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School of Forestry

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*A technical magazine devoted to the furtherance of knowledge of tropical woods and forests and to the promotion of forestry in the Tropics.*

*The editor of this publication and the writer of any articles therein, the authorship of which is not otherwise indicated, is SAMUEL J. RECORD, Dean of the Yale University School of Forestry.*

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### REVISION OF THE SPECIES OF THE GENUS *COUMAROUNA* AUBL. OR *DIPTERYX* SCHREB.

By ADOLPHO DUCKE

This genus of Leguminosae (Papilionatae-Dalbergieae), actually composed of 10 or 11 species of trees, is well characterized by the presence of two large-winged calyx lobes and by drupaceous fruits. Four of these species yield the Tonka beans (Cumarú in Brazil, Sarrapia in Venezuela) which are exported in large quantities from Amazonian Brazil, the Guianas, and chiefly Venezuela for use in medicine and perfumery. Some species have edible seeds or pericarp, or are remarkable for their beautiful flowers; all have very hard and heavy timber, of little use because it is too difficult to cut, and are often spared in forest clearings. The geographic area of the genus comprises the Amazonian hylaea (including Guiana) with nine or ten species growing in rain forest, and dry central



and northeastern Brazil where only one species exists, chiefly found in campos woods.

The genus was well described by Aublet, who observed the species *odorata* in the forests of French Guiana. Some years later the nomenclaturist Schreber (who never had seen one of these trees) united it with another genus of Aublet, *Taralea*, into a unique genus (which he named *Dipteryx*) on account of the mere resemblance of the flowers and notwithstanding the disparity of the fruits. The latter, drupaceous and indehiscent in *Coumarouna*, are bivalvate and elastically dehiscent pods in the genus *Taralea*, which, therefore, cannot be included in the group Dalbergieae but must be placed in the Galegeae, near *Poecilanthe* and the Old World genus *Milletia*. I have attempted in successive publications<sup>1</sup> to re-establish the two very natural genera of Aublet, but, unfortunately, my opinion has not been accepted by other authors because *Dipteryx* is one of the "nomina conservanda" of a botanical congress. If so, the name *Dipteryx* would be employed in the sense of Aublet's *Coumarouna*, while *Taralea* must be re-established as a distinct genus. I think, however, it might be better if another congress were to modify the ruling in this case, which seems to imply that taxonomists attribute more importance to rules of nomenclature than to natural classification, rejecting the latter to conserve an erroneously issued name only because admitted by a congress.

The genus can be divided in two natural species-groups, the first of which is characterized by a coriaceous calyx and cumarin-yielding seeds, the second by petaloid calyx wings and inodorous seeds. In Brazilian Amazonia the trees of the first group have the vernacular name Cumarú or Cumaruzeiro; the seeds are the Cumarú of Brazil, the Sarrapia of Venezuela, and the Tonka of the Guianas. The species appertaining to the second group are called Cumarú-rana (false Cumarú) in Brazilian Amazonia, with the exception of *C. ferrea*, which has the name Cumarú Ferro in the Purús and

<sup>1</sup> Arch. Jard. Bot. Rio de Janeiro 3: 142 and 162-164 (1922); 4: 72 (1925). Revue Bot. appl. et Agr. trop. 14: 400-407 (1934). Notizbl. Bot. Gart. Berlin-Dahlem 14: 120-127 (1938). "O cumarú, na botânica sistemática e geográfica," publ. by Serviço Florestal, Rio de Janeiro, 1939.

Acre basin; *C. alata* of central Brazil is known as Barú. Cumarú-rana is, however, a name which refers to divers Leguminosae; trees resembling Cumarú in leaves and flowers (*Taralea oppositifolia* Aubl.), the stem (*Apuleia molaris* Spruce in the Acre Territory), or the drupaceous fruits (*Andira inermis* [Sw.] H.B.K.). It should be mentioned that the Cumarú de Rato (Mouse Cumarú) of the Bragança railway region of Pará is *Poecilanthe effusa* (Huber) Ducke (Papilionatae-Galegeae) and that Cumarú de Cheiro is the name of the two species of the genus *Torresea* Fr. Allem. (Papilionatae-Sophoreae), oftener called Imburana de Cheiro, one inhabiting central and northeastern Brazil, the other the Acre Territory, both strongly cumarin-scented in all their parts.

#### Synoptical Key to the Species

Calyx coriaceous, more or less tomentous, obscure glandulous, its lower lip with small teeth. Leaflets on fertile branchlets 2-6. Petals rose, partly whitish. Ovary glabrous, with short stipes. Drupe with oily and aromatic-smelling pericarp and odorous seed rich in cumarin.

Bark and sapwood of stem and branches with a pea-like smell. Leaflets 4-6, in sterile branches to 8; without pellucid points. Branches of the panicle rather elongated and relatively laxiflorous, even before anthesis; bracteoles much shorter than the adult flower bud. Pericarp of the drupe bitter, not edible for man.

Wings of the calyx 10-12 mm. long, densely and uniformly covered with rusty tomentum. Leaves with very long-produced rachis point.

1. *odorata*.

Wings of the calyx 20-21 mm. long, dirty whitish, less densely tomentous. Rachis of the leaves with short point or not produced...

2. *rosea*.

Bark and sapwood of stem and branches with cumarin-odor. Leaflets, at least the younger, more or less pellucid-dotted. Branches of the panicle shorter, the younger densiflorous, the bracteoles large. Calyx wings 6-9 mm. long, dirty rose, less tomentous. Rachis point never very long.

Leaflets 4 or more, rarely 5 or 6, their pellucid points often only distinct along the borders. Bracteoles shorter than the adult flower bud. Pericarp of the drupe bitter, not edible for man.....

3. *punctata*.

Leaflets 3 or 2, even the oldest with conspicuous pellucid points. Bracteoles of the length of the adult flower bud. Pericarp of the drupe sweet and edible.....

4. *trifoliolata*.



Wings of the calyx petaloid, membranaceous, thinly tomentellous or subglabrous, well marked with transparent convex glandules; teeth of the lower lip small. Flowers rose. Ovary glabrous, with long stipes. Leaflets 4-14. No parts of the plant cumarin-scented.

Leaflets obtuse or with a very short and very obtuse acumen, without pellucid points. Rachis of the inflorescences, pedicels, and bracteoles puberulous. Bracteoles with short abrupt acumen. Flowers bright rose.

Leaflets 6-14, thick coriaceous, with revolute borders and often with some longitudinal stripes, pale and often glaucescent beneath. Inflorescence very ample. Flowers robust; calyx with thin glandulous points, its wings about 12 mm. long and 7 mm. broad. . . . . 5. *polyphylla*.

Leaflets 4-10, thin coriaceous, concolorous, lustrous chiefly on the upper side. Flowers elongated oblong; calyx with copious and very conspicuous glandulous dots, its wings 9-11 mm. long and 4-5 mm. broad. 6. *ferrea*.

Leaflets commonly oblong-lanceolate, seldom broader and subobtuse, membranous or subcoriaceous, more or less ferruginous beneath. Bracteoles subobtuse. Flowers purplish rose.

Leaflets 6-12, with pellucid points at least along the borders. Inflorescences with puberulous rachis and pedicels; bracteoles tardily deciduous, subelliptic, with pubescent dorsal keel. Flowers 6-12 mm. long, relatively broader than those of the species following; glandulous dots on the calyx very conspicuous. Drupe compresso-obovoid. . . . . 7. *alata*.

Leaflets 6-14, without pellucid points or with a very few near the base. Inflorescences subglabrous; bracteoles very early deciduous. Flowers 12-15 mm. long, oblong; glandulous dots of the calyx much thinner. Drupe moderately compressed, ovoid or ellipsoid. . . . . 8. *magnifica*.

Apparently near the preceding, but, according to the description, with much smaller flowers (calyx tube 2.5 mm. long, wings 8 mm. long, 3.5 mm. broad). Leaflets 9-11, lanceolate-oblong with acuminate apex, rather rigidly chartaceous (no pellucid points mentioned in the description). Inflorescences with puberulous rachis and pedicels; bracteoles oblong-lanceolate, acuminate; calyx glabrous or subglabrous. Drupe not described. Not seen. . . . . 9. *micrantha*.

Wings of the calyx petaloid, membranaceous, without glandulous points, of pure white color; the other calyx-laciniae rather long setaceous. Petals deep violet. Ovary with short and thick stipes, its vexillary suture and the basal two-thirds of the style with long white hairs. Panicle ample and multiflorous, tomentellous; bracteoles excessively caducous, unknown; flowers 10-12 mm. long, subglabrous. Petiole and rachis of the leaves narrow, depressed but not winged; leaflets 4-5, rarely 3 or 6, marked with very conspicuous transparent points. Genus not very certain, for lack of knowledge of the complete fruit.

10. *speciosa*.

### Species Yielding Commercial Tonka Beans

1. COUMAROUNA ODORATA Aubl. or DIPTERYX ODORATA (Aubl.) Willd. (= *Dipteryx tetraphylla* Benth.).—A large tree, often over 30 m. high in virgin forest, but scarcely medium-sized in secondary growth and in cultivation. Bark mostly rather smooth and yellowish brown; flowers highly perfumed, appearing in the middle of the drier season, in Manáos chiefly in September and October; fruits mature in June and July of the following year. Spontaneous and very frequent in the upland rain forest of the eastern and central parts of the hylaea. Herbarium specimens examined: State of PARÁ: Bragança, Ducke Herb. Jard. Bot. 17231; Ourem, Rio Guamá, Siqueira Herb. Amaz. Mus. Pará 4034; Alcobaca, Rio Tocantins, Ducke H.A.M.P. 15639; Cataracts of Mangabal, Rio Tapajoz, Ducke H.A.M.P. 16437. State of AMAZONAS: Manáos, Ducke 90 and with wood sample 117 (Yale 22577), and H.A.M.P. 12185 and H.J.B.R. 23831; Manáos, Spruce 1824, type of *tetraphylla* Benth. This last is merely an individual form of the species frequent at Manáos and identified as conspecific with the *odorata* from French Guiana by Bentham himself. The Cumarú cited as *odorata* in some works of Huber as growing in the varzea forest of the Upper Purús is, however, evidently the Cumarú Ferro, *C. ferrea*, with odorless seeds.

This is the species which yields the greatest part of the Cumarú beans exported from Brazilian Amazônia, nearly all produced in the State of Pará and most of the State of Amazonas. I am not sure of its occurrence in Dutch and British Guiana, much less Venezuela from where it is often cited though no herbarium material seems to be available. The species is frequently cultivated, chiefly at Manáos. Some trees in the Botanical Garden of Rio de Janeiro flower and fructify yearly in spite of their weak development.

2. COUMAROUNA ROSEA (Spr. ex Benth.) Taub. or DIPTERYX ROSEA Spr. ex Benth.—Tree of small or medium size, easily distinguished from *odorata* by the much larger flowers but not by the fruits, which apparently are the same for both species. Confined to the basin of the Upper Rio Negro, including the tributaries such as the Uaupés, the Curicuriary,



etc., in Brazil, Venezuela, and Colombia. The trees grow on rocky river shores, slightly inundable, chiefly along rapids. The seeds are as fragrant as those of *odorata* but do not have any commercial importance because the fruits nearly always fall into the water. Herbarium specimens examined: São Gabriel, Spruce 2096 (type collection); mouth of the Curicuriary, Ducke H.J.B.R. 23829. Young plants cultivated in the Botanical Garden of Rio de Janeiro.

3. *COUMAROUNA PUNCTATA* Blake or *DIPTERYX PUNCTATA* (Blake) Amshoff.—Tree usually of medium size, smaller in all its parts than *odorata* with which it is analogous by the bitter pericarp, while the cumarin-scented bark and sapwood as well as the inflorescences and flowers are like *trifoliolata*. Fruits generally a little smaller than in the three allied species. Spontaneous in Brazilian Amazonia, from the mouth of the great river up to the center of the basin, in upland rain forest but always on moist or slightly marshy places, mainly along streams; sometimes also found in higher, less flooded "varzea" forest. Flowers during the first half of the rainy season, December to March, according to the localities and the pluviosity of the year. Herbarium specimens examined: State of PARÁ: Furo Villanova near Mazagão, Ducke H.J.B.R. 20397, fructifying; São Luiz at the foot of the lowest cataract of the Rio Tapajoz, Ducke H.J.B.R. 11497, flowering; Obidos, banks of the Lake Jeretepaua, Ducke H.A.M.P. 10211, flowering and with fruits. State of AMAZONAS: Itacoatiara, Ducke H.A.M.P. 12519, fructifying; Porto Velho, Rio Madeira, in virgin forest, Ducke H.J.B.R. 23404, flowering; Manáos, Ducke 87, 326 (with wood sample, Yale 34090), and H.J.B.R. 23403, 34699 and 34700, flowering and with fruits. Part of this material was formerly classified as *odorata*, var. *tetraphylla* and some duplicates were distributed with this name. The comparison of a cotypic *tetraphylla* specimen and the receipt, through the kindness of Dr. Swingle and Dr. Killip (both of Washington, D. C.), of a photograph of the type specimen of *punctata* (northern Venezuela, cultivated, Pittier 6464), allowed me to clear up the classification of the latter. This species has been verified by Amshoff for the flora of Surinam, but I do not know if it is spontaneous there; ac-

ording to that author, it is cultivated on some of the West Indian islands, often under the name *odorata*. It is also cultivated here and there in Brazilian Amazonia, but less frequently than *odorata*; its seeds go into the exported Cumarú beans but in an insignificant quantity.

4. *COUMAROUNA TRIFOLIOLATA* Ducke, Notizbl. Dahlem 14: 121, 124 (1938) or *DIPTERYX TRIFOLIOLATA* Ducke.—The largest of the true Cumarú trees, 30 to 40 m. high, with brownish, often laminated-splitting bark. It is distinguished from all other species by the edible pericarp of the fruit and by the leaves of the fertile branches having only two or three leaflets; from the common *odorata* also by the scented bark and sapwood, the transparent-dotted leaflets, and the shape and color of the inflorescences and flowers. I found the trees beginning to flower in July, and therefore I think that blooming might be at its height during the second half of the local rainy season, probably in August. The sweet and aromatic pericarp is so much like that of the highly esteemed *Sarrapia* of the Orinoco basin that Venezuelan traders established in Brazil say that it is of the same species. We cannot as yet affirm this with certainty because there has never been a thorough botanical exploration of the southern part of the lower Orinoco basin. It is known, however, that many species of trees are common to the upper Rio Branco and the lower Orinoco.

The present species is of frequent occurrence on the foothills and lower slopes of the forest-clad granitic mountains of the upper Rio Branco region in the extreme northern part of the Brazilian state of Amazonas, Serra Grande, Serra da Lua, Serra da Malacacheta, etc. The seeds are exported in large quantities *via* Manáos and are reputed to be the best Cumarú of Brazil, equal to the finest quality of Venezuelan *Sarrapia*. Young plants were introduced into the Botanical Garden of Rio de Janeiro in 1937. Herbarium specimens: Foot of the Serra Grande, Ducke 521 and H.J.B.R. 34950.

#### Species Not Yielding Commercial Tonka Beans

5. *COUMAROUNA POLYPHYLLA* (Huber) Ducke or *DIPTERYX POLYPHYLLA* Huber.—Tree 15 to 25 m. high, with slender



stem, beautiful flowers of a pure rose, and fruits like those of *odorata* but having a pleasantly scented though nearly tasteless oily pericarp and a very oily inodorous seed. I have never heard anywhere that the fruit is eaten by man. The tree grows in the upland rain forest and hitherto has been observed only in the basins of the Rio Negro and Rio Japurá (= Caquetá, in the Colombian part). Herbarium specimens: COLOMBIA, Caquetá, forest on the foot of Cerro de Cupatí, Ducke H.A.M.P. 12324, type of the species. BRAZIL, State of Amazonas: Manáos, Ducke 308 (with wood sample, Yale 33835) and 370, and H.J.B.R. 23402; Upper Rio Negro above the mouth of the Curicuriary, Ducke H.J.B.R. 23830.

6. *COUMAROUNA FERREA* Ducke or *DIPTERYX FERREA* Ducke, Cumarú Ferro (Iron Cumarú) of Purús and Acre.—A big tree, 40 to 50 m. high, with dark brown and rather smooth trunk sustained by huge buttresses and having very hard wood. When in flower the bright rose crown, which rises high above the common level of the forest, affords a beautiful sight. The fruit has an inodorous, oily, edible seed, but I have seen only old endocarps, which resemble those of *polyphylla* though a little more compressed. The trees are not rare in the southwestern part of the State of Amazonas and in the Acre Territory; they grow in the varzea that is not flooded deeply or very frequently as well as in the upland rain forest. Herbarium specimens: State of AMAZONAS: Rio Purús above the mouth of the Acre, Ducke H.J.B.R. 23832 (type of the species, duplicates in Paris and Berlin-Dahlem); Tres Casas, municipality Humaytá, Rio Madeira, on varzea land, Krukoff 6407. Frequently seen in Acre Territory, Seringal Iracema.

7. *COUMAROUNA ALATA* (Vog.) Taub. or *DIPTERYX ALATA* Vog., Barú (Minas Geraes).—A small tree of the "campo," "chapada" or "cerradão," and dry woods of central and northeastern Brazil, from the northern part of Minas Geraes to the Atlantic coast of Maranhão. It is the only species in the southern part of tropical South America (south of the Amazonian hylaea) with sharply divided dry and wet seasons. It is well characterized by the relatively short and broad flowers. The seeds (but probably not the fruits, as said by some authors) are edible. Herbarium specimens: State of MARANHÃO: São Luiz, near Anil, in dry woods, Ducke Herb. Gener.

Mus. Pará 571; Caxias, on park-like "chapada," Ducke H.A.M.P. 696. State of MINAS GERAES: Pirapora, Mello Barreto 10091. Cited from Goyaz and Matto Grosso.

8. *COUMAROUNA MAGNIFICA* Ducke or *DIPTERYX MAGNIFICA* Ducke.—Tree 35 to 45 m. high, with beautiful flowers of a very showy purplish rose appearing in the middle of the drier season. The chief characters of this species are the nearly glabrous inflorescences and the fact that the bracteoles of the flower buds are very early deciduous. The leaflets, which are rather variable, resemble in form those of *alata*, but the flowers are much longer. The fruits are shorter and less compressed than in *ferrea* and *polyphylla*. The seeds are oily but so far as I can learn they are not eaten by man. The species grows in upland rain forest, from the head of the Amazon estuary westward up to the center of the Amazonian plain. Herbarium specimens: State of PARÁ: Gurupá, Ducke H.A.M.P. 16546; Rio Xingú west of the Volta Grande between Victoria and Ponte Nova, Ducke H.J.B.R. 11503; Rio Tapajoz, near the lowest cataract between Maria Luisa and Periquito, Ducke H.A.M.P. 16400 (type of the species), and hills of Bacabalzinho above the Mangabal cataracts, Ducke H.J.B.R. 5050. State of AMAZONAS: High banks of Lake Uaicurapá south of Parintins, Ducke 146 with wood sample (Yale 22606) and H.J.B.R. 23834; Manáos, Ducke 92 and H.J.B.R. 34698 (flowering) and H.J.B.R. 23833 (fructifying). Some specimens were distributed with the name *polyphylla*.

9. *COUMAROUNA MICRANTHA* (Harms) Ducke or *DIPTERYX MICRANTHA* Harms, Notizbl. Berlin-Dahlem 9: 976 (1926).—I have not seen this species which must, according to the description, differ from *magnifica* by the much smaller, and from *alata* by the narrower, flowers. The author makes no mention of translucent points on the leaflets. It is described as a tree 25 m. high, with roseate flowers having a greenish calyx tube, and with oily and edible fruits (seeds?); the locality is San Isidro on the Rio Marañon (Peruvian upper Amazon) at the mouth of the Rio Pastaza, on flood-free varzea land. The Peruvian name, according to the collector (Tessman), is Kumarut (probably Cumarú) or Charapilla (a diminutive of the Quechua word "charapa" meaning turtle, evidently because a half of an endocarp has the form



of a turtle shell). The range is the most western of the South American species of the genus so far as known.

10. *COUMAROUNA SPECIOSA* Ducke or *DIPTERYX SPECIOSA* Ducke.—I have included this magnificent species because a half endocarp gathered from under the tree undoubtedly belongs to this genus. However, it is not impossible that the shell was floated down from one of the trees of the common Cumarú (*C. odorata*), which is not rare on the neighboring hills, in which case our species may belong to a new genus. The species, whose chief characteristics are given in the preceding synoptic key, resembles *Taralea* in many of its flower details, but, unlike *Taralea*, the leaflets contain pellucid oil dots which suggest the genus *Pterodon* of central and northeastern Brazil since they are more abundant and much more conspicuous than in the other *Coumarouna* species in which they exist. It is a tree about 30 m. high and its plentiful and very lovely pure white and deep violet flowers exhale a strong scent like *Jasminum sambac*. Once observed on the marshy shores of a streamlet, tributary of the Mangabal cataracts, Middle Tapajoz, State of Pará. Herbarium specimens (distributed to many institutions of America and Europe): Ducke H.A.M.P. 16435, flowering September 1916.

The two Central American species attributed by authors to the present genus, namely, *Coumarouna panamensis* Pittier, from Panama, and *Dipteryx oleifera* Benth., from Nicaragua, cannot, I think, be included in this genus. Although, according to descriptions, their flowers may resemble those of *C. ferrea*, the fruits (more important than flowers in distinguishing genera of *Dalbergiaceae*) are quite different and show more generic affinities with *Pterodon*. According to Pittier (Contrib. U. S. Nat. Herb. 18: 236, 1917), "the fresh fruits of *Coumarouna panamensis* are covered with a grayish green pubescence and impregnated with an oily, sweet-smelling fluid which may have its origin in the resinous channels that crowd the mesocarp. When the fruits are dry these ducts are seen filled with a crystalline substance." It is therefore probable that these species ought to represent a new genus, intermediate between *Coumarouna* and *Pterodon*.

## AMERICAN WOODS OF THE FAMILY MORACEAE

By SAMUEL J. RECORD and ROBERT W. HESS

The Mulberry family, with about 70 genera and more than 1000 species of unarmed or thorny trees and shrubs and a few herbs, generally with milky juice, is of cosmopolitan distribution, though most abundant in tropical and subtropical regions. The leaves are alternate, stipulate, small to very large, entire, toothed, or lobed, thin to thick and leathery, smooth or as rough as sandpaper. The flowers are unisexual, the two sexes borne on the same or on different individuals. The fruits are indehiscent, one-seeded, free or aggregated, and variously designated as figs, berries, cherries, nuts, or oranges.

The largest genus by far is *Ficus*, but of its several hundred species the only two that are important commercially are *F. carica* L., whose fruits are the edible figs, and *F. elastica* Roxb., a common hot-house plant which in its native habitat is the source of India rubber. The Mulberry trees (*Morus*) of the north temperate zone have edible fruit and it is upon their leaves that silkworms are fed. The foliage of some species of *Brosimum* and *Tropis* is useful as green fodder for livestock. From the inner bark of several genera the Indians make clothing, blankets, and matting. The family supplies few commercial timbers. The best for heavy, durable construction is the West African Iroko, *Chlorophora excelsa* Benth.; the related American species, *C. tinctoria* (L.) Gaud., supplies a well-known yellow dyewood called Fustic. The Guiana Letterwood or Snakewood, with its peculiar hieroglyphic markings, is the heartwood principally of *Piratinera guianensis* Aubl. The beautiful Satiné of French Guiana is the heartwood of *Brosimum paraense* Huber. The Osage Orange, with a very limited natural range in the United States, has been widely planted for farm hedges and the wood is noted for its strength and elasticity, its high resistance to decay, and its low shrinkage. There are about 30 genera represented in the New World but only those mentioned are of any commercial value.

The family as a whole is well defined botanically, but the internal classification is in many instances unsatisfactory, principally because of the difficulty of obtaining ample and



complete herbarium specimens. The following descriptions of the wood are based upon authentic specimens of American species of 27 genera. For several genera the amount of material is inadequate for thorough treatment. Wood samples from type trees cannot always be relied upon, because the botanists who proposed the new species are sometimes uncertain as to the genera to which they should be referred. Until more and better material becomes available the generic concepts in closely related groups will continue to be hazy.

Sapwood thin, heartwood abundant, bright yellow, turning brown upon exposure, in *Bagassa*, *Clarisia*, *Chlorophora*, *Maclura*, *Morus*, and possibly *Sorocea*; sapwood very thick, heartwood sparingly developed, bright red in *Brosimum*, brown with black markings in *Helicostylis*, *Piratinera*, *Trophis*, *Trymatococcus*, and perhaps *Pseudolmedia*; sapwood very thick, heartwood absent or not clearly differentiated, in the others. Luster medium to high. Without distinctive odor or taste. Density widely variable from low or fairly so in *Castilla*, *Cecropia*, *Coussapoa*, *Ficus*, *Poulsenia*, and *Pourouma*, to exceptionally high in the heartwood of *Piratinera* and *Trymatococcus*; texture fine to coarse; grain very straight to uneven; working properties generally good; durability high for distinctively colored heartwood, otherwise low. Commercial importance of the timbers not likely to increase.

*Maclura* and *Morus* distinctly ring-porous, the late-wood pores clustered; tyloses thin-walled; small vessels with spiral thickenings. Other woods diffuse-porous, the pores typically rather small, solitary or in short radial multiples, well distributed; tyloses thin-walled to thick-walled, sclerotic in heartwood of some or all specimens studied of *Brosimum*, *Helicostylis*, *Piratinera*, *Pseudolmedia*, and *Trymatococcus*; spiral thickenings absent. Vessels with exclusively simple perforations; pits to other vessels mostly medium-sized to rather large, alternate. Rays usually not over 5, sometimes up to 12, cells wide and ranging from few to 150, commonly not over 40, cells in height; uniseriates very few to numerous, composed mostly or entirely of square or upright cells; multiseriates commonly with 1 or 2, sometimes up to 4 (occasionally up to 10) marginal rows of square or upright cells; sclerotic cells common in densest woods; crystals often present, sometimes abundant; latex tubes occasional to frequent in *Anonocarpus*, *Brosimopsis*, *Brosimum*, *Castilla*, *Helicostylis*, *Naucleopsis*, *Noyera*, *Ogcodeia*, *Olmedia*, *Olmedioperebea*, *Perebea*, *Pseudolmedia*, and *Trymatococcus*; pits to vessels medium and oval to large and elongated, the latter often in more or less scalariform arrangement. Wood parenchyma moderately to very abundant; typically vasicentric in

*Bagassa*, *Maclura*, *Morus*, *Olmedia maxima*, and *Olmedioperebea*; vasicentric and short aliform, with or without occasional concentric bands in *Cecropia*, *Helicostylis*, *Naucleopsis*, *Ogcodeia*, *Perebea*, *Poulsenia*, and *Pourouma*; long and narrowly aliform in *Brosimopsis*, *Brosimum*, *Helianthostylis*, *Piratinera*, and *Trymatococcus*; aliform and confluent into irregular, often anastomosing bands in *Castilla*, *Coussapoa*, *Noyera*, and *Pseudolmedia*, and sometimes in *Brosimum*, *Helicostylis*, and *Ogcodeia*; in concentric bands more or less independent of the pores in *Anonocarpus*, *Clarisia*, *Ficus*, *Olmedia aspera*, *Sorocea*, and *Trophis*; crystals sometimes present; sclerotic cells common in densest woods. Wood fibers with thin to very thick, sometimes gelatinous, walls; septate in *Castilla*, *Helicostylis*, *Naucleopsis*, *Noyera*, *Ogcodeia*, *Olmedia*, *Olmedioperebea*, and *Pseudolmedia*; pits small, but with distinct borders in *Brosimopsis* and *Brosimum* (in part), very small and simple or indistinctly bordered in the others. Ripple marks absent. No gum ducts seen.

*Anonocarpus amazonicus* Ducke, the only species, is a medium-sized to large, unarmed, laticiferous tree related to *Batocarpus*, and occurs in the Amazon region of Brazil and Peru. The generic name refers to the resemblance of the succulent fruit to that of certain species of *Anona*. L. Williams, who collected a specimen along the lower Huallaga, Loreto, Peru, where it is known as Machunasti, says (*Woods of northeastern Peru*, p. 73) that the tree is often 90 feet tall, with a spreading crown and fairly straight, cylindrical bole with small buttresses and clear of branches for upward of 65 feet. The timber is used for making canoes.

No colored heartwood seen; sapwood grayish or yellowish, streaked with parenchyma. Luster rather high. Moderately hard, heavy, tough, and strong; texture coarse; grain straight to irregular; easy to work, finishing smoothly; sapwood perishable in contact with soil. Presumably of no commercial possibilities.

Growth rings indistinct. Pores barely visible, few to locally rather numerous; mostly solitary, occasionally in short radial multiples. Thin-walled tyloses present. Rays 1 to 12, mostly 2 to 6, cells wide and up to 100, generally less than 50, cells high; distinctly heterogeneous; uniseriates rather few, with some procumbent cells; pits to vessels medium-sized and oval to large and elongated; crystals common. Wood parenchyma very abundant, visible without lens; in coarse tangential or concentric bands of variable width and spacing, regular to broken or anastomosing, not always including the pores; strands not in contact with vessels 2-4-celled; solitary crystals sometimes present. Wood fibers in part with moderately thick, in part with very thick and gelatinous, walls; pits small, simple or indistinctly bordered.



*Bagassa guianensis* Aubl., the only well-defined species, is a large forest tree of rather infrequent occurrence in the Guianas and Brazilian Amazon region. The fibrous bark contains an abundance of latex which is very attractive to certain beetles. The heart-shaped leaves are entire or 3-lobed. The fruits, which are about the size of an orange, are astringent but have an agreeable flavor and are comestible. The timber is of good quality and is used locally for general construction, carpentry, and furniture. It apparently is too scarce to become important in the export trade.

Heartwood lustrous golden brown, becoming russet upon exposure; sharply defined from the pale yellow or nearly white sapwood. Without distinctive odor or taste. Moderately heavy, tough, and strong; sp. gr. (air-dry) 0.70 to 0.80; weight 44 to 50 lbs. per cu. ft.; texture coarse; grain usually roey; easy to saw, difficult to split radially, finishes smoothly, holds its place well when manufactured; is fairly resistant to decay.

Growth rings poorly defined. Pores readily visible, rather few to fairly numerous; solitary or in radial multiples of few to several pores each, fairly uniformly distributed. Thin-walled tyloses abundant. Rays mostly 2 to 5 cells wide and up to 60, generally less than 40, cells high; homogeneous to weakly heterogeneous with large square cells marginal or interspersed; crystals common; pits to vessels medium-sized and rounded to large and elongated; latex tubes rarely present. Wood parenchyma fairly abundant, distinct with lens; vasicentric or blunt aliform; crystals sometimes present. Wood fibers with rather thin to thick and gelatinous walls; pits very small, simple or indistinctly bordered.

COMMON NAMES: Gele bagasse (Sur.); bagasse, b. jaune, bois bagasse (Fr.G.); amapá-rana, bagaceira, tatajuba (Braz.).

*Brosimopsis*, with five species of medium-sized to large, unarmed trees, is apparently limited to Brazil. *B. lactescens* Sp. Moore occurs in Matto Grosso. The three strictly Amazon species are *B. acutifolia* (Hub.) Ducke (= *Brosimum acutifolium* Huber) of the lower region, *B. amplifolia* Ducke of the central part, and *B. obovata* Ducke of the upper part. They are known as Mururé, and the latex, which contains an alkaloid called murerina, is used in local medicine as an anti-syphilitic. The wood is said to be yellowish with brownish stripes, and without dark-colored heartwood.

The most widely distributed species, and the only one represented in the Yale wood collections, is *Brosimopsis oblongifolia* Ducke (= *B. diandra* Blake), which grows on non-inundated lands throughout most of the Brazilian rain forests. H. M. Curran collected it in the Rio Grongogy basin, Bahia, where it is called Leiteira. It is a fairly common constituent of the upper story of the forest, attaining a maximum height of 150 feet, with a trunk three feet or more in diameter and free of branches for 50 to 60 feet. Although the felling and hewing of the green timber was accomplished without difficulty, the log obtained by Mr. Curran has proved almost impossible to saw when dry, owing to the large amount of gritty substance (silica) in the vessels. It is used locally to a minor extent as hewed timbers for interior construction.

Wood throughout grayish or oatmeal-colored, with a yellowish hue; apparently all sapwood. Luster rather high. Without distinctive odor or taste. Moderately hard, heavy, tough, and strong; sp. gr. (air-dry) 0.75; weight 47 lbs. per cu. ft.; texture coarse, feel harsh; grain straight; easy to cut with a knife, but very difficult to saw, finishes smoothly, is not resistant to decay.

Growth rings absent or poorly defined. Pores near limit of vision, fairly numerous; solitary or in radial multiples of few to several pores each, well distributed. Vessel lines often distinct because of white contents. Thin-walled tyloses abundant. Rays 1 to 6, mostly 4 to 6, cells wide and up to 100, generally less than 50, cells high; mostly distinctly heterogeneous, the uniseriate rays and ray margins being composed of square or upright cells; crystals common; pits to vessels in part small and rounded, often narrowly elongated; latex tubes common. Wood parenchyma fairly abundant but not distinct without lens; long and narrowly aliform and irregularly confluent; solitary crystals common. Wood fibers with medium walls and numerous small simple or indistinctly bordered pits.

COMMON NAMES: Leiteira, mercurio vegetal, moruré, murerú, or mururé (Braz.).

*Brosimum*, with numerous species of medium-sized to very large, unarmed, laticiferous trees, is of general distribution throughout tropical America. The generic term is here used in a restricted sense and the species with brown or brown and black heartwood are for convenience treated as a separate



genus, *Piratinera*. The species of *Brosimum* appear to be of two types, namely those without distinct heartwood and those with rich red or red and yellow heartwood. The first group includes *B. Alicastrum* Sw., *B. amplicoma* Ducke, *B. columbianum* Blake, *B. costaricanum* Liebm., and *B. terrabanum* Pittier. The second group is typified by *B. paraense* Huber, known as Muirapiranga (red wood) in Brazilian Amazonia and as Satiné Rubané or Bois de Feroles in French Guiana. Closely related to *B. paraense*, and perhaps only a variety of it, is *B. caloxylon* Standl., the Bloodwood Cacique of Panama. The taxonomic value of such a distinction is doubtful, however, as one specimen of *B. utile* (H.B.K.) Pittier has, near an injury, a thin layer of bright red heartwood very similar to that of *B. paraense*. Perhaps further investigation will reveal that other species may develop a small amount of heartwood, either normally or traumatically. A parallel case is that of *Pterocarpus*; the Asiatic and African species are the source of Padauk timber, whereas the American trees are virtually all sapwood, with only traces of richly colored heartwood formed near wounds.

*Brosimum Alicastrum* Sw. is a tall tree known in Jamaica as Breadnut as the cooked seeds are edible and have a nutlike flavor. The species is sparingly represented in Cuba and also grows on the mainland in Yucatán, Mexico, and northern British Honduras. Closely related to it are two Central American species, *B. costaricanum* Liebm. and *B. terrabanum* Pittier, which perhaps should be considered only as varieties, as Standley says (*Flora of Costa Rica* 1: 380) that they "are much alike in all their characters" and (*Forests and flora of British Honduras*, p. 110) "it is rather doubtful whether this species [*B. terrabanum*] is distinct from *B. Alicastrum*." The green foliage and the fruits of all three forms are locally important as fodder for livestock, especially during the dry season. The timber, which is hard, strong, and resilient but subject to decay, is used commercially to a small extent for veneer and locally for making tool handles and pack saddles, and for fuel. The latex is sometimes an adulterant of chicle.

Representatives of the *Alicastrum* group in northern South America are *Brosimum latifolium* Standl. of Ecuador

and *B. Dugandii* Standl. and *B. columbianum* Blake (= *Helicostylis bolivarensis* Pittier, published about a year earlier from the same type collection, Curran 304, Yale 1531). This last species serves to illustrate the difficulties confronting a wood anatomist working in this family. Pittier stated in 1921 (see *Timbers of Tropical America*, footnote on p. 127) that he thought the tree should be referred to *Pseudolmedia* rather than to *Helicostylis*. Blake, in a letter of April 20, 1938, to the author, says: "I was not able to find any staminate flowers when I described the plant, and neither was Pittier. To be a *Brosimum*, as you say you think it is, the plant should have staminate flowers on the same receptacle with the pistillate. So far as the material shows, it does not have these, and I do not feel like transferring Pittier's name to *Brosimum* without support from flower structure, in view of the very close generic relationships in this group." The wood structure agrees closely with that of the *Brosimum Alicastrum* complex.

The most noted *Brosimum* is the Venezuelan Cow Tree, *B. utile* (H.B.K.) Pittier (= *Galactodendron utile* H.B.K. = *B. Galactodendron* D. Don), discovered at the beginning of the nineteenth century by Alexander von Humboldt who describes it in the following manner (*Personal narrative of travels to the equinoctial regions of America during the years 1799-1804*. Eng. ed. London, 1852, Vol. II, pp. 47-48):

"For many weeks we have heard a great deal of a tree whose juice is a nourishing milk. The tree itself is called the Cow Tree and we were assured that the negroes on the farm, who are in the habit of drinking large quantities of this vegetable milk, consider it as highly nutritive; an assertion which startled us the more, as almost all lactescent vegetable fluids are acrid, bitter, and more or less poisonous. Experience, however, proved to us during our residence at Bárubula that the virtues of the Cow Tree, or Palo de Vaca, have not been exaggerated. This fine tree bears the general aspect of the Star-apple tree (*Chrysophyllum cainito*); its oblong, pointed, coriaceous, and alternate leaves are about ten inches long and marked with lateral nerves, which are parallel and project beneath. The flower we had no opportunity of seeing; the fruit is somewhat fleshy and contains one or two kernels. Incisions made in the trunk of the tree are followed by a profuse flow of gluey and thickish milk, destitute of acidity and exhaling a very agreeable balsamic odor. It was offered to us in calabashes, and though we drank large quantities of it, both at night before going to bed and again early in the morning, we experienced no uncomfortable effects. The viscosity of this milk alone renders it rather unpleasant to those who are unaccustomed to it. The negroes and free people



who work in the plantations use it by soaking in it bread made from maize, manioc, aropa, and cassava; and the superintendent of the farm assured us that the slaves become visibly fatter during the season when the Palo de Vaca yields most milk. When exposed to the air this fluid displays on its surface, probably by the absorption of the atmospheric oxygen, membranes of a highly animal nature, yellowish and thready, like those of cheese; which, when separated from the more watery liquid, are nearly as elastic as those of caoutchouc, but in process of time exhibit the same tendency to putrefaction as gelatine. The people give the name of cheese to the curd which thus separates when brought into contact with the air and say that a space of five or six days suffices to turn it sour, as I found to be the case in some small quantities that I brought to Valencia. The milk itself, kept in a corked bottle, had deposited a small portion of coagulum and, far from becoming fetid, continued to exhale balsamic scent. When mingled with cold water the fresh fluid coagulated with difficulty, but contact with nitric acid produced the separation of the viscous membranes."

The range of *Brosimum utile* extends along the Atlantic coast to Costa Rica. The tree attains a height of 80 feet with an erect trunk about 20 inches in diameter and covered with a thick, gray, smoothish bark. The leaves are large and leathery, with prominent pinnate venation, very distinct from those of the *Alicastrum* group. The latex is apparently harmless to drink, if taken in small quantities, but analysis has shown (see *Cont. U. S. Nat. Herb.* 20: 3: 104) that its composition is 57 per cent water, 37 per cent wax, and about 5 per cent gum and sugar, and hence is better suited for making chewing gum than as a food. (Other American Cow Trees are species of two genera, *Couma*, fam. Apocynaceae, and *Mimusops*, fam. Sapotaceae.) The timber, which is virtually all sapwood, is considerably less dense than that of *B. Alicastrum* and apparently is not utilized. In the thin strip of bright red heartwood about the hollow center in one Colombian sample (Yale 29517; A. E. Lawrance 765) the vessels and the wood and ray parenchyma cells are filled with garnet-colored deposits contrasting with the golden luster of the fiber background.

Closely related to *Brosimum utile* are at least three Amazonian species: *B. potabile* Ducke, locally known as Amapá Doce, is said to have a thick, yellowish white sapwood and a slender core of dense, beautiful brownish red heartwood. *B. parinarioides* Ducke, called Mureré-rana and Amapá-rana, attains a height of 140 feet and has a moderately hard wood,

yellowish white throughout, except in very large trunks which may develop hollow pipes of richly colored heartwood. *B. amplicomma* Ducke, called Caucho Macho, is especially noteworthy because of its great height and the wide extension of its crown, which perhaps even exceeds that of *B. potabile* (see *Tropical Woods* 31: 10-11, 22-23).

There is a small group of closely related species of *Brosimum* with sufficient red heartwood to be of value. Chief of these is *B. paraense* Huber (= *Ferolia guianensis* Aubl.) of the Amazon basin. Ducke says (*Tropical Woods* 51: 15-16) that it is "the true Muirapiranga of the timber dealers of Pará; at Manáos, however, it is more often called Páo Rainha (queen wood). It is a rather tall tree, widely distributed through the Brazilian states of Pará and Amazonas and perhaps the whole hylaea, growing in the upland rain forest, more frequently on sandy soils than on clay." Other Brazilian names are Condurú or Gondurú or Condurú de Sangre; in northeastern Peru the usual designation is Palo de Sangre. The wood best known commercially emanates from French Guiana and is usually called Satiné or Satiné Rubané. Karl Schmieg says (*Tropical Woods* 9: 2): "It has long been used in France and is found in some of the finest furniture of the Louis X and Louis XI periods, but is little known in America and England. It has a wonderful satiny luster and there are different hues and colors varying from gray to a rich strawberry red overlaid with a golden sheen. It is obtainable only in small logs, which rarely exceed eight inches in diameter, and is straight-grained, fine-textured, hard, and heavy, receives a beautiful polish, and takes glue very well. The Muirapiranga of the lower Amazon and the Palo de Sangre of the Peruvian Amazon are like the Satiné in many ways, but the samples I have seen lack the rich coloration of the French Guiana wood."

At least two other species have been described in the *paraense* group. According to Ducke (*loc. cit.* p. 16), "*Brosimum angustifolium* Ducke is a tall tree of the Brevos Islands in the mouth of the Amazon; also found in the lower Xingú. Its wood, which is more yellowish brown than red, is seldom found in the timber commerce of Pará and the dealers there consider it as an inferior quality of Muirapiranga." One of



the rarest and most highly prized woods of Panama is known as Cacique. A fragment (Yale 6747) collected by Alvin G. Cox in Bocas del Toro in 1923 was recognized by the senior author as being closely related to *B. paraense* (see *Timbers of Tropical America*, p. 139). In 1928, G. Proctor Cooper obtained sterile herbarium material of the tree and P. C. Standley named it *B. caloxylon*. "Although known at present only from sterile material, it seems advisable to give a name to this important tree, the first of this group to be reported from North America. *Brosimum caloxylon* is related to *B. paraense* Huber, which has much shorter leaf acuminations and broader leaves." (See *Tropical Woods* 17: 11.) Cooper gives the following account of tree and wood (*Tropical Woods* 14: 1-3):

"The name Cacique (meaning Indian chieftain) is applied to more than one wood of western Panama, but the most highly prized and perhaps the rarest is the one best described by the term Bloodwood Cacique. The wood, as known to the Indians, is not obtained from living trees, but from old trunks which have lain partially buried in the putrescent forest floor until all but a core of heartwood has long since disappeared under the combined attack of insects and decay. The Bloodwood Cacique is held in highest esteem by the Indians in Panama. It is believed to have both medicinal and supernatural properties and has been the favorite remedy of the tribal medicine man. A small piece or a chip placed over a wound is said to relieve the pain and quickly stop the bleeding, while if placed behind the ears and secured by a cord it will overcome pains in the head. The fine chips or shavings are placed in rum, making a bitter drink which is considered an excellent remedy for malarial fevers. The mountain tribes still believe that bodily ills are in some way connected with evil spirits entering the afflicted person, and the use of Cacique may be considered as a charm against the bad effects of the spirits. The old chiefs used the wood as a symbol of office and authority and it is said they carved out very weird designs from the old logs found half buried in the ground. . . . The tree apparently does not get very large, probably not over a foot in diameter and 40 feet in height. The bark is smooth and has a white latex. The buds are very long-pointed. The thick sapwood is white and sharply demarcated from the heart which is red, with black streaks and a golden luster. In one of the trees felled there was a central core about an inch and a half thick that was of golden yellow color with streaks of light red. The wood from the old logs on the ground is of a considerably darker color than the fresh material, but retains its satiny luster."

The woods of the various species of *Brosimum* available for study have the same type of structure, though differing in

details the significance of which cannot now be determined. Heartwood (so far as known) in various shades of rich lustrous red and yellow as stated above; sharply demarcated from the thick, yellowish white sapwood. Odorless and tasteless. Heartwood very hard and heavy; sp. gr. (air-dry) 0.90 to 1.05; weight 56 to 66 lbs. per cu. ft.; sapwood lighter, variable; sp. gr. (air-dry) 0.60 to 0.85; weight 38 to 53 lbs. per cu. ft.; texture rather fine to coarse; grain straight to variable; not difficult to work, finishing smoothly, taking a high polish. Heartwood of very limited commercial possibilities because of its small size and scarcity; sapwood suitable for veneers and miscellaneous purposes not requiring resistance to decay.

Growth rings absent or poorly defined. Pores usually not visible without lens, though sometimes appearing distinct because of parenchyma; visible in *Brosimum amplicomis*; not very numerous, well distributed; solitary or in small multiples. Tyloses abundant in heartwood sometimes sclerotic. Rays 1 to 3, sometimes to 5, cells wide and up to 50, usually less than 30, cells high; decidedly heterogeneous; crystals common; red gum abundant in heartwood; latex tubes few to common; pits to vessels medium and oval to large and elongated. Wood parenchyma variable in abundance, inconspicuous; long and narrowly aliform and more or less confluent, sometimes in irregular and anastomosing bands; red gum deposits abundant in heartwood. Wood fibers with medium to thick walls and small pits, with or without distinct borders.

COMMON NAMES: *B. Alicastrum* group: Breadnut (Jam.); guáimaro, ramón de Méjico (Cuba); moussara (Trin.); apomo, ash, capomo, Juandiego, nazareno, ojite, ojoche blanco, ojochillo, oox, ox, oxitl, oxotzin, ramón (Mex.); breadnut, capomo, ramoon, masico (Br.H.); masicarón, masico (Guat., Hond.); ojuste, ujuste (Salv.); mesica, ojoche (Nic.); feguó (C.R.); guaimaro, g. comestible, guayamero, manata, mare, mondongo, pasita (Col.); tillo (Ec.); muiratinga, murure (Braz.); *B. utile* group: Cow tree, Humboldt cow tree, milk tree (Eng.); mastate (C.R.); cuqua, palo de leche, sandy (Pan.); avichurí (Col.); palo de vaca, vacuno (Venez.); amapá doce, a. rana, caucho macho, murere-rana (Braz.); *B. paraense* group: Bloodwood, Brazil redwood, cardinal wood (Eng.); cacique (Pan.); ajeersi, oolemeriballi, polisthout, sokonéballi, warimiaballi (Sur.); bois baroit, b. de Cayenne, b. de lettre rouge, b. de feroles, satiné, s. gris, s. rubané (Fr.G.); amapá-rana, condurú, c. de sangue, cundurú,



gondurú, meurapiranga, moirapiranga, muirapiranga, mureré-rana, pau rainha, uanta (Braz.); palo de sangre (Peru).

*Castilla* (or *Castilloa*), with about 10 closely related species of unarmed, deciduous trees, is distributed from Mexico throughout Central America and northern South America to parts of the Brazilian Amazon region. The leaves are simple, large, coarse-textured, and usually densely hairy all over. The fruits are rather large, scaly, pubescent, and, in some instances, contain a soft, sweetish, edible pulp. About the only value of the trees is in their latex, the source of *Castilloa* rubber, now of minor importance as nearly all of the commercial rubber is produced by plantations of *Hevea* (family Euphorbiaceae).

The natural habitat of the trees is clearings and natural openings in the virgin forest and sparsely wooded alluvial flats, often in association with *Cecropias*. On rich soil growth is rapid and the trees attain great size, sometimes over 150 feet high and 5 feet in diameter; open-grown trees develop short, stout boles and large, coarse crowns. A peculiarity of the trees is the development of long, slender pseudo-branches or deciduous twigs bearing very large, showy leaves. Large forest trees are often buttressed by the spurs of the wide-spreading superficial roots. The best known and for long the only described species is *Castilla elastica* Cerv. Central American forms, e.g., *C. fallax* Cook, do not produce commercial rubber and are termed Cacho Macho or Hule Macho, literally male rubber, though the Spanish term "macho" when applied to plants often signifies some important departure from the type rather than any sexual difference. The Amazon species, *C. Ulei* Warb., is known locally as Cacho, whereas the tree (*Hevea*) producing Pará rubber is called Seringueira. The bark of *Castilla* is finely laminated and is used by the Sumo Indians in Nicaragua for making soft vegetable cloth, through a process of soaking and beating. The timber is rarely used as it is unattractive in appearance and lacks strength and durability.

Wood whitish when fresh, turning yellowish brown; apparently all sapwood. Luster medium to rather high. Odorless and tasteless. Rather light in weight, but firm and tough; texture

coarse; grain fairly straight; easy to cut, saws rather woolly; perishable in contact with the ground.

Pores near limit of vision, though frequently appearing distinct because of parenchyma about them; fairly numerous but not crowded; mostly solitary, sometimes in short radial multiples. Thin-walled tyloses present. Uniseriate rays few to very few; other rays 4 to 7 cells wide and generally less than 50, sometimes up to 70, cells high; weakly heterogeneous in part; pits to vessels medium-sized and rounded to large and elongated; latex tubes sometimes present. Wood parenchyma abundant, visible; vasicentric, short aliform, and confluent into irregular, often anastomosing, or sometimes regular concentric bands. Wood fibers thin-walled, septate; pits small, simple or indistinctly bordered.

COMMON NAMES: Rubber tree (English); cacho, hule or ule (Span.); árbol de ule, kiikche, yaxha (Mex.); cauchillo, ule macho, ule-ule (Cent. Am.); gsi-krá, serú, sini, soró, tseni, tsini (C.R.); cacho negro (Ec., Peru); cacho (Braz.).

*Cecropia*, with numerous closely related species of typically small, unarmed, deciduous trees, is distributed throughout tropical America and in many localities constitutes one of the most conspicuous and characteristic elements of the vegetation on lowland flats, often forming almost pure stands on old clearings. The trees grow quickly and are short-lived. At maturity they are commonly less than 40 feet high, with slender, upright, whitish trunks 8 to 12 inches in diameter, occasionally up to 60 feet tall and 24 inches through. The stems are hollow between the nodes, and the upper part and the branches are generally inhabited by small ants which inflict severe bites when the tree is molested. The very large long-stalked, peltate, deeply lobed, rough leaves are usually whitish beneath and being clustered at the ends of the few, coarse, candelabra-like branches produce a very striking effect. The bark supplies fiber for oakum and native cordage and latex for medicinal purposes. The trunks are sometimes used for making rafts or buoying heavy logs, and the wood is employed to some extent for match sticks, paper pulp, box-boards, charcoal powder, and kindling.

Wood whitish when fresh, becoming pale brown or oatmeal-colored upon exposure; apparently all sapwood. Fairly lustrous. Light and soft, but tough and strong for its weight; sp.



gr. (air-dry) 0.35 to 0.45; weight 19 to 28 lbs. per cu. ft.; texture coarse; grain generally straight; not always easy to finish smoothly, holds nails firmly; is perishable in contact with the soil. Of no interest to the export trade.

Growth rings sometimes distinct but usually poorly defined. Pores readily visible, rather few to numerous but not crowded; solitary or in occasional to common radial multiples, without definite arrangement. Vascular pitting coarse. Rays 1 to 3 cells wide in some specimens, up to 6 or 8 cells in others; height generally less than 50, sometimes up to 80 or 100, cells; decidedly heterogeneous, the cells greatly variable in size, with comparatively few distinctly procumbent; crystals common; pits to vessels large, irregular. Wood parenchyma variable in abundance; in denser specimens vasicentric, short aliform, locally confluent, and in rather widely spaced bands; in softer material sparingly developed and not distinct without lens. Wood fibers with rather to very thin walls; sometimes septate; pits small, simple or indistinctly bordered.

COMMON NAMES: Shake wood, trumpet tree, t. wood (Jam.); llagrumo, yagrumo (Cuba); yagrumo hembra (P.R.); bois trompette (Haiti); trompette (Guad.); bois canon (Granada); chancarro, coilotapalo or coilotopalo, guarima, guarumbo, guarumo, ix-coch, saruma, trompeta, xcoochlé (Mex.); igarata, trumpet (Br.G.); guarumo (Cent. Am., gen.); ikú, ko-krá, kokua-krá, kur, serúngo, srung-dó, xkur (C.R.); guarumo, g. morado, orumo, yarumo (Col.); congo pump, float wood, pumpwood, trumpet tree, wanasoro (Br.G.); boessi papaja, bosch papaya (Sur.); ambaita, bois canon, b. trompette, coulekin (Fr.G.); ambaiba, a. tinga, arvore da preguiça, embauba, imbauba, i. branca, i. da matta, i. verde, imbaubão, umbauba (Braz.); cetico, c. de oyada, imbauba, pungára, setico, tacona, tacuma, tacuna, umbauba (Peru); umbaubeira (Parag.); ambahú, ambaiba, ambatí, ambay, palo de lija (Arg.).

*Chlorophora*, with a few species of medium-sized to large, spiny or unarmed trees, is widely distributed in tropical West Africa and tropical America. *C. excelsa* B. & H. f. is an important African tree; the timber is esteemed locally for general construction and considerable quantities are exported to Europe; its most common trade name is Iroko (see *Tropical Woods* 28: 4-10).

In America the genus is usually considered as monotypic, but in addition to *C. tinctoria* (L.) Gaud. (= *Morus tinctoria* L. = *Maclura tinctoria* [L.] G. Don), one or two other forms are generally recognized either as varieties or sometimes as distinct species. The northern form, which grows in coastal lowlands of southern Mexico, Central America, the West Indies, and northern South America, where it is commonly called Mora, yields the well-known dyewood, Fustic, which has been an article of commerce since the middle of the seventeenth century. The tree rarely exceeds 65 feet in height, but may have a trunk diameter of 30 inches. The light brown, laticiferous bark is smooth on young stems and branches, which are sometimes spiny. The timber is exported in the form of short logs with the thin sapwood hewed off and vary in diameter from a few inches to two feet. The coloring principle, maclurin, is readily soluble in water and the natural color imparted is a fairly permanent dull yellowish brown or khaki. The use of mordants not only adds to the permanency of the dye, but permits a considerable range in shade; mixture with other dyewoods yields compound shades such as drab, fawn, and olive. Fustic has been largely superseded by aniline dyes but a remnant of the trade persists and probably will continue to do so indefinitely.

The southern form is a timber tree. H. M. Curran says that, though nowhere abundant, it is a constant factor in the forests of Misiones (Argentina), Paraguay, and southern Brazil. It is tall and symmetrical, with a rather fine-textured and comparatively smooth brown or gray bark and a rather narrow crown. At maturity the trunks are usually between 18 and 24 inches in diameter, with clear lengths of 40 to 50 feet. The timber reaches the market in the form of squared logs and is used where a hard, durable wood is needed, but not as a dyewood. It is favorably known to the wheelwright and carpenter and also makes good fence posts, props, and fuel.

Heartwood typically golden yellow when fresh, changing upon exposure to brown or russet, sometimes with a reddish tinge; sharply demarcated from the nearly white sapwood. Luster high. Without distinctive odor or taste. Mostly very hard, heavy, tough, and strong; sp. gr. (air-dry) 0.85 to 0.99;



weight 53 to 62 lbs. per cu. ft.; texture medium to coarse; grain variable, often interwoven; not very difficult to work, taking a lustrous polish; is highly resistant to decay.

Growth rings distinct to indistinct. Pores medium to small, appearing distinct because of parenchyma about them; rather numerous, well distributed; solitary or in radial multiples, the latter sometimes composed of one large and few to several small pores. Tyloses abundant; walls thin to moderately thick. Rays 1 to 5, mostly 2 to 4, cells wide and up to 50 cells high; homogeneous or nearly so; crystals common; pits to vessels medium-sized and rounded to rather large and elongated; latex tubes occasionally present. Wood parenchyma abundant, readily visible, showing rather prominently on tangential surface in proper light; varying from vasicentric in early wood to very irregularly confluent, frequently terminating in narrow concentric band; crystalliferous cells numerous, composing a part or all of a strand. Wood fibers small, with medium to thick walls and minute simple or indistinctly bordered pits.

COMMON NAMES: Dyer's mulberry, fustic, f. wood, old fustic (Eng., trade); bois jaune, fastique, fustique (Fr.); Fiselholz, Fisetholz, Fustik, Fustikholz, Gelbholz (Germ.); geelhout, stockvischhout (Dutch); fustete, mora (Sp.); jataiba (Port.); fustetto vecchio, legno giallo (Ital.); red fustic, snook (Jam.); fresno de America, mora del país (Cuba); mora macho, palo amarillo (Dom. R.); paaloe doesji (Curaçao); bois d'orange, palo naranjo (Trin.); barossa, moradilla, moral, m. amarilla, m. de clavo, m. liso, palo moral, yaga-huil (Mex.); palo negro (Guat.); jocomico, madrial, pinabete, quebracho de cerro (Hond.); brasil, palo de mora, tsukrá (C.R.); macano (Pan.); cauchillo, dinde, majagua gallina, palomora (Col.); charo, mora amarillo, mora lisa, moral (Venez.); moral, m. bobo (Ec.); insira, i. caspi, limulana, ynsira (Peru); amarillo (Boliv.); amoeira brava, a. de espinho, limão-rana, l.-r. amarello, moratana, runa, tatajiba, tatajuba, t. de espinho, tatayiba, tayuva (Braz.); mora amarilla, m. blanca, m. colorada, tatayibá, t. puitá, t. saiyú (Arg.).

*Clarisia*, with eight poorly distinguished species of unarmed small to large trees and shrubs, is distributed from southern Mexico to southeastern Brazil, but not in the West Indies, according to Lanjouw (*Rec. Trav. Bot. Néerlandais* 33: 254-276).

*Clarisia mexicana* (Liebm.) Lanj. (= *Sabagunia mexicana* Lieb.) is a tree, sometimes 100 feet tall and 24 inches in diameter, in southern Mexico and Guatemala. *C. urophylla* (Donn. Sm.) Lanj. (= *Sabagunia urophylla* Donn. Sm.) is said to be a related species in the forest about Puerto Sierra, Honduras. *C. colombiana* (Rusby) Lanj. (= *Sabagunia colombiana* Rusby) is a large tree of northern Colombia, called Ache or Aji. *C. biflora* R. & P. is a tree 50 feet high in northern Peru, where it is called Piamich and Yasmich. *C. mattogrossensis* Lanj. is a tree 70 feet high in Matto Grosso, Brazil. *C. Spruceana* Lanj. is described as a small tree in Venezuela. *C. ilicifolia* (Spreng.) Lanj. & Rossb. (= *Excoecaria ilicifolia* Spreng. = *Acanthophyllum strepitans* Fr. Allem. = *Sabagunia strepitans* [Fr. Allem.] B. & H. = *S. racemifera* Hub.) is distributed from the Guianas through the Amazon region to Rio de Janeiro, Brazil, and varies in size from shrubs to moderately large trees; the vernacular names in Brazil are Bainha d'Espada and Diconroque.

The best known species is *Clarisia racemosa* R. & P. (= *Soaresia nitida* Fr. Allem. = *C. nitida* [Fr. Allem.] Macbr. = *Olmmedia erythrorhiza* Hub.), a large tree widely distributed in Brazil and extending into northeastern Peru; its northern limits have not been determined. In eastern Brazil it is generally known as Oiticica or Oity, names applied also to fruit trees, *Licania rigida* Benth. and others, of the Chrysobalanoidae group of the Rosaceae. According to H. M. Curran, it is very common in the rain forests of Bahia where it grows scatteringly or in small clumps in association with Pau d'Alho (*Gallesia*), Massaranduba (*Mimusops*), Araça de Agua (*Terminalia*), and Jequitibá (*Cariniana*). It attains a height of 130 feet, with a well-formed, non-buttressed trunk sometimes 36 inches in diameter and free of branches for 50 to 60 feet. The bark is covered with small corky warts. The timber is well known to the rural population and is used for general construction and carpentry; shipments of lumber were made to Germany in 1938. Objections to it are that the irregular grain makes it difficult to finish smoothly with hand tools and that it is not adapted for use in places favorable to decay. It is common in the Amazon basin, where it is generally called



Guariuba, and grows to large size, mostly on lands that are not subject to inundation. The laticiferous bark of the stem is gray and warty on the surface, but intensely red within as are also the roots.

In the Yale collections there are numerous specimens of the wood of *Clarisia*, mostly from Brazil, but including a few from Venezuela, Colombia, Panama, and northeastern Peru. They are all so much alike that they might be the produce of a single species. Heartwood bright yellow, becoming brown or russet, but retaining a golden luster, upon exposure; sharply defined from the thin, white sapwood. Dry specimens without distinctive odor or taste. Rather light and soft to moderately heavy; sp. gr. (air-dry) 0.50 to 0.65; weight 31 to 40 lbs. per cu. ft.; texture medium to coarse; grain variable, often decidedly roey; easy to cut, but cross-grained material requires sharp tools to produce a smooth surface; fresh wood saws woolly; holds its place well when manufactured; quarter-sawed roe-grained lumber has attractive figure.

Growth rings mostly absent or poorly defined, occasionally distinct because of apparently terminal band of parenchyma. Pores barely visible, rather few to moderately numerous; solitary or in short radial multiples, well distributed. Thin-walled tyloses abundant. Rays 1 to 8, generally 1 to 4, cells wide and up to 50, occasionally to 80, cells high; definitely heterogeneous, at least in part; uniseriate with some procumbent cells; pits to vessels medium-sized and rounded or larger and elongated. Wood parenchyma abundant, distinct on cross section and producing wavy pattern on tangential surface; in numerous, rather narrow, fairly evenly spaced, regular or finely wavy, concentric bands 2 to 8 cells wide, associated with the pores but not always including them; occasionally more widely spaced at intervals suggesting seasonal growth; crystals common. Wood fibers with rather thick walls and very small simple or indistinctly bordered pits.

