JR.

Bisexual, monoecious or dioecious shrubs or trees, sap watery. Leaves simple, mostly alternate but sometimes opposite, often distichous, often inequilateral; petiolate; stipules lateral or interpetiolar, caducous. Inflorescences solitary, cymose or in axillary fascicles, borne on previous or current year's growth. Flowers bisexual or unisexual by abortion, anemophilous, obscurely zygomorphic; sepals 4-8, free or basally connate; petals 0; stamens generally equal to or twice, rarely more than twice, as many as the sepals, erect in bud, the anthers 2-celled, dehiscing longitudinally; pistil 1, rudimentary in staminate flowers, in pistillate and bisexual flowers the ovary superior, sessile or stipitate, 2-carpellate, 1-locular or rarely 2-locular, the ovule 1, anatropous, pendulous from locule apex, the styles 2, free or fused at the base, linear, stigmatose on upper inner surface; fruit a more or less winged samara with straight embryo and flat cotyledons or a drupe with curved embryo and rolled or folded cotyledons.

A widely distributed family of approximately 15 genera and more than 160 species.

- a. Fruit more or less samaroid, dry; seed flat; embryo straight with generally flat cotyledons, exendospermous..... 1. ULMUS
- aa. Fruit drupaceous; seed round; embryo curved with folded or rolled cotyledons; endosperm sometimes present.
  - b. Leaves opposite; stipules interpetiolar..... 2. LOZANELLA
  - bb. Leaves alternate; stipules lateral.
    - c. Stamens as many as the sepals.
      - d. Pistillate flowers in lax, many-flowered cymes; plants unarmed. 3. TREMA
      - dd. Pistillate flowers solitary or few; plants often armed..... 4. CELTIS
    - cc. Stamens at least twice as many as the sepals..... 5. AMPELOCERA

## 1. ULMUS L.

ULMUS L. Sp. Pl. 225. 1753.

*Microptelea* Spach, in Ann. Sc. Nat. Ser. 2. 15:358. 1841.

*Chaetoptelea* Liebm. in Kjoeb. Vidensk. Meddel. 76. 1850.

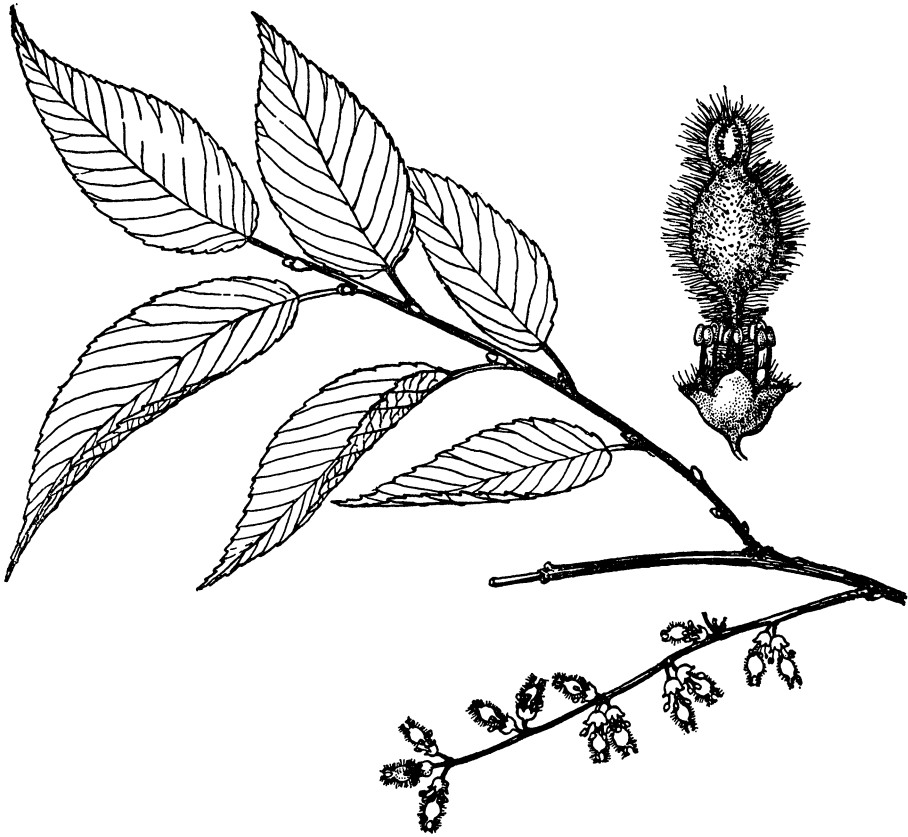
Bisexual shrubs or trees, the branches often flexuose. Leaves alternate, distichous, inequilateral, serrate; stipules lateral. Inflorescence racemose or fasciculate, borne axillary on last year's growth. Flowers bisexual; sepals 4-8, more or less connate at the base; stamens as many as and opposite the calyx lobes, the anther dehiscence extrorse; ovary sessile or stipitate, 2-carpellate, 1-locular, compressed, the styles 2, often introrsely recurved, persistent. Fruit more or less samaroid, dry; seed flat; embryo straight with generally flat cotyledons; exendospermous.

Represented in Panama by a single species.

1. ULMUS MEXICANA (Liebm.) Planch. in DC. Prodr. 17:156. 1873.

*Chaetoptelea mexicana* Liebm. in Kjoeb. Vidensk. Meddel. 77. 1850.

Trees to 25 m. tall, the young branches sparsely hirsute to glabrous. Leaves

Fig. 31. *Ulmus mexicana*

lanceolate- to ovate-elliptic, 4–16 cm. long, 2–7 cm. broad, acute to attenuate at the apex, only the costa pubescent above, glabrous to puberulent below, serrate; petiole 4–10 mm. long, glabrous to sparsely hirsute. Inflorescence racemose, to 6 cm. long. Flowers with pedicel to 5 mm. long, hirsute; tepals 5, connate into a more or less campanulate tube, white; stamens 5, exserted, the filaments about 3.5 mm. long, the anthers about 0.75 mm. long, 1 mm. broad; ovary obovate, velutinous on margins, borne on a cuneate gynophore, the styles introrsely recurved, papillose stigmatic surface. Fruit obovate, 9–11 mm. long, 2.5–3.0 mm. broad; seed about 1.75 mm. long, 1.25 mm. broad.

Mexico to Panama.

CHIRIQUÍ: Río Chiriquí Viejo, 3 kilometers n. of Camp El Volcán, *Little 6060, 6074, 6076*; trail from Paso Ancho to Monte Lirio, upper Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1591*; Boquete, el. 5500 ft., *Davidson 533*.

## 2. LOZANELLA Greenm.

LOZANELLA Greenm. in Proc. Amer. Acad. 41:236. 1905.

Dioecious trees. Leaves opposite, slightly inequilateral, serrate, long-petiolate; stipules interpetiolar. Inflorescence many-flowered, cymose, axillary, bracteolate, borne on current year's wood. Staminate flowers: shortly pedicellate; sepals 5 (-6), more or less connate at the base; stamens as many as and opposite the calyx lobes, disc present; pistil rudimentary. Pistillate flowers: sessile; perianth as in staminate flowers; staminodes 0; pistil 1, the ovary sessile, 2-carpellate, 1-locular, the styles 2, spreading, persistent. Fruit a small drupe, the embryo and cotyledons only slightly curved.

Two species, only one found in Panama. Mexico to Bolivia.



Fig. 32. *Lozanella enantiophylla*



1. *LOZANELLA ENANTIOPHYLLA* (Donn. Sm.) Killip & Morton, in Journ. Wash. Acad. Sci. 21:339. 1931.

*Trema enantiophylla* Donn. Sm. in Bot. Gaz. 33:259. 1902.

*Lozanella trematoides* Greenm. in Proc. Amer. Acad. 41:236. 1905.

Tree to 10 m. tall, the stems terete or slightly compressed at the nodes, young branches densely villous, mature branches glabrate with elliptic, white lenticels. Leaves ovate to ovate-lanceolate, 8–16 cm. long, 3–9 cm. broad, acuminate, obtuse or acute at the base, scabrous and hirsute above, hirsute below, serrate; petiole 1–4 cm. long. Staminate flowers: sepals 5(–6), 1.5–2.5 mm. long, connate at the base, margin ciliate, green; stamens exerted, the filaments broadly filiform, glabrous, the anthers about 1.25 mm. long, 1 mm. broad, subversatile, the disc minute, pilose; ovary rudimentary, about 1 mm. long. Pistillate flowers: perianth as in staminate flower; staminodes 0; fruit subglobose, approximately 2 mm. in diameter, orange.

Mexico to Peru.

CHIRIQUÍ: vicinity of Casita Alta, Volcán de Chiriquí, ca. 1500–2000 m., *Woodson, Allen & Seibert 841*; Quebrado Velo, alt. 1800 m., *Woodson & Schery 256*; valley of the upper Río Chiriquí Viejo, *P. White 344*; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1505*.

### 3. TREMA Lour.

TREMA Lour. Fl. Cochinch. 562. 1790.†

*Sponia* Comm. ex Lam. Encycl. 4:139. 1796.

Bisexual or monoecious trees or tall shrubs. Leaves alternate, distichous, more or less inequilateral, mostly serrate, shortly petiolate; stipules lateral. Inflorescences solitary, cymose or fasciculate. Bisexual flowers: sepals 4–5, connate at the base; stamens as many as and opposite the calyx lobes, anther dehiscence introrse; ovary sessile, 1-locular, the styles connate below. Staminate flowers with rudimentary pistil. Pistillate flowers without staminodes. Fruit a small ovoid or subglobose drupe with persistent styles, the embryo curved, the cotyledons falcate, thick.

A genus of highly variable taxonomically confused species. Widely distributed in subtropical and tropical regions. A single species found in Panama.

1. *TREMA MICRANTHA* (L.) Blume, in Ann. Mus. Bot. Lugd. Bat. 2:58. 1853.

*Rhamnus micranthus* L. Syst. Nat. ed. 10. 2:937. 1759.

*Celtis mollis* Humb. & Bonpl. ex Willd. Sp. Pl. 4<sup>2</sup>:996. 1806.

*Celtis rugosa* Willd. loc. cit. 1806.

*Celtis canescens* HBK. Nov. Gen. & Sp. 2:28. 1817.

*Celtis riparia* HBK. loc. cit. 1817.

*Celtis macrophylla* HBK. loc. cit. 30. 1817.

*Celtis schiedeana* Schlecht. in Linnaea 7:140. 1832.

*Sponia micrantha* (L.) Decne. in Nouv. Ann. Mus. Par. 3:498. 1834.

*Sponia mollis* (Humb. & Bonpl. ex Willd.) Decne. loc. cit. 1834.

*Sponia canescens* (HBK.) Decne. loc. cit. 1834.

*Sponia riparia* (HBK.) Decne. loc. cit. 1834.

*Sponia macrophylla* (HBK.) Decne. loc. cit. 1834.

Fig. 33. *Trema micrantha*

- Sponia lima* Decne. loc. cit. 1834.  
*Sponia schiedeana* (Schlecht.) Planch. in Ann. Sc. Nat. Sér. 3. 10:335. 1848.  
*Celtis microcarpa* Salzm. ex Planch. loc. cit. 333. 1848.  
*Celtis rufescens* Banks, ex Planch. loc. cit. 334. 1848.  
*Celtis chichilea* Ruiz & Pav. ex Planch. loc. cit. 335. 1848.  
*Sponia crassifolia* Liebm. in Vidensk. Selsk. Skr. 5<sup>2</sup>:340. 1851.  
*Sponia grisea* Liebm. loc. cit. 1851.  
*Trema canescens* (HBK.) Blume, loc. cit. 1853.  
*Trema schiedeana* (Schlecht.) Blume, loc. cit. 1853.  
*Trema lima* (Decne.) Blume, loc. cit. 1853.  
*Trema riparia* (HBK.) Blume, loc. cit. 1853.  
*Trema mollis* (Humb. & Bonpl. ex Willd.) Blume, loc. cit. 1853.  
*Trema macrophylla* (HBK.) Blume, loc. cit. 1853.  
*Trema chichilea* (Ruiz & Pavon, ex Planch.) Blume, loc. cit. 1853.  
*Trema rufescens* (Banks, ex Planch.) Blume, loc. cit. 1853.  
*Trema melinona* Blume, loc. cit. 64. 1853.  
*Sponia integerrima* Beurl. in Vet. Akad. Handl. Stockh. 1854:144. 1856.  
*Celtis lima* (Decne.) Sw. Prod. 53. 1888.  
*Trema micrantha* var. *obtusatum* Urb. Symb. Ant. 4:195. 1905.  
*Trema integerrima* (Beurl.) Standl. in Contrib. Arn. Arb. 5:55. 1933.  
*Trema strigillosa* Lund. in Phytologia 1:337. 1939.  
*Trema micrantha* var. *strigillosa* Standl. & Steyerl. in Fieldiana Bot. 24<sup>4</sup>:9. 1946.

Monoecious trees to 20 m. tall, the young branches flexuose, villous; stipules

narrowly lanceolate. Leaves lanceolate to ovate-elliptic, 5–17 cm. long, 1.5–7.0 cm. broad, attenuate at the apex, hirsute and scabrous above, sparsely to densely villous below, serrate or entire; petiole 0.5–1.8 cm. long, villous. Flowers small, subsessile, bracteolate. Staminate flowers: sepals 5, 0.75–1.0 mm. long, hirsute on outer surface; stamens 5, torus hairy; pistillode more or less cylindrical, about 0.5 mm. long, 0.5 mm. in diameter. Pistillate flowers: perianth as in staminate flowers; staminodes 0; the ovary globose, strigose toward the apex, the styles two, fused at the base. Fruit ovoid or subglobose, 3–4 mm. long, around 3 mm. in diameter, red, malodorous.

An extremely variable species which has been variously divided in the past. Very common in Panama on cut over land.

BOCAS DEL TORO: Water Valley, *von Wedel 867, 1624, 1791*; Changuinola Valley, *Cooper & Dunlap 18, Dunlap 442*; Changuinola Valley, Lincoln Creek, *Dunlap 431*. CANAL ZONE: two miles below Madden Dam, *Bro. Maurice 821*; south of island, *P. White 110*; vicinity of Miraflores Lake, *G. White 153*; Fort Kobe Road, *Woodson, Allen & Seibert 1409*; France Field, Colon, *Riley 101*; Barro Colorado Island, *Aviles 58*. CHIRIQUÍ: vicinity of San Bartolomé, Peninsula de Burica, alt. 0–50 m., *Woodson & Schery 911*; vicinity of Chiriquí Lagoon, Old Bank Island, *von Wedel 2117*; Río Chiriquí to Remedios, ca. 15–50 m., *Woodson, Allen & Seibert 1190*; vicinity of Río Tinta, along main highway, *Woodson, Seibert & Allen 410*; trail from Paso Ancho to Monte Lirio, upper valley Río Chiriquí Viejo, alt. 1500–2000 m., *Allen 1485*; Boquete, Volcán de Chiriquí, 7000 ft., *Davidson 924*; Boquete, Bajo Mono, el. 4500 ft., *Davidson 485*; vicinity of Casita Alta, Volcán de Chiriquí, ca. 1500–2000 m., *Woodson, Allen & Seibert 917*; vicinity of Finca Lérica, alt. 1750 m., *Woodson & Schery 208*; forested ridges south of Finca Lérica, alt. 6000–7000 ft., *Allen 4760*; vicinity of Puerto Armuelles, alt. 0–75 m., *Woodson & Schery 837*. COLÓN: vicinity of Camp Pina, alt. 25 m., *Allen 3670*. PANAMÁ: vicinity of Arenoso, lower Río Trinidad, 26–50 m., *Seibert 621*; Isla Taboga, ca. 0–186 m., *Woodson, Allen & Seibert 1543*; San José Island, Between Headquarters and Main Beach, *Johnston 1191, 1192*; San José Island, M-area road, edge of forest, *Johnston 269*. SAN BLAS: *Cooper 289*.

#### 4. CELTIS L.

CELTIS L. Sp. Pl. 2:1043. 1753.

*Mertensia* HBK. Nov. Gen. & Sp. 2:30. 1817, non L.

*Momisia* F. G. Diétr. in Vollst. Lexik. Gaertn. Nachtr. 5:122. 1819.

*Saurobroma* Raf. Sylva Tellur. 32. 1838.

*Solenostigma* Endl. Prod. Fl. Norf. 41. 1833.

Polygamo-monoecious or monoecious shrubs or trees, unarmed or with spinose branches. Leaves alternate, distichous, often inequilateral, serrate or entire; petiole; stipules lateral. Inflorescences borne on this year's wood: staminate inflorescence cymose or fasciculate, pistillate inflorescence solitary or few-flowered fasciculate. Flowers small, pedicellate. Bisexual flowers: sepals 4–5, more or less connate at the base; stamens as many as and opposite the calyx lobes, the anther dehiscence extrorse, disc present; ovary sessile, 1-locular, the styles 2, sometimes united at the base, reflexed. Staminate flowers with rudimentary pistil. Pistillate flowers without staminodes. Fruit an ovoid or subglobose drupe, the embryo curved, the cotyledons broad, conduplicate or rarely flat, variously folded.

Fig. 34. *Celtis iguanaeus*

Approximately 75 species, widely distributed in temperate and tropical regions. Only 1 represented in Panama.

1. *CELTIS IGUANAENS* (Jacq.) Sarg. *Silv. N. Amer.* 7:64. 1895.

*Rhamnus iguanaeus* Jacq. *Enum. Pl. Carib.* 16. 1762.

*Celtis aculeata* Sw. *Prod. Veg. Ind. Occ.* 53. 1788.

*Zizyphus iguanea* (Jacq.) Lam. *Dict.* 3:318. 1789.

*Celtis epiphylladena* Orteg. *Hort. Matr.* 79. 1800.

*Celtis rhamnoides* Willd. *Sp. Pl.* 4:998. 1806.

*Mertensia laevigata* HBK. *Nov. Gen. & Sp.* 2:31, t. 103. 1817.

*Mertensia zizyphoides* HBK. loc. cit. 1817.

*Momisia laevigata* (HBK.) F. G. Dietr. *Vollst. Lexik. Gaertn. Nachtr.* 5:123. 1819.

*Momisia zizyphoides* (HBK.) F. G. Dietr. loc. cit. 124. 1819.

*Zizyphus commutata* Roem. & Schult. *Syst. Veg.* 5:336. 1819.

*Mertensia iguanea* (Jacq.) Schult. *Syst. Veg.* 6:312. 1820.

*Mertensia rhamnoides* (Willd.) Schult. loc. cit. 313. 1820.

*Celtis laevigata* (HBK.) Spreng. *Syst.* 1:932. 1825.

*Celtis glabratum* Spreng. *Syst.* 5:150. 1828.

- Momisia ebrenbergiana* Klotzsch, in *Linnaea* 20:538. 1847.  
*Momisia aculeata* (Sw.) Klotzsch, loc. cit. 539. 1847.  
*Celtis orthacanthos* Planch. in *Ann. Sc. Nat. Ser. 3.* 10:309. 1848.  
*Celtis zizyphoides* (HBK.) Planch. loc. cit. 314. 1848.  
*Celtis anfractuosa* Liebm. in *Vidensk. Selsk. Skr. Ser. 5.* 2:338. 1851.  
*Celtis ebrenbergia* (Klotzsch) Liebm. loc. cit. 339. 1851.  
*Celtis aculeata* var. *pubescens* Griseb. *Fl. Br. W. Ind.* 149. 1861.  
*Celtis aculeata* var. *serrata* Griseb. loc. cit. 1861.  
*Celtis aculeata*  $\beta$  *laevigata* Planch. in *DC. Prod.* 17:187. 1873.  
*Mertensia commutata* (Roem. & Schult.) Hemsl. *Biol. Centr. Am. Bot.* 3:138. 1882-86.  
*Celtis platycaulis* Greenm. in *Proc. Amer. Acad.* 39:78. 1903.  
*Momisia iguanaea* (Jacq.) Rose & Standl. in *Contrib. U. S. Nat. Herb.* 16:8. 1912.  
*Momisia anfractuosa* (Liebm.) Rose & Standl. loc. cit. 1912.

Andromonoecious shrubs or small trees to 12 m. tall, the branches flexuose, armed with short recurved spines. Leaves ovate to broadly elliptic, 3-11 cm. long 1.5-4.5 cm. broad, acute or attenuate at the apex, obtuse to subcordate at the base, slightly inequilateral, 3-nerved at the base, sparsely pubescent to glabrous above and below, serrate at least toward the apex; petiole 0.5-1.0 cm. long. Inflorescence cymose, fasciculate. Bisexual flowers: sepals 5, about 1.5 mm. long, 0.75 mm. broad, connate at the base, margin ciliate, greenish-yellow; stamens 5, exserted, the filaments 1.5 mm. long, glabrous, the anthers 1 mm. long, 0.75 mm. broad, the torus hairy; ovary more or less cylindrical, shortly hairy, the styles 2, fused at the base. Staminate flowers with rudimentary pistil. Flowers described from Mexican specimens. Fruit ovoid, 8-12 mm. long, 6-8 mm. in diameter, yellow, orange or red.

Mexico to Argentina, and the Antilles.

CANAL ZONE: Barro Colorado Island, *Aviles 27b*.

##### 5. AMPELOCERA Klotzsch

AMPELOCERA Klotzsch, in *Linnaea* 20:541. 1847.

Bisexual or andromonoecious trees, unarmed. Leaves alternate, slightly inequilateral, remotely serrate or entire, short-petiolate; stipules lateral. Inflorescence many-flowered fasciculate, axillary, borne on this year's wood. Bisexual flowers: sepals 5, fused at the base; stamens at least twice as many as the calyx lobes; ovary sessile, the styles 2, fused at the base, spreading, persistent. Staminate flowers with rudimentary pistil. Fruit a small drupe.

Five species, only 1 Central American, the remainder Antillean or South American.

1. AMPELOCERA HOTTLEI (Standl.) Standl. in *Trop. Woods* 51:11. 1937.

*Celtis hottlei* Standl. in *Trop. Woods* 20:20. 1929.

Apparently bisexual trees to 30 m. tall. Leaves elliptic-oblong, 7-13 cm. long, 3-6 cm. broad, glabrous, coriaceous, shortly attenuate at the apex, acute at the base, entire; petiole 0.3-0.6 cm. long. Inflorescence dense, at most only slightly exceeding the petiole of the subtending leaf in length. Flowers sessile, subtended by a pair of bracteoles; sepals 5, fused for about half of their length, cream;



Fig. 35. *Ampelocera hottlei*

stamens 10 or rarely more, exserted, the filaments about 2 mm. long, glabrous, the anthers 1.25 mm. long, 0.75 mm. broad, basifixed; styles persistent, stigmas bifid, divergent. Fruit globose, about 10 mm. long, 5 mm. in diameter, densely puberulent, yellow.

A Central American species found generally at low altitudes in well developed forests.

SAN BLAS: forest about Puerto Obaldía, *Pittier 4319*.

## MORACEAE

Trees and shrubs, very rarely low herbs (*Dorstenia* spp.), more or less abundantly laticiferous; monoecious or dioecious. Leaves alternate, distichous or spiral, simple, entire to deeply lobed, basifixed or peltate (*Cecropia*), variously involute or convolute in vernation; stipules lateral or intrapetiolar, commonly amplexicaul. Flowers unisexual, monochlamydeous or naked, minute, commonly in racemes, spikes or heads, rarely in cymes, in *Ficus* enclosed within fleshy saccate axial receptacles (syconia). Stamens 1-4, the filaments involute or erect before anthesis, the anthers 1- to 2-celled, longitudinal or rarely circumscissile (*Brosimum* spp.) in dehiscence. Pistil 1- to 2-carpellate; ovary superior to inferior, 1-celled, containing a single erect to pendulous ovule. True fruit generally a drupe or an achene, but the perianth or the whole inflorescence becoming fleshy at maturity, as in the breadfruit (*Artocarpus*) and the fig (*Ficus*).

The family is very widely distributed throughout the warmer parts of the earth and supplies one of the most essential elements of a "typical" lowland landscape in the tropics. There are well over 1000 species, of which more than half are included within the familiar genus *Ficus*. This is a very fortunate circumstance for, with the exception of such well-known but smaller members as *Morus* and *Artocarpus*, the other genera are for the most part chaotically ill-defined. There can scarcely be an equally prominent family of flowering plants more in need of taxonomic revision than Moraceae, which have not had an inclusive monographer since Trécul and Miquel more than a century ago. Engler's treatment of the family for "Die natürlichen Pflanzenfamilien", derived from Bentham and Hooker, definitely lacks realism; *Trophis* and *Sorocea*, for example, which were placed in different subfamilies, possibly are congeneric. Although all genera reported from Panama are distinguished with some difficulty in the key which follows, probably less than a dozen natural groups actually exist.

## a. Trees and shrubs.

## b. Leaves distichous; stipules lateral to fully amplexicaul.

- c. Pistillate flowers with a simple filiform lateral stigma, in dense globular heads; staminate flowers in elongate spikes with spatulate glandular-carinate bracts; stipules lateral, not leaving a scar completely surrounding the stem; leaves usually strongly inequilateral and more or less cordate at the base, closely serrate to entire; stems frequently with stout axillary spines.....

1. CHLOROPHORA

## cc. Pistillate flowers with a central more or less prominently 2-lobed stigma.

- d. Both pistillate and staminate flowers in more or less elongate racemes or spikes (the pistillate flowers occasionally in axillary pairs or solitary in *Clarisia*), with small peltate bracts; stipules lateral to about half-amplexicaul, not leaving a scar completely surrounding the stems; leaves nearly or quite equilateral and cuneate to rounded at the base, entire to rather irregularly and remotely serrate; stems unarmed.

- e. Staminate inflorescences solitary or paired on separate peduncles, the flowers with an obvious perianth and 4 stamens; pistillate flowers without individual basal involucre.

- f. Staminate flowers spicate or racemose, with an obvious pistillode, the stamens strongly inflexed before anthesis, the anthers introrse; pistillate flowers spicate or racemose, epigynous..... 2. TROPHIS
- ff. Staminate flowers racemose, without an obvious pistillode, the stamens scarcely inflexed before anthesis, the anthers extrorse; pistillate flowers racemose, perigynous..... 3. SOROCEA
- ee. Staminate inflorescences usually 2-several on a common peduncle, the flowers with a vestigial perianth and a single stamen; pistillate flowers with inconspicuous but persistent individual basal involucre, epigynous..... 4. CLARISIA
- dd. Both pistillate and staminate flowers in globose or discoid heads (the pistillate usually solitary in *Brosimum*, *Olmedia* and *Pseudolmedia*); stipules fully amplexicaul and leaving a scar completely surrounding the stem (except in *Batocarpus* and occasionally in *Brosimum*).
- e. Inflorescences typically monoecious (occasionally dioecious) globose heads with 1-2 central pistillate flowers surrounded by innumerable minute staminate commingled with more or less conspicuous peltate bracts; stipules lateral or almost fully amplexicaul; unarmed trees..... 5. BROSIMUM
- ee. Inflorescences dioecious, without peltate bracts.
- f. Stipules lateral, not leaving a scar completely surrounding the stem; staminate heads discoid, involucre; pistillate heads globose, without an involucre; unarmed trees..... 6. BATOCARPUS
- ff. Stipules fully amplexicaul, leaving a scar completely surrounding the stem.
- g. Pistillate heads with several fertile flowers; anthers oval, scarcely longer than broad.
- h. Unarmed trees, pistillate heads with a definitely organized involucre; staminate heads discoid, with a definitely organized involucre.
- i. Staminate heads flat or nearly so, the flowers definitely organized with 4 tepals and 4 stamens; pistillate flowers free and hypogynous; leaves entire to indefinitely serrate-undulate, glabrous to softly puberulent..... 7. PEREBEA
- ii. Staminate heads more or less conduplicate-flabellate, with essentially unorganized flowers; pistillate flowers coherent at the base and perigynous; leaves closely and minutely ciliate-denticulate, scabrous to hispid..... 8. CASTILLA
- hh. Aculeate trees; pistillate heads without a definite involucre; staminate heads globose, without an involucre; leaves entire to indefinitely undulate..... 9. POULSENIA
- gg. Pistillate heads typically with a solitary prominently involucre flower; anthers oblongoid, much longer than broad; unarmed trees.
- h. Staminate flowers with a broadly campanulate perianth and 4 stamens; pistillate flowers hypogynous; leaves usually more or less serrate-undulate toward the tip..... 10. OLMEDIA
- hh. Staminate heads without organized flowers, the stamens commingled with prominent bracts and bracteoles; pistillate flowers perigynous or epigynous; leaves entire..... 11. PSEUDOLMEDIA
- bb. Leaves spiral; stipules fully amplexicaul and leaving a scar completely surrounding the stem.
- c. Flowers wholly contained within a more or less fleshy osteolate saccate predominantly monoecious receptacle; leaves of native species entire; stems mostly solid..... 12. FICUS
- cc. Flowers external in spikes or cymes; plants dioecious; stems usually hollow.
- d. Leaves basifixed, entire to palmately lobed.



- e. Leaves typically palmately lobed (entire in some extra-Panamanian species); inflorescences repeatedly cymose, the flowers rather indefinitely glomerate at the ends of the branches; staminate flowers with 4 nearly free tepals and 4 separate stamens; pistillate flowers with a fleshy cupular perianth and an obscurely 2-lobed stigma; fruit a rather large false drupe. ....13. *POUROUMA*
- ee. Leaves entire to more or less definitely undulate or crenate towards the tip; staminate inflorescences dichotomously compounded small globular heads, the flowers with 4 more or less united tepals and 2 completely united stamens; pistillate inflorescences superficially simple or rather obscurely dichotomous heads, the flowers much as in *Cecropia*; fruit a small slightly fleshy drupe.....14. *COUSSAPOA*
- dd. Leaves peltate, palmately lobed (or compound in some extra-Panamanian species); both staminate and pistillate inflorescences of spadiceous spikes in digitate clusters, the perianths tubular with thin shredding walls and a fleshy porous operculum, the stamens 2, the stigma penicillate, barely exerted; fruit a minute slightly fleshy drupe.....15. *CECROPIA*
- aa. Succulent subcaulescent herbs (our species); leaves spiral; stipules lateral; plants monoecious; staminate and pistillate flowers minute, interspersed and immersed in a common discoid or radiate head.....16. *DORSTENIA*

The genus *Ogcodeia* occurs in Costa Rica and may yet be found in Panama. It is related to *Perebea* and *Helicostylis*, but is distinguished by the burr-like pistillate inflorescences and fruits; the heads are involucrate as in *Perebea* but the flowers epigynous and reduced in number as in *Helicostylis*.

The East Indian and Micronesian genus *Artocarpus* is represented in cultivation by the breadfruit (*A. communis* Forst.) and the jackfruit (*A. heterophyllus* Lam.). Both are large and handsome shade trees and are monoecious, the staminate flowers in stout cylindrical spikes and the pistillate in great spherical or cylindrical heads somewhat reminiscent of the northern Osage orange [*Maclura pomifera* (Raf.) Schneid.] on a larger scale. The jackfruit has undivided leaves; breadfruit leaves are leathery, deep glossy green and incised like those of some monstrous oak. Breadfruit, which was the principal cargo of the ill-fated H.M.S. "Bounty" in 1789, still is an important article of food for many people in Panama, both for the starchy pulp of the fruit and for the large nut-like seeds of some varieties (breadnuts); by the Spanish-speaking people it is known as *árbol de pan* and *fruta de pan*. Jackfruits are edible but of inferior quality.

### 1. CHLOROPHORA Gaud.

CHLOROPHORA Gaud. Bot. Voy. Freycinet 509. 1830.

Dioecious trees, the branches occasionally with stout axillary spines. Leaves alternate, distichous; stipules lateral and about half-amplexicaul. Inflorescences axillary, the staminate spicate, the pistillate capitate; flowers associated with spatulate glandular-carinate bracts. Staminate flowers with 4 essentially free tepals; stamens 4, the filaments rather elongate, involute before anthesis, the anthers 2-celled, extrorse. Pistillate flowers with 4 basally coherent tepals, hypogynous, the pistil with a simple filiform lateral stigma. Fruit a loosely coherent slightly fleshy syncarp.

Two species—the following and *Ch. excelsa* (Welw.) Benth. & Hook. f. of western tropical Africa.

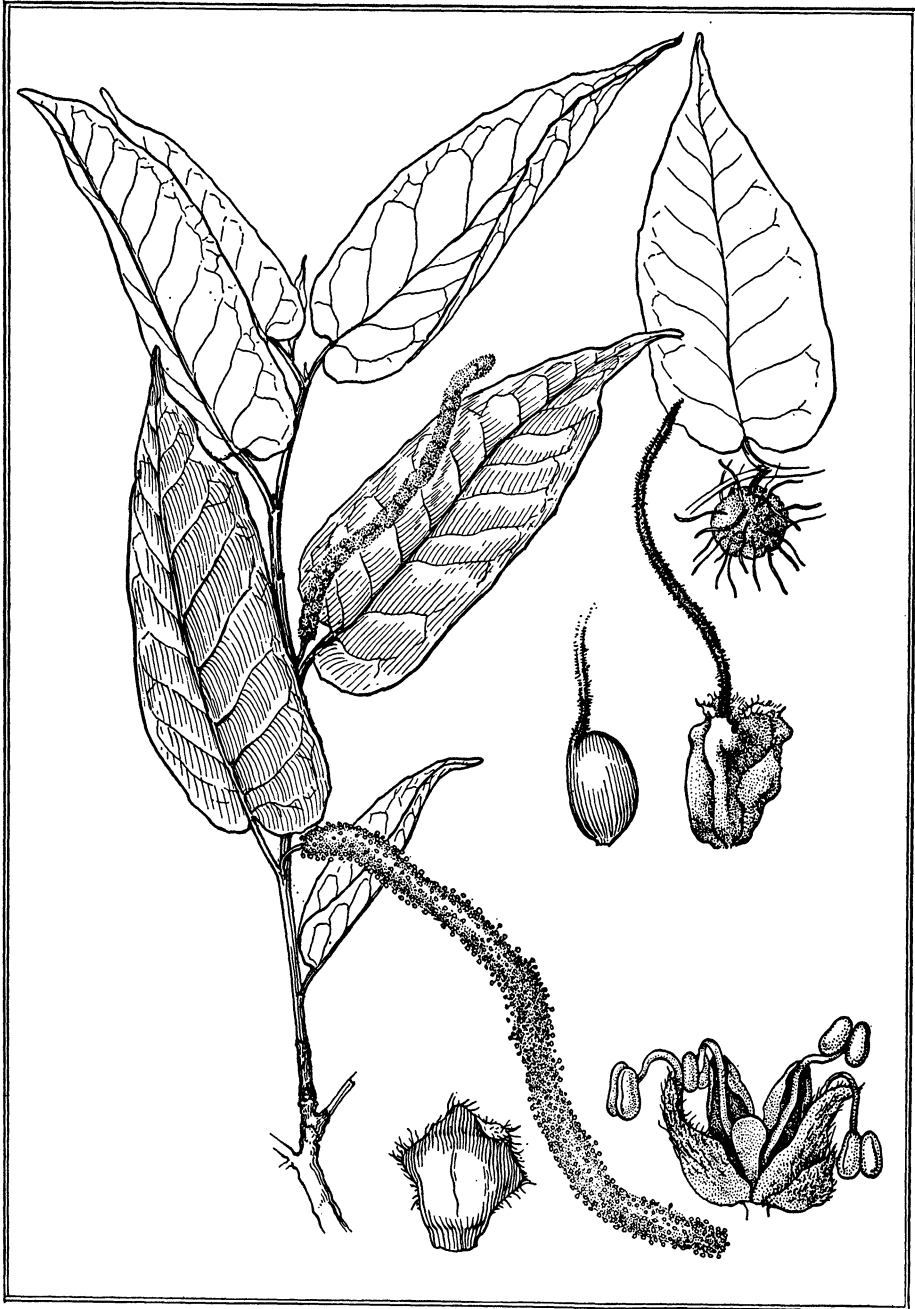


Fig. 36. *Chlorophora tinctoria*

(157)

## 1. CHLOROPHORA TINCTORIA (L.) Gaud. Bot. Voy. Freycinet 508. 1830.

- Morus tinctoria* L. Sp. Pl. 986. 1753.  
*Morus xanthoxylon* L. Syst. Nat. ed. 10. 2:1267. 1759.  
*Broussonetia tinctoria* (L.) HBK. Nov. Gen. & Sp. 2:32. 1817.  
*Broussonetia plumerii* Spreng. Syst. Veg. 3:901. 1826.  
*Morus tataiba* Vell. Fl. Flum. 10: t. 21. 1827.  
*Maclura tinctoria* (L.) D. Don, ex Steud. Nomencl. ed. 2. 2:87. 1841.  
*Maclura plumeria* D. Don, ex Steud. loc. cit. 1841.  
*Morus plumeria* (D. Don) Burm. ex Steud. loc. cit. 1841.  
*Broussonetia xanthoxylon* (L.) Mart. in Flora 24: 2 Beibl. 10. 1841.  
*Broussonetia brasiliensis* Mart. loc. cit. 1841.  
*Maclura sempervirens* Ten. Cat. Hort. Bot. Nap. 87. 1845.  
*Maclura xanthoxylon* (L.) Endl. Gen. Pl. Suppl. 4<sup>2</sup>:34. 1847.  
*Maclura chlorocarpha* Liebm. in Danske Vidensk. Selsk. Skr. 5 ser. 2:314. 1851.  
*Maclura polyneura* Miq. in Mart. Fl. Bras. 4<sup>1</sup>:154. 1853.  
*Maclura affinis* Miq. loc. cit. 155. 1853.  
*Maclura subintegerrima* Miq. loc. cit. 157. 1853.  
*Maclura velutina* Bl. Mus. Bot. Lugd.-Bat. 2:82. 1856.  
 also numerous infraspecific epithets.

