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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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CUPRESSUS BENTHAMI: A NEGLECTED OPPORTUNITY?

By WILSON POPENOE

United Fruit Company

Scanning the literature at my disposal, I find little to suggest the beauty, the adaptability, and the economic value of *Cupressus Benthami* Endlicher. *Biologia Centrali-Americana*, in its laconic manner, states simply that the species has been collected in north Mexico, south Mexico, and Guatemala, and lists three synonyms. Paul C. Standley, in his monumental *Trees and Shrubs of Mexico*—a work which we who live in northern Central America find invaluable—notes that it occurs as an indigenous tree from Tepic and Veracruz southward to Guatemala, ascending to 3000 meters, and comments: "The wood is undoubtedly of importance for lumber, although no details concerning it are available." And again, toward the end of the work, he says: "By European botanists

this is regarded as a form of *C. lusitanica* Mill. . . . or as a synonym of that species. It is probable that the Mexican tree was carried at an early date to Portugal (hence the specific name), where it has since been in cultivation. It seems necessary, therefore, to adopt Miller's misleading name for the Mexican species."

This same author, in his *Flora of Costa Rica*, says: "Cultivated commonly in the Meseta Central and elsewhere as an ornamental tree. Native of the mountains of Guatemala and Mexico. The species has been reported for Costa Rica as *Juniperus flaccida* Schlecht. The branches are employed commonly as decorations in churches and houses."

Standley and Calderón, in their *Lista Preliminar de las Plantas de El Salvador*, say (I translate): "The tree is planted in many places; a native of Mexico and Guatemala. Although widely cultivated in El Salvador, it is still more so in Guatemala, where, especially in the environs of the capital, it is the commonest of all trees."

Finally, Alfred Rehder, who did the genus *Cupressus* for L. H. Bailey's *Standard Cyclopedia of Horticulture*, notes that this species has been found in prehistoric asphalt beds at Los Angeles, California.

So much for the literature. It fails to tell us that *Cupressus Benthami* (as we prefer to term it, in spite of the technical necessity of referring the species to *C. lusitanica* Mill.) yields one of the principal commercial timbers of the Guatemalan highlands, well known to every carpenter and builder throughout that region. As a wild tree it grows abundantly at elevations between 8000 and 11,000 feet in the central and northwestern parts of the republic, often attaining a height of 70 to 80 feet and a trunk diameter of five to six feet. Further, it has for many years been planted extensively not only as an ornamental but also for the production of lumber.

As a cultivated tree it is most commonly seen at elevations between 4000 and 8000 feet, but it is not rare to find it in gardens and dooryards almost down to the level of the sea. It grows on soils of many different types, a notable feature being its ability to thrive on volcanic pumice where few other arborescent species are able to eke out an existence.

Because of its adaptability, this tree suggests itself for reforestation of eroded or otherwise barren mountain sides in many parts of tropical America. I have in mind particularly the upper slopes of the Blue Mountains in Jamaica, the mountain sides around the city of Caracas in Venezuela, the barren highlands in the Department of Boyacá, Colombia, and the slopes of the Cordillera Occidental near the city of Cali in the same country. These are mentioned as examples; there are many other regions where, it seems to me, *Cupressus Benthami* is worthy of trial. For it is of simple culture; easy to grow from seed, tolerating severe dry seasons after it has attained a few years' development, and obviously—from its occurrence in the wild state at high elevations in Guatemala—able to withstand hard frosts.

It is a beautiful tree, much used for decorative planting in Guatemala. It withstands constant trimming, and for this reason is one of the favorite hedge plants of this republic. Its growth impresses me as much more rapid than that of many other conifers.