COMMON NAMES: Árbol del pan (Mex.); ache, agi, aji, dinde (Col.); pellejo de Indio (Venez.); capinuri, guariúba, huariuba, imauba, killo-muena, mashonaste or machunaste, piamich, tulpay, yasmich (Peru); bainha d'espada, diconroque, guariúba, oiti, oiticica, o. amarella, quariúba (Braz.).

*Coussapoa*, with numerous species of unarmed laticiferous trees and shrubs, is widely distributed in continental tropical America from Mexico to Brazil, Bolivia, and Peru. The plants are usually epiphytic, at least when young, and frequently also

are more or less scandent; some of them develop into large trees. The stems are hollow and the leaves are large, sometimes 20 inches long, entire, leathery, prominently pinnately veined, and light colored on the under side. The fiber of the inner bark is used by the natives for making coarse baskets and bags. The timber is not utilized.

Heartwood absent or not clearly differentiated from the pale brown or pinkish sapwood. Luster medium to rather high. Odorless and tasteless. Light in weight but comparatively firm, tough, and strong; texture coarse; grain straight to irregular; easily worked, perishable in contact with the soil. An unattractive wood without commercial possibilities.

Growth rings usually indistinct. Pores readily visible, rather few; solitary or in small multiples, well distributed. Rays 1 to 8, mostly 1 to 4, cells wide and up to 80, generally less than 40, cells high; decidedly heterogeneous; pits to vessels large, oval to elongated. Wood parenchyma abundant, but scarcely distinct without lens; long aliform and confluent into narrow, irregular, tangential bands, with occasional fairly regular concentric bands; crystals present in cubical cells composing parts of strands. Wood fibers with thin walls and very small simple or indistinctly bordered pits.

COMMON NAMES: Caraco (Col.); yele (Br.G.); coassapoua or coussapoui (Fr.G.); matapalo, m. colorado (Ec.); higo del monte (Boliv.); chichillica, xenáco-caspi (Peru); apuhy, a. grande, apuí, caimbé, c. rana, cibueiro, gummileira (Braz.).

*Ficus*, with several hundred named species of small to very large trees and shrubs, many of them epiphytic, at least in youth, is distributed over the warmer regions of the world, being most abundant in the East Indies and Africa. The best known plants are the common cultivated fig, *F. carica* L., and the Rubber plant of the florists, *F. elastica* Roxb., native of India and Malaysia. The latter species is a gigantic evergreen tree in its native habitat and its latex is the source of the India rubber of commerce. The famous Banyan, *F. bengalensis* L., with its numerous prop roots, may spread over an acre of ground. The Peepul or Pipol tree, *F. religiosa* L., another East Indian tree, is planted in villages and held sacred by the Hindus and Buddhists. The Sycamore of Biblical literature, whose wood was used by the ancient Egyptians for mummy cases, is *Ficus Sycomorus* L., not to be confused with the English Sycamore, which is a kind of Maple (*Acer*), or the Ameri-



can Sycamore (*Platanus*), which is closely related to the English Plane-tree.

According to Standley (*Contr. U. S. Nat. Herb.* 20: 1: 1, 1917), there are 33 species of *Ficus* in the West Indies, about 50 in South America, and 41 in Mexico and Central America. "It is a remarkable fact that only two of these are common to the West Indies and Central America, and one of them is doubtfully indigenous to the latter region." *Ficus* is a genus that lends itself readily to the making of herbarium species. Standley says (*loc. cit.* p. 2): "While many of our [Mexican and Central American] species are constant in their characters, some are so variable that two collections may seem to represent quite distinct species until intermediate specimens are examined. Some characters which have been used to separate species are now found to be unreliable. Consequently, it is not improbable that certain species here recognized will have to be reduced when still more ample collections are obtained."

Some of the Fig trees develop normally and attain a height of 150 feet with a long trunk four to five feet in diameter above the buttresses and free of branches for 60 feet. Many others begin their growth in the tops of other trees and develop vine-like aerial roots which anastomose and grow around the host tree and eventually kill it, though a palm may survive for years with its trunk encased within a Strangler Fig or Matopalo, as they are commonly called. A Strangler Fig tree may finally assume the appearance of an ordinary tree, but during the course of its development it presents many fantastic or hideous forms.

In pre-conquest times the Aztecs of Mexico made extensive use of the bark of Fig trees for the preparation of paper for their records and correspondence. Large trunks are sometimes used for making dug-out canoes, but they are not very lasting. At present, the trees are considered as weeds in the tropical American forest, as their wood is likely to rot or at least discolor before it can be dried. In localities where timber is scarce it is sometimes used for making boxes and for light interior construction.

The woods of *Ficus* are light-colored and of fairly uniform structure, being composed of alternating bands of wood

fibers and soft parenchyma, the comparative thickness of each varying considerably in different species and specimens. This laminated structure is especially distinct if the soft layers have turned dark brown, as is so frequently the case with museum specimens. Heartwood not clearly differentiated. Luster low to medium. Odorless and tasteless. Light and soft to moderately hard and heavy, tough and strong for their weight; texture coarse to medium; grain variable; easy to work, finishes smoothly, holds nails firmly. Not likely to become of commercial importance, though suitable for many common purposes if lumber is kiln-dried before deteriorating.

Growth rings indistinct or absent. Pores variable in size, usually barely visible; few to rather numerous; solitary or in small multiples, irregularly distributed without pattern. Uniseriate rays commonly few to very few, with some procumbent cells; multiseriate rays up to 8, commonly not over 5, cells wide and up to 120, generally less than 50, cells high, somewhat heterogeneous in part; pits to vessels medium-sized and oval to large and irregular, sometimes vertically elongated and in scalariform arrangement. Wood parenchyma abundant, distinct to conspicuous; typically in regular metatracheal concentric bands about one pore-width thick and two to three pore-widths apart but occasionally considerably wider or narrower; strands not in contact with vessels 4-8-celled. Wood fibers with moderately thick walls and very small simple or indistinctly bordered pits. Ripple marks not observed in American woods, but they may be expected as they occur in a few species of the Far East.

COMMON NAMES: Fig, fig tree, wild fig (Eng.); higo, higón, higuieron, jagüecillo, jagüey, j. de lavar, j. de peladero, j. hembra, j. macho, pinipini (Cuba); hamo, hijo (Dom.R.); figuier, f. blanc, f. canelle, f. rouge (Haiti); álamo, amacostic, amacuahuatl, amate, a. amarillo, a. blanco, a. prieto, amatillo, amatl, amazquitl, amezquite, anabá, cabra-higo, camachín, capulín grande, chalote, chamachina, coamichín, comuchín, coobó, copó, copoy, cozahuique, higo loxe chico, h. l. grande, higuieron, higuito, hoeiamatl, itzmatl, jalamate, kopó, macahuite, matapalo, m. liso, nacapuli, ojite, palo chilamate, p. María, p. de coco, sabali, salate, s. bronco, samatito, tepeamate, tepeamatl, tescalama, tescalamate, texcalamate, texcalamatl, tlilamatl, xalama, zalate (Mex.); amate, copulamate, capulín amate, matapalo (Guat.); higo, higuero, higuillo (Hond.); betsúr, chilamate, detsí, gu-tsa, higuieron, h. colorado, higuito, káua-krá, keba-krá, krop, palo de agua, p.



de sal, psii-krá, sigín, sotacaballo (C.R.); higo, higuérón, igo, matapalo, nispero blanco (Pan.); copé, copei, c. de tierra fria, guaimarito, higuérón, h. blanco, h. negro, jagüey, matapalo, nisperillo, pibijai, pivijay (Col.); apamate, araguato, chopo, chuare blanco, higo, higuérón, higuero, higuero, jagüey, matopalo, murciaguero, sío (Venez.); dukalaballi, kumakaballi (Br.G.); doekoelia, doukaliebalie (Sur); figuier grand bois (Fr.G.); labiata, matapalo, m. blanco (Ec.); capinúri, consájo, coucho renaco, huitoc, ojé, renáco, renaquillo (Peru); apuhy, cachinguba, camelleira, caxinguba, coajinguba, cuaxinguba, gamelleira, guaxinguba, lombrigueira, mata-pau, uapuí, uapuim-assú (Braz.); figueira, higuérón, yatitá (Par.); agarro-palo, guajinguba, guapohy, guapoy, higuera blanca, h. del agua, h. morada, higuérón, h. bravo, ibapohy, ibapoy, i. caá-gui, i. morotí, i. say, ivapor (Arg.).

*Helianthostylis*, with two closely related species of small, unarmed laticiferous trees, is apparently confined to non-inundated land in the central Amazon region of Brazil. They are dioecious through reduction, the pollen-bearing staminate flowers being in heads with long-styled rudimentary pistils, whereas the fertile pistil is surrounded by staminate flowers without pollen. The twigs are slender and slightly zigzag; the smooth, leathery, entire leaves are 3 to 8 inches long, abruptly acuminate, the anastomosing veins depressed above and very prominent beneath; the yellowish green fruits are about the size of an ordinary marble. The timber is not utilized.

*Helianthostylis paraensis* Ducke (= *Androstylanthus paraensis* Ducke) was discovered in the forest along the Rio Tapajoz (see *Archiv. Inst. Biol. Vegetal* 2: 1: 30. 1935). It was first (1922) made the type of a new genus (*Androstylanthus* Ducke) and subsequently (1925) identified with *H. Sprucei* Baill., a similar tree of infrequent occurrence along the Rio Negro and near Manáos. The only wood sample available for study is of the latter species collected with fertile herbarium material near Manáos by Adolpho Ducke (Yale 23642; Ducke 180).

Heartwood absent or not distinguishable from the yellowish white sapwood. Luster rather high. Odorless and tasteless. Hard, heavy, tough, and strong; texture fine and uniform;

grain straight; not difficult to work, finishing very smoothly. Of no commercial importance.

Growth rings distinct because of denser fiber bands at intervals suggesting seasonal growths. Pores not distinct without lens, rather few; solitary or in short multiples, evenly distributed. Thin-walled tyloses present. Rays uniseriate and biseriate and up to 25 cells high; decidedly heterogeneous; pits to vessels frequently elongated radially and in scalariform arrangement. Wood parenchyma abundant, barely visible without lens, *Brosimum* type, long and narrowly aliform and confluent into narrow wavy, tangential bands. Wood fibers mostly moderately thick-walled, with concentric bands or arcs of variable width composed of fibers with thick, gelatinous walls; pits very small, simple or indistinctly bordered.

*Helicostylis*, with eight species of unarmed, laticiferous medium-sized to large, sometimes deciduous trees, is distributed from the Amazon region of Brazil through northern South America to Costa Rica. It is similar to *Perebea*, but the long and slender stigmas are somewhat contorted. The timber is rarely utilized.

The most northern species is *Helicostylis urophylla* Standl. of Costa Rica; it apparently is the only small tree in the group, and Standley states (*Flora of Costa Rica*, p. 389) that "it is possible that perfect material will show that this plant is better referable to the genus *Olmedia*." Two species described from Panama are *H. latifolia* Pitt., a tree 60 to 80 feet tall and 12 to 16 inches in diameter, growing in the hill forests of Canal Zone and southern Darién, and *H. montana* Pitt., a deciduous tree 80 to 100 feet high and 36 to 40 inches in diameter, in the mountains of San Felix Valley. *H. bolivarensis* Pitt. of Colombia appears to be misplaced generically, and Pittier stated in 1921 (see *Timbers of Tropical America*, p. 127, footnote) that "it is more likely to be a *Pseudolmedia*." A year later the same type specimen (H. M. Curran 304) was described by S. F. Blake as *Brosimum columbianum* (*Proc. Biol. Soc. Wash.* 35: 179).

In the Amazon basin there are five named species, all described as medium-sized trees. *Helicostylis asperifolia* Ducke is distinguished by the roughness on both sides of its leaves, which feel like a fine grade of sandpaper (for description of the tree and wood, see *Tropical Woods* 31: 11, 23). The most widely distributed species is *H. tomentosa* (P. & E.) Rusby



de sal, psií-krá, sigín, sotacaballo (C.R.); higo, higuérón, igo, matapalo, nispero blanco (Pan.); copé, copei, c. de tierra fria, guaimarito, higuérón, h. blanco, h. negro, jagüey, matapalo, nisperillo, pibijai, pivijay (Col.); apamate, araguato, chopo, chuare blanco, higo, higuérón, higuero, higueto, jagüey, matopalo, murcielaguero, sío (Venez.); dukalaballi, kumakaballi (Br.G.); doekoelia, doukaliebalie (Sur); figuier grand bois (Fr.G.); labiata, matapalo, m. blanco (Ec.); capinúri, consájo, coucho renaco, huitoc, ojé, renáco, renaquillo (Peru); apuhy, cacinguba, camelleira, caxinguba, coajinguba, cuaxinguba, gamelleira, guaxinguba, lombrigueira, mata-pau, uapuí, uapuim-assú (Braz.); figueira, higuérón, yatitá (Par.); agarro-palo, guajinguba, guapohy, guapoy, higuera blanca, h. del agua, h. morada, higuérón, h. bravo, ibapohy, ibapoy, i. caá-gui, i. morotí, i. say, ivapor (Arg.).

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Heartwood absent or not distinguishable from the yellowish white sapwood. Luster rather high. Odorless and tasteless. Hard, heavy, tough, and strong; texture fine and uniform;

grain straight; not difficult to work, finishing very smoothly. Of no commercial importance.

Growth rings distinct because of denser fiber bands at intervals suggesting seasonal growths. Pores not distinct without lens, rather few; solitary or in short multiples, evenly distributed. Thin-walled tyloses present. Rays uniseriate and biseriate and up to 25 cells high; decidedly heterogeneous; pits to vessels frequently elongated radially and in scalariform arrangement. Wood parenchyma abundant, barely visible without lens, *Brosimum* type, long and narrowly aliform and confluent into narrow wavy, tangential bands. Wood fibers mostly moderately thick-walled, with concentric bands or arcs of variable width composed of fibers with thick, gelatinous walls; pits very small, simple or indistinctly bordered.

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(=*Olmedia tomentosa* P. & E. = *H. Poeppigiana* Tréc.), which occurs from Bahia, Brazil, through the Amazon region to northeastern Peru and the Guianas. The heartwood is so slow developing that trunks several inches in diameter may be all sapwood. Such timber, being perishable in contact with the soil, is not very serviceable in the moist tropics, though it could be used for the same purposes as Hickory (*Carya*) in the United States.

In the Yale collections there are eight authentic samples of three species; namely, *Helicostylis asperifolia* (one, from type tree), *H. latifolia* (three, one from type tree), and *H. tomentosa* (four). Heartwood dark brown, somewhat streaked or variegated with black and yellow; sharply demarcated from the sapwood, which is nearly white when fresh, later becoming golden. Luster medium in heartwood, high in sapwood. Very hard, heavy, tough, and strong; texture medium; grain straight to roey; not very difficult to work, taking a high natural polish; heartwood appears highly durable.

Growth rings generally indistinct. Pores visible, fairly numerous, well distributed; mostly solitary, occasionally in small multiples. Tyloses thin-walled or sclerotic. Uniseriate rays abundant; others up to 5 cells wide and up to 80, mostly less than 30, cells high; decidedly heterogeneous, the margins of upright or square cells 2 to 10 cells high; latex tubes present; crystals abundant in *H. latifolia*; pits to vessels oval to elongated. Wood parenchyma abundant, distinct; in *H. asperifolia* and *H. tomentosa* vasicentric, short aliform, and sparingly confluent, occasionally in concentric lines independent of pores; in *H. latifolia* long aliform and confluent into very narrow, irregular, wavy bands suggesting *Brosimum*; commonly sclerotic in or near heartwood; crystals sometimes present. Wood fibers septate in part; walls thick; pits very small, simple or indistinctly bordered.

COMMON NAMES: Bi, birsk, feguó, kabá-krá, ojoche (C.R.); berbá, choybá, querendo (Pan.); sukune (Br.G.); basri, letri, b. pauletoe, berekoro, boelikoro, kapitin hoedoe, man letter, moejepau lattoé, oenbatapo, ombatapo, paida, pauletoe, aledin, perokoti, poevinga, sokoné fieroberoe, s. koereroe, sabana letri, toekoesie paida, tokolo apolikiri, tokora apolinore, wamiriaballi (Sur.); aimpem, inaré, jaboty, muiratinga (Braz.).

*Maclura* (or *Toxylon*), with a single species, *M. pomifera* (Raf.) Schneider (= *M. aurantiaca* Nutt. = *Toxylon pomi-*

*ferum* Raf.), is a thorny, bushy, laticiferous tree of very limited natural distribution centering in the valley of the Red River in Oklahoma, but widely planted elsewhere in the United States, especially in the prairie regions, for hedge fences. It is commonly known as Osage Orange or Bowdark, the latter a corruption of Bois d'Arc which refers to the use of the woods by the Indians for making bows. Owing to its strength and low shrinkage its principal use in manufacture has been for the rims of wagon wheels, particularly those for service in dry, sandy countries. Other special uses are spokes, insulator pins, tree-nails, and to a minor extent as a dyewood. It is considered the most durable of all North American timbers and, inasmuch as the sapwood is very thin, even small-sized stems will give long service as stakes and posts.

Heartwood golden yellow, sometimes with reddish streaks, when fresh, becoming russet brown upon exposure; sharply demarcated from the thin white sapwood. Luster high. Odor and taste absent or not distinctive. Very hard, heavy, tough, strong, and resilient; sp. gr. (air-dry) 0.85 to 0.90; weight 53 to 56 lbs. per cu. ft.; rather difficult to work, finishes very smoothly, holds its place remarkably well when manufactured, being comparatively inert to changes in atmospheric humidity. Tests by the U. S. Forest Service give the following results (U.S. Dept. Agr. Misc. Pub. No. 46, pp. 8-9): *Weight per cu. ft.*; green, 62 lbs., air-dry, 56 lbs., kiln-dry, 54 lbs. *Shrinkage* (in volume from green to oven-dry condition), 8.9 per cent, or only slightly more than Sugar Pine (*Pinus Lambertiana*) (8.4 per cent). Relative strength compared to White Oak (*Quercus alba* L.): *Bending*, 1.58; *crushing*, endwise 1.65, crosswise, 3.11; *stiffness*, 1.01; *hardness*, 1.94; *shock resistance*, 2.85.

Ring-porous, larger pores in a loose to compact, narrow band in early wood; pores in late wood small to minute, in clusters which tend to diagonal or concentric arrangement toward periphery of growth ring. Vessels completely filled with small, thin-walled tyloses in heartwood and inner sapwood; small vessels with distinct spiral thickenings. Rays 1 to 6, occasionally to 8, cells wide and up to 100, generally less than 50, cells high; more or less heterogeneous; pits to vessels medium to rather large, oval to lenticular. Wood parenchyma fairly abundant in association with pores and pore groups, tending to be confluent; often not readily distinguishable from small pores with lens. Wood fibers with thick walls and very small simple or indistinctly bordered



pits. Wood anatomy remarkably similar to that of Black Locust (*Robinia*) but lacks the vested vascular pits of that species.

COMMON NAMES: Bodark, bodock, bois d'arc, bow-wood, hedge, mock orange, Osage, O. orange, O. apple tree, yellow wood (U.S.A.).

*Morus*, with several species of small to rather large, unarmed, laticiferous, typically deciduous trees and shrubs, is widely distributed in the temperate regions of the northern hemisphere and sparingly in the tropics. The fruit, known in English as the Mulberry and in Spanish as Mora, is edible and is composed of numerous, small, juicy, 1-seeded drupes. The leaves are the principal food of silkworms. The lumber is of good quality and durable, but is not extensively utilized because of the scarcity and small size of the available timber. The smaller sizes are suitable for fence-posts, railway cross-ties, larger logs for furniture and cabinet work.

The most widely known species are the Black Mulberry, *Morus nigra* L., native to Persia, and the White Mulberry, *M. alba* L., of China. Both are widely planted for shade and fruit trees. There are four American species. The Red Mulberry, *M. rubra* L., occurs throughout most of the eastern United States and southern Ontario, attaining its best development in the lower Ohio River valley and the foothills of the southern Appalachian Mountains. Though usually rather small, it sometimes attains a height of 60 to 70 feet, with a dense crown and a short trunk having a maximum diameter of four feet.

The Mexican Mulberry, *Morus microphylla* Buckl., is a small tree, 15 to 25 feet high and 10 to 15 inches in diameter, or sometimes shrubby, in western Oklahoma and Texas, southern New Mexico and Arizona, and northern Mexico. The wood is used to a limited extent by Mexican carpenters and formerly by the Indians in Texas for making bows. The species may be only a form of *M. celtidifolia* H.B.K. (= *M. mexicana* Benth. = *M. mollis* Rusby), a tree rarely 30 feet high, occurring in the uplands from Mexico through Central America and Colombia to Ecuador and Peru. The timber is said to be valued in Ecuador for building purposes.

The following description is based upon samples of *Morus rubra* and *M. microphylla* obtained in the United States. Heartwood orange-yellow, becoming russet to dark brown upon exposure; sharply demarcated from the thin, white or yellowish sapwood. Luster medium to rather high. Without distinctive odor or taste, at least when dry. Moderately light to rather heavy; sp. gr. (air-dry) 0.60 to 0.75; weight 37 to 47 lbs. per cu. ft.; of medium to coarse texture; straight-grained; easy to work, taking a high polish, holds its place well when manufactured; is very resistant to decay. Of no commercial possibilities.

Ring-porous, the larger pores in narrow to rather wide band in early wood, the individual pores scarcely distinct without lens; pores in late wood small to minute, in clusters scattered or, in outer part of growth ring, appearing in diagonal or tangential arrangement because of parenchyma joining them. Vessels filled with thin-walled tyloses in heartwood and inner sapwood; small vessels with spiral thickenings. Rays 1 to 7, usually not over 5, cells wide and up to 100, generally less than 50, cells high; more or less heterogeneous; crystals common to abundant; pits to vessels medium to large, oval to lenticular. Wood parenchyma abundant; vasicentric and, especially in outer part of wide growth rings, confluent into short diagonal or wavy tangential bands. Wood fibers with thin to moderately thick walls and very small simple or indistinctly bordered pits.

COMMON NAMES: Mulberry (black, red, Mexican), m. tree, murier sauvage (U.S.A.); hamdek-kiup, mora (fruit), moral, tzitsi, yaga-biyozaa (Mex.); brasil (C.R.); mora (Ec., Peru).

*Naucleopsis*, with a single arborescent species, *N. macrophylla* Miq. (= *Ogcodeia venosa* Ducke), is a small or rarely medium-sized, unarmed tree in the understory of the forest on non-inundated land in the central Amazon region. The bark contains a green watery juice that is very bitter, and on that account the tree is called Quina. The thick, smooth, leathery, entire leaves are frequently more than a foot long and three inches wide. The timber apparently is not utilized.

The only wood specimen available was collected with fertile herbarium material near Manáos, Brazil, by Adolpho Ducke (Yale 31959; Ducke 232). Heartwood (?) light yellowish brown; not clearly differentiated from the nearly white sapwood. Luster medium. Odorless and tasteless. Of medium



density, but firm and strong; texture rather fine; grain straight; easy to work, saws somewhat woolly, but can be finished smoothly; probably not resistant to decay. Presumably of no commercial possibilities as the sample is not attractive in appearance and the trees seem to be scarce.

Growth rings present but indistinct. Pores medium to small, rather numerous; solitary or in short multiples, evenly distributed. Tyloses abundant. Rays nearly all 3 or 4 cells wide and between 50 and 150 cells high; weakly heterogeneous; pits to vessels medium-sized to large, oval to much elongated; latex tubes present. Wood parenchyma not very abundant, indistinct without lens, mostly unilaterally paratracheal and sometimes narrowly aliform, and occasionally finely terminal. Wood fibers septate; walls medium to very thick and gelatinous; pits very small, simple or indistinctly bordered. Wood shows affinity to *Noyera* and *Ogcodeia*.

*Noyera*, with two or three species of unarmed shrubs or small to medium-sized trees, occurs in the Guianas and Brazil. The best known is *N. mollis* (Poepp.) Ducke (= *Olmedia mollis* Poepp. = *Perebea mollis* [Poepp.] Hub. = *P. Le Cointei* Hub. = *P. paraensis* Hub.), a tree usually small but sometimes 65 feet high, fairly common in the second-growth forests of the middle and upper Amazon region. The rather large, leathery, distinctly pinnately-veined leaves are rough on the upper surface and typically covered with velvety brown pubescence below. The bark contains an abundance of grayish yellow latex. The timber is not utilized.

Heartwood absent or not distinguishable from the yellowish or brownish sapwood. Luster medium. Odorless and tasteless. Hard, heavy, tough, and strong; texture medium; grain straight; not difficult to work, finishing smoothly; is not resistant to decay. Has no commercial possibilities.

Growth rings distinct to indistinct. Pores medium-sized to large, visible, not very numerous; solitary or in short radial multiples, evenly distributed. Uniseriate rays few, others mostly 3 to 6 cells wide and variable in height up to about 100 cells, with 1 or 2 marginal rows of square or upright cells; crystals common; latex tubes present; pits to vessels oval to large and elongated. Wood parenchyma abundant, but not distinct without lens; short to long aliform and confluent into narrow tangential or occasionally concentric bands. Wood fibers septate; walls medium to very thick and gelatinous; pits very small, simple or indistinctly bordered.

COMMON NAMES: Caucho-rana, leche-caspi (Peru); caucho-

rana, iawara-po, muiratinga da terra firme, pama-caruara (Braz.).

*Ogcodeia*, with a dozen species of unarmed, laticiferous, small or occasionally medium-sized trees is distributed from Nicaragua to Bolivia, most of them occurring in the Amazon basin. There is no information about the uses, if any, of the timber.

The most northern species is *Ogcodeia naga* (Pitt.) Mildbr. (= *Naucleopsis naga* Pittier) of Costa Rica, Nicaragua, and Honduras. According to Standley (*Flora of Costa Rica* 1: 390), it is a forest tree 25 to 35 feet high. "The milky sap that exudes when the trunk is tapped has the appearance of cow's milk, and is reported to have a similar flavor." The three southernmost forms are *O. acreana* Mildbr., *O. pseudo-naga* Mildbr., and *O. Sandwithiana* Mildbr. (= *Duguetia ? glabra* Britt.) of Bolivia and adjacent region of Brazil. *O. guianensis* Mildbr. attains a height of 50 feet along the Cuyuni River in British Guiana; its latex is creamy white and very sticky. The species found in eastern Peru are: *O. tamamuri* Macbr., local name Tamamúri; *O. ternstroemiiflora* Mildbr., 15 feet high and 8 inches in diameter, called Laná or Saná; *O. Tessmannii* Mildbr., 25 feet high; and *O. Ulei* (Warb.) Macbr. (= *Acanthosphaera Ulei* Warb. = *Naucleopsis Ulei* [Warb.] Ducke), a small to tall tree extending into Brazilian territory and bearing sweet, edible fruits. Other Amazonian species are *O. caloneura* (Hub.) Macbr. (= *Olmedia caloneura* Hub. = *Naucleopsis caloneura* [Hub.] Ducke), sometimes called Muiratinga; *O. glabra* (Spruce) Mildbr. (= *Naucleopsis glabra* Spruce); and *O. amara* Ducke (= *Naucleopsis amara* Ducke), specific name referring to the very bitter latex which is used in local medicine as a febrifuge. This last species is called Quina, the usual designation for *Quassia amara* L., and Bál-samo, the name in northeastern Brazil for *Myroxylon*.

The following description is based on one wood sample each of six species. Heartwood (?) pale brown; not clearly differentiated from the lighter colored sapwood. Luster medium to rather high. Odorless and tasteless. Moderately hard and heavy; texture medium; grain straight; readily



worked, finishing smoothly; presumably not durable in contact with the ground. Of no commercial possibilities, apparently.

Growth rings absent or indistinct. Pores small to medium-sized, rather numerous; solitary or in short radial multiples. Tyloses thin-walled. Rays variable in size in different species; mostly uniseriate or biseriate in *Ogcodeia tamamuri*, 1 to 4, occasionally up to 6, cells wide in the others, with much irregularity in height, maximum about 80 cells; distinctly heterogeneous, except *O. ternstroemiiiflora* where they are nearly homogeneous; crystals common; latex tubes present (none seen in *O. tamamuri*); pits to vessels oval to large and elongated. Wood parenchyma not distinct without lens; vasicentric or often unilaterally paratracheal and short aliform, sometimes locally confluent, but not forming definite bands. Wood fibers septate; walls medium to very thick and gelatinous, the latter condition most pronounced in *O. tamamuri*; pits very small, simple or indistinctly bordered.

COMMON NAMES: Concha de Indio, majagua de Indio (Hond.); naga (C.R.); laná, naccho-huasca, saná, tamamuri (Peru); balsamo, muiratinga, m. da terra firme, quina (Braz.).

*Olmedia*, with a few species of small to very large, unarmed, laticiferous trees, has its center of distribution in the Amazon basin, with extensions southward into Bolivia and northward into Central America. The timber is not utilized.

*Olmedia aspera* R. & P. is a small to medium-sized tree occurring in Ecuador, Bolivia, eastern Peru, and the Brazilian Amazon country to Pará. It is well marked by its rather large, remotely and obscurely toothed, very scabrous leaves which feel like coarse sandpaper. By soaking and beating the inner bark the Indians make serviceable mats or blankets. The laminated wood resembles that of *Ficus*.

*Olmedia maxima* Ducke is one of the tallest trees on the periodically overflowed lands in the middle Amazon region, attaining a height of 130 feet or more, and attracting attention because of its dense, dark green foliage and its slender white or red-spotted trunk. Further eastward it becomes smaller and less conspicuous in the forest. It is the true Muiratinga, a Tupi Indian name meaning white wood. The copious grayish yellow latex is used in native medicine. The light, coarse-textured wood is not laminated.

The following description is based on specimens of *Olmedia*

*aspera*, *O. calophylla*, *O. maxima*, and *O. towarensis*. Heartwood absent or not distinguishable from the yellowish white sapwood. Luster medium. Odorless and tasteless. Rather light in weight, but firm and tough; texture coarse; grain straight; easy to work, finishing smoothly; perishable in contact with the soil. Of no commercial possibilities.

Growth rings absent or poorly defined. Pores near limit of vision, numerous; solitary or in small multiples. Tyloses thin-walled. Uniseriate rays few to rather numerous, with some procumbent cells; others up to 6 cells wide and greatly variable in height up to 80 cells, with 1 or 2, occasionally up to 6, marginal rows of square or upright cells; latex tubes present; pits to vessels often large and elongated. Wood parenchyma in *Olmedia aspera* very abundant, distinct, mostly in fairly uniform, coarse, concentric bands generally spaced from 3 to 5 pore-widths apart, the strands in contact with vessels 2-4-celled; in other species abundant but hardly distinct without lens, being vasicentric and vasicentric-confluent locally and diagonally, but not forming concentric bands. Wood fibers septate in part; walls medium thick; pits very small, simple or indistinctly bordered; trabeculae observed in *O. maxima*.

COMMON NAMES: Llanchama, minchi-pata (Peru); janitá, muiratinga (Braz.).

*Olmedioperebea sclerophylla* Ducke, the only species of the genus, is an unarmed tree 80 to 115 feet tall, growing on non-flooded land in the middle Amazon region of Brazil, where it shares the name Muiratinga with other white-wooded Moraceous trees. The leaves are 8 to 12 inches and 4 to 6 inches wide and very hard. The fruits have a strong musk-like scent. The bark contains a yellowish gray latex. The timber is not utilized.

Heartwood absent or not clearly differentiated from the yellowish white sapwood. Fairly lustrous. Odorless and tasteless. Rather hard and heavy, tough and strong; texture coarse; grain straight; not difficult to work, finishing smoothly; is not resistant to decay. Of no commercial possibilities.

Growth rings absent or sometimes indicated by band of parenchyma. Pores visible, rather numerous, evenly distributed; solitary or in small multiples. Rays 1 to 8, mostly 4 to 8, cells wide and ranging in height to 120 or more; definitely heterogeneous in part; latex tubes present; pits to vessels oval to much elongated. Wood parenchyma moderately abundant, not distinct without lens; narrowly vasicentric, blunt-aliform, and more or less vasicentric confluent, but only occasionally forming concentric bands. Wood fibers



septate; walls of medium thickness; pits very small, simple or indistinctly bordered.

*Perebea*, with about 15 described but mostly poorly known species of small to medium-sized, unarmed, laticiferous trees, occurs throughout the Amazon basin and northward to Costa Rica. Some of the plants bear considerable resemblance to *Castilla*. So far as known, the members of this genus supply no economic products and their timber is not utilized.

The wood material available for this study consists of authentic samples of five species, namely, *Perebea chimiqua* Macbr. of northeastern Peru (type); *P. laevigata* Standl. from Panama (type); *P. concinna* Standl. and *P. Tessmannii* Mildbr. from Brazil; and *P. castilloides* Pitt. from Panama (Yale 12142; Cooper 523). The last was originally determined as *Castilla panamensis* Cook, an error discovered in studying the wood (which is also unlike that of the other specimens of *Perebea*), thus adding strength to Pittier's expression of doubt (*Contr. U. S. Nat. Herb.* 13: 12: 438) whether it really belongs to *Perebea*. Pittier includes *P. calophylla* (P. & E.) B. & H. (= *Olmedia calophylla* P. & E.) in the list of species, but from the single wood specimen (Yale 23650; Ducke 188) it appears to be neither *Perebea* nor *Olmedia*.

Heartwood absent or indistinguishable from the yellowish white sapwood, which may acquire a pinkish tinge. Luster rather high, golden. Odorless and tasteless. Moderately hard, heavy, tough and strong; sp. gr. (air-dry) about 0.70; weight 44 lbs. per cu. ft.; texture coarse, feel harsh; grain straight; easy to split, saws rather woolly when fresh, takes a smooth finish; is not resistant to decay. Of no commercial possibilities.

Growth rings indistinct. Pores barely visible, rather numerous; solitary or in short radial multiples, well distributed. Rays 1 to 6, mostly 3 or 4, cells wide (1-3 cells wide in *Perebea Tessmannii*) and usually less than 50, sometimes over 100, cells high; definitely heterogeneous in part; pits to vessels medium-sized to large, oval to much elongated. Wood parenchyma in *P. castilloides* abundant, distinct, short aliform, or more often confluent into diagonal, tangential, or concentric bands, few to several cells wide, often irregularly anastomosed; in the others less abundant but usually visible, vasicentric, short aliform and occasionally confluent into short bands. Wood fibers septate (except in *P. castilloides*); walls thin to medium; pits very small, simple or indistinctly bordered.

In *P. calophylla*: Heartwood distinct, brown with black stripes, exceedingly dense, and containing sclerotic tyloses. Rays 1 to 5 cells wide, commonly less than 30 cells high, heterogeneous, all cells and particularly the square and upright ones sclerotic in or near the heartwood; latex tubes present. Wood parenchyma not very abundant, vasicentric and short aliform, the cells sclerotic in heartwood and inner sapwood.

COMMON NAMES: Caucho, ule, wild rubber (Pan.); kapiteinhout, zonderhart (Sur.); aberemou, vive éperou (Fr.G.); chimiqua, siparuna (Peru); caucho rana, muiratinga (Braz.).

*Piratinera*, best known as the source of Letterwood or Snakewood, includes several closely related species of medium-sized to large, unarmed, laticiferous trees, distributed throughout the Amazon region and northern South America, with one species (*B. panamensis* Pitt.) reaching southern Mexico. It was formerly customary to consider *Piratinera* Aublet (1775) synonymous with *Brosimum* Swartz (1788), and the latter name was made a *nomen conservandum* by the International Botanical Congress at Vienna in 1905. In 1918, however, Pittier (*Contr. U. S. Nat. Herb.* 20: 3: 96-100) presented evidence to show that the two genera are distinct. His conclusions were accepted, at least tentatively, by Blake who says (*Four. Wash. Acad. of Sci.* 12: 17: 393) that "the floral characters brought forward by Pittier are sufficient to justify the separation of the two genera," and by Standley who believes (*Tropical Woods* 17: 9) that "until ampler herbarium material is available for study, it seems best to recognize *Piratinera* as a valid genus." The opinion reached from a study of the woods is that the differences between *Brosimum* and *Piratinera* are fully as pronounced (or no less obscure) than those separating some of the other genera in this family. So far as known, all species of *Piratinera* have dense woods and develop a considerable amount of heartwood which is a rather dull reddish brown with vertical or radial markings of black pigment, whereas in *Brosimum* (*sens. str.*) such specimens of heartwood as have been studied are remarkable for their rich coloration and silky, golden luster. From the point of view of their anatomy the two genera might well be merged, but for practical reasons it seems better to treat them as though they were distinct. Letterwood has been an article of export from the Guianas



since the time of their European settlement. Evidence of the early importance of the industry is contained in article 7 of the terms of capitulation of March 6, 1667, by which the British Lieutenant General Byam gave over the Colony of Surinam to the Dutch Admiral Abraham Orijnsen. It is there specified that the English settlers should have the privilege of cutting Letterwood on the river. It is said that much of the original supply came from what was known as "tabukas," or heartwood parts of old fallen trees from which the sapwood had disappeared through the action of insects and decay.

The timber owes its value to the irregular black markings which have a fancied resemblance to hieroglyphs or letters and give to the tangential surface of the heartwood a peculiar appearance which suggests the spotted skin of certain snakes. Figured wood may occur in all species of *Piratinera*, so far as known, but they are not a constant character. They extend radially and vary greatly in size and number not only in different specimens but also in the same piece. In tracing them along a radius it is found that they are much branched and anastomosed so that the figure they produce on the surface is never the same at different depths. The dark areas owe their existence, not to structural differences of any kind, but to variations in the color of the gummy deposits filling all of the cell cavities, the darkest parts being at the margins rather than in the center of the patches. In some trees, without distinction as to species, the heartwood is marked only with vertical black bands and these may develop at intervals in otherwise speckled wood. The Negroes who make a business of cutting the timber in the Guianas cannot tell if a standing tree has figured or plain wood. Those with plain wood are considered false or bastard kinds, but present knowledge indicates that these differences in trees are individual rather than specific or even varietal. The darkening of the cell contents is presumably the result of oxidation, but a satisfactory explanation of its radial distribution cannot now be given. A specimen of Ebony (*Diospyros*) on exhibit in Field Museum of Natural History, Chicago, shows a somewhat similar radial pigmentation.

The principal species supplying commercial Letterwood is

*Piratinera guianensis* Aubl. (= *Brosimum guianensis* [Aubl.] Huber = *B. Aubletii* P. & E. according to Macbride, but not according to Pittier.) It often attains a height of 80 feet, with a long cylindrical bole sometimes over 30 inches in diameter above the root swelling and covered with a smooth bark containing a thick, sticky, white latex. Heartwood is slow in forming and a 15-inch log may have a core of heartwood only 1 to 4 inches thick. Trees vary in this respect and in Surinam certain creeks have a reputation among Letterwood hunters of producing timber with much heartwood, while in other localities equally large trees may not be worth felling.

The timber is exported in the form of small logs or sticks about seven feet long and from two to eight inches in diameter, with all sapwood removed. It is sold by weight and is one of the most expensive woods in the trade. It is very strong, though brittle, and was formerly used by the South American Indians for bows. Its principal use now is for walking sticks, for which purpose it is considered one of the finest of all woods, though it is difficult to bend without buckling and is also likely to split. Other uses are umbrella handles, drum sticks, fishing rod butts, and miscellaneous fancy articles. It is occasionally employed in violin bows, but is not very highly esteemed for this purpose. The larger sticks are sometimes sawed into thin veneers for cabinetwork. Owing to the difficulty of finding a specimen of much size that is finely figured throughout, it is a common practice to stain patches of plain wood to simulate the natural markings. The sapwood, comprising by far the greater bulk of the tree, is left in the forest. It is hard, tough, and strong, and would possibly make good handles for implements and tools.

The following description is based upon numerous authentic and trade samples of *Piratinera guianensis*, five of *P. panamensis* Pitt. (one, Yale 2985, Pittier 4336, from type tree); four of *P. scabridula* Blake (one, Yale 4947, Dem. For. Service 5495, from type tree); two of *P. velutina* Blake (one, Yale 4942, Dem. For. Service 1158, from type tree). Heartwood brown or reddish brown with irregular radial black markings or with black vertical stripes alone or in conjunction with the speckles; distinctness of markings reduced as the color of



background deepens upon exposure; sapwood thick, yellowish white, the line of demarcation often irregular and not very sharp. Luster medium. Odorless and tasteless. Heartwood extremely hard and heavy, strong but brittle; sp. gr. (air-dry) 1.20 to 1.365 (see *Tropical Woods* 6: 6); weight 75 to 84 lbs. per cu. ft.; texture fine and uniform; grain straight; hard to cut, splits readily, is inclined to be splintery, takes a very smooth finish and high natural polish; heartwood very resistant to decay, sapwood perishable. Of limited commercial importance because of the scarcity and small size of suitable timber.

Growth rings absent or poorly defined. Pores small, not distinct without lens, not very numerous; solitary or in small multiples, well distributed. Sclerotic tyloses abundant in heartwood and part of the sapwood. Rays 1 to 3, sometimes mostly 2, cells wide and up to 40, generally less than 20, cells high; definitely heterogeneous; sclerotic cells common; crystals numerous; latex tubes often present; pits to vessels medium and oval to rather large and elongated. Wood parenchyma moderately abundant, not distinct without lens; long, aliform and more or less confluent into very narrow wavy bands; cells often sclerotic; crystals common. Wood fibers with very thick walls and very small, simple or indistinctly bordered pits.

COMMON NAMES: Leopard wood, letterwood, snakewood, speckled wood, tortoiseshell wood (Eng.); bois de lettres (Fr.); Buchstabenholz, Letterholz, Muskatholz, Schlangenholz, Tigerholz (Germ.); letterhout (Dutch); legno serpente, l. tigre (Ital.); cacique carey (Pan.); palo de oro (Venez.); cangica, bourracourra, boutous, burokoro, burracurra, paira, tibicusi, tibikushi (Br. G.); basri letri, belokoro, bepaulétoe, boelekolle, gespikkeld, letterhout, kapeweri letri, koelero, koereroe, kolero, letri, man letri, m. letterhout, moejepaulétoe, paida, poevinga, roode letterhout, sokoné biberoe, tianalin wéwé, tokoro apolli marie, wekere paida (Sur.); bois d'amour-ette, b. de lettre gris, b. de l. moucheté, piratiner, piratinere (Fr.G.); barrueh, gomelleira preta, gateado, gatiá, moirapinima, muirapinima, pau rainha de listras, p. tartarugo (Braz.).

*Poulsenia*, with a single species, *P. armata* (Miq.) Standl. (= *Olmedia armata* Miq. = *P. aculeata* Eggers = *Inopbloecum armatum* Pitt. = *Coussapoa Rekoii* Standl.), is a medium-sized

to large, laticiferous tree, sometimes 100 feet tall with buttressed trunk, occurring from Vera Cruz, Mexico, through Central America and Colombia to Ecuador. It is readily distinguished from all other American members of the family by the numerous prickles investing the large stipules and the twigs. The ripe fruit heads, which are somewhat suggestive of small chirimoyas (*Anona cherimola* Mill.), are edible and are sometimes sold in the markets of Vera Cruz. (See *Tropical Woods* 33: 4-5.) According to J. M. Duque (*Notizbl. Bot. Gart. Berlin-Dablem* 13: 119: 496), the tree attains large dimensions in the virgin forest at an elevation of about 5500 feet along the Rio Cali in Colombia and the timber is preferred for construction because of its reputed resistance to fire.

The inner bark of mature trees is very thick and composed of many layers of strong, interlaced fibers; it has long been used by the aborigines for making hammocks, blankets, mats, and clothing. According to Edward Conzemius (see *Tropical Woods* 33: 32), bark cloth is still made by the Sumu Indians of Honduras and Nicaragua from the Tunu tree, which is believed to be either *P. armata* or *Ogcodeia naga* (Pitt.) Mildbr. The bark is soaked in water for a few days after which the sticky gum or milk adhering to it is scraped off. The bark is then dried in the sun and kept in the hut until the women find time to pound it into cloth. As it becomes hard and shrinks considerably, it has to be submerged in a neighboring stream for a short time before the pounding begins. The latter operation is performed on a small log with the aid of a wooden mallet made from the stems of two species of small palms. The bark extends gradually upon being pounded and becomes soft and flexible. After being washed and dried it is ready for use, and has a brownish color. A similar cloth, almost white in color and of superior quality, is obtained by the same process from the inner bark of a species of *Ficus* and likewise from the Rubber tree (*Castilla*), but in both cases manufacture of the cloth is more laborious.

Heartwood absent or not clearly distinguishable from the yellowish white sapwood, which becomes brownish or oatmeal colored upon exposure. Luster rather high. Odorless and tasteless. Rather light in weight, but firm and tough; texture



coarse; grain straight to irregular; saws woolly when fresh, easy to cut but rather difficult to finish smoothly; is perishable in contact with the ground. Presumably of no commercial possibilities.

Growth rings poorly defined. Pores barely visible, rather numerous; solitary, in pairs, or short multiples, sometimes with tendency to diagonal arrangement. Rays 1 to 6 cells wide and up to 60 cells high; definitely heterogeneous, at least in part; pits to vessels mostly large, oval to elongated. Wood parenchyma rather abundant but not distinct without lens; vasicentric, short aliform, and vasicentric confluent into short diagonal bands. Wood fibers septate in part; walls thin to medium; pits small, with narrow borders.

COMMON NAMES: Ababábite, carnero, chirimoya (Mex.); tumu (Hond., Nic.); cocuá, maragua, mastate, namagua (Pan.); corbón, cucúa (Col.); majagua (Ec.).

*Pourouma*, with numerous species of small, medium-sized, or occasionally large, unarmed trees, is widely distributed in tropical America from British Honduras to Peru and Brazil. The leaves are entire or palmately lobed or divided, the two forms sometimes appearing on the same tree. The pith is large and septate. The egg-shaped fruits are borne in cymes and in some species (e.g., *P. acuminata* Mart., *P. bicolor* Mart., and *P. cecropiaefolia* Mart., known in Brazil as Tararanga) contain a juicy, edible, grape-like pulp. The light and perishable timber apparently has no special uses.

The northernmost species is *Pourouma aspera* Tréc., growing from northern South America to southern British Honduras. In eastern Nicaragua, according to notes supplied by F. C. Englesing (*Tropical Woods* 17: 35), it is a slender tree 85 to 110 feet high, with a cylindrical and somewhat arcuate trunk sometimes 24 inches in diameter, growing on low hills. The bark is smooth and mottled in various shades of brown, mauve, and gray. The stump of a freshly felled tree exudes a quantity of watery sap. Branches are few and ascending, forming a crown suggesting a candelabrum. Clustered at the ends of the twigs are palmately lobed leaves which are so scabrous that they are used by the Indians for sandpaper.

Most of the species are Amazonian. *Pourouma cecropiaefolia* Mart. (= *P. multifida* Tréc.) has large radiately-

parted leaves that are velvety and gray or white beneath, suggesting *Cecropia*, though not peltate as in that genus. In at least one species, *C. myrmecophila* Ducke, the base of the petiole is enlarged and inhabited by very small, but pugnacious ants. A few species are cultivated in eastern Brazil for their fruits, but it is difficult to keep the trees low enough for convenient harvesting.

Heartwood absent or not clearly differentiated from the white sapwood, which becomes brownish. Luster rather high. Odorless and tasteless. Light in weight, but rather firm and tough; texture coarse, feel woolly; grain fairly straight; requires sharp tools for smooth working; poorly resistant to decay. Of no commercial promise.

Growth rings absent or occasionally indicated by parenchyma. Pores readily visible, rather numerous; solitary or in pairs, well distributed. Rays 1 to 4 cells wide, with few uniseriades, and variable in height up to about 70 cells; definitely heterogeneous; crystals common; pits to vessels medium to large, oval to elongated. Wood parenchyma rather abundant but not distinct without lens; vasicentric and short aliform; sometimes also in irregularly spaced, continuous or broken concentric bands apparently demarcating growth rings; crystals common; the cubical cells usually composing only a part of a strand. Wood fibers with thin walls and small, simple or indistinctly bordered pits.

COMMON NAMES: Trumpet (Br.H.); guarumo de montaña (Hond.); guarumo macho, yabal (Nic.); guarumo, g. de montaña (C.R.); mangabe (Pan.); cormi, serpe or sirpe (Col.); buruma (Br.G.); pourouma (Fr.G.); ambauba mansa, amandier, cucúra, mapaty, sacha-uvilla, ubilla or uvilla (Peru); cucúra, imbauba de cheiro, i. de vinho, i. puruma, mapaty, tararanga, t. branca, t. preta, t. vermelha (Braz.).

*Pseudolmedia*, with several species of unarmed, laticiferous shrubs and small to medium-sized or rarely large trees, is distributed as follows: *P. spuria* (Sw.) Gris. (= *Brosimum spurium* Sw. = *P. bavanensis* Tréc. = *Olmedia cubensis* Kl.) grows to a maximum height of about 50 feet in Jamaica, Cuba, Puerto Rico, the island of Haiti, and British Honduras. *P. oxyphyllaria* Donn. Sm., a similar tree, occurs from Vera Cruz, Mexico, to Panama; during the dry season the branches are sometimes used for fodder for oxen. *P. mollis* Standl. has been described for Salvador. *P. Eggersii* Standl. of Ecuador



is said to be "a tall erect tree with white wood used for inside construction" (see *Tropical Woods* 42: 27). The Peruvian species are *P. ferruginea* (P. & E.) Tréc. (= *Olmedia ferruginea* P. & E.), *P. laevigata* Tréc., *P. laevis* (R. & P.) Macbr. (= *Olmedia laevis* R. & P.), *P. macrophylla* Tréc., *P. Mildbraedii* Macbr., *P. scabra* Macbr., and *P. multinervis* Mildbr.; the last is said to reach a height of about 100 feet, with a long clear stem 36 inches in diameter above the root spurs which are about 6 feet high (see *Notizbl. Bot. Gart. Berlin-Dablem* 10: 92; 189-190). *P. alnifolia* Rusby and *P. birtellifolia* Rusby occur in Bolivia, *P. guaranitica* Hassl. in Paraguay, and *P. Sagoti* Benoist in British Guiana. *P. obliqua* (Hub.) Ducke (= *Olmedia obliqua* Hub.) is a shrub or little tree of the lower Amazon region; *P. Krukovii* Standl. is 30 to 65 feet tall in the State of Amazonas and *P. murere* Standl. is a 35-foot tree in the State of Maranhão; an undetermined species has been reported from the environs of Rio de Janeiro.

There are authentic specimens of five named species in the Yale collections, but the following description applies particularly to *Pseudolmedia spuria*. Heartwood reddish brown, not very sharply demarcated from the thick sapwood which becomes grayish or pinkish brown. Luster medium. Odorless and tasteless. Very hard, heavy, tough, and strong; texture medium coarse, feel harsh; grain variable; not very difficult to work, finishes smoothly; reputed to be perishable in contact with the ground as most of the timber is sapwood. Of no commercial possibilities.

Growth rings usually indistinct. Pores small, thick-walled, rather numerous, well distributed; solitary or less often in radial multiples of few to several pores each. Tyloses sclerotic in or near heartwood. Uniseriate rays numerous; others mostly 3 or 4 cells wide and variable in height to 100 cells or over, with 2 to 6 marginal rows of square or upright cells; crystals common to abundant; pits to vessels medium oval to large and elongated. Wood parenchyma abundant; incompletely vasicentric, aliform, and confluent, or more often in irregular and anastomosing to fairly uniform concentric bands, few to several cells wide and 1 to 3 pore-widths apart, giving rise to fine pattern on tangential surface, particularly when bands have become brown; crystals common; cells sometimes sclerotic. Wood fibers small, septate; walls very thick and gelatinous; pits very small, simple or indistinctly bordered.

In *Pseudolmedia oxyphyllaria* (Yale 14901; N. S. Stevenson 119) from British Honduras the rays are composed of much smaller cells, frequently 6 to 8

cells wide, rather weakly heterogeneous, and contain latex tubes. In *P. multinervis* from Peru, and *P. obliqua* (Hub.) Ducke and *P. scabra* Macbr. from Brazil, the wood parenchyma is vasicentric and locally vasicentric-confluent, but not in definite bands, and the fibers are rather large with comparatively thin to moderately thick walls.

COMMON NAMES: Bastard breadnut, milkwood (Jam.); macagua, m. amarilla (Cuba); negra lora (P.R.); macao (Dom.R.); bois mérese, longue barbe, mérisse (Haiti); cherry, manax (Br.H.); tepejuhste (Salv.); ojoche (C.R.); vara piedra (Col.); guión (Éc.); chimicua, itaúba amarilla, loromicunan (Peru); murere (Braz.).

*Sorocea*, with several species of unarmed, laticiferous shrubs and small trees, rarely 50 feet high and 18 inches in diameter, is distributed from Central America to northern Argentina and Uruguay. *S. affinis* Hemsl., a shrub or tree up to 20 feet tall with entire or sinuate leaves and small red fruit in racemes, is known only in Panama. *S. colombiana* Standl., of about the same size, was discovered by H. M. Curran in the Department of Bolívar, Colombia; *S. Hirtella* Mildbr. is a shrub or a tree sometimes 40 feet high and 8 inches in diameter growing in uplands in eastern Peru; *S. Briquetii* Macbr. and *S. opima* Macbr. are shrubs up to 12 feet high in the same general locality. *S. saxicola* Hassl. of Paraguay and Argentina is said to be a handsome tree 50 feet tall and 20 inches in diameter, with large dark green leaves and supplying a dark yellow, tough and strong wood formerly utilized in making wheel hubs. The most widely distributed species is *S. ilicifolia* Miq. (= *S. Klotzschiana* Baill. = *S. castaneifolia* Huber, according to Macbride in *Flora of Peru* 2: 2: 312), which is distinguished by leaves with spine-tipped serrations. It is a shrub or a small tree upward of 40 feet high and 12 inches in diameter, occurring along the Amazon from above the estuary into Peru and southward into Paraguay and northern Argentina. Its elastic wood is used in Argentina for making barrel hoops.

The wood specimens available for study are of five species, namely, *Sorocea Briquetii*, *S. Hirtella*, *S. ilicifolia*, *S. opima* (type), and *S. stenophylla* (type). Heartwood (present only in



sample of *S. stenophylla*) light brown with orange hue, fading gradually into the thin, nearly white sapwood. Luster medium to fairly high. Odorless and tasteless. Moderately hard and heavy; texture medium; grain straight; easy to work, finishing smoothly; durability doubtful. Of no commercial possibilities.

Growth rings absent or indistinct. Pores not visible without lens, rather few to fairly numerous; solitary or in small multiples, well distributed. Tyloses thin-walled. Uniseriate rays few to many, with some procumbent cells; others 2 to 4, sometimes to 6, cells wide and variable in height to 100 cells or over; with 1 or 2, occasionally 3 or 4, marginal rows of square or upright cells and sometimes with sheath cells; crystals common; pits to vessels medium and oval to large and elongated. Wood parenchyma very abundant, composing one-fourth to one-half the ground mass; in fairly regular concentric bands, 2 to 12 cells wide, including the pores or independent of them; giving rise to distinct pattern on tangential surface. Wood fibers with moderately thick walls and very small, simple or indistinctly bordered pits. Structure suggests *Clarisia*.

COMMON NAMES: Vara blanca (Col.); araçary (Braz.); ibirá-hú, María-molle, ñandipá-mí, ñ-rá, soroco (Arg.); cincho (Urug.).

**Trophis**, with a few closely related and doubtfully distinct species of shrubs and small to rather large, unarmed, laticiferous trees, is distributed throughout the West Indies, southern Mexico, Central America, and the Andean region of South America into Peru. The leaves are rather large, entire or toothed, smooth or rough. The staminate flowers are in long catkins, the pistillate (on separate trees) in short, few-flowered spikes or racemes, thus differing from *Chlorophora* which has the pistils in small heads. The fruit is a small drupe with a large seed and scant, edible flesh. The best known, perhaps the only distinct species, is *T. racemosa* (L.) Urb. (= *Bucephalon racemosum* L. = *T. americana* L. = *T. ramon* Schl.). The timber is employed to a limited extent locally, but the chief value is in the green foliage which is widely used as fodder for horses and oxen, hence the general Spanish name Ramón (browse), anglicized to Ramoon.

Heartwood dark brown, with parenchyma markings suggesting Elm (*Ulmus*); sharply demarcated from the thick, lighter-colored sapwood. Fairly lustrous. Odorless and taste-

less. Hard, heavy, tough, and strong; texture medium; grain straight to irregular; not difficult to work, finishes smoothly; heartwood fairly durable.

Growth rings present or absent. Pores not visible without lens, not very numerous, well distributed; solitary or in small multiples or clusters. Tyloses thin-walled. Uniseriate rays numerous, composed entirely of square or upright cells; others 2 to 6, sometimes to 8, cells wide and up to 50 cells high, with 2 to 6, occasionally up to 12, marginal rows of large square or upright cells; crystals common; pits to vessels medium and oval to large and elongated. Wood parenchyma very abundant, distinct; typically in fairly uniform concentric bands, few to several cells wide, composing one-third to one-half of the ground mass; strands not in contact with vessels mostly 4-celled. Wood fibers with moderately thick walls and very small, simple or indistinctly bordered pits.

COMMON NAMES: Ramón (Span., gen.); ramoon (Engl.); ramón de bestias, r. de caballos (Cuba); ramón de bestial (Dom. R.); chacox, confitura, huanchal, leche María, ramón de Castilla, ramoncillo (Mex.); white ramoon (Br.H.); chuljuhste, ojushte, pilijuhste, raspa lengua, ujushte (Salv.); San Ramón (Hond.); cafecillo (Nic.); gallote, lechoso, morillo, ojoche macho (Pan.); gigantón, guáimaro, g. lechoso, pan y cacao (Col.); charo, lechero, marfil (Venez.); cuchara-caspi, sinchi-caspi, urpai-machinga (Peru).

**Trymatococcus**, with four species of small to large, unarmed, laticiferous trees, is limited to the Amazon basin (see *Tropical Woods* 43: 34-35). *T. amazonicus* P. & E. is a shrubby little tree in northeastern Peru and northwestern Brazil. *T. turbinatus* (Baill.) Ducke (= *Lanessania turbinata* Baill.) is a small tree 20 feet high and 12 inches in diameter in Amazonas. *T. paraensis* Ducke is a large tree, sometimes 100 feet tall, with whitish wood; the latex is reported to be good for rheumatism. *T. oligandrus* (Benoist) Lanj. (= *Lanessania oligandra* Benoist) is a large tree in French Guiana and Surinam. Apparently the trees are poorly known and often confused with *Brosimum*. The timber is not utilized.

The available material consists of six authentic samples of *T. amazonicus* and one of *T. turbinatus*. Heartwood absent from specimens; sapwood yellowish. Luster rather high. Odorless and tasteless. Very hard, heavy, tough, and strong;



texture medium; grain straight; durability of heartwood unknown.

Growth rings indistinct. Pores near limit of vision, rather numerous, well distributed; solitary or in small multiples. Tyloses thin-walled. Rays 1 or 2, occasionally 3, cells wide and up to 60, commonly less than 30, cells high; definitely heterogeneous; latex tubes sometimes present; pits to vessels medium and oval to large and elongated. Wood parenchyma moderately abundant, hardly distinct without lens; long and narrowly aliform and locally confluent; frequently in contact with the pores on outer face only. Wood fibers with thick walls and numerous small bordered pits. Structure suggests *Brosimum*.

COMMON NAMES: Beloekoro, joekoeipio, letterhout (Sur.).

## THE YALE WOOD COLLECTIONS

### Accessions

At the end of the calendar year 1939 the total number of catalogued wood samples in the Yale wood collections amounted to 37,860, representing 11,158 named species of 2753 genera of 232 families. There were 1756 accessions during the year. The largest contributions were from Brazil (774) and the Bishop Museum in Honolulu (411). The sources of all the wood samples received are as follows:

*Africa*: Mr. S. B. Detwiler, Washington, D. C. (wood from South Madagascar).

*Argentina*: Sr. José F. Molino, Department of Agriculture, Buenos Aires.

*Australia*: Mr. H. E. Dadswell, Council for Sci. and Ind. Research, South Melbourne; Mr. M. B. Welch, Senior Research Officer, Forestry Commission of New South Wales, Sydney.

*Brazil*: Dr. B. E. Dahlgren, Field Museum of Natural History, Chicago; Dr. Adolpho Ducke, Jardim Botânico, Rio de Janeiro; Mr. B. A. Krukoff, N. Y. Botanical Garden; the J. H. Montearth Company, New York City; Sr. J. A. Pereira, São Paulo.

*Colombia*: Sr. A. Dugand G., Barranquilla; Rev. Hermano Daniel, Medellín.

*Costa Rica*: Mr. C. H. Lankester, Cartago.

*Ecuador*: New York Botanical Garden.

*England*: Forest Products Research Laboratory, Princes Risborough.

*Fiji Islands*: Bernice P. Bishop Museum, Honolulu, T. H.

*Hawaii*: Bernice P. Bishop Museum, Honolulu, T. H.

*British Honduras*: Mr. J. B. Kinloch and Mr. N. S. Stevenson, Belize.

*India*: Dr. P. Maheshwari, Allahabad.

*Mexico*: Prof. M. Martínez, Mexico, D. F.

*New Britain*: Nickey Brothers, Memphis, Tenn.

*New Guinea*: Mr. Alexander L. Howard, London, England.

*Nicaragua*: Mr. H. Bartlett Wells, Managua.

*Peru*: Mr. Feliz Woytkowski, Lima.

*Puerto Rico*: Mr. L. R. Holdridge, Rio Piedras.

*Salvador*: Priete, Whitener & Co., San Francisco, Calif.; Dr. S. Calderón, San Salvador.

*Trinidad*: C. H. Pearson & Son, New York City.