Trees, reputedly to 30 m. in height. Leafy twigs rather slender, somewhat flexuose, glabrous, developing a yellowish gray bark. Leaves alternate, distichous, petiolate, the blade quite variable, broadly oval to ovate, obovate or oblong, the tip usually subcaudate-acuminate, the base usually strongly inequilateral and more or less cordate, closely serrate to entire, 3–12 cm. long, 2–6 cm. broad, firmly membranaceous, glabrous to minutely puberulent above and below, the petiole 5–10 mm. long, slender; stipules lateral, leaving a scar about half-surrounding the stem or less, narrowly lanceolate, 2–10 mm. long. Staminate spikes slender, 3–10 cm. long, bearing innumerable densely congested flowers interspersed with minute puberulent spatulate glandular-carinate bracteoles about 6 mm. long: tepals 4, broadly oval, minutely puberulent, about 3 mm. long; stamens 4, the filaments about 5 mm. long, strongly involute before anthesis, the anthers broadly oval, about 1.5 mm. long; pistillode about 1 mm. long. Pistillate heads globose, about 1 cm. in diameter, very shortly pedunculate, the flowers very densely congested and interspersed with spatulate glandular-carinate bracteoles about 6 mm. long: tepals 4, narrowly spatulate, about 6 mm. long, minutely puberulent; ovary superior, obovoid, about 4 mm. long, the lateral filiform densely papillate stigma about 10 mm. long. Fruit a very slightly fleshy, globose aggregate to about 2 cm. in diameter.

Southern Mexico to Argentina; Antilles, at low elevations. *Mora* or *morillo* and *macano*; fustic. The wood is extremely durable and resistant to insects and decay according to Allen (Allen, P. H. The Rainforests of Golfo Dulce. Gainesville, Fla. 1956).

CANAL ZONE: between France Field and Catival, *Standley* 30301; Balboa Heights, *Killip* 3000; Darién Sta., *Standley* 31600. CHIRIQUÍ: Puerto Armuelles, *Woodson & Schery* 899, *Stern & Chambers* 136; Progreso, *Cooper & Slater* 237. DARIÉN: Garachiné, *Pittier* 5695. PANAMÁ: Las Sabanas, *Zetek* 3684; Panamá, *Standley* 26833; Río Tapía, *Standley* 28200; Río Tecumen, *Standley* 29381; Chepo, *Pittier* 4710.

## 2. TROPHIS P. Br.

TROPHIS P. Br. Hist. Jam. 357. 1756; L. Syst. Nat. ed. 10. 1289. 1759, nom. conserv.

*Bucephalon* L. Sp. Pl. 1190. 1753, nom. rejic.

*Skutchia* Pax & Hoffm. ex Morton, in Journ. Wash. Acad. Sci. 27:306. 1937.

Dioecious trees and shrubs, the branches unarmed. Leaves alternate, distichous; stipules lateral. Both staminate and pistillate inflorescences secund racemes and spikes, the small congested or relatively distant flowers interspersed with small, shortly stipitate, peltate bracts. Staminate flowers: tepals 4, united or essentially free to the base, with an obvious pistillode; stamens 4, the filaments much longer than the tepals and strongly inflexed before anthesis, later sharply reflexed, the anthers broadly oval, introrse. Pistillate flowers epigynous; tepals 4, minute; style central and deeply 2-lobed. Fruit a small fleshy 1-seeded drupe.

About 6 species ranging from southern Mexico to the Amazon basin, and in the Antilles. *Trophis chorizantha* Standl., with less congested staminate spikes and racemose pistillate inflorescences is to be expected in western Panama.

## 1. TROPHIS RACEMOSA (L.) Urb. Symb. Ant. 4:195. 1905.

*Bucephalon racemosum* L. Sp. Pl. 1190. 1753.

*Trophis americana* L. Syst. Nat. ed. 10. 1289. 1759.

*Trophis americana*  $\beta$  *ramon* Bur. et  $\gamma$  *meridionalis* Bur. in DC. Prodr. 17:253. 1873.

*Sabagunia urophylla* Donn. Sm. in Bot Gaz. 40:11. 1905.

Trees to about 15 m. in height. Leafy twigs rather slender, somewhat flexuose, glabrous, developing a yellowish gray bark. Leaves alternate, distichous, petiolate, the blade broadly oval to elliptic-oblong, occasionally irregularly pandurate, the tip subcaudate-acuminate, the base essentially equilateral and rounded to broadly obtuse, entire or somewhat serrate-undulate toward the tip, 6–20 cm. long, 2–9 cm. broad, firmly membranaceous, glabrous, the petiole 5–7 mm. long; stipules lateral, narrowly lanceolate, about 5 mm. long. Staminate spikes slender, 3–5 cm. long, bearing innumerable densely congested flowers interspersed with minute shortly stipitate peltate bracts: tepals 4, somewhat united at the base, broadly oval, about 2 mm. long, minutely papillate; stamens 4, the filaments about 3 mm. long, the anthers about 0.5 mm. long. Pistillate spikes rather short and strongly secund, 1.0–1.5 cm. long, densely and minutely ferruginous-puberulent, bearing rather few and distant sessile truncate conic flowers about 2 mm. long: perianth lobes minutely trigonal; stigma lobes about 1.5 mm. long. Fruits globose or ovoid, up to about 1 cm. long, reddish or yellowish, minutely puberulent.

Southern Mexico to the Amazon basin. *Ojoche macho*, *lechosa*, *ramón*, *gallote*, *morillo*; breadnut.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater*, 4, 4a, *Seibert* 1581, 1583; *Almirante*, *Cooper* 349; Old Bank Island, *Von Wedel* 2075; Water Valley, *Von Wedel* 1599; Río Cricamola between Finca St. Louis and Konkintoë, *Woodson, Allen & Seibert* 1924. CANAL ZONE: Barro Colorado Island, *Standley* 41080, 41082; Culebra, *Pittier* 2255, 3627; between France Field and Catival, *Standley* 30296, 30235; Gamboa, *Pittier* 6636, 6637, 6652; Río Pedro Miguel, near East Paraíso, *Standley* 29963; Gatún, *Standley* 27287; Fort Sherman, *Standley* 30970. CHIRIQUÍ: San Bartolomé, *Woodson & Schery* 866.



Fig. 37. *Trophis racemosa*

## 3. SOROCEA A. St.-Hil.

By WILLIAM C. BURGER

SOROCEA A. St.-Hil. in Mem. Mus. Paris 7:473. 1821.

*Pseudosorocea* Baill. in Adansonia 11:296. 1875.*Balanostreblus* Kurz, emend. Hutchinson, in Kew Bull. 1918:152. 1918.

Dioecious trees, the branches unarmed. Leaves alternate, distichous; stipules lateral. Both staminate and pistillate inflorescences racemes and spikes; the small, congested or relatively distant flowers interspersed with small, shortly stipitate, peltate bracts. Staminate flowers: tepals 4, united or essentially free to the base, imbricate in bud, without an obvious pistillode; stamens 4, the filaments about as long as the tepals and scarcely inflexed before anthesis, the anthers broadly oval, extrorse. Pistillate flowers hypogynous to perigynous: tepals 4, completely united or minutely 4-lobed; ovary superior to inferior, the style central and deeply bifid. Fruit a small 1-seeded drupe.

About a dozen species ranging from Costa Rica to Argentina.

- a. Leaves glabrous beneath, narrowly elliptic to elliptic-obovate, rarely over 20 cm. long, on narrow petioles 0.5–1.5 mm. thick; staminate flowers usually pedicellate. .... 1. *S. AFFINIS*
- aa. Leaves generally short-pilose on the veins beneath, broadly elliptic to elliptic-oblong, to 30 cm. long, on petioles 1.5–2.5 mm. thick; staminate flowers sessile. .... 2. *S. PUBIVENA*

## 1. SOROCEA AFFINIS Hemsl. Biol. Centr.-Amer. Bot. 3:150. 1883.

Trees to about 15 m. Leafy twigs rather slender, slightly flexuose, glabrous, developing a yellowish gray bark. Leaves alternate, distichous, petiolate, the blades narrowly elliptic to elliptic-obovate, abruptly subcaudate-acuminate, the base equilateral and acutely cuneate, more or less serrate-undulate toward the tip, 6–20 cm. long, 2–8 cm. broad, firmly membranaceous, glabrous, the petiole about 2–10 mm. long; stipules narrowly lanceolate, about 5 mm. long. Staminate racemes 2–8 cm. long, bearing numerous rather closely spaced flowers interspersed with minute peltate bracts, minutely puberulent-papillate: tepals 4, somewhat united at the base, broadly oval, about 2 mm. long. Pistillate raceme rather short, 1–3 cm. long, elongating in fruit, minutely puberulent-papillate, bearing 8 or more shortly pedicellate flowers about 2 mm. long, the perianth thickened above the middle of the flower. Drupes subglobose, about 8 mm. broad, green with orange tip or bright red when fully mature.

Presently known only from lowland forests of Panama but probably extending south into Colombia.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel* 1103, 1390; Water Valley, *Von Wedel* 598A, 961, 1715; Almirante, *Cooper* 554. CANAL ZONE: Quebrada Melgada, *Steyermark* 17494; Gatún, *Johnston* 1582, 1693; Gamboa, *Standley* 28412; Las Cruces, *Seibert* 576; Barro Colorado Island, *Aviles* 26, 52, 84, *Seibert* 566, *Bailey & Bailey* 538, *Starry* 314, *Woodworth & Vestal* 323, *Bangham* 558, 479, *Salvoza* 966, *Standley* 40797, 41053; Trinidad River, *Pittier* 4034. CHIRIQUÍ: El Boquete, *Pittier* 3045. COCLÉ: El Valle, *Seibert* 464. COLÓN: Fató (Nombre de Dios), *Pittier* 3856; Palenque, *Pittier* 4123. DARIÉN: Ensenada Guayabo, *Stern & Chambers* 180. PANAMÁ: Arraiján, *Woodson, Allen & Seibert* 1383; Taboga Island, *Hayes* 658.

Fig. 38. *Sorocea affinis*2. *SOROCEA PUBIVENA* Hemsl. Biol. Centr.-Amer. Bot. 3:150. 1883.*Trophis macrostachya* Donn. Sm. in Bot. Gaz. 40:10. 1905.*Clarisia mollis* Standl. in Ann. Missouri Bot. Gard. 30:85. 1943.

Trees to about 20 m. Leafy twigs rather thick (2–4 mm.), short-pubescent becoming glabrescent. Leaves alternate, distichous, petiolate, the blade broadly elliptic to elliptic-oblong, caudate-acuminate, the base equilateral and obtusely cuneate, entire to serrate-undulate, 10–30 cm. long, 5–10 cm. broad, firmly membranaceous, shortly pubescent beneath, the petiole about 8–20 mm. long; stipules narrowly acute, 6–8 mm. long. Staminate spikes 5–12 cm. long bearing numerous sessile flowers interspersed with minute peltate bracts; tepals 4, somewhat united at the base, about 2 mm. long, filaments broad and slightly connate at their base. Pistillate racemes short, elongating in fruit to 14 cm. bearing numerous flowers about 2 mm. long, the perianth thickened above, adnate to the ovary for about half its length. Drupes subglobose to ovoid, about 10 mm. broad.

Costa Rica to Panama.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *Von Wedel 1090* (Type of *Clarisia mollis* Standl.); Almirante, *Cooper & Slater 28*. CHIRIQUÍ: Progreso, *Cooper & Slater 174*; vicinity of Gualaca, *Allen 5059*.

## 4. CLARISIA R. &amp; P.

CLARISIA R. & P. Prodr. Fl. Peruv. & Chil. 128. 1794.

*Sabagunia* Liebm. in Kon. Danske Vidensk. Selsk. 2:316. 1851.

*Soaresia* Fr. Allem. in Arch. Palestr. Scientif. Rio Jan. 1:142. 1858.

*Acanthimophyllum* Fr. Allem. in Rev. Brazil. 1:368. 1858.

Dioecious trees, the branches unarmed. Leaves alternate, distichous; stipules lateral. Both staminate and pistillate inflorescences secund racemes and spikes, or the pistillate subcapitate or in some species reduced to paired or solitary axillary flowers, bearing small, shortly stipitate, peltate bracts as in *Tropis* and *Sorocea*. Staminate flowers with a single stamen and an indefinite vestigial perianth, the anther broadly oval. Pistillate flowers epigynous, with 4 minute superior perianth lobes and an inconspicuous but persistent basal involucre of several peltate bracteoles, the style central and deeply 2-lobed. Fruit a small 1-seeded drupe.

About 8 species ranging from southern Mexico to Brazil and Peru according to Lanjouw (in Rec. Trav. Bot. Néerl. 33:254. 1936.).



Fig. 39. *Clarisia panamensis*

1. *CLARISIA panamensis* Woodson, spec. nov.

Arbores usque ca. 10 m. altitudine attigentes ramulis sat validis glabris maturitate cortice tenue brunneo-griseo tectis. Folia alternata disticha lamina late obovato-elliptica apice obtuse subcaudato-acuminata basi obtusa 10–15 cm. longa 5–7 cm. lata membranacea glabra margine integra venis utroque latere ca. 10–12 petiolo valido ca. 1 cm. longo; stipulis lateralibus anguste lanceolatis ca. 1 cm. longis. Inflorescentiae femineae racemosae usque ca. 6-florae rhachide in fructu ca. 2 cm. longo glabro floribus ignotis. Inflorescentiae ac flores masculae ignotae. Fructus brevissime pedicellati late obovoideo-ellipsoidei ante maturitate usque 2.5 cm. longi 1 cm. crassi apice styli lobis persistentibus linearibus recurvatis ornati basi bracteis involucreatis peltatis pluribus minutissime puberulis cincti.

COCLÉ: region north of El Valle de Antón, alt. 1000 m., September 27, 1946, P. H. Allen 3741 (MO, HOLOTYPE).

This species keys to the general relationship of *C. colombiana* (Rusby) Lanj. in Lanjouw's treatment. The latter is known only from a single staminate specimen



Fig. 40. *Clarisia mexicana*

(*H. H. Smith 424*) which has smaller, narrowly obovate, strikingly caudate leaves. The fruits of *C. panamensis* differ both in shape and in size from those of any other *Clarisia* presently known.

Also to be expected in western Panama is *C. mexicana* (Liebm.) Lanj., which is known from the Golfo Dulce region of Costa Rica. It may be distinguished readily from *C. panamensis* by its rather narrowly oblong leaves and small globose fruits.

##### 5. BROSIMUM Sw.

*BROSIMUM* Sw. Prodr. Veg. Ind. Occ. 12. 1788, nom. conserv.

*Alicastrum* P. Br. Hist. Jam. 372. 1756, nom. rejic.

*Piratinera* Aubl. Hist. Pl. Guian. Fr. 2:888. 1775, nom. rejic.

*Galactodendrum* Humb. Relat. Hist. 2:108. 1819.

*Brosimopsis* S. Moore, in Trans. Linn. Soc. 2 ser. 4:473. 1895.

Monoecious or perhaps occasionally dioecious trees. Leaves alternate, distichous; stipules lateral to fully amplexicaul. Inflorescences globular to turbinate,

typically monoecious with 1-2 central pistillate flowers surrounded by numerous minute staminate commingled with more or less conspicuous peltate bracts, but infrequently dioecious. Pistillate flowers: epigynous, the perianth vestigial, the stigma deeply 2-lobed and apparently proterogynous. Staminate flowers with a definite 4-lobed perianth or the perianth vestigial or lacking; stamens 4, 2 or 1, the anthers oblongoid and basifixed to circular and peltate, dehiscing longitudinally to circumscissily. Fruit a false drupe.

Probably about 24 species ranging from southern Mexico to Argentina, and in the Antilles. A genus most interesting in its floral modifications and very badly in need of revision, as are most *Moraceae*.

The first three species of the enumeration which follows would be referable to *Brosimopsis* if a narrow generic concept were followed consistently in this treatment. I have indicated in a previous paragraph that I am not in sympathy with such a view and follow it in other instances merely in deference to previously established custom. In this case, however, custom is not greatly involved. Amongst the Panamanian genera of *Moraceae* alone no less than four parallel reductions of the male flowers to a vestigial perianth and a single stamen may be observed: *Trophis* → (*Sorocea*) → *Clarisia*; *Brosimopsis* → *Brosimum*; *Perebea* → *Castilla*; *Olmedia* → *Pseudolmedia*.

The eight Panamanian species also show a most interesting transition in the structure of the anther from a rather commonplace basifixed type with longitudinal dehiscence to a most unusual peltate body with perfectly symmetrical circumscissile dehiscence, aptly described by Aublet (loc. cit. sub *Piratinera*) as "*en forme de champignons*". The series is illustrated in the accompanying figures.

In the following text two new Costa Rican species are described, since they have been collected only a few miles from the Panamanian border and probably will yet be discovered in our flora.

- a. Flowers not wholly concealed before anthesis by the weakly expanded, long-stipitate peltate bracts, with a conspicuous perianth and 2-4 stamens with oblongoid basifixed anthers; heads globose; stipules lateral, their scars about half-surrounding the stem (except *B. allenii*).
- b. Stipules lateral; leaves membranaceous, oblong to obovate-oblong; flowering peduncles slender, almost as long as the rather small and delicate heads or somewhat longer; flowers with essentially equal tepals and 2-4 stamens.
- c. Leaves relatively large, 2- to 3-times as long as broad, glabrous; anthers setose-appendiculate; fruits relatively large, the seed about 2 cm. long..... 1. *B. OJOCHÉ*
- cc. Leaves relatively small, 3- to 4-times as long as broad, softly white-tomentellous beneath; anthers exappendiculate; fruits relatively small, the seed about 1 cm. long..... 2. *B. COSTARICANUM*
- bb. Stipules almost fully amplexicaul, their scars almost completely surrounding the stem; leaves rather heavily coriaceous, ovate-elliptic; flowering peduncles stout, much shorter than the massive heads; flowers with strongly unequal tepals and 2 stamens..... 3. *B. ALLENI*
- aa. Flowers wholly concealed before anthesis by the strongly expanded, shortly stipitate peltate bracts, with a vestigial or obsolete perianth and 1 stamen with a nearly circular anther; stipules almost fully amplexicaul, their scars nearly surrounding the stem (except *B. guianense*).
- b. Stipules lateral, about 3-5 mm. long; heads obconic or turbinate..... 4. *B. GUIANENSE*
- bb. Stipules almost fully amplexicaul; heads globose.

- c. Stipules 1.5–3.0 cm. long; flowering peduncles stout; anthers obliquely inserted on the filament, clearly longitudinal in dehiscence. .... 5. *B. UTILE*
- cc. Stipules 5–10 mm. long; flowering peduncles slender; anthers peltately inserted on the filament, circumscissile in dehiscence or falsely so.
- d. Anthers excentrically peltate, dehiscing by 2 basal valves; leaves elliptic-obovate. .... 6. *B. BERNADETTEAE*
- dd. Anthers centrally peltate, dehiscing circumscissily.
- e. Leaves oval to oblong-elliptic, obtuse to shortly subcuspidate-acuminate; peduncles about as long as the flowering heads to somewhat shorter. .... 7. *B. ALICASTRUM*
- ee. Leaves broadly ovate to oblong-ovate, narrowly subcaudate-acuminate; peduncles much longer than the flowering heads. 8. *B. TERRABANUM*

1. *BROSIMUM ojoche* Woodson, spec. nov.

Arbores magnae usque 35 m. altae ut dicitur, ramulis sat tenuibus glabris. Foliorum lamina oblonga vel obovato-oblonga apice obtuse acuminata basi late obtusa ca. 9–18 cm. longa 4–7 cm. lata firme membranacea glabra, petiolo 5–15 mm. longo; stipulis lateralibus ovato-lanceolatis 5–7 mm. longis cicatrice ramulum ca. dimidia cingenti. Inflorescentiae capituli usque 5–7 mm. pedunculati globosi ca. 1 cm. diametro metientes nostri prosus masculi an semper dioeci; florum masculorum tepalis 4 subliberis aequalibus ca. 1.5 mm. longis, staminibus 4 valde exsertis antheris oblongoideis apice setoso-appendiculatis basifixis longitudinaliter dehiscentibus ca. 1 mm. longis. Flores feminei ignoti. Fructus globosi ultra 2.5 cm. diam. metientes semine ca. 2 cm. longo.

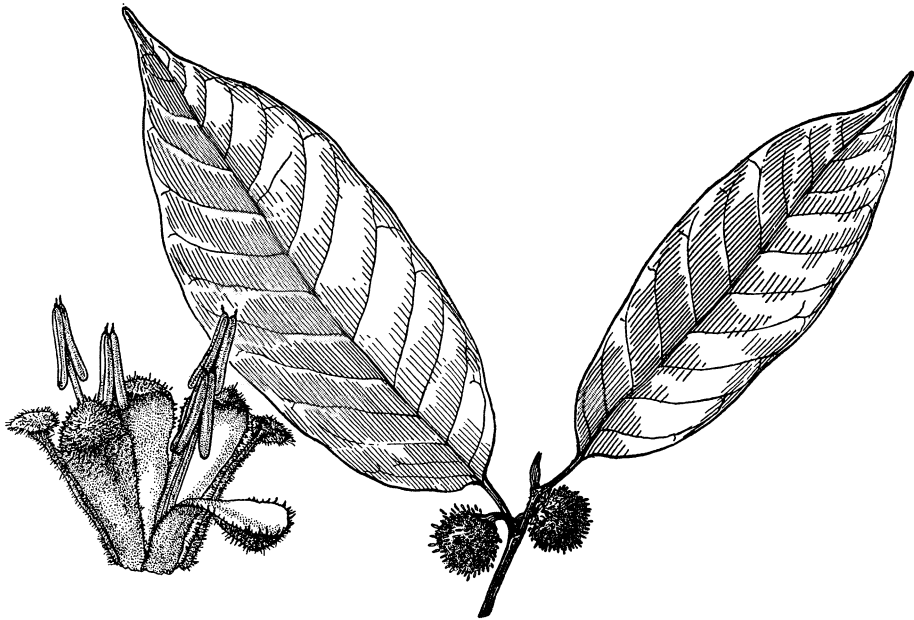


Fig. 41. *Brosimum ojoche*

COSTA RICA: CARTAGO: forêts de Turrialba, alt. 570 m., *Tonduz 8338* (US); pâturages de Turrialba, alt. 650 m., *Nuñez 16353* (US); PUNTARENAS: Esquinas forest, region between Río Esquinas and Palmar Sur de Osa, alt. 75 m., Jan. 30, 1951, *P. H. Allen 5809* (US, HOLOTYPE); Hacienda Liscano, vallée du Barú, alt. 0 m., *Pittier 12082* (US).

A northern extension of *B. ojoche* may be represented by five specimens from British Honduras which are discussed briefly under *B. terrabanum*.

This species and two which follow, although at present known only from Costa Rica, have been collected so close to the Panamanian border that it seems quite likely that sooner or later they will be found in Panama. The Allen specimen was identified previously as *B. terrabanum* Pittier, while the Nuñez and Brenes specimens were determined as *B. costaricanum* Liebm. by Pittier, who himself included his own collection within *Helicostylis montana* Pittier which, as it happens, is synonymous with true *Brosimum costaricanum*. It is curious that Pittier, although particularly interested in *Brosimum*, twice described species of that genus as species of *Helicostylis*, a genus which has yet to make its appearance in Central America as far as I am aware.

*Brosimum ojoche*, the specific epithet of which is taken from the vernacular name noted upon three of the cited sheets, is easily distinguished from *B. costaricanum* by the characters of the key. It appears more than somewhat questionable to me that the specimens from Cartago and those from Puntarenas could reasonably represent a single species but the foliage of the four sheets is strikingly similar. The Allen specimen is in flower while the three others are in fruit (in a rather pitiful state of disintegration).

2. *BROSIMUM COSTARICANUM* Liebm. in K. Dansk. Vidensk. Selsk. Skr. ser. 5. 2:334. 1851.

*Helicostylis montana* Pittier, in Contrib. U. S. Nat. Herb. 20:96. 1918.

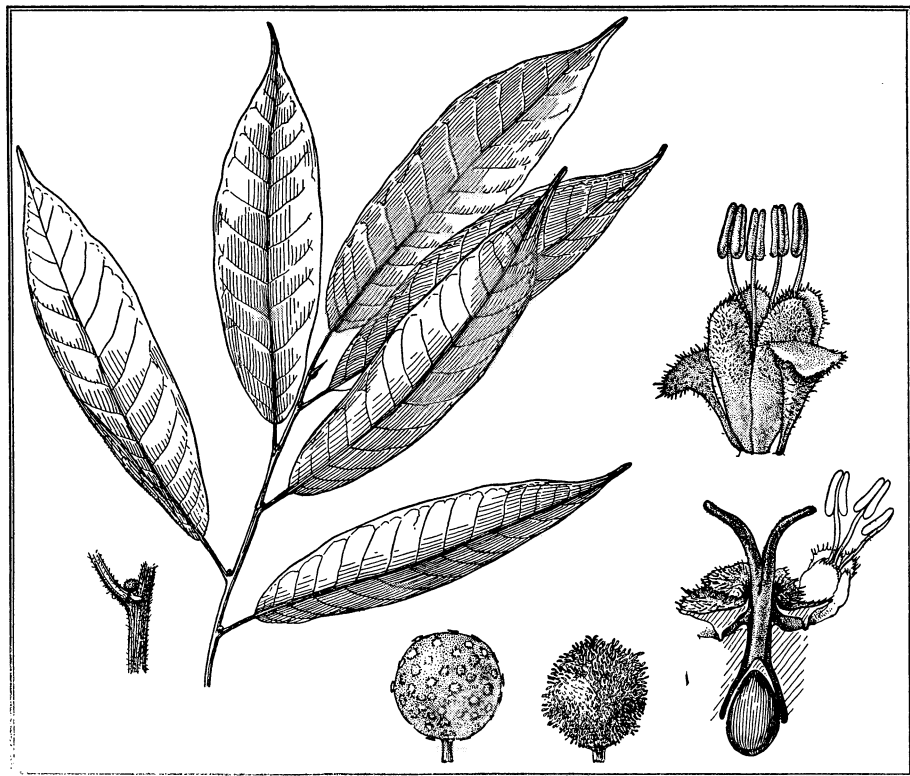
*Brosimum sapiiifolium* Standl. & L. Wms. in Ceiba 3:40. 1952.

Trees up to 30 m. tall, the younger twigs relatively slender, softly white-puberulent to glabrate. Leaves relatively small, rather narrowly obovate-oblong, the tip rather abruptly subcaudate-acuminate, the base obtuse or rounded, 8–18 cm. long, 2–4 cm. broad, membranaceous, softly white-tomentellous or puberulent on the veins beneath; petioles about 5 mm. long. Inflorescences possibly dioecious, globose, the staminate with peduncles about 1 cm. long, very slender, about 1 cm. in diameter. Staminate flowers: tepals 5, nearly free and essentially equal, about 2 mm. long; stamens 3–4, widely exerted, the anthers basifixed, oblongoid, about 1 mm. long. Pistillate flowers presently unknown. Nearly mature fruits globose, about 1.5 cm. in diameter, with persistent peltate bracts, the seed about 1 cm. long.

Costa Rica and Panama, in lowland forests.

CHIRIQUÍ: Paso de Quebrada Gato, between Hato Jobo and San Félix, *Pittier 5426*; Progreso, *Cooper & Slater 188*.

*Brosimum ramonense* Standl. of eastern Costa Rica, which may be expected in western Panama, differs from *B. costaricanum* chiefly in the scant and appressed ferruginous pubescence of the leaves.

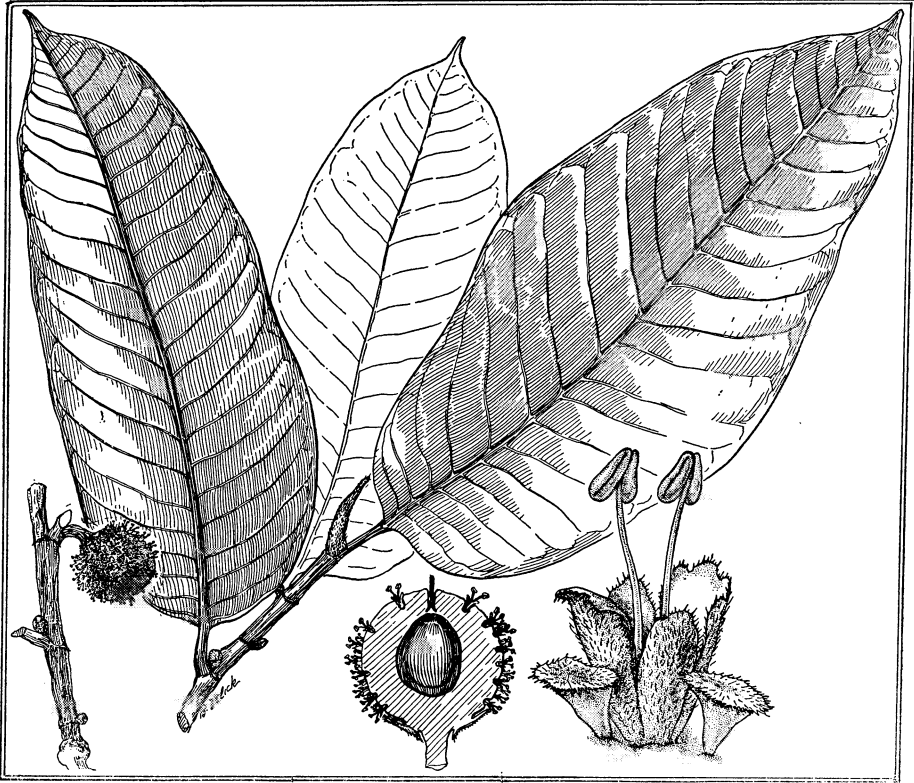
Fig. 42. *Brosimum costaricanum*

### 3. *BROSIMUM allenii* Woodson, spec. nov.

Arbores magna ut dicitur usque ca. 40 m. altitudine attingentes vulgo *palo de vaca* incolarum appellatur quod latice potabili, ramulis crassiusculis internodiis congestis glabris. Folia late ovato-elliptica abrupte brevissime acuminata basi rotunda 9–20 cm. longa 5–12 cm. lata coriacea omnino glabra, petiolis crassis ca. 1.5 cm. longis; stipulis amplexicaulibus ovatis longe acuminatis ca. 1.5 cm. longis cicatrice ramulum transverse cingenti. Inflorescentiae globosi ca. 1.5 cm. diam. metientes nostri monoici flore unico feminei cum masculis floribus multis, pedunculo crasso perbrevis ca. 8 mm. longo; florum masculorum tepalis 5 inaequalibus ca. 1 mm. longis, staminibus 2 valde exsertis antheris oblongoideis basifixis longitudinaliter dehiscentibus ca. 1 mm. longis. Fructus non visi.

COSTA RICA: PUNTARENAS: Esquinas forest, region between Río Esquinas and Palmar Sur de Osa, alt. 75 m., Jan. 30, 1951, P. H. Allen 5813 (US, HOLOTYPE).

Mr. Allen reports that the latex of this species, which he associated with *B. utile*, the famous "cow tree" first discovered by von Humboldt, is "of good flavor, rather like condensed milk, good in coffee." I believe that *B. allenii* is sufficiently distinguishable from true *B. utile* through the characters of the preceding key.

Fig. 43. *Brosimum allenii*

4. *BROSIMUM GUIANENSE* (Aubl.) Huber, in Bull. Mus. Goeldi 5:337. 1909.

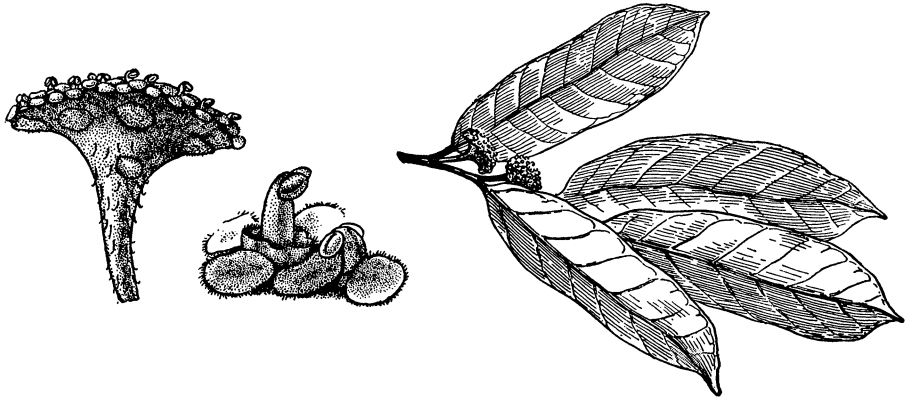
*Piratinera guianense* Aubl. Hist. Pl. Guian. Fr. 2:888; 4: t. 340. 1775.

*Piratinera panamensis* Pittier, in Contrib. U. S. Nat. Herb. 20:100. pl. 7. 1917.

*Brosimum panamense* (Pittier) Standl. & Steyerl. in Field Mus. Publ. Bot. 23:40. 1944.

Trees to about 25 m. tall, essentially glabrous throughout. Leaves oblong-obovate, abruptly and obtusely acuminate to subcuspidate, the base broadly obtuse to rounded, entire, 5–12 cm. long, 2.5–4.0 cm. broad, firmly membranaceous, the petiole about 5 mm. long; stipules lateral, about 5 mm. long. Heads broadly obconic to turbinate, usually somewhat lobed or convolute, about 7–10 mm. broad, the slender peduncle about 1.0–1.5 cm. long. Staminate flowers with a low vestigial perianth and 1 stamen with a rather thick filament about 2 mm. long and an obliquely inserted broadly oval anther up to 1 mm. long, associated with suborbicular shortly-stipitate peltate bracts. Pistillate flowers 1–3. Mature fruit unknown.

British Honduras to Venezuela, in lowland forests.

Fig. 44. *Brosimum guianense*

SAN BLAS: Puerto Obaldía, *Pittier 4336*.

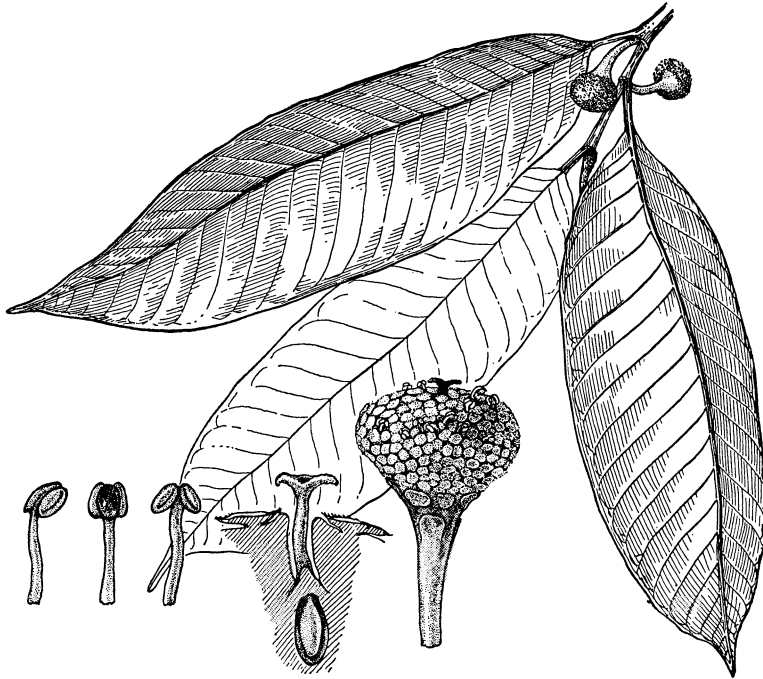
A photograph of Aublet's collection at the British Museum shows that Pittier was correct in associating *P. panamensis* with *P. guianensis*; they probably are conspecific. *Pittier 4336* is represented in the U. S. National Herbarium by three sheets, each with several inflorescences. I have been unable to detect the plural pistillate flowers which Pittier considered so important in maintaining *Piratinera* distinct from *Brosimum*, either in the remnants of the inflorescences which Pittier himself supposedly dissected or in an additional one which I dissected myself. One head, however, does indeed appear to be pistillate (without external evidence of staminate flowers), but I have not had the temerity to dissect it. Here, as in other species of *Brosimum* in Panama, the heads would appear frequently to be unisexual. As Standley expresses it pointedly in the cited references, "In typical *Brosimum* there is only one pistillate flower, in *Piratinera* two; but with ordinary herbarium specimens it is difficult to find even one pistillate flower, to say nothing of discovering two, and the difference is at least not a practical one."

5. *BROSIMUM UTILE* (HBK.) Pittier, in *Contrib. U. S. Nat. Herb.* 20:102. 1918.

*Galactodendrum utile* HBK. *Nov. Gen. & Sp.* 7:163. 1825.

*Brosimum galactodendron* D. Don, in *Sweet, Hort. Brit. ed. 2.* 462. 1830.

Trees 20–25 m. in height, with young twigs rather stout and with rather close internodes, minutely and indefinitely puberulent when young, eventually developing a rather thick periderm. Leaves rather broadly oblong, abruptly and acutely acuminate, rounded at the base, 10–25 cm. long, 3–10 cm. broad, subcoriaceous, sparsely puberulent to glabrate, the petioles stout, 5–15 mm. long; stipules amplexicaul, lanceolate, long-acuminate, 2–3 cm. long, pilosulose, leaving oblique scars nearly encircling the stem. Inflorescences globose, monoecious, about 1 cm. in diameter, the peduncle of about equal length, rather stout, staminate flowers: without an obvious perianth and with a single stamen with a broadly oval anther

Fig. 45. *Brosimum utile*

obliquely affixed to the filament, obviously longitudinal in dehiscence. Fruit depressed-globose, 2.0–2.5 cm. in diameter.

Costa Rica to Colombia.

SAN BLAS: hills of Sperdí, near Puerto Obaldía, *Pittier 4345, 4418*.

This is von Humboldt's "cow tree" (*palo de vaca*) with potable latex.

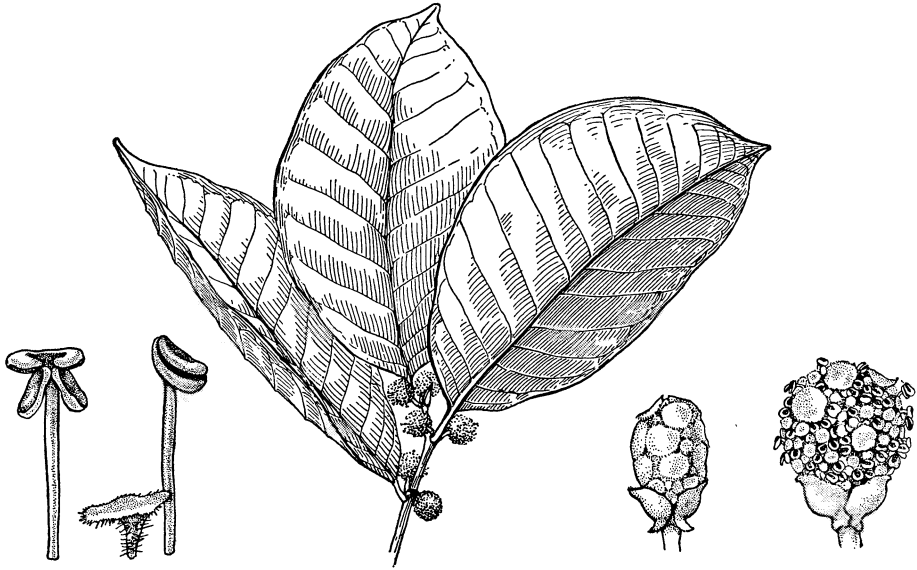
6. *BROSIMUM bernadetteae* Woodson, nom. nov.

*Helicostylis latifolia* Pittier, in *Contrib. U. S. Nat. Herb.* 20:95. 1914, non *Brosimum latifolium* Standl. in *Trop. Woods* 42:26. 1935.

Trees to about 25 m. tall, the branches grayish brown, inconspicuously puberulent to glabrate. Leaves elliptic-obovate, broadly acuminate-subcuspidate to obtuse or rounded at the tip, broadly cuneate to rounded at the base, 6–12 cm. long, 3–6 cm. broad, with about 12–18 pairs of rather crowded veins, subcoriaceous, glabrous, the petioles about 4–7 mm. long; stipules almost fully amplexicaul, about 5–7 mm. long. Inflorescences subglobose, ours staminate, about 5 mm. in diameter at anthesis, the peduncle about 4–5 mm. long. Staminate flowers without an obvious perianth; stamen 1, the anther excentrically peltate, about 1 mm. in diameter, dehiscing by 2 basal valves. Pistillate flowers and fruit unknown.

Panama, in lowland forests.



Fig. 46. *Brosimum bernadetteae*

CANAL ZONE: Barro Colorado Island, *Standley 41156, Kenoyer 662*. DARIÉN: Yaviza, *Pittier 6584*. PANAMÁ: Alhajuela, Chagres Valley, *Pittier 3488*.

This species so closely resembles *B. alicastrum* that the slight but very significant difference in the structure on the anthers had escaped me until it was called to my attention by our artist for the FLORA OF PANAMA, Mrs. Bernadette Velick. Nevertheless, the difference also apparently was noticed by Pittier and its significance over-emphasized as the synonymy testifies. Mrs. Velick was unable to detect the perianth segments described by Pittier, nor could I.

After an examination of the type specimen of *B. latifolium* Standl. (*Eggers 15721*, F), which bears a single immature pistillate head, I have concluded that it should be referred to *B. alicastrum* Sw.

7. *BROSIMUM ALICASTRUM* Sw. Prodr. Veg. Ind. Occ. 12. 1788.

*Brosimum latifolium* Standl. in Trop. Woods 42:26. 1935.

Trees to about 30 m. tall, the young branches slender, grayish brown, glabrous or essentially so. Leaves oval to oblong-elliptic, obtuse to shortly subcuspidate-acuminate at the tip, broadly obtuse to rounded at the base, 5–15 cm. long, 2–6 cm. broad, with about 12–18 pairs of slender veins, firmly membranaceous, glabrous, the petioles about 5–7 mm. long; stipules almost fully amplexicaul, about 5 mm. long. Inflorescences subglobose, monoecious or dioecious, 3–6 mm. in diameter at anthesis, the peduncle slender, about as long as the heads or somewhat shorter. Staminate flowers with a very indefinite vestigial perianth; stamen 1, the anther circular,

Fig. 47. *Brosimum alicastrum*

centrally peltate and dehiscing circumscissily, about 1 mm. in diameter. Fruit about 1.5 cm. in diameter.

Southern Mexico to Ecuador; Cuba and Jamaica, at low elevations.

CHIRIQUÍ: Progreso, Cooper & Slater 239, 263.

*Brosimum bernadetteae*, *B. alicastrum* and *B. terrabanum* appear to be well founded upon the basis of flower and inflorescence structure, but the leaves are not particularly distinctive. At the present time it is difficult to define their natural ranges not only because of the rather few fertile specimens available in herbaria but also because of the large number of sterile specimens labeled either as *B. alicastrum* or *B. terrabanum* which add considerable confusion and would much better have been left upon the trees.

8. *BROSIMUM TERRABANUM* Pittier, in Contrib. U. S. Nat. Herb. 18:69. 1914.

*Piratinera terrabana* (Pittier) Lundell, in Carnegie Inst. Wash. Publ. 478:208. 1937, as to basynym, not as to specimens cited.

Trees up to about 25 m. tall, the young branches moderately stout, reddish brown, indefinitely pilosulose to glabrate. Leaves broadly ovate to oblong-ovate, narrowly subcaudate-acuminate at the tip, broadly obtuse to rounded at the base, 10–25 cm. long, 3–9 cm. broad, with 18–22 pairs of prominent veins, subcoriaceous, glabrous, the petioles quite stout, about 1 cm. long; stipules almost fully amplexicaul, about 1 cm. long, minutely pilosulose. Flowering heads apparently usually dioecious, subglobose, 4–6 mm. in diameter at anthesis, the peduncles very slender, two or three times longer than the heads. Staminate flowers with an indefinite vestigial perianth; stamen 1, the anther circular, centrally peltate, about 1 mm. in diameter, dehiscing circumscissily. Fruit unknown.

Costa Rica and Panama (doubtfully in Guatemala and El Salvador), in lowland forests.

BOCAS DEL TORO: Farm 8, region of Almirante, *Cooper 441*.

Lundell misapplied *B. terrabanum* to include two specimens from British Honduras, *Gentle 1737* and *Schipp 522*, which, together with three others of the same collectors deposited in the herbarium of the Missouri Botanical Garden (*Schipp 1360*; *Gentle 3307, 3440*) appear to me probably to represent a northern extension of *B. ojoche*.

## 6. BATOCARPUS Karst.

BATOCARPUS Karst. Fl. Colomb. 2:67, 1863, emend. Woodson, non sensu Fosberg in Proc. Biol. Soc. Wash. 55:101. 1942.

Dioecious trees. Leaves alternate, distichous; stipules lateral. Staminate inflorescences in discoid involucre heads, the bracts and bracteoles basifixed, not peltate. Pistillate inflorescences in globose heads without involucre bracts nor obvious bracteoles. Staminate flowers with a deeply 4-lobed perianth and 4 stamens with broadly oval longitudinally dehiscent anthers apically attached to the filaments. Pistillate flowers with a fleshy tubular accrescent perianth, the ovary superior and with a central deeply 2-lobed papillate stigma. Fruit a globose rather fleshy syncarp.

Two well-authenticated species, the following and *B. costaricensis* Standl. and L. Wms., which may be expected in western Panama.

### 1. BATOCARPUS ORINOCENSIS Karst. Fl. Colomb. 2:67. *pl. 134*. 1863.

Trees to about 10 m. in height, the young twigs slender, minutely puberulent when very immature, becoming glabrate. Leaves broadly elliptic to oval-obovate, rather abruptly subcaudate-acuminate, broadly obtuse to rounded at the base, 8–20 cm. long, 4–7 cm. broad, entire, membranaceous, glabrous, the petiole slender, about 1 cm. long; stipules about 5 mm. long, narrowly lanceolate. Staminate heads discoid, about 1 cm. in diameter, prominently involucre with several broadly ovate minutely tomentellous bracts about 2 mm. long, the peduncle about 8 mm. long. Pistillate heads globose, about 2 cm. in diameter, the peduncle about 1 cm. long, without a definite involucre.

Panama to Amazonian Colombia and Peru.

BOCAS DEL TORO: Buena Vista Camp on Chiriquí Trail at 1250 ft., *Cooper 601*.

The staminate heads of this specimen (US) indeed superficially resemble those of *Brosimum costaricanum* Liebm. as originally identified, but dissection discloses the absence of the peltate bracteoles essential to *Brosimum*. The shape and size of the leaves and the character of the stipules agree startlingly with the excellent plate of a pistillate specimen of *Batocarpus orinocensis* provided by Karsten, and there appears to me no doubt concerning the identity of the two.



Fig. 48. *Batocarpus orinocensis*  
(Pistillate details after Karsten)

If this be true, our specimen thus provides the first information concerning the staminate structures of the genus, known previously only from Karsten's plate and the citation of an additional pistillate specimen from Peru by Fosberg (loc cit. 1942), since the second species, *Batocarpus costaricensis* Standl. & L. Wms., also is known only from pistillate specimens.

This view is in conflict with that of Fosberg that *Batocarpus* and *Anonocarpus* Ducke, a monotypic genus, are congeneric. *Anonocarpus amazonicus* Ducke (in Archiv. Jard. Bot. Rio Jan. 3:39. 1922) fortunately was described with full details of both staminate and pistillate inflorescences, the former being elongate spikes of naked 1-staminate flowers. Since the pistillate inflorescences of *Batocarpus* and *Anonocarpus* have much in common, as noted by Ducke, it is easy to sympathize with Fosberg's impulse to merge the two. This now becomes less plausible since inflorescence structure is such an inflexible criterion of genera in Moraceae.

*Batocarpus costaricensis*, presently known from western Puntarenas Province, Costa Rica, and to be expected in western Panama, is well distinguished from *B. orinocensis* by the prominently repand-serrate leaves and nearly sessile pistillate heads.

#### 7. PEREBEA Aubl.

PEREBEA Aubl. Hist. Pl. Guian. Fr. 2:952; 4: t. 361. 1775.

*Mikania* Neck. Elem. Bot. 2:217. 1790, non Willd.

Dioecious trees. Leaves alternate, distichous, entire to rather obscurely undulate-serrate toward the tip; stipules fully amplexicaul. Inflorescences axillary, solitary or clustered, involucrate, discoid. Staminate flowers: tepals 4, free or more or less united; stamens 4, nearly included, the anthers broadly oval. Pistillate flowers numerous and all fertile; tepals 4, free or somewhat united, accrescent and somewhat pulpy in fruit but essentially free and united only at the base; ovary superior to subinferior, the style central, the 2 stigma lobes short and broad to narrow and filiform. Fruit a more or less fleshy, weakly united syncarp.

Perhaps 4-6 species from Costa Rica to Brazil and Bolivia. Of the related South American genera may be mentioned *Helicostylis*, which differs from *Perebea* in the exinvolucrate inflorescences, the pistillate being most peculiar in having only one or very few of the epigynous central flowers fertile and the peripheral flowers reduced to a sort of enveloping involucre composed of the accrescent fleshy sterile perianths.

- a. Leaves predominantly cordate or subcordate, the stipules 2-4 cm. long; pistillate heads with approximately 25-50 flowers, 5-6 cm. broad in fruit, the bracts acuminate..... 1. *P. GUIANENSIS*
- aa. Leaves obtuse to rounded at the base, the stipules 5-10 mm. long; pistillate heads with about 5-10 flowers, 2-3 cm. broad in fruit, the bracts obtuse. .... 2. *P. XANTHOCHYMA*

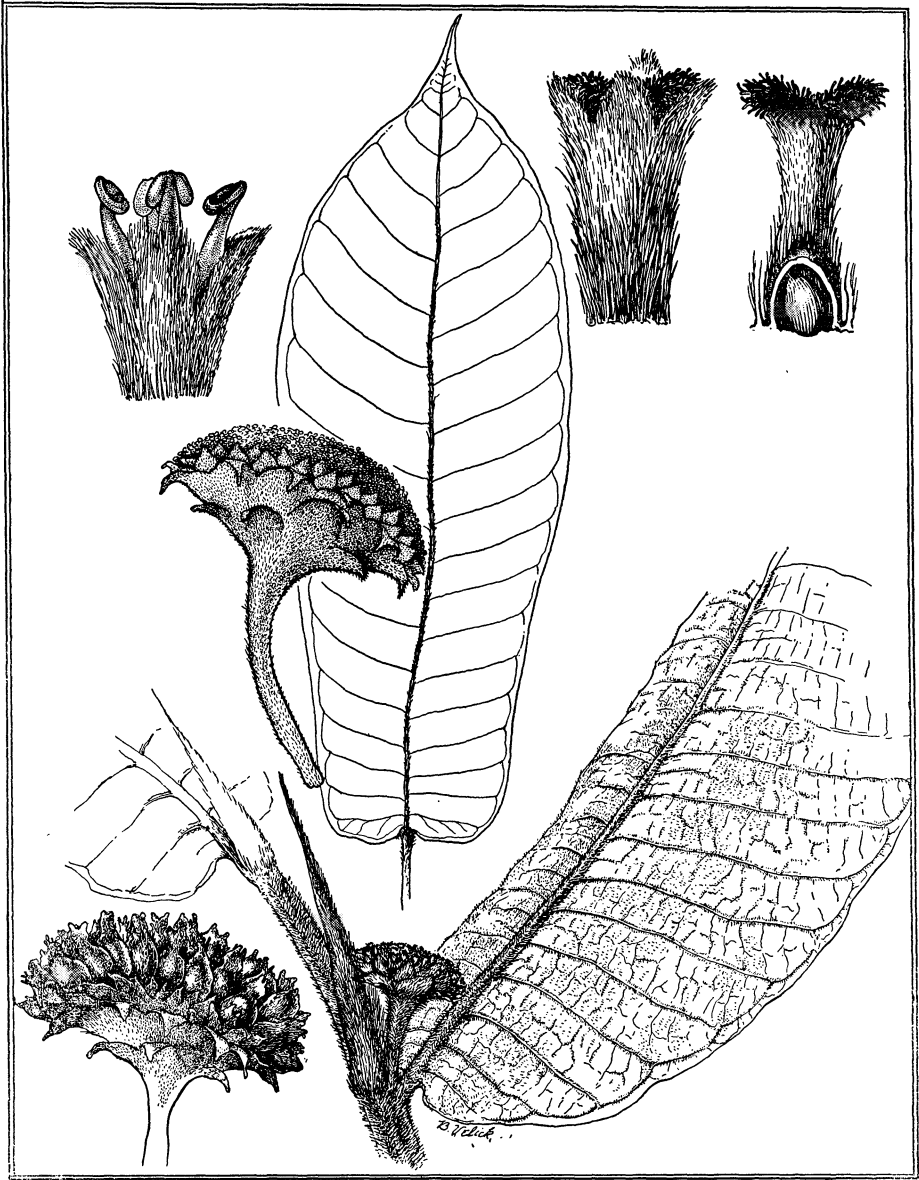


Fig. 49. *Perebea guianensis*

## 1. PEREBEA GUIANENSIS Aubl. Hist. Pl. Guian. Fr. 2:952; 4: t. 361. 1775.

*Perebea castilloides* Pittier, in Contrib. U. S. Nat. Herb. 13:438. t. 80-81. 1912.

*Perebea pseudopeltata* Mildbr. in Notizbl. 10:184. 1927.

*Perebea tessmannii* Mildbr. loc. cit. 185. 1927.

*Perebea laevigata* Standl. in Trop. Woods 16:36. 1928, nom. nud. in syn.

*Perebea glabrata* Standl. in Field Mus. Publ. Bot. 4:201. 1929.

*Perebea acanthogyne* Ducke, loc. cit. 11:579. 1932.

Small trees infrequently to 20 m. tall, with rather stout flexuose ferruginous-hirsutulous branches. Leaves broadly oblong-elliptic grading toward obovate or ovate, the apex abruptly and narrowly subcaudate-acuminate, the base predominantly more or less deeply cordate, infrequently broadly obtuse or rounded in young leaves, entire to indefinitely undulate-serrate toward the tip, 15-40 cm. long, 7-15 cm. broad, firmly membranaceous, more or less ferruginous-hirtellous, particularly beneath, the petiole rather stout, 5-10 mm. long; stipules narrowly ovate-lanceolate, long-acuminate, 2-4 cm. long, densely sericeous. Staminate heads about 1.0-1.5 cm. in diameter, the peduncle about 1 cm. long. Pistillate heads superficially similar to the staminate with about 25-50 flowers. Fruiting heads oblate-ovoid, about 5-6 cm. broad, the achenes about 1 cm. long.

Panama to Brazil and Bolivia, in lowland forests. Reported as *cerillo* by Standley, *ule* and *cuacho* by Proctor Cooper.

BOCAS DEL TORO: Cricamola, *Cooper* 523; Punta Peña, near Chiriquí Grande, *Pittier* s. n. CANAL ZONE: west of Pina Base Camp, Limón Bay, *Johnston* 1607; Frijoles, *Standley* 27453. SAN BLAS: Permé, *Cooper* 634.

The association of these plants with Aublet's name is made with some misgivings. *Perebea guianensis* was excellently and unmistakably illustrated by Aublet, but it is doubtful whether the holotype exists at Paris, since Trécul apparently was not able to find it and my friend Dr. F. G. Meyer did not find an isotype at the British Museum. Dr. Meyer did find a staminate specimen, apparently of this species collected by Martin in 1804, a duplicate of which is now available not only at the British Museum (and presumably Paris?) but at the Missouri Botanical Garden. This sheet corresponds generally to those cited from Panama on the one hand and on the other to several collections from South America which, because they are now distributed under other names, I shall cite both in support of my interpretation and for the use of others: BRAZIL: *Krukoff* 4827, 7041, 7209, 8076, 8350, *Ducke* 1221 (24-5-1940) PERU: *Klug* 2719, R. C. *Lorenz* 3210—all deposited in the herbarium of the Missouri Botanical Garden. For positive identification fruiting specimens from Panama are necessary, and I must confess that some of the Panamanian sheets are noticeably more pubescent than these from Brazil and Peru.

## 2. PEREBEA XANTHOCHYMA Karst. Fl. Colomb. 2:23. t. 112. 1862.

*Perebea integrifolia* Karst. loc. cit. 1862.

*Castilloa markhamiana* J. Collins, Rept. Caoutch. 12. t. 3. 1872.

*Perebea markhamiana* (J. Collins) Benth. ex Hook. f. in Trans. Linn. Soc. 2 ser. 2:211. 1886.

*Perebea hispidula* Standl. in Ann. Missouri Bot. Gard. 29:350. 1942.

*Perebea molliflora* Standl. & L. Wms. in Ceiba 3:41. 1952.

*Perebea trophophylla* Standl. & L. Wms. loc. cit. 196. 1953.

Small trees to about 10 m. tall, with rather slender and scarcely flexuose hispidulous to glabrate branches. Leaves oblong-elliptic, subcaudate, acuminate to abruptly subcuspidate at the tip, the base broadly obtuse to rounded, usually more or less conspicuously undulate-serrate toward the tip, infrequently subentire, 8–28 cm. long, 3–9 cm. broad, rather inconspicuously appressed-puberulent beneath to nearly glabrous, the petiole about 5 mm. long; stipules lanceolate, 5–10 mm. long. Staminate heads about 5 mm. in diameter, sessile or subsessile. Pistillate heads usually with about 5–10 flowers about 5 mm. in diameter, the peduncle rather slender, 3–5 mm. long, fruiting heads subsessile, about 1 cm. in diameter, the achenes to about 1 cm. long.

Costa Rica to Colombia, in lowland forests.

BOCAS DEL TORO: Daytonia Farm, Cooper 425; Old Bank Island, Von Wedel 1935.  
CANAL ZONE: Gatún, Johnston 1692.

These sheets agree very well with Karsten's plate which illustrates both *P. xanthochyma* and *P. integrifolia* (the chief differentium of which would appear to be sex!), and with a fragment of Karsten's isotype of the former (F).

#### 8. CASTILLA Cerv.

CASTILLA Cerv. in Gac. Lit. Mexico, Suppl. 7. 1794.

*Castilloa* auct.

Monoecious or dioecious trees (cf. O. F. Cook, in Science, ser. 2. 18:437. 1903; H. Pittier, in Contrib. U. S. Nat. Herb. 13:253. 1910), the branches unarmed. Leaves alternate, distichous, closely and minutely ciliate-denticulate to essentially entire; stipules fully amplexicaul. Inflorescences axillary, solitary or clustered, involucrate, the staminate discoid and conduplicate-flabellate, the pistillate discoid or subglobose. Staminate flowers essentially unorganized and naked, with stamens bearing oval anthers apically affixed to the filament. Pistillate flowers more or less coherent, with a fleshy accrescent conic-tubular perianth and a subinferior ovary, the stigma 2-lobed almost to the base of the central style. Fruit a more or less fleshy syncarp.

Probably no more than 4–6 species extending from southern Mexico to Bolivia. Pittier (loc. cit. 1910) provides a very difficult key to 10 species which I have found to be quite impractical when applied to herbarium specimens; I suspect that it would also present problems in the field. From the evidence available to me, I can visualize at most two scarcely distinguishable species in Panama. The genus has been of sporadic interest in the past as a possible source of commercial rubber.

- a. Leaves more or less cordate and usually nearly equilateral at the base; pistillate flowers half or more coherent and developing an orange or reddish pulp in fruit..... 1. C. ELASTICA
- aa. Leaves obtuse to acute and very strongly inequilateral at the base; pistillate flowers coherent only at the very base, greenish and nearly dry in fruit..... 2. C. TUNU



## 1. CASTILLA ELASTICA Cerv. in Gac. Lit. Mexico, Suppl. 7. 1794.

*Castilla panamensis* Cook, in Science, n. ser. 18:438. 1903.

Trees 5–10 m. tall, the young branches densely hirsute with spreading (less frequently appressed) golden hairs, eventually glabrate. Leaves oblong-obovate, more or less cordate and usually not strongly inequilateral at the base, subcuspidate-acuminate at the tip, 20–30 cm. long, 10–14 cm. broad, membranaceous, minutely and closely ciliate-denticulate, both surfaces golden spreading-hirsute but particularly beneath, the petioles about 1 cm. long; stipules 3–6 cm. long. Inflorescences in clusters of 2–4 in catenate series of the upper leaf-axils, occasionally solitary. Staminate heads conduplicate-reniform, about 1.5 cm. long and 2 cm. broad, the peduncle about 1 cm. long. Fruiting heads thickly discoid, 4–5 cm. in diameter, about 1.5 cm. thick, sessile or subsessile, the component flowers half or more coherent, developing an orange or reddish pulp at maturity.

Southern Mexico to Colombia and perhaps southward; in moist forests at low elevations. *Ule-ule, hule, caucho, mastate blanco.*

BOCAS DEL TORO: Laguna de Chiriquí, *Hart 140*; Chiriquicito, *Seibert 1551*; Punta Rovalo, *Seibert 1566*; Almirante, *Seibert 1574*; Fruit Dale Farm, *Seibert 1586, 1587, 1588*. CANAL ZONE: old site of Gorgona, *Maxon 6783*; Las Cascadas Plantation, *Standley 25697, 29497, Cook & Martin 46*; Ancón Hospital grounds, *Maxon 6769, Gaillard s. n.* COCLÉ: El Valle de Antón, *Allen 3625*. DARIÉN: along Sambú River, *Pittier 5526*; Boca de Pauarando, *Pittier 5714*. PANAMÁ: Río Tapía, *Standley 28048, 26186, 26177*; Juan Díaz region, *Maxon & Harvey 6748*; Arraiján, *Maxon & Cook 7032, 7033*; Río Tecumen, *Standley 29374*; Tumba Muerto Road, near Panamá, *Standley 29818*.

This species has been of more than passing interest to economic botanists for nearly two centuries, but has never become of commercial value.

## 2. CASTILLA TUNU Hemsl. in Hook. f. Icon. Pl. ser. 4. 7: pl. 2651. 1901.

*Castilla fallax* Cook, in Science n. ser. 18:438. 1903.

Trees 5–20 m. tall, the young branches densely hirsute with appressed rather dingy-brown hairs, eventually glabrate. Leaves broadly elliptic to oblong-obovate, subcuspidate-acuminate at the tip, obtuse to acute and very strongly inequilateral at the base, 15–40 cm. long, 7–15 cm. broad, minutely and closely ciliate-denticulate to subentire, membranaceous, appressed-hirsute above and below to glabrate, the petiole about 1 cm. long; stipules 4–5 cm. long. Inflorescences paired or solitary in the upper leaf-axils. Staminate heads conduplicate-reniform, about 2 cm. long and 2.5 cm. broad, sessile or subsessile. Fruiting heads oblate-globose, 2–3 cm. in diameter, quite sessile, the component flowers coherent only toward the base, greenish and nearly dry at maturity.

British Honduras to Panama, in moist forests at low elevations.

DARIÉN: Río Chico, near Yaviza, *Allen 4586*; trail between Pinogana and Yaviza, *Allen 276*; Garachiné, *Pittier 5696*. SAN BLAS: Puerto Obaldía, *Pittier 4341*; locality indefinite, *Cooper 284*.

This species, according to Allen, "is reported as NOT being used for rubber" in Darien, which Pittier confirms from his experience in Costa Rica. According

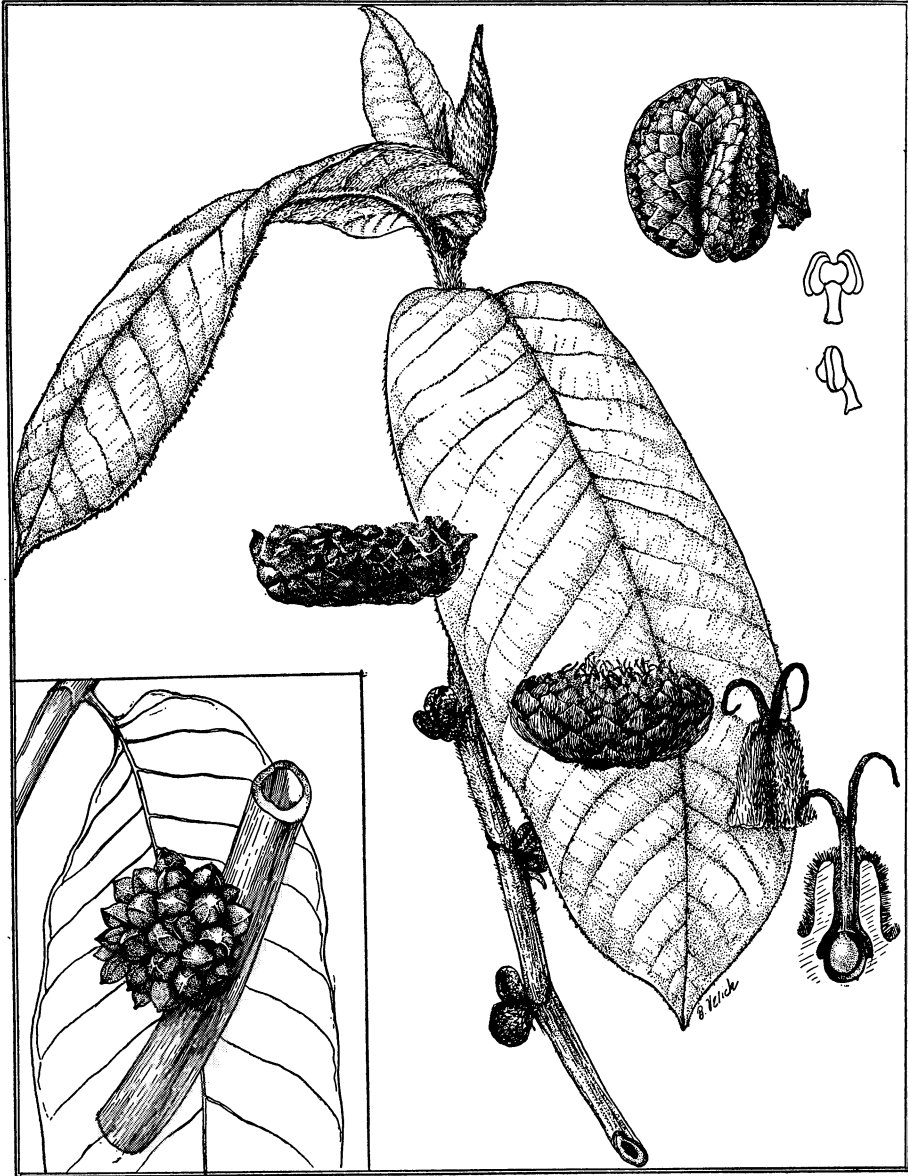


Fig. 50. *Castilla elastica* and *C. tunu* (lower left)

to Pittier, the species also is known to occur in Chiriquí, in the vicinity of David.

In spite of the faults which both Pittier and Cook have found with Hemsley's description and plate, there appears to me little doubt that *C. fallax* is a superfluous name.

### 9. POULSENIA Eggers

POULSENIA Eggers, in Bot. Centralbl. 73:65 [err. 49]. *pl* 3. 1898.

*Inophloem* Pittier, in Journ. Wash. Acad. Sci. 6:113. 1916.

Monoecious trees, the young branches usually more or less aculeate, rarely unarmed. Leaves alternate, distichous; stipules fully amplexicaul. Both staminate and pistillate inflorescences of globose or subglobose heads. Staminate flowers many: perianth of 4 scarcely united tepals; stamens 4, with broadly oval, basifixed anthers. Pistillate flowers few (3-9): perianths tubular-conic, shortly 4-dentate, strongly coherent in the head; ovary superior, the stigma deeply 2-lobed, widely exserted. Fruiting head a fleshy syncarp.

One species ranging from British Honduras to Bolivia.

#### 1. POULSENIA ARMATA (Miq.) Standl. in Trop. Woods 33:4. 1933.

*Olmedia* (?) *armata* Miq. in Seem. Bot. Voy. Herald 196. 1854.

*Poulsenia aculeata* Eggers, in Bot. Centralbl. 73:66 [err. 50]. 1898.

*Inophloem armata* (Miq.) Pittier, in Journ. Wash. Acad. Sci. 6:113. 1916.

*Coussapoa rekoï* Standl. in Contrib. U. S. Nat. Herb. 20:211. 1919.

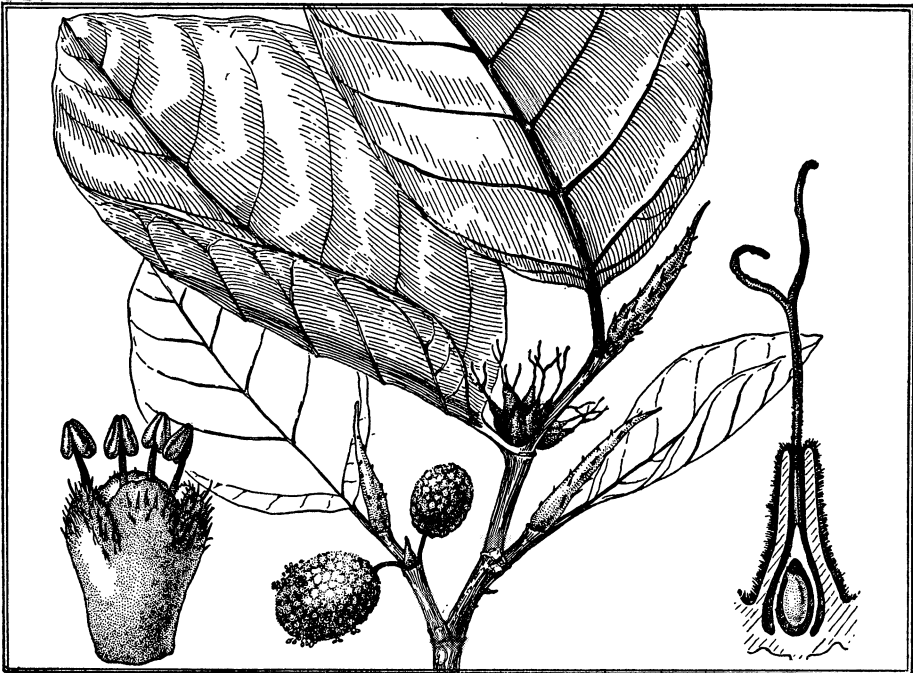


Fig. 51. *Poulsenia armata*

Trees to 25 m. tall, all young parts scatteringly hispid and aculeate to glabrous and smooth. Leaves broadly and rather obliquely oval or elliptic, the tip obtuse or rounded to shortly subcuspidate-acuminate, the base broadly obtuse, 8–40 cm. long, 4–20 cm. broad, entire, subcoriaceous, the petiole 1–3 cm. long; stipules 2–3 cm. long. Staminate heads globose, without an obvious involucre, many-flowered, about 1 cm. in diameter. Pistillate heads subglobose or ovoid, without an obvious involucre, 3–9-flowered, about 1.5 cm. in diameter. Mature fruiting heads unknown to us.

BOCAS DEL TORO: Changuinola Valley, *Cooper & Slater 88*; Almirante, *Cooper 455*. CANAL ZONE: Alhajuella, *Pittier 3731*; Gatún Valley, *Pittier s. n.*; Barro Colorado Island, *Sbattuck 1104*, *Carpenter 75*. COLÓN: Dos Bocas, Fató Valley, *Pittier 4202*. DARIÉN: Pinogana, *Pittier s. n.*

Pittier reports that the bark is very thick and fibrous and is soaked and pounded into cloth (*mastate*) by the Darién Indians, a use previously reported by Seemann.

#### 10. OLMEDIA R. & P.

OLMEDIA R. & P. Fl. Peruv. & Chil. Prodr. 129. t. 28. 1794.

? *Maquira* Aubl. Hist. Pl. Guian. Fr. Suppl. 2:36; 4: t. 380. 1775.