*U. S. A.*: Mr. E. W. Carls, Florence, Arizona; Dr. A. H. Graves, Brooklyn Botanic Garden; Mr. M. Scott, Miami, Fla.; U. S. National Museum, Washington, D. C.

*Venezuela*: Dr. H. Pittier, Caracas.

### Sections for Microscopic Study

During 1939 there were added to the slide collections, cross, radial, and tangential sections of 1247 specimens representing 889 named species, 186 genera, and 14 families, making a total (after allowing for duplications) of 10,013 specimens of 5871 named species, 2440 genera, and 218 families.

Many of these were prepared in the Yale laboratories; others were obtained by purchase, or in exchange, the principal sources during 1939 being Prof. I. W. Bailey, and Prof. R. H. Wetmore, of Harvard University, and Prof. E. S. Harrar, of Duke University.

### Specimens Distributed

There were distributed during the year 567 wood specimens, mostly for use in connection with specific scientific projects now under way or in preparation.

To Dr. I. W. Bailey, Harvard University, 40 samples;



Aextoxicaceae (3), Didiereaceae (1), Euphorbiaceae (9), Pandaceae (1); Sapindaceae (25), Theaceae (1).

To Dr. M. M. Chattaway, Imp. Forestry Institute, Oxford, Eng., 7 samples of *Alangium* (Alangiaceae).

To Mr. H. E. Dadswell, Council for Sci. and Ind. Research, South Melbourne, Australia, 13 samples of Proteaceae.

To Prof. E. S. Harrar, Duke University, 284 samples: Acanthaceae (5), Aceraceae (1), Aextoxicaceae (1), Alangiaceae (2), Amarantaceae (1), Anacardiaceae (8), Anonaceae (5), Apocynaceae (14), Araliaceae (16), Aquifoliaceae (1), Avicenniaceae (1), Betulaceae (1), Bignoniaceae (5), Bombacaceae (2), Boraginaceae (4), Brunelliaceae (1), Burseraceae (5), Canellaceae (1), Cappariaceae (2), Celastraceae (1), Chenopodiaceae (1), Combretaceae (3), Compositae (2), Connaraceae (1), Cupressaceae (1), Dilleniaceae (1), Diterocarpaceae (3), Ebenaceae (2), Elaeocarpaceae (2), Ericaceae (3), Euphorbiaceae (9), Fagaceae (1), Flacourtiaceae (23), Gesneriaceae (1), Guttiferae (5), Humiriaceae (1), Hydrangiaceae (1), Hypericaceae (1), Icacinaceae (1), Juglandaceae (2), Lauraceae (13), Lecythidaceae (3), Leguminosae (50), Loganiaceae (1), Lythraceae (1), Magnoliaceae (1), Malpighiaceae (1), Malvaceae (3), Melastomaceae (1), Meliaceae (6), Monimiaceae (2), Moraceae (6), Myristicaceae (3), Myrsinaceae (2), Myrtaceae (2), Olacaceae (2), Oleaceae (1), Opiliaceae (1), Piperaceae (1), Pittosporaceae (1), Polygonaceae (2), Proteaceae (3), Rhamnaceae (4), Rhizophoraceae (2), Rosaceae (1), Rubiaceae (8), Rutaceae (3), Samydaceae (1), Santalaceae (1), Sapindaceae (4), Sapotaceae (4), Simarubaceae (3), Ulmaceae (2), Verbenaceae (2), Vochysiaceae (1).

To Mr. B. J. Rendle, Forest Products Research Laboratory, Princes Risborough, Bucks, England, 44 samples: Araucariaceae (5), Cupressaceae (6), Pinaceae (23), Podocarpaceae (7), Taxaceae (2), Taxodiaceae (1).

To Mr. Milton Scott, Miami, Florida, 53 samples (in exchange): Anacardiaceae (1), Apocynaceae (3), Compositae (1), Euphorbiaceae (3), Guttiferae (3), Humiriaceae (1), Lecythidaceae (1), Leguminosae (23), Lauraceae (3), Moraceae (3), Myristicaceae (1), Ochnaceae (1), Olacaceae (1), Rubiaceae (3), Sapotaceae (3), Tiliaceae (1).

To Mr. F. Stockmans, Musée d'Histoire Nat. de Belgique, Brussels, 11 samples: Guttiferae (1), Humiriaceae (4), Myrtaceae (1), Sapindaceae (5).

To Dr. Irma Webber, Berkeley, Calif., 115 samples of Burseraceae (17 genera).

## CURRENT LITERATURE

**Certain palms of the Greater Antilles. II.** By L. H. BAILEY.

*Gentes Herbarium* (Ithaca, N. Y.) 4: fasc. 7: 237-284; Nov. 30, 1939.

With each fascicle appearing from the Bailey Hortorium the palms of the United States and West Indian islands take more definite shape. The fog and confusion are gradually being dispelled by Professor Bailey's illuminating studies. His methods and his conception of what is now required are much more adequate than those of the many taxonomists who have dealt with the subject. His objective is not quantity production of printed matter—this he has already accomplished elsewhere—but understanding and clarity in a field where the records are defective and cluttered with errors.

A paragraph from his Royal Palm of Hispaniola illustrates his approach and manner of working. "In my former collecting in Hispaniola I concluded that the Royal Palm of that country, which occurs in great quantities in the interior, is distinct from both *R. regia* of Cuba and *R. borinquena* of Puerto Rico, and I gave it a binomial. Diagnosis was drawn. That account I have withheld from publication until I could again visit Hispaniola and repeat my observations. This year I observed *borinquena* again in Puerto Rico, then went immediately to Santo Domingo and Haiti where I saw the Royal of those countries in great numbers, then returned directly to Puerto Rico and reviewed *borinquena* in many parts of the island. I concluded again that the native Royals of Puerto Rico and Hispaniola are distinct. This conclusion disregards many of the palms one sees about villages, in parks and plantations, for interchange of seeds between various islands may have taken place over many years."



"Whether the *Roystoneas*, on their various islands, are to be interpreted as species or varieties is of no pertinence to the present discussion. This question I plan to raise at another time. Variation in *Roystonea* is not understood, nor can the subject be adequately approached until field observations are made and correlated, and until herbarium methods with palms are vastly improved. Much work must yet be undertaken in the genus."

*Roystonea hispaniola* is described as new from Haiti, and *Coccolbrinax* and *Pseudophoenix* receive special attention, with the description of a new genus, *Zombia*, type *Z. antillarum*, and the new species *Coccolbrinax spissa*. *C. argentea* Sarg. and *C. alta* Becc. are redefined and *Sabal umbraculifera* Mart. clarified and emended. *Pseudophoenix vinifera* Becc. is distinguished from *P. Sargentii* Wendl., and *Geonoma oxycarpa* of Haiti from *G. mexicana*.—B. E. DAHLGREN, *Field Museum of Natural History*.

**The Caribbean forester.** Pub. quarterly by Tropical Forest Experiment Station, U. S. Forest Service, Rio Piedras, Puerto Rico. Vol. I: 1: 1-29; October 1939. Edited, multilithed, and distributed by Southern Forest Experiment Station, New Orleans, La.

This publication is an excellent medium by which a part of the aims of the new Tropical Forest Experiment Station in Puerto Rico may be achieved, namely, "to serve as far as feasible as a center for the reception and dissemination of knowledge in the field of tropical forestry in America."

**Forestry in British Honduras** (pp. 1-3), by N. S. Stevenson, Conservator of Forests, British Honduras.

**The forests of Dominica, B. W. I.** (p. 4), by H. B. Pidduck, Acting Agr. Supt., Dominica.

**Forestry in Jamaica** (pp. 5-6), by C. Swabey, Forest Officer, Jamaica.

**Forestry in Puerto Rico** (pp. 7-11), by L. R. Holdridge, Associate Forester, Puerto Rico.

**Forestry in St. Lucia** (pp. 12-13), by E. Y. Wald, Agr. Supt., St. Lucia.

**Forestry in Trinidad and Tobago** (pp. 14-15), by R. L. Brooks, Conservator of Forests, Trinidad.

**Compte rendu préliminaire du travail forestier a la station de Kenscoff, Haiti** (pp. 16-22), by Pierre Sylvain, Service National de la Production Agricole, Haiti.

**A mahogany seedling blight in Puerto Rico** (pp. 23-24), by L. A. Alvarez García, Asst. Phytopathologist, Agr. Exp. Sta., Puerto Rico.

**Some notes on forest entomology** (pp. 25-26), by Luis Martorell, Asst. Entomologist, Agr. Exp. Sta., Puerto Rico.

**Preparación y uso del mantillo o estiércol compuesto en viveros forestales** (pp. 27-28), by J. A. Gilormini, Asst. Forester, Puerto Rico.

**The forests of Surinam** (p. 29), by Gerold Stahel, Director, Agr. Exp. Sta., Surinam.

**New tropical forest experiment station** (p. 29).

**Trinidad. Forestry pamphlets for teachers.** By R. L. Brooks. Govt. Printing Office, Port-of-Spain, 1934-1937. Price 12 cents each.

A series of pamphlets prepared by the Conservator of Forests of Trinidad for use in connection with courses in nature study and geography in secondary schools. (1) What forestry in Trinidad means. Pp. 12; 2 figs. (2) The forest types of Trinidad and their principal species. Pp. 16; 2 maps. (3) Timber; its structure, properties, seasoning, and preservation. Pp. 18; 5 figs. (4) Notes on the more important timber trees of Trinidad and Tobago. Pp. 18; 24 plates. (5) Forestry and the oil industry. Pp. 4.

**Notes on the growing of teak (*Tectona grandis* Linn.) in Trinidad.** By R. L. Brooks. Leaflet No. 7, Forest Dept., Port-of-Spain, 1938. Pp. 14; 5½ x 8½; 4 plates. Price 12 cents.

"Teak seed was first imported by the Forest Department into Trinidad from Burma in the years 1913 and 1915, and was sown in the Central Range and Southern Watershed Reserves. Successful plantations were formed from the resulting plants and by 1920 seed giving a germination of over 60 per cent was being collected from Teak trees in Trinidad. Fresh seed obtained from selected seed bearers was imported from India in 1936.

"Caution has been exercised in the expansion of the Teak planting programme, following the sound principle that an exotic should be considered as still in the experimental stage up to the age of 25 to 30 years. The present area of pure Teak plantations in Trinidad, however, formed by the Forest Department amounts to approximately 1500 acres, the ages



ranging from 1 to 24 years; there is in addition a small area of plantations in which Teak is mixed with other species. Planting at the present rate, averaging approximately 140 acres per annum, did not commence until 1928."

This pamphlet contains a concise account of Teak, both in its natural habitat and in Trinidad, and gives instructions, based upon practical experience, for establishing and tending plantations.

**The Verbenaceae and Avicenniaceae of Trinidad and Tobago.** By HAROLD N. MOLDENKE. *Lilloa* (Tucumán, Arg.) 4: 283-366; 1939.

"The . . . discussion . . . is presented here as a matter of record and reference preparatory to its publication in much abbreviated form in the *Flora of Trinidad and Tobago* in a few years. The descriptions of families, genera, species, and varieties are made as brief as is consistent with accuracy and all keys as simple as possible. . . . All known common or vernacular names are also included immediately after the accepted name for each form."

**Studies of Mexican and Central American Plants. VII.**

By C. L. LUNDELL. *Lloydia* (Cincinnati) 2: 2: 73-108; 2 figs., 5 plates; June 1939.

The trees and shrubs described as new are *Tropis Matudai*, *Coccoloba Masoni*, *C. suborbicularis*, *Desmopsis lanceolata*, *Forchammeria Matudai*, *Calliandra Matudai*, *C. nogalensis*, *Diphysa macrophylla*, *Lonchocarpus apricus*, *Zantboxylum Genlei*, *Guarea Matudai*, *Trichilia Matudai*, *Sebastiania Standleyana*, *S. confusa*, *Celastrus Mainsiana*, *Zinowiewia tacanensis*, *Hampea macrocarpa*, *Clusia Chanekiana*, *Casearia Bartlettii*, *Gonzalagunia tacanensis*, *Viburnum montanum*, and *V. tacanense*. Among the new synonyms are *Coccoloba Browniana* Standl. (= *C. cardiophylla* Standl.), *Lonchocarpus orizabensis* Lundell (= *L. affinis* Pitt., non De Willd.), *Pithecolobium albicans* (Kunth.) Benth. (= *Albizia rubiginosa* Standl., non Miq. = *A. Lundellii* Standl.), *Phyllanthus antilanus* (A. Juss.) Muell. Arg. (= *P. nobilis* [L.f.] Muell. Arg. = *Celastrus tetramerus* Standl.), *Sebastiania Standleyana*

Lundell (= *S. longicuspis* Standl.), *Elaeodendron trichotomum* (Turcz.) Lundell (= *Maytenus trichotomus* Turcz.), *Euonymus enantiophyllus* (Donn. Sm.) Lundell (= *Maytenus enantiophyllus* Donn. Sm.), and *Paratbesis cubana* (A.DC.) Mol. & Maza (= *P. obovata* Standl.).

**Contributions to the flora of tropical America. XLII. Notes on the genus *Belotia*.** By A. A. BULLOCK. *Kew Bulletin*, 1939, pp. 517-521.

According to the author there are seven species of *Belotia*, namely, *B. Campbellii* Sprague (= *B. tabascana* Sprague), *B. caribaea* Sprague, *B. grandifolia* Sprague, *B. grewiifolia* A. Rich., *B. insignis* Baill., *B. mexicana* (DC.) Schum., and *B. panamensis* Pitt. (= *B. macrantha* Sprague). Notes on the ranges and the confused synonymy are given.

**Monograph of the North American species of the genus *Ephedra*.** By HUGH CARSON CUTLER. *Annals Mo. Bot. Garden* 26: 4: 373-428; pls. 27-28; November 1939.

"Correct determinations of material [of *Ephedra*] is extremely difficult, for the number of species has nearly doubled since the publication of the last monograph of the entire genus and many of them were originally described from sterile or from staminate material. Approximately two-thirds of collected specimens cannot be identified with certainty from existing descriptions. The present study determines the correct application of names, proposes several new ones for hitherto undescribed forms, delimits the North American species, and provides means for their accurate determination. The South American species are not discussed in the present work but will be taken up later."

**Beitrag zur morphologie von *Caryocar nuciferum* L.** By FRITZ BLANK. *Ber. Schweizerischen Bot. Gesellschaft* (Bern) 49: 438-494; 27 text figs.; 1939.

A detailed account of the morphology of the seed, root, hypocotyl, young stem, and leaf of *Caryocar nuciferum* L., a Guiana tree whose edible nuts are the source of a culinary oil.



Colheita de material botânico na região Amazonica per A. Ducke. *Boletim do Ministerio da Agricultura*, Rio de Janeiro, April-June 1938.

A report addressed to the Director of the Instituto de Biologia Vegetal on the author's botanical explorations in the State of Amazonas during the years 1935 to 1937. As botanist to the Brazilian Boundary Commission of the western sector of Brazil, Dr. Ducke was able to make three excursions during this time from Manáos to the Brazil-Colombian boundary in the region of the upper Rio Negro. From Santa Izabel, the terminus of steamer navigation on the river, four days from Manáos, transportation was by motor launch for river travel and by canoe on minor waterways to Tumbira, near Igarapé Capanari on the Rio Negro, and on the Rio Branco to the base of Serra Grande. In the intervals of travel on the Rio Negro, Dr. Ducke made excursions from Manáos to the Rio Madeira at Porto Velho and on the Rio Solimões to São Paulo de Olivença. The result of his botanical collecting was more than 1000 species of herbarium specimens, mostly from flowering trees difficult of access, and 162 boxes with living plants of 157 species for the botanic gardens in Belem and Rio.

Numerous references to his observations on Leguminosae, especially several new species of *Elizabetha*, *Dimorphandra*, *Hymenolobium*, *Parkia*, *Coumarouna*, *Ouratea*, *Baubinia*, and *Peltogyne*, testify to the author's well-known interest in the trees of this family. The Cumarú of Rio Branco is stated to be greatly superior to that of other parts of Amazonia, equal to the Sarrapia of the Orinoco, its fruits having a sweet and edible pulp. Martius' *Paullinia sorbilis* was rediscovered on the Rio Negro and found to be sufficiently distinct from *P. cupana* H. B. K. to be formally classified as variety *sorbilis* (Mart.) Ducke. Among other plants mentioned are the Sassafras of Rio Negro, *Nectandra elaiophora* B. Rodr. or *Ocotea barcellensis* (Meissn.) Mez, with aromatic wood containing pockets of an inflammable liquid, a terpentine; Tiririca Grande, *Thurnia sphaerocephala* Hook. f., one of the two species of the single genus of its family; Pupunha-rana, *Duckeodendron cestroides* Kuhl., the only very large solanaceous tree known (over 30 meters); *Recordoxylon stenopetalum*

Ducke, a new species of the genus that was named in honor of Professor Record who recognized from the study of the wood that this species could not belong in *Melanoxylon* where it had been placed by Dr. Ducke; *Crescentia amazonica*, with diminutive fruits; *Genipa caruto*, which is said to be very distinct from the usual Genipapo; and a new species of *Chaulmoogra*, several new species of *Sacoglottis*, and *Aguiaria excelsa*.—B. E. DALHGREN, *Field Museum of Natural History*.

Métodos de ensaios adotados no I. P. T. para o estudo das madeiras nacionais. By FREDERICO A. BROTERO. Bol. No. 24, Instituto de Pesquisas Tecnológicas de São Paulo, June 1939. Pp. 28; 7 x 10; 14 text figs.

Methods adopted as standard for testing Brazilian timbers. Results of tests on 150 lots are given in a large table.

Plantas e substancias vegetais tóxicas e medicinais. By F. C. HOEHNE, São Paulo, 1939. Pp. 355; 9 x 12½; 252 text figs., 26 pls. in color.

A collection of 114 "lessons," first published in the newspaper *O Estado de S. Paulo* from 1934-38 without illustrations, and now revised, copiously illustrated, and supplied with a well organized index of scientific and vernacular names, from the prolific pen of the industrious São Paulo botanist. Apparently the articles composing this work on poisonous plants were primarily intended to call attention to Brazilian plants injurious to stock, but as the theme developed in the course of some years, from fungi, ferns, and horsetails to composites, the text became a much more inclusive and excursive comment on poisonous and medicinal plants and their allies in general, including about 2000 species, with numerous suggestions for further investigations, especially of the properties of a host of known or potential fish poisons and their possible applicability as insecticides. For the benefit of stock raisers the action of the poisonous plants that concern them is stated in terms of symptomatology. The work will be useful to all students of plants everywhere. It is essentially a book about plants by a botanist.—B. E. DALHGREN, *Field Museum of Natural History*.



**Catalogo alfabetico de los nombres vulgares y cientificos de plantas que existen en el Peru.** By FORTUNATO L. HERRERA. Pub. by Universidad Mayor de San Marcos, Lima, 1939. Pp. 363; 5 x 6 $\frac{3}{4}$ .

The first hundred pages of this useful pocket-sized booklet are devoted to the history of botanical explorations in Peru, the remainder to a check list of the vernacular names with equivalent scientific designations of Peruvian plants compiled from various indicated sources.

**Las especies argentinas del genero *Tessaria*.** By ANGEL L. CABRERA. *Lilloa* (Tucumán) 4: 181-189; 3 plates; 1939.

An account of the three species of *Tessaria* (Compositae) that are represented in Argentina. Two are shrubs, but *T. integrifolia* R. & P. is a small tree (3 to 8 m. high) of wide distribution in South America and common along river banks in northern Argentina.

**Notas fanerogamicas. II.** By ALBERTO CASTELLANOS. *Lilloa* 4: 191-196; 2 plates; 1939.

Contains descriptions of one new Argentine species of Cactaceae and one of Rhamnaceae, the latter (*Condalia montana*) being a bushy, spiny tree 3 to 5 m. high and 10 c.m. in diameter in Córdoba where it is known as Piquillín Negro or Piquillín de la Sierra.

**Studies in the American Celastraceae. II. Notes on genera and species from Mexico and South America.** By C. L. LUNDELL. *Lilloa* 4: 377-387; 1 pl., 1 text fig.; 1939.

Contains, among other novelties, a description of *Maytenus Matudai*, a tree or shrub from Mt. Tacana, Chiapas, Mexico, and of a proposed new genus, *Viposia*, for *Plenckia integerrima* Lundell, a tree or shrub from northern Argentina, where it is known as Palo Blanco and possibly also as Guili.

**The American species of *Erythrina*.** By B. A. KRUKOFF. *Brittonia* (N. Y. Bot. Gard.) 3: 2: 205-337; October 1939.

"Sketchy reports of the existence of alkaloids with a curare-like action in species of *Erythrina* are to be found in the older

literature. However, these physiologically active alkaloids of *Erythrina* were so poorly defined that they could not be recognized as individual chemical compounds. Erythroidine from the seeds of *Erythrina americana* Mill. was the first of the active alkaloids to be isolated as a pure crystalline substance. Subsequent to the demonstration that erythroidine can cause a curare-like action it was of considerable interest to make an examination of other species of the genus. Such was the beginning of the task which eventually resulted in the isolation of many other new alkaloids, all physiologically active, from seeds of various species of *Erythrina*, in the extensive chemical and pharmacological studies of these alkaloids still under way at the Merck Research Laboratory and at the Merck Institute of Therapeutic Research, and in the present taxonomic revision of the American species."

"From the citations of specimens, it appears that the genus, as it is represented in herbaria, has an unusually high number of mixed collections. This is obviously due to the fact that inasmuch as many species are aphyllous at anthesis, collectors often obtain materials from several plants and distribute them under a single number. The presence of mixed collections in herbaria probably is partly responsible for the fact that certain species were overlooked and for the unusually high number of misidentified specimens."

"For further advancement of our knowledge of the genus, extensive collections are essential. The collections should include both sterile and fertile material, young as well as old leaves, and immature inflorescences. Extensive field notes as to the color of various parts of flowers, as well as of petiolules, costa, and secondaries of leaflets (these being colored in certain species) would be especially valuable."

"In my work on *Erythrina*, as well as in previous joint work with taxonomists on *Lonchocarpus*, *Menispermaceae*, and *Strychnos*, I have been fortunate in having certain chemical data for the plants that were under taxonomic study. I feel certain that the distribution (among the species) and the percentages of many alkaloids found in seeds of various species of *Erythrina*, when better known, will be of great assistance for taxonomic consideration."



"The species of *Erythrina* are distributed on all continents except Europe, being limited to the tropics and subtropics. I estimate that the genus consists of approximately 104 species, of which 51 species (and 2 varieties and 3 forms) are confined to America, approximately 32 species to Africa, 18 species to Asia and Polynesia, and 3 species exclusively to Australia. All species are limited in range to a single continent with the exception of *E. variegata* var. *orientalis*, which extends from Asia through Polynesia and to Australia."

"Geographic distribution in *Erythrina* is of great assistance in a taxonomic consideration. Usually only a few or even a single species occur in each region, and within each region the species are often unrelated or are confined to special habitats."

**Supplementary notes on Myristicaceae.** By A. C. SMITH. *Brittonia* 3: 2: 339-340; October 1939.

Notes supplementary to the author's monograph of the American species of Myristicaceae (*Brittonia* 2: 393-510). Among other items, *Iryanthera Krukovii* A.C.Sm. is reduced to synonymy under *Osteophloem platyspermum* (A.DC.) Wash.

**Philippine journal of forestry.** Pub. quarterly by Dept. Agr. & Commerce, Manila. (See *Tropical Woods* 57: 26.)

PARTIAL CONTENTS OF VOL. 1: 3-4; 1938.

**The effect of storage on the germination of West Indian cedar** (pp. 293-299), by Ramon A. Acuña. Seed of West Indian Cedar (*Cedrela mexicana* M. Roem.) has its highest rate of germination within 21 days of maturity. Germination percentage of seed stored in paraffin sealed bottles decreases rapidly after 90 days.

**Relative resistance to decay of American and Philippine woods under Philippine conditions** (pp. 301-326, 1 plate), by Luis J. Reyes and Luis Aguilar.

**Weights of Philippine woods** (pp. 327-332), compiled by Division of Forest Studies and Research.

**Storage and germination of large-leaf mahogany seeds** (pp. 397-410, 2 plates), by Melecio Lopez. Seeds of *Swietenia macrophylla* King, unless properly stored, lose their viability in 45 days. Cones stored with powdered charcoal in a can buried 40 cm. deep in the ground yielded seeds with a germinative capacity of 72 per cent after 132 days. Seeds stored in the same manner but without charcoal had a germinative capacity of 70 per cent after the same period.

PARTIAL CONTENTS OF VOL. 2: 1-3; 1939

**The mechanical properties of apitong from Tayabas Province and Negros and Basilan Islands** (pp. 145-159, 1 text fig.), by Luis Aguilar. Apitong (*Dipterocarpus* spp.), constituting 18.5 per cent of the volume of standing timber, is the most abundant structural timber available in the Philippines. Average strength values, corrected for moisture content, are given.

**"Flanging" system increases timber utilization** (pp. 209-225, 6 plates), by Nicolas P. Lansigan. High buttresses, or "flanges," are removed from the tree, down to a low stump height, before felling. Workmen standing on platforms use vertical saw cuts or chopping to remove the buttress. Additional cost is more than offset by additional logs obtained, reduced log and cable breakage, and cheaper yarding due to the absence of high stumps.

**Fiber length of Philippine coniferous wood** (pp. 277-286), by Luis Aguilar. *Agathis alba*, *Phyllocladus hypophyllum*, *Dacrydium falcatifolium*, and *Podocarpus Blumei* have long and reasonably uniform fibers. Comparing favorably in fiber length with Sitka Spruce it is suggested that these woods may have possibilities for use in airplanes.

**The formation of growth rings in Indian trees. Part I.** By K. AHMAD CHOWDHURY. *Indian Forest Records* (n.s.) 1: 2: 1-39; 2 text figs., 8 plates; 1938. Price 3s. 6d.

Growth rings are annual and usually distinct in Chir (*Pinus longifolia*), Teak (*Tectona grandis*), and Laurel (*Terminalia tomentosa*). Cutch (*Acacia catechu*) and Semul (*Bombax malabaricum*) have fairly distinct growth rings. Jaman (*Eugenia jambolana*) and Sal (*Shorea robusta*) have irregular marks that are not annual growth rings. "Deciduous trees do not always show growth rings nor are all evergreens without them."

In all species studied foliar development preceded diameter growth in the main trunk, but the emergence of new leaves did not indicate cambial activity in the trunk. In Chir and Teak cambial awakening was noticed simultaneously in the twigs and trunks, while in the diffuse-porous woods studied the cambial awakening began in the young shoots and spread gradually to the main trunk.

Analysis of external factors such as temperature, rainfall, and humidity, did not bring out any direct correlation with commencement and cessation of growth. The interdependence of these factors is discussed in detail.—R. W. HESS.



**Additions to the flora of Borneo and other Malay islands.**

XIII, XIV. By H. K. AIRY-SHAW. *Kew Bulletin*, 1939, pp. 504-509, 509-517.

These contributions are based on studies of specimens obtained by the Oxford University expedition to Sarawak in 1932. The first deals with the Theaceae and Symplocaceae, the second with the Olacaceae and Myrsinaceae. Several new species, varieties, and forms are described.

**Field studies on the gum veins of the eucalypts.** By M. R.

JACOBS. Bull. 20, Commonwealth Forestry Bureau, Canberra, 1936. Pp. 36; 8 x 10; 32 text figs.

"Kino ducts, or 'gum veins,' as they are usually termed, are a serious cause of degrade in many widely spread forest Eucalypts, and because of this they have received considerable attention from officers of the Bureau. The present bulletin discusses the natural factors found to be of importance in causing gum veins in different size-classes in the species examined, and describes numerous experiments on the formation of veins and their behavior. Measures likely to cause a reduction in the number of veins in future crops are considered, the most practicable measure being fire protection. The importance of fire in the gum-vein question is discussed at some length, and it is shown how fires influence three of the most important classes of veins in many species."—*From Foreword* by C. E. LANE POOLE.

**The fibre tension of woody stems, with special reference to the genus *Eucalyptus*.** By M. R. JACOBS. Bull. 22, Commonwealth Forestry Bureau, Canberra, 1938. Pp. 39; 8 x 10; 19 text figs.

"The bulletin describes a phenomenon that is apparently general in woody plants. Successive layers of growth differentiate in slight tension and are held stretched by the inside core. As a result of this a cumulative radial tension is built up which imposes an equal compression on the heart. In trees the compression of the heart becomes very severe and finally the heart is compressed beyond its limit of elasticity, the mechanical properties of the heartwood being seriously affected.

"This phenomenon has been called 'fibre tension,' and has been found to be the causative or an assisting influence behind brittle heart, compression failures, heart shakes in green timber, and other features of Eucalypt timber. Quantitative methods of measuring fibre tension, and the principles underlying them, are described. The only exception to the generally radially increasing tension found in a wide range of species was in the compression wood of Pines, which was found to be in compression in a green state."—*Author's abstract*.

**Mangrove woods from Tanganyika for paper-making.** Bull. Imperial Forestry Institute 37: 3: 331-344; September 1939.

"Makaka (*Rbizophora mucronata*) wood has an average fibre length of 1.5 mm. and a high cellulose content, and is superior in both these respects to the two other species of Tanganyika Mangrove wood, viz., Makandaa (*Ceriops Candolleana*) and Mchuu (*Avicennia officinalis*), examined.

"On account of its resin content and high color, Makaka would only be suitable for pulping by the alkaline digestion processes. The wood gives a good yield (47.5 per cent, on a moisture-free basis) of unbleached soda pulp, but the pulp is too weak and short-fibred to be suitable for the manufacture of unbleached wrapping papers. Soda pulp from Makaka is not easily bleached, and in spite of the employment of severe cooking conditions it was not found possible to prepare a pulp which bleached readily to a good white. . . . It is therefore unlikely that a profitable outlet could be found for Makaka wood as a raw material for paper-making."

**Atlante micrografico dei legni dell' Africa Orientale Italiana.**

By UGO FASOLO. Publ. by R. Erbario Coloniale di Firenze, Italy, 1939. Pp. 10 (introduction); 3 pp., 1 pl. for each fascicle; 9 x 11½.

This atlas consists of a series of descriptions of the woods of Italian East Africa according to a definite plan, namely, general features, and minute anatomy as seen on cross, radial, and tangential sections. For each wood there is one plate with four photomicrographs each, one (× 70) for each section and one (× 300) to show the type of ray-vascular pitting. The in-



roduction explains the nature of the undertaking and includes a glossary of 41 anatomical terms. The species described in the first four fascicles are *Juniperus procera* Hochst., *Ficus vasta* F., *Olea caryophylla* Lam., and *Acacia etbaica* Schwf.

**Cenni monografici sulle piante forestali e sui legnami dell'**

A. O. I. By GUGLIELMO GIORDANO. *La Revista Forestale Italiana* (Rome) 1: 3: 41-46; 4: 32-37; 7: 41-48; 9: 36-42; 10: 23-32; May-December 1939; illustrated.

The east African trees and woods described and copiously illustrated with photographs and drawings in this attractive magazine are *Myrica salicifolia* Hochst., *Celtis Kraussiana* Bernh., *Morus mesozygia* Stapf, *Bosqueia phoberos* Baill., *Protea abyssinica* W., *Pittosporum abyssinicum* Del., *Albizzia Schimperiana* Oliv., *Clausenopsis angolensis* Engl., *Bridelia micrantha* Baill., *Ilex mitis* Radlk., var. *kilimandscharica* Losen, *Allophylus africanus* P.B., *Syzygium guineense* DC., *Schefflera abyssinica* (Hochst.) Harms, *Polyscias ferruginea* (Hiern.) Harms, *Mimusops Kummel* Bruce, *Sideroxylon oxyacantha* Baill., *Acokanthera abyssinica* K. Schum., *Nuxia congesta* R. Br., *Cordia abyssinica* R. Br., *Stereospermum Kumbianum* Cham., and *Galiniera coffeoides* Del.

**Monographie forestière du *Chlorophora excelsa* Benth. et**

Hook. By G. TONDEUR. *Bulletin Agricole du Congo Belge* (Brussels) 30: 2: 163-198; figs. 20-29, 1 colored plate; June 1939.

A comprehensive report on *Chlorophora excelsa*, often known as Iroko, including common names, distribution, botanical description, silviculture, and natural enemies of the tree and the structure, properties, and uses of the timber.

**The significance of wood anatomy in the taxonomy of the Juglandaceae.** By CHARLES HELMSCH, JR. and RALPH H. WETMORE. *Am. Journ. Bot.* 26: 8: 651-660; 21 photomicrographs; October 1939.

"Manning has utilized evidence obtained from a study of the inflorescences found in the Juglandaceae for an interpretation of generic relationships within the family. The present investigation was undertaken in an effort to determine to what

degree a study of the xylem anatomy might confirm his findings. There were available for this study wood specimens from a greater majority of the species of the family. The criteria employed were those now generally recognized as significant in phylogenetic studies based on secondary xylem. The findings are as follows:

"*Alfaroa* seems to be the most primitive genus of the family. *Engelhardtia* is not dissimilar but is somewhat more advanced. *Pterocarya* and *Juglans* are closely allied with many anatomical features in common, though *Juglans* has reached a somewhat higher degree of specialization. *Carya* has attained a level of structural organization not found in any other genus. The isolated genus *Platycarya* seems to have achieved a high degree of organization along an independent pattern of specialization.

"The results of this investigation are in striking accord with those of Manning. *Platycarya* alone demands a different interpretation. Manning finds this genus generalized in inflorescence for the family and suggests it as primitive. Anatomical evidence cannot support this belief.

"Intensive study of intrageneric variations in anatomy gives few facts to support the idea that the established criteria employed in phylogenetic investigations based on anatomy are adequately refined for intrageneric interpretations."—*Authors' summary.*

**Crystalliferous strands.** By M. M. CHATTAWAY. **On crystalliferous strands. II.** By F. R. MILANEZ. *Rodriguésia* 4: 12: 55-58; 59-65; September-December 1939.

A continuation of a debate on terminology. One of the specific questions is whether a crystalliferous strand that is longer than its cambial initial should be classed as a parenchyma strand. The basis for the difference of opinion seems to be in definition No. 100 of the Glossary (*Tropical Woods* 36: 8) where a fusiform wood parenchyma cell and a wood parenchyma strand are each said to correspond in height to its cambial initial. Professor Milanez would qualify the definition by inserting the word "usually," whereas Miss Chattaway would apply the definition rigidly and make new categories for the intermediate or atypical forms.



The reviewer was chairman of the Committee on Nomenclature of the I.A.W.A. and was largely responsible for the wording of the definition. At that time it was thought that the length of cambial initials could be reliably inferred from the length of vessel members and parenchyma strands (see No. 97, definition of libriform wood fiber). This was recorded not as an essential character but as an interesting and probably significant observation to which no exceptions were then known. During discussion of the subject, however, the prediction was made that sooner or later it would be discovered that some vessel members and some parenchyma strands did elongate during their development from the cambial initials. Accordingly there is no reference to relative length of cells in the specific definitions of vessel and vessel element (Nos. 80, 81), fusiform wood parenchyma cell (No. 101), and wood parenchyma strand (No. 102).

Not long after the Glossary was printed, Professor Woodworth (see *Tropical Woods* 41: 8-16) demonstrated fibriform vessel members which "are about twice as long as the fusiform cambial initials and, therefore, appear unique among vessel elements." It is interesting to note that he first designated these cells "perforated fiber-tracheids" but later came to the conclusion that "any perforated cell is a vessel element."

Unfortunately there is no equally simple criterion for distinguishing wood parenchyma from certain wood fibers which (in sapwood) retain their living contents and may store starch. Professor I. W. Bailey says (*Tropical Woods* 45: 22): "Storage of starch and internal septation certainly are not characteristic attributes of fibers or of sclerenchymatous elements in general. Nor are they evidences of a transition to parenchyma, as fundamental differences in their ontogeny and in the physico-chemical constitution of their secondary walls so clearly indicate." If Bailey's statement is correct then it should be possible to determine definitely whether these elongated crystalliferous strands belong in the category of wood parenchyma or wood fibers or are distinct from both. An attempt at Yale to use these fibriform strands as a diagnostic feature has led to the conclusion that there is no sharp line of demarcation between them and ordinary crystalliferous parenchyma strands.



MMC

M. M. CHATTAWAY

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## TROPICAL WOODS

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*A technical magazine devoted to the furtherance of knowledge of tropical woods and forests and to the promotion of forestry in the Tropics.*

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### BOTANICAL EXPLORATION IN THE MIDDLE AND LOWER CAURA, VENEZUELA

By LLEWELYN WILLIAMS

*Servicio Botánico,*

*Ministerio de Agric. y Cría, Venezuela*

Situated in the torrid zone, with extensive maritime coast, vast plains, and intricate mountain ranges, Venezuela possesses one of the richest and most interesting floras in the Western Hemisphere. Penetrating from the coast as far south as the Brazilian frontier, one traverses three zones, distinct in topography and vegetation: (1) the Coastal Cordillera, beyond which lie (2) the Llanos, forming the northernmost plains of South America, and (3) the territory south and east of the River Orinoco, or what is popularly called the Venezuelan Guayana.

Although long known to be unusually rich in natural



products, this last-named region is the most sparsely populated part of Venezuela and constitutes one of the least known territories in Tropical America, despite the fact that it has been the object of many expeditions during the last four centuries. Of the various naturalists attracted to it, Humboldt and Bonpland figure among the earliest. At the beginning of the nineteenth century they traveled across the Llanos and ascended the Orinoco to the Río Negro and Casiquiare. During the period 1835 to 1839, Robert Hermann Schomburgk made extensive investigations in the valleys of the Cuquenán, Merevari, Padamo, and others, between Roraima and the Upper Orinoco. In 1853, the tireless Richard Spruce entered Venezuelan territory and, until the end of 1854, undertook several excursions from his base at San Carlos to the Casiquiare, Atabapo, and the falls of Maypures. His experiences in this region are vividly described in his *Travels of a botanist on the Amazon and Andes*. In 1909, Ule followed almost the same itinerary as Schomburgk, descending the Caroní and Cuquenán, and later botanizing near the summit of Roraima.

Notwithstanding the valuable contributions of Bonpland, Schomburgk, Spruce, Ule, and others, our knowledge of the composition of the vegetation within the limits of the Guayana still remains incomplete, while some parts have never been explored. It is known that balata, chicle, rubber, and tonka beans figure among the forest products, but precise determination and distribution of the trees that produce them are still wanting. With a view to initiating a systematic study of the Guayana, the writer was sent early in 1939 to the Caura valley. With the exception of the collection made by Passarge and Selwyn, in 1901-02, in the vicinity of the River Cuchivero, no plant collecting had heretofore been done in this region.

Of the large tributaries that feed the Orinoco, few are more picturesque or more dangerous to navigate than the Caura. Under the name Merevari, it rises in the mesa of Jauá and follows a southeastern direction, towards the Brazilian frontier, until it unites with the Emecuni; thence due east, almost parallel with the Sierra Pacaraima, and after forming a large

arc it continues in a northwestern direction until it joins the Orinoco, concluding a total run of approximately 500 miles.

Near its estuary the Caura has a width of about 300 meters. Intermittent narrow belts of woodland separate the river from the broad savannas extending westward to the Cuchivero and beyond Purguey to the east. The most characteristic tree in open areas is Salado (*Vochysia*), prominent in February on account of its long spikes of yellow flowers. A noticeable change in the topography and vegetation occurs a short distance above Maripa. Instead of open plains, heavily-wooded mountain ranges extend at right angles from the river and these are found at certain intervals as far as, and even beyond, the Salto de Para. Their summits appear from midriver like *mesetas*, and their average altitude above sea level is estimated at 600 m. The forests covering their slopes have long been famed as a rich source of tonka beans.

The Caura is comparatively free of islands or large rocks as far as Las Trincheras, thus facilitating navigation by sailboats and launches even during the dry season. Beyond that village, however, the river bed is strewn with large granite formations, or *lajas*, as they are known locally, and the prevalence of rapids limits the use of watercraft to canoes and dugouts. The commonest tree on these exposed rocks is the Chigo (*Campsiandra comosa* Benth.), which is found as far south as the mouth of the Nichare.

#### MIDDLE CAURA

We stopped at La Unión for nine days waiting for provisions and canoes to continue the journey southward. Along the rocky banks the most prominent tree is Cedro Dulce (*Bombacopsis*), with a massive bole and a rounded crown of corpulent branches; the reddish flowers appear in January and February after the leaves have fallen. Here also grows the Drago (*Pterocarpus podocarpus* Blake), a deciduous tree with yellow flowers; the incised bark exudes a dark reddish resin, whence is derived its other name, Sangre de Drago. In thickets appear Pardillo (*Cordia alliodora* Cham.), Majomo (*Lonchocarpus punctatus* H.B.K.), Guácimo Cimarrón (*Luebea candida* Mart.), and Pata de Vaca (*Baubinia Benthamiana*



Taub.). Open areas are dominated by such trees as Majaguillo (*Guatteria*), Zapatero (*Matayba*), and Carnaval or Carnestolenda (*Coccolospermum orinocense* Steud.), the last ranking among the more prominent because of its handsome yellow flowers. Shrubs include *Amphirrhox latifolia* Mart., *Helicteres guazumaefolia* H.B.K., *Clidemia pustulata* DC., and species of *Aegiphila*, *Hirtella*, and *Piper*. Many of the climbers, mostly Bignoniaceae, Leguminosae, and Sapindaceae, are particularly attractive and worthy of cultivation.

Within two hours after leaving La Unión we reached the first of a series of rapids, known collectively as La Mura. On its right the river is flanked by a large granite rock, almost bare, which forms part of the Carro La Prisión. On the opposite bank is the densely wooded rounded hill of El Castillo. Here the river is meandering, rocky, and divided into narrow channels. On open rocks abounds *Sauvagesia erecta* L., while lianas are represented by *Dalbergia Ecastophyllum* (L.) Taub., *Corynostylis arborea* (L.) Blake, and a species of *Pbryganocydia*. In rocky areas along the river banks often appear a species of *Swartzia* and *Zygia divaricata* (Brongn.) Pitt., the latter known locally as Cimbra-potro in reference to the remarkable elasticity of the wood. Both banks support exuberant vegetation, notably homogeneous in character, and many of the trees reach a considerable height. The Mery Montañero (*Anacardium Rbinocarpus* DC.) is a typical tree; its long, erect, cylindrical trunk is utilized by the Indians for making canoes and dugouts. Beyond reach of inundations grows the Cajimán or Palo de Vaca, a new species described recently by Pittier as *Couma caurensis*. Its mature fruit is dark blue and contains an edible, extremely sweet pulp. The incised bark yields abundant latex which coagulates readily and is considered the best material in the Caura for caulking canoes.

*Copaifera pubiflora* Benth. grows in such abundance in the Middle Caura that we would be justified in calling this the Copaiba belt. On open rocks it seldom exceeds 10 m. in height, but on dry, heavily wooded slopes it reaches up to 25 or 30 m. It has an irregular crown, a round though often bent trunk, and a yellowish or light brown bark. The most com-

mon as well as the handsomest epiphytic orchid found on the open stretches of sand is *Cattleya violacea* (H.B.K.) Rolfe.

One of the three largest tributaries of the Caura is the Nichare. A long range, with an altitude of 800 to 1000 m., runs parallel with its left bank. According to a local informant, the forests around the headwaters and its tributary, the Ycuta, are rich in Purguo and Pendare, sapotaceous trees of economic importance as the source of balata and chicle, respectively. A short distance above the estuary of the Nichare we collected for the first time specimens of Barbasco Blanco, a stout leguminous vine which favors humid areas in tall forest. The general characters of the leaves and wood show affinity to *Lonchocarpus nicou* (Aubl.) DC., common in the Amazonian forests. It is not only regarded as the most toxic fish poison in the Caura, but also represents an article of commercial value on account of the principle, rotenone, contained mostly in the young roots.

Several species of Guamo (*Inga*), with broad crowns and short trunks, form an uninterrupted curtain of considerable extent along the river banks, reaching to the level of the water. The change from these *guamales* to the high forest, however, is not abrupt; there is a transition zone of Yagrumo (*Cecropia*) and Sunsún (*Didymopanax*), trees usually associated with secondary growth. The most conspicuous component of the high forest is the Zarcillo (*Parkia pendula* Benth.), a deciduous tree attaining a height upward of 20 m., its stout arcuate limbs often reaching to the surface of the water. Its long, black pods are borne in clusters suspended from a common, black, wiry peduncle, upward of a meter in length, and during February to April, when the tree is leafless, they appear at a distance as a mass of withered limbs.

*Salto de Para*.—This may be regarded as a series of falls and cataracts which serves as an effective barrier against the ascent of aquatic life to the upper reaches and, furthermore, indicates the limit of distribution of many plants in the Caura basin. Its outlet has two branches—one, a rocky stream, the other a long, unimpeded channel through which the greater volume of water flows, hemmed in by tall cliffs. These unite below to form a large pool; in the dry season, a long stretch of



sand skirts the right bank of this pool. The most conspicuous species on this open area is Pílon (*Andira retusa* H.B.K.), with a broad, umbrella-shaped crown and a short bole provided with numerous, long, sinuous adventitious roots. These arid stretches are also favored by Congrio (*Swartzia*), which furnishes a heavy durable wood much esteemed for the keels and ribs of launches. Two of the common shrubs growing around rocks are Guayabo Perua (*Psidium*) and Guayabito Rebalsero (*Myrcia*). The outer margin of this sandy beach is inhabited by *Cochlospermum orinocense* (H.B.K.) Steud., *Simaba cedron* Planch., *Toulicia pulvinata* Radlk., as well as by species of *Cecropia*, *Genipa*, and *Connarus*. Among the climbers noted were *Dioclea guianensis* Benth., and Bejuco de Cadena, a new species described by Pittier as *Schnella bicomata*; also a *Securidaca* which is especially prominent on account of its purplish flowers.

One of the commonest trees in the tall forest extending inland is a *Tecoma* (or *Tabebuia*) known locally as Araguaney, Puy, or Chacaradanga. When devoid of leaves, in February and March, its crown is covered with large yellow flowers in terminal panicles, later with lineal, pendant pods containing numerous winged seeds. Here also abounds a euphorbiaceous tree (*Micrandra*) known as Caucho Tomoro. Its rough bark exudes an abundance of somewhat bitter latex which coagulates rapidly on being heated and is said to have formed at one time an important article of export from Ciudad Bolívar. In humid areas flourishes the Bucare (*Erythrina*), a large tree with a straight, cylindrical trunk armed with numerous sharp spines. The Avara or Matayaka (*Theobroma Mariae* Schum., *vel. aff.*), grows in the shade of tall trees; it is characterized by a simple trunk, large leaves, and ridged fruit containing several seeds arranged in three rows.

The opposite margin of the pool is rocky and grown up with species of *Brownea*, *Cestrum*, *Chamaefistula*, *Clusia*, *Inga*, *Miconia*, *Petraea*, *Rinorea*, and *Solanum*. The background is a gradual slope covered with a mixed forest of medium-sized trees and abounding in epiphytic orchids, such as *Cyrtopodium punctatum* (L.) Lindl., *Epidendrum anceps* Jacq. and *E. decipiens* Lindl., *Oncidium pumilum* (L.) Reichenb.f., *Oc-*

*tomeria* sp., *Ornithocephalus bicornis* Lindl. (?), and *Rodriguezia secunda* H.B.K.

Our equipment had to be portaged a distance of seven kilometers to reach the headwaters of the falls. Almost immediately on leaving the beach the path leads up a steep, rocky slope covered with ferns, palms, particularly Seje and Manaca, and medium-sized trees, of which the most common is the Arahueke, a species of *Coccoloba*, with a narrow crown and small, fleshy fruits clustered around the twigs. Within half an hour we reached a large open rock with an altitude above the surrounding country of about 250 m. From this elevation one gets an excellent view of the forest which extends in all directions with scarcely any interruption. Some of the trees could be recognized by their height, others by the shape of their crowns, while *Tecoma* and *Erythrina* stood out of the maze of green because of the brilliant color of their flowers. We found along the edge of this granite formation a species of *Turnera*, a slender shrub with yellow flowers, and another stouter shrub, *Miconia*, its rounded crown bearing fragrant, white flowers.

As we continued our journey the terrain became undulating, with a gradual rise in elevation. The path leads through a high forest, in which predominate the Cojón (*Chrysophyllum?*), one of the tallest trees in the Caura; Merrey Montañero (*Anacardium Rhinocarpus* DC.), almost equalling the former in height but not in diameter; Anime or Caraño (*Protium*), its dehiscent purplish fruit containing a white, edible pulp and the bark exuding an aromatic balsamic fluid; Chacaranda, with a heavy, durable wood which suggests Bignoniaceae; and a species of *Inga* with a long, twisted pod and its seeds imbedded in a sweet pulp. The understory is composed of several species of *Brownea* and such violaceous trees as *Amphirrhox latifolia* Mart. and *Rinorea riana* (DC.) O.Ktze. Where there are clearings one finds small stands of Casupo (*Ischnosiphon*), with slender stems up to 2 m. high, crowned with long-stalked leaves, at the base of which appear the delicate white flowers. The Maquiritare Indians plait the split stems into baskets of artistic design. In shaded areas, along the rocky banks of streams, flourish several species of ferns,



including a tree-fern (*Alsophila*); a *Carludovica*, about a meter high with white flowers; and a slender shrub (*Acalypha*), its diminutive pinkish male flowers arranged in axillary spikes. The most unusual specimen found here was a medium-sized tree, known among the Maquiritares as Guajuna. Its floral parts are densely covered with a dark brown pubescence and, though the wood structure suggests Bombacaceae, its taxonomic characters are at variance with those of this family.

Within three hours after leaving the beach we arrived at a temporary camp established on the right bank of the river immediately above the falls. A short distance farther up, a large wooded island divides the river into two main channels, while the water falls over five distinct cascades, all on the same altitude and with an average height of 70 m. The steep rocks between these cataracts, constantly bathed by mist rising from the deep pool, support small trees, shrubs, a few orchids, and some ferns. The Copey (*Clusia*) grows on exposed rocks along the margin; its trunk is usually twisted and the leathery capsule splits open at maturity, the segments radiating like the points of a star. Along the river bank are found Howi (*Cowellocassia racemosa* [Mill.] Pitt.) and a *Trigonía*, whose wood exhibits many of the characters of the Proteaceae. The most frequent herb is *Biophytum cassiquiarensis* Knuth. The Platanillo (*Heliconia*) appears in open patches in the forest and at times forms all but impenetrable thickets. The natives consider the leaves the best material for roofing temporary shelters. The families best represented by climbers are Bignoniaceae, Curcubitaceae, Malpighiaceae, and Passifloraceae.

Proceeding downstream, we found the large rocks in mid-stream inhabited by a species of *Apinagia*, a small plant with lustrous black seeds. Along the pebbly beach flourish a number of arborescent species, particularly of *Connarus*, *Faramea*, *Hirtella*, *Mabea*, *Myrcia*, *Ouratea*, and *Zygia*. The banks are low and during the flood period are completely submerged. The most conspicuous trees here are Matapalo (*Ficus*) and a combretaceous species (*Terminalia*) with its leaves congregated at the tip of the twigs and its small, yellow flowers in

terminal spikes. The forest becomes denser and taller farther in, and some of the more prominent trees are species of *Paratecoma* and *Peltogyne*. In the more elevated areas palms are especially common, particularly Seje, Manaca, and Yagua. Shaded and fairly humid patches are preferred by the Guatoso (*Gustavia angusta* L.), a small or medium-sized tree notable for its large, handsome flowers.

In view of the almost insurmountable difficulties of travel beyond Para and the scarcity of provisions, it was decided to continue the exploration of the region between the falls and the estuary of the Caura, making frequent trips into the forests as we proceeded downstream. Many trees were now in flower, especially the Laurels, Guarataro or Mano de Danta (*Sterculia pruriens* Schum.), Patatillo (*Cupania*), and Palo de Cruz (*Brownea grandiceps* Jacq.). The last is a small tree, with smooth, green trunk, imparipinnate leaves, and long-acuminate leaflets in 5 to 15 pairs. Its handsome carmine-colored flowers open in consecutive whorls from the periphery to the center and thus form what appears like a brilliant bouquet. Its local name (Palo de Cruz) is derived from the fact that its heartwood sometimes bears the form of a cross. The most interesting tree found in the middle Caura was the Manteca de Agua, which Pittier recently described as new under the name *Elvasia caurensis*. Although of small stature it is readily distinguished in March by the profusion of yellow flowers arranged in terminal racemes. It occurs in rocky places close to the water as well as on high banks, and its distribution extends from the rapids of La Mura to the mouth of the Nichare. Here, also, we discovered a rather rare climber, *Hippocratea crinita* Pitt., with persistent coriaceous leaves, numerous long filaments of a greenish color, and a large, bivalved, much depressed capsule.

*La Prisión*.—Towards the end of March we reached La Prisión, where Eugène André, author of *A naturalist in the Guiana*, established his headquarters on his first visit to the Caura in 1897-98. Between the river and the small village extends a narrow belt of low forest which is completely inundated during the wet season. It is composed in the main of species of *Gustavia*, *Brownea*, *Tabernaemontana*, and *Inga*,



all furnished with wide-spreading crowns and short, twisted trunks. Along the margin of this humid area, beyond reach of floods, grows the Putí (*Jacaranda superba* Pitt.), a handsome tree sometimes 30 m. high. Its moderately small, sub-rounded or almost flat crown is covered in March with a gorgeous mass of blue flowers of a pale purplish tint. Its fruit is a flat, orbicular capsule, maturing in late April or early May. The Malaguete (*Xylopia*) grows in the same type of soil; it attains a height of 22 m. and has a cylindrical, erect trunk. Open areas, especially well-drained slopes, are inhabited by the Algarrobo (*Hymenaea Courbaril* L.), a large tree with a rounded, moderately erect trunk, a meter or more in diameter, without buttresses and clear of limbs for at least 25 m.

As a local source of food the most important cultivated crops are maize, rice, and cassava. The agricultural methods practiced here are the same as those followed in most tropical American countries where there is abundance of virgin forest. During the dry season the natives choose a slope in the heart of the forest and make a clearing, *conuco*, by felling the trees. The vegetation is allowed to dry as much as possible, the tree trunks are piled, and the area then burned over. Corn or rice is planted between the stumps, but the soil is not tilled and the only care taken is to keep the crop free from invading weeds. These clearings produce only two or three crops, for the ground is quickly exhausted and new land has to be prepared for planting. Soon there appears in the abandoned patches a new formation of herbs and subligneous plants, followed by colonies of Yagrumo (*Cecropia*), Anisillo (*Piper*), Guayabo (*Psidium*), and other components of secondary growth.

To the north and east of the village the terrain is undulating and covered with dense forest. This is the type of ground preferred by the Cereipo (*Myrospermum frutescens* Jacq.); although said to have been common at one time, it is now difficult to find a single sizable tree. Its heavy, durable wood is utilized for such purposes as house posts and mortars for crushing corn and rice. One of the tallest members of this forest is the Misionero, often 40 m. high, with a perfectly straight, cylindrical bole, clear of limbs for three-fourths the entire height, but seldom exceeding a meter in diameter. It is

common along the river banks, but attains its best development on the crests of small hills. Another interesting tree, characteristic of this forest, is the moraceous Canalete or Canjelón. The trunk is always fluted for almost its entire length and the light-colored wood is much used for ax handles, oars, and paddles.

To the south extends a high forest inundated during the rainy season. Although many of the trees are the same as those found on the hillocks, these flat, humid areas are also favored by certain species not found elsewhere. Their height ranges between 25 and 30 m., and the well-formed trunks are straight, seldom more than 50 cm. in diameter, and support wide-spreading crowns. Typical of these are Guaray (*Hirtella*); Algodoncillo, a malvaceous tree, with pale yellow flowers, and a light-colored sapwood well demarcated from the heavy, dark brown heart; and the leguminous Barbasquillo, with a large, dehiscent, bivalved pod of a bluish color when mature and containing two or three large, rounded, flattened, light brown seeds. The banks of streams are inhabited by such palms as Cola de Pescado, Manaca, and the smaller, armed Cubaro. The Myristicaceae are represented by the Cuajo (*Virola surinamensis* [Rol.] Warb.), its dark brown seeds veiled by a pinkish red aril, rich in oil, which burns with a yellow flame and emits a sulphury odor. Another tree of the same family is *Iryanthera Hostmannii* (Benth.) Warb., its local name Sangrito alluding to the red sap exuding from the incised bark. Mention should also be made of a species of *Tabernaemontana*, a medium-sized tree with a pale yellowish wood.

Beyond this forest lies the Cerro de La Prisión, composed of a series of dark gray granitic formations. These large exposed rocks are of singular interest in that the scanty vegetation they support is entirely different from that of the surrounding forest. In shallow holes, where water and decayed plant material accumulate, there are terrestrial orchids, especially the Cebolleta (*Epidendrum*), with mottled yellow flowers. The most prominent of the arborescent species inhabiting the exposed crests, is the Escobillo or Guarataro (*Vitex capitata* Vahl). Its low, broad crown bears a profusion



of pale blue flowers in stalked panicles in March. Along the margin flourishes the bombacaceous Almácigo or Pellejo de Indio, also known among the Maquiritares as Sidima. This deciduous tree seldom exceeds 8 m. in height and is distinguished by its rounded trunk and especially by the reddish bark which peels off in small, curled papery layers and exposes the bright green part beneath. Its trunk provides support for the vanilla vine, with whitish flowers which appear but rarely, and long, fragrant, brown pods. Alongside of this, and almost with the same abundance, grows the Quino Blanco (*Cusparia*), but its smooth, thin bark does not have the bitter taste characteristic of Cuspa (*Cusparia trifoliata* [Willd.] Engl.), the base of Angostura bitters. Other trees characteristic of the *lajas* are *Spondias Mombin* L., *Clitoria arborescens* Ait., a species of *Coccolospermum* of smaller dimensions than *C. orinocense* Steud., and an *Aspidosperma* with a bright yellow wood.

Beyond these rocks extends a high, flood-free forest. One of the commonest and tallest trees here is *Sclerolobium chryso-phyllum* Poepp. & Endl., now reported for the first time in Venezuelan territory. It grows to a height of 30 m. and at the time of our visit the broad, umbrella-shaped crown was covered with yellow flowers. Its vernacular names are San Francisco Negro and Guamo Colorado.

We left La Prisión at the beginning of April to continue our investigations farther north. At least two species of *Inga* form a continuous curtain along the water's edge. Open, rocky areas are inhabited by Chaparro de Agua (*Symmeria paniculata* Benth.), while clearings along the margin of large islands are preferred by Clavelino (*Jacaranda filicifolia* D. Don), readily recognized by its bright blue flowers. Where the vegetation is dense and tall one finds the Candelero (*Toulicia guianensis* Aubl.), up to 25 m. high, with small, yellowish flowers in large terminal panicles. Guayabito, a myrtaceous shrub, is particularly common on open rocks extending as far as midriver. High, steep banks are favored by the Paraguatán (*Sickingia*), a straggly tree up to 6 or 7 m. high, its wood whitish when fresh, but soon turning to a bright pink on exposure to sunlight; its flowers are said to be rose-colored and

highly fragrant. Open areas, especially near abodes, are often occupied by Cañafístola (*Cassia leiandra* Benth.), a medium-sized, armed tree with yellow flowers arranged in lax, pendant racemes; the cylindrical, dark brown pods are upwards of 30 cm. in length.

*El Temblador*.—Within two hours we reached El Temblador, where there is located the oldest tonka-bean plantation in the Caura valley. Around the house there is cultivated the soft-wooded Amapola (*Plumeria*). Its trunk and few slender branches are covered with a smooth, greenish gray bark which exudes a caustic poisonous latex, but the white petals are used in preparing a delectable conserve. Guácimo (*Guazuma ulmifolia* Lam.) grows in the clearings and supplies a tough bark utilized for cordage and a mucilaginous sap used for clarifying syrup in the manufacture of sugar. Areas formerly cultivated are also favored by the Gregorito or Cazabe (*Neea*), a medium-sized tree whose wood is employed for cooperage and rough carpentry.

It has been generally believed that the tonka beans of commerce were derived from *Dipteryx odorata* (Aubl.) Willd., but as a result of our expedition it has been ascertained that this product is obtained from other species also. In the Caura two species are distinguished, namely Sarrapio Real (*Dipteryx punctata* [Blake] Amshoff = *Coumarouna punctata* Blake) and Sarrapio Mono (*Dipteryx rosea* Spruce). When cultivated in the open the Sarrapio Real seldom exceeds a height of 10 or 12 m. and has a full, rounded crown with dark green foliage. The trunk is short, approximately 50 cm. in diameter, and has a light-colored bark. The fragrant flowers, of lavender color, appear from the middle of April until the end of May, while the fruit attains maturity during February to April. Under similar conditions the Sarrapio Mono attains about the same height, but the crown is more open and the branches more slender. In the forest it is much taller, up to 25 m. or more, with a long, slender trunk, smooth light gray bark, and a small crown. The fruit of Sarrapio Real emits a fragrance suggestive of new-mown hay, whereas that of Sarrapio Mono is unscented.

A short distance beyond El Temblador the trail divides, one



branch turning south to La Prisión and the other north to Aripao, Maripa, and beyond. On both sides are dense thickets composed of *Trema micrantha* Blume, *Simaba cedron* Planch., and species of *Casearia*, *Clidemia*, *Hirtella*, *Myriocarpa*, and *Palicourea*. Small patches of open rocks are inhabited by *Habillo* (*Hura crepitans* L.), a species of *Bombacopsis*, and *Guaritoto* (*Jatropha*), the last a lactiferous plant with stinging hairs which, on contact with the skin, produce a painful inflammation.

On the northern path we soon came to a large lagoon which dries up almost completely during the summer months. The most characteristic tree along its margin is the Coco de Mono (*Jugastrum*), with large pendant fruits containing numerous, closely-packed, chestnut-brown seeds. There is also a species of *Ouratea*, which, though less abundant, is rather showy on account of its bright yellow flowers. The Euphorbiaceae are represented by a tall shrub *Reventillo* (*Mabea*), with a reddish brown, dehiscent, trisulcate capsule.