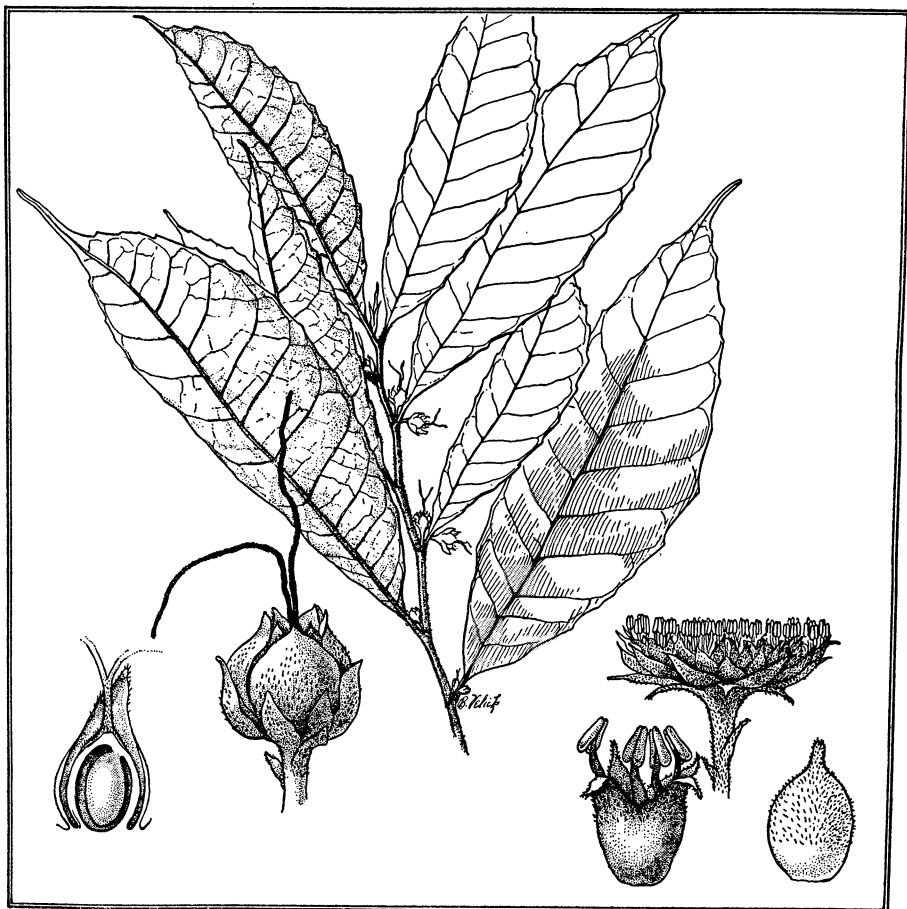
Dioecious trees. Leaves alternate, distichous; stipules wholly amplexicaul. Staminate inflorescences involucrate discoid heads. Staminate flowers definitely organized; perianth campanulate, broadly 4-dentate; stamens 4, the anthers basifixed, oblongoid. Pistillate inflorescences with a solitary prominently bracteate-involucrate flower, the ovary superior, the stigma with 2 widely exerted filiform lobes. Fruit a small slightly fleshy false drupe.

One species in Central America; the South American species are impossible to ascertain at present because of our faulty knowledge.

1. OLMEDIA ASPERA R. & P. Fl. Peruv. & Chil. Prodr. 129. t. 28. 1794.

Rather small trees or shrubs to about 6 m. tall, the young twigs rather slender, not conspicuously flexuose, densely to sparsely hispidulous, eventually glabrate. Leaves obovate- or oblanceolate-elliptic, rarely irregularly lyrate, narrowly subcaudate-acuminate at the tip, acutely or obtusely cuneate at the base, frequently more or less falcate, 7–20 cm. long, 2–9 cm. broad, usually more or less conspicuously and irregularly serrate-undulate toward the tip, firmly membranaceous, scabrous or hispidulous to glabrous, the petioles about 5–7 mm. long. Staminate inflorescences solitary or in clusters of 2–4, about 1 cm. in diameter, the peduncles about 5 mm. long. Pistillate inflorescences solitary or in small axillary clusters, the peduncles about 5–7 mm. long, the involucre bracts ovate, 2–4 mm. long, persistent.

BOCAS DEL TORO: Chiriquí Lagoon, *Von Wedel 1043, 1094*; Water Valley, *Von Wedel 896, 941, 1582, 1719*. CANAL ZONE: Gatún, *Pittier 6747*, *Johnston 1584*, *Standley 27209*; Quebrada Salamanca, *Steyermark & Allen 17142*; Rio Pina-Rio Media divide, *Johnston 1703*; Quebrada La Palma, *Dodge & Allen 17365*; Mindi Hills, *Johnston 1733*; Darién Station, *Standley 31597*; Cerro Gordo, near Culebra, *Standley 26015*; Gorgona, *Maxon*

Fig. 52. *Olmedia aspera*

4744; Barro Colorado Island, Standley 31450, Woodworth & Vestal 372, 666, Wetmore & Abbe 46, 666, Salvoza 930, 939, Bangham 521, 530. CHIRIQUÍ: San Félix, Pittier 5291; Paso Quebrada Gato, Pittier 5425; Hato del Jobo, Pittier 5425. COCLÉ: El Valle de Antón, Allen 1736. DARIÉN: Pinogana, Pittier 6578. PANAMÁ: Río Tecumen, Standley 29454; Chepo, Pittier 4707.

This is the only Panamanian species of Moraceae where I have been able to find anything comparable to the familiar leaf polymorphism of the northern mulberries.

#### 11. PSEUDOLMEDIA Tréc.

PSEUDOLMEDIA Tréc. in Ann. Sci. Nat. 3 ser. 8:129. t. 5. 1847.

*Olmediopsis* Karst. Fl. Colomb. 2:17. t. 109. 1862.

Diocious trees. Leaves alternate, distichous; stipules fully amplexicaul. Staminate inflorescences in discoid involucrate heads of numerous extremely reduced flowers represented by a solitary stamen with an oblongoid basifixed anther

and an extremely vestigial perianth, intermingled with more prominent spatulate bracteoles. Pistillate flowers solitary with an involucre of several closely imbricated bracts, perigynous or epigynous; perianth tubular with 4 minute dentate lobes; stigma narrowly 2-lobed, widely exserted. Fruit a false drupe subtended by the persistent involucre.

4-5 species of the Antilles, Central America and northern and western South America.

1. *PSEUDOLMEDIA SPURIA* (Sw.) Griseb. Fl. Brit. W. Ind. 1859.

*Brosimum spurium* Sw. Prodr. 12. 1788.

*Pseudolmedia havanensis* Tréc. in Ann. Sci. Nat. 3 ser. 8:130. 1847.

*Brosimum caloxydon* Standl. in Trop. Woods 17:11. 1929.

Trees 8-20 m. tall, the young branches relatively slender, glabrous. Leaves ovate- to oblong-elliptic, rather abruptly and bluntly subcaudate-acuminate to subcuspidate, the base obtuse to rounded, firmly membranaceous to subcoriaceous, entire, 9-15 cm. long, 3-5 cm. broad, glabrous or essentially so, the petiole 3-5 mm. long; stipules vary narrowly lanceolate, long-acuminate, 1-2 cm. long. Staminate heads usually paired, sessile or subsessile, about 8-10 mm. in diameter, the bracts broadly obtuse, minutely puberulent. Pistillate heads sessile, the flowers ovoid, about 2 mm. long, softly puberulent, the stigma lobes about equally long. Drupes broadly ovoid, fleshy, about 1 cm. long and broad.

British Honduras to northern South America; Antilles. Reported as *cuqua* by Cox, bloodwood and *cacique* by Proctor Cooper.

BOCAS DEL TORO: Buena Vista Camp on Chiriquí Trail, Cooper 607; "Bocas del Toro Region", Cox s. n.; Cricamola Valley, Cooper 535.

All three collections are quite sterile, hence their assignment to this species is not infallible. It is true that these leafy sheets could be matched fairly well by some South American species of *Brosimum* or even *Ficus*. But this guess appears to be quite the most likely.

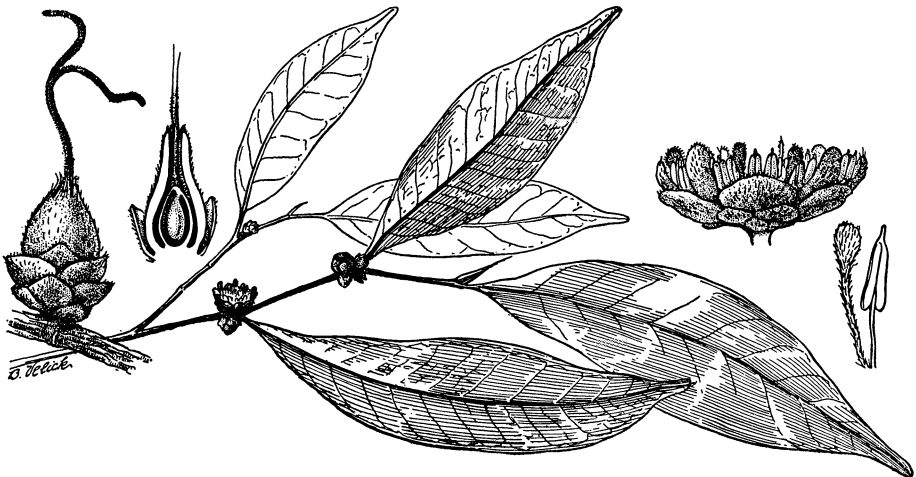


Fig. 53. *Pseudolmedia spuria*  
(185)

## 12. FICUS [Tourn.] L.

BY GORDON P. DEWOLF, JR.

FICUS [Tourn.] L. Gen. Plant. ed. 5. 482. 1754.

*Oluntos* Raf. Sylva Tell. 58. 1838.*Urostigma* Gasp. Nov. Gen. Fic. 7. 1844.*Pharmocosyceae* Miq. in Hook. Lond. Journ. Bot. 7:64. 1848.

(Synonyms not referring to American species not cited.)

A genus (at least so far as the American species are concerned) of soft-wooded, generally smooth-barked trees and shrubs with milky or opalescent latex. Many species begin life as epiphytes, or epiliths, which may eventually, through the coalescence of their roots, completely encircle the trunk of, and strangle, their host. Leaves entire and spiral in native species—rarely opposite and sometimes toothed or lobed in the Old World. Stipules long or short, enfolding the buds, generally quickly deciduous but rarely persistent, leaving a scar surrounding the stem. Flowers unisexual, borne over the inner surface of a hollow, globose, more or less fleshy structure (the receptacle or “fig”) the apical pore (ostiole or orifice) of which is closed by a series of interlocking bracts. The female flowers are of two kinds: functional females, generally sessile and maturing into viable achenes, and sterile females (gall flowers), generally stalked and functioning as incubators for the larvae of a wasp which pollinates the fertile flowers. Male, female and gall flowers are completely intermixed in American species. The figs are generally solitary or paired, borne among the leaves but sometimes on specialized short shoots behind the leaves in American species. In Old World species they may be borne similarly or in leafless racemes or panicles on the trunk and larger branches.

There are about 750 species in the tropics of both hemispheres. In the American tropics the genus is represented by two subgenera (of three) and about 70 species. In addition to the native species of Panama, numerous exotics are cultivated, particularly *F. elastica*, *F. nitida* and the banyan, *F. religiosa*, and the root-climbing ivy-like *F. pumila*. These usually can be distinguished by their persistent aerial and prop roots which are infrequent in the native species. The common edible fig with deeply lobed leaves, *F. carica*, is seldom encountered in Panama.

Subgenus UROSTIGMA (Gasp.) Miq. Most species of fig are disseminated by birds which eat the more or less fleshy receptacles and wipe their beaks clean of the sticky pulp upon the branch of a convenient tree. The small seeds embedded in the pulp deposited in this way germinate epiphytically, the seedlings grasping the supporting tree with their tentacles of aerial roots which in time reach the soil. Meanwhile the woody body of the fig develops rapidly and the supporting tree eventually is destroyed by the weight of its triumphant epiphyte. For this reason the name *matapalo* (tree-killer) often is applied to the strangler-figs of Central America. The appropriate Spanish words *higo* for the fleshy receptacles and *higuero* for the tree are current in Panama.

Subgenus PHARMACOSYCEA Miq. The Pharmacosyceas seldom, if ever, begin life as epiphytes. They are large, free-growing trees of the forest and of second growth. The subgenus was originally erected for a few American species but it is now known that about 46 Australasian species belong here as well.

In any consideration of a taxonomic treatment of tropical American plants it is important to realize that botanically scarcely one quarter of tropical America has been adequately explored. Literally thousands of square miles of rainforest and *campo* have either never been investigated by botanists or have not been so for fifty to one hundred years. Even so, our herbaria are full of alleged species whose only claims to distinction, when they are examined critically, are the political boundaries separating them.

With the exception of the West Indies, Mexico, parts of Central America and some areas in northern South America, what knowledge we have of the lowland evergreen forests seems to be restricted to the vegetation of the riverbanks. In addition, few, even of modern collectors, have bothered to make field notes—or, if they have made them, have not bothered to transcribe them onto labels to accompany their specimens. The net result is that, although there is a good deal of (literally scrappy) material in our herbaria, we can get only the most vague idea either of distribution or of variation of the species involved, and we know practically nothing of the ecology of the plants. As a final example and indictment, *Ficus nymphaeaeifolia* is apparently a fairly common species from Panama to the State of Amapa in Brazil at the mouth of the Amazon. Even as tropical trees go, it must be striking in appearance. Yet the only description of this species as a living plant that I have been able to find is in Humboldt's "Personal Narrative . . ." of his travels in the American tropics in 1799–1804.

The floral characters of American figs, unlike those of many Asian and African species are disconcertingly uniform. The precise form and structure of the fig itself is, however, particularly significant. In addition, microscopic vegetative characters have considerable taxonomic significance. These characters were first investigated by Otto Renner in 1907. More recently they have been exploited and practical techniques for their elucidation devised by Professor E. J. H. Corner, to whom I am greatly indebted for knowledge of them.

Over the past three years I have been able to see nearly all of the types of American species of *Ficus* preserved in European herbaria. More than a year ago, I was able to present to the Board of Research Studies of the University of Cambridge a taxonomic and nomenclatural revision of the species of *Ficus*, proposed on the basis of allegedly American material from the time of the publication of the *Species Plantarum* in 1753 to the first proper taxonomic revision of the genus by Miquel in 1847–48. This involved a taxonomic study of all the species known from Brazil, northeastern South America and the West Indies, as well as a cursory survey of the species of the Andes and of Central America and Mexico.

Over and above the courtesies extended to me by the directors and staffs of all institutions that I have visited or corresponded with (which will be acknowledged



explicitly in a forthcoming paper), I am particularly indebted to the directors of the New York Botanical Garden and the United States National Museum, who allowed me to borrow certain specimens in their care to use as a basis for study of the taxonomy of the species. I am also in particular debt of gratitude to the American Academy of Arts and Sciences who generously made a grant to allow me to visit certain continental herbaria, to consult the types in their care.

Some months ago, Dr. R. E. Woodson, Jr., hearing of my interest in the genus, sent me for comment a manuscript treatment which he had prepared for the FLORA OF PANAMA. It is a pleasure to record that, with one or two minor exceptions, our taxonomic conclusions were identical. After some subsequent correspondence, Dr. Woodson asked me to prepare a fresh treatment of *Ficus* for the Flora. The following descriptions and synonymy are the result. I have seen little Panamanian material for any species. The descriptions are drawn from the material which I have seen, modified freely from Dr. Woodson's manuscript. The specimens cited are quoted directly from that manuscript. The nomenclature and synonymy are based (with one or two exceptions) on my own studies.

- a. Figs borne singly in the leaf axils, the bracts at the base of fig 3 or 3-lobed; stamens 2; ovary pale, unspotted; tepals of female flowers narrowly deltoid or lanceolate; massive multicellular hairs present ( $\times 150$ ) on the lower surface of the leaf. (Subgenus PHARMACOSYCEA)
  - b. Stipules 1–2 cm. long; lateral veins of the leaves 5–16; lower surface of the leaves minutely pubescent to glabrous, almost always scabrid. 1. *F. MAXIMA*
  - bb. Stipules 2.5 cm. or more long.
    - c. Leaves very broadly oval or ovate, the lateral veins 10–16, rather distant; receptacles not beaked.
      - d. Lateral veins 9–15, departing from the midrib at an angle of  $10^\circ$  or less, connected by a very prominent submarginal vein.... 2. *F. TONDUZII*
      - dd. Lateral veins 12–16, departing from the midrib at an angle from  $10^\circ$ – $30^\circ$ , the marginal vein not prominent..... 3. *F. MACBRIDEI*
      - cc. Leaves oblong-elliptic, the lateral veins 10–30, rather close; receptacles generally somewhat beaked below the ostiole..... 4. *F. INSIPIDA*
- aa. Figs borne in pairs in the leaf axils, the basal bracts 2 or 2-lobed; stamen 1; ovary with a red spot at the base of the style; tepals of all flowers hooded; massive, multicellular hairs absent, 2-cellular glandular hairs ( $\times 150$ ) frequently present on the lower surface of the leaf. (Subgenus UROSTIGMA)
  - b. Figs cylindrical, to 20 mm. long, with densely spreading yellow-brown pubescence. .... 5. *F. POPENOEI*
  - bb. Figs more or less globose, glabrous or pubescent.
    - c. Mature figs 3–7 mm. in diameter.
      - d. Stipules glabrous; figs distinctly pedunculate..... 6. *F. PERFORATA*
      - dd. Stipules appressed-pubescent; figs sessile or nearly so.
        - e. Leaves smooth above, appressed-pubescent on the veins beneath. 7. *F. HARTWEGII*
        - ee. Leaves scabrid above, shortly spreading-pubescent beneath..... 8. *F. DENDROCIDIA*
    - cc. Mature figs 8–30 mm. in diameter.
      - d. Figs with a distinct peduncle.
        - e. Ostiole sunken into the body of the fig or surrounded by a more or less raised collar of receptacular tissue or both.
          - f. Figs and leaves glabrous.
            - g. Ostiole depressed within a relatively undifferentiated cavity..... 9. *F. PERTUSA*
            - gg. Ostiole depressed within a conspicuously elevated cylindrical collar. .... 10. *F. TRACHELOSYPCE*
          - ff. Figs and leaves spreading-pubescent..... 11. *F. BULLENEI*
        - ee. Ostiole level with the surface of the fig, or the bracts slightly umbonate.

- f. Figs 8–15 mm. in diameter, with thin wall, yellowish when ripe.....12. *F. CITRIFOLIA*
- ff. Figs 15–30 mm. in diameter, with a relatively thick wall, reddish when ripe.....13. *F. TRIGONATA*
- dd. Figs sessile or nearly so.
- e. Figs 15–30 mm. in diameter.
- f. Bracts at mouth of fig distinctly mammillate, to 3 mm. high, leaves oblong-ob lanceolate, distinctly acuminate, base rounded, lateral veins 9–18.....14. *F. PARAENSIS*
- ff. Bracts at mouth of fig level with the surface or only a little umbonate, leaves rotund to broadly oval or elliptic-oblong or oblanceolate, apex rounded to acuminate, base narrowly cuneate to cordate, lateral veins 4–12.
- g. Leaves rotund, very broadly oval or ovate, apex rounded to acuminate, the base distinctly and deeply cordate.....15. *F. NYMPHAEAEFOLIA*
- gg. Leaves ovate to oblanceolate, apex rounded to obscurely acuminate, base cuneate or rounded, sometimes emarginate.
- h. Leaves ovate to oblong-elliptic, apex rounded to obscurely acuminate, base rounded to emarginate.....13. *F. TRIGONATA*
- hh. Leaves oblanceolate to obovate, apex rounded to acute, base narrowly cuneate.....16. *F. OBTUSIFOLIA*
- ee. Figs 8–14 mm. in diameter.
- f. Bracts at mouth of fig distinctly mammillate, to 3 mm. high, leaves oblong-ob lanceolate, distinctly acuminate, base rounded, lateral veins 9–18.....14. *F. PARAENSIS*
- ff. Bracts at mouth of fig level with the surface or only a little umbonate, leaves not as above, apex rounded to obscurely acuminate, base cuneate to rounded, lateral veins 5–12.
- g. Stipules persistent.....17. *F. COSTARICANA*
- gg. Stipules deciduous.
- h. Stem at each receptacle-bearing node enlarged to form a shelf or socket on which figs are borne, basal bracts fused to the base of fig for about 5 mm.....18. *F. TUERCKHEIMII*
- hh. Stem not enlarged at the nodes, basal bracts not fused to the base of the fig.
- i. Leaves oblong-obovate or oblanceolate.
- j. Stipules about 10 mm. long, figs 8–10 mm. in diameter.....19. *F. DAVIDSONAE*
- jj. Stipules 10–30 mm. long, figs more than 10 mm. in diameter.....16. *F. OBTUSIFOLIA*
- ii. Leaves elliptic or obovate, stipules 15–30 mm. long, figs 10–14 mm. in diameter.....13. *F. TRIGONATA*

1. *FICUS MAXIMA* P. Mill. Gard. Dict. ed. 8 (*Ficus* no. 6). 1768.

*Ficus citrifolia* hort. ex Lamck. Encycl. Meth. (Bot.) 2:494. 1786, quoad syn. excl. typus (in herb. Lamarck).

*Ficus laurifolia* hort. ex Lamck. loc. cit. 2:495. 1786, quoad syn. excl. typus (spec. in herb. Desfontaines).

*Ficus virens* Dryand. in Ait. Hort. Kew. ed. 1. 3:451. 1789, quoad syn. excl. typus.

*Ficus anthelminthica* Rich. ex DC. Ess. Pl. Med. 267. 1804 (fide herb. Richard), nom. nud.

*Ficus martinicensis* Willd. Sp. Pl. ed. 4. 4<sup>2</sup>:1137. 1806, quoad syn. excl. typus.

*Ficus radula* H. & B. ex Willd. loc. cit. 1144. 1806.

*Pharmacosycea grandaeva* Mart. ex Miq. in Hook. Lond. Journ. Bot. 7:70. 1848.

*Pharmacosycea guyanensis* Miq. loc. cit. 67. 1848.

*Pharmacosycea glaucescens* Liebm. in Kong. Danske Vidensk. Selsk. Skr. ser. 5. 2:332. 1851.

*Pharmacosycea bernandezii* Liebm. loc. cit. 1851.

*Pharmacosycea rigida* Miq. in Seem. Voy. Herald. 195. 1854, nec Desf. nec Jack.

*Pharmacosycea mexicana* Miq. in Versl. en Med. Kon. Akad. Wetensch. 13:415. 1862.

*Pharmacosycea pseudoradula* Miq. loc. cit. 414. 1862.

*Ficus suffocans* Griseb. Fl. Brit. W. Ind. 150. 1864.

*Ficus glaucescens* (Liebm.) Miq. Ann. Mus. Bot. Lugd.-Bat. 3:300. 1867.

- Ficus hernandezii* (Liebm.) Miq. loc. cit. 1867.  
*Ficus parkeri* Miq. loc. cit. 1867.  
*Ficus mexicana* (Miq.) Miq. loc. cit. 299. 1867.  
*Ficus pseudoradula* (Miq.) Miq. loc. cit. 1867.  
*Ficus coybana* Miq. loc. cit. 300. 1867.  
*Ficus guadalajarana* S. Wats. in Proc. Amer. Acad. 26:151. 1891.  
*Ficus finlayana* Warb. in Urb. Symbol. Antill. 3:487. 1903 (pro parte).  
*Ficus picardae* Warb. loc. cit. 484. 1903.  
*Ficus rubricosta* Warb. loc. cit. 486. 1903.  
*Ficus subscabrida* Warb. loc. cit. 485. 1903.  
*Ficus ulei* Warb. ex Ule, in Engl. Bot. Jahrb. 40:141. 1907, nom. nud.  
*Ficus plumieri* Urb. in Fedde, Repert. 15:158. 1918.  
*Ficus bopiana* Rusby, in Mem. N. Y. Bot. Gard. 7:230. 1927.  
*Ficus ulei* Rossb. in Fedde, Repert. 42:60. 1937.  
*Ficus vicencionis* Dugand, in Caldasia 2:385-386. 1944.

Small to large trees 5-30 m. tall. Twigs 3-5 mm. in diameter, glabrous or pubescent, with a thin, scurfy, yellowish brown periderm. Stipules to 25 mm. long, narrowly deltoid, glabrous, puberulent, or pubescent at the base. Lamina 2.5-12 cm. wide  $\times$  6-24 cm. long, elliptic, broadly elliptic, lanceolate, oblanceolate, or obovate, glabrous above, glabrous or puberulent beneath; apex blunt, acute, acuminate or long acuminate; base cuneate or obtuse; lateral veins 5-16 pairs, departing from the midrib at an angle from  $0^{\circ}$ - $30^{\circ}$ ; basal veins departing from the midrib at an angle of  $40^{\circ}$ - $60^{\circ}$ ; intercostals slightly raised. Petiole 5-40 mm. long,  $\frac{1}{5}$ - $\frac{1}{9}$  the length of the lamina, the epidermis generally scurfy. Figs 10-25 mm. in diameter, globose, or sub-globose, glabrous or puberulent, sometimes with a stalk above the basal bracts 2-7 mm. long, borne among the leaves; color green or yellow, sometimes mottled darker; peduncle 2-25 mm. long, glabrous or pubescent; basal bracts 1-2 mm. long, deltoid, glabrous or pubescent; orifice 1-2 mm. in diameter, flat, or the bracts slightly outflexed.

Southern Mexico to and through the Amazon basin, lowlands to about 1000 ft.

BOCAS DEL TORO: Changuinola Valley, Cooper & Slater 92, Dunlap 498. CANAL ZONE: south of Ft. Sherman, Johnston 1656; Balboa, Standley 256II, 27006; Corozal, Standley 26829; Ancón, Pittier 2728; Culebra, Pittier 2211. COCLÉ: Penonomé, Williams 251. PANAMÁ: San José Island, Johnston 449, 533, 1338, 1383; Taboga Island, Standley 27976; Chepo, Pittier 4757; Juan Días, Standley 30481.

This seems to be a relatively common species in lowland forest and in lowland hill forest from Cuba and southern Mexico to, and through, the Amazon basin. In the low mountain rain forest in Jamaica this species occasionally overtops the forest canopy (Apsey, 1953), and it forms an element of the flora which springs up on waste land left after removal of bauxite in western Jamaica (Howard and Proctor, 1957).

Despite the multitude of names which have been proposed for various examples of this species, it does not seem to be particularly variable. There is, of course, considerable variation in leaf size (which is reflected, at least to some extent, in lateral vein number) between young and old plants and shoots, and, of course, leaves from vigorous shoots seem to be generally more strongly acuminate than leaves from mature twigs.

The oldest legitimate name for this species as here defined is *Ficus maxima* Mill.

There is no specimen from Miller's herbarium in the British Museum (NH), so the name must be typified on *Ficus indica maxima, folio oblongo...* of Sloane's "Catalogus..." 189 (1696) and "Voyage..." 2:140, t. 223 (1725). There is no specimen in the Sloane collection at the B.M. (NH) and the illustration is certainly not diagnostic, but the description is good and sufficiently specific, so that I have no hesitation in designating it the nomenclatural type of Miller's name and following Fawcett and Rendle (Fl. Jam. 3<sup>1</sup>:48-49. 1914) in referring it to the plant which for a century has been known as *Ficus suffocans* Griseb.

*Ficus protensa* (Griseb.) Hemsl. was included in the synonymy of *Ficus glaucescens* by Standley, but I do not know on what grounds. No type was cited in the original description and I have no record of having seen a specimen so labeled. The description is certainly not diagnostic of this taxon. I think that it is unwise to doubt Grisebach's assignment of his plant to the subgenus UROSTIGMA without being able to demonstrate his error from the original material.

I have not seen authentic material of *Ficus guadalajarana*, S. Wats. It is included here on the authority of Dr. Woodson. I have seen the types of all the other names.

2. *FICUS TONDUZII* Standl. in Contrib. U. S. Nat. Herb. 20:8. 1917.

*Ficus macrocyce* Pittier, sensu Dugand.

Large buttressed trees to about 15 m. tall. Twigs 4-7 mm. in diameter, glabrous, the epidermis frequently exfoliating, with a thick greyish brown periderm. Stipules 25-60 mm. long, narrowly deltoid, glabrous. Lamina 6-15 cm. wide  $\times$  12-30 cm. long, broadly ovate, elliptic or obovate; apex rounded acute, acute or very shortly and bluntly acuminate; base rounded or rounded cuneate; lateral veins sometimes very broad and conspicuous, 9-15 pairs, departing from the midrib at an angle of 10° or less; intercostals conspicuous, but not much raised; basal veins departing from the midrib at an angle of 15°-30°, continuous with the very conspicuous submarginal vein. Petiole 20-80 mm. long, 4-5 mm. thick,  $\frac{1}{2}$ - $\frac{1}{6}$  the length of the lamina. Figs 20-35 mm. in diameter, globose, glabrous or minutely scabrid, borne among the leaves; color not noted; peduncle obsolete to 10 mm. long, sometimes with a stalk above the bracts to 5 mm. long; basal bracts 2-3 mm. long, very broadly deltoid; ostiole about 2 mm. in diameter, plane with the surface of the receptacle, or produced in a beak 5-10 mm. high.

Costa Rica to northern Colombia, near sea level to about 640 m.

CANAL ZONE: Barro Colorado Island, *Wetmore & Abbe 303, Carpenter 5, Shattuck 199*; Obispo, *Standley 31706*. CHIRIQUÍ: Hiquerón, *Cooper & Slater 249*.

3. *FICUS MACBRIDEI* Standl. in Publ. Field Mus. Nat. Hist. (Bot.) 13:305. 1937.

*Ficus torresiana* Standl. loc. cit. 18:307. 1937.

Trees to 15 m. tall. Twigs 7-9 mm. in diameter, glabrous or very shortly brown-pubescent, the epidermis sometimes exfoliating. Stipules 50-75 mm. long, narrowly deltoid, glabrous or minutely pubescent. Lamina 12-28 cm. broad  $\times$  26-42 cm. long, broadly ovate; apex acute or slightly acuminate; base rounded or

emarginate; lateral veins 12–16 pairs departing from the midrib at an angle of  $10^{\circ}$ – $30^{\circ}$ ; basal veins 1–3 pairs, departing from the midrib at a similar angle or at an angle from  $30^{\circ}$ – $50^{\circ}$ ; intercostals slightly prominent. Petiole 20–85 mm. long, glabrous or pubescent,  $\frac{1}{2}$ – $\frac{1}{6}$  the length of the lamina. Figs 15–25 mm. in diameter, obovoid, glabrous or pubescent, borne among leaves (?); color not noted, but in dried material with yellowish maculations; peduncle obsolete; basal bracts 2–3 lobed, about 2 mm. long; orifice about 2 mm. in diameter, slightly crateriform.

This species, so far as I know, has not yet been found in Panama. It is found in Costa Rica and Peru, however, and should be looked for in areas between.

4. *FICUS INSIPIDA* Willd. Sp. Pl. ed. 4. 4:1143. 1806.

*Ficus glabrata* HBK. Nov. Gen. & Spec. 2:47. 1818.

*Ficus adhatodaefolia* Schott, ex Spreng. Syst. Veg. ed. 16. 4 (App.):409. 1827.

*Ficus anthelminthica* Mart. in Spix et Mart. Reise in Brasilien 3:1158. 1831.

*Pharmacosycea vermifuga* Miq. in Hook. Lond. Journ. Bot. 7:70. 1848.

*Pharmacosycea angustifolia* Liebm. in Kong. Danske Vidensk. Selsk. Skr. ser. 5. 2:333. 1851.

*Ficus vermifuga* (Miq.) Miq. Ann. Mus. Bot. Lugd.-Bat. 3:300. 1867.

*Ficus segoviae* Miq. loc. cit. 1867.

*Ficus radulina* S. Wat. in Proc. Am. Acad. 26:151. 1891.

*Ficus krugiana* Warb. in Urb. Symbol. Antill. 3:487. 1903.

*Ficus crassiuscula* Warb. ex Standl. in Contrib. U. S. Nat. Herb. 20:12. 1917.

*Ficus werckleana* Rossb. in Fedde, Repert. 42:60. 1937.

*Ficus boyacensis* Dugand, in Caldasia 1<sup>4</sup>:31. 1942.

*Ficus crassa* Kl. & Karst. ex Dugand, in Caldasia, 1<sup>4</sup>:35–36. 1942.

*Ficus mexicana* auct. non Miq.

Large or small buttressed trees, 8–40 m. tall. Twigs 2–6 mm. in diameter, generally glabrous, with a thin reddish or greyish brown periderm. Stipules 30–125 mm. long, narrowly deltoid, generally glabrous. Lamina 2–11 cm. wide  $\times$  5–25 cm. long, lanceolate to broadly elliptic, essentially glabrous, generally glossy above, sometimes slightly inequilateral; apex blunt or acute, to acuminate; base cuneate, round cuneate, rounded or emarginate; lateral veins 10–25 [–30] pairs, departing from the midrib at an angle of  $40^{\circ}$  or less; basal veins departing from the midrib at an angle from  $30^{\circ}$ – $60^{\circ}$ ; intercostals slightly prominent. Petiole 10–65 mm. long,  $\frac{1}{3}$ – $\frac{1}{8}$  the length of the lamina, the epidermis not exfoliating, though frequently wrinkled. Figs 15–30 mm. in diameter, globose with or without a stalk above the basal bracts, 1–6 mm. long, glabrous or pubescent, borne among the leaves; color green or yellowish-green; peduncle 3–22 mm. long, thin or stout; basal bracts three, 1–3 (–5) mm. long, deltoid or semicircular; orifice flat, or somewhat crateriform or mammillate, 2–4 mm. in diameter, 1–2 mm. high.

Southern Mexico to Southern Brazil, in lowland forests.

BOCAS DEL TORO: Almirante, *Cooper 444*. CANAL ZONE: upper Chilibre River, *Seibert 1512*; Ancón, *Piper 6006*; Chagres River, *Muenschner 12284, 12291*; Ft. Sherman, *Johnston 1510*; Barro Colorado Island, *Bailey & Bailey 479, Carpenter 3, Standley 40931, Wetmore & Abbe 126*. CHIRIQUÍ: Río Dupí, *Pittier 2539*. COLÓN: Río Fató, *Pittier 3880*. DARIÉN: Boca de Cupe, *Williams 679*; Yaviza, *Allen 4589*.

This is, undoubtedly, the most widely distributed of the *Pharmacosycea*s, though with the exception of one doubtful record it does not occur in the West Indies. It ranges, on the continent, from northwestern Mexico to Paraguay. In Mexico

and Central America it seems to be a component of the arid or sub-arid forests—but, since Standley notes that figs are usually left standing when forests are cleared and since much of the accessible forest of Central America and Mexico is not virgin, it seems unwise to try to guess as to the natural habitat. Standley records, of the populations which he called "*mexicana*," that they were stranglers. This is, presumably, a very unusual state of affairs for any plant of this subgenus.

Both Dugand (*Caldasia* 3<sup>12</sup>:133–148. 1944) and Little (in sched.) report the use of the latex of this species as a vermifuge in Colombia. The south Brazilian vernacular name *figueira purgante* and Miquel's epithet *vermifuga* for material from this same area, suggests that its medicinal usage is widespread. In addition, Archer (in sched.) records that Pará the latex is sometimes used in the coagulation of the latex of *Hevea*.

5. *FICUS POPENOEI* Standl. in Field Mus. Publ. Bot. 4:301. 1929.

*Ficus tolimensis* Standl. loc. cit. 17:177. 1937.

Trees to 25 m. tall. Twigs 4–6 mm. in diameter, fulvous spreading pubescent, eventually glabrate and developing a moderately thick greyish brown periderm. Stipules about 10 mm. long, densely spreading fulvous pubescent. Lamina 5–15 cm. long  $\times$  4–10 cm. wide, broadly oval to obovate-oblong, pubescent below and scabrid above; lateral veins 5–9 (–10) pairs, departing from the midrib at an angle of 20°–40°; basal veins departing at a similar angle; intercostals somewhat prominent. Petiole 5–15 mm. long, pubescent,  $\frac{1}{6}$ – $\frac{1}{16}$  the length of the lamina. Figs 14–22 mm. long  $\times$  9–16 mm. in diameter, cylindric, pubescent, borne among the leaves; color green, brown tinted (yellow-brown pubescent in dried material); peduncle 3–5 mm. long, pubescent; basal bracts broadly deltoid about 2–5 mm. long, pubescent; orifice about 2 mm. in diameter, flat or very slightly umbonate.

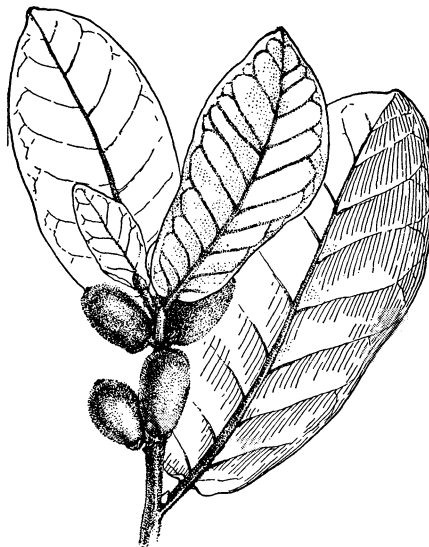


Fig. 54. *Ficus popenoei*

British Honduras to central Colombia, in lowland forests.

COCLÉ: El Valle, Allen 3789, Harvey 5169. PANAMÁ: San José Island, Johnston 483, 640, 660, 804.

Dr. Johnston reports that the habit of this species is quite variable: some may be stranglers, while others may germinate in the soil; a few develop a banyan-like stilted habit, but this is exceptional.

This seems to be a relatively common plant in Central America which has been identified, in the past, as *Ficus velutina*. There may be some vegetative similarity, but the cylindrical, densely yellow-brown pubescent figs are quite distinctive.

6. *FICUS PERFORATA* L. Pl. Surin. 17. 1775.

*Ficus americana* Aubl. Pl. Guian. 2:952. 1775.

*Ficus jacquiniaefolia* A. Richard. Fl. Cub. Fanerog. 3:221. t. 72. 1850.

*Urostigma eugeniaefolium* Liebm. in K. Danske Vid. Selsk. Skrivt. 5 ser. 2:329. 1851.

*Urostigma oerstedianum* Miq. in Seem. Bot. Voy. Herald 196. t. 36. 1854.

*Urostigma liebmannianum* Miq. loc. cit. 195. 1854.

*Urostigma chiriquianum* Miq. in Versl. en Med. Kon. Akad. 13:412. 1862.

*Ficus chiriquiana* (Miq.) Miq. in Ann. Mus. Bot. Lugd.-Bat. 3:298. 1867.

*Ficus liebmanniana* (Miq.) Miq. loc. cit. 1867.

*Ficus oerstedianum* (Miq.) Miq. loc. cit. 299. 1867.

*Ficus eugeniaefolia* (Liebm.) Hemsl. Biol. Centr.-Amer. Bot. 3:144. 1883.

*Ficus sintenisii* Warb. in Urb. Symbol. Antill. 3:464. 1903.

*Ficus omphalophora* Warb. loc. cit. 466. 1903.

*Ficus wilsoni* Warb. loc. cit. 467. 1903.

Shrubs or small to medium sized trees to 30 m. tall. Twigs 2–3 mm. in diameter, glabrous, with a rather close brownish grey periderm. Stipules 4–15 mm. long, glabrous, ciliolate or glaucous. Lamina 1–5 cm. wide  $\times$  1.7–11 cm. long, elliptic or obovate; apex rounded, acute, or short, abruptly acuminate; base cuneate or narrowly rounded, sometimes somewhat emarginate; lateral veins 6–14 pairs, departing from the midrib at an angle from 20°–30°; basal veins departing from the midrib at a similar angle; intercostals not, or only somewhat, prominent. Petiole 4–10 mm. long,  $\frac{1}{4}$ – $\frac{1}{9}$  the length of the lamina. Figs 3–7 mm. in diameter, globose, glabrous, borne among the leaves; color reddish; peduncle 1–5 mm. long, glabrous or minutely puberulent; basal bracts two, 1–2 mm. long, ovate, glabrous or minutely puberulent; orifice 1–2 mm. in diameter, somewhat mammillate.

Guatemala to Colombia, at intermediate or higher elevations; and in the Bahama Islands and the Greater Antilles. *Mata palo*.

CANAL ZONE: Barro Colorado Island, *Wilson 122, Carpenter 64, Woodworth & Vestal 658, Bangham 509*. CHIRIQUI: Gualaca, *Allen 5026*; Boquete, *Davidson 612*; Caldera, *Pittier 3346*; David, *Pittier 2822, 2823*. COCLÉ: El Valle, *Allen 2228*. DARIÉN: Cana, *Williams 944*. PANAMÁ: Punta Paitilla, *Standley 26243*. VERAGUAS: Río Cañazas, *Allen 158*.

This is an exceedingly variable taxon, the West Indian plants called *Ficus jacquiniaefolia* and *F. sintenisii* being, superficially, very different in appearance. There is, however, no important character by which they can be circumscribed and it seems wise, therefore, to include them here.

*Ficus perforata* L. is based on t. 132, f. 2. of Burmann's edition of Plumier's plates. Neither Warburg nor Urban were sure of the identity of the plant, but I believe that Warburg was correct in suggesting that it is the plant which he called *F. omphalophora*, the common shrubby fig of the Lesser Antilles. *F. wilsoni* of Jamaica is indistinguishable, save only that the stomates are somewhat larger.

7. *FICUS HARTWEGH* (Miq.) Miq. Ann. Mus. Bot. Lugd.-Bat. 3:299. 1867.

*Urostigma hartwegii* Miq. in Hook. Lond. Journ. Bot. 6:545. 1847.

*Ficus colubrinae* Standl. in Contrib. U. S. Nat. Herb. 20:16. 1917.

Trees, 10–35 m. tall. Twigs 3–4 mm. in diameter, appressed pubescent to

glabrate, soon developing a rather thin yellowish brown periderm. Stipules to 20 mm. long, deltoid, appressed pubescent. Lamina 2.5–8 cm. wide  $\times$  3.5–13.5 cm. long, broadly elliptic or obovate, appressed pubescent on the veins; apex short abrupt acuminate; base rounded, emarginate or cuneate; lateral veins 4–6 (–8) pairs, departing from the midrib at an angle from  $20^{\circ}$ – $30^{\circ}$  ( $-40^{\circ}$ ); basal veins departing from the midrib at an angle from  $30^{\circ}$ – $40^{\circ}$  ( $-60^{\circ}$ ); intercostals only slightly prominent. Petiole 6–30 mm. long, ( $\frac{1}{4}$ –)  $\frac{1}{5}$ – $\frac{1}{7}$  the length of the lamina, appressed pubescent. Figs 6–7 mm. in diameter, globose, glabrous, borne among the leaves; color pale red; peduncle obsolete; basal bracts two, to 2 mm. long, semicircular, pubescent; ostiole to 2 mm. in diameter, plane in a very slight rim of receptacular tissue.

Guatemala and British Honduras to Colombia, in lowland forests and thickets.

BOCAS DEL TORO: Old Bank Island, *Von Wedel 1099*; Cricamola Valley, *Cooper 510*; Almirante, *Cooper 404*. CANAL ZONE: Fort Sherman, *Johnston 1626, 1748, Standley 31122*; Fort Randolph, *Standley 28676*; France Field, *Standley 30339*; Barro Colorado Island, *Sbattuck 239, Carpenter 20, Woodworth & Vestal 571, Kenoyer 319*. COCLÉ: El Valle de Antón, *Allen 2000, 2478, 2889*.

The basal veins appear to be three but are accompanied on either side by a pair of very inconspicuous nerves.

According to Dugand (*Caldasia* 2<sup>9</sup>:274–275. 1943) this is an extremely common fig in the central Andes of Colombia between 500 and 1600 m. altitude.

8. *FICUS DENDROCIDA* HBK. Nov. Gen. & Spec. Pl. 2:46. 1817.

*Ficus elliptica* HBK. loc. cit. 1817.

*Ficus arboricida* Schult. Mantissa 1:331. 1822.

*Ficus dendroctonia* Spreng. Syst. Veg. ed. 16. 3:780. 1826.

Large spreading trees, to 30 m. tall, frequently with many air roots. Twigs 2–3 mm. in diameter, pubescent, developing a rather thick dark brown periderm. Stipules 5–8 mm. long, narrowly deltoid, appressed pubescent. Lamina 2.5–5 cm. wide  $\times$  5–8.5 cm. long, elliptic or slightly obovate, scabrid above, pubescent beneath; apex acute; base rounded; lateral veins 5–8 (–12) pairs, departing from the midrib at an angle from  $30^{\circ}$ – $40^{\circ}$ ; basal veins departing from the midrib at an angle  $30^{\circ}$ – $50^{\circ}$ ; intercostals somewhat raised. Petiole 6–15 mm. long,  $\frac{1}{5}$ – $\frac{1}{10}$  the length of the lamina. Figs 5–6 mm. in diameter, globose, pubescent or glabrescent, borne among the leaves; color not noted; peduncle obsolete; basal bracts 1–2 mm. long, connate, semicircular, pubescent; ostiole 1–2 mm. in diameter, flat.

Panama and Colombia, perhaps to northern Brazil.

PANAMÁ: margins of tidal swamp, Pacora, *Allen 3446*.

This is a species which seems to be almost completely confined to the drainage of the Río Magdalena in Colombia, below 700 m. altitude. What little we know of its variation is due to the efforts of Dr. A. Dugand (*Caldasia* 2<sup>8</sup>:169–171. 1947), who notes that it is extremely variable in size, shape, texture and pubescence of the leaves.



9. *FICUS PERTUSA* L. f. Suppl. Plant. 442. 1781.

- Ficus padifolia* HBK. Nov. Gen. & Sp. 2:47. 1817.  
*Ficus complicata* HBK. loc. cit. 48. 1817.  
*Ficus ciliolosa* Link, Enum. Pl. Berol. 2:450. 1822.  
*Ficus myrtifolia* Link, loc. cit. 1822.  
*Ficus arbutifolia* Link, loc. cit. 1822.  
*Ficus cestrifolia* Schott, ex Spreng. Syst. Veg. ed. 16. 4 (App.):409. 1827.  
*Ficus lancifolia* Hook. et Arn. Bot. Beech. Voy. 310. 1841.  
*Ficus subtriplinervia* Mart. in Flora 24 (2 Beibl.):67. 1841.  
*Ficus arpazusa* Casaretto, Nov. Stirp. Bras. 15. 1842.  
*Ficus cerasifolia* Kunth & Bouché, Ind. Sem. Hort. Berol. 16. 1846.  
*Ficus planicostata* Kunth & Bouché, loc. cit. 1846.  
*Ficus periplocaefolia* Kunth & Bouché, loc. cit. 1846.  
*Ficus consanguinea* Kunth & Bouché, loc. cit. 1846.  
*Urostigma erythrosticktum* Miquel, in Hooker, Lond. Journ. Bot. 6:540. 1847.  
*Urostigma geminum* Ruiz ex Miquel, in Hooker, Lond. Journ. Bot. 6:547. 1847.  
*Urostigma scheideanum* Miquel, in Hooker, Lond. Journ. Bot. 6:539. 1847.  
*Pharmacosycea peruviana* Miquel in Hooker, Lond. Journ. Bot. 7:72. 1848.  
*Urostigma baccatum* Liebm. in Kong. Danske Vidensk. Selsk. Skr. 5 ser. 2:327. 1851.  
*Urostigma sapidum* Liebm. in Kong. Danske Vidensk. Selsk. Skr. 5 ser. 9:327. 1851.  
*Urostigma turbinatum* Liebm. in Kong. Danske Vidensk. Selsk. Skr. 5 ser. 9:327. 1851.  
*Urostigma sulcipes* Miq. in Vers. Med. Akad. Amsterdam, 13:413. 1862.  
*Ficus ochroleuca* Griseb. Fl. Brit. W. Ind. Isl. 151. 1864.  
*Ficus faydeni* Miq. Ann. Mus. Bot. Lugd.-Bat. 3:219. 1867.  
*Ficus baccata* (Liebm.) Miq. loc. cit. 3:299. 1867.  
*Ficus erythrostickta* (Miq.) Miq. loc. cit. 3:298. 1867.  
*Ficus liebmänniana* Miq. loc. cit. 1867.  
*Ficus gemina* (Ruiz, ex Miq.) Miq. loc. cit. 1867.  
*Ficus sapida* (Liebm.) Miq. loc. cit. 1867.  
*Ficus sulcipes* (Miq.) Miq. loc. cit. 1867.  
*Ficus turbinata* (Liebm.) Miq. loc. cit. 1867.  
*Ficus fasciculata* S. Wats. in Proc. Amer. Acad. 24:78. 1889, non King (1888).  
*Ficus sonora* S. Wats. loc. cit. 1889.  
*Ficus immersa* Warb. in Bull. Soc. Bot. Fr. 59 (Mem. 3):641. 1912. (1913), nom. nud.  
*Ficus palmicida* Pittier, in Bol. Soc. Venez. Cienc. Nat. 4<sup>30</sup>:69. 1937.  
*Ficus peruviana* (Miq.) Rossb. in Fedde, Repert. 43:61. 1937.  
*Ficus kanukuensis* Standl. in Lloydia. 2:174. 1939.  
*Ficus tarapotina* Warburg, mss.

Large spreading trees to 30 m. or more tall. Twigs 1–2 mm. in diameter, glabrous, or pubescent, developing a yellowish grey periderm. Stipules 5–7 mm. long, narrowly deltoid, glabrous or minutely puberulent. Lamina 1–5 cm. wide  $\times$  2.5–12 cm. long, elliptic or lanceolate; apex bluntly acute, acute or acuminate, the acumen 5–20 mm. long; base commonly cuneate, sometimes rounded cuneate, seldom rounded and slightly emarginate; lateral veins (4–) 6–12, departing from the midrib at an angle from 20°–60°; intercostals somewhat raised. Petiole 5–30 mm. long,  $\frac{1}{5}$ – $\frac{1}{8}$  ( $-\frac{1}{12}$ ) as long as the lamina. Figs 5–18 mm. in diameter, globose, glabrous, borne among the leaves; color pink or yellow or green with brown flecks; peduncle 2–5 mm. long, glabrous; basal bracts 1–4 mm. long, semi-circular, glabrous; ostiole 1–2 mm. in diameter, crateriform, the bracts sunken into the receptacle or surrounded by a raised ring of receptacular tissue.

Southern Mexico and Jamaica to Paraguay. In lowland to highland forests and savannas. *Mata palo*, *biguito*.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 350. CANAL ZONE: Barro Colorado Island, *Aviles* 47, *Salvoza* 910, *Bangham* 444. CHIRIQUÍ: Boquete, *Davidson* 652, *Pittier* 2889.

This, and *Ficus citrifolia* are undoubtedly the most widespread of the American species of the genus. This species, which is immediately recognized by its peculiar crateriform ostiole and narrowly lanceolate or elliptic leaves, differs from *F. citrifolia* in being absent from all of the West Indies except Jamaica, and being very common in Mexico and Central America (The Jamaican population is obviously related to the Central American!). There is a very definite distinction between populations on the basis of fruit size, but there is no sharp discontinuity either in measurements or in geography. In general, however, it can be said that the populations on the Caribbean coast of South America from Venezuela east to the Amazon, and in the Amazon basin, are relatively small fruited, while the Jamaican, Mexican, Central American, and southern and central Brazilian populations are relatively large fruited. With a few exceptions, in the island of Jamaica, the Brazilian population has larger figs than the Central American. This seems to me a peculiar, and probably quite significant pattern of distribution, but of what, or how, I cannot say. It goes without saying that an intensive study of this species in the field should be most rewarding.

The synonymy of this species is extensive but relatively simple. The name *Ficus pertusa* is based on a specimen from Surinam which represents the small fruited populations of that area. *F. subtriplinervia*, *F. erythrostickta*, *F. gemina*, *F. tarapotina* and *F. kanukuensis* all refer to this same general population. *F. padifolia* is the earliest name for the relatively large fruited populations in Colombia, Central America, Mexico and Jamaica. *F. complicata*, *F. lancifolia*, *F. ochroleuca*, *F. faydeni*, *F. baccata*, *F. sulcipes*, *F. sapida* and *F. turbinata* all refer to the same general population. *Ficus arpazusa* is the earliest name for the plants of south Brazilian and eastern Peruvian regions, which Warburg called *F. immersa*.

10. *FICUS TRACHELOSyce* Dugand, in *Caldasia* 4:69. fig. 14. 1942.

Strangler trees to about 25 m. tall, the young branches slender, glabrous, developing a thin yellowish periderm. Leaves oblong-elliptic, narrowly subcaudate-acuminate, broadly obtuse at the base, 6–12 cm. long, 2.5–5.0 cm. broad, rather closely pinnate-veined, submembranaceous, glabrous, the petiole 1.5–2.0 cm. long, slender; stipules narrowly lanceolate, subcoriaceous, about 1.5 cm. long. Receptacles paired at the nodes, subglobose, about 15 mm. broad, glabrous, the ostiole



Fig. 55. *Ficus trachelosyce*

depressed within a conspicuously elevated collar about 5 mm. long; involucre bracts 2, minutely deltoid, scarcely 1 mm. long; peduncle rather slender, about 5 mm. long.

Panama and Colombia, probably also in southwestern Costa Rica, in lowland forests.

CHIRIQUÍ: Puerto Armuelles, *Allen 6295*.

The above description was prepared by Dr. Woodson. I strongly suspect that this is simply a form of *Ficus pertusa*.

11. *FICUS BULLENEI* I. M. Johnston, in *Sargentia* 8:113. 1946.

Trees to 21 m. tall; twigs 3–4 mm. in diameter, frequently conspicuously angled, densely spreading reddish-brown pubescent, eventually developing a rather thick grey periderm; stipules 10–20 mm. long, deltoid, densely appressed, reddish-brown pubescent; lamina 45–110 mm. wide  $\times$  100–200 mm. long, oblong-obovate to broadly obovate or oval, densely spreading pubescent, especially below, becoming glabrate above; apex rounded, acute, or minutely acuminate; base rounded, rounded cuneate, or cuneate, sometimes emarginate; lateral veins 4–8 pairs, departing from the midrib at an angle of 20°–40°; basal veins departing from the midrib at a similar angle or from 40°–60°; intercostals not prominent; petiole 10–30 mm. long,  $\frac{1}{6}$ – $\frac{1}{10}$  the length of the lamina. Figs about 15 mm. in diameter, globose, minutely and densely spreading pubescent, borne among the leaves; color not noted; peduncle 1–4 mm. long; basal bracts two, 4–5 mm. long, ovate-deltoid; orifice about 2 mm. in diameter, surrounded by a raised collar of receptacular tissue, 2–3 mm. high.

Panama, in lowland forests and savannas.

CANAL ZONE: Corozal, *Allen 1837*. PANAMÁ: San José Island, *Johnston 231, 389, 643, 723, 805, 1367, Erlanson 136*.

12. *FICUS CITRIFOLIA* P. Mill. *Gard. Dict.* ed. 8. *Ficus* no. 10. 1768.

*Ficus pedunculata* Dryand. in *Ait. Hort. Kew.* ed. 1. 3:450. 1789.

*Ficus populifolia* Desf. *Tabl.* ed. 1. 239. 1804, nom. nud. (fide herb. Desf.).

*Ficus populnea* Willd. *Sp. Pl.* ed. 4. 4:1141. 1806.

*Ficus laevigata* Vahl, *Enum.* 2:183. 1806.

*Ficus lentiginosa* Vahl, loc. cit. 1806.

*Ficus gigantea* HBK. *Nov. Gen. & Spec.* 2:48. 1817.

*Ficus rubrinervis* Link, *Enum. Pl. Hort. Berol.* 2:448. 1822.

*Ficus eximia* Schott, ex Spreng. *Syst. Veg.* ed. 16. 4 (App.):410. 1827.

*Ficus pyriformis* Desf. *Cat. Hort. Par.* ed. 3. 413. 1829.

*Ficus catesbaei* Steud. *Nomencl.* ed. 2. 1:636. 1840.

*Ficus botryapioides* Kunth & Bouché, *Ind. Sem. Hort. Berol.* 15. 1846.

*Ficus syringaeifolia* Kunth & Bouché, loc. cit. 1846.

*Urostigma angustifolium* Miq. in Hook. *Lond. Journ. Bot.* 6:539. 1847.

*Urostigma amazonicum* Miq. loc. cit. 541. 1847.

*Ficus brevifolia* Nutt. *Sylva*, ed. 1. 2:3. 1854.

*Ficus surinamensis* Miq. *Ann. Mus. Bot. Lugd.-Bat.* 3:219. 1867.

*Ficus angustifolia* (Miq.) Miq. loc. cit. 298. 1867, nec Blume (1826) nec Roxb. (1814).

*Ficus amazonica* (Miq.) Miq. loc. cit. 1867.

*Ficus thomaea* Miq. loc. cit. 299. 1867.

*Ficus populoides* Warb. in Urb. *Symbol. Antill.* 3:479. 1903.

*Ficus rectinervis* Warb. in Bull. Soc. Bot. France 59 (Mem. 3):642. 1912 (1913), nom. nud.

- Ficus brittonii* Boldingh, Fl. Curaçao 20. 1914.  
*Ficus hemsleyana* Standl. in Contrib. U. S. Nat. Herb. 20:29. 1917 (non King, 1887).  
*Ficus guaranitica* Chodat, in Bull. Soc. Bot. Genève. 2 ser. 11:254. 1919 (1920).  
*Ficus turbinata* Pitt. in Bol. Soc. Venez. Cienc. Nat. 4<sup>30</sup>:61. 1937 (non Willd. 1806).  
*Ficus subandina* Dugand, in Caldasia 1<sup>4</sup>:66. 1942.  
*Ficus standleyana* Dugand, loc. cit. 2:441. 1944.  
*Ficus antimanensis* Pitt. Mss.  
*Ficus dugandii* auct.

Trees to 16 m. tall, or in exposed places, a shrub 0.3–2 m. tall. Twigs 2–6 mm. in diameter, glabrous, with a thin yellowish periderm. Stipules 5–30 mm. long, narrowly deltoid, glabrous, sometimes somewhat glaucous. Lamina 1.5–12 cm. wide  $\times$  2.5–20 cm. long, lanceolate, ovate, elliptic, elliptic-lanceolate, elliptic-ovate, oblong, or obovate; apex acute to acuminate; base rounded, rounded-cuneate cuneate, or truncate, frequently emarginate or subcordate; lateral veins 4–16 pairs, departing from the midrib at an angle from 10°–40°; basal veins, departing from the midrib at a similar angle, or to 60°; intercostals not, or scarcely, prominent. Petiole 7–70 mm. long, slender,  $\frac{1}{2}$ – $\frac{1}{4}$  ( $-\frac{1}{8}$ ) the length of the lamina. Figs 6–12 [–15] mm. in diameter, globose, glabrous, borne among the leaves; color reddish or yellowish when ripe; peduncle 2–18 mm. long, glabrous or puberulent; basal bracts two, 2–3 mm. long, broadly deltoid to semicircular, with a hyaline margin, glabrous or puberulent; orifice 2–3 mm. in diameter, flat or very slightly raised.

Florida to Paraguay, in lowland forests.

CANAL ZONE: Chagres, *Fendler 286*; Limón Bay, *Johnston 1533, 1548*; Culebra, *Pittier 2318*; Balboa, *Standley 25473, 25580*; Barro Colorado Island, *Standley 41129*. PANAMÁ: San José Island, *Johnston 109, 494, 680, 752, 1063, 1077, 1109, 1168, 1177, 1381, 1387, 1389, 1390*; Taboga Island, *Standley 27887*.

*F. hemsleyana* Standl. Standley published this name as a substitute for the epithet *verrucosa* of Liebmann. Standley apparently did not see the type, for the material that he has cited which I have seen (*Tonduz 11576*; *Fendler 286*) represents a form of *F. citrifolia*. Oersted's plant is a very different thing, perhaps allied to *F. petiolaris* or *F. obtusifolia*.

*Ficus citrifolia*, as I understand it, is a species which ranges from Florida to Paraguay. Though there seems to be little direct evidence, I presume that this is frequently a species of disturbed habitats. Specimens from relatively high altitudes (600–1700 m.) in the Greater Antilles and Venezuela and Colombia (*F. populoides*, *F. turbinata*, *F. subandina*) may represent a separate taxon, though present information suggests that they are only ecological forms. There is not enough information at present to evaluate their status.

The leaf shape is generally ovate, with the base rounded and/or more or less emarginate. The leaf bases may vary from round to emarginate on the same twig. Along the northern coast of South America and the eastern coast of Central America, from the Guianas to Honduras, the leaf form seems to be predominantly oblong (*F. angustifolia*, *F. surinamensis*, *F. hemsleyana*, *F. standleyana*). Forms occur, however, which are transitional to the normal leaf form of the species.

The type of *Ficus citrifolia* is in the Banksian Herbarium at the British Museum (NH). It consists of a twig with two leaves and a peduncle with the remnants of a fig. There is no doubt that it represents this common lowland fig of the West Indies. The Catesby plant to which Miller makes reference is not a particularly good representation, but N. L. Britton refers to it here.

13. *FICUS TRIGONATA* L. Pl. Surinam. 17. 1775.

*Ficus crassinervia* Desf. ex Willd. Sp. Pl. ed. 4. 4:1138. 1806.

*Ficus berteroi* Warb. in Urb. Symbol. Antill. 3:468. 1903.

*Ficus eggersii* Warb. loc. cit. 469. 1903.

*Ficus mamillifera* Warb. loc. cit. 470. 1903.

*Ficus stablii* Warb. loc. cit. 1903.

*Ficus hartii* Warb. loc. cit. 458. 1903.

*Ficus coombsii* Warb. loc. cit. 456. 1903.

*Ficus mitrophora* Warb. loc. cit. 457. 1903.

*Ficus yucatanensis* Standl. in Cont. U. S. Nat. Herb. 20:33. 1917.

*Ficus pittieri* Standl. loc. cit. 31. 1917, pro parte, quoad paratypus.

*Ficus campbellii* I. M. Johnston, in Sargentia 8:114. 1949.

*Ficus leavensii* I. M. Johnston, loc. cit. 117. 1949.

*Ficus fawcettii* Britton, Mss.

Large, spreading trees, to 15–25 m. tall. Twigs 2–5 mm. in diameter, glabrous or pubescent, developing a greyish-yellow periderm; stipules 15–27 mm. long, deltoid, glabrous or pubescent. Lamina 3–12 cm. wide  $\times$  4.5–25 cm. long, elliptic, or generally somewhat obovate; apex sometimes acute or even slightly acuminate, but generally rounded; base cuneate, rounded, or emarginate, sometimes slightly inequilateral; lateral veins (5–) 6–11 pairs, departing from the midrib at an angle from 20°–40°; basal veins 1–2, departing from the midrib at an angle from 30°–50°; intercostals slightly prominent. Petiole 7–50 mm. long,  $\frac{1}{4}$ – $\frac{1}{9}$  the length of the lamina. Figs 10–14 (–30) mm. in diameter, globose, glabrous or pubescent, borne among the leaves; color green when immature, red when mature; peduncle obsolete, or 2–10 mm. long, glabrous or puberulent; basal bracts two, 2–5 mm. long, deltoid or semicircular, sometimes variously split, variously glabrous, ciliolate, or puberulent; orifice 1–3 mm. in diameter, plane or slightly umbonate.

Greater Antilles and the Caribbean coast of Central America from Yucatan to Colombia.

CANAL ZONE: Gamboa, *Pittier 2602*; Chagres, *Fendler 285*; south of Fort Sherman, *Johnston 1640*. COCLÉ: El Valle de Antón, *Allen 1981*; Penonomé, *Williams 404*. PANAMÁ: San José Island, *Johnston 3, 495, 695, 721, 730, 791, 959, 1012, 1121, 1125, 1127, 1353, 1384*; *Erlanson 106, 206*; *Miller 1910*.

This is apparently one of the common figs of the Greater Antilles. While there is considerable vegetative variation within the species, there seems to be no discernable geographical restriction of the variation and, consequently, there seems to be little justification in recognizing a distinct species on each island. Besides this, it seems to be fairly common in Central America.

I have not seen all of the material cited by Standley under the name *Ficus velutina*, but the Panama collection (*Pittier 3359*) is surely this species.

14. *FICUS PARAENSIS* (Miq.) Miq. in Ann. Mus. Bot. Lugd.-Bat. 3:298. 1867.

*Urostigma paraensis* Miq. in Hook. Lond. Journ. Bot. 6:534. 1847.

*Ficus myrmecophila* Warb. in Karsten & Schenck, Vegetationsbilder 3: t. 2 et sub t. 3-4. 1905.

*Ficus panamensis* Standl. in Contrib. U. S. Nat. Herb. 20:15. 1917.

*Ficus thelephora* Benoist, in Arch. Bot. (Caen) Bull. 3:171. 1929 (1931).

*Ficus haughtii* Standl. in Publ. Bot. Field Mus. Nat. Hist. 17:170. 1937.

*Ficus uberrima* Standl. loc. cit. 177. 1937.

*Ficus putumayonis* Dugand, in Caldasia 14:62. 1942.

*Ficus arukensis* Standl. in Bull. Torr. Bot. Club 75:295. 1948.

*Ficus manabiensis* Standl. Mss.

Shrubs, or small to large trees to 10 m. tall. Twigs 2-7 mm. in diameter, glabrous or minutely puberulent, developing a greyish-brown, striate, periderm. Stipules to 35 mm. long, narrowly deltoid, glabrous or minutely puberulent. Lamina 2.5-9 cm. wide  $\times$  6-27 cm. long, oblong, oblong-elliptic, oblong-ob lanceolate or oblanceolate, glabrous; apex acuminate, the acumen commonly 5-10 mm. long, but sometimes to 25 mm.; base cordate, emarginate, rounded, or cuneate; lateral veins 9-18 pairs, departing from the midrib at an angle from 10°-30°; basal veins, at least the strongest, departing from the midrib at an angle from 40°-60°; intercostals scarcely, or somewhat, prominent. Petiole 5-35 (-80) mm. long,  $\frac{1}{3}$ - $\frac{1}{9}$  ( $-\frac{1}{11}$ ) the length of the lamina. Figs 10-18 mm. in diameter, globose to sub-pyriform, glabrous or minutely puberulent, borne among the leaves; color greenish or yellowish, sometimes with red streaks and sometimes with crimson basal bracts; peduncle obsolete to 3 mm. long; basal bracts 2-5 mm. long, ovate, connate, puberulent; ostiole 2-4 mm. in diameter, umbonate, to 3 mm. high.

Southern Mexico to Peru and northern Brazil, in lowland forests.

CANAL ZONE: Barro Colorado Island, *Bailey & Bailey 23*; Madden Road, *Allen 2540*. COLÓN: Río Fató, *Pittier 3893, 3908*. PANAMÁ: San José Island, *Johnston 627, 251, 1134, 1174 1365, 1409*.

The ripe receptacles appear to be olive green with purplish stripes and prominent purplish osteoles. Johnston (in *Sargentia* 8:118-119, 1949, *sub F. panamensis*), notes that although a strangler, *F. paraensis* does not appear to kill its host tree.

As here understood, *Ficus paraensis* is a common and widespread species in the lowland rainforest, ranging from southern Mexico (fide Standley) along the Caribbean coast to Panama, thence along the western coast of South America at least as far as Ecuador, and along the eastern coast of South America to the mouth of the Amazon, and westward from this to the foot of the Andes. There are a good many collections, particularly from Central America and the western part of the Amazon basin, with rather thick (5-7 mm. in diameter) twigs. In these same areas, and on the western coast of South America, forms with strongly emarginate (or cordate) leaf bases are also common. I suspect that these collections represent juvenile plants or shoots. Throughout the area of distribution, mention is made that ants build nests on the stems and branches of plants of this species.

15. *FICUS NYMPHAEAEFOLIA* P. Mill. Gard. Dict. ed. 8. *Ficus* no. 9. 1768.

*Ficus nymphaeifolia* L. Mant. Plant. Alt. 305. 1771.

*Ficus nymphoides* Thunb. Ficus Genus Dissert. 7. 1786.

*Ficus ierensis* Britton, in Bull. Torr. Bot. Club 48:329. 1921.

*Ficus anguina* R. Benoist, in Bull. Mus. Hist. Nat. (Paris) 30:104. 1924.

*Ficus duqueti* Dugand, in *Caldasia* 1<sup>4</sup>:42. 1942.

Trees 7–35 m. tall, glabrous. Twigs 4–13 mm. in diameter, glabrous or minutely puberulent. Stipules to 40 mm. long, lanceolate or deltoid, glabrous or minutely puberulent, or glaucous. Lamina 6.5–20 cm. wide  $\times$  9–30 cm. long, ovate or ovate-rotund; apex acute, broadly acute, rounded, or sometimes shortly acuminate; base cordate; lateral veins (4–) 5–11 pairs, departing from the midrib at an angle from 10°–40°; basal veins departing from the midrib at an angle of 20° or less; intercostals not prominent. Petiole 30–200 mm. long,  $\frac{1}{2}$ – $\frac{1}{4}$  the length of the lamina. Figs 15–25 mm. in diameter, globose, minutely puberulent or glaucous, borne among the leaves; color greenish, with purple spots; peduncle obsolete to 5 mm. long; basal bracts 4–19 mm. long, deltoid or ovate, connate, minutely puberulent or glaucous; ostiole 2–3 mm. in diameter, probably plane with the surface, but in dried material frequently raised, or surrounded by a more or less distinct ring of receptacular tissue.

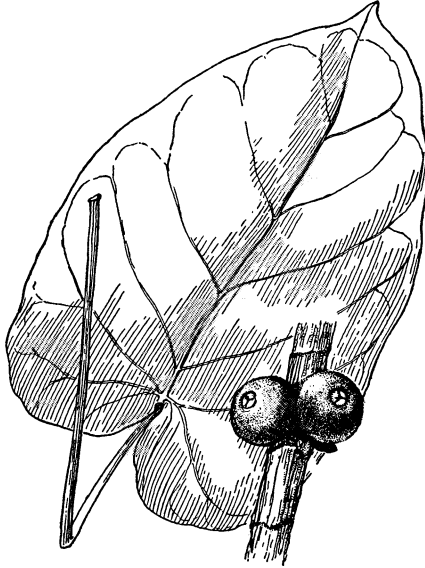


Fig. 56. *Ficus nymphaeaeifolia*

Costa Rica to State of Amapa, Brazil, in lowland forests.

CANAL ZONE: northwestern part of Canal Zone, *Johnston 1596*; Maru Towers, *Johnston 1550*; Barro Colorado Island, *Shattuck 267*, *Woodworth & Vestal 708, 392*, *Bailey & Bailey 373*; Madden Reservoir, *Muenschler 12299*.

This seems to be a fairly common species on the lower slopes (below 1000 m.) of the mountains behind the coast, and in the lowland forests, from Panama to the mouth of the Amazon. Humboldt found it in the coastal mountains of Venezuela and recorded it as having many buttress-like aerial roots. The species seems to be quite uniform throughout its range, though there are a few minor variations. The few specimens I have seen from Panama have the apex of the leaf very shortly acuminate. Some of the Colombian material and specimens from Trinidad have larger basal bracts to the fig than are found in material from other areas, but the Trinidad material differs from the Colombian in that it seems not to have tabular crystal cells in the veins.

16. *FICUS OBTUSIFOLIA* HBK. Nov. Gen. & Sp. 2:49. 1817, non Roxb. (1814).

*Urostigma involutum* Liebm. in K. Dansk. Vid. Selsk. Skrivt. 5 ser. 2:320. 1851.

*Urostigma bonplandianum* Liebm. loc. cit. 323. 1851.

*Ficus involuta* (Liebm.) Miq. in Ann. Mus. Bot. Lugd.-Bat. 3:298. 1867.

*Ficus bonplandiana* (Liebm.) Miq. loc. cit. 1867.

*Ficus proctor-cooperi* Standl. in Field Mus. Publ. Bot. 4:201. 1929.

Trees to about 20 m. tall. Twigs 5–6 mm. in diameter, glabrous or pubescent, with thick wrinkled grey periderm. Stipules to 30 mm. long, deltoid, glabrous. Lamina 3.5–12 cm. wide  $\times$  9–25 cm. long, oblanceolate to broadly obovate, glabrous; apex rounded or bluntly acute; base cuneate; lateral veins 5–11 pairs, departing from the midrib at an angle from 20°–40°; basal veins departing from the midrib at an angle from 40°–50°; intercostals not, or scarcely, prominent. Petiole 10–30 mm. long,  $\frac{1}{6}$ – $\frac{1}{9}$  the length of the lamina. Figs 15–20 mm. in diameter, globose, glabrous or minutely puberulent, borne among the leaves; color not noted; peduncle obsolete to 8 mm. long, puberulent; basal bracts two, 4–7 mm. long, semicircular, connate, sometimes more or less split, finely pubescent; orifice 3–5 mm. in diameter, flat or somewhat umbonate.