Between this lagoon and the main stream is a belt of medium high, moderately dense forest subject to seasonal floods. The most typical tree here, as well as the most important from an economic standpoint, is the lauraceous *Sasfras* which suggests *Acrodiclidium*. Its wood is used almost exclusively for the construction of launches, and a clear yellow oil, extracted from the trunk, is utilized as an illuminant and in local medicine. Other trees forming the upper story include members of Annonaceae, Guttiferae, and Sapindaceae, while in the undergrowth are *Catbedra caurensis* Pitt., a small twisted tree with minute white flowers, and species of *Jussiaea*, *Solanum*, *Miconia*, and *Piper*.

#### LOWER CAURA

In the middle of April we moved farther north to Guayapo, long considered as an important tonka-bean collecting center in the Caura. The vegetation of this territory may be divided into two major belts—that of the plains or savannas and that of the surrounding mountain ranges. The first of these possesses a more varied flora, but this depends to a certain degree upon the soil and geological conditions. Considering

primarily the riparian vegetation, it is noted that *Chigo* (*Campsiandra comosa* Benth.) inhabits the exposed rocks. Here, also, we found in considerable abundance the Toco (*Crataeva gynandra* L.), a small tree with ternate leaflets and an ovoid, mucronate fruit. High, steep banks are preferred by Pico de Guaro (*Conarus venezuelensis* Baill.) and Carrasposo (*Swartzia*).

*Rebalse*.—Running parallel with the river and varying in width from 1 to 2 kilometers, is a belt of tall forest which is inundated every year at high water. This is known locally as *rebalse* and corresponds to the type known in the Brazilian hylaea as *varzea*. The subsoil, formed of sediment carried by the floods, is covered with a grayish layer rich in humus. At first sight the vegetation appears to be intricate, but in reality the greater part is composed of a variety of tall trees with narrow crowns and large, but much twisted and often fluted, trunks. The high limbs support a wide assortment of orchids, but terrestrial species of these, as well as of ferns and grasses, are almost completely absent.

The arborescent species considered typical of this formation is the Brasil, a leguminous tree up to 30 m. high, and a meter in diameter, with a thin bark which exudes a small quantity of dark red resin. The Rosaceae are represented by several species of *Couepia*, known in the vernacular as Querebero. Smaller trees include *Symmeria paniculata* Benth., *Gustavia angusta* L., *Inga marginata* Willd., *Ouratea caracasana* (Planch.) Engl., *Rudgea cornifolia* (H. & B.) Standl., *Heisteria guayanensis* Engler, and species of *Annona*, *Guarea*, *Cupania*, *Olmedia*, *Jugastrum*, *Sickingia*, *Zantboxylum*, and *Casearia*.

*Transition Forest*.—The transition from rebalse to the savanna is not abrupt. On the contrary, there is a zone of undulating land not subject to inundations and covered with a dense forest which gradually diminishes in height as it approaches the margin of the savanna. The trees constituting this formation are smaller but more symmetrical than those of the rebalse. Their crowns are generally broad, while the trunks are erect, cylindrical, and usually furnished with small buttresses. Characteristic of these are *Jacaranda superba* Pitt., *Peltogyne*, *Abarema avaremotemo* (Mart.) Pitt., *Vitex*



*capitata* Vahl, *Sterculia excelsa* Mart., *Chamaesenna racemosa* (Mill.) Pitt., *Ouratea surinamensis* (Planch.) Wehl., *Apeiba tibourbou* Aubl., *Tapirira guianensis* Aubl., *Bellucia grossularioides* Triana, and species of *Matayba*, *Cupania*, *Hirtella*, *Protium*, and *Vismia*.

*Savanna*.—One of the most interesting excursions made in the lower Caura was across the plains to the Sipao River. Proceeding westward, the savanna is not uniform in its aspect or in the vegetation that covers the sandy or pebbly surface. The subsoil is a compact layer which may be considered as a conglomeration of quartz. Consequently, the soil dries out rapidly and does not permit the development of an exuberant growth. The dominant plants are low, hardy, xerophytic herbs, along with shrubs and small, twisted trees, particularly of the families Anacardiaceae, Dilleniaceae, Flacourtiaceae, Leguminosae, Malpighiaceae, and Myrtaceae. The principal woody plants are *Byrsonima crassifolia* H.B.K., *Curatella americana* L., *Bowdichia virgilioides* H.B.K., *Palicourea rigida* H.B.K., and species of *Casearia*, *Psidium*, and *Anacardium*. Exposed to intense heat on the open summits of hillocks are small islands of shrubs and stunted trees such as *Xylopia aromatica* (Lam.) Mart., *Tapirira guianensis* Aubl., and *Piptadenia peregrina* Benth.; also a palm, the Coroba (*Jessenia*), with long fronds and a yellowish fruit containing edible pulp.

*Gallery Forests*.—The vegetation of the savanna is not limited to herbs, shrubs, and dwarfed trees. At intervals, mostly along watercourses, are long stretches of woodland usually about 200 meters wide, though in favorable areas, as along the banks of the Sipao River, they expand considerably and reach the foot of the mountains.

Many of the trees of these gallery forests furnish timber of excellent quality and others are economically important sources of gums, resins, or medicinal bark. Congrio (*Swartzia*) grows along the margin and sometimes forms small stands. Open, well-drained slopes are favored by Peonía (*Ormosia*), distinguished by its smooth, scarlet and partly black seeds. In low, slightly humid areas we found the Caujaro or Alatrique (*Cordia*), Caruto (*Genipa*), Guanábano Cimarrón

(*Annona*), Toronjillo (*Palicourea*), Simaruba (*Simaruba amara* Aubl.), and a species of *Toovomita*. In the center of the forest the undergrowth is almost impenetrable. Many of the trees attain a height of 25 to 35 m. and have straight, cylindrical trunks, upward of a meter in diameter, supporting a broad, dense crown with persistent, dark green foliage. From a commercial standpoint the most important species is Purguo (*Manilkara*), the source of the balata of commerce. Other prominent trees are Cuajo (*Virola surinamensis* [Rol.] Warb.), Aceite (*Copaifera pubiflora* Benth.), Araguaney (*Tecoma*), Cascarare (*Lecythis*), Guaray (*Hirtella*), Majaguillo (*Guatteria*), Malagueta (*Xylopia*), Coquito (*Eschweilera*), Pilon (*Andira*), Bosua (*Zanthoxylum*), Copito de Cerro (*Talisia*), and Matapalo (*Ficus*).

After passing several stretches of these gallery forests, we entered a broad savanna which extended from Las Culatas and La Aurora, at the estuary of the Caura, as far west as Cuchivero. The ground becomes more rolling, large granitic boulders are frequent, and the vegetation is dominated by the graceful Moriche palm (*Mauritia flexuosa* L.f.). These extensions provide good pasturage. During the wet season the fertile lands along banks of streams or in depressions are completely inundated, but the receding waters are followed by a lush growth of grasses and sedges which remains green throughout the dry period. Winter pasture is found on the crests of hillocks away from the watercourses and thus clear of seasonal floods. The savannas are covered with fresh vegetation during the rainy months, but it soon dries up when the rains cease.

The most common trees in the periodically inundated areas are *Fugastrum Sifontesii* Pitt. and the Arepito (*Macrobium discolor* Benth.). The natives living in these savannas usually cultivate one or two Serrapio trees for the fruit, while for ornamental purposes they prefer the Retama (*Thevetia*), a small lactiferous tree, with linear, glabrous leaves, yellow flowers, and a fleshy drupe.

*Sarrapiales*.—Upon our return from the Sipao we undertook another excursion to the forest covering the slopes of the Sierra Guayapo. After traversing a belt of rebalse, followed



by savanna, we arrived at the edge of a high forest, exceedingly rich in the variety of trees, such as *Pourouma guayanensis* Aubl., *Protium insigne* Engl. and *P. guianense* Mart., *Hymenaea Courbaril* L., *Enterolobium cyclocarpum* Griseb., *Couma caurensis* Pitt., *Sterculia excelsa* Mart., and *Macrolobium acaciaefolium* Benth. There is a gradual rise in the elevation to the foot of the range, and this is accompanied by a corresponding change in the forest composition. On the margin of a small stream we came across a species of *Cedrela*, with a soft, pale pinkish wood of light weight, and on small, rounded hills, in fairly open growth, we found the Uverillo or Mulato (*Sloanea macrophylla* Spruce, *vel aff.*), its woody capsule covered with numerous long bristles and the gray seeds enveloped in a scarlet aril. Other common trees in this type of terrain are species of *Talisia*, *Terminalia*, *Matayba*, and *Annona*, with an undergrowth containing Pata de Grulla (*Rinorea guayanensis* [Aubl.] Pitt.) and the Sajarito Montanero (*Randia*), an armed shrub with fragrant, white flowers.

Small patches of open rocks are inhabited by *Spondias Mombin* L., *Bombacopsis*, and *Bombax*, all medium-sized, deciduous trees. Open rocky slopes are favored by Cartán (*Centrolobium orinocense* Pitt.), also known in other parts of Venezuela as Balaústre, which forms pure stands of appreciable extent. It is a deciduous tree, 25 m. or more tall, with a round trunk clear of limbs for at least half the entire length. Its wood is considered among the handsomest of tropical American species.

The summit of the range is the zone of the tonka bean (*Dipteryx*), regarded, from an economical standpoint, as the most important forest product of the Caura. The tree is handsome, often 30 m. high, easily distinguished from its associates by the smooth, yellowish bark and lustrous dark green foliage. It attains its best development in sandy soil. It does not form pure stands but is sometimes so abundant that the natives refer to such areas as *sarrapiales*. The regions considered the most fruitful are the ridges of Guayapo, Suapure, Hilaria, Monte Oscuro, Chiveta, and El Manteco, all in the lower Caura. Other important regions are the forests of the middle Caura, between the rapids of La Mura

and the mouth of the Nichare, in addition to the high ranges of the upper Orinoco.

Many other trees in this formation attain immense size, some of them reaching up to 40 m. These include *Virola surinamensis* (Rol.) Warb., which seems to favor the bottoms of depressions; *Hura crepitans* L.; an unidentified tree known as Gateado, with smooth, gray bark and a heavy, pale yellowish wood; Acapro (*Tecoma*); and a species of *Aspidosperma*, bearing the local name Vera. In open rocky areas we found a species of *Cecropia* and the Cuspa Amarilla (*Cusparia*), a small, straggly tree with a heavy, light-colored wood. Tall climbers, such as the Orosul (*Ibatia*), Guaco Real Morado (*Aristolochia*), and Zarzaparrilla (*Smilax*), are also common.

*Savanna of Maripa*.—Towards the end of April we crossed the Caura a short distance above its estuary. Unlike the undulating savanna between the Caura and Sipao, that of Maripa is completely flat; it extends to the southeast as far as the Cerro Juan Rivas and to the northeast beyond Purguey. A trail leads south past Aripao, Las Trincheras, and terminates at La Prisión. In parts the savanna is open, in others grown up with mixed or nearly pure stands of Chaparro (*Curatella americana* H.B.K.), Alcornoque (*Bowdichia virgilioides* H.B.K.), or Congrio (*Swartzia*). Herbaceous vegetation resembles that of the opposite side of the Caura and consists of species of *Eriosema*, *Mimosa*, *Chamaecrista*, *Clitoria*, *Galactia*, *Ichthyothere*, *Eupatorium*, *Pavonia*, *Borreria*, *Ipomoea*, *Buchnera*, *Evolvulus*, *Polygala*, and *Ruellia*. Cyperaceae are represented by *Bulbostylis paradoxa* (Spreng.) Kunth. and a species of *Eleocharis*. Along the margins of streams there are small stretches of woodland similar to the gallery forests already described. Within three hours we reached the Urbana River and the edge of a dense forest of tall trees, whose dimensions contrast with the species scattered over the savanna. One of the most characteristic species of this forest is *Copaifera pubiflora* Benth., esteemed for the oil tapped from its trunk and which, at one time, formed an article of export from Ciudad Bolívar.

Traveling in the opposite direction, towards Purguey, the savanna continues to be free of woody species, except such



low shrubs as Tortolito (*Casearia*). A fresh breeze blows almost constantly from the northeast. The soil appears to be poor in nutritive substances and supports a meager herbaceous vegetation composed of many of the genera already cited, in addition to a few terrestrial orchids. The rain water filters rapidly through the sandy top soil and reappears in small streams, with slow current, or in boggy areas. Along their margins flourish grasses and sedges, almost always bright green and providing abundant pasture. But the most distinctive member of these humid patches is the Moriche (*Mauritia flexuosa* L.f.). This handsome palm forms small stands, or at times extends in long belts, technically known as *morichales*. As in the days of the Carib Indians, the Moriche continues to play an important part in the economic life of the natives. Its leaves are utilized almost exclusively for roofing, the fiber of the young leaves is woven into *chinchorros* (hammocks), and the pulp of the fruit serves to prepare a conserve. Another palm common in this region is the Macanilla (*Bactris*), although it seldom forms stands equal in extent to the morichales.

Within four hours we reached San Pedro, at one time an important settlement of Carib Indians. In addition to a *Dalbergia*, which the natives claim to be efficient as a fish-poison, one of the most common plants collected here was Icaico (*Chrysobalanus icaco* L.), a small shrub with coriaceous leaves, yellowish flowers, and an ovoid fruit which is edible, although not of particularly pleasing flavor. Within the last two years efforts have been made, and with some success, to cultivate Sarrapio trees. A short distance to the east flows the River Tauca, flanked by a low, fairly open forest. Beyond this stream are small rolling savannas, with stands of *Swartzia*. These open areas are interrupted by narrow stretches of deciduous forest, in which are found the Cruceto Real (*Strychnos*) and a small myrtaceous tree, Guayabo Montañero, with smooth trunk and a heavy, light-colored, fine-textured wood.

At the end of April we began the return trip to Ciudad Bolívar, thence over the Llanos by way of San Tomé to Barcelona and along the coast to Caracas.

## NOTES ON THE WALLABA TREES

(EPERUA AUBL.)

By ADOLPHO DUCKE

*Jardim Botânico do Rio de Janeiro*

The trees of the genus *Eperua* occupy an important place in the northeastern quarter of the South American equatorial hylaea, which includes the three Guianas, the northern half of the Brazilian State of Pará, and the northeastern quarter of the Brazilian State of Amazonas, as well as the neighboring parts of Venezuela and Colombia. The northern frontier of this geographical area lies in British Guiana not far from the Atlantic, the western one probably crosses the Colombian Uaupés and the Guaviare; the easternmost locality hitherto known is the mouth of the Rio Pará; southward, two species reach Borba on the Lower Madeira (about 4° S). Of the eleven species actually known, eight are trees of medium size, two are large, often over 30 m. high, and one, growing in open campina, is a humble treelet.

The *Eperuas* are of economic importance in British Guiana as some species furnish large quantities of timber noted for its durability in muddy soil; in the other countries where the genus occurs, the wood is very little used, hence the name in the international timber trade is the British Guiana native name Wallaba. The Brazilian vernacular names vary not only according to the species, but also for the same species in different localities. In British Guiana, the Wallabas are also of interest to the ecologist studying the various types of forest.<sup>1</sup> Three of the Brazilian species are remarkable for the beauty of their flowers, and one species furnishes a sort of balsam used in making varnish and paint.

The type specimens of the species I have hitherto described are preserved in the herbarium of the Jardim Botânico do Rio de Janeiro. Cotypes have been largely distributed to the principal botanical institutions of America and Europe. Wood

<sup>1</sup> See "The Wallabas of British Guiana," by J. B. Aitken in *Tropical Woods* 23: 1-5 (1930), and "Contributions to the flora of Tropical America. VII," by N. Y. Sandwith in *Kew Bulletin* 7: 364-366 (1931).



samples with herbarium material of five species have been sent to Yale University School of Forestry.

*Eperua oleifera*, *E. campestris*, *E. bijuga*, and *E. purpurea* are cultivated in the Jardim Botânico do Rio de Janeiro, the trees being four to six years old. The plants of *E. oleifera* are vigorous, but the others are making very slow growth.

Some *Eperua* species constitute the dominant elements among the forest trees of certain areas, principally *E. falcata* in the "Wallaba forest" of British Guiana's ecologists. *E. rubiginosa*, *E. grandiflora*, and *E. Jenmani* appear in analogous conditions in that Colony, according to the work of the botanists of the Oxford Expedition. *E. bijuga* var. *glabriflora* predominates around Manáos in many places with moist acid soil of white sand and black humus; the shrubby *E. campestris* in the same soil in a *campina* near Borba. In the Upper Rio Negro region, two species (*E. purpurea* and *E. leucantha*) furnish the most showy floristic element of the higher *catanga* association. *E. Schomburgkiana* grows less frequently along the marshy shores of small forest rivers or streamlets. *E. oleifera* occurs as single individuals in the high upland rain forest.

#### Synoptical Key to the species

Inflorescence very long (1 m. or more), pendulous. Ovary tomentous. Stipules never large. Leaflets 2-3-jugate.

Five stamens fertile, 5 anatherous; filaments densely villous at their base. Inflorescence with finely adpressed pale-brownish subsericeous hairs. "The flowers vary in color from deep rose to greenish white" (Sandwith, *l.c.*)..... 1. *E. falcata* Aubl.

Stamens (10) all fertile, glabrous or with a few hairs on their connate base. Inflorescence covered with a dense, rust-colored, scurfy wool. Petal deep red..... 2. *E. rubiginosa* Miq.

Inflorescence covered with a thin pale grayish subsericeous tomentum. Petal white..... 3. *E. leucantha* Benth.

Inflorescence very short, not pendulous.

Base of stamens forming a very short tube. Ovary glabrous. Leaflets 2-4-jugate.

Filaments densely villous at their base. Stipules never large.

Inflorescence perfectly glabrous. Five stamens perfect, the others sterile, with small anthers or anatherous. Petal purplish crimson.

4. *E. purpurea* Benth.

Inflorescence covered with short and dense pale-brownish pubescence. All stamens apparently fertile, but the five shorter ones with smaller anthers.

Bracteoles persistent until anthesis. Petal purplish crimson. Humble *campina* tree or shrub..... 5. *E. campestris* Ducke.

Bracteoles deciduous before anthesis. Petal very pale lilac. Large forest tree..... 6. *E. oleifera* Ducke.

Filaments glabrous or finely pubescent or hirtellous, never villous. All anthers fertile, large. Stipules often conspicuous. Petal purplish crimson or rose. Inflorescence thinly covered or subglabrous.

Leaflets up to 75 mm. long and up to 40 mm. broad; smooth above, foveolate beneath; nervures obsolete. Pedicel 5 mm.; sepals 9 mm. long; petal 25 mm. long, 30 mm. broad. Not seen..... 7. *E. kourouensis* R. Ben.

Leaflets and flowers much larger than in preceding species. Leaflets not foveolate beneath.

Inflorescence very finely hirtellous. Leaflets 3-4-jugate; reticulate on both sides.

"Stipules small and inconspicuous, 2-5 mm. long, up to 3 mm. broad; bracteoles inserted close to the calyx, normally above the middle of the pedicel; petal rather small, rarely up to 50 mm. long" (Sandwith, *l.c.*)..... 8. *E. grandiflora* (Aubl.) Benth.

"Stipules large and conspicuous, usually 7-20 mm. long and up to 15 mm. broad; bracteoles distant from the calyx, normally below the middle of the pedicel or at its base; petal large, 45-85 mm. long (usually 60-80 mm.)" (Sandwith, *l.c.*) Not seen 9. *E. Jenmani* Oliv.

Inflorescence thinly ferruginous-pubescent or subglabrous. Leaflets almost constantly 2-jugate, rarely 3-jugate; rather obsoletely reticulated, often nearly smooth above. Petal 50-70 mm. long and broad. Stipules small and soon deciduous, only in young plants large and more persistent..... 10. *E. bijuga* Mart. ex Benth.

Base of stamens forming a rather long tube covered with a short pale brown rather detergent wool. All stamens with perfect anthers. Ovary pubescent. Petal white, not over 35 mm. long. Leaflets up to 6-jugate; reticulated on both sides. Inflorescence densely grayish or ferruginous tomentose. Stipules large and rather persistent..... 11. *E. Schomburgkiana* Benth.

1. *EPERUA FALCATA* Aubl.—The best known of the Guiana species of the genus, and the principal source of the famous Wallaba timber of British Guiana. Frequent in the three Guianas, but apparently not in the southern parts of these colonies; not known to occur in Brazil, although, through con-



fusion with the allied species *E. rubiginosa*, cited mistakenly by Huber and by myself for the northern part of the State of Pará. Herbarium specimens examined: Moraballi Creek near Bartica, Br. Guiana, Sandwith Oxford Expedition 137 and 329, determ. N. Y. Sandwith.

2. *EPERUA RUBIGINOSA* Miq.—This species has sometimes been confounded with *E. falcata*. Its geographical area also comprehends the three Guianas, although apparently not extending so far north (perhaps not including the northern part of Br. Guiana) but reaching farther south to the extreme north of the State of Pará, Brazil. Herbarium specimens examined: Surinam river, Dutch Guiana, Tresling 334, determ. A. Pulle. State of Pará, Brazil: Rio Counany, E. Goeldi, Herb. Amaz. Mus. Pará 1158; Rio Mapuera (tributary of Rio Trombetas), above the Escola rapids on the rocky shores, Ducke Herb. Amaz. Mus. Pará 9022. Brazilian vernacular names: Apá or Apazeiro (Counany); Espadeira (Rio Mapuera).

3. *EPERUA LEUCANTHA* Benth.—A handsome small or scarcely medium-sized tree, confined exclusively to the higher catinga-woods<sup>1</sup> of the upper Rio Negro basin where it is one of the most characteristic elements of the flora and dominant in many places. I observed it along the Rio Negro from the rapids of Massaraby (Brazilian State of Amazonas) upward to the neighboring regions of Venezuela and Colombia, including the Uaupés and the other tributaries. Herbarium specimens examined: Iucabí above the mouth of the Curicuriary, Ducke Herb. Jard. Bot. Rio de Janeiro 23289; São Gabriel, Ducke H.J.B.R. 23732, with wood sample 164 (Yale 22624). Brazilian vernacular name: Yauácano.

4. *EPERUA PURPUREA* Benth.—This is perhaps the finest of all the species of this lovely genus, for it is a tall tree (20–35 m.) whose crown rises above those of the other catinga trees and whose beautiful flowers cover the summit of the crown. In normal years the flowering season extends from September

<sup>1</sup> Very well described by R. Spruce, *Notes of a Botanist on the Amazon and Andes*. The evergreen Amazonian catingas should not be confused with the dry deciduous-leaved catingas of northeastern Brazil.

to November, and certain hill regions where the species is plentiful offer the marvelous aspects of the bright green of the young foliage alternating with the rose-purple of the tree tops whose color is so intense that Indians say "no man must look at them, as it is bad for the eyes."

*Eperua purpurea* is highly characteristic of the Upper Rio Negro (from Santa Izabel upwards) and its tributaries in Brazil, Venezuela, and Colombia. It grows in the higher catinga as well as in moist places of the upland rain forest. The first trees appear at the rapids of Santa Izabel. Herbarium material examined: Panuré (now Ipanoré), Rio Uaupés, Spruce 2577; Iucabí, Ducke H.J.B.R. 23288; Rio Curicuriary, Ducke 52, with wood sample (Yale 20996). Brazilian vernacular names: Yébaro, seldom Copahiba-rana.

5. *Eperua campestris* Ducke, sp. nov. = *E. oleifera*, var. *campestris* Ducke 1932.—A specie affini *E. oleifera* differt statura humili, foliolis rigidioribus distinctius prominenti-reticulatis, bracteolis sub calice usque ad anthesin persistentibus, petalo pulchre roseo-purpureo saepe ad 50 mm. lato, legumine vix ad 100 mm. longo.

Borba, Rio Madeira in civitate Amazonas, frequens inter fruticeta in campo aperto arenoso et humoso, 17–1–1930 leg. A. Ducke H.J.B.R. 23291, 9–11–1935 Ducke 73. Nomen vulgare: Copahiba-rana (= Copahiba spuria).

I first described this plant as a variety of *Eperua oleifera*, but careful observations in the field induced me afterwards to separate it under specific range. I have since that time repeatedly encountered both plants in considerable numbers but have never observed transitions between them. The species has not been found hitherto except in the "Campo Grande" near Borba, where it is frequent and constitutes, when flowering, a great ornament of the locality.

6. *EPERUA OLEIFERA* Ducke 1932.—A large forest tree with the aspect of a *Copaifera* (but with large flowers of a very pale lilac color), which often exceeds the biggest trees of *E. purpurea* in size. The species is closely allied to *E. campestris*, but the differential characters of the two are constant in the numerous individuals I have studied. The stems of *E. oleifera* furnish a resinous oil or balsam, "jacaré-copahiba," employed



in Brazilian Amazonia in making paints and varnishes. This species, unlike most of the other members of this genus, always occurs as isolated individuals. It grows in the upland rain forest between Parintins (Lake José-Assú) and the Lower Madeira, in the Brazilian State of Amazonas, mainly at the margin of streamlets or moist depressions with more argilous than silicious soil. Herbarium specimens examined: Borba, Lower Madeira, Ducke H.J.B.R. 23290 and Ducke 213, with wood sample 235 (Yale 31962); Maués Lago Massauary, Ducke H.J.B.R. 20217 (sterile).

7. *EPERUA KOUROUENSIS* R. Ben.—Kourou river, French Guiana. Not seen.

8. *EPERUA GRANDIFLORA* (Aubl.) Benth.—This species has so far been observed only in the three Guianas. Herbarium specimen examined: Moraballi Creek near Bartica, British Guiana, Sandwith Oxford Expedition 314, determ. N. Y. Sandwith.

9. *EPERUA JENMANI* Oliv.—Another species limited to the three Guianas; according to Sandwith, it may possibly be a variety of *E. grandiflora* of the same region. *E. stipulata* Kleinh., of Surinam, described on very incomplete (sterile) specimens, is, according to Amshoff (*On South American Papilionaceae*, p. 17, Utrecht 1939), "in all probability identical with *E. jenmani*."

10. *EPERUA BIJUGA* Mart. ex Benth.—There are two well defined geographical forms of this beautiful species. One occupies a very limited area of the southern half of the Amazon estuary, the other grows in the northwestern part of the Lower Amazon.

*Forma typica*.—A little tree appearing here and there in the igapó along small rivers or streamlets in the western and southern parts of the island of Marajó and at the mouth of the Tocantins and Rio Pará. It differs from var. *glabriflora* in the pubescence of the inflorescences and the persistence of the bracteoles until anthesis. Herbarium material examined: Soure on the southeastern shore of Marajó, Ducke H.J.B.R. 20312; Rio Maratauá tributary of Rio Aramá in the Breves islands west of Marajó, Ducke H.J.B.R. 16.927; Mosqueiro on the eastern shore of the Rio Pará, Ducke H.J.B.R. 16928;

Belem do Pará, igapó or Catú, Ducke H.J.B.R. 16929. Vernacular names, in most localities, Ipê (more frequently referred to species of *Macrolobium*, sometimes also to *Crudia*; in southern and central Brazil, to arborescent *Bignoniaceae*); Muirapiranga in Soure.

*Eperua bijuga* Mart., var. *glabriflora* Ducke, var. nov.—A speciei typo differt inflorescentiis praeter stamina glabris, bracteolis ante anthesin deciduis. Arbor vulgo mediocris, frequentissima circa urbem Manáos in silva non inundabili praesertim in solo silico-humoso locis humidis vel paludosis. Legit A. Ducke 158, H.J.B.R. 23733, et 14 cum ligno (Yale 20965); A. Goeldi, H.A.M.P. 3862. Specimina solum fructifera verisimiliter ad hanc varietatem pertinentia legit A. Ducke in civitatis Pará limine occidentali prope lacum Faro, H.J.B.R. 20313. Nomen vulgare in Manáos, Muirapiranga; in Faro, Espadeira.

This is the western form of the present species, observed only at the mouths of the Rio Negro and Rio Jamundá (Lake of Faro), but certainly spread through the intermediate country where no collections have been made. It is common and in many places dominant in the upland rain forest with more or less marshy humo-silicious soil, rarely appearing also in other soils, very exceptionally in argilous soil. The pretty brown-red wood is resinous and frequently used as firewood in Manáos, where it is known as Muirapiranga, a vernacular name applied elsewhere to the wood of the moraceous *Brosimum paraense* Huber (chiefly in timber trade) and sometimes to that of the guttiferous genus *Haploclatbra*.

11. *EPERUA SCHOMBURGKIANA* Benth.—This very distinct species seems to occur in two local forms, one from the Guianas, the other from Brazilian Amazonia, but I do not have enough botanical material to permit a definite decision. Specimens examined: Moraballi Creek near Bartica, British Guiana, Sandwith Oxford Expedition 142, determ. N. Y. Sandwith; Rio Mapuera (tributary of Rio Trombetas, Pará), islands in cataracts, Ducke H.A.M.P. 9088; Manáos, marshy upland forest along the upper course of Igarapé Mindú, Ducke H.J.B.R. 23734 including wood sample 244 (Yale 31971). The Guiana specimen has larger flowers, and its in-



florescence is covered with a dense, conspicuous, pale brown, scurfy wool (as described by Sandwith, *l.c.*), while the Brazilian specimens have small flowers with thinner, more grayish and not woolly tomentum. The middle-sized tree is rather frequent along the upper courses of Igarapé Mindú, Igarapé do Crespo and affluent small brooks.

NOTES ON THE GENUS *AMBURANA* SCHWACKE  
& TAUB. (*TORRESEA* FR. ALLEM.)

By A. C. SMITH

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*Torresea* was proposed as a monotypic leguminous genus by Francisco and Manoel Freire Allemão, with the species *T. cearensis*, in 1864, in a publication which is extremely rare, "Trabalhos de Comissão científica de exploração." This appears to have been printed at Rio de Janeiro between 1861 and 1866. A copy is available in the library of the Arnold Arboretum; I am indebted to Dr. E. D. Merrill and Dr. A. Rehder for the privilege of consulting this and to Dr. J. H. Barnhart for his suggestions incorporated in the present treatment. The publication has been cited under several different abbreviations, and the exact title is a matter of doubt; the copy at the Arnold Arboretum does not have a printed title page. After 170 pages of introductory matter (dated Dec. 6, 1861, and signed Manoel Ferreira Lagos), the "Seccão Botanica" commences; this is apparently the joint work of Francisco and Manoel Freire Allemão. This section contains three fascicles or "folhetos"; the first of these (pages 1-14) is dated July, 1862. This is followed by an unpaginated sheet dated April, 1864 (apparently intended as pages 15 and 16). Pages 17-40 make up the second fascicle, dated April, 1864, and followed by an insert page of errata for the first and second "folhetos." The third fascicle contains pages 41-75, dated Feb. 20, 1866, and is followed by an unpaginated "errata" for the second and third "folhetos." The Arnold Arboretum copy has a separately paged section, entitled "Considerações sobre as plantas medicinais da flora Cearense," pages 1-46, dated Dec. 1862, following the first fascicle mentioned above.

The description of *Torresea cearensis* is very complete and is accompanied by an unnumbered plate (the fifth in the series). Although no type is cited, the species is presumably based upon a plant collected by the authors, who state: "In provincia Ceará non raro has arbores inveniuntur, ad arida loca, quae ser toes nuncupantur."

This description was overlooked by Schwacke and Taubert when they described the genus *Amburana*, based on the single species *A. Claudii* (in Engl. & Prantl, Pflanzenfam. 3 [3]: 387-1894). The identity of this plant with *Torresea cearensis* was pointed out by Harms (in Engl. & Prantl, Pflanzenfam. 3 [3]. Nachtr.: 199. 1897); but the fact that *Torresea* Fr. Allem. was a later homonym of *Torresia* R. & P. has not been noted and the necessary new binomial has not yet been proposed. No type was cited for *Amburana Claudii*, but in Harms' discussion there is an implication that the type is a Glaziou specimen, since he remarks: "Die Namensänderung geschah auf die Autorität Glaziou's hin (in briefl. Mitteilung an Herrn Prof. Urban). Die Publikation von Freire Allemão kenne ich nicht."

A specimen of *Glaziou 13721* in the herbarium of the New York Botanical Garden is certainly conspecific with the plant described and illustrated by the Freire Allemãos. This Glaziou specimen may conceivably be a duplicate of the type of *Amburana Claudii*; it does not bear locality data and apparently is not listed in Glaziou's "Liste des plantes du Brésil Central recueillies en 1861-1895" (Bull. Soc. Bot. Fr. 52: Mem. 3: 1-661. 1905-13).

The species was next mentioned, as "*Torresia*" *cearensis*, by Gleason (Phytologia 1: 136. 1935), who referred to it a plant collected by Krukoff in the Acre Territory, describing the fruits in detail. Ducke (Arq. Inst. Biol. Veg. Rio 1: 143. Aug. 1935; Trop. Woods 43: 19. Sept. 1935) described a second species of the genus, under the name of "*Torresia*" *acreana*. This has more recently been re-collected in Bolivia by Krukoff.

As to the systematic position of the genus, Taubert placed it in the Tribe Amherstieae of the Caesalpinioideae, assigning to it a position near *Eperua* Aubl. Harms, however, suggested that it more properly belongs in the Tribe Sophoreae of the



Papilionatae. It is, at any rate, an isolated genus, conspicuous by its usually solitary seed with an expanded basal wing.

The use of the generic name *Torresea* is excluded by the earlier *Torresia* R. & P. According to the International Rules, names must be considered orthographic variants when a difference of only one letter causes confusion (see Art. 70 of the latest Rules, Note 3 and the final examples). In the present case it is obvious that there has been confusion, both Gleason and Ducke having spelled Allemão's genus as "*Torresia*."

Local names referred to both species of the genus are Cumarú de cheiro and Imburana de Cheiro. Mr. Krukoff states that the wood, and especially the bark, of *A. acreana* yields a strong odor of coumarin. A similar observation was made by Le Cointe (Arvores e plantas uteis, 142. 1934) under the generic name only (as "*Torresia*").

All specimens cited in the present paper are deposited in the herbarium of the New York Botanical Garden.

AMBURANA Schwacke & Taub, in Engl. & Prantl, Pflanzenfam. 3 (3): 387. 1894. *Torresea* Fr. Allem. Trab. Com. Sci. Explor. [Ceará] Sec. Bot. 17. 1864. Not *Torresia* R. & P. (1794).

1. *Amburana cearensis* (Fr. Allem.) A. C. Smith, comb. nov. *Torresea cearensis* Fr. Allem. Trab. Com. Sci. Explor. [Ceará] Sec. Bot. 17. [pl. 5.] 1864. *Amburana Claudii* Schwacke & Taub, in Engl. & Prantl, Pflanzenfam. 3 (3): 387. 1894.

Distribution: BRAZIL: Ceará and Minas Geraes (according to Harms). The only specimen I have seen is *Glaziou 13721* (without locality data, but perhaps the record from Minas Geraes indicated by Harms).

2. *Amburana acreana* (Ducke) A. C. Smith, comb. nov. *Torresea* ("*Torresia*") *acreana* Ducke, Arq. Inst. Biol. Veg. Rio 1: 143. Aug. 1935; Trop. Woods 43: 19. Sept. 1935.

Distribution: BRAZIL (Acre Territory) and Amazonian BOLIVIA. I have seen *Ducke 23769* (type coll., from Seringal Iracema, Rio Acre) and *Krukoff 10596* (from Asunta [near Evenay], basin of Rio Bopi, Province of S. Yungas, Dept. La Paz, Bolivia, alt. 690-750 m.).

This species is a tree 30 m. or more in height, and is dis-

tinguished from *A. cearensis* by somewhat inconspicuous characters. In addition to its size, it is separated by the fact that it has 17-25 (rather than 7-15) leaflets and by its longer and more lax inflorescences. Ducke also points out differences in the shape and apex of the leaflets, but in comparing his type with the Glaziou and Krukoff specimens, I hardly believe that these differences are of consequence. As a rule, the leaflets toward the apices of leaves are somewhat lanceolate, those towards the bases being ovate or elliptic. The Krukoff specimen has somewhat narrower leaflets than the other two, but even this has some leaflets which are distinctly ovate and undistinguishable from those of *Ducke 23769*.

The specimen (*Krukoff 5495*) described by Gleason (Phytologia 1: 136. 1935) as *Torresea* ("*Torresia*") *cearensis*, was obtained from the ground beneath a tree near mouth of Rio Macauhan (tributary of Rio Yaco), Territory Acre, Brazil. The fruits and seeds of this specimen (described by Gleason) are quite identical with those of *Krukoff 10596*. However, the detached leaflets are entirely unlike those of the two known species of *Amburana*, being coriaceous, linear-oblong, 5-10 cm. long, 1-2 cm. broad, and completely glabrous. If it can be established with certainty that these leaflets belong with the fruits, a new species is doubtless represented, but for the time being it seems advisable merely to refer the specimen to the genus.

#### NOTE ON *DALBERGIA RETUSA* BAILL.

The name *Dalbergia retusa* Baill., published in 1884 (Bull. Soc. Linn. Paris 1: 436) for a Madagascar tree, is a homonym of *D. retusa* Hemsley, 1878 (Diagn. Pl. Nov., 8), a species of Panama. A letter to Professor Humbert of Paris, enquiring as to the proposed treatment of the species in his *Flore de Madagascar*, now in preparation and part already published, has elicited the following information.

The late Professor H. Lecomte, recognizing that the name *Dalbergia retusa* Baill. was a later homonym, gave to the Madagascar species the name *D. obtusa* H. Lec. (Bull. Mus. Paris, 2ème série, 1: 159, 1929). The late Professor R. Viguier,



who was working on the Leguminosae of Madagascar, reduced *Dalbergia retusa* Baill. and *D. tingens* Baill. to synonyms of *D. toxicaria* Baill. in Bull. Soc. Linn. Paris 1: 438. 1884. On the assumption that Viguier is correct in his view that these three "species" of Madagascar are conspecific, the name *D. toxicaria* Baill. (1884) must stand, in place of *D. obtusa* H. Lec. (1929), which becomes a synonym of *D. retusa* Baill. —J. BURTT DAVY.

ADDITIONS TO "REVISION OF THE SPECIES OF THE GENUS *ELIZABETHA* SCHOMB."

By ADOLPHO DUCKE

In *Tropical Woods* 37: 18-27, March 1934, I published an enumeration of the species of the little known leguminous genus *Elizabetha*. Since then I have accumulated considerable new material, with field observations on some species, which enables me to round out my information on these beautiful trees.

The species cultivated in the Jardim Botânico do Rio de Janeiro are *Elizabetha princeps*, *E. paraensis*, *E. bicolor*, *E. speciosa*, and *E. durissima* (*E. leiogyne* and *E. Duckei*, cited in my former note, subsequently died). They can be considered rather satisfactorily acclimated, though only *E. princeps* shows a really good development. *E. speciosa* flowered in the garden while very young.

*ELIZABETHA COCCINEA* Schomb. ex Benth., and *E. OXYPHYLLA* Harms.—Amshoff (*On South American Papilionaceae*, Utrecht, 1939) placed the second of these species in the synonymy of the first, the type of which she considers "a specimen with abnormal leaflets." I think, however, that we cannot maintain this unity before we know that there are transitions between the two described species. *E. coccinea* has retuse leaflets and, according to the Schomburgks, scarlet flowers, while *E. oxyphylla* has acute or obtuse leaflets and, according to Ule, white flowers. The first species has been collected only by the two Schomburgks at Brazilian frontiers in British Guiana; the second, in the same region as well as along the Corentijne River in Surinam (Amshoff, *l.c.*).

*ELIZABETHA PRINCEPS* Schomb. ex Benth.—I recently found this beautiful species, which had not been collected since Schomburgk's time, in two localities of the hill country of the upper Rio Negro, in the Brazilian State of Amazonas. Here it appears in many points as the dominant element among the forest trees, in fine associations, mainly on lower hill slopes. The trees have an average height of 15-20 m. but can attain 30 m.; their foliage is handsome; the globose-spicate inflorescences have the form of those of *Brownea grandiceps* but are much smaller; the flowers are white, with flesh-colored stamens and pistil, and have a pleasant scent; the younger pods are a beautiful pink.

Rio Negro above Santa Izabel, Serras do Jacamim, Ducke 328, and 302 with wood sample (Yale 33829), and H.J.B.R. 29025; Rio Curicuriary near the foot of the Serra, Ducke 34962. Specimens have been compared by Professor Harms with Schomburgk's plant and found conspecific. Flowering in November and beginning of December.

*ELIZABETHA BICOLOR* Ducke.—The flowers are normally deep rose or scarlet with more or less whitish calyx-tube, petals, and stamens, or exceptionally pure white with greenish bracteoles. I recently collected copious material which allows me to include the Borba specimens in this species with certainty. The ovary is normally sericeous, the glabrous condition being exceptional.

Additional herbarium specimens: Parintins, forest on the plateau south of the Lake José-Assú, Ducke 113 and H.J.B.R. 34960 (flowers red), and Ducke H.J.B.R. 34961 (flowers white); Borba, Ducke H.J.B.R. 34959. Flowering in December and January.

*ELIZABETHA DURISSIMA* Ducke.—I encountered sterile trees and young plants of this species beyond its typical locality; also near Borba, Lower Madeira.

*ELIZABETHA PARAENSIS* Ducke.—A 20-year-old tree flowered in the garden of the Goeldi Museum at Pará. It developed from one of the seedlings I obtained in 1917 at Igarapé das Pedras near the Furnas cataract of the Tapajoz. Herbarium specimens have been distributed under the H.J.B.R. no. 34958, coll. R. Siqueira.



## AMBOYNA WOOD FROM ANDAMANS

Mr. E. L. P. Foster, Chief Forest Officer, Andamans, states in a recent letter to the editor that he sent specimens of the burr of Andaman Padauk, *Pterocarpus dalbergioides*, to London and a prominent timber dealer there said that for all practical purposes they were Amboyna wood. They were not considered saleable in the London market, however, because their color does not conform to present-day fashions and the supply of material available is too small to justify trying to popularize the wood. The burrs are usually less than two feet in diameter, rarely up to four feet, and are more or less defective. There is considerable variation in the size of the curl, ranging up to an inch and a half in diameter in the large burrs. The wood, when properly finished, is considered one of the most beautiful in the world.

## CURRENT LITERATURE

**Forestry and erosion in Haiti and Puerto Rico.** By C. SWABEY. Bull. No. 21 (n. s.), Dept. Sci. & Agr. Jamaica, Kingston, 1939. Pp. 10; 6 x 9 $\frac{3}{4}$ ; 10 plates. Price 6d.

"Land usage in the West Indies is dominated by (a) limited land area, (b) rapidly increasing population, and (c) dependence on agricultural crops, declining in value.

"In Haiti excessive deforestation has created land problems of major importance. Legislation designed to regulate this has failed through lack of staff to enforce it. No forest reserves under public ownership are maintained. Insecurity of tenure exaggerates effects of erosion. Practically no re-afforestation is done. The formation of a Forest Service is urged.

"The erosion problems of Puerto Rico are discussed and a brief history of the Forest Service and its organization is given. An annual appropriation of £400,000 is spent by the Forest Service, largely financed by CCC and PRRA. The total forest area is 88,000 acres (4 per cent of country) and acquisition programme aims at 250,000 acres (11 $\frac{1}{2}$  per cent). Forests are developed as recreational areas with roads, res-

taurants, etc. Silvicultural work is mainly re-afforestation of denuded lands and 20,000 acres have been treated. A modified "taungya" method is being encouraged. Work at various forest units is described. The work of the Extension Service is to distribute trees to private persons (over a million annually). The effectiveness of roadside planting is very apparent in Puerto Rico. The work of the Soil Conservation Service in erosion research and planning of land settlement schemes is described."—*Author's summary.*

**The Caribbean Forester.** Pub. quarterly by Tropical Forest Experiment Station, U. S. Forest Service, Rio Piedras, Puerto Rico. Vol. I: 2: 1-33; January 1940. Edited, multilithed, and distributed by Southern Forest Experiment Station, New Orleans, La.

## CONTENTS

- Mapping vegetational types in British Honduras from aerial photographs.** (pp. 1-4), by J. B. Kinloch, Asst. Conservator of Forests.
- Forestry in Grenada** (pp. 5-6), by H. W. Hagley, Forest Officer.
- Forestry and forest resources in Haiti.** (pp. 7-9), by Schiller Nicolas, Service Technique.
- Reservation policy in Jamaica** (pp. 10-12), by C. Swabey, Forest Officer.
- El Servicio Forestal en la Republica Dominicana** (pp. 13-16), by Tomás Erickson, Agrónomo Encargado, Servicio de Foresta, Caza Y Pesca.
- Conservación** (pp. 17-24), by José Marrero, Asst. Planting Officer, Puerto Rico.
- A rapid method of extracting balsa seed** (p. 25), by L. R. Holdridge, Associate Forester, Puerto Rico.
- A cedar seedling blight in Puerto Rico** (p. 26), by L. A. Alvarez García, Asst. Phytopathologist, Agr. Exp. Sta., Puerto Rico.
- Calophyllum antillanum, a desirable tree for difficult planting sites** (pp. 27-28), by L. R. Holdridge, Associate Forester, Puerto Rico.
- The entomologist looks at maga [Montezuma speciosissima Sessé & Moc.]** (pp. 29-30), by George N. Wolcott, Entomologist, Agr. Exp. Sta., Puerto Rico.
- Some notes on forest entomology** (pp. 31-32), by Luis F. Martorell, Asst. Entomologist, Agr. Exp. Sta., P. R.
- In memoriam [Ferdinand A. Silcox and Edmundo Martínez Mato]** (p. 33).
- Una nueva especie de haya, descubierta in México.** By MAXIMINO MARTÍNEZ. *Mexico Forestal* 17: 66; December 1939.
- The Beech (Haya) discovered by Professor Martínez near



Zacualtipán, Hidalgo, and reported in *Tropical Woods* 60: 10 without specific name, is here referred to as *Fagus mexicana*.

**Organo transitorio en una Talamiflora serrana.** By G. CONZATTI. *Anales del Hospital General* (Oaxaca de Juárez) 2: 5: 4-7; 1 plate; Jan. 20, 1940.

Contains a description of a new genus and species of Theaceae (Ternstroemiaceae), *Heptacarpus salmonicolor* Conzatti, a small tree occurring at an altitude of 900 meters near Cacalotepec, Sierra de Ixtlán, Oaxaca, Mexico.

**Two new trees from the mountains of Mexico.** By C. L. LUNDELL. *American Midland Naturalist* (Notre Dame, Ind.) 23: 1: 175-176; January 1940.

The two new species are *Abies tacanensis*, "obviously very close to *A. guatemalensis* Rehder," and *Liniociera areolata*, a tree 10 m. high and 15 cm. in diameter, the first representative of the genus from Mexico.

**Studies of Mexican and Central American Plants. VIII.** By C. L. LUNDELL. *Bull. Torrey Bot. Club* 66: 9: 583-604; December 1939.

Seventeen species, mostly small or medium-sized trees, six of them Coccolobas, are described for the Yucatan Peninsula.

**Studies of tropical American plants. I.** By C. L. LUNDELL. *Contr. Univ. Mich. Herbarium* 4: 1-32; April 1940.

Contains diagnoses of 38 new species of herbs, shrubs, and little trees, nearly all in the Maya area of Mexico and British Honduras. There are also some new combinations and synonyms.

**Plants probably utilized by the old empire Maya of Petén and adjacent lowlands.** By C. L. LUNDELL. *Papers of Mich. Acad. Science, Arts & Letters* 24: 1: 37-56; 1938 (1939).

"The Old Empire Maya undoubtedly were an agricultural people, as are their modern descendants; they depended

largely upon the produce of their cornfields (milpas), door-yards, orchards, and the native forests to supply their needs for food and other vegetable products. The region covered by the Old Empire included most of the Yucatan Peninsula and all the land southward through Guatemala into Honduras and westward into Chiapas and Tabasco. This brief report deals mainly with the plants probably important to the Maya who occupied the Department of Petén, Guatemala, and adjacent lowlands."

**Studies in the Boraginaceae. XIV. Miscellaneous species from Asia, Malaysia and America.** By IVAN M. JOHNSTON. *Jour. Arnold Arboretum* 21: 1: 48-66; January 1940.

The only arborescent species described is *Bourreria superba*, a small tree of southwestern Michoacán, Mexico.

**Thirty-five new species of American Croton.** By LEON CROIZAT. *Jour. Arnold Arboretum* 21: 1: 76-107; January 1940.

The range of the species of *Croton* published or named as new in this paper extends from Mexico to Argentina. "A rough tabulation from the best available sources shows that there are about 1000 published species which may lay claim to the status of valid binomials. Of this number, America has 650 species, Continental Africa 65 species, Madagascar 70 species, India and south tropical Asia 65 species; Malaysia, Australia, and Oceania 30 species."

**Studies of American plants. IX.** By PAUL C. STANDLEY. *Bot. Ser. Field Museum* 22: 1: 1-62; Jan. 26, 1940.

Contains numerous proposed new species of herbs and shrubs, and a few trees. "It was a great surprise to the writer to discover in the mountains of the Cobán region [of Guatemala] a tree of the genus *Engelhardtia* [*E. guatemalensis* Standl., sp. nov.]. . . . The trees are easy of recognition, even from a considerable distance, when once noticed, because of the crimson coloring of the young foliage. . . . Several Indians and 'ladinos' who were questioned about the



tree stated that it was common in Alta Verapas, but they knew no local name for it."

Other new trees are *Quercus boquetensis*, *Q. Davidsoniae*, and *Ficus Davidsoniae*, Panama; *F. matogrossensis* and *Coccoloba Zernyi*, Brazil; *F. zarzalensis*, Colombia; *Tropis nubium*, *Inga subvestita*, and *Zschokkea Standleyi* Woodson, Guatemala; *Capirona erythroxyton* and *Sickingia badrantha*, Peru.

A specimen from Shapajilla, Dept. Huanuco, Peru, is determined as *Calatola venezuela* Pittier, but Standley adds that "more material is needed before it can be determined whether there are any sure characters for separating *C. venezuelana* from *C. costaricensis* Standl." "The genus now may confidently be expected to grow in Ecuador and perhaps also in eastern Bolivia."

**Contributions to the flora of tropical America. XLIII.** By N. Y. SANDWITH ET AL. *Kew Bulletin*, 1939, pp. 545-563.

The trees described as new by Sandwith are *Quiina oblanceolata*, *Ayenia praeclara*, *Spiranthera parviflora* (a kind of Mamuriballi), and *Hirtella macrosepala*. Several new species of shrubs in the Melastomaceae are proposed by H. A. Gleason.

**New or noteworthy Euphorbiaceae from Suriname.** By J. LANJOUW. *Recueil Trav. Bot. Néerland.* 36: 697-704; figs 2; January 1940.

Notes on several species, with a description of *Croton sipaliwinensis*, a new species, described as a small shrub.

**Two interesting species of *Manihot* L. from Suriname.** By J. LANJOUW. *Recueil Trav. Bot. Néerland.* 36: 543-549; ill.; May 1939.

Description of *Manihot saxicola*, a shrubby new species, with notes on *M. melanobasis* Muell. Arg.

**Dezoito novas espécies para a flora do Brasil e outras regiões da América Meridional e Central.** By F. C. HOEHNE. *Arquivos de Botânico do Estado de S. Paulo* (n. s.) 1: 2: 39-49; pls. 46-61, 2 in color; 1939.

Contains descriptions of 18 new species: Orchidaceae (9), Aristolochiaceae (2), Leguminosae-Mimosoideae (1), and Leguminosae-Papilionaceae (6). The last group is confined to *Machaerium*, mostly scandent shrubs; *M. longistipitatum* and *M. tortipes* are small trees, the former in Ecuador and Bolivia, the other in Acre Territory, Brazil.

**Apontamentos sobre a cultura de árvores florestais amazônicas no Jardim Botânico do Rio de Janeiro.** By ADOLPHO DUCKE. *Bol. Minist. Agr.* (Rio de Janeiro) pp. 1-3; July-September, 1939.

A relatively small number of Amazonian trees have been planted in Rio de Janeiro for shade and ornament. Some of them were brought there from foreign countries to which they had been introduced from Amazonia. In the botanic garden of Rio more than 300 selected Amazonian species are now growing and two-thirds of them may be considered acclimated. About one-fourth have produced flowers and many have fruited.

**O cumarú na botânica sistemática e geográfica.** By ADOLPHO DUCKE. *Bol. Minist. Agr.* pp. 3-6; 3 pls.; 1939.

Cumarú is the Brazilian name of a seed exported in large quantities to Europe and the United States for use in perfumery and medicine. In English the seeds are called Tonka beans. These seeds are produced by four species: *Coumarouna odorata* Aubl., the most common species of eastern Amazonia, occurring also in French Guiana and Venezuela; *C. rosea* Taub., of Brazil, Venezuela, and Colombia; *C. punctata* Blake, widely distributed in Amazonia but less frequent than *C. odorata*, also in Surinam, and in cultivation in northern Venezuela and the Antilles; *C. trifoliolata* Ducke of Amazonas and probably also of Venezuela.—PAUL C. STANDLEY.

**As Leguminosas da Amazonia brasileira.** By ADOLPHO DUCKE. Pub. by Ministerio da Agricultura, Serviço Florestal, Rio de Janeiro, 1939. Pp. 1-170; frontispiece.

An exceedingly valuable and authoritative account of the Leguminosae of Amazonian Brazil, enumerating 785 species,



a number which it is believed will be increased by later exploration to at least 900. There is included a list of woods of this family collected by the author and sent for study to the Yale School of Forestry.

The account includes keys to the genera represented in the list, also a bibliography of the subject. Brief notes give local and general distribution of the species, and often detailed and extensive information regarding the species of greater economic importance or geographic significance. In conclusion there is provided a list of vernacular names.

The many years of field work of the author, with his equally long studies in the herbarium, give this work a peculiar value. It will be invaluable to those interested in timber and other economic products supplied by Amazonian Leguminosae, and no less useful to taxonomists in determination of herbarium material.—PAUL C. STANDLEY.

**Plantes nouvelles ou peu connues de la région amazonienne (XIe série).** By ADOLPHO DUCKE. *Arquivos Serv. Florestal* (Rio de Janeiro) 1: 1-40; pl. 1-13; November 1939.

The greater part of the paper is devoted to Amazonian Moraceae, but there are included also plants of the families Myristicaceae, Lauraceae, Rosaceae, Euphorbiaceae, Caryocaraceae, Guttiferae, Bixaceae, Lecythidaceae, Convolvulaceae, and Rubiaceae. Among the new plants described (from Amazonian Brazil unless otherwise stated) may be mentioned: *Anonocarpus peruvianus* (Loreto, Peru); *Paraclarisia amazonica*, a new genus of Moraceae (vernacular name Janitá); *Brosimum longifolium*, *B. pallescens*, *B. platyneurum*; *Pseudolmedia brosimifolia*; *Naucleopsis insculpta*, *N. pauciflora*; *Ogcodeia imitans*, *O. pallescens*, *O. inaequalis*; *Palmolmedia stipularis*, new genus of Moraceae, based on *Naucleopsis stipularis* Ducke; *Couepia cataractae*; *Vismia lateriflora*; *Toxomita humilis*.—PAUL C. STANDLEY.

**Sobre algunas Rosáceas sudamericanas. I. Sinopsis de *Tetraglochin*.** By WERNER ROTHMALER. *Darwiniana* (Buenos Aires) 3: 329-347; 1939.

In the genus *Tetraglochin* eight species are recognized, referable to two new sections, *Caulia* and *Johnstonia*. The plants are low shrubs, native chiefly in Argentina, Chile, Bolivia, and Peru. *T. Tragacantha* is described as new from Peru and Bolivia, its vernacular name Caulle. *Margyri-carpus inermis* Johnston and *M. paucijugatus* Johnston, of Argentina, are transferred to *Tetraglochin*.—PAUL C. STANDLEY.

**Descripción de *Mimozyganthus*, nuevo género de Leguminosas y synopsis preliminar de los géneros argentinos de Mimosoideas.** By ARTURO BURKART. *Darwiniana* 3: 445-469; 1 plate; figs. 3; 1939.

*Mimozyganthus* is a new genus, based upon *Mimosa carinata* Griseb. of Argentina, Paraguay, and Bolivia. It differs from all other Argentine Mimosoideae in having the sepals imbricate in bud, rather than valvate or open. The author presents a key for separation of the Argentine Mimosoideae, and lists the genera and species briefly and informally, with miscellaneous notes concerning them.—PAUL C. STANDLEY.

**Fue creada la División Forestal.** By JOSÉ PADILLA. *Maderil* (Buenos Aires) 12: 138; 12, 25-26; December 1939.

Attention is called to the recent presidential decree which emphasizes the importance of forestry in the Republic of Argentina and creates a new División Forestal to which will be transferred the existing Sección Técnica de Bosques as well as the Chaco and Misiones Nurseries. The functions of the division, as listed in the decree, comprise a broad program of forestry work and investigation.

**Fiber measurement studies of anabiong.** By FRANCISCO L. SIRIBAN. *Philippine Journal of Forestry* 2: 4: 301-315; 1939.

"Anabiong (*Trema orientalis* [Linn.] Blume) is one of the many species of trees in the Philippines which have little or no commercial value at present. Its wood is poor, very susceptible to decay and is seldom used for permanent construction. In some parts of the Islands its log which is comparatively light (sp. gr. 0.408 air-dry) is used for floating or rafting heav-



ier logs of other species. The bark is occasionally utilized for dyeing and tanning and the leaves for fodder.

"This species is abundant in the Philippines and as its wood is light, soft, and white or buff in color, and because the tree makes rapid growth, it may have possibilities as a source of material for paper pulp. For this purpose the length of the wood fibers is a criterion of the quality of wood pulp obtainable from the wood."

"The results of the study show that the wood fibers of 7-year-old Anabiong trees have an average length of  $1.1588 \pm .0175$  mm. This compares favorably with the fibers of *Populus tremuloides*, *P. deltoides*, and *P. grandidentata* which are the most important of the hardwood species in the United States as a source of paper manufacture. The average fiber length of these species is 1.130 mm."

***Antherostele*, genus novum rubiacearum *Urophyllum* affine.**

By C. E. B. BREMEKAMP. *Jour. Arnold Arboretum* 21: 1: 25-31; January 1940.

*Antherostele*, with three former species of *Urophyllum* and one newly described, is endemic to the Philippine Islands. The plants are shrubs or small trees.

A preliminary account of the Philippine species of *Urophyllum* Wall., *Pleiocarpidia* K. Schum, and *Praravinia* Korth. (Rub.). By C. E. B. BREMEKAMP. *Jour. Arnold Arboretum* 21: 1: 32-47; January 1940.

Includes an annotated list of the 13 species of *Urophyllum*, one of *Pleiocarpidia*, and 19 of *Praravinia*, with keys to the genera and species.

An enumeration of the Myrsinaceae of Yunnan. By EGBERT H. WALKER. *Bull. Fan Inst. Biology* (Bot. ser.) 9: 3: 135-194; plates 13-23; Aug. 30, 1939.

Contains descriptions of all of the Myrsinaceae known to occur in Yunnan, with keys to the genera and species. There are 48 species and four varieties of five genera, namely, *Ardisia*, *Embelia*, *Maesa*, *Myrsine*, and *Rapanea*.

***Limnocitrus*, a new genus; also new species of *Wenzelia*, *Paramignya* and *Atalantia* (Rutaceae-Aurantioideae).**

By WALTER T. SWINGLE. *Jour. Arnold Arboretum* 21: 1: 1-24; 4 pls.; January 1940.

*Limnocitrus*, with a single species, is a shrub or little tree growing in tidal marshes in the Netherlands East Indies. The plant has previously been classed in the genera *Atalantia*, *Limonia*, *Paramignya*, and *Pleiospermum*.

**The ochraceous genus *Capusia* H. Lecomte (1926) a synonym of the celastraceous *Sipbonodon* Griffith (1844).**

By E. D. MERRILL. *Jour. Arnold Arboretum* 21: 1: 108-109; January 1940.

"While the generic identity of the two entities is unmistakable, the species apparently represents a form distinct from the widely distributed *Sipbonodon celastrineus* Griff., and in reducing *Capusia* to *Sipbonodon* the following new combination is made: *Sipbonodon annamensis* (H. Lecomte), comb. nov."

**Cenni monografici sulle piante forestali e sui legnami dell'A. O. I.** By GUGLIELMO GIORDANO. *La Rivista Forestale Italiana* (Rome) 2: 1: 32-36; 2 half-tones, 9 drawings; January 1940.

A continuation of the well illustrated series of descriptions of east African trees and woods. The species are *Dombeya Schimperiana* A. Rich., *Hypericum lanceolatum* Lam., and *Lasiosiphon glaucus* Fresen.

**La coltivazione della acacie da tannino in A. O. I.** By L. SENNI. *La Rivista Forestale Italiana* 2: 3: 6-14; 7 half-tones; March 1940.

An account of Wattle culture with particular reference to the possibilities in Italian East Africa. The principal species considered are *Acacia mollissima* Willd., *A. decurrens* Willd., *A. pycnantha* Benth., and *A. dealbata* Link.



**Le sablier élastique (*Hura crepitans* L.).** By L. TIHON. *Bull. Agricole du Congo Belge* (Brussels) 30: 3: 468-477; figs. 110-112; September 1939.

An account of the tropical American tree, which has been introduced into the Belgian Congo, with particular reference to the chemical properties and possible uses of the seeds. The oil is unfit for cattle food because of its purgative properties and is also unsuited for lubricants, but can be used in the manufacture of linoleum and (mixed with other oils) in making soap. The author advises against planting the tree for shade.

**Quatre Légumineuses nouvelles de l'Afrique Occidentale.**

By R. PORTÈRES. *Rev. Bot. Appl. et d'Agr. Tropicale* 19: 219: 785-789; 3 figs.; November 1939.

Descriptions of four new West African species, three of them shrubs, the remaining one, *Cynometra glandulosa*, a medium-sized tree in the French Soudan. Unlike most of its associates this tree remains green during the dry season.

**Zur Gliederung der Gattung *Entandrophragma* C.DC.** By H. HARMS. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 125: 431-449; Aug. 20, 1939.

An annotated list of the species of *Entandrophragma* with lists of synonyms and a key to the five sections into which the genus is divided. The two species considered most valuable for timber are *E. cylindricum* Sprague, the source of Sapele, and *E. angolense* (Welw.) C.DC., both large trees widely distributed in the rain forests of tropical West Africa.

**Le *Cassia siamea* Lam., essence de reboisement.** By G. TONDEUR. *Bull. Agr. Congo Belge* (Brussels) 30: 2: 249-257; figs. 43-46; June 1939.

*Cassia siamea* Lam. (= *C. florida* Vahl) is a medium-sized leguminous Indo-Malayan tree of rapid growth and capable of producing good timber. It is easily propagated and is particularly suited for restoring worn-out and eroded soils and for use as a nurse crop for other trees.

**The growth, structure, and properties of wood.** By S. H. CLARKE. *For. Prod. Res. Special Report No. 5*, Dept. Sci. & Ind. Res., 1939. Pp. iv + 32; 6 x 9 $\frac{3}{4}$ ; 5 fig., 2 plates. Price 25 cents, British Library of Information, 50 Rockefeller Plaza, New York.

"This report summarizes a series of investigations into the causes of variation in the properties of wood, particularly the strength properties. By selecting specimens so as to eliminate the influence of certain variables, and by the use of statistical methods, it has been possible to show that the physico-chemical nature of the cell walls is of greater importance than anatomical structure in determining certain types of strength and other properties. In particular the degree of lignification of the secondary walls of the fibers, as judged by the phloroglucin reaction, enables the compressive strength of individual specimens to be estimated with greater accuracy than is possible where only specific gravity and gross anatomical structure are taken into account. Some environmental factors influencing lignification are indicated.

"Toughness, as measured by the work done in breaking a specimen transversely by a single blow, depends rather on the proportion and arrangement of the thin-walled elements, and on the properties of the middle lamellae and primary walls of the fibers; the secondary walls of the fibers are ordinarily so strong that they do not break when wood fails across the grain.

"For practical purposes specific gravity is undoubtedly a useful index of the strength of timber, particularly in indicating a lower limit below which wood will inevitably be weak compared with the average for the species concerned. Above this point specific gravity is of limited value in estimating the strength of a particular specimen. Rate of growth (ring-width) and the proportion of summerwood in ring-porous woods add little to the information supplied by a consideration of specific gravity. These features are, however, of some value as visual indications of strength in so far as they are themselves related to specific gravity.

"Comparison of Beech tension wood and normal wood of



similar specific gravity indicates that so far as compressive strength and toughness are concerned tension wood compares more favorably with normal wood in the air-dry than in the green condition.

"It is also shown that cell wall composition influences the shrinkage and the machining properties of wood."—*Author's summary.*

**The manufacture of charcoal in portable kilns.** By G. H. DONALD. *For. Prod. Res. Records* No. 29, Dept. Sci. & Ind. Res., 1939. Pp. iii + 20; 6 x 9 $\frac{3}{4}$ ; 3 figs. Price 15 cents, British Library of Information, 50 Rockefeller Plaza, New York.

"While this publication is not intended to be a manual of charcoal burning it does bring out what are the essential conditions which must be observed and shows that, if they are observed, a quality of charcoal can be produced entirely suitable for transport and general industrial requirements."

"Small steel kilns, of a size and construction such that they can readily be transported into woodland areas, appear to offer certain advantages over the traditional method of carbonizing wood in earthen 'beehive' kilns. . . . The process of carbonizing wood in portable steel kilns is a much simpler one and, provided that the technique is fully understood, these kilns are capable of turning out charcoal of excellent quality."



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# TROPICAL WOODS

NUMBER 63

SEPTEMBER 1, 1940

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## TROPICAL WOODS

NUMBER 63

September 1, 1940

*A technical magazine devoted to the furtherance of knowledge of tropical woods and forests and to the promotion of forestry in the Tropics.*

*The editor of this publication and the writer of any articles therein, the authorship of which is not otherwise indicated, is SAMUEL J. RECORD, Dean of the Yale University School of Forestry.*

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### SOME NEW NAMES FOR TROPICAL AMERICAN TREES OF THE FAMILY LEGUMINOSAE

By SAMUEL J. RECORD

During the course of my study of the woods of the Leguminosae, I have had occasion to question the generic positions of several tropical American species. I have referred most of these problems to Ellsworth P. Killip, Associate Curator, Division of Plants, United States National Museum, who has considered them solely from the standpoint of the taxonomist. Some of the results are incorporated in this paper.

#### ANGELIM RAJADO OR BOIS SERPENT

There is considerable confusion in the literature on South American trees regarding the identity of the leguminous timber that has long been known to the Brazilian trade as Angelim Rajado (streaked Angelim) and to the French as Bois Serpent. The lumber has a highly distinctive appearance be-



cause of large irregular streaks and patches of purplish brown on a background of brownish yellow. Owing to the limited supply of the timber, it has never been extensively used, but samples of it are included in every representative collection of woods from French Guiana and the Amazon.

Herbert Stone (*Les bois utiles de la Guyana française* 3: 132; pls. I-II. 1917) describes and illustrates the wood under the name of *Stryphnodendron guianense* (Aubl.) Benth. (= *Mimosa guianensis* Aubl.), and corrects his earlier mistaken identification of Hoobooballi (*Loxopterygium Sagotii* Hook. f.) with that species. Leaves from a Surinam tree called Boschtamalen and supposed to be the source of the timber in question were made the basis for an incompletely described new species, *Stryphnodendron flammatum* Kleinhoonte (*Rec. Trav. Bot. Néerlandais* 22: 417. 1925), but the foliage is totally different from that of *Marmaroxylon*.

Adolpho Ducke, the first to obtain adequate herbarium material of the Amazonian tree producing Angelim Rajado, named it *Pitbecolobium racemiflorum* in 1915, but later (1922) changed the name to *P. racemosum*, as the specific epithet (*racemiflorum*) had been used by Donnell Smith to designate a Central American tree. A wood sample (Yale 20720; Ducke 30), with flowering herbarium material collected and determined by Ducke, has the distinctive structure and appearance of trade samples of Angelim Rajado.

Ducke says that the trees are of fairly common occurrence in the sparsely populated parts of Faro, Oriximiná, Santarem, Tapajoz, Almeirim, and Gurupá, Brazil; its usual vernacular name, Ingá-rana, is not very distinctive. The presence of the species in British Guiana was first established in 1937 by A. C. Smith, of the New York Botanical Garden, who found a tree 100 feet tall growing in dense forest on high land in the basin of the Essequibo River, and collected flowering herbarium material and a wood specimen (Yale 35671; Smith 2721). According to Bertin (*Les bois de la Guyana et du Brasil*, pp. 79-80), the tree is rare but reaches large size in the forests of French Guiana. The bole attains a length of 60 to 80 feet to the first large limb and a diameter of 18 to 24 inches just above the heavily buttressed base. The natives use the timber

for wheelwright work, but it is considered suitable also for cabinet-making, marquetry, and decorative panels.

A study of this wood convinced me that the species is generically distinct from the other Leguminosae. Mr. Killip's agreement with my opinion resulted in the diagnosis and transfer given below. The name *Marmaroxylon* (marble wood) refers to the characteristic appearance of the lumber.

**MARMAROXYLON** Killip, gen. nov.—Arbores inermes pubescentes; folia bipinnata, pinnis plurijugis, foliolis parvis membranaceis numerosis, rhachi inter pinnas glandulifera, petiolo glandula magna onusto; flores parvi capitati, capitulis racemosis, racemis e modis defoliatis oriundis saepissimi geminis vel trinis; flores sessiles, calyce cupulari minuto obsolete denticulato; corolla tenuis extus puberula, tubo sursum paullo dilatato, lobis brevissimis; stamina numerosa, filamentis longe connatis, tubo longiexserto; legumen toment osum solemniter saepe semicirculare curvatum, lineari-oblongum, marginibus incrassatis, inarticulatum sed inter semina transverse sulcatum, bivalve, valvis crassiusculis post dehiscenciam vix contortis; semina numerosa.

Type species, *Pitbecolobium racemosum* Ducke.

**Marmaroxylon racemosum** (Ducke) Killip, comb. nov. *Pitbecolobium racemosum* Ducke, *Archiv. Bot. Jard. Rio de Janeiro* 3: errata following p. 272, 1922. *P. racemiflorum* Ducke, op. cit. 1: 14. pl. 4. 1915, non Donn. Sm., 1913.

The genus, so far as known, consists of a single species, widely distributed in the Amazon Valley of Brazil, and known also from French Guiana and the basin of the Essequibo River in British Guiana. In the account by Britton and Killip of the Mimosaceae of Colombia (*Ann. N. Y. Acad. Sci.* 35: 108. 1936), the most elaborate recent treatment of the group as it is represented in South America, *Marmaroxylon* would run to either *Artibrosamanea* or *Albizia*, depending upon one's interpretation of the character of the fruit. The genus evidently is not closely similar to *Albizia*, which has a thin and often almost papery fruit, not at all constricted between the seeds. *Artibrosamanea* differs in having the legume definitely septate between the seeds, but the valves of the fruit of *Marmaroxylon* apparently are not truly septate, in spite of the well-defined constrictions between the seeds.



COMMON NAMES: Bousi tamarin, puta locus, slang houdou, snecki housou (Sur.); bois serpent, b. zebra (Fr. G.); angelim rajado, ingá caetitú, inga-rana, inga-rana da terra firme, urubuzeiro (Braz.).

#### BOIS LA MORUE OR TAMARINDE PLOKONIE

The timber commonly known in French Guiana as Bois la Morue, in British Guiana as Red Manariballi, and in Surinam as Tamarinde Plokonie, has long borne the scientific name of *Pitbecolobium pedicellare* (DC.) Benth. A study of the wood suggested that the species was wrongly placed generically, and Mr. Killip proposes a transfer to *Samanea*, as follows:

*Samanea pedicellaris* (DC.) Killip, comb. nov. *Inga pedicellaris* DC. Prodr. 2: 441. 1825. *Pitbecolobium pedicellare* Benth. Lond. Journ. Bot. 3: 219. 1844.

According to Ducke (*Archiv. Jard. Bot. Rio de Janeiro* 3: 63), another synonym for *P. pedicellare* (DC.) Benth. is *Mimosa terminalis* Vell. Fl. Flum. 2c. XI t. 30 (= *P. polycephalum* Benth., according to Bentham). Elsewhere (*As Leguminosas da Amazonia brasileira*, 1939, p. 26) he states that the species is common in the forest of the estuary of the Amazon River and also occurs in Rio de Janeiro. Ducke's reference to the wood as yellowish white, coarse-textured, and not utilized in Pará seems much more appropriate for *P. polycephalum* than for the timber under consideration.

COMMON NAMES: Red manariballi (Br. G.); aboonkini, alawatta-moelerie, arawata-moerere, asau, baboen-banjie, hoerowassa, kabana, manaliballi-hororodikoro, manariballi-koereroe, plokonie, proekoenie, prokonie, sera, tamalin, tamarinde plokonie (Sur.); bois ara, b. cerf, b. la morue, b. macaque rouge, b. pagode, bougouni, cèdre d'argent, préfontaine rouge (Fr. G.); cambui, ingá-rana (Braz.).

#### THE BITTER ANGELIMS

Twenty years have elapsed since I first attempted to identify a group of moderately hard, coarse-textured woods, yellowish in color when fresh but becoming brown or reddish upon exposure, and noted for the extremely bitter and lasting taste of the yellow powder that fills the vessels. As a result

largely of the valuable collections of Adolpho Ducke, it is now known that the woods represent two closely related genera, *Vatairea* and *Vataireopsis*, which are sometimes placed in the section *Aristobulia* of *Andira*. The timbers are much alike in general appearance and properties, but from such information as is now available it appears that the specimens with the finer and more numerous rays belong to *Vatairea* and those with few and coarser rays to *Vataireopsis*.

As stated in *Timbers of Tropical America* (p. 303), there were at that time (1924) two specimens collected under the name of Guacamayo along the eastern Guatemala-Honduras boundary which evidently belonged in this Brazilian group. Other material was subsequently obtained from Guatemala and British Honduras, and in 1937 Llewellyn Williams collected two wood samples of a tree called Picho in the Isthmus of Tehuantepec, Mexico. Paul C. Standley identified the Mexican material with his *Tipuana Lundellii*. Killip studied the Central American and Mexican specimens and concluded that they belong to *Vatairea* and are not referable to any of the South American species. At Standley's suggestion he proposes the following transfer:

*Vatairea Lundellii* (Standl.) Killip, comb. nov. *Tipuana Lundellii* Standl. Carnegie Inst. Washington Publ. 461: 65. 1935.

COMMON NAMES: Picho (Mex.); bitterwood (Br. H.); frijollillo (Guat.); amargoso, guacamayo (Hond.); amargo (Pan.).

#### VINHATICO DE ESPINHO

The Vinhatico de Espinho of the Bahia region of Brazil is a large, well-formed timber tree sometimes 100 feet tall and four feet in diameter, of scattered occurrence on upper hill slopes in association with the Vinhatico Castanho (*Platymania reticulata* Benth.). It is closely related to *Cbloroleucon tortum* (Mart.) Pittier (= *Pitbecolobium tortum* Mart.), a low branched, crooked shrub or small tree with a range extending from northeastern Argentina through eastern Brazil, northern South America, the West Indies, and Central America to Baja California, Mexico. The woods of the two species are readily separable though obviously of the same genus. They



are also distinct from those of other sections of *Pitbecolobium* (*sens. lat.*). The following transfer is accordingly proposed:

*Chloroleucon vinhatico* Record, comb. nov. *Pitbecolobium vinhatico* Record, Timbers of Tropical America, p. 211. 1924.

#### MISCELLANEOUS TRANSFERS

*Albizia polycephala* (H.B.K.) Killip, comb. nov. *Pitbecolobium polycephalum* Benth. Lond. Journ. Bot. Hook. 3: 219. 1844. *Samanea polycephala* Pittier, Arb. y Arb. Venez. 55. 1925.

*Arthrosamanea daulensis* (Spruce) Killip, comb. nov. *Pitbecolobium daulense* Spruce ex Benth. Trans. Linn. Soc. 30: 586. 1875.

*Macrosamanea Spruceana* (Benth.) Killip, comb. nov. *Pitbecolobium Spruceanum* Benth. Trans. Linn. Soc. 30: 590. 1875.

*Punjuba dependens* (Rusby) Killip, comb. nov. *Pitbecolobium dependens* Rusby, Mem. N. Y. Bot. Gard. 7: 253. 1927.

*Samanea coripatensis* (Rusby) Killip, comb. nov. *Pitbecolobium coripatense* Rusby, Bull. N. Y. Bot. Gard. 4: 349. 1907.

*Senegalia multiflora* (H.B.K.) Killip, comb. nov. *Acacia multiflora* H.B.K. Nov. Gen. & Sp. 6: 277. 1824. *Pitbecolobium multiflorum* Benth. Lond. Journ. Bot. Hook. 3: 220. 1844. *Samanea multiflora* Pittier, Arb. y Arb. Legum. I. Mimos. 61. 1927.

*Senegalia paniculata* (Willd.) Killip, comb. nov. *Acacia paniculata* Willd. Sp. Pl. 4: 1074. 1806.

*Zygia cauliflora* (Willd.) Killip, comb. nov. *Inga cauliflora* Willd. Sp. Pl. 4: 1021. 1806. *Mimosa cauliflora* Poir. in Lam. Encycl. Suppl. 1: 45. 1810. *Pitbecolobium cauliflorum* Mart. Flora 20, pt. 2, Beibl. 116. 1837; ex Benth. Trans. Linn. Soc. 30: 595. 1875.

*Zygia Engelsingii* (Standl.) Record, comb. nov. *Pitbecolobium Engelsingii* Standl. Trop. Woods 34: 40. 1933. *Inga Engelsingii* Standl. Trop. Woods 17: 27. 1929; Field Mus. Bot. 4: 211. 1929.

*Zygia Stevensonii* (Standl.) Record, comb. nov. *Inga Stevensonii* Standl. Trop. Woods 23: 7. 1930.

## NEW NAMES IN *CYBISTAX* AND *TABEBUIA*

By RUSSELL J. SEIBERT

Recently it was found necessary to transfer the lower Mexican and Central American *Primavera* (*Tabebuia Donnell-Smithii*) to *Cybistax Donnell-Smithii* (Rose) Seibert, Carnegie Inst. Publ. No. 522, p. 392. 1940. Further studies of the genus *Tabebuia* have led to the conclusion that the Venezuelan and Colombian species, *Tabebuia chrysea*, should also be transferred to *Cybistax*.

*Cybistax chrysea* (Blake) Seibert, comb. nov. *Tabebuia chrysea* Blake, Contr. Gray Herb. No. 53, p. 50, 1918; Trop. Woods 36: 17. 1933.

Tree to 20 m. high and 8 dm. in diam.; branchlets, petioles and petiolules sordid stellate-tomentulose; leaves 5-foliolate; leaflets oval-ovate to ovate-lanceolate, 10-22 cm. long and 4-8.5 cm. broad, the lateral ones somewhat smaller, crenate, membranaceous, acute, base truncate to subcordate, stellately puberulous above and below, pilose along the main nerves, especially above; inflorescence a dense flowering raceme about 10 cm. long; flowers golden yellow; calyx campanulate about 2 cm. long, thinly membranaceous, yellow, of about the same texture as the corolla, the lobes of 5 deltoid acute teeth about 5 mm. long, somewhat tomentellous, becoming subglabrate when mature; corolla 6-7 cm. long, thinly membranaceous, more or less minutely tomentellous on the outer surface; fruit conspicuously costate when mature, about 50 cm. long and 3 cm. broad, stellately puberulous when young; seeds flat, surrounded by a large, white hyaline wing.—Apparently restricted to northern Colombia and northwestern Venezuela.

COLOMBIA: Dept. Atlántico: Finca "Santa Rosa," near Barranquilla, st. Nov. 1932, *A. Dugand* G. 237 (Yale); Arroyo Cipacua, alt. 150-250 m., st. Sept. 1934, *Dugand* 711 (Yale); along the Puerto Colombia road, fl. Jan. 1934, *Dugand* 517 (Yale); near Santo Tomas, fl. Dec. 1932, *Dugand* 288 (Yale).

VENEZUELA: State of Falcón: vic. Alta Garcia, fl. May 1917, *H. M. Curran* & *M. Haman* 737A (Gray, NY), 737 B



(Gray); between Coro and Alta Garcia, fl. May 1917, *Curran & Haman 737* (AA, Gray, type of *Tabebuia cbrysea* Blake, NY, US). State of Lara: between Rio Tocuyo and Carora, fl., fr. Jan. 1928, *H. Pittier 12613* (Gray, MBG, NY, Yale). State of Zulia: vic. of Maracaibo, fl., fr. Dec. 1922, *Pittier 10966* (Gray, NY); cultivated in vic. of Maracaibo, st. Oct. 1922, *Pittier 10499* (Gray, NY).

VERNACULAR NAMES: Araguán (*Pittier 12613*); cañada (*Pittier 10499, 10996*); penda (*Pittier 10996*); roble (*Dugand 237, 288*); roble amarillo (*Dugand 237, 288, 517, 711*).

The above species is readily distinguishable from *Cybistax antispythitica* Mart. (Brazil, Argentina, Bolivia, and Peru), which has entire leaflets, conspicuously glandular-lepidote and sparsely puberulous and acute or broadly acute towards the base. The inflorescence is of a paniculate rather than a racemose type as found in *C. cbrysea*. *C. Donnell-Smithii* has 5-7-foliolate leaves and entire or somewhat irregularly serrate leaflets which are glabrous above and below, except along the nerves. The inflorescence is a broad, open panicle; calyx bilabiate and both the calyx and corolla pubescent with capitate-glandular hairs.

*Tabebuia dubia* (C. Wright) Britton ex Seibert, comb. nov. *Tecoma dubia* C. Wright, in Sauvalle Fl. Cub. p. 95. 1873. *Tabebuia crassifolia* Britton, Bull. Torr. Bot. Cl. 42: 376. 1915.

CUBA: PROV. Oriente: Guaro River Dam, st. Feb. 1926, *Crosby & Matthews 44* (NY, Yale); southeast of Holguin, Barren savannas, fl. Apr. 1909, *J. A. Sbafer 1285* (MBG, NY type of *Tabebuia crassifolia* Britton); Moa, Baracoa, fl. fr. Aug. 1917, *J. T. Roig 34* (NY). Without definite locality: st. Dec. 1925, *T. H. Gill 99* (NY); fl. Mar., *C. Wright s.n.* (Gray, cotype (?) of *Tecoma dubia* C. Wright).

VERNACULAR NAME: Roble negro.

According to a note on the type specimen of *Tabebuia crassifolia*, Britton "compared [the specimen] with *Tecoma dubia* C. Wright in Gray Herbarium July 25, 1919" and found the two plants to be conspecific. The correct combination, however, apparently was never published by Dr. Britton.

## AMERICAN TIMBERS OF THE FAMILY BIGNONIACEAE

By SAMUEL J. RECORD and ROBERT W. HESS

The Bignoniaceae comprise more than 100 genera and several hundred species of general distribution in the tropics, a few in temperate regions. A great many of the plants are scandent shrubs or woody climbers, one of the best known being the Trumpet Creeper cultivated in gardens. The stems of many of the lianas are of anomalous structure, a common form having regularly spaced deep furrows filled with phloem wedges, the line of separation appearing on cross section like a miniature staircase (see Solereder's *Systematic anatomy of the dicotyledons*, pp. 605-610). The plants are noted for the beauty of their showy flowers and many are planted for decorative purposes. There are numerous arborescent genera and a few of them yield timber of commercial importance.

In the New World the trees are of 16 genera, namely, *Amphitecna*, *Astianibus*, *Catalpa*, *Chilopsis*, *Cotema*, *Crescentia*, *Cybistax*, *Ekmanianthe*, *Enallagma*, *Jacaranda*, *Macrocatalpa*, *Paratecoma*, *Parmientiera*, *Tabebuia*, and *Tecoma*. They are all tropical except *Catalpa* and *Chilopsis*. The timbers exhibit a wide range of variation in appearance and properties. Many are light-colored throughout, others have a distinct heartwood in various shades of brown to olive or blackish, uniform or more or less variegated or striped; dark specimens frequently have an oily appearance and abundant sulphur-like deposits (*Cotema*, *Godmania*, *Paratecoma*, and *Tabebuia* in part). Luster low to satiny. Taste bitter in *Tecoma* and in inner bark of *Godmania*, absent or not distinctive in the others; odor suggesting kerosene in *Catalpa*, absent or mild and not describable in the others. Density range very great; sp. gr. 0.40 to 1.25; texture fine to coarse; grain straight to roey or otherwise irregular; working properties fair to excellent; durability poor to very high.

Growth rings usually present, sometimes conspicuous; ring-porous structure occasionally present (*Catalpa* and *Chilopsis*). In diffuse-porous woods, pores medium-sized to minute, few to numerous; commonly solitary and in small multiples or little clusters, evenly distributed or tending to diagonal or



concentric arrangement. Vessels with exclusively simple perforations (reticulate perforation plates sometimes present in certain Old World species; see *Forestry* 7: 1: 16-25); spiral thickenings characterize smallest vessels of *Catalpa* and *Cbilopsis*; tyloses common; intervacular pitting alternate, rather fine to fairly coarse. Rays 1 to 8, generally 1 to 3, cells wide, often uniformly low, sometimes up to 50 or more cells high; distinctly heterogeneous in *Astianthus*, *Tecoma*, *Jacaranda* in part, weakly so in *Catalpa*, *Cbilopsis*, and *Paratecoma*, mostly homogeneous in the others; small cubical crystals seen in *Tabebuia stenocalyx*, otherwise apparently absent; pits to vessels small and rounded to rather large, oval to irregular (e.g., *Catalpa*); pitting sometimes unilaterally compound. Wood parenchyma sparse to very abundant; paratracheal, narrow to coarse aliform to confluent in narrow or wide, short to concentric bands; often finely terminal; no crystals seen. Wood fibers with thin to very thick and gelatinous walls; septate in *Macrocatalpa* and in *Cydistax* in part; pits simple or more or less distinctly bordered. Ripple marks present in *Cotema*, *Crescentia*, *Cydistax*, *Godmania*, *Paratecoma*, and *Tabebuia*; 80 to 140 per inch; regular to irregular; all elements involved; secondary seriation often distinct with lens in the bands of 2-celled parenchyma strands. No gum ducts seen.

*Astianthus viminalis* (H.B.K.) Baill., the only species, is a tree sometimes 50 feet high growing on sand bars along streams from southern Mexico to Gualán, Guatemala. The simple, linear leaves are ternately whorled; the yellow flowers are borne in loose terminal paniced cymes; the small linear capsule contains numerous small broad-winged seeds. So far as known, the timber is not utilized for any special purpose because of its scarcity.

The following description is based upon a small twig from a herbarium specimen supplied by R. J. Seibert from the Missouri Botanical Garden. Pores small ( $60\mu$ ), numerous, fairly well distributed, often in short radial multiples. Vessels with simple perforations; walls finely striate; pits alternate, very small ( $4.5\mu$ ). Rays uniseriate and biseriate and up to 50 cells high; decidedly heterogeneous, with high margins of square and upright cells; pits to vessels very small. Wood parenchyma sparingly paratracheal. Wood fibers with very numerous, very small, indistinctly bordered pits. Ripple marks absent.

*Amphitecna macrophylla* (Seem.) Miers is a shrub or small tree, closely related to *Enallagma*, of restricted occurrence in the mountainous forests of southern Mexico and Guatemala. The large, simple, alternate, nearly sessile leaves are clustered at the ends of the branches; the long-pedicellate greenish flowers are borne on short bracteate shoots on the old wood; the fruit resembles Cacao (*Theobroma*) and the seeds, which

are without wings, are imbedded in pulp. There are no known uses for the timber. The wood has not been studied.

COMMON NAME: Huiro de montaña.

*Catalpa*, excluding the section *Macrocatalpa* as a separate genus, is composed of four species of deciduous trees of the north temperate zone, two occurring in Japan and northern China, the others of limited natural distribution in the south-eastern quarter of the United States, though rather widely cultivated. They have stout twigs without a terminal bud; the large to very large leaves are typically in whorls of three; the flowers are conspicuous in terminal panicles; the fruit is a long, 2-valved capsule containing numerous flat, hairy-winged seeds.

*Catalpa bignonioides* Walt., often called Indian bean, is typically a short, stout-boled tree, with a spreading crown, rarely attaining a height of 60 feet. It is planted for decorative purposes and is hardy as far north as eastern New England. It is of no importance as a source of timber. *C. speciosa* Warder, generally known as the Hardy Catalpa, is a forest tree, said to attain a maximum height of 120 feet with a tall straight trunk upward of 50 inches in diameter on fertile bottomlands in the lower Ohio River region. The easily worked, durable timber has never been available in sufficient quantity to be a factor in the market, but it served as a background for the commercial exploitation of the species for forest plantations. Thirty to forty years ago no other tree was so generally and indiscriminately recommended for planting in the Middle West. Some of the plantations have proved successful, but a larger number have, for various reasons, been partial or complete failures. The principal use for the product is for fence posts and fuel.

Heartwood light brown, sometimes tinged with olive; sapwood nearly white, tending to discolor and merging gradually in the heartwood. Luster fairly high. Odor suggesting kerosene; taste not distinctive. Light and soft; sp. gr. (air-dry) 0.40 to 0.45; weight 25 to 28 lbs. per cu. ft.; texture medium to coarse; grain generally straight; very easy to work, finishing smoothly, holds place well when manufactured; durability good to fair.



Ring-porous; larger pores visible, in rather wide band; pores in late wood small to minute, in multiples and clusters, associated with parenchyma and tending to form irregular bands near periphery of growth rings. Vessels with simple perforations; small vessels with spiral thickenings; tyloses abundant; pitting medium coarse, alternate. Rays mostly 2 to 4 cells wide (few uniseriate) and up to 30 cells high; weakly heterogeneous; pits to vessels moderately large, oval to irregular. Wood parenchyma paratracheal, sparse to fairly abundant in different parts of growth ring. Wood fibers thin-walled, non-septate. Ripple marks absent.

COMMON NAMES: Bean tree, bois puant, catalpa (common, hardy, western), catawba, cigar tree, Indian bean, I. cigar tree, smoking bean, Shawnee wood (U.S.A.).

*Chilopsis*, with a single species, *C. linearis* (Cav.) Sweet (= *C. saligna* Don), is a small deciduous tree, sometimes 30 feet high with a short trunk a foot or more in diameter, growing along arroyos and in depressions in the desert in southwestern United States and northern Mexico. The showy, sweet-scented flowers, the long seed pods, and the rather soft brownish wood resemble *Catalpa*, but the narrow leaves and slender branches suggest *Salix*, hence the usual American name of Desert Willow or Flowering Willow. The pliable withes are used locally for making baskets and the stems supply a limited amount of post timber and fuel.

Heartwood golden brown and more or less streaked when fresh, and sometimes with a metallic luster; fairly distinct but not sharply demarcated from the thin, lighter-colored sapwood. Luster rather high. Slightly odorous, but without distinctive taste. Wood moderately light, but hard; sp. gr. (air-dry) 0.60; weight about 38 lbs. per cu. ft.; texture coarse, grain generally straight; working properties excellent; durability good. Of no commercial possibilities.

Growth rings distinct. Pores small and barely visible to minute, numerous; more or less distinct zonate arrangement of larger pores in early wood and of minute pores and parenchyma at terminus of growth ring; pores in median part variable in size; solitary and in small multiples, with local tendencies to diagonal arrangement. Tyloses abundant. Minute vessels with spiral thickenings. Rays 1 to 3 cells wide and up to 70, commonly less than 40, cells high; weakly heterogeneous; pits to vessels medium-sized, rounded. Wood parenchyma mostly sparingly paratracheal, becoming fairly plentiful in band of minute pores. Wood fibers with rather thin walls and very small pits. Ripple marks absent.

COMMON NAMES: Catalpa willow, desert willow, flowering willow, Spanish willow (U.S.A.); mimbre (Mex.).

*Cotema*, with four species of little trees rarely 25 feet high, is limited in distribution to eastern Cuba. The leaves are typically 3-5-foliolate, with slender petioles; the rather large, long-pedicelled flowers are solitary or in small axillary clusters; the slender terete capsule is curved or coiled; the thin, oblong seeds are winged at each end. The only specimen available (Yale 16261; Bucher 90) was collected near Santiago de Cuba by G. C. Bucher with leaves and fruits determined by Juan T. Roig as *C. spiralis* (C. Wr.) Britt. & Wils. (= *Tecoma spiralis* C. Wright). The wood belongs in the Lapacho group of *Tabebuia*; it apparently is not utilized because of the small size and scarcity of the trees.

Heartwood brown, strongly marked with yellowish green vessel deposits (lapachol compound); distinct but not very sharply demarcated from the brownish sapwood. Luster rather low. Very hard and heavy; texture fine and uniform; grain fairly straight; not easy to work, but finishing very smoothly; a yellow dust arises in sawing; durability high.

Growth rings present. Pores very small, barely visible because of deposits; rather numerous but not crowded; solitary and in pairs, occasionally in short radial multiples, fairly evenly distributed. Intervascular pitting fine, alternate. Rays uniseriate or more often biseriate and up to 10 cells high; homogeneous; storied; pits to vessels small. Wood parenchyma sparingly paratracheal and sometimes aliform and confluent; also in concentric lines or narrow bands at irregular intervals which in some instances may correspond to seasonal growths. Wood fibers with very thick, gelatinous walls and small lumen; pits with very small borders. Ripple marks fairly regular; about 140 per inch. No gum ducts seen.

*Crescentia*, with a few species of small to medium-sized, irregular, evergreen trees, is widely distributed in tropical America and commonly planted there and in the Old World for the gourd-like fruits. The best known species is *C. Cujete* L., the Calabash tree, with a short trunk, crooked limbs, and often drooping branches. The leaves are simple, obovate and often spatulate (in *C. alata* H.B.K. they are trifoliolate, with winged petiole), and generally borne in irregularly spaced fascicles; the purple-blotched yellowish flowers appear singly or in clusters in the leaf axils or along the larger branches; the fruits,



which are large and borne close to the trunk, have a thin skin over a woody shell inclosing a mass of pulp and seeds. The shells are used by the natives for making cups, dishes, and other household utensils and some of them are ornately carved or painted. The firm, tough timber is used for the ribs and knees of small boats (for which the natural shapes of the limbs are peculiarly suited), hubs and felloes of wheels, and for saddle-trees, firewood, and charcoal.

Wood nearly white when fresh, becoming pale brownish with fine darker markings of parenchyma; sapwood not clearly defined. Luster medium. Without distinctive odor or taste. Of medium density; sp. gr. (air-dry) 0.60 to 0.71; weight 37 to 44 lbs. per cu. ft.; texture medium, though appearing coarse; grain generally irregular; fairly easy to work, finishing smoothly, does not split readily; is poorly resistant to decay. Of no export possibilities.

Growth rings present. Pores not distinct without lens, rather numerous; solitary and in small multiples, well distributed or with tendency to diagonal or zonate arrangement. Vessel lines distinct because of parenchyma. Rays 1 or 2, occasionally 3, cells wide and up to 25, usually less than 15, cells high; homogeneous; pits to vessels small, rounded. Wood parenchyma abundant, broad aliform or more often confluent into rather broad, coarse-celled concentric bands; sometimes also finely terminal. Wood fibers with very small pits. Ripple marks irregular and indistinct, about 120 per inch; all elements more or less storied.

COMMON NAMES: Calabash, wild calabash (Br. W. I.); güira, g. cimarrona, totuma (Cuba); higuero (P.R.); calabasse, c. marron (Haiti, Fr. W.I.); ayal, ayele, cirián, cuastecomate, cuastecomatl, cuautecomate, cuiro, cujete, guaje, g. cirial, g. cirián, güiro, huajerición, huas, huiro, jayacaste, jícara, luch, morro, pog, tecomate, t. ayele, tecomatl (Mex.); morro, m. guacalero (Guat.); cuchara, cutuco, guacal, huacal, jícara, j. de cuchara, j. de guacal, morrito, morro (Salv.); jícara (Hond.); calabacero, ferú-kó-uo, jícara, kuakrá, me, mékuru, tamkrá (C.R.); calabazo, jícara, palo de calabaza, p. de turumas, totumbo, totumo (Pan.); calabazo, mate, totumo (Col.); camasa, cotumo, cucharo, güiro, taparito, taparo, taparón, totumo (Venez.); mate (Ec.); huingo, pati (Peru); cabaceira, coité, cuia maracá, c. pequena do igapó, cuieira, cuité, cuiteseira, cujeté (Braz.); ibirá-acá-hiá (Par.); japacary (Arg.).

*Cybistax*, with four or five species of small to large trees, is widely but irregularly dispersed in tropical America. The leaves are opposite or sub-opposite, digitate, with 5 to 9, usually 7, leaflets; the golden yellow, rarely greenish, flowers are borne in contracted or large open terminal inflorescences; the capsule is linear-oblong, with 10 to 16 ridges on the coriaceous valves; the broadly heart-shaped seeds are surrounded with a large thin wing.

*Cybistax Sprucei* K. Sch., native to the Andean region of Peru, is cultivated for its leaves which are a source of a blue dye used as a substitute for indigo. *C. antisiphilitica* Mart. occurs in eastern Brazil and Misiones, Argentina. According to Pio Corrêa (*Diccionario dos plantas uteis do Brasil*, Vol. II, p. 61), it attains moderate size and supplies white, coarse-textured timber of medium density (sp. gr. 0.57 to 0.63) which is utilized locally for interior construction and boxes. The leaves and bark are employed medicinally. There are no wood samples available for this study.

COMMON NAMES: Caroba de flôr verde, carobeira, cinco chagas, ipé branco, i. de flôr verde, i. mèrim, i. pardo, jacarandá (Braz.); lapacho blanco (Arg.); yangua (Peru).

*Cybistax Donnell-Smithii* (Rose) Seibert (= *Tabebuia Donnell-Smithii* Rose) is a large tree with a long smooth trunk often four feet in diameter, occurring in southern Mexico, Guatemala, Salvador, and Honduras. The large, digitately compound leaves are deciduous; the yellow flowers appear before the new leaves and are borne in great pyramidal panicles, and the trees, "standing out against the sky like golden clouds," are considered the most beautiful in the region. The timber has been in the export trade for many years and was formerly known in the furniture industry by the incorrect designation of White Mahogany, but now by its proper name, Primavera. The wood finishes to resemble Ceylon Satinwood (*Chloroxylon*) and its principal use is in the form of veneers for cabinet work. The timber can be had in large logs, usually free of defects, but the annual imports into the United States are not very great.

Color yellowish white to light yellowish brown throughout, often more or less striped. Luster fairly high. Odorless and



tasteless. Light in weight, but firm; sp. gr. (air-dry) 0.45 to 0.55; weight 28 to 34 lbs. per cu. ft.; texture medium to rather coarse; grain straight to finely and attractively roey; easy to work, finishing smoothly, does not check badly in drying, holds its place well when manufactured; is poorly resistant to decay.

Growth rings present. Pores large to small, the largest barely distinct without lens; rather numerous; solitary and in small multiples and less often in little clusters, sometimes in irregular diagonal or tangential arrangement. Vessel lines fine but distinct. Tyloses present. Rays 1 to 8, mostly 4 to 6, cells wide and up to 30, commonly less than 20, cells high; homogeneous; ray-vessel pitting often unilaterally compound. Wood parenchyma rather sparingly paratracheal, sometimes diagonally or tangentially confluent for short distances; also finely terminal. Wood fibers with medium walls; occasionally septate; pits small. Ripple marks irregular, barely visible; 85 to 100 per inch; all elements involved.

COMMON NAMES: Primavera (Trade); duranga, palo blanco, primavera (Mex.); copal, palo blanco (Guat.); cortex, c. blanco (Salv.); San Juan (Hond.).

*Cybistax chrysea* (Blake) Seibert (= *Tabebuia chrysea* Blake) is a common deciduous tree, up to 60, rarely to 80, feet tall, with a large crown supported by a stout, erect trunk sometimes three feet in diameter, apparently restricted in distribution to northern Colombia and northwestern Venezuela. The bark is rough and gray; the leaves are large, digitate, with five grayish green, rough, crenate leaflets covered with stellate pubescence; the profuse golden yellow flowers are borne in dense terminal racemes just before the advent of the new leaves; the capsules are 12 to 20 inches long and contain hundreds of white, flat, winged seeds. The timber is of good quality and according to L. Williams (*Maderas económicas de Venezuela*, p. 89) is used for cabinet work, carpentry, railway cross-ties, and naval construction. It is worthy of consideration for the same purposes as Primavera and as a substitute for the brownish shades of Satinwood.

Heartwood brownish yellow, with a golden luster; rather sharply demarcated from the thick whitish sapwood. Odorless and tasteless. Moderately hard and heavy; sp. gr. (air-dry) 0.65 to 0.70; weight 40 to 44 lbs. per cu. ft.; texture uniform, medium; grain finely roey; does not check badly in drying;

easy to work, finishing smoothly and taking a lustrous polish. Suitable for fine furniture.

Growth rings distinct. Pores small to medium-sized, the largest near limit of vision; more numerous in early wood; often in small multiples and occasionally in clusters, with tendency to diagonal arrangement. Tyloses common to abundant. Intervascular pitting fine to medium (6 to 8 $\mu$ ), alternate. Rays 1 to 3, sometimes 4, cells wide and up to 15 cells high; homogeneous; irregularly storied; pits to vessels small. Wood parenchyma sparingly paratracheal, occasionally aliform; also terminal in a band 1 to 4 cells wide. Wood fibers septate, at least in part; pits very small. Ripple marks irregular; 110 to 120 per inch.

COMMON NAMES: Roble, r. amarillo (Col.); araguán, cañada, penda (Venez.).

*Ekmanianthe* is a genus proposed by Urban in 1924 for two species of West Indian trees segregated from *Tecoma*. *E. longifolia* (Gris.) Urb. grows in the rocky uplands of central Cuba and in Haiti; *E. actinophylla* (Gris.) Urb. occurs in western Cuba, where it is known as Roble Caimán. The timber is of good quality, but appears to be scarce. The only available authentic wood sample (Yale 13572) is of the second species and was collected by Alberto J. Fors, Pinar del Río, with herbarium material determined by Juan T. Roig.

Heartwood brown, with lighter and darker stripes appearing as seasonal growth layers; has a slightly waxy appearance; sapwood not seen. Superficially dull, but with golden luster below. Tasteless, but with mild odor. Very hard, heavy, tough, and strong; texture medium, grain somewhat roey; not very difficult to work, taking a high polish; is probably durable under exposure.

Growth rings present. Pores very small to medium, scarcely distinct without lens, rather numerous; solitary and in small multiples and clusters, irregularly distributed, with tendency to local zonation. Tyloses present; no lapachol compound seen. Rays 1 to 3 cells wide and up to 20, commonly less than 15, cells high; homogeneous; pits to vessels rather small, rounded. Wood parenchyma rather sparingly paratracheal, occasionally short aliform; also finely terminal. Wood fibers, especially in late wood, with very thick, gelatinous walls. Ripple marks absent.

COMMON NAMES: Roble caimán, r. real (Cuba); chène a glandes (Haiti).

*Enallagma*, with several species of small trees or shrubs,



occurs in southern Florida, the West Indies, southern Mexico, Central America, and northern South America. The genus is closely related to *Crescentia*, but the simple leaves are of a different shape and are alternate instead of fascicled; the flowers are large, with long peduncles, and borne singly or in small clusters, terminal or axillary; the fruit is large and gourd-like. The most widely distributed species is *E. latifolia* (Mill.) Small (= *Crescentia latifolia* Mill. = *C. cucurbitina* L.), a tree sometimes 35 feet tall, common on lowlands, especially in tidal swamps. The tough and strong wood is used to a very limited extent in making ox yokes, plows, and handles.

Wood not distinctively colored when fresh, becoming pale brownish with an orange hue upon exposure. Luster medium. Odorless and tasteless. Moderately hard and heavy; texture coarse, at least in appearance; grain variable; easy to work, poorly resistant to decay. Of no commercial possibilities.

Growth rings present. Pores not distinct without lens, rather numerous; solitary and in pairs, less often in larger multiples, well distributed. Rays uniseriate and up to 15 cells high; homogeneous; pits to vessels small, rounded. Wood parenchyma abundant, coarse-celled; short aliform and confluent into broad concentric bands; often also finely terminal. Ripple marks local or very irregular.

**COMMON NAMES:** Black calabash (Florida, B.W.I.); güira, g. boba, g. de olor, magüira, masgüira (Cuba); higuerrillo (P.R.); calebasse zombe (Haiti); calabash (Trin.); higuerrillo, huiro de montaña, jicarillo (Mex.); calabash, wild calabash (Br. H.); morito del río (Guat.); cacao silvestre, gsií-krá (C.R.); tutumillo, tutumito (Pan.); camuro, taparito (Venez.).

**Godmania**, with two species of small trees, is distributed from southern Mexico to the Amazon region of Brazil. The common species is *G. aesculifolia* (H.B.K.) Standl. (= *G. macrocarpa* Hemsl.), a tree rarely over 25 feet high occurring from British Guiana to Mexico. The leaves are opposite, long-stalked, digitately compound with 5 to 9 leaflets; the rather small, variously colored flowers are borne in dense corymbs; the pods are very long, slender, and spirally curved and contain numerous flat seeds with a long thin wing at each end. The tree is not utilized for any special purposes.

Heartwood dull yellow-brown, becoming darker upon ex-

posure; sharply demarcated from the lustrous pale brownish sapwood. Without distinctive odor, but with mild spicy taste (inner bark very bitter). Heartwood moderately hard and heavy, sapwood considerably lighter; texture medium; grain irregular to roey; easy to work, finishing smoothly; appears highly resistant to decay.

Growth rings usually present. Pores 100 to 125 $\mu$ , indistinct without lens, numerous; solitary and in small multiples, in irregular diagonal to broken ulmiform arrangement. Vessel lines often distinct because of dark gummy deposits. Vascular pits small (4 to 5 $\mu$ ), alternate. Rays 1 to 3 cells wide and up to 10 cells high; uniseriates few, very low, heterogeneous, the others homogeneous; orange-brown gum abundant; pits to vessels small (4.5 to 6 $\mu$ ), rounded. Wood parenchyma abundant; about pores and joining them into rather wide, irregular, wavy, broken tangential bands composing a third to half of the ground mass; sometimes in a fairly regular concentric pore-and-parenchyma band demarcating a growth ring; strands mostly with 2, sometimes 4, cells; fusiform cells also present. Wood fibers with indistinctly bordered pits. Ripple marks regular to irregular; about 100 per inch; all elements storied.

**COMMON NAMES:** Cacho de toro, hoco, joco, roble (Mex.); palo blanco, señorita (Guat.); cortéz blanco (Salv.); corteza de chivo (C.R.); araguaney de sabana, cacho de chivo, c. de venado, cornicabro, cuerno de cabra, sabanero (Venez.).

**Jacaranda**, with numerous species of shrubs and small to large trees, is widely distributed in tropical America, though most of the representatives are Brazilian. The leaves are opposite, typically bipinnate with numerous small leaflets; the large blue or violet flowers are commonly borne in terminal panicles; the fruit is a rounded and compressed woody capsule with winged seeds. The plants are highly ornamental because of their foliage and flowers and a few of them supply useful timber. *Jacaranda coerulea* (L.) Gris. (= *J. Sagreana* DC.) attains a maximum height of 40 feet in the Bahamas, where it is known as Boxwood, Cancer Tree, and What O'clock. It is also reported from Martinique, and from Cuba where it is called Abey and Abey Macho. The timber is yellowish white, hard, moderately heavy (sp. gr. 0.72), fine-textured, and easy to work, and is used for carpentry in rural districts. Other species producing woods of this type are *J. arborea* Urb., *J. mimosifolia* D. Don (= *J. ovalifolia* R. Br.), and *J. rhombifolia* G.F.W. Mey. (= *J. filicifolia* [Anders.] D.



Don). All have numerous small, tangentially arranged pores and uniseriate, homogeneous rays.

The name Caroba is applied to various species of *Jacaranda* in Brazil and Argentina, notably *J. caroba* DC. and *J. semi-serrata* Cham. They are said to be trees 30 to 60 feet tall and 16 to 30 inches in diameter, supplying some lumber for carpentry, though the principal uses are for fuel and charcoal. The woods are yellowish white or grayish, with fine brown parenchyma and vessel lines producing a distinct pattern on the tangential surface. They are rather light and soft (sp. gr. about 0.55), not very strong, brittle, straight-grained, fine-textured, easy to work, and finishing smoothly. A distinguishing feature of this group is that the rays, which are 1 to 3 cells wide, are definitely heterogeneous.

The best known and most widely distributed species is *Jacaranda copaia* (Aubl.) D. Don; it is a tall tree with pinnate leaves sometimes nearly five feet long and is very showy when covered with abundant panicles of blue or purplish flowers. It is distributed from British Honduras to Brazil. Huber (*Bol. Mus. Goeldi* 6: 202) says that it occurs in the upland forests of the Amazon region, where it is known as Caroba do Matto and Parapará, and supplies a soft white wood often mistaken for Marupá (*Simaruba*). According to Heyder (*Tropical Woods* 3: 7), the tree is common in the mixed hardwood forests throughout British Guiana, making its best growth on the coastal reefs and along the banks of the Essequibo, Demerara, Berbice, and Corentyne rivers, particularly near their mouths. A total height of 80 feet is common and is often exceeded. The distance from the root to the first large branch varies from 18 to 48 feet, occasionally more. The diameters range from 6 to 30 inches. Some of the tallest trees are often very slender, while those with the largest diameter may be comparatively short. The supply of the timber is abundant and the growth is rapid. Owing to the lightness of the wood the logs are used by the Indians and others to add buoyancy to rafts of heavier timber. Other uses are for making corials, or buck shells, cheap coffins, match sticks or splints, boxes, and houses. The wood is perishable in contact with the ground or exposed to the weather, but is suitable for all sorts of in-

terior work where cheap material is required. A suggested use is paper pulp.

The following description applies particularly to the woods of *Jacaranda copaia* and *G. rbombifolia*. Color oatmeal to dingy white throughout, with prominent brown vessel lines. Luster rather high. Odorless and tasteless. Light in weight but firm; sp. gr. (air-dry) 0.40 to 0.50; weight 25 to 31 lbs. per cu. ft.; texture medium to coarse, uniform; grain straight; very easily worked, but saws woolly when fresh, finishes smoothly, holds nails firmly; perishable in contact with the ground.

Growth rings, if present, often poorly defined. Pores readily visible, rather few; solitary and more or less often in small multiples, evenly distributed. Rays mostly 2 to 4 cells wide and up to 40, rarely to 60, cells high; homogeneous, with occasional irregular marginal cells; pits to vessels rather large. Wood parenchyma distinct with lens; long, narrow aliform, sometimes confluent. Wood fibers with numerous rather large pits. Ripple marks absent or local and irregular.

COMMON NAMES: Boxwood, cancer tree, what o'clock (Bah.); abey, a. macho (Cuba); l'abbe blanc, l'a. franc (Haiti); samarapa (Br. H.); gallinazo (C.R.); palo de buba (Pan.); caballitos, caco, chingali, gualanday, pavito (Col.); abey, amuscu, árbol de roseto, chingali, cupay, guarupa, nogal blanco, saca-candela (Venez.); fotui, futi, phootee, sand trysil (Br. G.); alieskie-ie, a. wewe, diamilikie, fettejje, foete-ie, footee, futi, gobaia, jaivie, jawie, jassie-hoehoe, jessie-noedol, kabana, kandra-hoedoe, koepaja, kopaia, koroballi, maja-ariran, mari-mari, tjoekoenda, totui (Sur.); bois á pian, copaia, c. des chantiers, faux simarouba, onguent-pian (Fr. G.); barbatimão, camboatá pequena, camboté, caraúba, caroba, c. do campo, c. do carrasco, c. do matto, c. miúda, c. preta, c. roxa, carobeira, carobinho, c. do campo, c. do matto, c. guassú, carobossú, casco de cavahlo, jacarandá caroba, j. da serra, j. mimosa, j. preto, marupaúba, parapará, p. guassú, simaruba copaia, s. falsa (Braz.); caroba, jacarandá, nazare, tarco (Arg.); amchiponga, ishpingo, ishtápi, paravisco, solimán del monte (Peru).

*Macrocatappa* includes a few closely related species of small to medium-sized evergreen trees occurring in the West Indies. The group is generally included as a section of *Catalpa*, but Britton (*Journ. N. Y. Bot. Gard.* 19: 8. 1918) considers it a



distinct genus and his classification is convenient for use in describing the woods.

*Macrocatalpa punctata* (Gris.) Britt. (= *Catalpa punctata* Gris.) occurs in the Bahamas, where it is sometimes 35 feet tall, and in Cuba, where it is common in lowlands and river swamps, but is usually not over 25 feet high. It has highly fragrant yellow flowers, long, slender pods, and linear seeds. The lead-colored wood has a distinctive odor when fresh and is used to a minor extent for small structural work. *M. longissima* (Jacq.) Britt. (= *Catalpa longissima* Jacq.) also occurs in Cuba, but is at its best in Haiti where it is highly esteemed locally for carpentry, flooring, and furniture. The logs available are 12 to 18 inches in diameter and the supply is too limited to permit development of an export trade.

The wood is like that of *Catalpa* in many ways but differs in the following important details: Diffuse-porous; pores solitary and in short, occasionally long, radial multiples, well distributed. Vessels without spirals. Rays heterogeneous, many of the cells square. Wood parenchyma sparingly paratracheal, sometimes finely terminal. Wood fibers septate.

COMMON NAMES: Roble de olor (Cuba); roble (Dom. R.); bois chêne, chêne (Haiti); chêne de Antilles (Mart.); randegonde (Guad.).

*Paratecoma*, with only one species, *P. peroba* (Record) Kuhl. (= *Tecoma peroba* Record = *P. diandra* Kuhl.), is a large and important forest tree of eastern Brazil (see Bol. 4, Serviço Florestal do Brasil, Rio de Janeiro, 1931). It attains a maximum height of about 130 feet, with a slender symmetrical bole about 95 feet long and 60 inches in diameter and covered with a distinctly ridged, yellowish bark. The leaves are opposite, digitately compound with 3 to 7, mostly 5, serrate leaflets; the long-tubed flowers are borne in terminal panicles; the fruit is a flattened woody capsule containing numerous flat, entire-winged seeds. The timber is one of the most important in the market of Rio de Janeiro and is known as a kind of Peroba, a name usually applied to species of *Aspidosperma*. It is used for interior trim in the better class of houses, banks, and stores and for making high-grade furniture. Small shipments have been made to New York and a cabinetmaker there says of it: "Peroba is a yellowish, moderately hard wood

obtained in logs sometimes 30 inches through. It takes stain fairly well, is of about the color of Greenheart, and has a texture suggesting Santo Domingo Satinwood. If not properly dried it is likely to check when exposed to warm temperatures. Experienced workmen are careful to avoid the splinters which they believe to be poisonous."

Heartwood light olive, with a yellowish, greenish, or reddish hue, sometimes indistinctly striped; sharply demarcated from the white or yellowish sapwood. Fairly lustrous. Odor and taste not distinctive. Moderately hard and heavy; sp. gr. (air-dry) 0.70 to 0.83; weight 43 to 52 lbs. per cu. ft.; texture medium; grain straight to roey or curly; not difficult to work, finishing smoothly and attractively; is highly durable. An excellent wood with export possibilities.

Growth rings present. Pores near limit of vision, numerous, crowded in places; solitary and in small multiples, rather irregularly distributed, with tendency to diagonal arrangement. Tyloses abundant; lapachol compound sparingly present. Rays 1 to 3, mostly 2, cells wide and up to 35, generally less than 25, cells high; homogeneous or nearly so; pits to vessels medium-sized, rounded. Wood parenchyma sparingly vasicentric and finely terminal. Wood fibers with thick, gelatinous walls; oily deposits common. Ripple marks irregular, barely visible with lens, 90 to 95 per inch; all elements more or less in seriation.

COMMON NAMES: Ipé peroba, peroba, p. amarella, p. branca, p. do campo, p. manchada, p. resaca, p. tigrinha, p. tremida, p. verdadeira (Braz.).

*Parmentiera*, with five described species of shrubs or trees sometimes 40 feet high, is apparently limited to southern Mexico and Central America. The branches are often armed with short, incurved spines; the alternate or subopposite leaves are typically trifoliolate; the large greenish flowers are borne singly or in clusters along the main stem and larger branches; the fruit is gourd-like. There are two Mexican species, the better-known being *P. edulis* DC., often cultivated there and in Central America for its short, thick, yellowish green fruit which is sweet and edible either raw or cooked. There are three species in southern Central America. *P. cereifera* Seem. is of rather frequent occurrence in the forests on the Atlantic side of Panama, and suggests a very large shrub as it is usually branched almost to the base. The pendant, smooth



and yellowish fruits look like long wax candles and have an apple-like odor; they are said to provide excellent feed for cattle. So far as known, the woods of the several species of *Parmentiera* are not utilized for any special purposes.

The only sample available (Yale 12023; Cooper 402) is from the type of *Parmentiera macrophylla* Standl., a small tree discovered by G. Proctor Cooper in the Province of Bocas del Toro, Panama. Sapwood pale yellowish brown with faint greenish tinge; heartwood not seen. Fairly lustrous. Odorless and tasteless. Hard, heavy, tough, and strong; texture fine; grain irregular; not difficult to work; durability presumably low. Of no commercial possibilities.

Growth rings present. Pores scarcely visible with lens, rather numerous; solitary and in pairs, well distributed. Rays uniseriate and biseriate and up to 15 cells high; homogeneous; pits to vessels small, rounded. Wood parenchyma barely visible to unaided eye; narrow and long aliform and confluent; also finely terminal. Wood fibers with thick gelatinous walls. Ripple marks absent or local and irregular.

COMMON NAMES: Cat, catcuuk, chote, cuachilote, cuajilote, guajilote, gueto-xiga, juajilote, kaat, kat, pepina, xkat-cunc (Mex.); cow okra (Br. H.); cuajilote (Cent. Am.); candle tree, palo de velas, wild calabash (Pan.).

*Tabebuia* is a large and important genus of trees of general distribution throughout the whole of tropical America. Some botanists include in it only the comparatively few species having simple leaves, placing those with trifoliolate and quinquefoliolate leaves in a different genus, *Tecoma*, but this is not a natural division and separates otherwise closely related forms. Moreover there are intermediate forms. Sprague and Sandwith (*Kew Bulletin*, 1932, p. 18) say: "Rehder (*Mitteil. Deutsch. Dendr. Ges.* 1913, 262) accepted the genus *Tabebuia* in the same sense as Bentham and Hooker, and showed that the genus *Tecoma* Juss. (1789), which originally covered species of three genera, namely, *Stenolobium* D. Don, *Campsis* Lour., and *Tabebuia* Gomes, should properly be applied to *Stenolobium*."

*Tabebuia*, in the sense used here, includes species with simple, unifoliolate, and digitately compound leaves, while *Tecoma* (= *Stenolobium*) comprises species with pinnate leaves.

The material at hand, though abundant, is not sufficient for a comprehensive systematic treatment, and the classification followed has an economic rather than a botanical basis. The herbarium vouchers for the woods have been critically examined by R. J. Seibert.

The designations and types of the groups treated are as follows: (1) White cedar, *Tabebuia insignis* (Miq.) Sandw., var. *monophylla* Sandw., a pale brownish, medium-weight timber of the Guianas; (2) Roble, *T. pentaphylla*, a brownish, moderately hard wood resembling plain-sawn Oak, occurring from the West Indies and Mexico to northern South America; (3) Lapacho, a large, widely distributed group of species with olive-brown, more or less oily, very dense timbers containing an abundance of sulphur-like deposits (lapachol compound); (4) miscellaneous.

*White cedar group*.—Apparently there are two species and one variety of South American trees involved in this group. *Tabebuia aquatalis* (E. Mey.) Spr. & Sandw. (= *Couralia fluviatilis* [Aubl.] Splitg.) is said by Sandwith (Pulle's *Flora of Suriname* 4: 2: 70) to be a small tree or a shrub distributed from the Guianas to Pará and Maranhão, Brazil. According to Bertin (*Les bois de la Guyane française*, p. 73), the species, known as Bois Blanchet, attains large size, upward of three feet in diameter and over 100 feet in height, on inundated savannas in French Guiana. The leaves are alternate, digitate, with five leaflets; the white flowers are borne in dichotomous cymes on the old branches; the capsule is cylindrical, 2-valved, and contains numerous seeds with oblong wings. Since Sandwith (*loc. cit.*) says the seeds of this species are "almost sub-orbicular, wholly coriaceous," it may be that the Bois Blanchet is *Tabebuia insignis* (Miq.) Sandw. The wood (Yale 12735; Bertin 3011) closely resembles the White Cedar of British Guiana.

There are no authentic specimens of *Tabebuia insignis* in the Yale collections. The tree is said to be of small to medium size in swamp forests and wet savannas of the Amazonian region of Venezuela, the Guianas, and Brazil. The leaves are 3-5-foliolate; the flowers are white; the shortly linear capsule is densely lepidote; the seeds are transversely oblong, with broad membranous wings.



The tree commonly known as White Cedar in British Guiana, probably because of the resemblance of the bark to that of *Cedrela*, differs from *Tabebuia insignis* only in having constantly a single large leaflet articulated to the petiole. It is sometimes considered a distinct species (*T. longipes*, Baker), but more commonly now as a variety, namely, *T. insignis*, var. *monophylla* Sandw. The timber appears to be well known locally and is used to a limited extent for general carpentry and interior construction. The published statements that it is highly durable in contact with the ground are incorrect and indicate confusion with some other timber.

Heartwood brownish, with reddish or olive hue, varying in different specimens; distinct but not sharply demarcated from the lighter-colored sapwood. Luster fairly high. Odorless and tasteless. Rather hard and heavy; sp. gr. (air-dry) 0.68 to 0.74; weight 42 to 46 lbs. per cu. ft.; texture medium, uniform; grain fairly straight; not difficult to work, finishing very smoothly and with a glossy polish. A good wood for the same general purposes as Birch (*Betula lutea* L.) which it somewhat resembles. Results of tests at University of Michigan (Bull. 7, School of Forestry and Conservation, 1938, table 1) on small clear specimens in green condition (in lbs. per sq. in. unless otherwise stated): *Static bending*: Fiber stress at elastic limit, 9700; modulus of rupture, 13,700; modulus of elasticity, 2,300,000. *Endwise compression*: Fiber stress at E.L., 5870; max. crushing strength, 6200; M. of E., 2,610,000. *Hardness* (in lbs.): End, 1310; side, 1230. *Shear*: Max. strength along grain, 1160. *Tension*: Max. strength across grain, 650.

Growth rings present. Pores near limit of vision, rather numerous; solitary and in pairs, with tendency to diagonal or wavy arrangement. Rays uniseriate or locally biseriate and up to 15, sometimes to 25, cells high; homogeneous; pits to vessels medium-sized. Wood parenchyma narrowly vasicentric, aliform and confluent; also finely terminal. Ripple marks local or very irregular.

COMMON NAMES: Woracoori, warakuri, warikuri, white cedar (Br. G.); alasoabo johoto, alas-waboe, anago-switie, courali, koepaia, mattoe, panda, pandorana, panta, p. hoedoe, waroekoelie, warokorie (Sur.); bois blanchet, cèdre blanc (Fr. G.).

*Roble group*.—Roble, a Spanish name for Oak (*Quercus*), is applied to several different kinds of trees, but to none more commonly than to *Tabebuia pentaphylla* (L.) Hemsl., whose wood bears a superficial resemblance to Oak, though lacking conspicuous rays. The species attains large size, inhabits various sites from wet lowlands to dry mountain sides, and occurs from the West Indies and southern Mexico to Venezuela and Ecuador. Other species should probably be included in this group, but their identities are uncertain.