Southern Mexico to northern Peru, in lowland forests.

CANAL ZONE: Daytonia Farm, *Cooper 436*; Gamboa, *Standley 28524*; Fort Randolph, *Standley 28729*; Barro Colorado Island, *Woodworth & Vestal 619*, *Kenoyer 320*. SAN BLAS: *Permé, Cooper 641*.

This is apparently a fairly widespread species, ranging from Central Mexico to northern Guatemala, thence along the Pacific Coast through Costa Rica and Colombia to northern Peru. It ranges in altitude from near sea level to 1500–1800 m.

I have seen the HBK. type in Paris and the Liebmann types from Copenhagen. There can be no question but that these are conspecific.

The name *Ficus obtusifolia* was first used by Roxburgh in the Hortus Bengalensis in 1814. It was here a nomen nudum, not validly published, so that it does not invalidate the publication of *Ficus obtusifolia*, HBK. in 1817. Roxburgh's name was not validly published until 1832.

I have not seen the type of *Ficus proctor-cooperi* Standley. That name is included in synonymy here on the authority of Dr. Woodson.

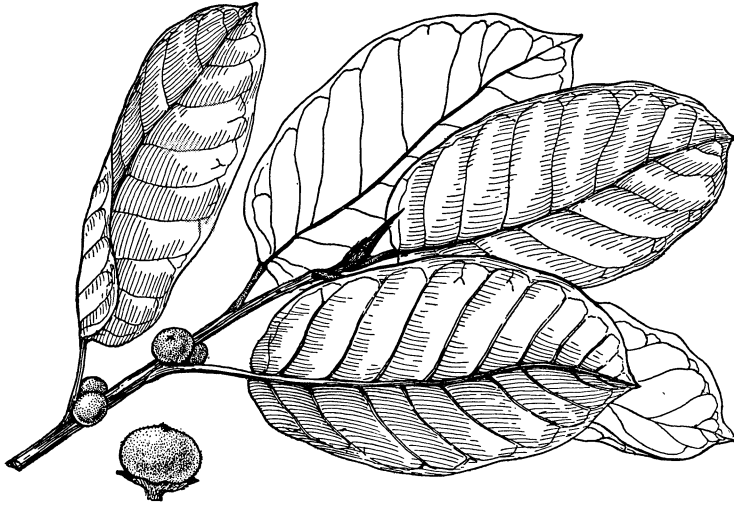
17. *FICUS COSTARICANA* (Liebm.) Miq. in Ann. Mus. Bot. Lugd.-Bat. 3:298. 1867.

*Urostigma costaricanum* Liebm. in K. Dansk. Vid. Selsk. Skrivt. 5 ser. 2:322. 1851.

*Ficus kellermannii* Standl. in Contrib. U. S. Nat. Herb. 20:18. 1917.

Trees 12–15 m. tall. Twigs 3–5 mm. in diameter, pubescent or glabrate, developing a rather thin brownish grey periderm. Stipules 12–25 mm. long, broadly deltoid, glabrous, persistent. Lamina 3–7.5 cm. wide  $\times$  6–18 cm. long, oblanceolate or oblong-elliptic, frequently somewhat inequilateral, glabrous; apex rounded, acute, or shortly blunt acuminate; base rounded or rounded cuneate, emarginate; lateral veins 5–12 pairs, departing from the midrib at an angle from



Fig. 57. *Ficus costaricana*

20°–30°; basal veins departing from the midrib at an angle of 50°–60°; intercostals prominent. Petiole 5–30 mm.,  $\frac{1}{6}$ – $\frac{1}{9}$  the length of the lamina. Figs 10–12 mm. in diameter, depressed globose; glabrous, borne among the leaves; color reddish with darker spots; peduncle obsolete; basal bracts 5–10 mm. broadly deltoid, glabrous.

Guatemala to Panama, at low or intermediate elevations.

CANAL ZONE: Barro Colorado Island, *Woodworth & Vestal 572, Salvoza 937, Standley 41148*. CHIRIQUÍ: *David, Pittier 2826, 2835; Caldera, Pittier 3348*.

The persistent stipules and the oblate reddish receptacles with rather thin flesh are outstanding traits of this species. It also is represented by *S. Hayes 838 (sine loco)*.

18. *FICUS TUERCKHEIMII* Standl. in *Contrib. U. S. Nat. Herb.* 20:13. 1917.

*Ficus isophlebia* Standl. loc. cit. 14. 1917.

*Ficus jimenesii* Standl. loc. cit. 1917.

Trees to 30 m. tall. Twigs 4–6 mm. in diameter with crowded internodes, glabrous, developing a rather thick reddish-brown periderm. Stipules 15–20 mm. long, narrowly deltoid, glabrous, sometimes glaucous. Lamina 3–10.5 cm. wide  $\times$  4–17 cm. long, broadly oval or ovate, glabrous; apex rounded or bluntly acute; base rounded cuneate, rounded, truncate, sometimes more or less emarginate or subcordate; lateral veins 7–10 pairs, departing from the midrib at an angle from (15°–) 25°–40°; basal veins departing from the midrib at a similar angle or up to 70°; intercostals not prominent. Petiole 20–65 mm. long, 2–3 mm. thick,  $\frac{1}{2}$ –

$\frac{1}{3}$  ( $-\frac{1}{5}$ ) the length of the lamina. Figs 9–14 mm. in diameter, depressed globose, glabrous, borne among the leaves; color not noted; peduncle obsolete; basal bracts 10–15 mm. long, rounded deltoid, surrounding the receptacle and adherent to it for about 5 mm.

British Honduras to Panama and possibly southward, in lowland forests.

BOCAS DEL TORO: Puerto Armuelles, *Woodson & Schery, 812*. CHIRIQUÍ: David, *Pittier 2821*.

Possibly more than one species is represented here, but I doubt it. The receptacles are so closely sessile as a rule that the growing twig beneath them develops curious persistent sockets which remain long after the fruit has fallen.

19. *FICUS DAVIDSONIAE* Standl. in *Field Mus. Publ. Bot.* 22:15. 1940.

Trees to 30 m. tall. Twigs stout, glabrous, with a thick brown periderm. Stipules about 10 mm. long, deltoid. Lamina 4–7 cm. wide  $\times$  8–15 cm. long, oblanceolate or broadly obovate, glabrous; apex rounded or obtuse; base cuneate or broadly cuneate; lateral veins 8–12, departing from the midrib at an angle of  $20^{\circ}$ – $30^{\circ}$ ; basal veins departing from the midrib at an angle of  $50^{\circ}$ – $60^{\circ}$ ; intercostals not prominent. Petiole 10–20 mm. long,  $\frac{1}{3}$  the length of the lamina. Figs 8–10 mm. in diameter, globose, glabrous, borne among the leaves; color unknown; peduncle obsolete; basal bracts broadly rounded, deltoid, about as long as the receptacle.

El Salvador to Panama, in higher-elevation forests.

CHIRIQUÍ: Boquete, *Davidson 534, 688*; *Von Hagen & Van Hagen 2095*. COCLÉ: La Mesa, *Allen 2832*.

For this species I have seen only a leaf of *Davidson 688*. On the basis of general shape and proportions, confirmed by the structure of the lower epidermis, this seems to be fairly closely related to *Ficus clusiaefolia* Schott, ex Spreng. of the eastern coast of South America from Venezuela to Rio de Janeiro.

13. *POUROUMA* Aubl.

*POUROUMA* Aubl. *Hist. Pl. Guian. Fr.* 2:891. 1775.

*Puruma* St.-Hil. *Expos. Fam.* 2:313. 1805, var. orth.

Diocious trees, frequently epiphytic and strangling when juvenile, the branches usually stout and hollow. Leaves spiral, basifixed, entire to deeply lobed; stipules fully amplexicaul and leaving a scar completely surrounding the stem. Inflorescences repeatedly cymose, the flowers rather indefinitely glomerate at the ends of the branches. Staminate flowers with 4 nearly free tepals and 4 free stamens. Pistillate flowers with a fleshy cupular or tubular perianth, epigynous; stigma obscurely 2-lobed. Fruit a somewhat fleshy false drupe of moderate size.

Perhaps 30 or more species from southern Mexico to Bolivia and Brazil. In Panama and Costa Rica the trees are known locally as *guarumo*, a name applied to certain other quite unrelated plants with a milky or mucilaginous sap.

The species of *Pourouma* are perhaps the most ambiguous and vexatious of American Moraceae, a dubious distinction. The representation from Panama is extremely meagre and very little, if anything, is known of the variability of the species of the genus in any part of its range. The flowers apparently display little in the way of systematic variation. Consequently the species which follow are quite tentative.

- a. Leaves not deeply lobed, the median lobe divided about halfway or less to the petiole and scarcely constricted at the base (sometimes entire or subentire in *P. radula*).
- b. Pubescence spreading fulvous-tomentellous; leaves 3-lobed or sometimes entire. .... 1. *P. RADULA*
- bb. Pubescence rubiginous-papillate, variously interspersed-hispid; leaves usually 5-lobed. .... 2. *P. JOHNSTONII*
- aa. Leaves deeply lobed, the median lobe divided about two-thirds or more to the petiole, definitely constricted at the base.
- b. Pubescence (except the upper inflorescence) appressed-sericeous; leaves usually 3-lobed. .... 3. *P. SCOBINA*
- bb. Pubescence rubiginous-papillate, variously interspersed-hispid; leaves usually 7- to 9-lobed. .... 4. *P. ORARIA*

1. *POUROUMA RADULA* R. Bén. in Bull. Mus. Hist. Nat. Paris 28:320. 1922.

Trees of moderate size, the young branches relatively slender, minutely fulvous-tomentellous to glabrate. Leaves variable, entire and ovate-elliptic to broadly 3-lobed with the median lobe divided about halfway to the petiole and scarcely constricted at the base, obtuse to broadly acute at the tip, rounded to cordate at the base, 10–25 cm. long and 6–15 cm. broad, firmly membranaceous, scabridulous above, densely and minutely fulvous-tomentellous beneath, the petiole 2–12 cm. long, rather slender, densely and minutely fulvous-tomentellous. Inflorescences about as long as the subtending petioles or somewhat shorter, densely and minutely fulvous-tomentellous. Fruits broadly ovoid, about 1.5 cm. long, minutely fulvous-tomentellous.

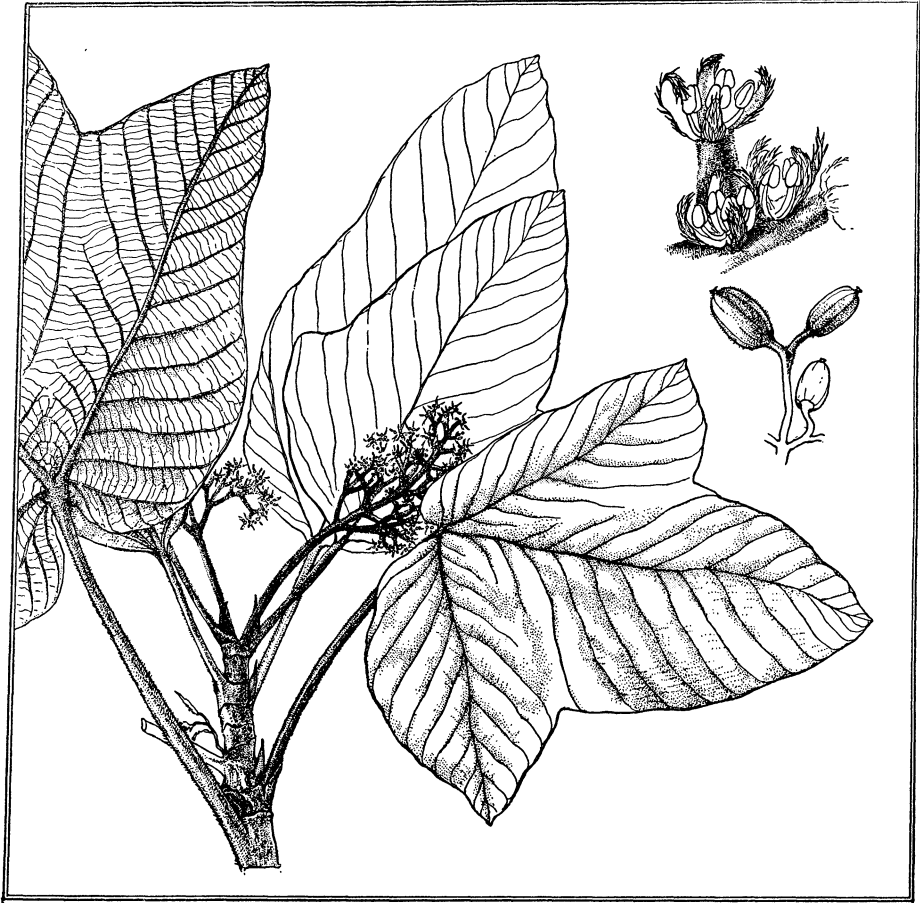
Panama to the Guianas, in lowland forests.

"PANAMA": locality unknown, *Hayes 860*.

The leaves of this specimen coincide fairly well with those of the type specimen of *P. aspera* Tréc., tracings of which were sent me by M. Léandri of Paris. However Trécul describes the pubescence of *P. aspera* as consisting of "*pilis albis adpressis*".

2. *POUROUMA johnstonii* Woodson, spec. nov.

Arbores ut dicitur ca. 7–12 m. attingentes, ramulis crassis fistulosis dense rubiginoso-papillatis pilis hispidis interspersis. Folia latissime 5-lobata basi amplectante cordata supra scaberula subtus pallidiora inter venas venulasque hirtellas minute appresse arachnoideo-villosula, lobis breviter acuminatis per longitudinem ca. dimidiam basi conjunctis parte libera medii ca. 20 cm. longa 15 cm. lata, 2 exteriorum ca. 5 cm. longa et lata sinibus obtusis, petiolis ca. 20 cm. longis minute rubiginoso-papillatis pilis hispidis interspersis; stipulis anguste laceolatis ca. 8–10 cm. longis extus rubiginoso-papillatis pilis hispidis interspersis. Flores sexum

Fig. 58. *Pourouma radula*

amborum ignoti. Pedunculi fructiferi 2 ca. 10–15 cm. longi parte inferiori rubiginoso-papillatis pilis hispidis interspersis, fructibus late compressis ovoideis ca. 1.5 cm. longis 1 cm. latis dense rubiginoso-papillatis.

CANAL ZONE: Maru Towers, west of Limón Bay, March 27, 1956, I. M. Johnston 1714 (MO, HOLOTYPE); railroad relocation between Gorgona and Gatún, Pittier 2286.

Closely related to *P. oraria*, but probably distinct as set forth in the key.

3. *POUROUMA SCOBINA* R. Bén. in Bull. Mus. Hist. Nat. Paris 28:320. 1922.

Trees to about 30 m. tall, the branches stout, hollow, appressed-sericeous to glabrate. Leaves at maturity deeply 3-lobed, broadly cordate, about 10–25 cm. long and broad, the lobes divided about two-thirds to the petiole, the median lobe definitely constricted at the base, scaberulous above, pale and densely papillate beneath and appressed-sericeous along the veins, the petiole 20–30 cm. long, densely

appressed-sericeous; stipules narrowly lanceolate, about 8–10 cm. long, densely appressed-sericeous. Peduncles paired at the nodes, slightly shorter than the subtending petioles, densely appressed-sericeous below, rubiginous-papillate above. Neither staminate nor pistillate flowers known from Panama. Fruits broadly compressed-ovoid, about 1.5 cm. long and 1 cm. broad, minutely puberulent.

Guatemala to the Guianas, in forests of intermediate elevations.

COCLÉ: north of El Valle de Antón, *Allen 3742*. DARIÉN: Cana, *Williams 983*.

Closely related to *P. palmata* Poeppig & Endl., in which the leaf base is typically truncate.

#### 4. *POUROUMA ORARIA* Standl. & Cuatr. in *Caldasia* 7:301. 1956.

Apparently trees of moderate size, the young branches stout and hollow, densely rubiginous-papillate interspersed-hispid to glabrate. Leaves at maturity deeply 7- to 9-lobed about two-thirds or more to the petiole, deeply amplexant-cordate at the base, about 25–35 cm. long and broad, the median lobe strongly contracted at the base, scaberulous above, paler and densely arachnoid-vilosulose beneath, the petiole about 15–25 cm. long, densely rubiginous-papillate sparsely interspersed-hispidulous; stipules oblong, 8–10 cm. long, densely rubiginous-pulverulent interspersed hispid. Peduncles paired at the nodes, the peduncle somewhat shorter than the subtending petiole, rubiginous-papillate sparsely interspersed-hispidulous. Staminate flowers unknown. Fruits compressed-ovoid, about 1.5 cm. long and 1 cm. broad, densely rubiginous-papillate interspersed-hispidulous.

Panama and Colombia.

"PANAMA": *Hayes 348, 862*.

Reminiscent of *P. cecropiaefolia* Mart. ex Miq. of the Amazon basin, but the leaf lobes are not as deeply divided nor as many as in that species. *Shattuck 260* from Barro Colorado Island may represent a juvenile leaf form.

#### 14. *COUSSAPOA* Aubl.

*COUSSAPOA* Aubl. *Hist. Pl. Guian. Fr.* 2:955. 1775.

Dioecious trees, usually epiphytic when juvenile. Leaves spiral, basifixed, entire to more or less definitely undulate or crenate; stipules fully amplexicaul, leaving a scar completely surrounding the stem. Inflorescences usually paired at the nodes, the staminate dichotomously compounded small globular heads, the pistillate superficially simple or (in *C. magnifolia*) obscurely compound heads. Staminate flowers with 4 (–3) free tepals and 2 completely fused stamens. Pistillate flowers tubular or clavate, the limb thickened and calyptriform and minutely porous much as in *Cecropia*, the ovary superior, with a barely exerted penicillate stigma. Fruit a scantily fleshy syncarp.

About 30 species ranging from southern Mexico to Brazil and Peru. *Coussapoa* resembles *Ficus* in its frequently epiphytic germination and strangling habit, but it is less aggressive in the latter trait. The hollow branches frequently are inhabited by ants.

- a. Leaves more or less deeply cordate, the venation subpalmate, with 6-8 pairs of upper secondaries, the tertiaries prominently dendroid and forming a coarse and irregular reticulum; pistillate heads obscurely compound, 2- to 4-lobed..... 1. *C. MAGNIFOLIA*
- aa. Leaves obtuse or rounded at the base, rarely truncate or obscurely cordate, the venation typically and closely pinnate with 10-20 pairs of secondaries, the tertiaries densely parallel and forming a delicate uniform reticulum; pistillate heads apparently simple, spherical.
- b. Pistillate heads long-pedunculate; leaves persistently arachnoid-tomentellous beneath..... 2. *C. PANAMENSIS*
- bb. Pistillate heads subsessile or very shortly pedunculate; leaves nearly glabrate beneath..... 3. *C. BREVIPES*

1. *COUSSAPOA MAGNIFOLIA* Tréc. in Ann. Sci. Nat. 3 ser. 8:98. 1847.

*Coussapoa nymphaeifolia* Standl. in Proc. Biol. Soc. Wash. 37:50. 1924, as to specimens cited, in part, not as to type.

*Coussapoa chagresiana* A. D. Hawkes, in Phytologia 3:30. 1948.

Trees to about 10 m. tall, the branches stout and hollow, minutely ferruginous-tomentellous to glabrate. Leaves broadly oval, broadly rounded at the tip, more or less deeply cordate at the base, 15-30 cm. long, 10-25 cm. broad, entire or indefinitely undulate, firmly membranaceous, minutely puberulent to glabrate beneath, the venation subpalmate and rather distant, with 6-8 pairs of upper secondaries, the tertiaries prominently dendroid and forming a coarse and irregular reticulum, the petioles 5-15 cm. long; stipules about 3-5 cm. long, minutely ferruginous-tomentellous. Staminate inflorescences much shorter than the subtending petioles, about 3- to 4-times dichotomous, the heads nearly 1 cm. broad at anthesis. Pistillate inflorescences obscurely compound, the heads 2- to 4-lobed, 4-5 cm. broad at anthesis, the peduncles simple, about 2-3 cm. long.

Panama to Peru, in lowland forests.

CANAL ZONE: Chagres, *Hayes 354*; Fort San Lorenzo, *Allen 5120*; west of Limón Bay, *Johnston 1768*; Barro Colorado Island, *Kenoyer 321*, *Woodworth & Vestal 606*.

*Hayes 354*, the type of *C. chagresiana*, was cited by Standley following the description of *C. nymphaeifolia*, but the type of the latter from Costa Rica, *Cook & Doyle 157*, has foliage with more typically pinnate, crowded venation and the pistillate heads are quite sessile. The Panamanian plants seem to coincide exactly with a Pavón isotype photographed at Berlin by Dr. J. Francis Macbride.

2. *COUSSAPOA PANAMENSIS* Pittier, in Contrib. U. S. Nat. Herb. 18:226. 1917.

Trees up to about 30 m. tall, the branches relatively slender, glabrous or essentially so. Leaves ovate, obtuse at the tip, obtuse or rounded, rarely truncate or obscurely cordate at the base, 10-30 cm. long, 7-15 cm. broad, subcoriaceous, entire to somewhat crenate toward the tip, persistently arachnoid-tomentellous and cinereous beneath, the venation closely and typically pinnate with 10-20 pairs of secondaries, the tertiary venation densely parallel and forming a delicate and uniform reticulum, the petioles 2-8 cm. long; stipules 2-6 cm. long, densely and minutely puberulent-papillate. Staminate inflorescences about equaling or much shorter than the subtending petioles, 2- to 4-times dichotomous, the heads about 5



Fig. 59. *Coussapoa panamensis*

mm. broad at anthesis. Pistillate inflorescences apparently simple, the heads about 1 cm. broad at anthesis, the peduncles 2–6 cm. long, minutely puberulent.

Southern Mexico to Panama and probably extending into northern South America, in lowland forests.

BOCAS DEL TORO: Chaguinola Valley, *Dunlap 299*; Río Cricamola, *Woodson, Allen & Seibert 1893, Cooper 538*; Coca Cay, *Von Wedel 2879*; Water Valley, *Von Wedel 1733*. CANAL ZONE: Fort Sherman, *Standley 30924*; Río Medio, *Miller 1718*; Gatún, *Hayes 414, 986, 1008*; Barro Colorado Island, *Standley 41170, Kenoyer 314, Woodworth & Vestal 445, 660*. COLÓN: Río Fató, *Pittier 3892*. PANAMÁ: San José Island, *Johnston 606, 652, Erlanson 240*.

3. *COUSSAPOA BREVIPES* Pittier, in *Contrib. U. S. Nat. Herb.* 18:225. 1917.

Epiphytic shrubs, the branches relatively stout, glabrate. Leaves broadly oval, obtuse to rounded at the tip and at the base, crenate, 10–17 cm. long, 6–11 cm. broad, subcoriaceous, inconspicuously arachnoid beneath to nearly glabrate, the venation rather typically and closely pinnate, with about 11 to 14 pairs of secondaries, the tertiary venation densely parallel and forming a delicate uniform reticulum, the petioles 4–6 cm. long; stipules 4–7 cm. long, minutely and densely arachnoid-puberulent. Staminate inflorescences unknown. Pistillate inflorescences apparently simple, sessile, the heads about 1 cm. broad at anthesis.

Panama in lowland forests. Known only from the type collection.

SAN BLAS: Sperdí, near Puerto Obaldía, *Pittier 4386*.

A puzzling species, possibly present in Colombia also.

#### 15. *CECROPIA* L.

*CECROPIA* L. in *Loefl. Iter Hisp.* 272. 1758, nom. conserv.

*Coilotapalus* P. Br. *Hist. Jam.* 111. 1756, nom. rejic.

*Ambaiba* Adans. *Fam.* 2:377. 1763.

Diocious trees, the trunk and branches stout and hollow. Leaves spiral, eccentrically peltate when mature; stipules fully amplexicaul and leaving a scar completely surrounding the stem. Inflorescences of spadiceous spikes in digitate clusters. Staminate flowers: perianth tubular with a somewhat thickened porous operculum; stamens 2. Pistillate flowers: perianth tubular with thin shredding walls and a fleshy porous circumscissile operculum, the penicillate stigma barely exerted. Fruit a minute achene.

Possibly in excess of 80 species of tropical America; a genus badly in need of revision as in most *Moraceae*, the species of which are probably not as difficult to distinguish as has been supposed.

*Cecropia* is one of the most conspicuous and picturesque trees of moderate size in clearings and thicket areas because of its rapid growth and long-petioled digitate leaves; it is seldom if ever found in established forests. The hollow trunks and branches almost invariably are the homes of myriads of aggressive ants. It is commonly known as *guarumo*, with various modifications.

Young seedlings of *Cecropia* present what may be an interesting instance of juvenile reversion. The first stem leaves of *C. peltata* are subtended by lateral stipules and are undivided although with more or less undulate-serrate margins; next ensue leaves with fully amplexicaul stipules and basifixed blades which are palmately divided into 3 segments as in many species of *Pourouma*. Finally the excentrically peltate mature foliage is attained.





Fig. 60. *Cecropia peltata*

- a. Leaves divided about midway to the center or scarcely beyond, the lobes not contracted toward the base or scarcely so; spadices usually shorter than the common peduncle; spathes about 4–6 cm. long shortly before anthesis.
  - b. Basal pulvinus of petioles minutely ferruginous-velutinous without conspicuous interspersed longer hairs; staminate spadices in pedunculate clusters of 12–30; pistillate spadices in clusters of 4–6, nearly half as long as the common peduncle; spathes densely arachnoid-villous. .... 1. *C. PELTATA*
  - bb. Basal pulvinus of petioles with the ferruginous velamen more or less concealed by interspersed dense white longer hairs; staminate spadices in pedunculate clusters of 50–60; pistillate spadices in clusters of 10–12, far shorter than the common peduncle; spathes shortly hirtellous. .... 2. *C. LONGIPES*
- aa. Leaves divided about two-thirds to three-quarters to the center, the lobes conspicuously contracted toward the base; spadices usually longer than the common peduncle; spathes 10–15 cm. long shortly before anthesis.
  - b. Leaves smooth above; petioles densely arachnoid-villous; pistillate spadices with enlarged subcalyculate pruinose stipes, 8–10 cm. long at anthesis; staminate spadices about 10..... 3. *C. EXIMIA*
  - bb. Leaves scaberulous above; petioles minutely puberulent or hirtellous; pistillate spadices subsessile or with slender stipes.
    - c. Leaves conspicuously pellucid-maculate; staminate spadices in clusters of 12–15, 5–6 cm. long; pistillate spadices in clusters of 3–4, about 15 cm. long in fruit..... 4. *C. MAXONII*
    - cc. Leaves not pellucid-maculate; staminate spadices in clusters of 3–6, 12–14 cm. long; pistillate spadices in clusters of 3–4, 25–30 cm. long..... 5. *C. OBTUSIFOLIA*

1. *CECROPIA PELTATA* L. Syst. Nat. ed. 10. 1286. 1759.

*Cecropia humboldtiana* Kl. in Linnaea 20:530. 1847.

*Cecropia arachnoidea* Pittier, in Contr. U. S. Nat. Herb. 18:226. 1917.

*Cecropia asperima* Pittier, loc. cit. 227. 1917.

Trees 6–20 m. tall with stout, seldom-branching trunks, the young branches stout, hispidulous to glabrate. Mature leaves divided about midway to the center or scarcely beyond, scabridulous above, paler and densely arachnoid-villosulose to glabrate beneath, the lobes usually 9–11, not contracted toward the base or scarcely so, obtuse to rounded at the tip, the petioles densely and minutely hirtellous, with a ferruginous-velutinous basal pulvinus; stipules about 6–9 cm. long, hirtellous. Staminate spadices in clusters of 12–30, 3–5 cm. long, about 4 mm. in diameter, with slender hirtellous stipes about 3–5 mm. long, the spathes 4–6 cm. long shortly before anthesis, broadly conic-oblongoid, densely white-arachnoid-villous, the common peduncle 7–10 cm. long after anthesis, slender, minutely hirtellous. Pistillate spadices in clusters of 4–6, at anthesis about 4–5 cm. long and 5 mm. in diameter, in fruit about 5–10 cm. long and 1 cm. in diameter, subsessile or with very inconspicuous stipes, the spathes as in the staminate inflorescences, the common peduncle about 7–8 cm. long at anthesis, somewhat accrescent in fruit.

Southern Mexico to northern South America and in the Greater Antilles, chiefly in clearings and thickets at low elevations.

CANAL ZONE: Frijoles, *Piper* 5837; Gamboa, *Standley* 28477; Matachin, *Pittier* 4056; Culebra, *Pittier* 4060; Tabernilla, *Pittier* 3823; Barro Colorado Island, *Kenoyer* 310, *Seibert* 565. PANAMÁ: San José Island, *Johnston* 154, 155, 78, 471, *Erlanson* 233, *Harlow* 87.

The leaves of this species, as in all *Cecropias*, vary so greatly in size and are frequently so large that only a very poor impression is imparted by herbarium specimens. In *C. peltata* mature leaves may attain a diameter of nearly one half meter.

2. *CECROPIA LONGIPES* Pittier, in Contr. U. S. Nat. Herb. 18:227. 1917.

Trees to about 10 m. tall with stout seldom-branching trunks, the young branches very stout, densely gray-hispid to glabrate. Mature leaves divided about midway to the center or less, scabridulous above, paler and subarachnoid-puberulent beneath, the lobes 9–13, not contracted toward the base or scarcely so, broadly obtuse to rounded at the tip, the petioles very stout, densely gray-hirtellous, with the ferruginous velamen of the basal pulvinus more or less concealed by interspersed white longer hairs; stipules about 9 cm. long, ferruginous-hirtellous with interspersed longer white hairs. Staminate spadices in clusters of 50–60, 4–12 cm. long and about 2 mm. in diameter, with slender gray-hirtellous stipes about 2 cm. long, the spathes unknown, the common peduncle about 10–12 cm. long, gray-hirtellous after anthesis. Pistillate spadices in clusters of 8–12, at anthesis about 8–9 cm. long and 5 mm. in diameter, in fruit about 10–12 cm. long and 1 cm. thick, very shortly stipitate, the spathes about 5–6 cm. long, gray-hirtellous, the common peduncle 5–6 cm. long, rather irregularly but conspicuously gray-hirtellous, somewhat accrescent in fruit.

Presently known only from Panama, in thickets and secondary forests at low elevations.

CANAL ZONE: Tabernilla, Pittier 3823, 3825; Madden Dam, Woodson Allen & Seibert 1312, 1313; Fort Sherman, Johnston 1503; Barro Colorado Island, Aviles 63, Bailey & Bailey 421.

The extremely long pendulous pistillate peduncles are most impressive. The mature leaves may attain a diameter of nearly a meter.

3. *CECROPIA EXIMIA* Cuatr. in Rev. Acad. Colomb. Cienc. 6:287. 1945.

Trees to about 10 m. tall with stout seldom-branching trunks, the young branches very stout, shortly hispidulous to glabrate. Mature leaves divided nearly to the center, smooth and when juvenile sparsely arachnoid-villous above, paler and minutely canescent beneath, the lobes about 9, conspicuously contracted toward the base, broadly acute or obtuse at the tip, the petioles very stout, densely arachnoid-villous with the basal pulvinus ferruginous-velutinous; stipules about 6 cm. long, ferruginous-velutinous with interspersed longer canescent hairs. Staminate inflorescences of about 10 spadices 12–15 cm. long with slender basal stipes about 1.5 cm. long, the common peduncle about 15–20 cm. long, arachnoid-villosulose to glabrate. Pistillate spadices in clusters of about 5, at anthesis 8–10 cm. long and about 8 mm. thick, with enlarged subcalyculate pruinose basal stipes about 1 cm. long, the spathes oblongoid, long-apiculate, about 10–12 cm. long and 2–3 cm. thick shortly before anthesis, gray-hirtellous, the common peduncle about 8–10 cm. long, gray-hirtellous.

Costa Rica to Colombia, in lowland thickets and secondary forests.

BOCAS DEL TORO: Almirante Region, *Slater 48*. CANAL ZONE: area west of Limón Bay, etc., *Johnston 1758*.

At one time I suspected that an earlier name for this species might be *C. insignis* Liebm., described very inadequately from San Juan de Nicaragua. In the herbarium at Copenhagen, which is the chief depository of Oersted's collections, there is no specimen labeled as *C. insignis*. However, 5 sheets of *Oersted 586I*, one of which is noted as having been collected at San Juan de Nicaragua, are referable to *C. peltata* L. in the broad sense employed here.

The description of the staminate inflorescence is taken from a Costa Rican specimen collected in the region of Limón. The Panamanian specimens are pistillate, as in the Colombian type. Three leaf specimens from the Canal Zone and deposited in the U. S. National Herbarium, possibly represent juvenile forms of this species: *Piper 5847, 5840*, and *Killip 12173*. It really is something of a crime, or at least a misdemeanor, to collect leaves of *Cecropia* unaccompanied by inflorescences of at least one sex.

4. *CECROPIA MAXONII* Pittier, in *Contrib. U. S. Nat. Herb.* 18:228. 1917.

Trees 10–12 m. tall with stout, seldom-branching trunks, the young branches very stout, minutely cinereous to glabrate. Mature leaves divided nearly to the center, scabridulous and irregularly pellucid-maculate above, paler and inconspicuously hirtellous beneath, the lobes 9–11, conspicuously contracted toward the base, broadly obtuse to rounded at the tip, the petioles rather stout, densely and minutely puberulent, with the basal pulvinus densely ferruginous-velutinous. Staminate spadices in clusters of 12–15, up to about 10 cm. long and 4 mm. thick, with slender minutely puberulent-papillate stipes about 5–10 mm. long, the spathes oblongoid, shortly apiculate, about 12–14 cm. long shortly before anthesis, minutely subarachnoid-puberulent, the common peduncle about 5–7 cm. long shortly before anthesis, minutely pilosulose. Pistillate spadices about 10 cm. long in mature fruit (our specimen fragmentary), the common peduncle about 6–7 cm. long.

Known only from the type locality, in highland secondary forest.

CHIRIQUÍ: Boquete, *Maxon 5132, Davidson 862*.

The maculation of the leaves is most peculiar and possibly is pathological, but I have seen nothing comparable to it in other specimens of *Cecropia*. It may be similar to the cystolith maculations of *Urticaceae*.

5. *CECROPIA OBTUSIFOLIA* Bertol. *Fl. Guat.* 39. 1840.

*Cecropia schiedeana* Kl. in *Linnaea* 20:531. 1847.

*Cecropia bicolor* Kl. loc. cit. 1847.

*Cecropia digitata* Ten. ex Miq. in *Mart. Fl. Bras.* 4<sup>1</sup>:149. 1853.

*Cecropia commutata* Schott, ex Miq. loc. cit. 148. 1853.

*Cecropia mexicana* Hemsl. *Biol. Centr.-Am. Bot.* 3:151. 1883.

*Cecropia panamensis* Hemsl. loc. cit. 1883.

*Cecropia vogeleri* Burret, in *Notizbl.* 9:49. 1924.

*Cecropia mexicana* var. *macrostachya* Donn. Sm. in *Bot. Gaz.* 27:442. 1899.