In Puerto Rico, Roble or Roble Blanco is a tree 20 to 60 feet high, of general occurrence throughout the island and said to be most common in the limestone hills. The wood is used for ox yokes, house construction, boat-building, and piling. In Cuba, the Roble Blanco grows best on moist but not stagnantly wet soils in association with the Jucaro (*Terminalia*), where it attains a height of 70 to 80 feet and a diameter of 24 to 30 inches, more commonly 14 to 20 inches. The trees are of good timber form, with clear lengths of 30 to 40 feet. The timber is used for ox yokes, carpentry, interior finish, and sheathing. The Roble de Yugo, with similar wood, is *T. leptoneura* Urb. (Yale 13363; A. J. Fors 26).

In Venezuela, *Tabebuia pentaphylla*, generally called Apamate, is a tree of the coastal forests and reaches a height of 80 to 90 feet, with a smooth-barked, symmetrical bole often clear of limbs for 50 feet. The tree is deciduous and bears great masses of rose-colored flowers before the new leaves appear, giving it value for ornamental planting. The fruits are Caltapa-like pods which later carpet the ground with their winged seeds. The timber is common in all the local sawmills and carpenter shops, and provides the native lumber most commonly used for rough structural purposes. It is also employed for flooring and interior finish. It is not very durable in contact with the ground and is liable to attack by insects. Regarding the Roble in Colombia, H. M. Curran says: "Scattered individuals were met with in the forests of Magdalena and it is a common second-growth tree about towns and along the waterways. As a rule it is short-boled, 18 to 20 inches in diameter, with heights under 75 feet and clear lengths not over 20 feet. It seemed to be well known and



appreciated by the local carpenters for furniture and interior finish."

Northward the range of *Tabebuia pentaphylla* extends to Oaxaca and Tamaulipas, Mexico. Standley (*Flora of Costa Rica*, p. 1130) says: "This is one of the best known and most useful trees of Central America, common throughout most of the Pacific slope and occurring also on the Atlantic watershed. In beauty it has few rivals. The trees often form pure stands of considerable extent and when covered with their blossoms, during spring months, afford an exquisite display of color, suggestive of that of Japanese Cherries in variation of tints."

In Nayarit, Mexico, the tree is commonly called Amapa, and logs and heavy timbers have been shipped under that name into Nogales, Arizona, for manufacture into flooring, interior trim, panelling, and miscellaneous millwork. Emanuel Fritz (*Tropical Woods* 8: 8) has described the use of the lumber in two homes of moderate cost in Berkeley, California. In one it was employed as flooring in living room, dining room, and vestibule; in the other for an ornamental mantel and a heavy panelled front door, and for the interior door, baseboards, and the window and door trim of the principal rooms. "Amapa wood is of medium density, light grayish brown in color, and has an attractive appearance. The rays are fine and inconspicuous, but the parenchyma layers give rise to a distinct pattern on the tangential faces of lumber. Sharp, clean edges are readily obtained and the surface planes to a glossy smoothness, except for the fine depressions of the vessel lines. It nails well, although in thin tongue-and-groove flooring it is advisable to pre-bore the nail holes in the tongues. In each of the Berkeley installations the wood is finished in natural color, only filler, white shellac, and wax being used. The effect is bright, but neat and dignified, harmonizing especially well with furnishings of a light color. The writer has finished some specimens with Mahogany and Oak stains with good results, particularly with moderately dark Oak stain. As flooring, Amapa seems to be a good substitute for Oak where a lighter color and finer figure are desired. While the two installations described may not be the forerunners of wider applications of Amapa in the San Francisco Bay region, they, nevertheless,

call attention to a comparatively new wood which possesses certain characteristics of color and beauty that should offer architects the means for obtaining certain effects not possible in other woods."

Heartwood pale brown, deepening somewhat upon exposure; finely striped with brown parenchyma lines or markings, conspicuous on tangential surface; not clearly differentiated from the sapwood. Luster low to medium. Odorless when dry, faint and suggesting watermelon when fresh; taste absent or bitter. Moderately light to fairly heavy; range of sp. gr. (air-dry) 0.62 to 0.80; weight 39 to 50 lbs. per cu. ft.; texture medium to rather coarse; grain straight to roey; working properties excellent, seasons without difficulty, holds its place well when manufactured; durability fair.

Growth rings present. Pores small to large, the latter visible to unaided eye; rather numerous; solitary and in small multiples, tending to diagonal or tangential arrangement. Vessel lines very distinct. Rays 1 to 3 cells wide and up to 15, often less than 10, cells high; homogeneous; cells thick-walled; pits to vessels medium-sized. Wood parenchyma abundant; aliform and confluent into irregular tangential to concentric bands; also finely terminal. Ripple marks fairly regular, 80 to 95 per inch, visible without lens; all elements storied.

COMMON NAMES: Roble (Span. Am., gen.); roble blanco, r. de yugo (Cuba); roble blanco, white cedar (P.R.); poirier, p. du pays (Mart.); white cedar (Grenada); pink poui (Trin.); amapa, a. rosa, amapola, hokab, macuil, maculiz, m. prieto, maquile, palo de rosa, p. yugo, roble blanco, rosa morada (Mex.); Mayflower (Br. H.); mano de león, maqueliz, matilisqueate (Guat., Hond.); macuilis, maculigua, maculis, maquiliqua (Salv.); roble blanco, r. de sabana (C.R.); roble del río, r. morado (Col.); apamate, roble blanco (Venez.).

*Lapacho group*.—This group is represented in all parts of continental tropical America and some of the Lesser Antilles. Many closely related species have been described, but from the standpoint of their woods the number could be greatly reduced. All are trees, usually of medium to large size with well-formed trunks. The leaves are typically quinquifoliate and deciduous; the flowers are mostly yellow, sometimes pink, red, or violet; the fruit is a long woody capsule with winged



seeds. The timber is noted for its great strength and durability. The vessels contain an abundance of yellow powder (lapachol compound) which looks like sulphur but in the presence of alkaline solutions turns deep red. (For references to the properties of lapachol see *Tropical Woods* 48: 47.)

Lapacho is the name commonly applied in northeastern Argentina and adjoining regions to two or three species, of which the most important appears to be *Tabebuia ipe* (Mart.) Standl. (= *T. Avellanadae* Lorentz). The principal commercial operations are along the Paraná River in Misiones and across the river in Paraguay. The tree is one of the tallest in the Misiones forest, reaching a height of 100 to 125 feet, with a cylindrical though slightly buttressed bole, free of limbs for 60 to 70 feet, and often 3 or 4, sometimes 6, feet in diameter. The digitate leaves are 6 to 8 inches in diameter and are deciduous; the flowers, usually of a rose color, are borne in profusion just before the new leaves appear, making the trees a resplendent feature of the landscape. The trees occur gregariously on steep rocky hillsides and are also found in smaller numbers through the lowland forests. The timber reaches the market in the form of square-hewn logs, and between four and five million board feet are used annually for general construction, carpentry, cabinetwork, turnery, and vehicles. It is considered one of the best woods for wagon spokes. It is highly resistant to decay and consequently is used for many purposes requiring a strong and durable material. It also yields a purplish dye.

The group is well represented in Brazil and numerous species have been described. In the southern part of the country the common name is Ipé, with many qualifying terms in reference to the color of the flowers or appearance of the trees and woods. The principal species there is probably *Tabebuia ipe*, but *T. serratifolia* (Vahl) Nicholson is also present as far south as São Paulo and Bolivia. The latter species is most important of all in this group and its range extends northward through the lower Amazon country and the Guianas to Venezuela, Trinidad, and Colombia. It is probably the chief source of the Brazilian timber known as Pau d'Arco. Huber (*Bol. Mus. Goeldi* 6: 201) says that it is one

of the tallest trees in the uplands of the Amazon and when, at the close of the dry season, it loses its leaves and covers itself with an infinite number of large golden yellow flowers the crowns look like gigantic bouquets in the midst of the forest. It is sometimes called Pau d'Arco Amarello to distinguish it from the Pau d'Arco Rôxo, *T. ipe* (= *T. violacea* Huber). The timber is used for railway crossties, fence and house posts, bridges, and all sorts of purposes requiring strength, toughness, resilience, and resistance to wear, insects, and decay.

There are several species in northern South America (see *Tropical Woods* 30: 44; 36: 16), but they are typified by *T. serratifolia* and the timber finds the same applications as in Brazil. Limited quantities are exported from Surinam to the United States for the manufacture of fishing rods; the usual trade names are Surinam Greenheart (not to be confused with Demerara Greenheart from British Guiana) and Bethabara (see *Tropical Woods* 19: 7). The trees attain a height of 120 feet, with trunks large enough to square 30 inches free of sapwood, but the largest logs are usually too heavy for the primitive methods of extraction.

The principal Central American species is *Tabebuia guayanensis* (Seem.) Hemsl., a small to large, yellow-flowered tree having a range extending from Colombia to southern Mexico. In Panama it is called Guayacán, a name also given to *Lignum-vitae* (*Guaiacum*), and the timber is considered one of the best available for durable construction. The cathedral of Old Panama contains beams of Guayacán and some of them are still perfectly sound though exposed to weather since the destruction of the city 275 years ago. During the World War some attempts were made to use Panama Guayacán for propeller-shaft bearings in steamships, but the wood, though dense and strong enough, lacks the oily resin which makes genuine *Lignum-vitae* self-lubricating and is not a satisfactory substitute for that timber. The northern form with pink or rose-colored flowers is *T. Palmeri* Rose, a medium-sized tree growing from southwestern Mexico to Panama. According to J. G. Ortega (see *Tropical Woods* 7: 37), it is found in all parts of Sinaloa at altitudes of 30 to 1300 feet and requires more



than 100 years to reach maturity. The timber, which is obtainable in pieces 16 to 20 feet long and 16 inches square, is highly valued for house posts, beams, sills, door and window frames, and also for railway crossties, fence posts, fuel, and charcoal. The yellow dust arising in milling operations produces reddish stains on sweat-moistened parts of the laborers' clothing and also gives rise to a mild form of dermatitis. The usual Mexican name for this species is *Amapa Prieta*.

There are two species, namely, *Tabebuia serratifolia* and *T. rufescens* J. R. Johnston, in Trinidad, where they are known as Poui; the former, called Yellow Poui, is generally distributed, thriving on pure sands, but preferring the tops and sides of ridges and avoiding swampy areas. The other species, called Black Poui because of its very dark heartwood, is a smaller tree preferring heavier, clay soil; it is readily distinguished by its rough leaves. This species also grows in Tobago, where it is called Cogwood, and in Grenada, where it is known as Poui and Greenheart.

The description of the Lapacho group (given below) is based on specimens of *Tabebuia alliacea* Cham., *T. Billbergii* (Bur. & Schum.) Standl., *T. capitata* (Bur. & Schum.) Sandw., *T. cbrysantha* (Jacq.) Nichols., *T. cbrysotricha* (Mart.) Standl., *T. coralibe* Standl., *T. Dugandii* Standl., *T. ecuadorensis* Standl., *T. flavescens* B. & H., *T. guayacan* (Seem.) Hemsl., *T. ipe* (Mart.) Standl., *T. ochracea* (Cham.) Standl., *T. Palmeri* Rose, *T. rufescens* J. R. Johnston, *T. serratifolia* (Vahl) Nichols., *T. spectabilis* DC., *T. trachycarpa* (Gris.) K. Schum., and *T. Uleana* (Kraenzl.) Sandw.

Heartwood olive-brown to blackish, often with lighter or darker striping; sometimes rather oily-looking; sawed surface often covered with yellow powder; sapwood whitish, yellowish, or pinkish, rather sharply demarcated. Luster low to medium. Odor and taste not distinctive; very to extremely hard, heavy, tough, and strong; sp. gr. (air-dry) 0.95 to 1.25; weight 59 to 78 lbs. per cu. ft.; texture fine to medium, uniform; grain straight to very irregular; rather difficult to work, inclined to be splintery, takes a very smooth finish; is highly durable.

Growth rings usually present, but not always distinct. Pores small to minute, usually visible because of light-colored deposits (lapachol compound); numerous but not crowded laterally; solitary and in pairs and less often in larger multiples, tending to diagonal or irregular tangential arrangement. Rays 1 to 3, mostly 2, cells wide and rarely more than 10 cells high; homogeneous; cells thick-walled; gum deposits abundant; pits to vessels medium-sized, rounded. Wood parenchyma sparse to abundant, usually distinct with lens, vasicentric to short confluent; also finely terminal. Wood fibers with thick, often gelatinous walls. Ripple marks fairly regular, variable in different specimens from 80 to 130 per inch; all elements storied.

COMMON NAMES: Arcwood, bastard lignum-vitae, bethabara, noibwood, Surinam greenheart, washiba, yellow guayacan (U. S. trade); greenheart, poui (Grenada); cogwood (Tobago); poui (black, white, yellow), p. vert, pui (Trin.); ahan-ché, amapa, a. prieta, hahuache, roble, r. cinero, verde-cillo, xha-hua-ché (Mex.); cortez colorado (Guat.); cortez (Hond.); cortez, c. amarillo, c. coyote, c. negro, c. prieto (Salv.); aoka, cortez (Nic.); cortez de venado, corteza, c. amarilla, guayacán (C.R.); guayacán (Pan.); alumbre, arco, canaguante, c. amarillo, c. morado, chicalá, coralibe, c. de arco, guayacán, g. polvillo, lumbre, polvillo, roble, r. amarillo (Col.); acapro, alcapro, arabone, araguaney, aravaney, canãda, curarí, echahumo, flor amarillo, penda, pui, p. araguaney, p. chiripe, p. negro, puy (Venez.); arawnig-yek, bow-wood, hackia, hackooya, hakkea, washiba, whoua-whoua (Br. G.); akkeja, akkekeja, alahorré, ala-oné, ala-onni, arowoné, arra-oné, courali, enbotta-koenatjepie, gienhatti, gienharti, groenhart, maka-grien, makka groenhart, mangienhatti, wasieba, wassiba, wehete, woite (Sur.); arahoni, arrhonée, bois d'evilasse, b. d'èbène verte, èbène jaune, e. verte, guirapariba (Fr. G.); madera negra (Ec.); tahuari, t. amarillo, t. negro (Peru); capitary, caraúba do campo, carau-beira do campo, caroba do campo, carobeira, guirapariba, ipé, i. cascudo, i. jabotia, i. preto, i. tobacco, pau d'arco, p. d. amarello, p. d. rôxo, quiarapaíba, tamurá tuiira, tauary, t. do gapo, urupariba (Braz.); lapacho, l. negro, peúva amarella, p. roxa (Par.); lapachillo, lapacho, l. amarillo, l. blanco, l. crespo, l. negro, l. rosa, tally, tayí, t. pichái, t. pirurú, t. saiyú (Arg.).

*Miscellaneous.*—Some wood specimens labelled Taipoca



than 100 years to reach maturity. The timber, which is obtainable in pieces 16 to 20 feet long and 16 inches square, is highly valued for house posts, beams, sills, door and window frames, and also for railway crossties, fence posts, fuel, and charcoal. The yellow dust arising in milling operations produces reddish stains on sweat-moistened parts of the laborers' clothing and also gives rise to a mild form of dermatitis. The usual Mexican name for this species is *Amapa Prieta*.

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The description of the Lapacho group (given below) is based on specimens of *Tabebuia alliacea* Cham., *T. Billbergii* (Bur. & Schum.) Standl., *T. capitata* (Bur. & Schum.) Sandw., *T. chrysantha* (Jacq.) Nichols., *T. chrysotricha* (Mart.) Standl., *T. coralibe* Standl., *T. Dugandii* Standl., *T. ecuadorensis* Standl., *T. flavescens* B. & H., *T. guayacan* (Seem.) Hemsl., *T. ipe* (Mart.) Standl., *T. ochracea* (Cham.) Standl., *T. Palmeri* Rose, *T. rufescens* J. R. Johnston, *T. serratifolia* (Vahl) Nichols., *T. spectabilis* DC., *T. trachycarpa* (Gris.) K. Schum., and *T. Uleana* (Kraenzl.) Sandw.

Heartwood olive-brown to blackish, often with lighter or darker striping; sometimes rather oily-looking; sawed surface often covered with yellow powder; sapwood whitish, yellowish, or pinkish, rather sharply demarcated. Luster low to medium. Odor and taste not distinctive; very to extremely hard, heavy, tough, and strong; sp. gr. (air-dry) 0.95 to 1.25; weight 59 to 78 lbs. per cu. ft.; texture fine to medium, uniform; grain straight to very irregular; rather difficult to work, inclined to be splintery, takes a very smooth finish; is highly durable.

Growth rings usually present, but not always distinct. Pores small to minute, usually visible because of light-colored deposits (lapachol compound); numerous but not crowded laterally; solitary and in pairs and less often in larger multiples, tending to diagonal or irregular tangential arrangement. Rays 1 to 3, mostly 2, cells wide and rarely more than 10 cells high; homogeneous; cells thick-walled; gum deposits abundant; pits to vessels medium-sized, rounded. Wood parenchyma sparse to abundant, usually distinct with lens, vasicentric to short confluent; also finely terminal. Wood fibers with thick, often gelatinous walls. Ripple marks fairly regular, variable in different specimens from 80 to 130 per inch; all elements storied.

COMMON NAMES: Arcwood, bastard lignum-vitae, bethabara, noibwood, Surinam greenheart, washiba, yellow guayacan (U. S. trade); greenheart, poui (Grenada); cogwood (Tobago); poui (black, white, yellow), p. vert, pui (Trin.); ahan-ché, amapa, a. prieta, hahuache, roble, r. cinero, verde-cillo, xha-hua-ché (Mex.); cortex colorado (Guat.); cortex (Hond.); cortex, c. amarillo, c. coyote, c. negro, c. prieto (Salv.); aoka, cortex (Nic.); cortex de venado, corteza, c. amarilla, guayacán (C.R.); guayacán (Pan.); alumbre, arco, canaguante, c. amarillo, c. morado, chicalá, coralibe, c. de arco, guayacán, g. polvillo, lumbre, polvillo, roble, r. amarillo (Col.); acapro, alcapro, arabone, araguaney, aravaney, canãda, curarí, echahumo, flor amarillo, penda, pui, p. araguaney, p. chiripe, p. negro, puy (Venez.); arawnig-yek, bow-wood, hackia, hackooya, hakkea, washiba, whoua-whoua (Br. G.); akkeja, akkekeja, alahorré, ala-oné, ala-onni, arowoné, arra-oné, courali, enbotta-koenatjepie, gienhatti, grienharti, groenhart, maka-grien, makka groenhart, mangienhatti, wasieba, wassiba, wehete, woite (Sur.); arahoni, arrhonée, bois d'évilasse, b. d'ébène verte, ébène jaune, e. verte, guirapariba (Fr. G.); madera negra (Ec.); tahuari, t. amarillo, t. negro (Peru); capitary, caraúba do campo, carau-beira do campo, caroba do campo, carobeira, guirapariba, ipé, i. cascudo, i. jabotia, i. preto, i. tobacco, pau d'arco, p. d. amarello, p. d. rôxo, quiarapaíba, tamurá tuira, tauary, t. do gapo, urupariba (Braz.); lapacho, l. negro, peúva amarella, p. róxa (Par.); lapachillo, lapacho, l. amarillo, l. blanco, l. crespo, l. negro, l. rosa, tally, tayí, t. pichái, t. pirurú, t. saiyú (Arg.).

*Miscellaneous.*—Some wood specimens labelled Taipoca



from Bahia, Brazil, bear a superficial resemblance to the Roble group of *Tabebuia*, but the pores are very small and arranged in rather definite wavy bands and diagonal rows, suggesting *Jacaranda* in part. Wood parenchyma is sparingly developed and ripple marks are present.

*Tabebuia nodosa* Gris. is a small Argentine tree or shrub. The wood is light-colored, only moderately dense, contains no lapachol deposits, but is otherwise similar to those of the Lapacho group. It has no important uses other than for fuel.

COMMON NAMES: Caspí-cruz, ibirá ti, i. curuzú, palo cruz, p. sinvergüenza, toro-rataí, uinaj, yaguá-rataí (Arg.).

In the larger islands of the West Indies there are numerous species whose woods differ in many details from those of the other groups described. The specimens examined have been determined as follows: *Tabebuia Cowelli* Britt., *T. dubia* (C. Wr.) Britt., *T. heterophylla* (DC.) Britt., *T. lepidota* (H.B.K.) Britt., *T. Maxonii* Urb., *T. mogotensis* Urb., *T. petrophylla* Greenm., and *T. Schurmanniana* Urb. They are shrubs or small trees with simple or digitately compound leaves and white, pink, red, or purplish flowers. The wood is pale brown or yellowish, sometimes with a faint greenish tinge; moderately hard and heavy; pores with tendency to diagonal or tangential arrangement; wood parenchyma abundant, aliform to confluent into concentric bands. There are no important special uses.

COMMON NAMES: Cucharillo, ébano blanco, roble caimán, r. de costa, r. de playa, r. de sierra, r. macho, r. negro, r. sabanero, r. yanillo, roblecillo, rompe ropa (Cuba); roble blanco, r. colorado, r. de mona, r. de sierra, r. prieto (P.R.); bois nago, b. savane (Haiti).

*Tabebuia barbata* (E. Mey.) Sandw. (= *Couralia toxophora* [Mart.] C. & H.), is a small to medium-sized tree of fairly common occurrence on lowlands in the Amazon region of Brazil and Venezuela. The large leaves have five smooth, leathery leaflets; the large violet or roseate flowers are borne in terminal clusters; the long, thick, cylindrical capsule contains many large, wholly coriaceous seeds. The olive-brown heartwood shows distinct vessel lines. It is hard and heavy, coarse-textured, straight-grained, not difficult to work, and

is probably durable. The presence of lapachol in many of the vessels of the heartwood indicates a relationship to the Lapacho group, but the pores are considerably larger ( $160\mu$ ) and the wood parenchyma is coarse-celled and abundant, aliform, confluent, and terminal; sclerotic cells are common. Ripple marks are uniform, about 120 per inch, with the parenchyma cells in secondary seriation. (Description based on one sample: Yale 22613; Ducke 153.)

COMMON NAMES: Capitary, pau d'arco blanco, p. d'a. rôxo, tauary do gapó (Braz.).

*Tabebuia stenocalyx* Spr. & Stapf is a large Guiana tree sometimes 115 feet tall with a low-buttressed trunk nearly three feet in diameter. The large, smooth, leathery leaves are simple; the flowers have a long, green calyx tube and a large white corolla. The wood of a single specimen (Yale 35960; A. C. Smith 3497) is pale brownish within, but with a golden sheen on long exposed surface; rather light in weight, but firm and crisp, medium-textured, straight-grained, and very easy to work. The pores are medium-sized ( $130\mu$ ) and joined by rather narrow confluent parenchyma into wavy or uniform concentric series, 1 or 2 pores wide and 3 to 6 pore-widths apart. The vessels do not contain lapachol. The rays, which are 1 to 3 cells wide and up to 30 cells high, are homogeneous and not storied; very small cubical crystals are common. The wood fibers have rather thin walls and are septate in part. Ripple marks are absent.

**Tecoma.** This name is often used in the sense of *Tabebuia*, but is here employed in place of *Stenolobium* (see *Kew Bull. Misc. Inf.* 1932, p. 18). It consists of a few species of shrubs and small trees, of which the best known and most widely distributed is *Tecoma stans* (L.) H.B.K. This is an ornamental plant growing naturally or as an escape from cultivation from southern United States to Argentina. It rarely attains a height of 25 feet; its leaves are opposite and pinnate, with 5 to 13 leaflets; the bright yellow flowers are borne in terminal racemes or panicles; the fruit is a dehiscent linear capsule containing broadly winged seeds. The genus does not supply any timber of value.

Heartwood light brown, somewhat variegated; rather



sharply demarcated from the whitish sapwood. Luster medium. Odor not distinctive; taste bitter. Moderately hard and heavy; texture fine; grain fairly straight; not difficult to work, finishing smoothly; durability probably rather poor. Of no commercial possibilities.

Growth rings present. Pores not distinct without lens, rather numerous; solitary and in small multiples, less often in little clusters, with tendency to diagonal or even concentric arrangement. Tyloses common. Rays mostly 2 or 3 cells wide and up to 40, commonly less than 25, cells high; distinctly heterogeneous; pits to vessels small, rounded. Wood parenchyma sparingly paratracheal and finely terminal. Ripple marks local or very irregular.

COMMON NAMES: Ginger Thomas, trumpet-flower, yellow elder, yellow cedar (Br. W.I.); saúco amarillo (Cuba); roble amarillo, ruibarba (P.R.); chevalier (Haiti); borla de San Pedro, corneta amarilla, flor amarilla, f. de San Pedro, gloria, guie-bichi, hierba de San Nicolás, h. de San Pedro, huachacata, ichculili, kanlo, mazorca, miñona, nixtamaxochitl, retamo, San Pedro, trompeta, trompetilla, tronador, tula-súchil, xkanlol (Mex.); chanté timbogue (Guat.); flor de San Andrés, f. de San Sebastián, marchucha, San Andrés, tache, tagualaishte, tasto (Salv.); sardinillo (Hond.); chilca, sardinillo (Nic.); candelillo, carboncillo, vainilla (C.R.); copete (Pan.); caballito, chirlobirlos, fresno, palo hueso, roble amarillo (Col.); flor amarilla, fresnillo (Venez.); garrocha (Urug.); guarán amarillo, g. colorado, guaranguarán, guaranguay amarillo, g. colorado (Arg.).

#### Key to the Generic Groups

- 1 a. Woods definitely ring-porous. Very small vessels with spirals  
*Catalpa, Chilopsis.*
- b. Woods not definitely ring-porous, but sometimes with part or all of pores in tangential arrangement. Spirals lacking. . . . . 2
- 2 a. Rays uniseriate or uniseriate and biseriate. . . . . 3
- b. Largest rays 3 or 4, rarely up to 6 or 8, cells wide. . . . . 8
- 3 a. Ripple marks present, regular. Lapachol present in heartwood  
*Cotema, Tabebuia* (Lapacho group).
- b. Ripple marks absent or irregular. Lapachol absent. . . . . 4
- 4 a. Pores arranged with confluent parenchyma in concentric bands  
*Jacaranda coerulea.*
- b. Pores with no more than tendency toward tangential arrangement . . . . . 5

- 5 a. Parenchyma sparingly paratracheal. Rays decidedly heterogeneous. . . . . *Astianthus.*
- b. Parenchyma aliform, confluent, or in concentric bands. Rays homogeneous. . . . . 6
- 6 a. Parenchyma narrow aliform and confluent  
*Parmentiera, Tabebuia* (White Cedar group).
- b. Parenchyma coarse aliform and confluent in rather broad, broken bands. . . . . 7
- 7 a. Parenchyma in fairly uniform secondary seriation. . . . . *Crescentia.*
- b. Parenchyma not in definite secondary seriation. . . . . *Enallagma.*
- 8 a. Largest rays 6 or 8 cells wide. . . . . *Cybistax Donnell-Smitbii.*
- b. Largest rays 3 or 4 cells wide. . . . . 9
- 9 a. Lapachol present in vessels of heartwood. . . . . 10
- b. Lapachol absent. . . . . 12
- 10 a. Pores (and abundant parenchyma) forming rather coarse diagonal to irregular tangential bands. Rays up to 10 cells high. . . . . *Godmania.*
- b. Pores not in bands. Parenchyma sparingly vascentric to aliform and confluent. . . . . 11
- 11 a. Rays up to 35 cells high. Ripple marks irregular. Parenchyma sparingly vascentric and terminal. . . . . *Paratecoma.*
- b. Rays rarely over 10 cells high. Ripple marks fairly regular. Parenchyma variable in different woods from sparingly vascentric to aliform and confluent; also terminal. . . . . *Tabebuia* (Lapacho group).
- 12 a. Rays heterogeneous. . . . . 13
- b. Rays homogeneous. . . . . 15
- 13 a. Pores (and parenchyma) forming concentric bands. *Jacaranda caroba.*
- b. Pores with no more than tendency toward tangential arrangement . . . . . 14
- 14 a. Ray-vessel pit-pairs very small to small. Fibers infrequently septate. Sapwood whitish; heartwood brownish orange or light yellowish brown. . . . . *Tecoma.*
- b. Ray-vessel pit-pairs medium-sized to rather large. Fibers abundantly septate. Sapwood light brown; heartwood somewhat golden olive-brown. . . . . *Macrocatalpa.*
- 15 a. Part or all of pores arranged with confluent parenchyma in concentric bands. . . . . 16
- b. Pores sometimes with tendency to tangential arrangement but not forming concentric bands with parenchyma. . . . . 17
- 16 a. Ripple marks fairly regular, 80 to 100 per inch. Largest rays less than 15 cells high. . . . . *Tabebuia* (Roble group).
- b. Ripple marks absent. Largest rays up to 30 cells high. *Tabebuia stenocalyx.*



- 17 a. Parenchyma abundant, aliform and confluent into irregular tangential to concentric bands; also finely terminal. . . . . 18  
 b. Parenchyma sparingly paratracheal or occasionally aliform, and with narrow terminal band. . . . . 20
- 18 a. Ripple marks fairly regular, 80 to 95 per inch. Wood pale brown, deepening somewhat on exposure. Rays up to 3 cells wide and 15 cells high. . . . . *Tabebuia* (Roble group).  
 b. Ripple marks irregular or absent. Wood dingy white to pale brownish. . . . . 19
- 19 a. Pores few, large, readily visible without lens. Rays up to 4 cells wide and 40 or more cells high. Ripple marks absent. Wood dingy white or oatmeal. . . . . *Jacaranda copaia*.  
 b. Pores rather numerous, not distinct without lens. Rays only occasionally up to 3 cells wide and 25 cells high. Ripple marks irregular, 120 per inch. Wood nearly white, becoming pale brownish on exposure. . . . . *Crescentia*.
- 20 a. Heartwood brown, very hard and heavy. Fiber walls mostly very thick. . . . . *Ekmanianthe*.  
 b. Heartwood brownish yellow; moderately hard and heavy. Fiber walls medium to rather thin. . . . . *Cybistax cbryssea*.

### THE BOTANICAL NAME OF THE NARGUSTA

Enquiries have been received at the Imperial Forestry Institute, Oxford, as to the reason for the change of name of the Nargusta, which appears in the recently published "British Standard Nomenclature of Hardwoods" (1939) as *Terminalia amazonia* (J. F. Gmel.) Exell, with *T. obovata* (Ruiz & Pav.) Steud. as a synonym.

The change was made by Exell (in 1935), because the name *Terminalia obovata* does not belong to this tree, but to a different species and the same name can be used, legitimately, for one species only; to have two different species bearing the same name is confusing. As the Nargusta was first named *Cbuncoa amazonia* (by J. F. Gmelin, who published books in 1777 and 1778) the epithet *amazonia* must be retained for it; but as the generic name *Cbuncoa* is a synonym of *Terminalia*, it was necessary to make the new combination *Terminalia amazonia* (J. F. Gmel.) Exell.—J. BURTT DAVY.

### CURRENT LITERATURE

**New Species of *Coccolobis* from Antigua.** By N. Y. SANDWITH. *Journ. Bot. Brit. & For.* (London) 78: 96-100; April 1940.

Two new species of *Coccolobis* are described from the island of Antigua. One is believed to be possibly of hybrid origin.

**The Caribbean Forester.** Pub. quarterly by Tropical Forest Experiment Station, U. S. Forest Service, Rio Piedras, Puerto Rico. Vol. I: 3: 1-29; April 1940.

#### CONTENTS

Balsa in British Honduras (pp. 1-3), by N. S. Stevenson.  
 Forestry and forest legislation in the Dominican Republic (pp. 4-9), by J. G. Scarff.  
 Venezuela forestal (pp. 10-14), by Manuel González Vale.  
 The use of geometric figures in ecological description (pp. 15-19, seven figs.), by Ivan T. Sanderson.  
 Forestry and forest resources in Haiti (pp. 20-22), by Schiller Nicholas.  
 Some notes on forest entomology (pp. 23-24), by Luis F. Martorell.  
 The possibility of close coöperation for mutual benefit between agriculture and forestry in the American tropics (pp. 25-29), by L. R. Holdridge.

**New phanerogams from Mexico. III.** By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 21: 253-265. April 1940.

Most of the new species are herbaceous plants, but woody plants are described in the genera *Vauquelinia* and *Bernardia*.

**The 1936 Michigan-Carnegie botanical expedition to British Honduras.** By CYRUS LONGWORTH LUNDELL. *Carnegie Inst. Wash. Publ.* 522: 1-57; pls. 1-4, map; June 20, 1940.

A descriptive account of the vegetation of the limestone plateau and mountain Pine ridge regions of British Honduras visited by the expedition. Lists are given of species observed in each region, with some indication of the relative abundance of each species.



**The apocynaceous flora of the Yucatan Peninsula.** By ROBERT E. WOODSON, JR. *Carnegie Inst. Wash. Publ.* 522: 61-102; figs. 1-6; June 20, 1940.

For the region are reported 27 genera, many of which are represented by trees. Keys for determination, with complete descriptions and synonymy, are provided, with citation of all collections studied, and much further information of varied nature.

**The Eriocaulaceae, Verbenaceae, and Avicenniaceae of the Yucatan Peninsula.** By HAROLD N. MOLDENKE, *Carnegie Inst. Wash. Publ.* 522: 139-223; June 20, 1940.

The Verbenaceae are represented in the Yucatan region by 17 genera, all of which, with their species, are described in detail. *Lantana scorta* is published as new. The Avicenniaceae are represented by a single genus and species.

**The Melastomaceae of the Yucatan Peninsula.** By HENRY ALLAN GLEASON. *Carnegie Inst. Wash. Publ.* 522: 325-373; June 20, 1940.

The Melastomaceae of the Yucatan region represent 20 genera and numerous species. Described as new are *Topobea rosea*, *Henriettea strigosa*, *Conostegia Lundellii*, and *Mouriria exilis*.

**The Bignoniaceae of the Maya area, including Yucatan, Campeche, Quintana Roo, Chiapas, Tabasco, British Honduras, and Guatemala.** By RUSSELL J. SEIBERT. *Carnegie Inst. Wash. Publ.* 522: 377-434; pls. 1-3; June 20, 1940.

This is an exceptionally important and valuable paper, since it reduces to an apparently satisfactory order a group of Central American plants whose taxonomy, especially as regards generic segregation, has always been in a chaotic state. There are recognized 39 genera, none with many species, but together constituting an important group of trees and woody vines. Many reductions to synonymy have been found necessary, and several transfers of species have been made. *Tab-*

*buia Donnell-Smithii* Rose, an important timber tree, is transferred to the genus *Cybistax*. The genus *Scobinaria*, based on *Adenocalymna verrucosum* Standl., is described as new. *Chodanthus puberulus*, a new species of Chiapas and Veracruz, is the first member of its genus to be reported from North America.—PAUL C. STANDLEY.

**Studies of American plants. X.** By PAUL C. STANDLEY. *Bot. Ser. Field Mus.* (Chicago) 10: 65-129; June 12, 1940.

Descriptions of miscellaneous new species, chiefly from Mexico, Central America, and South America, and representing numerous families. Included are many trees in the genera *Brosimum*, *Cecropia*, *Coussapoa*, *Pourouma*, *Coccoloba*, *Ruprechtia*, *Acacia*, *Inga*, *Pithecolobium*, *Amyris*, *Trichilia*, *Tapura*, *Ilex*, *Sloanea*, *Clusia*, *Blakea*, *Diospyros*, *Chione*, and other groups.

**Maderas económicas de Venezuela.** By L. WILLIAMS. Bol. Técnico No. 2, Ministerio de Agricultura y Cría, Caracas, 1939. Pp. 97; 8 x 12½; 24 figs.

The first 15 pages of this valuable publication are concerned with the uses of the principal timbers of Venezuela. There follows a glossary of the terms (pp. 16-23) used in the main part of the work, the descriptions of 65 trees and their woods (pp. 25-92).

**The uricury wax palm.** By F. N. HOWES. *Kew Bulletin*, 1940, pp. 155-158.

Uricury wax, a product of recent introduction to commerce, is obtained from the leaves of *Syagrus coronata* (Mart.) Becc. (= *Cocos coronata* Mart.), a palm tree of wide distribution in eastern Brazil from Pernambuco to Uruguay.

"In general appearance and in hardness this wax is very similar to Carnauba wax (*Copernicia cerifera* Mart.), but manufacturers using it find it possesses certain definite characteristics of its own. In the crude state it is of a deeper green color than is usual with Carnauba wax and more resinous. However, it is regarded as quite a good quality wax and intermediate in value between Carnauba and Candelilla wax



(*Euphorbia cerifera* Alc.) by manufacturers using vegetable waxes. . . . Uricury wax is used in much the same way as Carnauba wax, which is the best known and most extensively used of the true vegetable waxes."

**O litoral do Brasil meridional. Excursão botânica realizada de 16-19 a 26-10-1929, pela zona litorânea de de Santo até Laguna.** By F. C. HOEHNE. Secretaria da Agr., Industr. e Com. de São Paulo, Dept. Bot. do Estado, São Paulo, 1940. Pp. 1-111; 9½ x 12¾; 146 half-tones.

A descriptive account of a botanical excursion by the author along the coast of central Brazil during September and October, 1929. The many handsome photographs illustrate well the botanical, geographic, and cultural features of the region, and the text contains a large amount of important information regarding the more conspicuous or interesting plants of the coastal areas.—PAUL C. STANDLEY.

**The Combretaceae of Argentina.** By A. W. EXELL. *Lilloa* (Tucumán, Argentina) 5: 123-130; pls. 1-7; Feb. 14, 1940.

Combretaceae are represented in Argentina by two genera, *Combretum* and *Terminalia*, each with two species. The genera and species are described in detail and illustrated.

**Las Bignoniáceas del territorio del Chaco.** By AUGUSTO G. SCHULZ. *Lilloa* 5: 131-158; pls. 1-6, figs. 1-3; Feb. 14, 1940.

In the Chaco Territory of Argentina are found 11 species of Bignoniáceas, all of which are described and illustrated, with citation of specimens studied and vernacular names. The Lapacho, *Tabebuia ipe*, is one of the most valuable timbers of northern Argentina because of its durability when exposed to weather, being used for fence posts and many other purposes. It also supplies dyes of various colors, dependent upon the mordant used in their preparation.—PAUL C. STANDLEY.

**Las Compuestas del parque nacional del Nahuel Huapi.** By ANGEL L. CABRERA. *Revista Mus. La Plata* (Buenos Aires) Nueva Ser. 2 (Sec. Bot.); 227-396; 47 figs., 10 pls.; 1939.

This handsome pamphlet, beautifully illustrated with line

drawings representing all 41 genera of Compositae represented in the Argentine national park of Nahuel Huapí, and with numerous half-tone illustrations of its scenery, is another of the fine monographic accounts of Argentine Compositae with which Professor Cabrera during the past few years has so enriched the literature of this family. Nowhere has there appeared a more scholarly and lucid account of the Compositae of a limited area, and it is so conveniently and attractively presented that one longs for the opportunity of using it in the field, where it would be found highly practical. While most of the plants discussed are, naturally, herbs, a substantial number of woody plants are treated, particularly in such genera as *Baccharis*, *Flotovia*, and *Cbuquiragua*. Vernacular names are reported for many species.—PAUL C. STANDLEY.

**Travels of Ruiz, Pavón, and Dombey in Peru and Chile (1777-1788).** By HIPÓLITO RUIZ, with an epilogue and official documents added by AGUSTÍN JESÚS BARREIRO. Translated from the Spanish by B. E. DAHLGREN. *Bot. Ser. Field Mus.* (Chicago) 21: 1-372; 2 maps; March 28, 1940.

In connection with the publication of its *Flora of Peru*, under way since 1936, Field Museum of Natural History has issued an American edition of the *Relación del Viaje* of Ruiz. This account of the historic botanical expedition that furnished the material for the first flora of Peru, was prepared by Ruiz in 1790, almost immediately after his return to Spain, but for some reason was not printed during his lifetime. After the death of the author the manuscript passed into the hands of a member of his family. It was forgotten and remained unknown in Spain for 140 years, until 1930, when it was brought to light, edited, and published by the Academy of Sciences of Madrid, together with pertinent official documents from Spanish archives. It provides a running account of the activities and incidents of ten years of travel by the two Spanish botanists and their French companion and is of interest as an addition to the early botanical literature of two American republics. Another copy in the handwriting of Ruiz is listed in the catalogue of the library of the British Museum.



A large part of the text consists of an enumeration, with vernacular and scientific names, of the plants collected, with comments on their characteristics, properties or reputed virtues, and uses. A large proportion of them are herbaceous plants of the highlands, but the montañas or forests at Cuchero and Pozuzo yielded large numbers of woody plants. The study of *Cinchona* was a special objective of the botanists, but there are interesting comments also on many trees yielding latex, oil, resins, and other products, or useful for their wood. "In the bishopric of Concepción we made an excellent collection of wood in small cut boards which, by their colors, grain and consistency makes one admire the greatness of the Creator."

Two of the ten years of travel and collecting were spent in Chile. At Fort Nacimiento, situated at the foot of the cordillera, Chilean pine was being cut by royal order for masts and the interiors of boats. The three botanists were agreed that it was "a species of the genus *Pinus* of Linnaeus, although a dioecious tree."

"I finished the description of the *Pinus chilensis* started in Huilguelmu, by going with Dn. José Brunete, so that he might sketch the habits of this magnificent tree, to the road of Talcahuano, where there were three female trees, one of them stretched on the ground but held to it by the roots. This very tall tree, although dioecious, corresponds in all its parts of fructification with the generic character of *Pinus* of Linnaeus, according to the examination made by us three companions; we agreed unanimously that it was a new species of this genus and probably the most valuable of all those discovered up to that time, for its exquisite white wood of excellent grain for working and for use for masts of boats and many other purposes, for its pine nuts contained in great cones and serving as nourishment to the Pehuenche and Huiliche Indians, and finally for its resin, very useful in medicine."

Some of the botanical binomials used appear not to have been published elsewhere, e.g., *Swietenia macrocarpa*. *Pullipuntu macrocarpon* and *P. microcarpon*, Vegetable Ivory or Ivory-nut palms of the "Viaje," became *Phytelephas* when later published in the *Systema* of Ruiz and Pavón.

The numerous typographical errors in the botanical names of the Spanish edition have been eliminated as far as possible in the translation. Not the least interesting part of the book consists of the numerous appendices which give much information regarding this and other similar expeditions patronized by the Spanish government. Most readers will be surprised by the magnitude of these undertakings and the large sums expended on them. Of very special interest is the inventory of the collecting outfit taken to Peru by Ruiz and Pavón, very much the same as would be taken by collectors of today who planned several years of field work, but increased by the supplies required by the artist-draftsmen who accompanied them to make delineations of plants in the field.—PAUL C. STANDLEY.

**Las hayas australes o antarticas de Chile.** By ERNESTO L. BERNATH. Santiago de Chile, 1940. Pp. 43: 7½ x 10½; 1 map, 26 half-tones, 11 plates of drawings.

This pamphlet is a copiously illustrated manual of the Antarctic Beeches native to Chile. Ten species and one variety of *Nothofagus* are described with reference to their common names, distribution, botanical characters, properties and uses of the timber, and silviculture. This work is the most comprehensive published on these important trees.

**Additions to the Loranthaceae of Siam.** By B. H. DANSER. *Bull. Jard. Bot. Buitenzorg* 3: 16: 253-267; February 1940.

A synopsis of the genera and species of Loranthaceae known from Siam, with keys to the genera and species. Twelve genera are represented. Extensive notes are provided regarding many of the species.

**The Malaysian species of the genus *Ixora* (Rub.). Additions and emendations.** By C. E. B. BREMEKAMP. *Bull. Jard. Bot. Buitenzorg* 3: 16: 276-299; February 1940.

Seventeen new species of *Ixora* are described from the Malaysian region, and notes are published pertaining to numerous older species.



**Studies in Theaceae. V. The Theaceae of New Guinea.**

By CLARENCE E. KOBUSKI. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 21: 134-162; April 1940.

An enumeration of the Theaceae of New Guinea, based principally on collections made by L. J. Brass. Numerous new species are described in *Gordonia*, *Ternstroemia*, *Adinandra*, and *Eurya*. A new genus, *Archboldiodendron*, with two species of trees, is described.

**Plantae Papuanae Archboldianae. II.** By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 21: 163-200; 1 pl.; April 1940.

New species from Papua are described in the genera *Freycinetia*, *Pandanus*, *Pittosporum*, *Rubus*, *Pygeum*, *Parastemon*, and *Excavatia*, and there are notes upon older species.

**Notes on two Asiatic genera of Lauraceae.** By H. K. AIRY-SHAW. *Kew Bulletin*, 1940, pp. 74-77.

The new genus *Caryodaphnopsis* consists of two species, *C. tonkinensis* (*Notbaphoebe tonkinensis* Lecomte; *Persea pyri-formis* Elmer), of Tonkin, Annam, Philippines, and British North Borneo; and *C. Henryi* (*N. tonkinensis*, f. *brevipedicellata* Liou Ho), of Yunnan. *Stemmatodaphne perakensis* Gamble (*Beilschmiedia longipedicellata* Merr.) is reported from British North Borneo.

**New Bornean Araliaceae.** By W. R. PHILIPSON. *Journ. Bot.* (London) 78: 116-119; 1940.

*Gilibertia borneensis* and *Polyscias borneensis* are new species from British North Borneo. Neither genus has been reported previously from Borneo.

**Notes on plants of the Pacific Islands. II.** By F. R. FOSBERG. *Bull. Torrey Club* (Burlington, Vermont) 67: 417-425; May 1940.

Chiefly an enumeration of Rubiaceae collected in Fiji, with new species of *Phaleria* and *Psychotria*. There is also an annotated list of species of *Diospyros*.

**The wood anatomy of some Australian Lauraceae with methods for their identification.** By H. E. DADSWELL and AUDREY M. ECKERSLEY. Bul. No. 132, Council for Sci. & Ind. Research, Melbourne, 1940. Pp. 48 (photo-lithographed); 6 x 9½; 1 large table; 8 plates (36 photomicrographs).

"This publication deals with the anatomical features of 31 different Australian species of the family Lauraceae and, in addition, gives details of the habit and distribution of the tree, and the general properties of the timber. Photomicrographs showing details of the structure of various species have been included. A key for the identification of the Australian species has been prepared; reference has been made to the fact that, in anatomical features, the Australian representatives of the family fall into two main groups, namely, (i) including the genera *Beilschmiedia*, *Cryptocarya*, and *Endiandra* and (ii) including the genera *Cinnamomum*, *Litsea*, and *Persea*. This separation agrees with botanical classifications in which the genera of the first division are members of the Lauroideae subgroup of the family, and the genera of the second division are members of the Persoideae subgroup of the family."—*Authors' summary*.

**The density of Australian timbers. 2. Air-dry and basic density data for 172 timbers.** By W. L. GREENHILL and H. E. DADSWELL. Pamphlet No. 92, Council for Sci. & Ind. Research, Melbourne, 1940. Pp. 75; 6 x 9½.

"The various factors which must be taken into consideration when determining the density of a piece of wood are discussed; chief amongst these are the moisture content and the incidence of collapse. The advantage of using basic density for purposes of comparison are pointed out. In the laboratory, basic densities and air-dry (12 per cent moisture content) densities before and after reconditioning are determined, and a brief description is given of the procedures. Results and statistical data are tabulated for 172 timbers. It is pointed out that there is a somewhat closer relationship between basic density and air-dry density after reconditioning than between basic density and air-dry density before reconditioning. This is due



to the irregular occurrence of collapse, the widespread incidence of which is not generally recognized. Finally, results are presented to illustrate the type of density variation found within a single tree, the variation in different trees of the same species, and the use that can be made of the density variation between material of different species for identification purposes."—*Authors' summary.*

**Ecological studies on the rain forest of Southern Nigeria.**

II. The atmospheric environmental conditions. By G. C. EVANS. *Journal of Ecology* (Cambridge) 27: 2: 436-482; 12 text figs.; August 1939.

In the chapter entitled "The carbon dioxide concentration in the undergrowth of primary and secondary forest" the author says: "It has been shown as a result of numerous investigations that the carbon dioxide content of the air in the lower layers of a temperate woodland is for a considerable proportion of the day higher than that outside the wood. A vigorous soil respiration has frequently been observed, and the structure of the wood must impede the mixing of the air near the soil with that outside the wood. In tropical rain forests not only is there a vigorous decomposition (seldom is any continuous layer of dead leaves seen on the ground) but also the structure is much denser than that of most temperate woods. This led to the supposition that the carbon dioxide concentration in the lower layers of the former would be found to be much higher. . . . At the 'normal' [0.03 vol. per cent] concentration of carbon dioxide the rate of photosynthesis with a high light intensity increases almost proportionately with increasing carbon dioxide concentration. Even at low light intensities such as are met with in tropical rain forest a five- or tenfold increase in concentration would cause a large increase in the assimilation rate and might be of importance in enabling plants to live under conditions of very low light intensity. The term 'carbon dioxide flora' has even been coined to describe these plants. . . . It will be shown that these measurements of very high concentrations are unsubstantiated, and that the concept of 'carbon dioxide flora' is without foundation."



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# TROPICAL WOODS

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## TROPICAL WOODS

NUMBER 63

September 1, 1940

*A technical magazine devoted to the furtherance of knowledge of tropical woods and forests and to the promotion of forestry in the Tropics.*

*The editor of this publication and the writer of any articles therein, the authorship of which is not otherwise indicated, is SAMUEL J. RECORD, Dean of the Yale University School of Forestry.*

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### SOME NEW NAMES FOR TROPICAL AMERICAN TREES OF THE FAMILY LEGUMINOSAE

By SAMUEL J. RECORD

During the course of my study of the woods of the Leguminosae, I have had occasion to question the generic positions of several tropical American species. I have referred most of these problems to Ellsworth P. Killip, Associate Curator, Division of Plants, United States National Museum, who has considered them solely from the standpoint of the taxonomist. Some of the results are incorporated in this paper.

#### ANGELIM RAJADO OR BOIS SERPENT

There is considerable confusion in the literature on South American trees regarding the identity of the leguminous timber that has long been known to the Brazilian trade as Angelim Rajado (streaked Angelim) and to the French as Bois Serpent. The lumber has a highly distinctive appearance be-



cause of large irregular streaks and patches of purplish brown on a background of brownish yellow. Owing to the limited supply of the timber, it has never been extensively used, but samples of it are included in every representative collection of woods from French Guiana and the Amazon.

Herbert Stone (*Les bois utiles de la Guyana française* 3: 132; pls. I-II, 1917) describes and illustrates the wood under the name of *Stryphnodendron guianense* (Aubl.) Benth. (= *Mimosa guianensis* Aubl.), and corrects his earlier mistaken identification of Hooboballi (*Loxopterygium Sagotii* Hook. f.) with that species. Leaves from a Surinam tree called Boschtamalen and supposed to be the source of the timber in question were made the basis for an incompletely described new species, *Stryphnodendron flammatum* Kleinhoonte (*Rec. Trav. Bot. Néerlandais* 22: 417, 1925), but the foliage is totally different from that of *Marmaroxylon*.

Adolpho Ducke, the first to obtain adequate herbarium material of the Amazonian tree producing Angelim Rajado, named it *Pitbecolobium racemiflorum* in 1915, but later (1922) changed the name to *P. racemosum*, as the specific epithet (*racemiflorum*) had been used by Donnell Smith to designate a Central American tree. A wood sample (Yale 20720; Ducke 30), with flowering herbarium material collected and determined by Ducke, has the distinctive structure and appearance of trade samples of Angelim Rajado.

Ducke says that the trees are of fairly common occurrence in the sparsely populated parts of Faro, Oriximiná, Santarem, Tapajoz, Almeirim, and Gurupá, Brazil; its usual vernacular name, Ingá-rana, is not very distinctive. The presence of the species in British Guiana was first established in 1937 by A. C. Smith, of the New York Botanical Garden, who found a tree 100 feet tall growing in dense forest on high land in the basin of the Essequibo River, and collected flowering herbarium material and a wood specimen (Yale 35671; Smith 2721). According to Bertin (*Les bois de la Guyana et du Brasil*, pp. 79-80), the tree is rare but reaches large size in the forests of French Guiana. The bole attains a length of 60 to 80 feet to the first large limb and a diameter of 18 to 24 inches just above the heavily buttressed base. The natives use the timber

for wheelwright work, but it is considered suitable also for cabinet-making, marquetry, and decorative panels.

A study of this wood convinced me that the species is generically distinct from the other Leguminosae. Mr. Killip's agreement with my opinion resulted in the diagnosis and transfer given below. The name *Marmaroxylon* (marble wood) refers to the characteristic appearance of the lumber.

**MARMAROXYLON** Killip, gen. nov.—Arbores inermes pubescentes; folia bipinnata, pinnis plurijugis, foliolis parvis membranaceis numerosis, rhachi inter pinnas glandulifera, petiolo glandula magna onusto; flores parvi capitati, capitulis racemosis, racemis e modis defoliatis oriundis saepissimi geminis vel trinis; flores sessiles, calyce cupulari minuto obsolete denticulato; corolla tenuis extus puberula, tubo sursum paullo dilatato, lobis brevissimis; stamina numerosa, filamentis longe connatis, tubo longiexserto; legumen toment osum solemniter saepe semicirculari curvatum, lineari-oblongum, marginibus incrassatis, inarticulatum sed inter semina transverse sulcatum, bivalve, valvis crassiusculis post dehiscenciam vix contortis; semina numerosa.

Type species, *Pitbecolobium racemosum* Ducke.

**Marmaroxylon racemosum** (Ducke) Killip, comb. nov. *Pitbecolobium racemosum* Ducke, *Archiv. Bot. Jard. Rio de Janeiro* 3: errata following p. 272, 1922. *P. racemiflorum* Ducke, op. cit. 1: 14. *pl. 4*, 1915, non Donn. Sm., 1913.

The genus, so far as known, consists of a single species, widely distributed in the Amazon Valley of Brazil, and known also from French Guiana and the basin of the Essequibo River in British Guiana. In the account by Britton and Killip of the Mimosaceae of Colombia (*Ann. N. Y. Acad. Sci.* 35: 108, 1936), the most elaborate recent treatment of the group as it is represented in South America, *Marmaroxylon* would run to either *Artbrosamanea* or *Albizzia*, depending upon one's interpretation of the character of the fruit. The genus evidently is not closely similar to *Albizzia*, which has a thin and often almost papery fruit, not at all constricted between the seeds. *Artbrosamanea* differs in having the legume definitely septate between the seeds, but the valves of the fruit of *Marmaroxylon* apparently are not truly septate, in spite of the well-defined constrictions between the seeds.



COMMON NAMES: Bousi tamarin, puta locus, slang houdou, snecki housou (Sur.); bois serpent, b. zebra (Fr. G.); angelim rajado, ingá caetitú, inga-rana, inga-rana da terra firme, urubuzeiro (Braz.).

#### BOIS LA MORUE OR TAMARINDE PLOKONIE

The timber commonly known in French Guiana as Bois la Morue, in British Guiana as Red Manariballi, and in Surinam as Tamarinde Plokonie, has long borne the scientific name of *Pitbecolobium pedicellare* (DC.) Benth. A study of the wood suggested that the species was wrongly placed generically, and Mr. Killip proposes a transfer to *Samanea*, as follows:

*Samanea pedicellaris* (DC.) Killip, comb. nov. *Inga pedicellaris* DC. Prodr. 2: 441. 1825. *Pitbecolobium pedicellare* Benth. Lond. Journ. Bot. 3: 219. 1844.

According to Ducke (*Archiv. Jard. Bot. Rio de Janeiro* 3: 63), another synonym for *P. pedicellare* (DC.) Benth. is *Mimosa terminalis* Vell. Fl. Flum. 2c. XI t. 30 (= *P. polycephalum* Benth., according to Bentham). Elsewhere (*As Leguminosas da Amazonia brasileira*, 1939, p. 26) he states that the species is common in the forest of the estuary of the Amazon River and also occurs in Rio de Janeiro. Ducke's reference to the wood as yellowish white, coarse-textured, and not utilized in Pará seems much more appropriate for *P. polycephalum* than for the timber under consideration.

COMMON NAMES: Red manariballi (Br. G.); aboonkini, alawatta-moellerie, arawata-moerere, asau, baboen-banjie, hoe-roewassa, kabana, manaliballi-hororodikoro, manariballikoereroe, plokonie, proekoenie, sera, tamalin, tamarinde plokonie (Sur.); bois ara, b. cerf, b. la morue, b. macaque rouge, b. pagode, bougouni, cèdre d'argent, préfontaine rouge (Fr. G.); cambui, ingá-rana (Braz.).

#### THE BITTER ANGELIMS

Twenty years have elapsed since I first attempted to identify a group of moderately hard, coarse-textured woods, yellowish in color when fresh but becoming brown or reddish upon exposure, and noted for the extremely bitter and lasting taste of the yellow powder that fills the vessels. As a result

largely of the valuable collections of Adolpho Ducke, it is now known that the woods represent two closely related genera, *Vatairea* and *Vataireopsis*, which are sometimes placed in the section *Aristobulia* of *Andira*. The timbers are much alike in general appearance and properties, but from such information as is now available it appears that the specimens with the finer and more numerous rays belong to *Vatairea* and those with few and coarser rays to *Vataireopsis*.

As stated in *Timbers of Tropical America* (p. 303), there were at that time (1924) two specimens collected under the name of Guacamayo along the eastern Guatemala-Honduras boundary which evidently belonged in this Brazilian group. Other material was subsequently obtained from Guatemala and British Honduras, and in 1937 Llewellyn Williams collected two wood samples of a tree called Picho in the Isthmus of Tehuantepec, Mexico. Paul C. Standley identified the Mexican material with his *Tipuana Lundellii*. Killip studied the Central American and Mexican specimens and concluded that they belong to *Vatairea* and are not referable to any of the South American species. At Standley's suggestion he proposes the following transfer:

*Vatairea Lundellii* (Standl.) Killip, comb. nov. *Tipuana Lundellii* Standl. Carnegie Inst. Washington Publ. 461: 65. 1935.

COMMON NAMES: Picho (Mex.); bitterwood (Br. H.); frijolillo (Guat.); amargoso, guacamayo (Hond.); amargo (Pan.).

#### VINHATICO DE ESPINHO

The Vinhatico de Espinho of the Bahia region of Brazil is a large, well-formed timber tree sometimes 100 feet tall and four feet in diameter, of scattered occurrence on upper hill slopes in association with the Vinhatico Castanho (*Platymania reticulata* Benth.). It is closely related to *Chloroleucon tortum* (Mart.) Pittier (= *Pitbecolobium tortum* Mart.), a low branched, crooked shrub or small tree with a range extending from northeastern Argentina through eastern Brazil, northern South America, the West Indies, and Central America to Baja California, Mexico. The woods of the two species are readily separable though obviously of the same genus. They



are also distinct from those of other sections of *Pitbecolobium* (*sens. lat.*). The following transfer is accordingly proposed:

*Chloroleucon vinhatico* Record, comb. nov. *Pitbecolobium vinhatico* Record, Timbers of Tropical America, p. 211. 1924.

MISCELLANEOUS TRANSFERS

*Albizia polycephala* (H.B.K.) Killip, comb. nov. *Pitbecolobium polycephalum* Benth. Lond. Journ. Bot. Hook. 3: 219. 1844. *Samanea polycephala* Pittier, Arb. y Arb. Venez. 55. 1925.

*Arthrosamanea daulensis* (Spruce) Killip, comb. nov. *Pitbecolobium daulense* Spruce ex Benth. Trans. Linn. Soc. 30: 586. 1875.

*Macrosamanea Spruceana* (Benth.) Killip, comb. nov. *Pitbecolobium Spruceanum* Benth. Trans. Linn. Soc. 30: 590. 1875.

*Punjuba dependens* (Rusby) Killip, comb. nov. *Pitbecolobium dependens* Rusby, Mem. N. Y. Bot. Gard. 7: 253. 1927.

*Samanea coripatensis* (Rusby) Killip, comb. nov. *Pitbecolobium coripatense* Rusby, Bull. N. Y. Bot. Gard. 4: 349. 1907.

*Senegalia multiflora* (H.B.K.) Killip, comb. nov. *Acacia multiflora* H.B.K. Nov. Gen. & Sp. 6: 277. 1824. *Pitbecolobium multiflorum* Benth. Lond. Journ. Bot. Hook. 3: 220. 1844. *Samanea multiflora* Pittier, Arb. y Arb. Legum. I. Mimos. 61. 1927.

*Senegalia paniculata* (Willd.) Killip, comb. nov. *Acacia paniculata* Willd. Sp. Pl. 4: 1074. 1806.

*Zygia cauliflora* (Willd.) Killip, comb. nov. *Inga cauliflora* Willd. Sp. Pl. 4: 1021. 1806. *Mimosa cauliflora* Poir. in Lam. Encycl. Suppl. 1: 45. 1810. *Pitbecolobium cauliflorum* Mart. Flora 20, pt. 2, Beibl. 116. 1837; ex Benth. Trans. Linn. Soc. 30: 595. 1875.

*Zygia Engelsingii* (Standl.) Record, comb. nov. *Pitbecolobium Engelsingii* Standl. Trop. Woods 34: 40. 1933. *Inga Engelsingii* Standl. Trop. Woods 17: 27. 1929; Field Mus. Bot. 4: 211. 1929.

*Zygia Stevensonii* (Standl.) Record, comb. nov. *Inga Stevensonii* Standl. Trop. Woods 23: 7. 1930.

NEW NAMES IN *CYBISTAX* AND *TABEBUIA*

By RUSSELL J. SEIBERT

Recently it was found necessary to transfer the lower Mexican and Central American *Primavera* (*Tabebuia Donnell-Smitbii*) to *Cybistax Donnell-Smitbii* (Rose) Seibert, Carnegie Inst. Publ. No. 522, p. 392. 1940. Further studies of the genus *Tabebuia* have led to the conclusion that the Venezuelan and Colombian species, *Tabebuia chrysea*, should also be transferred to *Cybistax*.

*Cybistax chrysea* (Blake) Seibert, comb. nov. *Tabebuia chrysea* Blake, Contr. Gray Herb. No. 53, p. 50, 1918; Trop. Woods 36: 17. 1933.

Tree to 20 m. high and 8 dm. in diam.; branchlets, petioles and petiolules sordid stellate-tomentulose; leaves 5-foliolate; leaflets oval-ovate to ovate-lanceolate, 10-22 cm. long and 4-8.5 cm. broad, the lateral ones somewhat smaller, crenate, membranaceous, acute, base truncate to subcordate, stellately puberulous above and below, pilose along the main nerves, especially above; inflorescence a dense flowering raceme about 10 cm. long; flowers golden yellow; calyx campanulate about 2 cm. long, thinly membranaceous, yellow, of about the same texture as the corolla, the lobes of 5 deltoid acute teeth about 5 mm. long, somewhat tomentellous, becoming subglabrate when mature; corolla 6-7 cm. long, thinly membranaceous, more or less minutely tomentellous on the outer surface; fruit conspicuously costate when mature, about 50 cm. long and 3 cm. broad, stellately puberulous when young; seeds flat, surrounded by a large, white hyaline wing.—Apparently restricted to northern Colombia and northwestern Venezuela.

COLOMBIA: Dept. Atlántico: Finca "Santa Rosa," near Barranquilla, st. Nov. 1932, *A. Dugand* G. 237 (Yale); Arroyo Cipacua, alt. 150-250 m., st. Sept. 1934, *Dugand* 711 (Yale); along the Puerto Colombia road, fl. Jan. 1934, *Dugand* 517 (Yale); near Santo Tomas, fl. Dec. 1932, *Dugand* 288 (Yale).

VENEZUELA: State of Falcón: vic. Alta Garcia, fl. May 1917, *H. M. Curran* & *M. Haman* 737A (Gray, NY), 737B



(Gray); between Coro and Alta Garcia, fl. May 1917, *Curran & Haman 737* (AA, Gray, type of *Tabebuia cbryseae* Blake, NY, US). State of Lara: between Rio Tocuyo and Carora, fl., fr. Jan. 1928, *H. Pittier 12613* (Gray, MBG, NY, Yale). State of Zulia: vic. of Maracaibo, fl., fr. Dec. 1922, *Pittier 10966* (Gray, NY); cultivated in vic. of Maracaibo, st. Oct. 1922, *Pittier 10499* (Gray, NY).

VERNACULAR NAMES: Araguán (*Pittier 12613*); cañada (*Pittier 10499, 10996*); penda (*Pittier 10996*); roble (*Dugand 237, 288*); roble amarillo (*Dugand 237, 288, 517, 711*).

The above species is readily distinguishable from *Cybistax antispythitica* Mart. (Brazil, Argentina, Bolivia, and Peru), which has entire leaflets, conspicuously glandular-lepidote and sparsely puberulous and acute or broadly acute towards the base. The inflorescence is of a paniculate rather than a racemose type as found in *C. cbryseae*. *C. Donnell-Smitbii* has 5-7-foliolate leaves and entire or somewhat irregularly serrate leaflets which are glabrous above and below, except along the nerves. The inflorescence is a broad, open panicle; calyx bilabiate and both the calyx and corolla pubescent with capitate-glandular hairs.

**Tabebuia dubia** (C. Wright) Britton ex Seibert, comb. nov. *Tecoma dubia* C. Wright, in Sauvalle Fl. Cub. p. 95. 1873. *Tabebuia crassifolia* Britton, Bull. Torr. Bot. Cl. 42: 376. 1915.

CUBA: Prov. Oriente: Guaro River Dam, st. Feb. 1926, *Crosby & Matthews 44* (NY, Yale); southeast of Holguin, Barren savannas, fl. Apr. 1909, *J. A. Sbafer 1285* (MBG, NY type of *Tabebuia crassifolia* Britton); Moa, Baracoa, fl. fr. Aug. 1917, *J. T. Roig 34* (NY). Without definite locality: st. Dec. 1925, *T. H. Gill 99* (NY); fl. Mar., *C. Wright s.n.* (Gray, cotype (?) of *Tecoma dubia* C. Wright).

VERNACULAR NAME: Roble negro.

According to a note on the type specimen of *Tabebuia crassifolia*, Britton "compared [the specimen] with *Tecoma dubia* C. Wright in Gray Herbarium July 25, 1919" and found the two plants to be conspecific. The correct combination, however, apparently was never published by Dr. Britton.

## AMERICAN TIMBERS OF THE FAMILY BIGNONIACEAE

By SAMUEL J. RECORD and ROBERT W. HESS

The Bignoniaceae comprise more than 100 genera and several hundred species of general distribution in the tropics, a few in temperate regions. A great many of the plants are scandent shrubs or woody climbers, one of the best known being the Trumpet Creeper cultivated in gardens. The stems of many of the lianas are of anomalous structure, a common form having regularly spaced deep furrows filled with phloem wedges, the line of separation appearing on cross section like a miniature staircase (see Solereder's *Systematic anatomy of the dicotyledons*, pp. 605-610). The plants are noted for the beauty of their showy flowers and many are planted for decorative purposes. There are numerous arborescent genera and a few of them yield timber of commercial importance.

In the New World the trees are of 16 genera, namely, *Amphitecna*, *Astianthus*, *Catalpa*, *Chilopsis*, *Cotema*, *Crescentia*, *Cybistax*, *Ekmanianthe*, *Enallagma*, *Jacaranda*, *Macrocatalpa*, *Paratecoma*, *Parmientiera*, *Tabebuia*, and *Tecoma*. They are all tropical except *Catalpa* and *Chilopsis*. The timbers exhibit a wide range of variation in appearance and properties. Many are light-colored throughout, others have a distinct heartwood in various shades of brown to olive or blackish, uniform or more or less variegated or striped; dark specimens frequently have an oily appearance and abundant sulphur-like deposits (*Cotema*, *Godmania*, *Paratecoma*, and *Tabebuia* in part). Luster low to satiny. Taste bitter in *Tecoma* and in inner bark of *Godmania*, absent or not distinctive in the others; odor suggesting kerosene in *Catalpa*, absent or mild and not describable in the others. Density range very great; sp. gr. 0.40 to 1.25; texture fine to coarse; grain straight to roey or otherwise irregular; working properties fair to excellent; durability poor to very high.

Growth rings usually present, sometimes conspicuous; ring-porous structure occasionally present (*Catalpa* and *Chilopsis*). In diffuse-porous woods, pores medium-sized to minute, few to numerous; commonly solitary and in small multiples or little clusters, evenly distributed or tending to diagonal or



concentric arrangement. Vessels with exclusively simple perforations (reticulate perforation plates sometimes present in certain Old World species; see *Forestry* 7: 1: 16-25); spiral thickenings characterize smallest vessels of *Catalpa* and *Chilopsis*; tyloses common; intervascular pitting alternate, rather fine to fairly coarse. Rays 1 to 8, generally 1 to 3, cells wide, often uniformly low, sometimes up to 50 or more cells high; distinctly heterogeneous in *Astianthus*, *Tecoma*, *Jacaranda* in part, weakly so in *Catalpa*, *Chilopsis*, and *Paratecoma*, mostly homogeneous in the others; small cubical crystals seen in *Tabebuia stenocalyx*, otherwise apparently absent; pits to vessels small and rounded to rather large, oval to irregular (e.g., *Catalpa*); pitting sometimes unilaterally compound. Wood parenchyma sparse to very abundant; paratracheal, narrow to coarse aliform to confluent in narrow or wide, short to concentric bands; often finely terminal; no crystals seen. Wood fibers with thin to very thick and gelatinous walls; septate in *Macrocatalpa* and in *Cydistax* in part; pits simple or more or less distinctly bordered. Ripple marks present in *Cotema*, *Crescentia*, *Cydistax*, *Godmania*, *Paratecoma*, and *Tabebuia*; 80 to 140 per inch; regular to irregular; all elements involved; secondary seriation often distinct with lens in the bands of 2-celled parenchyma strands. No gum ducts seen.

*Astianthus viminalis* (H.B.K.) Baill., the only species, is a tree sometimes 50 feet high growing on sand bars along streams from southern Mexico to Gualán, Guatemala. The simple, linear leaves are ternately whorled; the yellow flowers are borne in loose terminal paniced cymes; the small linear capsule contains numerous small broad-winged seeds. So far as known, the timber is not utilized for any special purpose because of its scarcity.

The following description is based upon a small twig from a herbarium specimen supplied by R. J. Seibert from the Missouri Botanical Garden. Pores small ( $60\mu$ ), numerous, fairly well distributed, often in short radial multiples. Vessels with simple perforations; walls finely striate; pits alternate, very small ( $4.5\mu$ ). Rays uniseriate and biseriate and up to 50 cells high; decidedly heterogeneous, with high margins of square and upright cells; pits to vessels very small. Wood parenchyma sparingly paratracheal. Wood fibers with very numerous, very small, indistinctly bordered pits. Ripple marks absent.

*Amphitecna macrophylla* (Seem.) Miers is a shrub or small tree, closely related to *Enallagma*, of restricted occurrence in the mountainous forests of southern Mexico and Guatemala. The large, simple, alternate, nearly sessile leaves are clustered at the ends of the branches; the long-pedicellate greenish flowers are borne on short bracteate shoots on the old wood; the fruit resembles Cacao (*Theobroma*) and the seeds, which

are without wings, are imbedded in pulp. There are no known uses for the timber. The wood has not been studied.

COMMON NAME: Huiro de montaña.

*Catalpa*, excluding the section *Macrocatalpa* as a separate genus, is composed of four species of deciduous trees of the north temperate zone, two occurring in Japan and northern China, the others of limited natural distribution in the southeastern quarter of the United States, though rather widely cultivated. They have stout twigs without a terminal bud; the large to very large leaves are typically in whorls of three; the flowers are conspicuous in terminal panicles; the fruit is a long, 2-valved capsule containing numerous flat, hairy-winged seeds.

*Catalpa bignonioides* Walt., often called Indian bean, is typically a short, stout-boled tree, with a spreading crown, rarely attaining a height of 60 feet. It is planted for decorative purposes and is hardy as far north as eastern New England. It is of no importance as a source of timber. *C. speciosa* Warder, generally known as the Hardy Catalpa, is a forest tree, said to attain a maximum height of 120 feet with a tall straight trunk upward of 50 inches in diameter on fertile bottomlands in the lower Ohio River region. The easily worked, durable timber has never been available in sufficient quantity to be a factor in the market, but it served as a background for the commercial exploitation of the species for forest plantations. Thirty to forty years ago no other tree was so generally and indiscriminately recommended for planting in the Middle West. Some of the plantations have proved successful, but a larger number have, for various reasons, been partial or complete failures. The principal use for the product is for fence posts and fuel.

Heartwood light brown, sometimes tinged with olive; sapwood nearly white, tending to discolor and merging gradually in the heartwood. Luster fairly high. Odor suggesting kerosene; taste not distinctive. Light and soft; sp. gr. (air-dry) 0.40 to 0.45; weight 25 to 28 lbs. per cu. ft.; texture medium to coarse; grain generally straight; very easy to work, finishing smoothly, holds place well when manufactured; durability good to fair.



H. H. Chittaway

Price 35 cents

Yale University

School of Forestry

# TROPICAL WOODS

NUMBER 64

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## TROPICAL WOODS

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*A technical magazine devoted to the furtherance of knowledge of tropical woods and forests and to the promotion of forestry in the Tropics.*

*The editor of this publication and the writer of any articles therein, the authorship of which is not otherwise indicated, is SAMUEL J. RECORD, Dean of the Yale University School of Forestry.*

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### AMERICAN WOODS OF THE FAMILY RUTACEAE

By SAMUEL J. RECORD and ROBERT W. HESS

This family, best known as the source of Citrus fruits and Satinwood, consists of about 140 genera and 1600 species of aromatic trees, shrubs, and a few herbs, of cosmopolitan distribution, though most abundant in the warm regions of the world. The plants are often armed with spines and usually have glands in the bark, leaves, and fruit. The leaves are opposite or alternate, or sometimes whorled, simple or digitately or pinnately compound, and without stipules; the flowers are perfect or unisexual, large or small, the stamens as many or twice as many as the petals; the fruit is a follicle, capsule, samara, drupe, or berry.

In the New World there are about 400 species of shrubs and small to medium-sized, rarely large, trees, representing 44 genera as follows (asterisk indicates woods studied): \**Adis-*  
*cantbus* (1 sp.), *Almeidea* (4), \**Amyris* (20), \**Balfourodendron*



(1), \**Casimiroa* (5), \**Cboisya* (4), \**Citrus* (12, introduced), \**Cneoridium* (1), \**Cusparia* (25), \**Decagonocarpus* (1), \**Decatropis* (2), \**Decazyx* (1), \**Dictyoloma* (2), \**Erythrobiton* (5), \**Esenbeckia* (30), \**Euxylophora* (1), \**Galipea* (8), \**Helietta* (5), \**Hortia* (6), \**Jabnia* (1), \**Leptothyrsa* (1), \**Lubaria* (1), \**Megastigma* (2), \**Metrodorea* (5), \**Naudinia* (1), \**Nycticalanthus* (1), \**Peltostigma* (3), \**Pilocarpus* (20), \**Pitavia* (1), \**Plethadenia* (2), \**Polyaster* (2), \**Ptelea* (1), \**Raputia* (8), \**Rauia* (2), \**Ravenia* (10), \**Sargentia* (1), \**Sobnreyia* (1), \**Spatbelia* (10), \**Spiranthera* (1), \**Stauranthus* (1), \**Taravalia* (1), \**Thamnosma* (6), \**Ticorea* (3), and \**Zantboxylum* (180). The only native genus listed that is not exclusively American is *Zantboxylum* (including *Fagara*). The only genera supplying commercial wood are *Amyris*, *Balfourodendron*, *Citrus*, *Esenbeckia* (?), *Euxylophora*, and *Zantboxylum*. Only two species of the entire family, namely, *Zantboxylum flavum* Vahl, the West Indian Satinwood, and *Cbloroxylon Swietenia* DC., the Ceylon or East Indian Satinwood, are well known to the timber trade of the world. All of the timbers have good technical properties, but with very few exceptions they are too small or too scarce to be of more than local utility.

Color of wood predominantly yellow, whitish, brownish, or greenish, often without much contrast between heartwood and sapwood; exceptions are *Ptelea* (chestnut-brown), *Plethadenia* (very dark brown), *Ravenia spectabilis* Engl. (roseate brown), and a few species of *Zantboxylum* typified by *Z. monophyllum* Lam. (coppery brown). Luster medium to very high. Odor distinctive in some species of *Amyris* and *Zantboxylum*; taste mildly bitter in *Hortia*, decidedly bitter in *Ptelea*, otherwise not distinctive. Density medium to high; texture fine to moderately coarse; grain straight to irregular; working properties generally excellent; resistance to decay variable, often low.

Growth rings usually visible; ring-porous structure more or less pronounced in *Cboisya*, *Cneoridium*, *Erythrobiton*, *Ptelea*, *Thamnosma*, *Zantboxylum americanum* L., and *Z. Clava-Herculis* L. Pores sometimes visible, but mostly indistinct or invisible without lens; commonly thick-walled; variable in abundance; mostly in short, sometimes long, radial multiples. Vessels with exclusively simple perforations except in *Adiscanthus*; spiral thickenings present in *Cboisya*, *Cneoridium*, *Ptelea*, and *Thamnosma*; gum deposits com-

mon to very abundant; pitting fine to very fine. Rays all uniseriate in *Amyris* and *Cboisya*; 1 or 2, occasionally 3, cells wide in *Adiscanthus*, *Cneoridium*, *Erythrobiton*, *Helietta*, *Sobnreyia*, and certain species of *Zantboxylum*; 1 to 3, 4, 5, or 6 cells wide in the others; frequently less than 25, nearly always less than 60, rarely up to 100, cells high; homogeneous or weakly heterogeneous in *Amyris*, *Casimiroa*, *Citrus*, *Cneoridium*, *Dictyoloma*, *Euxylophora*, *Helietta* (in part), *Hortia*, *Nycticalanthus*, *Raputia*, *Sobnreyia*, and *Zantboxylum*; decidedly heterogeneous in *Cboisya*, *Erythrobiton*, *Esenbeckia*, *Metrodorea*, and *Ravenia*; less distinctly heterogeneous in the others; crystals common; enlarged, thin-walled oil cells present in *Euxylophora*; ray-vessel pitting mostly fine to very fine, often unilaterally compound. Wood parenchyma very sparse to very abundant; forms represented are paratracheal, aliform, confluent, and apparently demarcating seasonal growths; crystals common; numerous large bundles of raphides present in the diffuse parenchyma of *Raputia magnifica* Engl. Wood fibers with medium to very thick and gelatinous walls; pits small to very small, simple or indistinctly bordered. Ripple marks absent. Small to very small, vertical, traumatic gum ducts of sporadic occurrence in *Balfourodendron*, *Citrus*, *Esenbeckia*, *Euxylophora*, *Helietta*, *Metrodorea*, *Pilocarpus*, *Ravenia*, and *Zantboxylum*.

*Adiscanthus fusciflorus* Ducke, the only species, is an unarmed shrub or little tree, sometimes 15 feet high, in the undergrowth of somewhat open forests on rather swampy but non-inundated land in the central Amazon region of Brazil. The simple, alternate leaves are smooth, leathery, gland-dotted, entire, the larger ones being 14 to 20 inches long and gradually tapering from the base to a maximum width of about 3 inches; the flowers, which are dark purple outside and white and woolly within, are borne in clusters at the ends of the finely speckled or cross-stripped peduncles a foot or more in length; the fruit consists of 1 to 5, dehiscent, 1-seeded, little capsules, each shaped like a clam shell. There are no known uses for the plant. The following description is based on a wood sample (Yale 31961; Ducke 234) collected with flowering herbarium material by Adolpho Ducke near Manáos, Brazil.

Heartwood absent or not distinguishable from the pale brownish yellow sapwood. Luster medium. Odorless and tasteless. Hard, heavy, tough, and strong; texture moderately fine; grain straight; easy to work, finishing very smoothly; not durable. Of no commercial possibilities.

Growth rings absent or poorly defined. Pores not distinct without lens (60  $\mu$ ); numerous, but not crowded; mostly in little multiples tending to form short radial or diagonal chains, but without distinctive pattern. Vessels some-



times with simple perforations, but usually with circular or oval scalariform plates having 5 to 12 delicate bars, frequently anastomosing; pits very small (4.5  $\mu$ ). Rays uniseriate or biseriate, and up to 30 cells high; heterogeneous, though distinctly upright cells are uncommon; pits to vessels very small (3 to 4  $\mu$ ). Wood parenchyma sparingly paratracheal. Wood fibers with very thick gelatinous walls.

*Amyris* (= *Elemifera*), with about 20 species of unarmed shrubs and small to medium-sized trees, occurs from the southern boundary of the United States (Florida and Texas) through the West Indies and Middle America to northern South America. The alternate to opposite leaves are compound, unifoliolate, trifoliolate, or imparipinnate, the leaflets with very numerous pellucid dots, the petioles sometimes winged; the small white flowers are borne in axillary or terminal panicles; the fruit is a small, oily, aromatic, black or reddish drupe.

The type of the genus is *Amyris balsamifera* L., and so closely related to it that they might well be considered only varieties are two other species, namely, *A. elemifera* L. and *A. sylvatica* Jacq. Though often only shrubs, all three forms attain tree size, occasionally 40 to 50 feet high and a foot or more in diameter. The resinous timber is of excellent quality but too small and scarce to be of value for lumber; owing to its resinous nature it is used locally for fuel, torches, and small cabinet work, and to a limited extent commercially as a source of ethereal oil. The only country now exporting the timber appears to be Venezuela. Pittier says (*Bol. Min. de Rel. Ext.* 7: 346. 1930) that the wood of Quigua or Tigua, *A. balsamifera*, contains a resin of the elemi type which yields upon distillation about 30 per cent of ethereal oil; the resin is also the source of an alkaloid, *amirina*, of the formula  $C_{30}H_{40}OH$ . The wood is shipped in small quantities to Germany and the United States in the form of branches and short logs, in mixture with Candil, *A. simplicifolia* Karst. The first imports into the United States were under the name of West Indian or Venezuelan Sandalwood, but this was later changed to *Amyris* Wood. The following description is based on numerous specimens representing seven species, namely, *A. balsamifera*, *A. Brenesii* Standl., *A. diatrypa* Spreng., *A. elemifera*, *A. lineata* C. Wright, *A. simplicifolia* Karst., and *A. sylvatica* Jacq. All have similar structure.

Heartwood yellowish brown deepening upon exposure; more or less streaked; has an oily appearance; sharply demarcated, at least in old specimens, from the thin, nearly white sapwood. Luster medium to high. Odor mildly fragrant or sometimes rather unpleasant; taste somewhat spicy resinous. Very hard, heavy, and strong but brittle; sp. gr. (air-dry) 0.99 to 1.10; weight 62 to 68 lbs. per cu. ft.; texture fine and uniform; grain variable; very easy to work, takes a lustrous polish, holds its place well when manufactured; very oily material highly resistant to decay.

Growth rings usually distinct. Pores small to minute (45 to 85  $\mu$ ), not visible without lens; rather numerous; mostly in multiples and radial chains. Vessels filled with yellow gummy material in heartwood; pits small or very small (4 to 6  $\mu$ ). Rays uniseriate, mostly less than 10, sometimes up to 20, cells high; homogeneous; pits to vessels small or very small (4 to 6  $\mu$ ). Wood parenchyma rather abundant; in narrow, concentric, metatracheal bands of variable spacing, but often appearing to demarcate seasonal growths; also sparingly paratracheal and diffuse; crystalliferous strands numerous. Wood fibers with thick walls.

COMMON NAMES: Torch, torchwood (Florida); candle wood (black, white), rosewood, torchwood (Jam.); cuaba, c. amarilla, c. a. de costa, c. blanca, c. de costa, c. de la maestra, c. del monte, c. de sabana, cuabilla, incienso, i. de costa, palo de incienso, p. de roble, p. de resina, sasafrás del país (Cuba); palo de tea, puerco, tea, torchwood (P. R.); guaconejo (Dom. R.); bois chandelle, chandelle blanc (Haiti); bossoea (Curaçao); limoncillo, ocotillo blanco, palo de gas, tojtanyuc (Mex.); waika pine (Br. Hond.); melón, ocotillo, roldán (Salv.); chilillo, pimienta (Hond.); marfil, palo de marfil, naranjito, ulanda (Col.); candil, c. de montaña, c. de playa, quigua, tigua (Venez.); seca olorosa (Ec.).

*Balfourodendron*, with a single species, *B. Riedelianum* Engl. (= *Esenbeckia Riedelianum* Engl. = *Helietta multiflora* Engl. = *B. eburneum* Mello), is an unarmed tree, rarely up to 80 feet high and 30 inches in diameter, usually much smaller, occurring in the State of São Paulo, Brazil, northern and central Paraguay, and in Misiones and Corrientes, Argentina. The leaves are large, digitately compound, with three pellucid-punctate leaflets; the small flowers



are borne abundantly in terminal panicles; the fruit is a capsule about an inch long with 3 or 4 greenish, leathery, netted-veined wings. The wood, which has about the consistency of Sugar Maple (*Acer saccharum* Marsh.), is of excellent quality and is highly esteemed in Argentina, where the largest sizes are obtainable, for turnery, tool handles, oars, agricultural implements, interior construction, and furniture.

Heartwood apparently absent or not readily distinguished from the nearly white or pale yellowish brown sapwood; sometimes with a slight greenish tinge. Luster medium. Without distinctive odor or taste. Hard, heavy, strong, and elastic; sp. gr. (air-dry) 0.75 to 0.83; weight 47 to 52 lbs. per cu. ft.; texture fine and uniform; grain generally straight; not difficult to work, splits readily, takes a high polish; is not resistant to decay.

Growth rings usually distinct because of limiting parenchyma band. Pores small (80 to 95  $\mu$ ), not clearly visible without lens; numerous, locally crowded; mostly in pairs but frequently also in multiples of 3 to 6, well distributed. Vessels with simple perforations; pits very small (3 to 4  $\mu$ ). Rays 1 to 4 or 5 cells wide and up to 35, rarely 50, cells high; heterogeneous, usually with single marginal rows of square cells; gum abundant; crystals numerous; pits to vessels very small. Wood parenchyma abundant, mostly in bands several cells wide at intervals apparently corresponding to seasonal growths, and with narrow bands occasionally interspersed; also sparingly paratracheal; crystals abundant, occupying whole strands or only parts of them. Wood fibers with moderately thick walls. Small vertical gum ducts sometimes present in tangential series in association with parenchyma bands; may show on longitudinal surface as narrow brownish streaks.

COMMON NAMES: Marfim, pau liso, p. marfim, pequia marfim (Braz.); guatambú blanco, g. morotí, ibirá-ñeté (Arg.).

*Casimiroa*, with a few closely related and doubtfully distinct species of unarmed shrubs and trees, is limited in natural distribution to Mexico and Central America to Costa Rica. The leaves are alternate, digitately compound, usually with 3 or 5 leathery, pellucid-dotted leaflets; the small white or greenish yellow flowers are borne in axillary racemes; the fruit is a 2-5-celled drupe with a single seed in each cell. The timber is not utilized for any special purpose.

The typical species is *Casimiroa edulis* Llave & Lex., a medium-sized tree, commonly called Zapote Blanco or White

Sapote. Standley says (*Trees and Shrubs of Mexico*, p. 527): "The White Sapote (including also *Casimiroa Sapota* Oerst.) is a well-known tree in Mexico, but is little grown outside that country. It is cultivated in the West Indies and has been introduced into southern California. The fruit varies in size and quality. It somewhat resembles an apple, and the best varieties are as large as a good-sized orange. The tender yellowish skin is thin, like that of an apple; the pulp is soft and cream-colored, of delicate texture, with a pleasant sweet flavor. The fruit ripens in July and August. It is much eaten in Mexico and is commonly sold in the markets. The fruits are popularly believed to induce sleep if eaten in quantity, and to calm rheumatic pains. The bark, leaves, and especially the seeds are said to contain a glucoside, casimiroside, which has a hypnotic and sedative effect upon cerebral centers. A small dose, it is stated, produces, at the end of an hour, deep sleep which lasts four to six hours. This principle, obtained chiefly from the seeds, has been used by Mexican physicians." The Central American species is usually referred to *Casimiroa tetrameria* Millsp., but according to Standley (*loc. cit.* p. 526), it may be only a pubescent form of *C. edulis*. The following description is based upon two authentic specimens of *C. edulis*, one from Mexico, the other from Guatemala.

Color whitish throughout. Luster medium. Odorless and tasteless. Density medium; texture rather coarse; grain straight; easy to work, finishing very smoothly; not durable. Of no commercial possibilities.

Growth rings present. Pores medium-sized (125 to 160  $\mu$ ), not distinct without lens; fairly numerous; mostly in short radial multiples, well distributed. Vessels with simple perforations; pits small (4 to 5  $\mu$ ). Rays 1 to 6, mostly 3 to 5, cells wide and up to 60, generally less than 30, cells high; mostly homogeneous, though often with somewhat enlarged and irregular marginal cells; pits to vessels very small. Wood parenchyma very abundant, often composing a third of the cross-sectional area; paratracheal and confluent into wavy tangential or concentric bands few to 10 cells wide, the cells large and thin-walled; crystals abundant, in whole or only parts of strands, often heavily integumented. Wood fibers with thick walls and very small pits. No gum ducts seen.

COMMON NAMES: Mango tarango, sapote blanco (Cuba, intr.); chapote, coaxmutza, cochitzapotl, hyuy, iztactzopotl,



matasano, yuy, zapote, z. blanco, z. de rata (Mex.); white sapote (Br. H.); matasano (Cent. Am., general).

**Choisya**, with four species of unarmed aromatic shrubs or little trees, is limited in distribution to the southwestern United States and Mexico. The leaves are opposite or nearly so, digitately compound, with 3 to 13 oblong to linear leaflets; the white flowers are borne in showy axillary cymes near the ends of the branches; the fruit consists of 3 to 5 leathery, 2-valved carpels. Some species are often cultivated in gardens for decorative purposes. The stems are too small to be utilized for the wood. The following description is based on a single specimen (Yale 14789; Detwiler 64) of *C. dumosa* (Torr.) A. Gray (= *Astrophyllum dumosum* Torr.) collected by S. B. Detwiler in the Coronado National Forest, Arizona.

Heartwood absent; sapwood yellowish white. Luster medium. Odorless and tasteless. Hard, heavy, and strong; texture fine and uniform. Of no commercial interest.

Growth rings present. Pores small ( $45\ \mu$ ) to minute, the larger ones mostly solitary in an irregular row in early wood, the others in association with larger pores and in radial patches resembling parenchyma. Vessels with simple perforations and spiral thickenings; minute vessel members fibriform. Rays uniseriate and up to 30, generally less than 15, cells high; heterogeneous, nearly all of the cells square or upright; pits to vessels very small. Wood parenchyma very sparse. Wood fibers with very thick, gelatinous walls and very small pits. No gum ducts seen.

COMMON NAMES: Zorillo (New Mex.); clavillo, clavo de olor, flor de clavo, hierba de clavo (Mex.).

**Citrus** is an Asiatic genus, with about a dozen species of aromatic shrubs and small trees, mostly with thorny branches, widely planted throughout the warmer regions of the world, and in many places thoroughly naturalized. The principal fruits are of the following species: Citron, *C. medica* L.; lemon, *C. Limonia* Osbeck; lime, *C. aurantiifolia* (Chr.) Swingle; common or sweet orange, *C. sinensis* (L.) Osbeck; sour orange, *C. Aurantium* L.; tangerine, *C. nobilis* Lour.; grapefruit, *C. paradisi* Macf.; and shaddock, *C. grandis* Osbeck. The woods of the different species are similar and enter the market in limited quantity in the form of small and generally

irregular logs or sticks under the name of Orangewood. It is used for making small articles of turnery and carving, fancy boxes and novelties, inlays, and particularly for manicure sticks. Other woods used for the latter purpose and under the name of Orangewood are Venezuelan "Boxwood," *Gossypiospermum praecox* (Gris.) P. Wils., European Spindletree, *Evonymus europaeus* L., and Black Gum, *Nyssa sylvatica* Marsh. (see *Tropical Woods* 25: 28). The so-called Lemonwood of the archery bow-makers is the Cuban Degame or Dagama, *Calycophyllum candidissimum* (Vahl) DC., family Rubiaceae.

Wood light clear yellow throughout. Luster high. Odorless and tasteless. Hard, heavy, and strong; texture fine and uniform; grain variable; fairly easy to work, taking a glassy polish, holds its shape well when manufactured; is perishable in contact with the soil.

Growth rings usually present. Pores small to medium-sized (90 to  $120\ \mu$ ), visible because of the parenchyma about them; fairly numerous; solitary and in short radial multiples, well distributed. Vessels with simple perforations, pits very small. Rays 1 to 6, mostly 2 to 4, cells wide and up to 50, generally less than 25, cells high; homogeneous or locally heterogeneous, with occasional rows of square cells; pits to vessels very small. Wood parenchyma abundant; vasicentric, aliform, and more or less confluent; also in concentric bands which sometimes appear to limit seasonal growths or a few may occur close together and somewhat anastomosed; large crystals common, the inflated cells composing entire strands or only parts of them. Wood fibers with numerous small pits. Vertical traumatic gum ducts of common occurrence.

**Cneoridium dumosum** (Nutt.) Hook f. (= *Pitavia dumosa* Nutt.), the only species, is a densely branched, unarmed, strongly scented shrub of southern California and northern Baja California, Mexico. The linear, gland-dotted leaves are opposite or fascicled on short branches; the flowers are very small and white; the fruit is a little reddish brown capsule containing 1 or 2 seeds. The plant apparently is of no utility.

Growth rings well defined. Pores very small ( $45\ \mu$ ) to minute, the latter of about the same size as the wood fibers; larger pores with local tendencies to ring-porous arrangement; distribution otherwise irregularly radial, producing flame-like pattern. Vessels with simple perforations and very fine spiral thickenings; pits small. Rays uniseriate or locally biseriate, and up to 20, generally less than 10, cells high; weakly heterogeneous, with numerous square cells but very few upright; pits to vessels small. Wood parenchyma



very sparse. Wood fibers with medium walls in early wood to very thick in late wood; pits minute. *Material*: Yale 23750, collected by Dr. I. E. Webber in southern California.

*Dictyoloma*, with two species of unarmed shrubs or small trees, is limited in distribution to eastern Brazil and eastern Peru. The leaves are doubly pinnate; the small flowers are borne in many-flowered, umbel-like racemes; the fruit is a 5-celled dehiscent capsule containing a few small kidney-shaped seeds, each with a cleft membranous wing. The Brazilian species, *D. incanescens* DC. (= *D. Vandelianum* Juss.), grows in dry localities and rarely exceeds 20 feet in height. *D. peruviana* Planch. is a shrubby tree in the uplands of north-eastern Peru. The crushed fresh leaves are said to be used locally as a substitute for soap and to stupefy fish. The wood apparently has no special uses. The following description is based on two specimens (Yale 18436 and 18769; L. Williams 4296 and 5530, resp.) of *D. peruviana*.

Heartwood pale yellow; not sharply demarcated from the white sapwood. Luster high. Without distinctive odor or taste. Of rather light weight, but firm; texture fine; grain straight; very easy to work, taking a lustrous polish; not durable. Of no commercial possibilities.

Growth rings poorly defined. Pores small ( $90\ \mu$ ), not distinct without lens; rather numerous; mostly in radial multiples of 2 to several pores each. Vessels with simple perforations; pits small ( $6\ \mu$ ). Rays 1 to 3 cells wide and up to 40 cells high; weakly heterogeneous; pits to vessels very small. Wood parenchyma sparingly vasicentric and sometimes in narrow, apparently terminal bands. Wood fibers with rather thin walls and very small pits. No gum ducts seen.

COMMON NAMES: Barbasco negro, huaman-samane (Peru).

*Erythrochiton*, with five species of unarmed shrubs or little trees, is widely but sparingly distributed in tropical America. The leaves, which are clustered at the ends of the branches, have three leaflets in *E. trifolius* Pilger, but only one in the others; the showy white or roseate flowers are in long-pedunculate cymes or clusters except in *E. hypophyllanthus* Planch. & Linden, where they are borne singly on the dorsal midrib of the leaves; the fruit is a 5-parted capsule. The wood is not

used for any special purpose. The only species in North America is *E. Lindenii* (Baill.) Hemsl. (= *Toxosiphon Lindenii* Baill.), a shrub or little tree, ranging from southern Mexico along the Pacific coast to Costa Rica. The most widely distributed species in South America is *E. brasiliense* Nees & Mart., a shrubby tree in southern and northern Brazil and eastern Bolivia and Peru. It is sometimes cultivated for ornamental purposes and the bark of the root is used in local medicine as a vermifuge. The only wood sample available (Yale 19063; Williams 6761) is of *E. brasiliense* collected by L. Williams in northeastern Peru.

Heartwood absent; sapwood nearly white. Luster medium. Odorless and tasteless. Hard and heavy; texture rather fine; grain irregular; easy to work; not durable. Has no commercial possibilities.

Growth rings present; wood more or less ring-porous. Pores small ( $70\ \mu$ ) to minute; numerous; larger ones more or less zonate, others in short radial multiples or series and small clusters. Vessels with simple perforations; pitting very fine ( $3\ \mu$ ). Rays uniseriate and biseriate and up to 60 cells high; decidedly heterogeneous, the cells mostly square with marginals upright; pits to vessels minute. Wood parenchyma rather abundant; vasicentric and in rather wide bands apparently limiting seasonal growths. Wood fibers in part with thick gelatinous walls; pits very small. No gum ducts seen. (Raphides abundant in bark.)

COMMON NAME: Sabia miuda (Braz.).

*Esenbeckia*, with about 30 species of unarmed shrubs and small to medium-sized trees, is widely distributed in America from Texas and northern Mexico to Chile, Argentina, and southern Brazil, though poorly represented in the Amazon basin. The leaves are simple, unifoliate, or palmately compound with 3 to 5 leaflets; the yellowish flowers are borne in large terminal or axillary panicles; the fruit is an angled, usually rough or spiny, woody capsule with 4 or 5 elastically dehiscent carpels.

Best known of the northern species is *Esenbeckia pentaphylla* (Macfad.) Gris. (= *Galipea pentaphylla* Macfad.), a medium-sized tree occurring in Jamaica, Yucatán, Mexico, British Honduras, and eastern Guatemala. The smooth, greenish bark has irregular vertical rows of light-colored



lenticels. The yellowish, fine-textured wood is suitable for tool handles and turned articles but is not used except for fuel.

There are numerous species in Brazil. *Esenbeckia febrifuga* A. Juss., a tree sometimes 45 feet high and 20 inches in diameter, occurs in the southeastern parts of that country and also in Paraguay and Misiones, Argentina, in much of its range only a shrub. The bark is used as a substitute for quinine in treating fevers and the wood is a local favorite for making wooden spoons and dishes and other articles of carving and turnery. Other species, such as *E. leiocarpa* Engl. and *E. grandiflora* Mart., provide some timber for fence posts, implement frames, spokes of wagon wheels, and similar purposes requiring strength, durability, and fine texture.

*Esenbeckia alata* (Karst. & Tr.) Tr. & Pl. (= *Kuala alata* Karst. & Tr.) is a tree 30 to 40 feet high, with a straight trunk 12 inches in diameter, of infrequent occurrence in northern Colombia. The bark is smooth and gray; the leaves and fruits are mildly aromatic. The timber is not utilized. *E. atata* Pittier occurs in the thorn forest of the dry coastal region of Venezuela and attains a maximum height of 50 feet and a diameter of 16 inches. It is claimed that small quantities of the timber were formerly exported to Germany and the United States as a substitute for Boxwood (*Buxus*), but the trees are now too scarce to be of commercial value. (See Record & Garratt's *Boxwoods*, Bull. 14, Yale School of Forestry, pp. 68-71.)

The following description is based on wood samples of eight species of *Esenbeckia*. Heartwood light clear yellow; not always sharply demarcated from the nearly white sapwood. Odorless and tasteless. Luster high. Very hard, heavy, and strong; sp. gr. (air-dry) 0.95 to 1.12; weight 59 to 70 lbs. per cu. ft.; texture very fine and uniform; grain straight to very irregular; easy to work, taking a lustrous polish; some heartwood specimens apparently durable. An excellent wood, but apparently without commercial possibilities.

Growth rings usually distinct, due to parenchyma. Pores small to medium-sized (80 to 130  $\mu$ ); numerous, but not crowded; mostly in small multiples or

short radial chains, with some tendency to diagonal arrangement. Vessels with simple perforations; pits mostly very small (3 to 5  $\mu$ ). Rays 1 to 3, occasionally 4, cells wide and up to 50 cells high; definitely heterogeneous; large crystals common; pits to vessels small to very small. Wood parenchyma variable in amount, in some species very abundant; in fine to rather numerous, narrow to fairly wide, concentric bands, sometimes terminal, sometimes in pairs; also sparingly vasicentric and diffuse; crystalliferous strands common. Wood fibers with thick, gelatinous walls; pits very small. Small vertical traumatic gum ducts sometimes present.

COMMON NAMES: Wild orange (Jam.); red, white, or yellow gasparee (Trin.); hokab, jopoy, palillo, palo amarillo, yax-hocob (Mex.); angustora del Brasil, quina del Brasil (Col.); anacoa, ata-ata, atata (Venez.); apogitaguára, canella de cotia, guarantá, guaratan, lorangeira, l. do matto, mamonhinho, mendanha, pau de veado, p. duro, quina do matto, tres folhas vermelhas (Braz.); apoitá-guará (Par.); ibirá-obiguazú (Arg.).

*Euxylophora paraensis* Huber, the only species, is a large, unarmed tree, sometimes 130 feet tall, confined to non-inundated lands of lower Amazon region in the State of Pará, Brazil. The alternate, simple, entire, leathery leaves have a deeply grooved petiole and a blade ranging up to 10 inches long and 4 inches wide; the creamy white, fragrantly scented flowers are borne in large, terminal, cymose panicles; the fruit is a 5-parted capsule, with each of the dehiscent carpels containing two shiny black seeds.

Huber, who described the genus and species, says of it (translated from *Bol. Mus. Goeldi* 6: 184-185. 1909): "The most important representative of this family [Rutaceae] in Pará, from the standpoint of the utilization of its timber, is the Pau Amarello, a large tree of the forests on *terra firme* in the eastern and southern part of the State. Only in the last few years has it been possible for me to get flowers and fruits of this tree, emanating from the Augusto Montenegro Experiment Station where it is fairly common though not abundant. Examination of this material revealed the unexpected fact that the Pau Amarello is a representative of a new genus of the tribe Cusparieae, to which I have given the name *Euxylophora* in token of the excellent wood that it



produces. . . . The Pau Amarello is one of the timbers most used in Pará and if found in greater abundance (I hear that in some places, for example along the upper Capim and in certain stretches of the Tocantins, it is of very frequent occurrence) it would have even more varied applications. On account of the large size of the boles and the great homogeneity of the lovely light yellow heartwood, it can be used for doors, tables, etc., which require wide planks. Its most frequent application is in the beautiful floors made of alternate boards of Acapú [*Vouacapoua*] and Pau Amarello which add so much to the attractiveness of the houses in Pará. In furniture, also, the juxtaposition of Pau Amarello, especially curly-grained pieces which are sometimes called Pau Setim, to dark-colored wood such as Acapú, Pau Santo [*Zollernia*], Jacarandá [*Dalbergia Spruceana* Benth.], Macacaúba [*Platymiscium*], etc., produce a most beautiful effect. It is probable this timber, were it possible to cultivate it (which unfortunately, judging from our experiments, appears not to be a very easy thing to do), could be exported on a large scale and meet with an unlimited market. As conditions now exist, Pau Amarello is a rather costly wood even here and probably could not be exported with profit."

The timber is known in the New York market, sometimes as Brazilian Satinwood or Sateen, but it lacks attractive figure, high luster, and other special properties essential for fine cabinet work. It has been used to some extent for the backs of hair brushes. A New York manufacturer attempted to use this timber for making Mah Jongg tiles faced with pyralin which is applied in a heated hydraulic press and requires that the wood be very dry. According to a report to the author, "wood experimentally dried to 4 per cent of moisture was so brittle that a board would shatter upon being dropped on a hard floor." Apparently the most satisfactory use for the timber is in a type of flooring and furniture for which the local demand is equal to the supply.

Heartwood bright clear yellow, deepening upon exposure; not sharply defined from the yellowish white sapwood. Luster fairly high. Without distinctive odor or taste. Rather hard and heavy; sp. gr. (air-dry) about 0.81; weight 51 lbs. per

cu. ft.; texture medium and uniform; grain straight to irregular; not very difficult to work, taking a high polish; probably of low resistance to decay.

Growth rings usually present. Pores small to medium-sized, the larger ones (150  $\mu$ ) barely visible without lens; fairly numerous; mostly in short radial multiples, well distributed. Vessels with simple perforations; pitting very fine. Rays 1 to 4, mostly 3 or 4, cells wide and up to 50 cells high; homogeneous or nearly so; enlarged, thin-walled oil cells present; crystals common; pits to vessels very small. Wood parenchyma sparingly paratracheal. Wood fibers with medium walls and very small pits. Vertical traumatic gum ducts of rare occurrence.

COMMON NAMES: Brazilian boxwood, B. satinwood, canary wood, sateen wood (U. S. trade); limão-rana, pau amarello, p. setim, pequia setim (Braz.).

**Helietta**, with five or six species of unarmed shrubs and small trees, occurs in tropical and subtropical America from Texas and northern Mexico to Paraguay. The leaves are compound, with 3 leaflets; the small flowers are borne in terminal or axillary panicles; the fruit consists of 3 or 4 indehiscent, winged carpels, suggesting a group of Maple (*Acer*) seeds.

The only North American species is *Helietta parvifolia* (A. Gray) Benth. (= *Ptelea parvifolia* A. Gray = *H. parviflora* Small), a shrub or little tree up to 25 feet high, forming thickets of considerable extent in the valley of the Rio Grande, but becoming somewhat larger on the limestone ridge of the Sierra Madre in Nueva León, Mexico. The only West Indian species is *H. glaucescens* Urb. of eastern Cuba. *H. Plaeana* Tul. is a little tree of Colombia and Venezuela, and Pittier suggests (*Bol. Min. Rel. Ext.* 7: 344) that it may have industrial possibilities as a substitute for Boxwood (*Buxus*). The species with southernmost range is *H. longifoliata* Britt. (= *Esenbeckia cuspidata* Engl. = *H. cuspidata* [Engl.] Chod. & Hassl.), a tree usually less than 35 feet high and 12 inches in diameter, occasionally considerably larger. The timber is used locally for tool handles and various articles of turnery and appears suitable for making weaving shuttles. The following description is based upon four specimens of *H. longifoliata* and one of *H. Plaeana*.



Wood yellowish or nearly white throughout. Lustrous. Odorless and tasteless. Very hard, heavy, tough, and strong; sp. gr. (air-dry) 0.90 to 0.95; weight 56 to 61 lbs. per cu. ft.; texture fine and uniform; grain irregular; easy to work, taking a lustrous polish; probably poorly resistant to decay.

Growth rings present. Pores numerous; very small to small (40 to 60  $\mu$ ), not distinct without lens; thick-walled, rounded; solitary or in pairs or in short to rather long radial series, often with tendency to diagonal arrangement. Vessels with simple perforations; pitting very fine. Rays 1 or 2, sometimes 3, cells wide and up to 20, generally less than 12, cells high; homogeneous in *Helietta longifoliata*, heterogeneous in *H. Placana*; pits to vessels very small. Wood parenchyma sparingly developed; in apparently terminal row and occasionally in wider bands, and a few cells about vessels; crystaliferous strands common. Wood fibers with thick to very thick walls and very small pits. Vertical traumatic gum ducts sometimes present in wider parenchyma bands.

COMMON NAMES: Baretta, barreta, barretta (Texas, Mex.); gipato (Col.); caritivá, caritivano, caritivar, marfil (Venez.); canella do veado (Braz.); canela de venado, hira-oby, ibirá-obí (Arg.).

*Hortia*, with six species of unarmed trees and shrubs, occurs in tropical south and central Brazil and the Amazon basin. The simple, alternate, leathery leaves are sometimes 36 inches long and 6 inches wide, with the margin rolled toward the base; the small, unscented, red or roseate flowers are borne in large cymose panicles; the fruit is a drupe.

*Hortia regia* Sandw. is the only species known to occur in British Guiana, where it is one of the most distinctive trees in the forest because of its very long and narrow leaves. The fruit is yellow, juicy, and edible. The largest species is *H. excelsa* Ducke, a tree sometimes 100 feet tall in the humid high forest near Garupá in the Brazilian Amazon region. The inner bark has an odor suggesting wine made from sugar cane and this is imparted to the fresh wood. Closely related to it, but not so large a tree, is *H. superba*, also with scented bark; the only wood sample available for study is from the type of this species (see *Tropical Woods* 43: 21).

Color yellowish throughout. Fairly lustrous. Odorless when dry, but with slightly bitter taste. Very hard, heavy, tough,

and strong; texture medium; grain straight; not difficult to work, easy to split, takes a glossy polish; is poorly resistant to decay. A good wood of the general type of Maple (*Acer*), but apparently of no commercial possibilities because of its scarcity.

Growth rings apparently absent. Pores medium-sized (125  $\mu$ ), faintly visible without lens; rather numerous; solitary or more often in radial multiples of 2 or 3, well distributed. Vessels with simple perforations; pitting very fine. Rays very distinct on radial surface; 1 to 4 cells wide and up to 60 cells high; homogeneous or nearly so; all cells comparatively large; pits to vessels very small. Wood parenchyma sparingly vasicentric. Wood fibers with very thick walls and very small pits. No gum ducts seen.

COMMON NAMES: Bush orange, powis-tail tree, warunama (Br. G.); cachaceiro, pau amarello (Braz.).

*Metrodorea*, with five or six species of unarmed shrubs and small to medium-sized trees, is apparently confined to Brazil. The leaves are opposite, compound, with 2 or 3 leaflets; the flowers are small and borne in mostly terminal panicles; the fruit is a rather large, irregular, woody, 5-angled capsule. *M. pubescens* St. Hil. is a medium-sized tree of common occurrence on the plains of southeastern Brazil, and is said to supply a very dense, yellowish white timber of rather poor quality used for interior construction, but not suitable for flooring; its bark is medicinal. Another tree of the same general region is *M. nigra* St. Hil.; its wood is used to a limited extent for carving and carpentry. *M. flavida* K. Krause occurs in the central Amazon region and attains a height of about 60 feet; apparently the timber has no special uses. The following description is based on one sample each of the last two species.

Wood light yellow or yellowish white throughout. Luster high. Odor and taste absent or not distinctive. Hard, heavy, tough, and strong; sp. gr. (air-dry) 0.90 to 1.10; weight 56 to 72 lbs. per cu. ft.; texture fine; grain fairly straight; not very difficult to work, finishing very smoothly; poorly resistant to decay. Presumably of no commercial possibilities.

Growth rings distinct, because of parenchyma. Pores medium-sized (115  $\mu$ ), not distinct without lens; rather numerous; mostly in short radial multiples, well distributed. Vessels with simple perforations; pitting very fine. Rays



1 to 3, occasionally 4, cells wide and up to 40 cells high; definitely heterogeneous, many of the cells square, the marginal ones often upright; crystals common; pits to vessels very small. Wood parenchyma very abundant, distinct; in bands of variable width, some of them appearing to demarcate seasonal growths; also sparingly paratracheal to more or less aliform; crystaliferous strands numerous. Wood fibers with thick to very thick walls and very small pits. Vertical gum ducts sometimes present.

COMMON NAMES: Caputuna, caputuna, cataguá, c. bianca, c. rajada, chupa-ferre, laranjeira do matto, limoeiro do matto, tembletaru (Braz.).

*Nycticalanthus speciosus* Ducke, the only species of the genus, is an unarmed, night-blooming shrub discovered in 1930 near Manáos, Brazil. The 3-foliolate leaves are very large; the large and conspicuous white flowers are borne in cymose panicles and suggest certain Bauhinias; the fruit is capsular. The plant is related to *Spiranthera*. The wood is yellowish white; odorless and tasteless; hard, heavy, strong, and fine-textured.

Growth rings present. Pores small ( $90\ \mu$ ); numerous; mostly in short radial multiples, well distributed. Vessels with simple perforations; pitting very fine. Rays 1 to 3 cells wide and up to 60 cells high; nearly homogeneous; pits to vessels very small. Wood parenchyma abundant; narrowly aliform and irregularly confluent; also in narrow terminal bands, and diffuse; large crystals abundant, the cells composing parts of strands. Wood fibers with very thick gelatinous walls and very small pits. *Material*: Yale 31975; Ducke 248.

*Pilocarpus*, with about 20 species of unarmed shrubs and little trees, is widely distributed in tropical America, but is only sparingly represented in the Amazon basin and apparently not at all in Central America. The leaves, which are simple or odd-pinnate with 3 to 9 leaflets, are congested at the ends of the branches and are alternate, opposite, or whorled; the small flowers are borne in terminal or axillary racemes or spikes; the fruit is a capsule with 1 to 5 dehiscent, 1-seeded carpels. The principal value of the plants is medicinal, as the leaves contain an alkaloid, pilocarpine, well known to the drug trade. The woods have no special uses.

The West Indian species is *Pilocarpus racemosus* Vahl (= *P. heterophyllus* A. Gray = *P. laurifolius* Vahl); it also oc-

curs in Mexico, though the form there has been named *P. longipes* Rose (= *P. insularis* Rose). It rarely exceeds 20 feet in height. The Venezuelan shrub, *P. Alvaradoi* Pittier, does not appear essentially different from *P. racemosus*. Most of the species are native to eastern and southern Brazil, Paraguay, and Misiones, Argentina, the best known being *P. pennatifolius* Lem. and variety *Selloanus* (Engl.) Hessel. The following description is based on three authentic specimens of the foregoing species and variety from Mexico, Venezuela, and Argentina.

Wood lustrous yellowish or yellowish brown; sometimes with fairly distinct heartwood. Odorless and tasteless. Hard, heavy, and strong; texture fine; grain variable; rather easily worked, taking a high polish; poorly resistant to decay.

Growth rings present. Pores thick-walled; very small ( $45\ \mu$ ), not distinct to unaided eye; fairly numerous; occurring mostly in short radial multiples, well distributed. Vessels with simple perforations; pitting very fine. Rays 1 to 5 or 6 cells wide and up to 60 cells high; heterogeneous; large crystals present; pits to vessels very small. Wood parenchyma not very abundant; mostly in narrow bands apparently demarcating seasonal growths; wider bands occasionally present. Wood fibers with thick walls and very small pits. Vertical traumatic gum ducts common.

COMMON NAMES: Kokob-ché (Mex.); borrachero, sarna (Venez.); jaborandy (Braz.); pau de cotia (Urug.); caá-tay-guazú, ibirá-tay (Par.); ibirá-tai, jaborandí, yaguarandí (Arg.).

*Plethadenia*, with two closely related species of unarmed shrubs or little trees, is of limited distribution in the West Indies. The leaves are evenly pinnate, with narrowly winged rachis and 2 to 4 pairs of small, glandular and punctate leaflets; the small white flowers are borne in axillary cymes; the capsular fruit is composed of four 1-seeded carpels. *P. granulata* (Krug & Urb.) Urb. (= *Fagara granulata* Krug & Urb.) occurs in dry uplands in the Dominican Republic, and *P. cubensis* Urb. is found in similar situations in eastern Cuba. The plants appear to be rare and no common names for them are recorded. The following description is based upon an authentic wood sample (Yale 21435; Ekman &



Bucher 299) of *P. cubensis* collected in the vicinity of Santiago de Cuba.

Color deep reddish brown throughout small branches, at least in dry material, becoming blackish brown with an oily appearance toward the center of older stems. Luster medium. Odor mildly fragrant; taste not distinctive. Very hard, heavy, and strong; texture fine; grain fairly straight; takes a high natural polish; probably durable. Of no commercial possibilities.

Growth rings present. Pores thick-walled; very small to minute, the largest ( $45\mu$ ) scarcely distinct with lens; very numerous; mostly in long radial series. Vessels with simple perforations; pitting very fine. Rays normally 1 to 3, occasionally 4, cells wide and up to 15 cells high; more or less heterogeneous, many of the cells being square; pits to vessels very small. Numerous, apparently abnormal, circular or fusiform radial structures, composed of parenchyma cells and distorted fibers, present in specimen, giving a "bird's-eye" grain effect to tangential surface. Wood parenchyma sparingly paratracheal. Wood fibers with very thick gelatinous walls and very small pits. No gum ducts seen. The wood is not typical of the Rutaceae.

*Ptelea*, in a conservative sense, consists of a single species, *P. trifoliata* L., an unarmed shrub or a small tree rarely 25 feet high, with a smooth-barked trunk sometimes 8 inches in diameter, widely distributed in North America from southern Canada throughout the eastern half of the United States and southward from New Mexico and California to Tamaulipas and Oaxaca, Mexico. The species exhibits much variation and more than 50 segregates have been described and named, but according to Standley (*Trees and shrubs of Mexico*, p. 531) "it seems impossible to divide the specimens into groups by any constant character." The alternate leaves are digitately compound, with 3 or rarely 5 leaflets which are either glabrous or pubescent and variable in size and form; the greenish white flowers are borne in compound cymes; the fruit is a wafer-like samara nearly an inch across or rarely wingless. The bark and foliage are strong-scented. Standley says (*loc. cit.*): "In the United States, where the plant is known as Hop-tree and Wafer Ash, the fruit has been employed as a substitute for hops. The root has a bitter, pungent, and slightly acrid but not disagreeable taste and a somewhat aromatic odor. It contains the alkaloid berberine. It has been employed

as a remedy for dyspepsia and as a mild tonic." The tree is often planted for ornamental purposes in parks and gardens. There are no special uses for the wood.

Heartwood chestnut-brown; rather sharply demarcated from the yellowish sapwood. Luster medium. Odor absent, taste of heartwood very bitter. Hard, heavy, tough, and strong; sp. gr. (air-dry) 0.85 to 0.90; weight 53 to 58 lbs. per cu. ft.; texture medium; grain straight to irregular; not difficult to work, finishing very smoothly; fairly durable. Of no commercial possibilities.

Growth rings present; distinctly ring-porous to diffuse-porous, sometimes in same specimen. Pores small to minute; numerous, locally crowded; the larger ones commonly in a zone 1 to several pores wide, the smaller ones in short radial multiples in the interior of wide rings, becoming clustered and in diagonal and tangential arrangement in outer late wood; minute pores commonly in association with the others and resembling parenchyma cells. Vessels with spiral thickenings; perforations simple; pitting rather fine ( $6\mu$ ). Rays 1 to 5 cells wide and up to 40, generally less than 20, cells high; more or less heterogeneous, many of the cells being square or irregular but rarely definitely upright; pits to vessels rather small ( $6\mu$ ). Wood parenchyma sparingly vasicentric. Wood fibers with thick walls and very small pits. No gum ducts seen.

COMMON NAMES: Ague-bark, hop tree, wafer ash (U. S. A.); cola de zorillo (Mex.).

*Raputia*, with eight species of unarmed shrubs and small trees, is distributed from Venezuela through the lower Amazon region to southeastern Brazil. The 1-7-foliolate leaves are alternate or opposite and clustered at the ends of the branchlets; the flowers are large and racemose; the fruit is a dehiscent capsule composed of five 2-seeded carpels. The largest tree is *R. magnifica* Engl., with a range extending from Rio de Janeiro to São Paulo. It is known as Arapóca and is said to be up to 50 or 60 feet high, with a trunk 20 to 25 feet long and 16 to 32 inches in diameter. The timber is used locally for joinery and general construction. The following description applies to this species, as it is the only one represented in the Yale collections.

Wood yellowish throughout; fairly uniform except for occasional fine brownish streaks. Luster rather high. Without dis-



tinctive odor or taste. Moderately hard and heavy; having about the consistency of Sugar Maple (*Acer saccharum* Marsh.); texture rather fine, uniform; grain fairly straight; easily worked, taking a very smooth finish; appears suitable for turnery and carving.

Growth rings present. Pores small (90 to 105  $\mu$ ), indistinct without lens; thick-walled; numerous; mostly in short to long radial multiples. Vessels with abundant gum deposits; pits very small (3  $\mu$ ). Rays 1 to 3 cells wide and up to 20 cells high; homogeneous, though often with single marginal rows of large and irregular procumbent cells; ray-vessel pitting frequently unilaterally compound. Wood parenchyma sparingly paratracheal and in more or less continuous initial rows; also diffuse, with some of the cells greatly enlarged and containing bundles of raphides. Wood fibers septate; pits minute. No gum ducts seen.

COMMON NAMES: Amarellinho, arapóca, a. amarella, a. branca, a. de cheiro, gemma de ova, guatayapóca, gurataiapóca, pau amarello (Braz.).

*Ravenia*, with 10 species of unarmed shrubs and small to rarely medium-sized trees, occurs from the West Indies to southeastern Brazil, with a single species in Central America. The leaves are opposite, large and simple or palmately compound with three rather small leaflets; the white, roseate, or red flowers are large and showy; the fruit is a capsule, with 1 to 5 dehiscent carpels. There are apparently no special uses for the plants except for decorative purposes.

The largest species is the Tortugo Prieto, *Ravenia Urbani* Engl., of Puerto Rico, where in the high forests of the eastern mountains it is said to attain a height sometimes of 50 feet. Its wood has not been studied.

*R. spectabilis* (Lindl.) Planch. is a shrub or little tree growing in Haiti, Guadeloupe, and Cuba; it is known in Cuba as Lemonia and possibly also as Arraiján. The two wood samples available are so different from that of *R. rosea* Standl. that they will be described separately.

Heartwood pinkish or roseate brown; distinct and rather sharply demarcated from the thin, brownish sapwood. Luster medium. Odorless and tasteless. Very hard and heavy; texture fine; grain fairly straight; appears durable.

Growth rings present. Pores thick-walled, rounded; very small (40 to 60  $\mu$ ); mostly in small multiples, well distributed, but with tendency to radial or wavy diagonal arrangement. Vessels with simple perforations and very small pits. Rays 1 or 2, sometimes 3, cells wide and up to 25 cells high; decidedly heterogeneous, the procumbent cells short and in a low stratum; pits to vessels very small. Wood parenchyma sparingly developed; mostly unilaterally paratracheal and more or less aliform; also incompletely and narrowly terminal. Wood fibers with very thick, gelatinous walls and very small pits. Small vertical traumatic gum ducts sometimes present.

*Ravenia rosea* Standl. is a small branchy tree or a shrub not exceeding 25 feet in height and 4 inches in diameter, discovered by F. C. Englesing in Nicaragua and said by him to be abundant in dense shade over the whole area between the Rawawas and Ocongwas Rivers. The timber is usually straight and cylindrical, the bark smooth and almost black except for the numerous small brown lenticels. The plant has no known uses and even the Indians have no name for it despite the fact that it bears rather conspicuous deeply rose-colored flowers from September to early February.

Wood yellowish white throughout. Luster rather high. Without distinctive odor or taste. Hard, moderately heavy, tough, and strong; has about the consistency of Maple (*Acer*); easy to work, finishing very smoothly; is presumably low in resistance to decay.

Growth rings absent or poorly defined. Pores thin-walled, angular; not visible without lens; numerous but not crowded; mostly in small multiples or clusters, with tendency to diagonal or zonate arrangement. Vessel pitting very fine. Rays 1 to 6, mostly 3 to 5, cells wide and up to 120 cells high; decidedly heterogeneous, with comparatively few distinctly procumbent cells; sheath cells common; pits to vessels very small. Wood parenchyma abundant; vascentric, short aliform, and more or less confluent diagonally; also occasionally in concentric bands apparently demarcating seasonal growths. Wood fibers with medium walls and very small pits. No gum ducts seen. *Material*: Yale 1232; Englesing 48; type tree.

*Sohnreyia excelsa* Krause, the only species, is an unarmed tree, 50 to 65 feet high, with the aspect of a palm, growing in the lower and central Amazon regions of Brazil. The pinnate leaves are sometimes seven feet in length, with many leaflets about an inch wide and 8 to 12 inches long; the flowers are small and racemose; the winged, 2-seeded fruit resembles that



of *Ptelea*. The plant is highly ornamental, but supplies no important products.

Wood lustrous golden yellow throughout specimen. Odorless and tasteless. Of moderate density, firm, and strong; texture medium and uniform; grain straight; easy to work, taking a satiny polish; probably not very resistant to decay. An excellent wood suitable for many purposes, but not available in sufficient quantity to be of economic value.