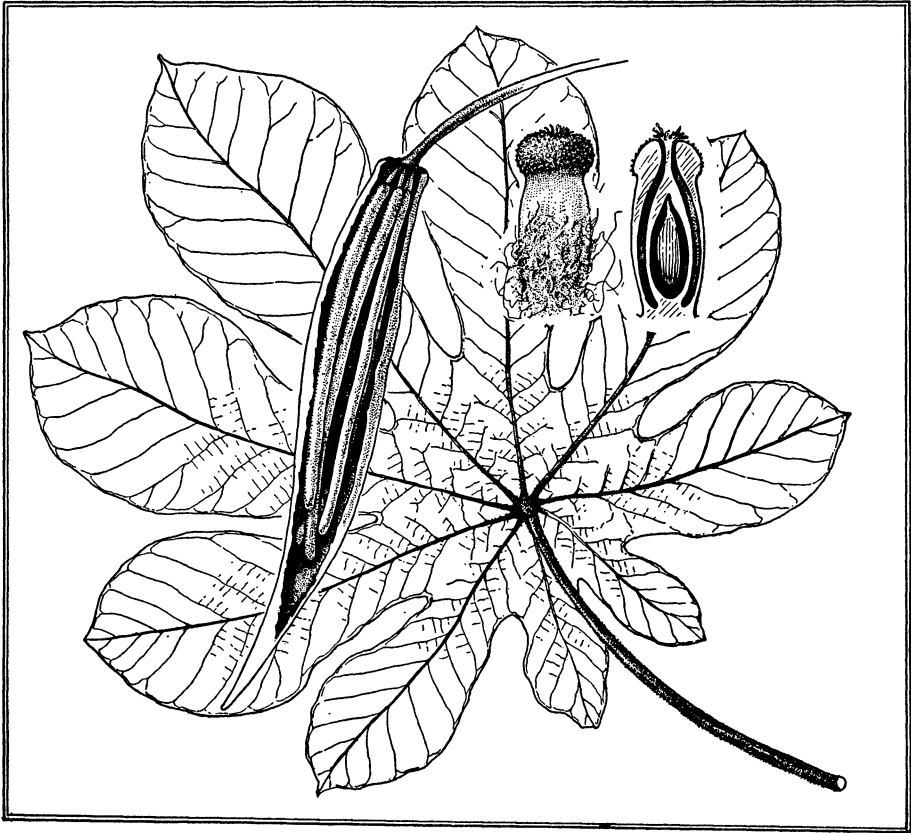


Fig. 61. *Cecropia obtusifolia*

Trees to about 10 m. tall or more, with stout seldom-branching trunks, the young branches stout, ferruginous-hirtellous to glabrate. Mature leaves divided nearly to the center, scabridulous above, paler and minutely cinereous beneath, the lobes usually 9-13, conspicuously contracted toward the base, rounded to shortly acuminate at the tip, the petioles rather slender, minutely ferruginous-hirtellous, with the basal pulvinus densely ferruginous-velutinous. Staminate spadices usually in clusters of 3, 12-16 cm. long and about 4 mm. thick, sessile or with slender puberulent stipes to about 5 mm. long, the spathes 12-20 cm. long shortly before anthesis, narrowly oblongoid-fusiform and frequently somewhat falcate, rather sparsely arachnoid-villosulose, the common peduncle about 5-10 cm. long, relatively slender. Pistillate spadices in clusters of 3-4, 25-30 cm. long and about 5 mm. thick at anthesis, somewhat accrescent in fruit, sessile or with a very indefinite stipe, the spathes about 16-20 cm. long shortly before anthesis,

narrowly oblongoid-fusiform and frequently somewhat falcate, sparsely arachnoid-villosulose to glabrate, the common peduncle 8–14 cm. long, nearly glabrous.

Southern Mexico to northern South America, in lowland clearings, thickets and secondary forests.

BOCAS DEL TORO: Water Valley, *Von Wedel* 771, 1559. CANAL ZONE: Las Cruces Trail, *Hunter & Allen* 462; Gatún, *Standley* 27304; Masambi, *Pittier* 2673; Darién Station, *Macbride* 2697; Summit, *Harvey* 5282; Monte Lirio, *Christopherson* 195; Tabernilla, *Pittier* 3826; Barro Colorado Island, *Wetmore & Abbe* 128, 204, *Woodworth & Vestal* 644, *Kenoyer* 309. DARIÉN: Pinogana, *Allen* 4311. VERAGUAS: Santa Fé to Río Santa María, *Allen* 4422.

## 16. DORSTENIA L.

DORSTENIA L. Spec. Pl. 121. 1753.

*Kosaria* Forsk. Fl. Egypt.-Arab. 164. 1775.

*Sychnium* Desv. in Mem. Soc. Linn. Paris 4:216. 1826.

Succulent or subsucculent herbs. Leaves spiral, entire or variously lobed; stipules lateral. Flowers minute, monoecious, interspersed and immersed in a common discoid or radiate head, the obsolete perianths more or less conrescent with the receptacle. Staminate flowers with 1–3 minute stamens, the filaments inflexed before anthesis. Pistillate flowers with the ovary included and the excentric stigma shortly 2-lobed. Receptacles accrescent and fleshy in fruit, at length extruding the minute achenes.

Perhaps 75 or more very diverse species of the tropics of both hemispheres. In Panama only one species is presently known.

DORSTENIA CONTRAJERVA L. Sp. Pl. 121. 1753.

*Dorstenia houstoni* L. loc. cit. ed. 2. 176. 1762.

*Dorstenia contrajerva* var. *houstoni* (L.) E. Bur. in DC. Prodr. 17:259. 1873.

*Dorstenia contrajerva* ssp. *tenuiloba* S. F. Blake, in Contr. U. S. Nat. Herb. 24:2. 1922.

*Dorstenia contrajerva* var. *tenuiloba* (S. F. Blake) Standl. & Steyerl. in Field Mus. Bot. 23:40. 1944.

Succulent or subsucculent acaulescent or subacaulescent herbs. Leaves densely crowded, long-petioled, of relatively small or moderate size, extremely variable in dimensions and outline, commonly deeply pinnatifid, basifixed, usually scabridulous or inconspicuously puberulent. Receptacles on rather long slender peduncles, centrally peltate, variously radiate to nearly quadrangular, accrescent in fruit to as much as 5 cm. in diameter.

Southern Mexico to northern South America and in the Antilles, in moist thickets and forests from sea level to about 2,000 m. Widely known as *contrajerba* in Central America, which is a reflection of its use as a febrifuge.

BOCAS DEL TORO: Water Valley, *Von Wedel* 1530. CANAL ZONE: Las Cruces, *Seibert* 574; Ancón, *Pittier* 2748. COCLÉ: Cerro Valle Chiquito, *Seibert* 502. DARIÉN: Cana, *Williams* 938. PANAMÁ: Isla Taboga, *Woodson, Allen & Seibert* 1505; Juan Díaz, *Maxon & Harvey* 6716.

Far more frequent than the rather few citations imply.

Fig. 62. *Dorstenia contrajerva*

## URTICACEAE

BY ELLSWORTH P. KILLIP

Monoecious or dioecious herbs, shrubs, or trees, sometimes armed with stinging hairs and spines, usually bearing cystoliths; leaves simple, alternate or opposite (those of adjacent nodes or of a pair often unequal and dissimilar), entire, toothed, or rarely lobed, stipulate; flowers unisexual, small, greenish or greenish white, in unisexual or androgynous clusters, the perianth 2–5-lobed or parted or sometimes wanting; stamens as many as the perianth lobes and opposite them; ovary superior, 1-celled; style undivided, the stigma penicillate-capitate or filiform; fruit an achene, sometimes enclosed in the persistent perianth.

About 40 genera of the tropics and temperate zones of both hemispheres, including the stinging nettles, *picas* and *ortigas*. Here also may be included the Asian hemp and hashish plant, *Cannabis sativa* L., known as *marijuana* in Latin America, an erect herb with watery sap and digitately 5- to 9-divided leaves and inconspicuous dioecious flowers. Despite some attempts of the authorities, *marijuana* is grown more or less openly and used as a constituent of narcotic cigarettes.

- a. Leaves opposite, those of a pair often unequal.
  - b. Stigma short-penicillate; inflorescence paniculate, cymose, or capituliform..... 1. PILEA
  - bb. Stigma filiform; flowers in sessile clusters in the leaf axils or in spikes. 2. BOEHMERIA
- aa. Leaves alternate.
  - b. Pistillate flowers with a perianth.
    - c. Stigma sessile; plants usually armed with stinging hairs.
      - d. Annual herbs; stigma becoming hooked in fruit..... 3. FLEURYA
      - dd. Trees, shrubs, or suffrutescent herbs; stigma penicillate..... 4. URERA
    - cc. Stigma filiform; plants without stinging hairs.
      - d. Pistillate perianth nerveless; leaves toothed, those of the adjacent nodes often very unequal..... 2. BOEHMERIA
      - dd. Pistillate perianth strongly nerved; leaves entire (in Panama species), those of the adjacent nodes subequal..... 5. POUZOLZIA
  - bb. Pistillate flowers without a perianth.
    - c. Flowers in axillary glomerules..... 6. PHENAX
    - cc. Flowers in long, slender spikes..... 7. MYRIOCARPA

## 1. PILEA Lindl.

PILEA Lindl. Coll. Bot. *pl.* 4. 1821, nom. conserv.

*Adicea* Raf. Anal. Nat. 179. 1815, nom. rejic.

Annual or perennial, monoecious or dioecious herbs, sometimes suffrutescent, often succulent, without stinging hairs; stipules intra-axillary, deciduous or persistent; leaves opposite, usually petiolate, toothed or entire, those of a pair equal or markedly unequal, similar in shape or very dissimilar; flowers in unisexual or androgynous clusters, these solitary or forming cymes or panicles; staminate flowers 4 (rarely 2 or 3)-parted, the pistillate normally 3-parted, the middle segment usually larger than the lateral ones; stigma sessile, penicillate; achenes compressed, orbicular or ovate.



- a. Leaves entire.
- b. Leaves orbicular to obovate, not more than 1 cm. long, 1-nerved or nerveless, succulent..... 1. *P. MICROPHYLLA*
- bb. Leaves ovate-lanceolate or elliptic, more than 1 cm. long, 3-nerved, membranous..... 2. *P. PARIETARIA*
- aa. Leaves (at least the larger of a pair) toothed.
- b. Leaves of a pair dissimilar or very unequal, the larger more than twice as long as the smaller.
- c. Inflorescence sessile or subsessile, few-flowered; smaller leaves subentire..... 3. *P. IMPARIFOLIA*
- cc. Inflorescence peduncled, often branched; smaller leaves toothed.
- d. Leaves all distinctly petiolate; stipules persistent.
- e. Smaller leaves broadly ovate or suborbicular; stem drying straw-colored; plant glabrous throughout..... 4. *P. CORNMANEA*
- ee. Smaller leaves oblong; stem drying dark; plant usually pubescent toward tip of stem and on under side of leaf nerves..... 5. *P. TRIANAEEANA*
- dd. Smaller leaves of a pair sessile or sub-sessile; stipules soon deciduous.
- e. Larger leaves oblanceolate, up to 2 cm. wide, their petioles not more than 5 mm. long; segments of staminate flowers with filiform tips..... 6. *P. CHIRIQUINA*
- ee. Larger leaves ovate or elliptic, 4-7 cm. wide, their petioles more than 5 mm. long; segments of staminate flowers not filiform-tipped..... 7. *P. DONNELL-SMITHIANA*
- bb. Leaves of a pair similar and equal, or if unequal the larger not more than twice as long as the smaller.
- c. Achenes 1-2 mm. long, strongly flattened.
- d. Leaves sessile or with a petiole much less than a third the length of the blade, often long-tapering at base..... 8. *P. PTERICLADA*
- dd. Leaves distinctly petiolate, rounded or abruptly narrowed at base.
- e. Stipules not more than 1.5 mm. long, soon deciduous; plants glabrous throughout; tips of staminate perianth segments minute..... 9. *P. GRACILIPES*
- ee. Stipules well developed and persistent or subpersistent; plants, especially the leaves, usually pubescent; staminate segments with long, filiform tips.
- f. Stem densely pubescent; leaves ovate or ovate-lanceolate, generally more than 2 cm. long, rugose..... 10. *P. RUGOSISSIMA*
- ff. Stem glabrous; leaves rhombic-ovate, generally not more than 2 cm. long, flat..... 11. *P. AURICULATA*
- cc. Achenes minute, scarcely more than 0.5 mm. long, only slightly flattened.
- d. Stem repent or trailing, with nearly equal internodes; leaves all orbicular..... 12. *P. NUMMULARIFOLIA*
- dd. Stem erect, repent only at base; at least the principal leaves ovate, obovate, rhombic, or elliptic.
- e. Inflorescence shorter than the petioles; plants essentially glabrous.
- f. Annual; leaves rhombic-ovate or ovate, thin, up to 4 cm. long; achenes stramineous, smooth..... 13. *P. HYALINA*
- ff. Perennial; leaves elliptic-lanceolate, thick, 8-20 cm. long; achenes black, papillose..... 14. *P. PALLIDA*
- ee. Inflorescence longer than the petioles; plants more or less pubescent.
- f. Leaves obovate, rounded at apex, the cystoliths on upper surface much more numerous toward the margin..... 15. *P. INVOLUCRATA*
- ff. Leaves ovate, ovate-lanceolate, or elliptic-lanceolate, acute or acuminate, rarely subobtusate, the cystoliths more evenly covering the upper surface.
- g. Leaves ovate-lanceolate or elliptic-lanceolate, averaging more than 4 cm. long, sharply dentate; plants usually dioecious..... 16. *P. ACUMINATA*
- gg. Leaves broadly ovate, averaging less than 4 cm. long, coarsely crenate-serrate; plants usually monoecious..... 17. *P. PUBESCENS*

1. *PILEA MICROPHYLLA* (L.) Liebm. in Dansk. Vid. Selsk. Skrift. V. 2:296. 1851.

*Parietaria microphylla* L. Syst. ed. 10. 1308. 1759.

*Pilea muscosa* Lindl. Coll. Bot. pl. 4. 1821.

Glabrous, succulent, much-branched herb, up to 30 cm. high, variable in size and habit; leaves usually crowded throughout the length of the branches, entire, succulent, those of a pair unequal, the larger prevailing obovate, up to 1 cm. long, petiolate, obtuse or subacute, tapering at base, the smaller orbicular or obovate-orbicular, rarely more than 3 mm. long, sessile or short-petioled; cystoliths linear, transverse across the leaf-blade; plants monoecious, rarely dioecious, the flower clusters very small, sessile or nearly so; achenes ovate, about 0.3 mm. long.

Throughout the American tropics, up to 2500 m. altitude, occurring in a variety of habitats, as in crevices of stone walls or pavements, on mossy roots or rocks, or on the forest floor; often cultivated as a border plant or in pots.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 358, 387; Chiriquí Lagoon, *von Wedel* 2487. CANAL ZONE: Balboa, *Standley* 28554, 29384 (cultivated; distributed as *P. serpyllacea*); Ancón, *Piper* 6017; Fort Sherman, *Standley* 30946; Barro Colorado Island, *Killip* 40003; *Shattuck* 196 (cited as *P. serpyllacea*); Chagres, *Fendler* 259. COLÓN: Porto Bello, *Pittier* 2447. PANAMÁ: near Panamá, *Standley* 26888, 29807, *Heriberto* 67; between Las Sabanas and Matías Hernández, *Standley* 31834; Chepo, *Pittier* 4460.

A related species, *P. herniarioides* (Sw.) Lindl., may occur in Panama. It is distinguished by rhombic-orbicular leaves, the upper two or three pairs rosulate at the tip of the branches, the flower-clusters sessile within these rosettes. *Pilea serpyllacea* (H.B.K.) Liebm., also a related species, has been reported from Panama, but the records were apparently based on robust *P. microphylla*.

2. *PILEA PARIETARIA* (L.) Blume, Mus. Bot. Lugd. 2:48. 1856.

*Urtica parietaria* L. Sp. Pl. 985. 1753.

*Urtica ciliaris* L. Sp. Pl. ed. 10, 1266. 1759.

*Pilea ciliaris* Wedd. in Ann. Sci. Nat. III. 18:209. 1852.

Plant herbaceous or suffrutescent; leaves of a pair (especially the petioles) somewhat unequal, the blades thin, elliptic or ovate-lanceolate, 2–8 cm. long, 1–3 cm. wide, rarely longer, acuminate at apex, rounded or subacute, sometimes subauriculate at base, 3-nerved, entire, usually ciliate, glabrous or sparingly strigillose with pellucid hairs, usually punctate beneath, the cystoliths linear or fusiform, usually inconspicuous; plants monoecious, the panicles 1 or 2 to an axil, shorter than the leaves, pedunculate, androgynous, or the upper almost wholly staminate and the lower pistillate; achenes minute, barely 0.5 mm. long.

Guatemala to Panama, on shaded banks and in moist forests, at altitudes between 1000 and 2000 m.; also in the West Indies.

CHIRIQUÍ: Quebrada Velo, alt. 1800 m., *Woodson & Schery* 242; Chiquero, Boquete District, *Davidson* 549.

3. *PILEA IMPARIFOLIA* Wedd. in Ann. Sci. Nat. III. Bot. 18:212. 1852.

Decumbent or subrepent herb with numerous erect branches, essentially gla-

brous throughout; leaves of a node unequal and dissimilar, the larger rhombic-ovate to elliptic-oblong or obovate, 1–6 cm. long, 0.8–2 cm. wide, narrowed at apex, acute or attenuate at base, sessile or short-petioled, crenate-serrate above middle, the smaller leaves obovate-orbicular or orbicular-reniform, 0.6–1.5 cm. long, strongly asymmetrical, subentire; cystoliths linear on upper leaf surface, unequally punctiform beneath; plants dioecious, the cymes sessile or subsessile, few-flowered; achenes about 1 mm. long.

Panama to northern Peru, eastward to the Guianas and Amazonian Brazil; usually in dense forests.

COCLÉ: trail to Las Minas, north of El Valle de Antón, alt. 1000 m., climbing on trees and boulders, *Allen 2470*; El Valle de Antón, 1000 m., on tree trunk, *Alston 8791*.

This species is common in the forests of the Chocó, Colombia, where it shows much variation in shape and size of the leaves. Doubtless it occurs in Darién.

4. *PILEA CORNMANAE* Killip, in Jour. Washington Acad. Sci. 15:292. 1925.

Plant erect, up to 60 cm. high, glabrous throughout except the leaves, the stem as well as the foliage densely covered with elevated linear cystoliths; stipules orbicular or ovate, persistent; leaves coarsely serrate, dark green above, paler beneath, thin, sometimes sparingly strigillose above with hyaline hairs, the leaves of a node unequal and somewhat dissimilar, the larger ovate-lanceolate, 2–7 cm. long, 1.5–3 cm. wide, acuminate at apex, acute and often oblique at base, the petioles up to 4 cm. long, the smaller leaves broadly ovate or suborbicular, 1.5–2 cm. long, 1–1.5 cm. wide, acute; plants monoecious or dioecious, the flower-clusters unisexual, pedunculate; staminate heads globose, about 1 cm. wide, the segments long-caudate; pistillate flowers loosely clustered in subglobose heads; achenes broadly ovate or suborbicular, about 1 mm. long.

In wet forests of western Panama and San José Province, Costa Rica, between 1300 and 2000 m. alt.

CHIRIQUÍ: Holcomb's Trail, along Río Caldera, *Killip & Cornman (Killip 3543, type)*; Cerro Horqueta, *von Hagen & von Hagen 2010*.

5. *PILEA TRIANAANA* Wedd. in DC. Prodr. 16<sup>1</sup>:121. 1869.

Stem repent below, at length erect, up to 20 cm. high, glabrescent or sometimes puberulent or strigillose above; leaves of a node similar in shape but at least the upper very unequal, oblong or oblong-lanceolate, acute or acuminate, usually acute at base, petiolate, crenate-serrate, glabrous, or sometimes pilose on the nerves beneath, the larger leaves 7–15 cm. long, 2–6 cm. wide, the smaller ones 1.5–4 cm. long, 0.5–1.3 cm. wide; plants dioecious; staminate flowers in dense globose heads which are solitary or form a branched cyme, the tips of the segments about 1.5 mm. long; pistillate flowers in lax, pedunculate panicles, the achenes 1–1.5 mm. long.

Panama and adjacent parts of Colombia, up to 1000 m. alt.

COCLÉ: vicinity of La Mesa, north of El Valle de Antón, 1000 m. alt., *Allen 2395*; El Valle de Antón, 1000 m. alt., *Alston 8786*.

6. *PILEA CHIRIQUINA* Killip, in Jour. Washington Acad. Sci. 15:291. 1925.

Fleshy herb, up to 1 m. high, slightly suffrutescent toward base, glabrous throughout; leaves dark green above, paler, sparingly punctate beneath, crenate-serrate, triplinerved, those of a pair unequal and dissimilar, the larger oblanceolate, 3–9 cm. long, 1–2 cm. wide, caudate-acuminate, subauricular at base, suboblique, the petioles up to 5 mm. long, the smaller leaves ovate or ovate-lanceolate, 0.7–3 cm. long, 0.5–1.5 cm. wide, acute, obliquely subcordate, sessile or subsessile; cystoliths minute, linear; plants dioecious, the flowers in compact peduncled cymes, the staminate perianth segments with filiform tips, the pistillate cymes smaller, the achenes broadly ovate, about 1 mm. long.

Panama; in wet highland forests, between 1400 and 2100 m. alt.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, *Allen 4914, 4915* (only ♂ collection known). CHIRIQUÍ: upper Río Caldera, *Killip 3546* (type); Bajo Chorro, *Woodson & Schery 668*; slopes of Cerro Horqueta, *Allen 4825*.

7. *PILEA DONNELL-SMITHIANA* Killip, in Jour. Washington Acad. Sci. 15:292. 1925.

Erect herb, about 1 m. high, glabrous throughout; leaves ovate or elliptic, crenate-serrate nearly to base, rounded or subauriculate and often oblique at base, those of a node very unequal, the larger 10–20 cm. long, 4–7 cm. wide, caudate-acuminate, the petioles up to 2.5 cm. long, the smaller leaves up to 3 cm. long and 1.5 cm. wide, their petioles up to 5 mm. long; plants dioecious, the staminate flowers in small clusters in a small, few-branched panicle, the pistillate in few-flowered, short-peduncled, subglobose heads; achenes about 2 mm. long.

Costa Rica and adjacent parts of Panama; in wet forests at 1300 to 1700 m. alt.

CHIRIQUÍ: Holcomb's Trail, about 10 miles above El Boquete, *Killip 3562*.

A related species, *P. costaricensis* Donn. Sm., may occur in western Panama, material from Bajo Chorro, Chiriquí (*Davidson 56 and 717*), with very young inflorescence, perhaps being referable to it.

8. *PILEA PTERICLADA* Donn. Sm. in Bot. Gaz. 31:121. 1901.

Usually a stout herb, somewhat suffrutescent below, erect, up to 30 cm. high, glabrous throughout or fuscous-pubescent on the petioles and leaf-nerves; stipules orbicular-ovate, persistent; leaves of a node similar and subequal, oblong-elliptic or somewhat oblanceolate, 5–20 cm. long, 3–7 cm. wide, acuminate, cuneate-attenuate at base and sometimes long-decurrent on the petiole, coarsely crenate-serrate above middle, triplinerved, the petioles up to 1 cm. long; cystoliths mostly punctiform; plants dioecious, the inflorescence cymose-paniculate, borne in the upper axils, shorter than the leaves; staminate flowers long-pedicelated, whitish, the lobes short-mucronate; pistillate flowers sessile, the achenes ovate, 1.5–2 mm. long, suboblique.

Costa Rica and Panama.

BOCAS DEL TORO: Fish Creek, vicinity of Chiriquí Lagoon, *von Wedel* 2203, 2237, 2318. DARIÉN: Cana, alt. 750 m., *R. S. Williams* 810. CANAL ZONE: between Peluca Hydrographic Station and Quebrada Peluca, along Río Boquerón, *Steyermark & Allen* 17252 (plant smaller in every way).

9. *PILEA GRACILIPES* Killip, in *Jour. Washington Acad. Sci.* 15:294. 1925.

Plants glabrous throughout; stem repent at base, the branches erect, up to 40 cm. high; leaves of a node similar in shape and subequal (or the smaller about three-quarters as long as the larger), lanceolate or ovate-lanceolate, 1–8 cm. long, up to 3 cm. wide, acuminate at apex, acute or somewhat rounded at base, crenate-serrate, the cystoliths linear, faint; plants monoecious or dioecious, the staminate and pistillate inflorescences often borne in the same axil, their peduncles very slender; staminate flowers in globose heads, 5–7 mm. wide, the pistillate in loose glomerules forming an interrupted spike, or racemose-paniculate; achenes lance-ovate, 1–1.5 mm. long.

Guatemala to Panama; in wet mountain-forests, 1500 to 4000 m. alt.

CHIRIQUÍ: Cerro Horqueta, 1700–2100 m., *Pittier* 3230, 5426 (type); Volcán de Chiriquí, *Woodson, Allen & Seibert* 894, *Woodson & Schery* 449, *Davidson* 1027; Monte Lirio, *Seibert* 293; Bajo Chorro, *Woodson & Schery* 659; Quebrada Velo, *Woodson & Schery* 243, 269; between Casita Alta and Cerro Copete, *Woodson & Schery* 347.

10. *PILEA RUGOSISSIMA* Killip, in *Proc. Biol. Soc. Washington* 52:28. 1939.

Stem 30–100 cm. high, densely appressed-strigose; stipules oblong, persistent; leaves ovate or ovate-lanceolate, 1.5–6 cm. long, 1.5–3 cm. wide, acuminate at apex, rounded or cordulate at base, sharply serrate, strongly rugose, appressed-strigose between the veins of the upper surface, appressed-setose on the nerves and veins of the lower surface; plants dioecious, the staminate flowers sessile in a dense globose, peduncled head, the perianth about 5 mm. long, including prominent subulate tips.

Panama.

CHIRIQUÍ: Bajo Chorro, Boquete District, about 1800 m. alt., *Davidson* 335 (type).

11. *PILEA AURICULATA* Liebm. in *Dansk. Vid. Selsk. Skrift.* V. 2:299. 1851.

Stem repent at base, with many slender, erect or decumbent branches; stipules ovate, persistent; leaves rotund-rhombic, 8–20 (rarely to 50) mm. long and wide, cuneate at base, coarsely crenate, strigillose with a few hyaline hairs above, the leaves of a node similar and subequal but one usually with a shorter petiole; plants usually dioecious, the flowers in small clusters up to 1 cm. wide, their peduncles generally exceeding the adjacent petioles; staminate flowers nearly 4 mm. long, including appendages about 1.2 mm. long; pistillate flowers with 1 of the segments larger than the others, auriculate; achenes broadly ovate, nearly 2 mm. long.

Southern Mexico, Guatemala, Costa Rica (where common), and western Panama; wet forests from 1500 to 3000 m. alt.

CHIRIQUÍ: Chiriquí Volcano, *Woodson, Allen & Seibert* 934, *Woodson & Schery* 346, *P. White* 228; Bajo Chorro, *Davidson* 214.

12. *PILEA NUMMULARIFOLIA* (Sw.) Wedd. in Ann. Sci. Nat. III. 18:255. 1852.  
*Urtica nummularifolia* Sw. in Svensk. Vet. Akad. 8:63, pl. I, f. 2. 1787.

Stem reptant or trailing, rooting at most of the nodes, villosulous; stipules persistent; leaves almost orbicular, 5–12 mm. wide, crenate, usually strigillose with stiff, hyaline hairs on both surfaces, the cystoliths inconspicuous; plants dioecious or occasionally monoecious, the staminate flowers usually clustered in the uppermost axils, the pistillate in dense, short-peduncled cymes; achenes barely 0.4 mm. long.

West Indies to Venezuela and Amazonian Peru; sometimes cultivated.

CANAL ZONE: in Powell's garden, *Standley 28555, 41191*.

13. *PILEA HYALINA* Fenzl, in Denkschr. Akad. Wiss. Math. Naturw. (Wien) 1: 256. 1850.

Slender, erect annual, 10–30 cm. high, the stem simple, glabrous; stipules very small, soon deciduous; leaves rhombic-elliptic or ovate, 1–4 cm. long, 0.8–2.5 cm. wide (extremes up to  $6 \times 4$  cm.), acute at apex, cuneate at base, serrate except toward the base, thin-membranous, glabrous, or sparsely hyaline-strigose above; plants monoecious, the inflorescences androgynous, cymose-paniculate, shorter than the petioles, borne at nearly every node, the staminate flowers relatively few; achenes suborbicular, not more than 0.5 mm. long.



Fig. 63. *Pilea auriculata*

Widely distributed in the American tropics, from Mexico and the Lesser Antilles to Chile, Argentina, and Brazil, up to 1500 m. alt.

BOCAS DEL TORO: Changuinola Valley, in garden, *Dunlap* 399. CANAL ZONE: Las Cascadas Plantation, near Summit, *Standley* 25764.

This species has been confused with *P. pumila* Gray, of the United States; the plant from Santiago de Veraguas, cited as *P. pumila* by Seeman (Bot. Voy. Herald 194), is undoubtedly *P. hyalina*.

14. *PILEA PALLIDA* Killip, in Jour. Washington Acad. Sci. 15:295. 1925.

Plant erect, 30 cm. or more high, essentially glabrous throughout; leaves elliptic-lanceolate, 8–20 cm. long, 3–7 cm. wide, caudate-acuminate, acute at base, sometimes suboblique, serrate, densely covered with fusiform and punctiform cystoliths, slightly silvery-lustrous and punctate beneath, the petioles up to 7 cm. long; plants dioecious; staminate flowers densely congested in globose, sessile clusters, the perianth 1.5–2 mm. long including tips about half as long; pistillate flowers in much-branched cymes, shorter than the petioles, the achenes about 0.6 mm. long, black, minutely papillose.

Panama and Costa Rica; in forests, 1000–1400 m. alt.

BOCAS DEL TORO: Sibubi Falls, Sixaola Valley, *Rowlee & Rowlee* 376 (type). COCLÉ: El Valle de Antón, 1000 m. alt., *Akston* 8797.

15. *PILEA INVOLUCRATA* (Sims) Urban, Symb. Antill. 1:298. 1899.

*Urtica involucrata* Sims, Bot. Mag. 51: pl. 2481. 1824.

*Pilea chrysosplenoides* Wedd. in Ann. Sci. Nat. III. 18:231. 1852.

*Pilea pubescens* var. *involucrata* Wedd. in DC. Prodr. 16<sup>1</sup>:153. 1869.

Stem repent at base, the branches ascending, up to 30 cm. high, appressed-hirsute above; leaves massed at end of branches, obovate or rotund-ovate, up to 5 cm. long and 3.5 cm. wide, rounded at apex, rounded or subauriculate at base, short-petioled, finely crenate, ciliate, strigillose with appressed hyaline hairs (rarely glabrate) above, sparingly to densely pubescent beneath, especially on the nerves, the cystoliths on the upper surface linear or fusiform and confined to the margin; plants monoecious or dioecious, the cymes generally unisexual, sessile or subsessile, shorter than the leaves; achenes minute, less than 0.5 mm. long.

Panama and the West Indies to Colombia and Venezuela, usually below 1000 m. alt.; cultivated in the United States.

CANAL ZONE: Empire, *Crawford* 574; Salamanca Hydrographic Station, Río Pequení, *Woodson, Allen & Seibert* 1600.

16. *PILEA ACUMINATA* Liebm. in Dansk. Vid. Selsk. Skrift. V. 2:302. 1851.

Stem subrepent at base, the branches erect, 20–40 cm. high, glabrous, or sparingly pubescent in upper part; leaves ovate-lanceolate, 4–10 cm. long, 2–3 cm. wide (extremes to 15 × 6 cm.), acuminate, cordate or somewhat narrowed at base, coarsely serrate, sometimes bullate, usually strigillose with a few hyaline hairs above, hirsutulose on the nerves beneath; plants usually dioecious, the cymes

diffusely branched, with peduncles up to 6 cm. long; staminate flowers with filiform appendages; achenes minute, barely 0.5 mm. long.

Mexico to Colombia; in wet shady places, between 600 and 1000 m. alt.

COCLÉ: El Valle de Antón, *Allen 1737, Alston 8792.*

17. *PILEA PUBESCENS* Liebm. in Dansk. Vid. Selsk. Skrift. V. 2:302. 1851.

Stem repent, at length erect and usually with several erect or ascending branches, brownish-pubescent; leaves usually massed at the end of the stem or branches, wanting or much reduced below, broadly ovate, up to 7 cm. long and 6 cm. wide, petiolate, usually coarsely crenate-serrate, often ciliate, sparingly strigillose with hyaline hairs or rarely glabrous above, hirsutulous beneath on the nerves and veins, the cystoliths linear and fusiform above, obscure beneath; plants monoecious or occasionally dioecious, the flowers in dense globose clusters forming a panicle up to 7 cm. long, slender-peduncled, the panicles usually androgynous with relatively few staminate flowers, the achenes minute, scarcely 0.5 mm. long.

*Pilea pubescens* evidently has a wide distribution in the lowland tropics although doubtless much material has been wrongly referred to it. Direct comparison has been made between the Panama specimens here cited and the type, collected in southeastern Brazil by Lund and generously lent the author by the Botaniske Museum, Copenhagen, and there is perfect agreement.

CHIRIQUÍ: El Boquete, 1200 m. alt., *Davidson 860.* COCLÉ: El Valle de Antón, *Alston 8781.* DARIÉN: Cana, R. S. *Williams 837.*

2. *BOEHMERIA* Jacq.

*BOEHMERIA* Jacq. Enum. Pl. Carib. 9. 1760; Stirp. Amer. 246, *pl. 157.* 1763.

Trees, shrubs, or perennial herbs, unarmed and without stinging hairs; leaves opposite or alternate, toothed, 3-nerved, those of the adjacent nodes sometimes unequal and dissimilar; plants monoecious or dioecious, the flowers in globose, usually unisexual clusters in the axils of the leaves or forming a spike; staminate flowers 3 or 4 (rarely 5)-parted; pistillate flowers tubular, contracted at the throat, 2-4-toothed or entire, the stigma filiform, the achene enclosed in the persistent, sometimes enlarged perianth.

- |  |                         |
|--|-------------------------|
| a. Flower-clusters forming a spike, often leafy at summit; leaves opposite on stem, alternate or branched; plants herbaceous.....                  | 1. <i>B. CYLINDRICA</i> |
| aa. Flower-clusters axillary on the main stem and leafy branches; leaves alternate; shrubs, trees, or suffrutescent herbs.                         |                         |
| b. Leaves coriaceous, bullate.....   | 2. <i>B. ASPERA</i>     |
| bb. Leaves membranous or subcoriaceous, flat or slightly rugulose.   |                         |
| c. Leaves of adjacent nodes very unequal and dissimilar, the smaller, ones orbicular or subreniform, sessile.....                                  | 3. <i>B. ULMIFOLIA</i>  |
| cc. Leaves of adjacent nodes similar or nearly so, though unequal, all petiolate or the smaller leaves sometimes subsessile in <i>B. pavonii</i> . |                         |
| d. Leaves membranous, coarsely serrate; staminate perianth 3-lobed.....  | 4. <i>B. CUSPIDATA</i>  |
| dd. Leaves subcoriaceous, finely serrulate or sub-entire; staminate perianth 4-lobed.....  | 5. <i>B. PAVONII</i>    |



1. *BOEHMERIA CYLINDRICA* (L.) Sw. Prodr. 34. 1788.

*Urtica cylindrica* L. Sp. Pl. 984. 1753.

Erect herb up to 1.5 m. high, the stem simple or branched; leaves opposite on the stem, alternate on the branches, narrowly lanceolate, ovate-lanceolate, or ovate, up to 18 cm. long and 7 cm. wide, acuminate at apex, rounded, subcordate, or subtruncate at base, coarsely dentate or serrate-dentate, glabrous, or puberulent beneath on the nerves; flower-clusters sessile in an erect or ascending spike which often is leafy toward the tip; plants monoecious; staminate perianth 4-lobed; pistillate perianth rotund-obovate, 1.5–2 mm. long and broad, 4-toothed, compressed, nearly sessile.

Eastern Canada; eastern and southern United States; Mexico to Panama; West Indies; southeastern Brazil.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 365. CANAL ZONE: Barro Colorado Island, *Standley* 41177, *Starry* 255.

2. *BOEHMERIA ASPERA* Wedd. in Arch. Mus. Paris 9:349. p. II, f. 24–28. 1856.

Shrub or suffrutescent herb, 1–3 m. high; leaves alternate, those of the adjacent nodes very unequal and somewhat dissimilar, crenate-serrate, coriaceous, strongly bullate, smooth or hispid above, densely cano-hirsute beneath, the larger lanceolate, 4–15 cm. long, 1–4 cm. wide, long-acuminate, the smaller leaves ovate, 1–5 cm. long, 1–2.5 cm. wide, acute; plants monoecious, the flower-clusters predominantly pistillate; staminate perianth 4-lobed; pistillate perianth about 1 mm. long, sericeo-pubescent at throat, bidentate.

Costa Rica to Peru.

CHIRIQUÍ: vicinity of Bajo Mona and Quebrada Chiquero, alt. 1500 m., *Woodson & Schery* 560.

3. *BOEHMERIA ULMIFOLIA* Wedd. in Ann. Sci. Nat. IV. 1:202. 1854.

*Boehmeria fallax* var. *ulmifolia* Wedd. in DC. Prodr. 16<sup>1</sup>:198. 1869.

Shrub or small tree up to 6 m. high, with slender, more or less pubescent branches; leaves serrate, thin, appressed-hispidulous above, pilosulous or puberulent beneath, those of adjacent nodes strongly dimorphic and unequal; larger leaves elliptic-ovate, 5–15 cm. long, 1.5–5 cm. wide, cuspidate-acuminate, acute or rounded at base, somewhat oblique, with slender petioles 5–20 mm. long, the smaller leaves (often soon deciduous) orbicular or subreniform, 5–10 mm. long and broad, usually emarginate at base, sessile; plants monoecious or dioecious, the flower-clusters axillary, generally unisexual; staminate perianth 4-lobed; pistillate perianth about 2 mm. long, stipitate, very slightly compressed, bidentate.