Growth rings present. Pores medium-sized ( $135 \mu$ ), not distinct to the unaided eye; numerous, but not crowded laterally; mostly in radial multiples or series of 2 to 6, sometimes more, well distributed. Vessel pitting very fine. Rays 1 or 2, infrequently 3, cells wide and up to 45 cells high; homogeneous to weakly heterogeneous; pits to vessels very small. Wood parenchyma in narrow terminal band, 1 to 3 cells wide, and also sparingly paratracheal. Wood fibers with medium walls and small pits. No gum ducts seen.

**Thamnosma**, with six species of strong-scented shrubs and half-shrubs, occurs in South Africa and in southwestern United States and northern Mexico. The leaves are simple, alternate, entire, and sometimes reduced to scales; the flowers are small and racemose; the fruit is a leathery 2-lobed capsule opening at the apex. The only authentic specimen available (Yale 26658) is of *T. montana* Torr. & Frém. collected by S. B. Detwiler in Arizona, where it is known as Cordoncillo.

Wood uniform pale yellow throughout. Luster medium. Odorless and tasteless. Rather hard and moderately heavy; texture fine; grain straight. Apparently of no commercial possibilities because of the small size of the plants.

Growth rings distinct. Pores thick-walled; those in early wood very small ( $40 \mu$ ), solitary, and rather widely spaced in a single row; those in late wood minute, numerous, and mostly in short to long radial multiples. Vessels with spiral thickenings and small ( $6 \mu$ ) alternate pits. Rays 1 to 4 cells wide and up to 80 or more cells high; heterogeneous, most of the cells square or upright; pits to vessels small ( $6 \mu$ ). Wood parenchyma very sparse. Wood fibers with very small pits. No gum ducts seen.

**Zanthoxylum** and **Fagara** were treated as distinct genera by Linnaeus and this view was adopted by Engler (see *Pflanzenfamilien*) and many other botanists. Considered separately, *Zanthoxylum* includes about 15 species of shrubs and trees of

the north temperate zone, all in eastern Asia with the exception of *C. americanum* Mill., the Prickly Ash of eastern North America, while over 200 pantropical species of shrubs and trees are referred to *Fagara*. Prominent American authorities, including Sargent, Sudworth, Wilson, and Standley, consider *Fagara* a synonym for the older name *Zanthoxylum* (or *Xanthoxylum*).

The trees are mostly small or medium-sized, in comparatively few instances exceeding 50 feet in height, with trunk diameters of 12 to 18, rarely 24, inches. In many species the branches are armed with stipular spines or prickles, and parts of the stems may be covered with corky knobs. The leaves are alternate, even-pinnate, odd-pinnate, or rarely unifoliate, the leaflets entire or crenulate, the rachis often grooved, sometimes winged, unarmed or prickly; the flowers are small, white, yellowish, or greenish, borne mostly in clustered axillary racemes or terminal panicles; the fruit consists of 1 to 5 follicles. The bark is aromatic and that of the roots is sometimes used in medicine as a stimulant and tonic.

The most northern species is *Zanthoxylum americanum* Mill., a much-branched spiny shrub or a tree sometimes 20 feet high, often forming dense thickets, from Quebec and Ontario, Canada, to North Dakota and southward to Georgia, Alabama, and Oklahoma, in U. S. A. The wood is definitely ring-porous. The prickly shrub or little tree, *Z. Clava-Herculis* L., commonly known as Hercules Club, Toothache-tree, and also Prickly Ash, grows from Virginia to Florida and westward into Texas. The bark is used as a remedy for toothache and rheumatism.

There are about 25 species in Mexico and Central America and about 25 more in the West Indies and northern South America. The genus is poorly represented in the Amazon basin, but there are numerous species in southern South America. A few are large enough to supply some timber for local use, but are not likely to contribute to the export trade.

The only important commercial timber is the West Indian Satinwood. Although more than one species may contribute to the supply, the principal one is *Zanthoxylum flavum* Vahl (= *Fagara flava* [Vahl] Krug & Urb.). This is an unarmed tree



sometimes 40 feet high and 20 inches in diameter, usually much smaller and often reduced to a shrub, with a range including Dominican Republic, Puerto Rico, the Bahamas, Bermuda, and southern Florida. The wood is hard and heavy (sp. gr. about 0.90; weight 56 lbs. per cu. ft.), fine-textured, often with a beautiful, wavy grain, and is of a creamy or golden yellow color, with an oily appearance and feel, and when freshly worked gives off a pronounced scent of coconut. It has been known to the fine-furniture trade for a long time and is used for all kinds of cabinet work, inlays, and marquetry; it also is employed in turnery and for making the backs of hand mirrors and hair brushes. Antique Satinwood furniture is almost exclusively of this species, but in later times Ceylon or East Indian Satinwood (*Chloroxylon Swietenia* DC.) came into general use. The latter is generally more highly figured, paler in color, and somewhat harder than the other; it differs structurally in having distinct ripple marks and in the definite radial arrangement of the pores.

Another kind of West Indian Satinwood is exported in small quantities from Dominican Republic where it is known as Pino Macho. The tree has been provisionally identified as *Zantboxylum elephantiasis* Macfad. (= *Fagara elephantiasis* [Macfad.] Krug & Urb.). It grows also in Cuba and Jamaica, and sparingly on the mainland from Vera Cruz, Mexico, to Panama. The wood differs from that of *Z. flavum* in being coarser-textured, less heavy and solid, and is slightly dull brown rather than lustrous golden yellow, and lacks the coconut scent. Some of it is beautifully figured and gives a very pleasing effect when made into furniture. It has been used successfully to a minor extent in New York and England, mostly under the name of Concha Satinwood, though Howard (*Manual of the timbers of the world*, p. 211) says that it is known in London as Harewood, and he identifies it with the Harewood employed in the form of marquetry in the seventeenth century. Authorities on period furniture generally attribute the name Harewood to gray-stained Maple or European Sycamore (*Acer*).

Heartwood typically yellowish, with a more or less pro-

nounced greenish hue, becoming brown superficially upon exposure; not clearly differentiated from the sapwood. In a few species, notably *Zantboxylum monophyllum* Lam., the heartwood is coppery brown and sharply demarcated from the lemon-yellow sapwood. Luster usually high, suggesting some of the Lauraceae. Without distinctive odor and taste except in *Z. flavum* which is coconut-scented. Light and soft to heavy and hard, but mostly in the class of Birch (*Betula*) and Yellow Poplar (*Liriodendron*) and suitable for the same purposes; working properties excellent; durability fair to poor.

Growth rings usually distinct. Pores mostly between very small and lower medium-size class, rarely large; few to rather numerous; in part solitary, but more often in small multiples, well distributed; ring-porous arrangement characteristic of *Zantboxylum americanum* and *Z. Clava-Herculis*. Vessels with simple perforations; no spiral thickenings seen; pitting fine to very fine. Rays commonly 1 to 3, sometimes up to 5, cells wide and up to 60, generally less than 20, cells high; homogeneous or weakly heterogeneous; crystals common; ray-vessel pitting frequently unilaterally compound, the vascular pits very small. Wood parenchyma usually terminal and sparingly paratracheal; occasionally (e.g., *Z. Kellermanii* P. Wils. and *Z. martinicense* [Lam.] DC.) abundant in rather narrow to wide, wavy to fairly regular, confluent bands; crystalliferous strands few to numerous. Wood fibers with thin to thick walls and small pits. Vertical traumatic gum ducts sometimes present.

COMMON NAMES: *Zantboxylum elephantiasis*: Concha satinwood (trade); satinwood, yellow sanders (Jam.); ayúa varía (Cuba); pino macho (Dom. R.); lagartillo (C. R.). *Z. flavum*: West Indian satinwood (trade); satinwood, yellow sanders, y. wood (Florida, B. W. I.); aceitillo (Cuba, P. R.); ayúa amarilla, limoncillo cimarrón (Nassau); espinillo (Dom. R.); satiné jaune (Fr. W. I.); calibori (Venez.). *Z. monophyllum*: Carubio, mapurito, mopurito, rubia, yellow prickly (P. R.); malacapa (Hond.); lagarto amarillo, l. negro (C. R.); bosúa, bosuda, bosuga, paneque (Venez.). *Other species*: Bastard ironwood, colima, correosa, doctor's club, frêne piquant, Hercules club, pepperwood, pillenterry, prickly ash, sea ash, sting-tongue, tear-blanket, toothache tree, wait-a-bit, wild lime, w. orange, yellow wood (U. S. A.); Caesar wood, licca tree, lignum-rorum, prickly yellow, rosewood, saven tree, sevin tree, suarra wood, yellow Hercules, y. sanders (Jam.);



aceitillo, ayúa, a. blanca, a. varía, ayuda, a. blanca, a. hembra, a. macho, a. varía, bayúa, b. lisa, bayuda, chivo, espino, limón café, limoncillo, mate arbol, niaragato, tomeguín, uña de gato, zorillo (Cuba); ayúa, carubio, cenizo, espino, e. rubial (P. R.); bois piné, piné, p. jaune (Haiti); arbre à pian, bois espinaux jaune, b. jaune, espin de bobo, espineaux blanc, e. jaune, e. rouge (Fr. W. I.); bosoo, l'épinet, stinking l'épinet (Trin.); colima, limoncillo, palo de ropa, p. mulato, sinanche, tamcazche, tancazche, uña de gato, vole, xic-ché, zorillo (Mex.); prickly yellow—alligator-toothed, bastard, black, smooth-barked (Br. H.); ceibillo, lagarto, l. amarillo (Guat.); cedro espino, pochote, rosillo, salitrero (Salv.); cedrillo, cedro espino, chincho, lagarto amarillo (Hond.); ku-krá, lagartillo, lagarto amarillo, l. blanco, l. colorado, l. negro, limoncillo, norí, zorillo (C. R.); acabú, alcabú, arcabú, ruda (Pan.); amamor, araña-gato, barbasco, carey vegetal, matijón, palo carey, uña de gato (Col.); araña-gato, bosúa, bosuda, bosuga, mapurite, m. blanco, ñaragato, panequa, uña de gato (Venez.); sada (Br. G.); awarratalla, awarratarra, boeboeraballi, boeroeaballi, geel steckel boom, ha-pau, he-he, he-makoa, karidan, k. hariraroe, karimadan kakhekora, kawarratarra, mana, palakoea, pieterjarie, pritiari, pritiarie, toepoeroe-proroem (Sur.); bois piquant, cacatier, clavalier des Antilles (Fr. G.); arruda do matto, betaru amarello, chupa ferro, coentrilho, cupim, curaturá, espinheiro, espinho de vintem, laranjeira do matto, laranjinha, limãozinha, mammica de cachorra, m. de cadella, m. de porca, mamminha de porca, marupá-rana, tamanqueira, t. de espinho, t. da terra firme, t. da varzea, tambataruga, tembetarú, t. de espinho, temetarú, tinguaciba (Braz.); alcanfor-sacha, culantrillo, espino, hualaja, quillo-casha, shapillejo (Peru); coentrilho, culentrilho, mamica de cadena, mamilla de cadena, tembetarí, tembetarí, teta de cadena (Urug.); cochudo, coco, c. de cordoba, cuentrilho, culantrillo, curatú-rá, c. morotí, mamica da cadella, naranjillo, sacha limón, saúco hediondo, tembetarí, t. blanco, t.-hú, t.-mí, t.-morotí, t.-puiá, t.-puitá, t.-saiyú, tembetary, t.-guazú (Arg.).

NEW SPECIES AND VARIETIES OF *VITEX* FROM SOUTH AMERICA

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Monographic work on the Verbenaceae during the past ten years has brought to light a considerable number of new species and varieties. Ten of these, all Brazilian, are described below. One is an exceptionally large tree which is said to supply Teak-like timber of local importance in ship-building.

*Vitex amazonica* Moldenke, Geogr. Distrib. 26, nom. nud. (1939), sp. nov.—Arbor; ramulis obtuse tetragonis sparsiuscule strigillosis et granuloso-pulverulentis; foliis 3-foliolatis; petiolis strigillosis; foliolis petiolulatis chartaceis nitidis ellipticis vel subobovato-ellipticis acuminatis, ad basin acutis vel acuminatis, utrinque glabris vel ad basin substrigillosis; inflorescentiis axillaribus cymosis paucifloris.

Tree, to 17 m. tall; branchlets and twigs medium-slender, obtusely tetragonal and usually decussate-flattened, rather sparsely strigillose and granular-pulverulent, brown, medullose; nodes annulate; principal internodes 3–8 cm. long; axillary buds densely villous with fulvous hairs; leaves decussate-opposite, 3-foliolate; petioles rather slender, 2–4.5 cm. long, convex beneath, flattened above, strigillose throughout beneath, strigillose on the margins or not at all toward the base above or on the margins and in a central channel, usually strigillose throughout toward the apex, not much ampliate at base; leaflets subequal in size or the lateral ones slightly smaller, all petiolulate with margined petiolules 2–8 mm. long, those of the lateral leaflets often shorter, strigillose; leaflet-blades chartaceous, rather dark green above, lighter beneath, shiny on both surfaces, the central one elliptic or subobovate-elliptic, 6–16.5 cm. long, 2.3–5.6 cm. wide, acuminate (rarely acute or blunt on stunted leaves) at apex, acute or acuminate at base, glabrous on both surfaces or sometimes slightly strigillose on the midrib and margins at the base; midrib slender, slightly impressed above, prominent beneath; secondaries slender, 11–13 per side, ascending, mostly



inconspicuous above, very prominent and conspicuously arcuate-joined near the margins beneath; vein and veinlet reticulation abundant and delicate, mostly inconspicuous or barely discernible above, the larger portions subprominulous beneath; inflorescence axillary, cymose; cymes opposite, solitary in each axil, sparse, 5-9 cm. long, 2-5 cm. wide, divaricate, few-flowered, dichotomous but often only one branch of each fork maturing, sparsely strigillose throughout, apparently conspicuously bracteate in fruit; peduncles flattened, 2-4.5 cm. long, strigillose, conspicuously ampliate at apex; fruiting-pedicels stout, about 1 mm. long, puberulent; bracts at fruiting time large and foliaceous, 1 or 2 subtending the first dichotomy of each cyme, mostly simple and elliptic, long-stipitate, 4-7 cm. long, 1.6-3 cm. wide, similar to a leaflet; fruiting-calyx incrassate, cupuliform, about 5 cm. long and 10 mm. wide, puberulent outside, glabrous within, venose on both surfaces, its rim rather irregularly 5-lobed; fruit drupaceous, hard and dry, elliptic, 1.2-1.7 cm. long, 6-8 mm. wide, obtuse and slightly umbilicate at both ends, densely short-puberulent throughout with brownish or gray hairs, 2-seeded.

The type of this species was collected by Boris Alexander Krukoff (no. 7149) on "campinarana alta" at Municipality Humayta, on the plateau between the Rio Livramento and the Rio Ipixuna, in the Rio Madeira basin, Amazonas, Brazil, between November 7 and 18, 1934, and is deposited in the Britton Herbarium at the New York Botanical Garden.

*Vitex brevipedunculata* Moldenke, sp. nov.—Frutex vel arbor; ramis ramulisque obtuse tetragonis plusminus dense griseo-pubescentibus glabrescentibus; sarmentis densissime fulvo-vel ferrugineo-villosis; foliis 3-foliolatis; petiolis densissime fulvo-villosis; foliolis sessilibus ellipticis vel obovato-ellipticis obtusis vel acutis, ad basin acutis, utrinque dense villosotomentosis; inflorescentiis axillaribus cymosis paucifloris.

Shrub or tree; branches and branchlets slender, dark gray, obtusely tetragonal, more or less densely gray-pubescent, glabrate in age; twigs very slender, short, very densely villous with spreading fulvous or ferruginous multicellular often gland-tipped hairs; nodes not annulate; principal internodes

1-6.5 cm. long; leaves clustered on the twigs only, decussate-opposite, 3-foliolate; petioles slender, 1-1.5 cm. long, very densely villous with spreading fulvous hairs like the twigs; leaflets sessile, the central one elliptic or obovate-elliptic, 2.5-9 cm. long, 1.8-5 cm. wide, obtuse or acute at apex (or obscurely subacuminate), acute at base, densely villous-tomentose on both surfaces, the pubescence grayish above and fulvous beneath, the lateral ones similar, but smaller; midrib subimpressed above, prominent beneath; secondaries 8-10 pairs, very slender, arcuate-ascending, anastomosing near the margins, very slightly impressed above and prominulous beneath; vein and veinlet reticulation mostly hidden by the dense pubescence; inflorescence cymose, axillary; cymes opposite, several pairs on each twig, about 4 cm. long, few-flowered, surpassing the petioles; fruiting-calyx cupuliform, 9-11 mm. long, 8-10 mm. wide, densely villous like the slender peduncles, pedicels, and twigs, its rim deeply 5-lobed, the lobes lanceolate, sharply acute, 4-6 mm. long; bractlets and prophylla linear, 2-8 mm. long, densely villous; fruit fleshy, oblong-elliptic, about 1 cm. long and 7 mm. wide, black in drying.

The type of this remarkable species was collected by Bror Eric Dahlgren (no. 889) at Croatá, Ceará, Brazil, in 1935, and is deposited in the herbarium of the Field Museum of Natural History at Chicago.

*Vitex Chrysleriana* Moldenke, Geogr. Distrib. 26, nom. nud. (1939), sp. nov.—Frutex vel arbor; ramulis obtuse tetragonis minute puberulis vel glabratis; sarmentis abbreviatis dense villosopubescentibus, pilis flavescensibus vel rufescentibus; foliis 4- vel 5-foliolatis; petiolis dense tomentoso-pubescentibus vel flavescens-villosis; foliolis sessilibus vel subsessilibus ellipticis breviter acuminatis integris, ad basin acutis vel breviter acuminatis, supra puberulis, subtus dense breviterque pubescentibus; inflorescentiis axillaribus cymosis capitatis vel subcapitatis.

Shrub or tree; branchlets quite stout and heavy, obtusely tetragonal, gray, minutely puberulent or glabrate, greatly thickened at the nodes, with very large and greatly elevated corky leaf-scars; twigs very short, densely villous-pubescent



with flavescent or rufescent hairs; nodes apparently not annulate; principal internodes greatly abbreviated, 2-25 mm. long; leaves decussate-opposite, 4- or 5-foliolate; petioles slender, 3.5-4.8 cm. long, densely tomentose-pubescent or villous with flavescent hairs, subterete or slightly flattened above, not noticeably ampliate at base; leaflets unequal in size, the 3 central ones usually subequal, the 1 or 2 others much reduced, all sessile or subsessile; leaflet-blades thin-chartaceous, dark green above, somewhat lighter beneath, the central one elliptic, 4-9.5 cm. long, 1.9-4.3 cm. wide, short-acuminate at apex, entire, acute or short-acuminate at base (rarely rounded), puberulent above, densely short-pubescent beneath, the lateral ones similar in all respects except size and always acute at base; midrib slender, subimpressed above, prominent beneath; secondaries slender, 10-15 per side, arcuate-ascending, flat above, prominulous and more densely pubescent beneath, rather obscurely joined near the margins; vein and veinlet reticulation rather abundant, mostly obscure or indiscernible above, subprominulous beneath on mature leaflets, obscure on immature ones; inflorescence axillary, cymose, capitate or subcapitate, 3-4 cm. long, 1-3 cm. wide, rather densely many-flowered, sometimes bifurcate with two many-flowered cymes and a central terminal flower; peduncles very slender, 1.5-3 cm. long, densely short-pubescent or tomentose like the petioles, decidedly flattened; pedicels slender, 1 mm. long or less, densely short-pubescent; bracts none; bractlets and prophylla linear or setaceous, 1-2 mm. long, densely pubescent.

The type of this species was collected by Auguste François Marie Glaziou (no. 11320) at Itatiaia, Minas Geraes, Brazil, in 1878 or 1879, and is deposited in the herbarium of the Universitetets Botaniske Museum at Copenhagen. The species is named in honor of my good friend and respected colleague, Dr. Mintin Asbury Chrysler, professor of botany at Rutgers University, extensive traveler and collector, and for many years editor of the Torrey Botanical Club.

*Vitex Degeneriana* Moldenke, *Alph. List Common Names* 21, nom. nud. (1939); *Geogr. Distrib.* 27, nom. nud. (1939), sp. nov.—Frutex vel arbor; ramis ramulisque obtuse tetra-

gonis dense ferrugineo- vel fulvo-puberulis; sarmentis gracillimis densissime hirsutulo-pubescentibus, pilis fulvis; foliis 3-5-foliolatis; petiolis dense fulvo-hirsutulis vel breviter adpresso-pubescentibus; petiolulis nullis vel usque ad 1 mm. longis; foliolis ellipticis obtusis vel acutis integris, ad basin attenuatis vel acutis, utrinque dense brunneo-velutinis, senectute breviter pubescentibus vel dense puberulis; inflorescentiis terminalibus valde abbreviatis congestis dense multifloris ubique fulvo-velutinis.

Shrub or tree, to 8 m. tall; branches and branchlets medium-slender, obtusely tetragonal, gray, densely puberulent with ferruginous or fulvous hairs, becoming less so in age, more or less flattened and ampliate at the nodes; twigs very slender, very densely hirsutulous-pubescent with longer decidedly fulvous hairs; nodes annulate; principal internodes 0.5-3 cm. long or elongate on vigorous shoots to 12.5 cm.; leaves decussate-opposite, 3-5-foliolate; petioles slender, 1.5-2.5 cm. long, densely hirsutulous with decidedly fulvous hairs when young, becoming more appressed- and short-pubescent and ferruginous or brown in age, flattened above, not canaliculate or margined, convex beneath, not ampliate at base; petiolules absent or to 1 mm. long and densely hirsutulous like the petioles; leaflet-blades membranous when young, firmly chartaceous in age, uniformly dark green on both surfaces, the terminal one elliptic, 4.5-6.5 cm. long and 1.2-2.8 cm. wide, obtuse or acute at apex, entire, attenuate or acute at base, the lateral ones slightly smaller, densely velutinous with brownish hairs on both surfaces when young, becoming merely short-pubescent or densely puberulent in age; inflorescence terminal, much abbreviated and congested, densely many-flowered, densely and conspicuously velutinous throughout with fulvous hairs; peduncles very short or obsolete; pedicels obsolete; bractlets linear, 4-5 mm. long; corolla white, with light red-violet and yellow patches on the lobes; filaments dark violet.

The type of this species was collected by Dr. Emil Heinrich Sneathlage (no. 653) in a light forest at Urussuby (Remanso), Piahy, Brazil, on July 7, 1925, and is deposited in the herbarium of the Botanisches Museum at Berlin. It is named in



honor of my good friend and colleague, Otto Degener, indefatigable worker, author and publisher of the monumental *Flora Hawaiiensis*, whose name will always be indelibly associated with the flora of the Hawaiian Islands.

*Vitex excelsa* Moldenke, *Alph. List Common Names* 29, nom. nud. (1939); *Geogr. Distrib.* 27, nom. nud. (1939), sp. nov.—Arbor altissima; ramulis crassis obtuse tetragonis dense brevissimeque tomentosis; sarmentis crassis densissime longeque flavescendo-tomentosis; foliis 5-foliolatis; petiolis crassis dense flavescendo-tomentosis; foliolis petiolulatis vel subsessilibus obovatis rotundatis vel obtusis integris, ad basin acutis vel subcuneatis, supra dense pubescentibus, subtus dense velutino-tomentosis; inflorescentiis axillaribus cymosis paucifloris dense flavescendo-tomentosis.

Tree, to 200 feet tall; branchlets stout, obtusely tetragonal, densely but very shortly tomentose, dark; twigs stout, very densely tomentose with long flavescens hairs (1–2 mm. long); buds densely long-villous; leaves decussate-opposite, petiolate, 5-foliolate; petioles stout, 9–14 cm. long, densely flavescens-tomentose (becoming very shortly so in age), expanded and club-shaped at apex; leaflets mostly symmetrical, subequal or the 2 lowest conspicuously smaller and on shorter petiolules, young leaves with the leaflets all subsessile; petiolules 1–6 mm. long, very stout and very densely tomentose like the twigs and petioles; central leaflet-blades obovate, 11.5–18.5 cm. long, 4.8–8 cm. wide, rounded and obtuse at apex, entire, acute or subcuneate at base, densely pubescent above, densely velutinous-tomentose beneath with very glistening flavescens hairs; the basal leaflets similar, but smaller, 5.5–10 cm. long, 2.7–4.7 cm. wide; midrib marked above by a conspicuous raised and erect line of tomentum; secondaries close together, 7–21 per side, rather straight, rather obscurely arcuately joined at the margins, prominent beneath; inflorescence axillary, solitary, opposite, cymose; cymes few-flowered, 5–6.8 cm. long (in fruit), much shorter than the subtending petioles; peduncles somewhat flattened, erect, divergent, 3.2–4.5 cm. long, densely flavescens-tomentose; branches of the inflorescence short and few; fruiting-pedicles 1–5 mm. long, densely flavescens-tomentose; fruiting-calyx

campanulate, about 8 mm. long and 18 mm. in diameter, densely short-pubescent with appressed hairs, its rim deeply but irregularly 5-lobed almost to the base; fruit subglobose, about 13 mm. long and wide, very densely villous throughout with regular flavescens hairs about 1 mm. long.

The type of this beautiful species was collected by Boris Alexander Krukoff (no. 6873) on "terra firma" near Livramento on the Rio Livramento, Municipality Humayta, Amazonas, Brazil, between October 12 and November 6, 1934, and is deposited in the Britton Herbarium at the New York Botanical Garden. The tree is said to be of tremendous size, reaching 200 feet in height, with wood resembling that of commercial Teak and used extensively by the natives for boat-building.

*Vitex maranhana* Moldenke, *Alph. List Common Names* 29, nom. nud. (1939); *Geogr. Distrib.* 27, nom. nud. (1939), sp. nov.—Arbor; ramulis crassis, juventute dense fulvo-villosis, senectute dense brunneo-puberulis glabrescentibus; internodiis valde abbreviatis; foliis 3-foliolatis; petiolis dense fulvo- vel brunneo-pubescentibus vel ad basin fulvo-villosis; foliolis sessilibus vel subsessilibus ellipticis abrupte acute vel breviter acuminatis, ad basin subcuneatis vel acutis, utrinque dense breviterque velutinoso-pubescentibus; cymis axillaribus paucifloris.

Tree, to 10 m. tall; trunk to 15 cm. in diameter at breast-height; branchlets stout, obtusely tetragonal, at first densely fulvous-villous with long appressed hair, later merely very densely brown-puberulent or short-pubescent, eventually glabrous and light-gray in color; pith tetragonal; nodes not annulate; principal internodes greatly abbreviated, 5–10 mm. long; leaves 3-foliolate, clustered at the ends of the youngest twigs, opposite; petioles rather stoutish, 3–6 cm. long, densely fulvous- or brownish-pubescent, the base often long-villous with fulvous silky hairs like the young twigs, plainly flattened above; leaflets sessile or subsessile, elliptic, subequal in size or the 2 lateral ones slightly smaller, 3.5–10.5 cm. long, 2–5 cm. wide, abruptly acute or short-acuminate at apex, the very tip often blunt, emarginate, or minutely apiculate, entire, sub-cuneate or acute at base, densely short-pubescent with brown-



ish velutinous hair on both surfaces; midrib slender, impressed to the apex above, very prominent beneath; secondaries slender, ascending, rather straight and parallel, close together, 17-20 per side, impressed above, prominent beneath, anastomosing close to the margins; veinlet reticulation abundant, fine, prominulous beneath, the tertiaries subimpressed above; inflorescence cymose, axillary, equaling or slightly surpassing the petioles, few-flowered; peduncles rather stout, about 4 cm. long, densely fulvous- or brownish-pubescent; fruiting-pedicels incrassate, about 3 mm. long; fruiting-calyx patelliform, about 7 mm. wide, puberulent; fruit drupaceous, fleshy, elliptic, about 1.3 cm. long and 1 cm. wide, densely whitish-puberulent.

The type of this species was collected by Ricardo de Lemos Fróes (no. 4) in "terra firma" highland forest at Pirucana, Maranhão, Brazil, on February 12, 1933, and is deposited in the Britton Herbarium at the New York Botanical Garden. The collector records the vernacular name Tarumá Assú.

*Vitex Panshiniana* Moldenke, Geogr. Distrib. 27, nom. nud. (1939), sp. nov.—Arbor; ramis crassis obtuse tetragonis; ramulis dense ferrugineo-tomentosis; foliis 5-foliolatis; petiolis densissime villosa-tomentosis vel hirsutis; foliolis subsessilibus vel stipitatis, laminae submembranaceis ellipticis vel subobovatis vel oblanceolatis acutis integris, ad basin longe attenuatis vel cuneatis, supra dense villosis vel villosa-tomentosis, subtus densissime tomentosis; inflorescentibus axillaribus cymosis saepe subcapitatis dense flavescendo-villosis.

Tree; branches very stout and woody, with corky bark, very obtusely tetragonal, gray-brown, puberulent on the younger parts and nodes or glabrous; branchlets similar but usually more acutely tetragonal and densely tomentose-pubescent with ferruginous tomentum; twigs stout, usually short and more acutely tetragonal, very densely villous-tomentose or hirsute with long and shaggy flavescent or ferruginous hairs; nodes somewhat corky-annulate, but usually not conspicuously so; principal internodes 1-4 cm. long or very much more abbreviated on branchlets and twigs; leaves decussate-opposite, 5-foliolate; petioles stout, 7-13.5 cm.

long, flattened above, very densely villous-tomentose or hirsute with long and shaggy flavescent or ferruginous hairs, slightly or hardly at all ampliate at base, somewhat disciform at apex; leaflets usually unequal in size, the 2 lowermost considerably smaller than the 3 central ones, all subsessile or petiolulate with petiolules to 7 mm. long and shaggy-villous like the petioles; leaflet-blades submembranous, dark green above, much lighter and yellowish beneath, the central one elliptic or subobovate or oblanceolate, 10.5-19 cm. long, 3.2-5.6 cm. wide, acute at apex, entire (or slightly undulate-repand), rather long-attenuate or cuneate at base, densely villous or villous-tomentose above, very densely matted-tomentose and velutinous on the lamina beneath and villous on the larger venation, the hairs flavescent or ferruginous, the lateral leaflets similar only smaller, usually less distinctly petiolulate, and less attenuate at base; midrib slender, flat above but conspicuous by being much more densely silky-villous, prominent and densely ferruginous-villous beneath; secondaries slender, 14-17 per side, arcuate-ascending, flat above, slightly prominulous beneath, rather obscurely joined at the margins beneath; vein and veinlet reticulation abundant, mostly indiscernible above, rather conspicuously sunken in the tomentum of the lamina beneath; inflorescence axillary, cymose, often somewhat subcapitate, 2-7.5 cm. long, 1.5-4.5 cm. wide, many-flowered, rather dense, usually more or less branched in a subumbelloid fashion, densely flavescent-villous throughout; peduncles rather stoutish, 1-6 cm. long, densely flavescent- or ferruginous-villous with shaggy or spreading hairs like the petioles, usually somewhat flattened; pedicels obsolete or to 3 mm. long and densely villous, obscure; bractlets linear or spatulate, to 1 cm. long, densely villous-tomentose; prophylla linear, 1-3 mm. long, tomentose; corolla lilac; fruit described as a "sweet purple drupe."

The type of this species was collected by George Gardner (no. 1817) in woods around Crato, Ceará, Brazil, in September, 1838, and is deposited in the Britton Herbarium at the New York Botanical Garden. The species is known also from Pará and is named in honor of Alexis John Panshin, who has done and is continuing such notable work on comparative wood anatomy.



*Vitex Pansbiniana* var. *pulchra* Moldenke, Geogr. Distrib. 27, nom. nud. (1939), var. nov.—Haec varietas a forma typica speciei recedit foliolis maturis subcoriaceis, supra distincte impresso-reticulatis et brevioribus pubescentibus.

This variety differs from the typical form of the species in its subcoriaceous mature leaflets (at time of anthesis), which are distinctly impressed-reticulate above and somewhat more shortly pubescent on the lamina above, instead of long-villous.

The type was collected by Alberto Löfgren (no. 349) at São Benedicto, Ceará, Brazil, on March 18, 1910, and is deposited in the herbarium of the Naturhistoriska Riksmuseet at Stockholm.

*Vitex Perriana* Moldenke, Geogr. Distrib. 27, nom. nud. (1939), sp. nov.—Frutex; ramulis gracilibus obtuse tetragonis ubique dense puberulis; sarmentis dense ferrugineo-vel fulvo-pubescentibus; petiolis dense ferrugineo-pubescentibus; foliis 3-foliolatis; foliolis submembranaceis vel chartaceis oblongis vel ellipticis rotundatis vel acutis vel subacuminatis integris, ad basin acutis vel attenuatis, supra densissime velutinoso-villosis, subtus densissime velutinoso-tomentosis; inflorescentiis axillaribus cymosis.

Shrub, about 1.5 m. tall; branchlets slender, obtusely tetragonal, rather densely puberulent throughout, corky, the bark flaking off, slightly compressed and ampliate at the nodes, not very medullose; twigs slender, mostly short, tetragonal, usually decidedly flattened or compressed, often sulcate, densely pubescent with decidedly ferruginous or fulvous pubescence; nodes obscurely or not at all annulate; principal internodes 1-6.5 cm. long; leaves decussate-opposite, 3-foliolate; petioles rather slender or stoutish, 2-7 cm. long, densely ferruginous-pubescent like the twigs, flattened and often subcanaliculate above, not conspicuously ampliate at the base; leaflets normally subequal in size, rarely one or both the lateral ones somewhat smaller, submembranous or thin-chartaceous, dark green on both surfaces or somewhat lighter beneath, the central one oblong or elliptic, 3-10.7 cm. long, 1.3-3.9 cm. wide, varying from rounded to acute or very shortly subacuminate at apex, entire, acute or somewhat attenuate at base, very densely velutinous-villous above, very

densely villous-tomentose beneath, the tomentum flavescent or fulvous, the lateral ones similar in all respects only usually less attenuate at the base; midrib slender, flat or subprominulous above, prominent beneath, usually more densely villous than the lamina on both surfaces; secondaries slender, 7-12 per side, ascending, usually not much arcuate, flat and often more or less obscure above, prominulous beneath, not very conspicuously joined; vein and veinlet reticulation usually indiscernible (because of the tomentum) on both surfaces; inflorescence axillary, cymose, 4-7 cm. long, 2-4 cm. wide, once or twice furcate with a central terminal flower between the branches, few- to many-flowered, rather dense, densely ferruginous- or flavescent-pubescent or subvillous throughout; peduncles rather slender, 2-4 cm. long, densely pubescent-tomentose like the petioles, usually conspicuously flattened; pedicels obsolete or to 2 mm. long and densely villous-pubescent; bractlets sessile, oblong, to 1 cm. long, densely tomentose; prophylla linear, 1-2 mm. long, hidden in the tomentum; corolla blue or violet.

The type of this species was collected by Jacques Samuel Blanchet (no. 3434) at Igreja Velha, Bahia, Brazil, in 1837 or 1841, and is deposited in the Meisner Herbarium of Columbia University at the New York Botanical Garden. The species is also known from Pernambuco and Piahy, and is named in honor of Dr. Lily May Perry, who has done such noteworthy work on the North American species of *Verbena* and on other groups.

*Vitex Perriana* var. *abludens* Moldenke, Alph. List Common Names 21, nom. nud. (1939); Geogr. Distrib. 27, nom. nud. (1939), var. nov.—Haec varietas a forma typica speciei recedit petiolis elongatis, foliolis majoribus late ellipticis, ad apicem rotundatis vel obtusis vel emarginatis, supra sparsiore brevioribus pubescentibus.

This variety differs from the typical form of the species in its mostly longer petioles, which are 6.5-7.5 cm. long, and in its larger leaflets, which are broadly elliptic, to 14.5 cm. long and 7 cm. wide, rounded or obtuse to emarginate at apex, and 7 cm. wide, rounded or obtuse to emarginate at apex, brunnescent in drying, the upper surface with sparser and shorter pubescence.



The type was collected by Jaques Samuel Blanchet (no. 241) in Bahia, Brazil, in 1844 or thereabouts, and is deposited in the herbarium of the Naturhistorisches Museum at Vienna. The species is also known from Pernambuco.

### SECTIONS FOR MICROSCOPIC STUDY FROM INCREMENT BORINGS

By H. E. STORK

*Professor of Botany, Carleton College*

The Swedish steel increment borer that cuts core samples of wood from stems of trees or from logs is well known to the forester and dendrologist but deserves a wider popularity among the general collectors for our herbaria. While the importance of wood characteristics and the desirability of securing wood samples at the same time that herbarium specimens are obtained from woody plants are becoming more generally recognized, the average general collector regards it too time consuming and too laborious a task to secure wood samples. Particularly in a tropical climate, the work of chopping out wood samples is rather trying if undertaken by the collector himself and may occasion too much delay if entrusted to the slow efforts of a native woodsman. As an alternative, the writer carried an increment borer while collecting in Costa Rica and was able to get wood cores from many trees from which larger samples were not taken. These serve quite adequately for the preparation of temporary or permanent microscopic sections. The borer is easily carried, suspended from the belt, and it takes but a few minutes to cut a core sample and put it in a 6-inch screw cap vial of 70% alcohol. The vial is cork-stoppered under the screw cap. If a long core is taken the sections are numbered so their position in the stem can be determined. Labels are written in graphite pencil on good quality paper and enclosed with the sample in the alcohol.

A 14-inch increment borer cutting a  $\frac{1}{8}$  inch core was used. This gives microscope preparations in the form of  $\frac{1}{8}$  inch circles for the tangential sections and rectangles,  $\frac{1}{8}$  inch

wide and of any length, for the cross and radial sections. This is adequate for microscopic study and has the advantage over larger size borers that it is more easily driven into a very hard wood. If the instrument is sharp and in good condition there is surprisingly little compression of even the softest woods. Such woods as do have rather large regions of thin-walled parenchyma are of course somewhat distorted in those regions, but while such slides do not make good photomicrographs, they nevertheless show the characteristics of the wood elements, as one can allow for the distortion or compression of the thin-walled elements in study.

The best steel instruments are required. These hold their edge for a remarkably long time and they will not break if correctly used. Carelessness in exerting side pressure while driving into a tree may break the best of tools.

Our experience with increment borer samples for microscope preparations leads us to express the hope that more collectors in the tropics will make an increment borer a part of their standard collecting equipment.

### PREVENTING THE CURLING OF WOOD SECTIONS

By FAY HYLAND

*Assistant Professor of Botany, University of Maine*

The tendency of wood sections to curl while being passed through the higher alcohols and xylol is a common source of annoyance in the preparation of permanent mounts. And once the sections are curled they are not readily flattened because they have become hard and brittle during dehydration. Any practical method of overcoming this difficulty should be helpful not only to xylotomists but also to those less skilled in technique.

It is only when sections are cut from non-imbedded material that this difficulty is encountered, for if celloidin or some other embedding material is used the sections can be kept flat during the staining process by fastening them to the slide with proper fixatives. The ordinary practices in staining and dehydrating include the use of tea strainers, watch glasses, and glass



slides. The first two methods allow the sections to curl and oftentimes to become stained unevenly in cases where they overlap. The method where the sections are placed between glass slides has the disadvantage of preventing ready access to stains and dehydrating agents.

The idea of placing the sections between wire screens, pieces of woven glass cloth, and other materials occurred to the writer. Of these materials only the wire screens proved satisfactory. In selecting the screens the following points were considered: resistance to corrosion, diameter of wire, size of mesh, and rigidity. It was found that stainless steel, monel metal, and aluminum screens would withstand the rigors of the staining schedule without corrosion. The diameter of wire and the size of mesh were found to be of less importance, but the wire should be small enough to allow the sections to lie flat without sagging, and the mesh should be just large enough to allow liquids to pass through freely. The last two qualifications are somewhat dependent upon the rigidity of the metals used. Stainless steel and monel metal are rigid and this quality permits the use of smaller wire than in the aluminum screens which are more soft and flexible. It was found that stainless steel wire cloth with mesh 35 x 35 and wire diameter of 0.009 inches proved ideal. Unfortunately this size is not carried in stock by most commercial companies. However, the following more generally available sizes will prove satisfactory: Stainless steel or monel metal, mesh 40 x 40 and wire diameter of 0.0095 or 0.01 inches; or aluminum, mesh 40 x 40 and wire diameter of 0.01 inches.

The screen cloth must be kept flat. It is probably best to have it cut into pieces of desired size by the company before shipping. A size of 2.5 x 3 inches is convenient for use with the ordinary finger bowls. Clip off the corners of the screens to prevent raveling.

Method: Cut the sections and transfer by means of a brush directly to the screen (which should previously be placed in a shallow dish or on the bottom side of a finger bowl with enough liquid added to fill the meshes of the screen). Use 50 per cent alcohol or the liquid employed in flooding the knife. The surface tension of the liquid will hold the sections

flat and at the same time prevent them from drying. After the screen is filled or "loaded" add the other half and wrap together with coarse white cotton thread. Place in finger bowls containing the stain. After staining has been accomplished transfer to the dehydrating and clearing agents. Drain off the excess liquid on paper toweling between changes. When the xylol or final step is reached leave the sections for at least 10 minutes in the xylol after which time the sections will have become hardened and the screens may be removed. Sections thus prepared may be mounted immediately or left for an indefinite period of time without curling.

A feature of the method which may be considered a disadvantage is the fact that the sections are partly hidden by the screens during the staining process. However, a section may be carried through outside the screens and observations may be made on this section in order to determine the progress of the others.

#### CURRENT LITERATURE

**The Caribbean Forester.** Pub. quarterly by Tropical Forest Exp. Sta., U.S.F.S., Río Piedras, Puerto Rico. Vol. I: 4: 1-33; July 1940.

#### CONTENTS

- A list of woods arranged according to their resistance to the attack of the "polilla," the dry-wood termite of the West Indies, *Cryptotermes brevis* Walker (pp. 1-10), by George N. Wolcott.  
 Blue mahoe of Jamaica (pp. 11-12), by C. Swabey.  
 Notes on the yarey palm of Puerto Rico and the straw industry derived from it (pp. 13-16), by L. E. Gregory.  
 The uses of the conical spade (pp. 17-18), by J. C. Cater.  
 Some notes on the mangrove swamps of Puerto Rico (pp. 19-29), by L. R. Holdridge.  
 Notes on the Pacific region of Nicaragua (pp. 30-31), by R. E. Harding.
- Pinaceas Mexicanas. Descripción de algunas especies y variedades nuevas.** By MAXIMINO MARTÍNEZ. *Anales del Instituto de Biología (Universidad Nacional de México)* 11: 1: 57-84; 23 text figs.; 1940.  
 Described as new are *Pinus oocarpa* Schiede, vars. *Ocbote-*



*renai* and *Manzanoi*; *P. Herrerae*; and *P. Strobilus* L., var. *chiapensis*. There are also descriptions of related species and varieties, with range maps and illustrations of the principal diagnostic characters.

**Una nueva especie forestal (*Fagus mexicana* sp. nova).**

By MAXIMINO MARTÍNEZ. *Anales del Instituto de Biología* 11: 1: 85-89; 3 text figs.; 1940.

Mexican Beech, *Fagus mexicana* Martínez, commonly known as Haya, is a tree 100 to 125 feet tall, with a smooth-barked trunk 20 to 40 inches in diameter, occurring in very humid places at elevations of approximately 6000 feet in the Zacatlamaya Mountains, Hidalgo.

**Esencia de lináloe Mexicano.** By JULIÁN FERNÁNDEZ R.

*Boletín Forestal e de Caza* (Mexico, D. F.) 1: 3: 13-23; August 1940.

An interesting account of the source, collection, and distillation of the Mexican oil of Lináloe, which is obtained from the wood and occasionally the fruit of certain burseraceous trees.

**Additions to the flora of Mexico and Central America.** By

C. L. LUNDELL. *Phytologia* 1: 11: 369-372; September 1940.

Among the five species described as new are two small Mexican trees, namely, *Prunus Matudai* of Chiapas and *Gilbertia Matudai* of Tobasco.

**New Asteraceae from Guatemala and Costa Rica collected by A. F. Skutch.** By S. F. BLAKE. *Brittonia* (Lancaster, Penn.) 2: 329-361; June 1937.

New species of woody plants are described in the genera *Archibaccharis*, *Clibadium*, *Montanoa*, *Perymenium*, *Liabum*, and *Trixis*.

**A collection of flowering plants from Mount Roraima and adjacent Venezuela, British Guiana, and Brazil.** By A. C. SMITH ET AL. *Bull. Torrey Bot. Club* 67: 283-299; April 1940.

Includes 14 apparently new species of trees in the genera *Licania*, *Vochysia*, *Mabea*, *Cunuria*, *Croton*, *Ouratea*, *Tovomitia*, *Conomorpha*, *Rapanea*, and *Psychotria*.

**Plantas medicinales brasileñas.** By EURICO TEIXEIRA DA FONSECA. Rio de Janeiro, 1940. Pp. 102; 6½ x 9; 27 text figs.

An annotated list of more than 170 Brazilian plants with particular reference to their medicinal uses.

**Especies novas equatoriais e tropicais-orientais brasileiras.**

By J. G. KUHLMANN. *Anais da Primeira Reunião Sul-Americana de Botânica 12 a 19 de Outubro de 1938* (Rio de Janeiro) 3: 69-86; 18 plates.

The following are described as new: *Ampelocera edentula* (Ulmaceae); *Pseudolmedia birtula* and *Ogcodeia oblongifolia* (Moraceae); *Licania litoralis* Warm., var. *cuneata* and *Pari-narium gracile* (Rosaceae); *Riedeliella sessiliflora* and *Dioclea edulis* (Leg.-Pap.); *Qualea magna* (Vochysiaceae); *Polygonanthus punctulatus* and *Didymocistus chrysodeniis*, the latter a new genus and species (Euphorbiaceae); *Cissus nobilis* and *C. fusco-ferrugineus* (Vitaceae); *Vasivaea podocarpa* (Tiliaceae); *Lacistemopsis poculifera*, a new genus and species closely resembling *Lozania Klugii* Mansf. (Lacistemaceae); *Aspidosperma longipetiolatum*, *A. compactinervium*, *A. subumbellatum*, and *A. laxiflorum*, all trees with sulcate stems (Apocynaceae); and *Schlegelia albiflora* (Bignoniaceae).

**Sinonimias científicas, nombres técnicos que deben excluirse de algunas plantas que existen en el Peru.**

By FORTUNATO L. HERRERA. *Revista de Ciencias* (Lima) 41: 430; 511-513; 1940.

Gives the scientific equivalents for 35 vernacular names of Peruvian plants.

**Estudios sobre la flore de Departamento del Cuzco. Suplemento III.** By FORTUNATO L. HERRERA. *Revista de Ciencias* 41: 430: 537-541; 1940.



A list of 24 additions (species or varieties) to the known flora of the Department of Cuzco, Peru, with localities and a few vernacular names.

**The Labiatae of Bolivia.** By CARL EPLING. *Revista Sudamericana de Botánica* 4: 21-53; January 1937.

The first part of a systematic account of the Labiatae of Bolivia, consisting of keys to genera and species, with descriptions of most of the species, and citation of specimens or ranges. Sixteen genera are represented, some of them by woody plants.

**Maderas Argentinas. Estudio xilológico y tecnológico de las principales especies arbóreas del país.** By LUCAS A. TORTORELLI. Pub. by Universidad de Buenos Aires, July 1940. Pp. 218; 6¼ x 49; 5 maps, 49 plates.

A carefully prepared, well printed, and profusely illustrated manual of the principal Argentine timbers with reference to their structure, properties, uses, and identification.

**Materiales para una monografía del género *Prosopis* (Leguminosae).** By ARTURO BURKART. *Darwiniana* (Buenos Aires) 4: 57-128; 15 figs., 23 pls.; 1940.

The genus *Prosopis* is arranged in six sections, some of which have been treated by authors as distinct genera. Most of the species, including those of the Old World, are considered and described, with full synonymy and citation of material studied. Types of most species have been examined and many are illustrated. Numerous vernacular names are cited and there is often extensive discussion of nomenclature and other pertinent subjects. The monograph is admirably presented and is to be criticized only in its treatment of the section *Algarobia*, or of that part of it containing *Prosopis juliflora* and the related species of Mezquite that have been described by recent and early authors. A more detailed account of these closely related species was impossible because of lack of access to sufficient material of the numerous species of *Neltuma* recognized by Britton and Rose. The author considers *P. juliflora* as somewhat limited in distribution—West

Indies, Mexico, Nicaragua, Colombia, and Venezuela. *P. chilensis* he reports only from Peru, Chile, and Argentina. While various species of this section are discussed in detail, no key is provided for distinguishing them. A complete and rational treatment of all the species of section *Algarobia* related to *P. juliflora* is greatly to be desired, but would probably be difficult of preparation even if all material in American herbaria were assembled in one place for study. The present treatment of the genus is easily the most complete and satisfactory account that ever has been published.—PAUL C. STANDLEY.

**Nota sobre algunas Leguminosas indígenas o introducidas en Chile.** By ARTURO BURKART. *Revista Chilena Hist. Nat.* 43: 156-164; 1939.

Notes upon the nomenclature and occurrence in Chile of *Albizia lophantha*, *Acacia borrida*, *Acacia visco*, *Gymnocladus dioica*, *Caesalpinia angulata*, *Balsamocarpon brevifolium*, *Indigofera tinctoria* var. *brachycarpa*, and *Desmodium sericeum*.

**A revision of the Hawaiian species of *Labordia* described by H. Baillon.** By HAROLD ST. JOHN. *Bishop Mus. Occas. Papers* (Honolulu) 12: 8: 1-11; pls. 1-4; Aug. 1, 1936.

Five species of *Labordia* (Loganiaceae) described by Baillon are correlated with species of other authors, synonymy being given for three older species discussed. *L. Baillonii* is described as new.

**Notes on Micronesian Rubiaceae.** By F. R. FOSBERG. *Bishop Mus. Occas. Papers* 15:20: 213-226; Jan. 10, 1940.

The notes are based mainly upon the collections of Rubiaceae made by Mr. Masahiku Takamatsu, botanical collector of the Bishop Museum expedition to Micronesia in 1936. There are several new combinations, changes of name, and diagnoses of new varieties. In discussing *Psychotria* the author says: "There is, so far as I can see, no reason whatever for separating from *Psychotria* those Micronesian species which have been assigned to the genus *Amaracarpus*."



**Psychotria (Rubiaceae) in the Marquesas Islands.** By F. R. Fosberg. *Not. Syst.* 8: 3: 161-173; October 1939.

In this paper "are described the nine species of the genus *Psychotria* known to occur in the Marquesas Islands, in the eastern central Pacific Ocean. Four of the species are here described for the first time." *Psychotria Adamsonii* is based on a specimen that had previously been referred to *Tarenna sambucina*. According to the author, *Tarenna* "should no longer be regarded as a part of the Marquesan flora."

**Plantae boninenses novae vel criticae. VIII.** By Takasi Tuyama. *Bot. Mag. (Tokyo)* 51: 22-24; figs. 37, 38; January 1937.

A discussion of the occurrence in the Bonin Islands of *Pandanus boninensis* Warb., of which three new forms and varieties are described and illustrated.

**Atlas of Formosan timbers.** By R. Kanehira. Bull. 2, Forest Exp. Station, Govt. of Taiwan, Taihoku, Japan, January 1940. Pp. 70; 7½ x 10½; 60 plates.

Contains full-page reproductions of negative prints of photomicrographs showing cross sections of 60 Formosan woods at a uniform magnification of 15 diameters. The descriptive text is in English and Japanese.

**Timber tests: Mersawa (*Anisoptera marginata* Korth and *Anisoptera laevis* Ridl.)** *Malayan Forester* 9: 3: 133-138; July 1940.

"The genus *Anisoptera* is distributed from southern Burma throughout the Malayan region to New Guinea and is represented by some 12 to 15 species. Seven species occur in Malaya, of which *A. marginata* and *A. laevis* are probably the most common. *A. marginata* is known from Sumatra and Borneo, and its usual habitat is semi-swamp jungle. *A. laevis* has not been found outside Malaya, where it grows on the slopes of low ridges of hills up to a height of 2800 feet."

"The results show that both forms of Mersawa are mechanically approximately equivalent to light Red Meranti,

except in strength as a beam and hardness. The timber of *A. marginata*, which grows mainly in inland swamps, is not as strong as that of *A. laevis*, which is restricted chiefly to the slopes of inland hill forest, but the differences are not very significant. The weight of the timber of each species is about the same and is approximately equal to that of heavy Red Meranti; but, mechanically, Mersawa is only equal to heavy Red Meranti in hardness and resistance to shear. The timber of both species has a considerable dulling effect on sharp tools, but planes to a smooth surface. It is remarkably free of sponginess, borer holes, and other defects. It dries very slowly, and during seasoning is very liable to attack by fungus.

"The timber is suitable for planking and packing cases, and, if properly seasoned, could be used for flooring, decking, and indoor building construction. Its lack of a distinctive appearance caused certain United Kingdom importers to express interest in this timber some years ago, presumably to meet the demand that always exists for a characterless wood for artificial finishing to simulate other timbers. A trial shipment was attempted, but was disappointing; half the consignment had to be thrown away because it was close-piled (after 5 months in stickers) and developed serious fungal decay. The prolonged drying period, necessary before the timber can be safely shipped, rules out Mersawa for the export trade until such time as mills adopt kiln-seasoning. There is no prospect of this, or even need for it, for many years, and the limited quantities of Mersawa available preclude any large-scale development of trade in this timber."

**Weights of New South Wales timber.** Pamphlet 2, Div. of Wood Tech., N. S. W. For. Com., Sydney, 1940. Pp. 16; 6 x 9½.

Tables giving average green and dry weights of 84 kinds of timber representing 40 different genera.

**New South Wales timbers for building purposes.** Pamphlet 6, Div. of Wood Tech., N. S. W. For. Com., Sydney, 1940. Pp. 8; 6 x 9½.



"In this publication there are listed the most important timbers for various building purposes. The timbers are arranged in alphabetical order, and all may be considered satisfactory for the purpose indicated."

Does *Xylocarpus granatum* Koen. occur on the African coast? By J. BURTT DAVY, *Journ. So. Afr. Bot.* 6: 31-32; January 1940.

As *Carapa moluccensis* Lam., *Xylocarpus granatum* Koen. has been reported and illustrated by Sim from Mozambique, but its occurrence on the African coast seems doubtful, although the species is known from Madagascar and the Seychelles. *H. benadirensis* Mattei does occur on the east coast of Africa, from Mozambique to Italian Somaliland, and *X. moluccensis* (Lam.) Roem. has been collected in Kenya Colony.—PAUL C. STANDLEY.

Field notes on the species of *Brachystegia* and *Isoberlinia* of Tanganyika Territory. By C. H. N. JACKSON. *Journ. So. Afr. Bot.* 6: 33-40; January 1940.

The closely related genera *Brachystegia* and *Isoberlinia* (Caesalpiniaceae) dominate the dry woodland on alluvial soils to a height of about 6000 feet over a vast area of eastern Africa—a part of the Kenya coast, most of Tanganyika except the thornbush country in the north, the eastern part of Belgian Congo, and much of Rhodesia, Nyasaland, Portuguese East Africa, and Angola. They are trees of large or medium size. Woodland of Tanganyika dominated by these genera is known locally as Miombo. A key is provided for separation of 12 species of *Brachystegia* and three of *Isoberlinia* known from Tanganyika. One species, *B. Burtii* Hoyle, is apparently new, but without Latin description.—PAUL C. STANDLEY.

Tropical African plants. XVIII. *Kew Bulletin*, 1940, pp. 49-66.

Among woody plants described as new are *Lasiosiphon mollissimus* E. S. Bruce, Northern Rhodesia; *Aeglopsis Egelingii* M. R. F. Taylor, Anglo-Egyptian Sudan and Uganda; *Linociera latipetala* M. R. F. Taylor, Uganda, Kenya, and Tanganyika. There are brief notes regarding several earlier published species of ligneous plants.

Osservazioni sul genere *Swietenia* e possibilità di acclimatizzazione del vero mogano (*Swietenia Mahagoni*) nella regione del Giuba (A. O. I.). By R. CIFERRI. *L'Alpe* (Milan) 25: 4: 89-95; 5 figs.; April 1938.

A study of Mahogany with particular reference to the possibility of introducing *Swietenia Mahagoni* into Somalia, where climatic conditions approximate those of Dominican Republic.

Nuove piante forestali dell'A. O. I. By GUGLIELMO GIORDANO. *La Revista Forestale Italiana* (Rome) 2: 5: 34-42; 2 half-tones, 12 drawings; May 1940.

Contains an illustrated account of the trees and woods of four Ethiopian species described as new by Prof. E. Chiovenda (*Atti della Reale Accademia d'Italia*, 1940). They are: *Olea Mussolinii*, *Manilkara Butugi*, *Pouteria (Sersalisia) ferruginea*, and *Cantbium Giordanii*.

Contribución à la connaissance des cédres et en particulier du deodar et du cèdre de l'Atlas. By LOUIS EMBERGER. *Rev. Bot. App. & Agr. Tropicale* (Paris) 18: 198: 77-92; February 1938.

A descriptive account of the four species of *Cedrus*.

Carta fitográfica de Angola. By J. GOSSWEILER and F. A. MENDONÇA. Pub. by Ministério das Colónias, Lisbon, Portugal, 1939. Pp. 242; 7¾ x 10¾; 76 half-tones, 1 large colored map.

A large, well-printed, handsomely illustrated account of the principal types of vegetation in Angola as determined by their physiographic aspects and ecological characters.

Three new species of *Citropsis*, also new varieties of *Atalantia* and *Fortunella* (Rutaceae-Aurantioidae). By WALTER T. SWINGLE. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 21: 115-133; pls. 1-4; April 1940.

New species of *Citropsis* are described from Belgian Congo, Sierra Leone, and Mozambique, and two subgenera are pro-



posed for the genus, of which 11 species are recognized. Three new varieties in *Atalantia* are published from China and Siam.

**Additional notes on the genus *Aegiphila*. VI.** By HAROLD N. MOLDENKE. *Phytologia* 1:11:372-400; September 1940.

In addition to the notes and new citations for previously described species there are diagnoses of four new species and one new variety.

**The Old World species of the celastraceous genus *Microtropis* Wallich.** By E. D. MERRILL and F. L. FREEMAN. *Proc. Amer. Acad.* 71: 271-310; May 1940.

In the genus the authors recognize 64 species, many of which are described as new. The group is poorly represented in America, only four species being recognized from that continent, and distributed from southern Mexico to Costa Rica.

**Wood anatomy and pollen morphology of *Rhus* and allied genera.** By CHARLES HEIMSCH, JR. *Journ. Arnold Arboretum* 21: 3: 279-291; 3 plates.

"In a monograph of the North and Central American species of the *Rhus* complex of the Anacardiaceae, Barkley has grouped these plants under six genera: *Rhus*, *Cotinus*, *Toxicodendron*, *Metopium*, *Malosma*, and *Actinocbeita*. A detailed study of the secondary xylem and the pollen grains of these plants indicates that on the basis of each of these structures the plants of the *Rhus* complex are segregated into the same six groups. Whether these should be considered as genera or subgenera is a matter of interpretation. However, the structure of the xylem in these groups is distinctive even when compared with the other genera of the tribe *Rboideae*. Thus, in a relatively small taxonomic group such as this complex, anatomical studies can provide data which are significant in classification." — *Author's summary*.

**The formation of septa in the fiber-tracheids of *Hypericum Androsaemum* L.** By PAUL A. VESTAL and MARY R. VESTAL. *Botanical Museum Leaflets* (Harvard University) 8: 169-188; 2 plates; Aug. 2, 1940.

"The formation of septa in the fiber-tracheids of *Hypericum Androsaemum* L. is reported. The development of the fiber-tracheids is normal in that they undergo elongation and maturation of the secondary wall. However, the protoplast remains active and usually undergoes division at a right angle to the original division of the cambial initial. This division consists of true karyokinesis followed by cytokinesis. The septum is formed in the region of the cell plate and the daughter nuclei migrate to the central portion of the newly formed compartments. As far as can be determined, the formation of septa is not confined to any particular region, but may occur in any part of the secondary wood formed during a single growing season. The evidence is clear that the definition of a septate fiber-tracheid suggested by the Committee on Nomenclature of the International Association of Wood Anatomists is in agreement with the observable ontogeny and later development of the fiber-tracheid." — *Authors' summary*.

**Contribution to the study of the cell wall. I. Methods for demonstrating lignin distribution in wood.** By H. E. DADSWELL and DOROTHIE J. ELLIS. Reprint No. 70, *Journ. Council Sci. & Ind. Research* 13: 1: 44-54; 2 pls. (12 photomicrographs); February 1940.

"Methods have been described for the study of the lignin pattern in the secondary wall of both coniferous and dicotyledonous woods; in the survey, normal and compression wood of numerous conifers and a wide range of tropical and temperate dicotyledonous woods, many Australian, have been employed. The methods involved treatment of thin cross and tangential sections with 72 per cent sulphuric acid; in some cases the sections were pretreated with a solution of iodine in potassium iodide; gentle warming of the slide was found essential in order to reveal the cell wall patterns with any degree of clarity. It was found to be a comparatively simple matter to show cell wall lignin patterns in the case of a number of the species investigated, somewhat more difficult in others, and in a number of instances no cell wall pattern could be demonstrated. The degree of lignification as indicated by the



cell wall lignin pattern was correlated with that supposedly revealed by staining reactions using safranin and light green; there appeared to be a high degree of correlation between staining indications of the cell wall lignification and presence of cell wall lignin pattern. In those species in which a lignin pattern was observed in cross section, the pattern was predominantly radio-concentric in nature; exceptions to this were found with compression wood tracheids and anomalous fibers from several dicotyledonous woods. The importance of the work as a starting point for numerous additional investigations has been stressed."—*Authors' summary.*

**Tropische Papierhölzer.** By F. HOYER. *Tropenpflanzer* 40: 503-529; 1937.

A check list of the tropical woods that have been suggested for paper-making and references to the literature.

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