Southern Mexico to Panama, from about 1000 to 2000 m. alt., ascending higher in western Panama.

BOCAS DEL TORO: Robalo Trail, northern slopes of Cerro Horqueta, alt. 1800–2100 m., *Allen* 4913 (tentatively referred here). CHIRIQUÍ: upper Chiriquí Viejo valley, vicinity of Monte Lirio, alt. 1300–1900 m., *Seibert* 183; Potrero Muleto to summit, Volcán de Chiriquí, alt. 3500–4000 m., *Woodson & Schery* 465.

4. *BOEHMERIA CUSPIDATA* Wedd. in Arch. Mus. Paris 9:345. 1856.

*Boehmeria ramiflora* var. *cuspidata* Wedd. in DC. Prodr. 16<sup>1</sup>:197. 1869.

Slender shrub or suffrutescent herb, up to 3 m. high, the stem appressed-pubescent; leaves of adjacent nodes similar but unequal, cuspidate-acuminate, coarsely serrate, entire toward the cuneate or slightly rounded, suboblique base, appressed-hispidulous above, sparingly pilosulous beneath, the larger leaves 6–15 cm. long, 2–5 cm. wide (smaller on the branches), the petioles slender, up to 5 cm. long, the smaller leaves 3–5 cm. long, 1.5–2.5 cm. wide, the petioles up to 1.5 cm. long; plant monoecious (or dioecious?), the flower-clusters axillary; staminate perianth 3-lobed; pistillate perianth elliptic, about 1.5 mm. long, narrowly margined, bidentate.

Southern Mexico to Panama.

PANAMÁ: hills above Campana, alt. 600–800 m., *Allen 1310*.

5. *BOEHMERIA PAVONII* Wedd. in Ann. Sci. Nat. IV. 1:202. 1854.

Shrub or small tree, 2–6 m. high, the branches finely appressed-pubescent;



Fig. 64. *Boehmeria ulmifolia*

leaves alternate (those of the adjacent nodes similar or nearly so though quite unequal), finely serrulate or sometimes subentire, subcoriaceous, finely appressed-hispidulous above, usually appressed sericeo-pubescent on the nerves and veins beneath and puberulent in the areoles, the larger leaves oblong-lanceolate or elliptic-lanceolate 4–16 cm. long, 1.5–4.5 cm. wide, attenuate-acuminate, the petioles 1–2.5 cm. long, the smaller leaves similar though sometimes ovate, sessile, and merely acute; plants dioecious, rarely monoecious, the clusters generally unisexual; staminate perianth 4-lobed; pistillate perianth attenuate at base, narrowly margined.

Guatemala and Panama; Peru and Bolivia.

CHIRIQUÍ: El Boquete, alt. 1150 m., *Davidson 830*.

### 3. FLEURYA Gaud.

FLEURYA Gaud. *Voy. Uran. Bot.* 497. 1826.

Annual herbs, usually with stinging hairs; leaves alternate, petiolate, toothed, trinerved; plants monoecious or dioecious; flowers in androgynous or unisexual clusters in large panicles; staminate perianth 4–5-parted, with 4–5 stamens; pistillate perianth with 4 imbricated segments, the stigma papillose, at length hooked, the achenes oblique, compressed.



Fig. 65. *Fleurya aestuans*

## 1. FLEURYA AESTUANS (L.) Gaud. Voy. Uran. Bot. 497. 1826.

*Urtica aestuans* L. Sp. Pl. ed. 2. 1397. 1762.

Plant generally terrestrial, erect, simple or few-branched, up to 2 m. high, with stinging hairs usually present, the stem sometimes glandular; leaves broadly ovate, rarely ovate-lanceolate, up to 18 cm. long and 12 cm. wide, acute or acuminate, usually rounded at base, coarsely and sharply dentate, thin-membranous, the petioles up to 12 cm. long; panicles often much longer than the petioles; achenes 1–1.5 mm. long.

Widely distributed in the tropics at low elevations; often occurring in waste places.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *von Wedel 1269, 2848*. CANAL ZONE: San Pablo, *Pittier 4063*; Ancón, *Pittier 2751*; Balboa, *Standley 25286, 25601, 26981*; Gamboa, *Standley 28305*. CHIRIQUÍ: Puerto Armuelles, *Woodson & Schery 849*. DARIÉN: Boca de Cupe, *Allen 873*. PANAMÁ: Bella Vista, *Killip 39944*; Exposición, *Heriberto 279*; Corozal road, *Standley 26765*; Tumba Muerto road, *Standley 29707*; Las Sabanas, *Paul 32*; Chepo, *Pittier 4767*. VERAGUAS: Isla de Coiba, *Mendez 128*.

## 4. URERA Gaud.

URERA Gaud. Voy. Uran. Bot. 496. 1826.

Trees or shrubs, rarely scandent, usually with stinging hairs or stout prickles; stipules free, or more or less connate; leaves alternate, petiolate, 3- or 5-nerved at base, penninerved above, the cystoliths punctiform, linear, or wanting; plants usually dioecious, the flowers in axillary, dichotomous or irregularly branched cymes or panicles; staminate flowers with a 4–5-parted perianth and 4–5 stamens and a rudimentary ovary; pistillate flowers with 4 equal or unequal segments, the stigma penicillate-capitate, persistent; achenes straight or oblique, at least partially surrounded by the fleshy, enlarged perianth.

- a. Leaves incised-lobed usually more than halfway to the midnerve..... 1. U. LACINIATA
- aa. Leaves not lobed, dentate, crenate, or subentire.
  - b. Achenes more than 2 mm. long; leaves coarsely dentate or sinuate-dentate; plants usually with stout prickles or spines..... 2. U. BACCIFERA
  - bb. Achenes less than 2 mm. long; leaves crenate, crenate-dentate, or subentire.
    - c. Leaves broadly ovate to orbicular-ovate, usually cordate; pistillate inflorescences usually long-peduncled and equaling the adjacent petioles, the flowers in glomerules..... 3. U. CARACASANA
    - cc. Leaves ovate-oblong to elliptic-ovate, rounded or slightly emarginate at base; pistillate inflorescences much shorter than the petioles, the flowers separate, pedicellate..... 4. U. ELATA

## 1. URERA LACINIATA (Goudot) Wedd. in Ann. Sci. Nat. III. 18:203. 1852.

*Urtica laciniata* Goudot, ex Wedd. loc. cit., as synonym.

*Urera girardinoides* Seem. Bot. Voy. Herald 194. 1854.

Low tree, shrub, or erect herb, 1–4 m. high, the branches densely covered with stout bristles or spines; leaves 15–35 cm. long and wide, deeply incised-lobed (lobes acuminate, entire or few-toothed), spiny on the nerves beneath, membranous, glabrescent; inflorescence paniculate, up to 20 cm. long; staminate flowers in glomerules, the pistillate in glomerules or often distinct, sessile; achenes about 1.5 mm. long, suboblique.

Costa Rica to Venezuela and Peru, at low altitudes.

CANAL ZONE: Las Cruces, *Seemann 872* (type of *U. girardinoides*).

2. URERA BACCIFERA (L.) Gaud. Voy. Uran. Bot. 497. 1826.

*Urtica baccifera* L. Sp. Pl. ed. 2. 1398. 1762.

Coarse, erect, subliguous herb, or a shrub or small tree, 1–6 m. high, the stem usually covered with short, stout prickles; leaves broadly ovate or round-ovate to oblong-ovate, up to 35 cm. long and 25 cm. wide, rounded or cordate at base, coarsely dentate or irregularly sinuate-dentate, usually with scattered stinging hairs above and with such hairs or prickles on the nerves beneath; plants dioecious, the flowers in much-branched cymes; fruit succulent, 3–5 mm. long, white or rose-colored.

Widely distributed in tropical America. The hairs are very painfully stinging.

CANAL ZONE: Ancón, *Piper 6000*; Fort Sherman, *Standley 31160*. COLÓN: Lagarto, *Cowell 257*. DARIÉN: Pinogana, *Allen 926*; Marraganti, R. S. *Williams 692*. PANAMÁ: Taboguillo Island, *Miller 2001*; sabanas near Panamá, *Paul 361*; Juan Díaz, *Standley 30536*; Río Tecumen, *Standley 26692, 26732*; Río Tapia, *Standley 28244*.

3. URERA CARACASANA (Jacq.) Griseb. Fl. Brit. W. Ind. 154. 1859.

*Urtica caracasana* Jacq. Hort. Schoenbr. 3:71. pl. 396. 1798.

*Urtica verrucosa* Liebm. in Vidensk. Selsk. Skr. V. 2:295. 1851.

*Urera jacquini* Wedd. in Ann. Sci. Nat. III. 18:200. 1852.

Shrub or small tree, 2–10 m. high, with elongate branches, the young twigs, petioles, inflorescence, and leaf nerves usually armed with stinging hairs; leaves broadly ovate to ovate-lanceolate, up to 30 cm. long and 25 cm. wide, acuminate, cordate or cordulate at the base (basal lobes sometimes overlapping), crenate-dentate, scabrous, sometimes verrucose, above, more or less pubescent beneath; plants dioecious, the cymes regularly dichotomous; staminate flowers sessile in distinct, compact glomerules; pistillate flowers sessile or pedicillate in compact glomerules (rachis and segments sometimes becoming enlarged), the segments usually densely covered with white, punctiform cystoliths; achenes 0.5–1 mm. long.

Widely distributed in continental tropical America from sea level to 2000 m. altitude. The species is here interpreted in a very broad sense, and the specimens cited show considerable variation in shape and texture of the leaves, presence or absence and nature of the foliar cystoliths, degree of pubescence, arrangement of the flowers, and size of the achenes. The American species of *Urera* are greatly in need of taxonomic revision.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 174*; Nievecita, *Woodson, Allen & Seibert 1849*; Darkland, *von Wedel 1*; Water Valley, *von Wedel 686*. CANAL ZONE: Mamei Hill, *Pittier 3804*. CHIRIQUÍ: Puerto Armuelles, *Woodson & Schery 863*; between Paso Ancho and Monte Lirio, upper Río Chiriquí Viejo valley, *Allen 1471* (variant described as *Urtica verrucosa* Liebm.); Cerro Galera Chorchá, near Gualaca, *Allen 5063*; Bajo Chorro Boquete District, *Davidson 349*. COLÓN: Río Fató, *Pittier 3899*. DARIÉN: Boca de Cupe, *Allen 911*, R. S. *Williams 716*; Cana, R. S. *Williams 815*; Yape, *Allen 855*; headwaters of Río Chico, *Allen 4592*. PANAMÁ: Juan Díaz, *Standley 30487*; Arenoso, lower Río Trinidad, *Seibert 608*.

4. *URERA ELATA* (Sw.) Griseb. Fl. Brit. W. Ind. 154. 1859.

*Urtica elata* Sw. Prodr. 37. 1788.

Shrub or small tree, 2–4 m. (occasionally to 6 m.) high, sometimes becoming scandent; leaves ovate-oblong to elliptic-ovate, up to 30 cm. long and 12 cm. wide, acuminate at apex, rounded at base, sometimes slightly emarginate, crenate-serrate, crenulate, or subentire, glabrescent, or occasionally hirsutulous on the principal nerves beneath; plants dioecious, the inflorescences dichotomous, much shorter than the petioles, staminate flowers sessile in glomerules, glabrous; pistillate flowers short-pedicelated, usually borne singly.

With much the same distribution in Panama as the preceding species; also in Jamaica and Colombia.

Two forms are represented by the specimens cited below; one has relatively small leaves which bear punctiform cystoliths densely massed all over the upper surface, and agrees best with type material of *U. elata* in the British Museum; the other has leaves generally more than 15 cm. long, the cystoliths being short-linear and radiating from the center of the areoles to the veinlets. This latter variant has been confused with *U. alceifolia* (Poir.) Gaud., of French Guiana, which apparently cannot be separated from the common *U. caracasana*.



Fig. 66. *Urtica elata*

BOCAS DEL TORO: Changuinola Valley, *Dunlap 241*; Río Cricamola, between Finca St. Louis and Konkintoë, alt. 10–50 m., *Woodson, Allen & Seibert 1923*. CANAL ZONE: *Hayes 750*; Barro Colorado Island, *Standley 41132, Kenoyer 396*; Madden Dam, *Allen 2008*. CHIRIQUÍ: vicinity of Bajo Mona, alt. 1500–2000 m., *Woodson & Schery 593, Woodson, Allen & Seibert 1005*; near Monte Lirio, Río Chiriquí Valley, *G. White 63*; Progreso, *Cooper & Slater 176*; El Boquete, alt. 1000–1300 m., *Maxon 4992, Pittier 2939*. COCLÉ: El Valle de Antón, trail to Las Minas, alt. 1000 m., *Allen 2461, 2712*; vicinity of Finca Tomás Arias, alt. 600 m., *Allen 3617*. COLÓN: Río Fató, alt. 10–100 m., *Pittier 4189*. DARIÉN: Cana, *R. S. Williams 794*.

### 5. POUZOLZIA Gaud.

POUZOLZIA Gaud. *Voy. Uran. Bot.* 503. 1826.

*Leucococcus* Liebm. in *Dansk. Vid. Selsk. Skrift.* V. 2:311. 1851.

*Margarocarpus* Wedd. in *Ann. Sci. Nat.* IV. 1:203. 1854.

Low shrubs, rarely woody vines; stipules free, often persistent; leaves alternate (in American species), entire or rarely toothed; petiolate, trinerved, densely covered with punctiform cystoliths above; plants usually monoecious, the flowers in small clusters, in the leaf axils or forming spikes; staminate perianth depressed-globose in bud, 3–5-parted or -lobed, the stamens 3–5; pistillate perianth tubular, contracted at the throat, 2–4 toothed, completely enclosing the ovary, strongly nerved, the stigma pubescent on one side, the achenes crustaceous, shiny.

- a. Leaves white-tomentose beneath, long-petiolate..... 1. *P. GUATEMALANA*
- aa. Leaves not white-tomentose.
  - b. Petioles not more than 1 cm. long; base of leaves oblique and usually subemarginate..... 2. *P. OBLIQUA*
  - bb. Petioles much more than 1 cm. long; base of leaves not oblique, cuneate or rounded..... 3. *P. OCCIDENTALIS*

1. *POUZOLZIA GUATEMALANA* (Blume) Wedd. in *DC. Prodr.* 16<sup>1</sup>:233. 1869.

*Boehmeria guatemalana* Blume, *Mus. Bot. Lugd. Bat.* 2:206. 1856.

Slender shrub; branches hirsutulous; leaves lanceolate or ovate-lanceolate, 6–15 cm. long, 2–4.5 cm. wide, caudate-acuminate, obtuse or acute at base, entire, sometimes bullate, asperate above, pilose on the nerves and veins and white-tomentose elsewhere beneath; petioles 2–5 cm. long, very slender; glomerules androgynous; staminate flowers 4-merous, the pistillate 4-toothed.

Guatemala to Panama, lowlands of the Atlantic side; rare.

BOCAS DEL TORO: beyond Río San Juan, Changuinola Valley, *Dunlap 457*.

2. *POUZOLZIA OBLIQUA* (Poepp.) Wedd. in *Arch. Mus. Paris* 9:405. 1857.

*Margarocarpus obliquus* Poepp. et Wedd. *Ann. Sci. Nat.* IV. 1:204. 1854. (*Boehmeria obliqua* Poepp., nom. nud. as synonym).

Shrub or small tree, 1–5 m. high, densely hirsute nearly throughout, the branches sometimes scandent; leaves oblong or oblong-lanceolate, 2–15 cm. long, 1–5 cm. wide, entire, attenuate-acuminate at apex, oblique and usually emarginate at base, scabrous above, the petioles up to 1 cm. long; flower clusters androgynous or unisexual; staminate flowers 4-merous; achenes light brown or white, the styles 7–10 mm. long.

Fig. 67. *Pouzolzia obliqua*

Guatemala to Venezuela and Peru, at low elevations; common in the Canal Zone; forests and thickets.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, *von Wedel 1434, 2597*; Changuinola Valley, *Dunlap 370*. CANAL ZONE: Barro Colorado Island, *Kenoyer 327, Aviles 24b*; Balboa, *Standley 25410, 25587, 29265*; Mamei Hill, *Pittier 3792*; Río Pedro Miguel, *Standley 29976*; Las Cascadas Plantation, *Standley 25783*; Cerro Gordo, near Culebra, *Standley 25972*; Gamboa, *Pittier 6651, Standley 28306*; Darién Station, *Standley 31606*; Las Cruces Trail, *Standley 29070*; Cocoli, *Riley 128*.

3. *POUZOLZIA OCCIDENTALIS* (Liebm.) Wedd. in Arch. Mus. Paris 9:410. 1857.

*Leucococcus occidentalis* Liebm. in Dansk. Vid. Selsk. Skrift. V. 2:311. 1851.

Shrub or small tree, up to 5 m. high, the branches densely hirsutulous to nearly glabrous; leaves elliptic-lanceolate to broadly lanceolate-ovate, 7–15 cm. long, 3–9 cm. wide, acuminate at apex, cuneate or rounded at base, entire, appressed-pubescent above with stiff scattered hairs, more or less pilosulous beneath, especially on the nerves and at the margin; petioles slender, 2–8 cm. long; glomerules androgynous, rarely unisexual, few-flowered, the staminate flowers 4-merous.

Honduras to Colombia and Venezuela; also in Puerto Rico. In forests and thickets at low elevations.

DARIÉN: Boca de Cupe, 40 m. alt., *Allen 868*. PANAMÁ: Taboga Island, *Pittier 3530, Standley 27923*.



## 6. PHENAX Wedd.

PHENAX Wedd. in Ann. Sci. Nat. IV. 1:191. 1854.

Unarmed shrubs or suffrutescent herbs; leaves alternate, petiolate, toothed, rarely entire, the cystoliths mainly punctiform; plants monoecious or dioecious, the flowers in dense, sessile, axillary clusters; staminate flowers usually 4-lobed; pistillate flowers without a perianth, the small achene sessile and subtended by a brown, scarious bractlet, the stigma elongate-filiform, persistent.

- a. Plants dioecious; leaves narrowly lanceolate, minutely serrulate, attenuate-acuminate..... 1. *P. ANGUSTIFOLIUS*
- aa. Plants monoecious; leaves ovate or ovate-lanceolate, coarsely crenate-serrate or crenulate-serrate.
  - b. Leaves ovate-lanceolate, narrowed at base, flat, glabrous except occasionally for a few hairs on the nerves beneath; stem glabrous..... 2. *P. MEXICANUS*
  - bb. Leaves ovate, rounded or cordulate at base, more or less rugose, densely pubescent beneath; stem hirsute..... 3. *P. RUGOSUS*

1. *PHENAX ANGUSTIFOLIUS* (H.B.K.) Wedd. in Ann. Sci. Nat. IV. 1:193. 1854.  
*Boehmeria angustifolia* H.B.K. Nov. Gen. & Sp. 2:34. 1817.

Shrub or suffrutescent herb, up to 3 m. high; leaves narrowly lanceolate, 5–15 cm. long, 0.5–5 cm. wide, attenuate-acuminate, minutely serrulate, entire toward base, thin membranous, glabrous above, very sparingly strigillose on the nerves and veins beneath, the petioles very slender; plants dioecious; achenes minute, about 0.3 mm. long, the styles 4–5 mm. long.

Costa Rica to Peru and Bolivia, usually at elevations of less than 800 meters.

BOCAS DEL TORO: Changuinola Valley, *Dunlap 371*. COCLÉ: vicinity of El Valle, 100–800 m. alt., *Allen 764*.

2. *PHENAX MEXICANUS* Wedd. in Ann. Sci. Nat. IV. 1:193. 1854.

Shrub, 2–6 m. high, glabrous throughout except occasionally on the under side of the leaf nerves and veins; leaves ovate-lanceolate, up to 15 cm. long and 5 cm. wide, acuminate, narrowed at base, crenate-serrate except toward base, membranous or subcoriaceous, the petioles up to 5 cm. long, usually much shorter; plants monoecious; achenes about 0.8 mm. long.

Southern Mexico to western Panama, usually at elevations of more than 800 meters.

CHIRIQUÍ: El Boquete, *Maxon 4995*, *Pittier 2881*, *Davidson 452*; Finca Lérica to Peña Blanca, *Woodson & Schery 312*; valley of the upper Río Chiriquí Viejo, *P. White 340*.

A related species, *P. hirtus* (Sw.) Wedd., a common plant of the tropics, apparently has not yet been collected in Panama.

3. *PHENAX RUGOSUS* (Poir.) Wedd. in DC. Prodr. 16<sup>1</sup>:235<sup>38</sup>. 1869.

*Procris rugosa* Poir. in Lam. Encycl. 5:628. 1804.  
*Boehmeria rugosa* Pers. Synops. 2:556. 1807.

Shrub, 1–3.5 m. high, the stem stout, densely hirsute; leaves ovate, 3–12 cm. long, 1–7 cm. wide, acute or acuminate at apex, rounded or rarely cordulate at base, crenate-serrate, rugose, usually villous-tomentose beneath; plants monoecious, the glomerules very dense; achenes about 0.5 mm. long.

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Fig. 68. *Phenax rugosus*

Southern Mexico to Venezuela and Bolivia, usually occurring above 1000 m. altitude.

CHIRIQUÍ: El Boquete, *Pittier 2902, Davidson 544*; vicinity of "New Switzerland," central valley of Río Chiriquí Viejo, *Allen 1370*.

#### 7. MYRIOCARPA Benth.

MYRIOCARPA Benth. Bot. Voy. Sulph. 168. 1844.

Unarmed trees or shrubs, without stinging hairs, leaves alternate, large, toothed or rarely subentire, 3-nerved, petiolate, bearing conspicuous cystoliths; plants dioecious, rarely monoecious; staminate flowers in small, contiguous glomerules, forming slender, dichotomous spikes, the perianth 4-parted; pistillate flowers in slender, elongate, dichotomous, sub-unilateral spikes, rarely in panicles, without a perianth but subtended by 2 or 4 bractlets, the achenes stipitate or sessile.

1. *MYRIOCARPA YZABALENSIS* (Donn. Sm.) Killip, in Proc. Biol. Soc. Washington 40:29. 1927.

*Myriocarpa longipes* var. *yzabalensis* Donn. Sm. in Bot. Gaz. 16:13. 1891.

Shrub or tree, 2–10 m. high; leaves elliptic-ovate or broadly ovate, up to 35 cm. long and 18 cm. wide, acuminate at apex, rounded or slightly narrowed at base, denticulate, bearing numerous conspicuous linear cystoliths which radiate from the center of the areoles, glabrous above, glabrous, or pubescent on the nerves beneath, the petioles up to 35 cm. long; staminate spikes up to 10 cm. long; pistillate spikes very slender, pendent, up to 60 cm. long, the bractlets 2, soon deciduous, the achenes scabrid with sparse short hairs, ciliate, at length black and sometimes lustrous.

Guatemala to Panama, generally at elevations of less than 1000 meters.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 300; Chiriquí Lagoon, *von Wedel* 1411, 1445, 1505, 1692, 1699, 1886; Columbus Island, *Skutch* 5; Almirante, *Cooper* 414. CANAL ZONE: Chagres, *Fendler* 280; Barro Colorado Island, *Shattuck* 242, 494, *Aviles* 27, *Standley* 31451, 40922; Frijoles, *Killip* 3379, *Standley* 27572, *Piper* 5841; Gatún, *Standley* 27194; Gamboa, *Standley* 28400; Obispo, *Standley* 31687; Fort Sherman, *Standley* 30956; Santa Rita Trail, *Cowell* 113; Río Indio, *Dodge & Allen* 17289; Quebrada Salamanca, *Dodge, Steyermark & Allen* 16997. CHIRIQUÍ: El Boquete, *Maxon* 4946, *Pittier* 2878, 5157. COCLÉ: El Valle, *Allen* 4218. COLÓN: Porto Bello, *Pittier* 2487. PANAMÁ: Río Tapia, *Standley* 26215, 28277; Río Tecumen, *Standley* 29368.



Fig. 69. *Myriocarpa yzabalensis*

## PROTEACEAE

BY LORIN I. NEVLING, JR.

Trees, shrubs or rarely herbaceous, rarely dioecious. Leaves alternate, rarely opposite or whorled, simple or compound, sometimes heteromorphic, pinnately veined; stipulate. Inflorescence a head, spike or raceme, axillary or terminal, bracteate, the bracts persistent or caducous, subtending 1 to several flowers. Flowers bisexual or unisexual by abortion, monochlamydeous, cyclic, hypogynous, actinomorphic or zygomorphic. Tepals free or variously connate, petalaceous, tetramerous, valvate in bud. Stamens 4, antipetalous, the anthers dehiscing longitudinally, the filaments variously adnate to the perianth. Pistil 1, often surrounded basally by glands or a disc, often stipitate, the ovary superior, 1-carpellate, 1-loculate, the ovules 1—many, with 2 integuments, the placentation parietal or the ovules pendulous, the style 1, slender, the stigma 1, lateral or terminal. Fruit a follicle, achene, samara or drupe; seeds lacking endosperm, sometimes winged.

A family primarily restricted to the dry regions of the Southern Hemisphere, consisting of about 55 genera and 1200 species of which the majority are Australian and South African. Eight genera are represented in the New World of which two are indigenous to Panama.

A number of species are cultivated in numerous parts of Central America for their extremely showy inflorescences. At present I have no evidence of cultivated species in Panama.

The following treatment is based on a revision of the American Proteaceae by Dr. H. Sleumer (in Bot. Jahrb. 76:139–211. 1954).

- a. Leaves alternate, simple or pinnately compound (heteromorphic), entire or dentate; inflorescences racemes or spikes; disc of 4 hypogynous glands; fruit a follicle, obliquely 2-valved; seeds 2, winged..... 1. ROUPALA
- aa. Leaves alternate, opposite or whorled, simple, entire; inflorescences racemes; disc cupuliform, 4-lobed; fruit indehiscent; seeds 1, exalate..... 2. PANOPSIS

## 1. ROUPALA Aubl.

ROUPALA Aubl. Pl. Guyan. Franc. 1:83, *t.* 32. 1775.

*Leinkeria* Scop. Intr. 345, *n.* 1607. 1777.

*Rhopala* Schreb. Gen. Pl. 1:62, *n.* 144. 1789.

*Ropala* J. F. Gmel. Syst. 2:225. 1791.

*Rupala* Vahl, Symb. 3:20. 1794.

Shrubs or trees. Leaves alternate, heteromorphic, simple or pinnately compound, dentate to entire, petiolate. Inflorescence spikes or racemes, axillary or terminal. Flowers bisexual, actinomorphic. Tepals free. Stamens inserted at about the middle of the perianth, the anthers oblong-linear, subsessile to sessile, connective sometimes broadly but briefly produced. Disc of 4 hypogynous glands. Ovary with 2 pendulous ovules, the stigma terminal. Fruit a follicle, obliquely 2-valved, with 2 winged seeds.

An American genus containing about 50 species distributed from the Isthmus of Tehuantepec southwards to Peru, Bolivia and Brazil (Rio Grande do Sul). One species is known from Panama.

1. *ROUPALA MONTANA* Aubl. Pl. Guyan. Franc. 1:83. 1775.

- Roupala pyrifolia* Salisb. & Knight, in Knight Prot. 102. 1809.  
*Rhopala media* R. Br. in Trans. Linn. Soc. 10:191. 1810.  
*Rhopala dentata* R. Br. loc. cit. 192. 1810.  
*Rhopala complicata* Kunth, in HBK. Nov. Gen. & Sp. 2:153, t. 119. 1817.  
*Rhopala ovalis* Pohl, Pl. Bras. Ic. 1:107, t. 86. 1827.  
*Rhopala macropoda* Klotzsch & Karst. in Linnaea 20:473. 1847.  
*Rhopala gardneri* Meissn. in Mart. Fl. Bras. 5<sup>1</sup>:83, t. 31, f. 1. 1855.  
*Rhopala martii* Meissn. loc. cit. 87, t. 32, f. 3. 1855.  
*Rhopala martii* var. *simplicifolia* Meissn. loc. cit. 1855.  
*Rhopala frondosa* Rich. ex Meissn. in DC. Prod. 14:427. 1856, in syn.  
*Rhopala tomentosa* a *integrifolia* Meissn. loc. cit. 428. 1856.  
*Rhopala boissieriana* Meissn. loc. cit. 430. 1856.  
*Rhopala veraguensis* Klotzsch, ex Meissn. loc. cit. 435. 1856, in synon.  
*Roupala borealis* Hemsl. Biol. Centr. Am. Bot. 3:78, t. 76. 1882.  
*Roupala darienensis* Pittier, in Contr. U. S. Nat. Herb. 18:228. 1917.  
*Roupala panamensis* Pittier, loc. cit. 229. 1917.  
*Roupala discolor* Rusby, Descr. N. Sp. Am. Pl. 12. 1920.  
*Roupala dissimilis* Pittier, Bol. Soc. Venez. Cienc. Nat. 5:303. 1939.  
*Roupala repanda* Lundell, in Am. Midl. Nat. 29:472. 1943.  
*Roupala montana* var. *dentata* (R. Br.) Sleumer, in Engl. Bot. Jahrb. 76:173. 1954.

Trees to 20 m. tall, the young stems terete, ferrugineous-strigillose and glabrescent. Leaves heteromorphic; juvenile leaves pinnately compound, generally larger than the adult forms, the number of leaflets extremely variable even on a single branchlet, margin generally coarsely serrate or sometimes undulate, the veins conspicuous; adult leaves ovate, 5–12 cm. long, 2–9 cm. broad, acute or acuminate at the apex, cuneate to more or less obtuse at the base and often decurrent upon the petiole, subcoriaceous or coriaceous, ferrugineous-strigillose and glabrescent above and below, the costa plane to immersed above, emersed below, the primary lateral veins numerous, conspicuous, the margin entire, undulate to variously dentate or serrate, often repand; petiole 1–6 cm. long. Inflorescence racemose, terminal or more often axillary, multi-flowered, the rhachis 6–15 (–18) cm. long, tomentose, the flowers borne singly or in pairs. Tepals linear-ob lanceolate, 7.0–8.5 mm. long, about 1 mm. broad, widely reflexed, strigillose without, glabrous within; stamens inserted about at the middle of the perianth, the anthers linear-oblong, 2–3 mm. long, 0.5 mm. broad, the filaments about 0.5 mm. long, glabrous; hypogynous glands about 0.5 mm. tall, carnosose, glabrous; ovary about 1 mm. long, 1 mm. in diameter, densely strigose, the style about 3 mm. long, glabrous, the stigma narrowly clavate; pedicel to 3 mm. long, strigillose. Fruit a flattened follicle, often minutely spurred at the base, 2.5–4.0 cm. long, about 1.5 cm. broad, glabrous, the winged seeds oval, 1.5 cm. long, 0.8 cm. broad.

Distribution of the species essentially that of the genus. Flowering in January and February in Panama.

CANAL ZONE: between Corozal and Ancón, *Pittier 2630*; Ancón Hill, *Standley 26370*, *26395*; without precise locality, *Hayes 1068*, *1070*. CHIRIQUÍ: Sabana de la Tortuga, between El Boquete and Caldera, *Pittier 3341*; Boquete, *Davidson 1061*, *Pittier 3341*; David, *Seemann 1580*. COCLÉ: Penonomé and vicinity, *Williams 152*; El Valle de Antón, *Allen 2514*; between Las Margaritas and El Valle, *Woodson, Allen & Seibert 1283*.



Fig. 70. *Roupala montana*

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DARIÉN: Cana, *Williams* 739; Río Pirre, *Pittier* 6975. PANAMÁ: San José Island, Perlas archipelago, Gulf of Panama, *Johnston* 331, 348, 1285, 1292, 1293, 1368; near Matías Hernández, *Standley* 28949; Taboga Island, *Standley* 28001; Tumba Muerto Road, near Panamá, *Standley* 29739; Río Las Lajas, *Allen* 1600; Punta Paitilla, *Standley* 26242.

Sleumer recognized three varieties of *R. montana* in his recent revision. One variety, var. *tomentosa*, is not treated herein, nor are its synonyms as it is restricted to Brazil. The two varieties which concern us, var. *montana* and var. *dentata*, are both represented in Panama. The character which serves to distinguish these varieties is "Folia subintegra vel undulata" for var. *montana* and "Folia bene obtuse subcrenato-serrata" for var. *dentata*. Young shoots and suckers have pinnately compound leaves, the number of leaflets is quite variable although the older generally have more than the younger, all leaflets have a serrate margin. This pinnately compound leaf is a typical juvenile form. The mature form is a simple leaf with serrate to entire margin. Although flowering is usually evidence of a mature shoot it is not necessarily evidence that the subtending leaves have attained the mature form. A few specimens show the transition from simple leaves with serrate margin to subentire or entire margin while others show that the larger stems have leaves with undulate or entire margins and the young stems have leaves which are quite serrate. It is my belief that the simple leaf with serrate margin is transitional between the compound leaf and the simple leaf with entire margin. Finally, in many collections some of the leaves are entire while others are variously serrate—needless to say this leads to the condition in which many collections and some specimens are classified in two separate varieties. Accordingly, I have not recognized var. *dentata* of Sleumer.

## 2. PANOPSIS Salisb.

PANOPSIS Salisb. in Knight, Prot. 104. 1809.

*Andriapetalum* Pohl, Pl. Bras. Ic. 1:113. 1827.

*Andriapetalum* Schott ex Endl. Gen. Pl. 342. 1836.

Trees. Leaves alternate, opposite or verticillate, entire, simple. Inflorescences racemes, terminal or axillary, bracts small or 0. Flowers bisexual, actinomorphic. Tepals free. Stamens inserted below the middle of the perianth, the anthers oblong, connective apiculate, the filaments obvious. Disc cupuliform, 4-lobed. Ovary subsessile, with 2 pendulous ovules, the stigma terminal. Fruit indehiscent with a thick woody pericarp and 1 exalate seed.

An American genus distributed from Costa Rica southwards to Peru, Bolivia and Brazil. It contains about 11 species of which 1 is known from Panama.

### 1. PANOPSIS SUAVEOLENS (Kl. & Karsten, ex Klotzsch) Pittier, in Contr. Fl. Venez. 22. 1923.

*Andriapetalum suaveolens* Kl. & Karsten, ex Klotzsch, in Linnaea 20:472. 1847.

*Panopsis costaricensis* Standl. in Journ. Wash. Acad. Sc. 17:164. 1927.

*Panopsis mucronata* Cuatr. in Lloydia 13:202, f. 1. 1950.

Trees to 12 m. tall, the young branches terete, ferruginous-strigillose and glabrescent, conspicuously lenticellate. Leaves elliptic, oblong-elliptic or oblance-

olate, 4–17 cm. long, 1.5–5.0 cm. broad, obtuse, mucronulate or sometimes retuse at the apex, cuneate to obtuse at the base, coriaceous, ferrugineous-strigillose and glabrescent above and below, the costa plane above, emersed below, the primary lateral veins numerous, extremely reticulate, conspicuously emersed; petiole 2–8 mm. long. Inflorescence racemose, terminal or axillary, multi-flowered, the rhachis 6–15 cm. long, ferrugineous-strigillose, the flowers borne singly or to 4 per cluster. Tepals linear-oblongate, 7–8 mm. long, 0.5–0.75 mm. broad, revolutely reflexed, strigillose without, glabrous within; stamens inserted at the base of the perianth, the anthers oblong, 1 mm. long, 0.5 mm. broad, the filaments liguliform, about 6.5 mm. long, 0.5 mm. broad, glabrous; pistil long-conical, the ovary to 2 mm. long, 0.5–0.75 mm. in diameter, densely hirsute, the style 4–5 mm. long, glabrous, the stigma narrowly clavate; pedicel 4–8 mm. long, ferrugineous-strigillose. Fruit ellipsoid to ovoid, 3.5–6.0 cm. long, 2–4 cm. in diameter.

Distributed in Costa Rica, Panama, Venezuela, Colombia and Ecuador. In Panama flowering in May between 1000 and 2000 meters. According to G. White the wood ranks about 5th in Panama as a building material and is very hard and heavy. Known in Panama as *aguacatía*.

CHIRIQUÍ: Río Chiriquí Viejo, G. White 112; trail from Paso Ancho to Monte Lirio, upper valley of Río Chiriquí Viejo, Allen 1483; Boquete, Davidson 630, Maxon 5133, Pittier 2954.



Fig. 71. *Panopsis suaveolens*