To gain an accurate idea of the value of its lumber, I have talked with Don Fernando Pullín, one of the leading lumbermen of Guatemala. "Bentham's Cypress," he says, "has quality, but not character. By this I mean that it is an excellent wood for construction purposes, but for interior finish it has not the beauty of certain other woods. Nevertheless, it is much used for siding, for ceilings, and for lining houses of the humbler sort, as well as for sills, beams, and many other purposes. In the highlands it resists exposure to the weather admirably, but on the coast it is not so satisfactory from this angle. Probably the best idea of the esteem in which it is held can be obtained by comparing its commercial value with that of other timbers. Native Pine sells in Guatemala City for 30 Quetzales (the Quetzal is equivalent to the U. S. dollar) per M feet; Cypress for 50 Quetzales; Spanish Cedar (*Cedrela mexicana*) for 80 Quetzales; and Mahogany (*Swietenia macrophylla*) for 100 to 200 Quetzales, depending upon the quality."

Among the Indians of the Guatemalan highlands, Cypress is much used for construction purposes, also for furniture.

In fact it is a popular favorite. It is soft and easily worked. In color and general appearance it is similar to White Pine.

Reforestation has been a subject slow to receive attention in tropical America, but it is coming. And with it there is a demand for trees which will grow rapidly under conditions at times unfavorable, and which, in addition to furnishing good forest cover for protection against erosion, will eventually produce timber of good commercial quality. I repeat the question asked at the head of this note: Is not *Cupressus Benthami* worthy of more consideration than it has yet received by those interested in tropical American problems?

AMERICAN WOODS OF THE FAMILY VERBENACEAE

By SAMUEL J. RECORD *and* ROBERT W. HESS

The Verbenaceae comprise about 80 genera and 3000 species of herbs, shrubs, vines, and tropical trees, and are of very wide geographical distribution. The leaves are mostly simple, sometimes (*e.g.*, *Vitex*) digitately compound, typically opposite, generally deciduous; the flowers, which often are highly colored, are borne in spikes, racemes, cymes, or panicles; the fruit is either dry, separating at maturity into 2 to 4 nutlets, or a drupe containing the nutlets.

The best known and most important timber tree is Teak, *Tectona grandis* L.f., native to southeastern Asia and Malaya and planted to a limited extent for forestry purposes in West Africa and tropical America (see *Phytologia* 1: 154–164). Commercial timbers are also supplied by species of *Vitex* in the Philippine Islands, India, and New Zealand.

The American arborescent species belong to the following genera: *Aegiphila*, *Callicarpa*, *Citharexylum*, *Clerodendrum*, *Cornutia*, *Duranta*, *Lantana*, *Lippia*, *Petitia*, *Petrea*, *Pseudocarpidium*, *Recordia*, *Rehdera*, *Rhaphithamnus*, and *Vitex;* the woods of *Recordia* and *Rehdera* are not available for study. A few of the American timbers are of local utility for carpentry and construction, but the only genus having commercial possibilities is *Vitex*. The following description is based upon 160 wood samples, representing 91 species of 13 genera. The differences observed between genera are not distinct enough to permit making a reliable key.

Heartwood yellowish, olive, or light to dark brown, sometimes more or less variegated or streaked; often distinct, but generally not sharply differentiated from the sapwood; in some specimens the color is whitish or pale brownish throughout. Luster variable from low to high. Odor and taste usually not distinctive. Density moderate to high; texture fine to medium; grain typically straight, sometimes wavy or roey; working properties good; resistance to decay poor to good.

Growth rings commonly present. Pores mostly medium-sized or small, the largest scarcely distinct without lens; commonly thick-walled; fairly numerous; occuring singly and in pairs, less frequently in small clusters; fairly evenly distributed in *Callicarpa*, *Clerodendrum*, *Cornutia*, *Duranta*, *Petitia*, and *Pseudocarpidium*, but in more or less concentric (ring-porous), tangential, or diagonal arrangement in the others. Vessels with simple perforations and rarely also with occasional scalariform plates; without spiral thickenings; tyloses common to abundant in *Citharexylum*, *Cornutia*, *Petitia*, *Pseudocarpidium*, and *Vitex;* deposits of calcium carbonate observed in some of the vessels of *Citharexylum* and *Lippia;* pitting alternate, fine to moderately so. Rays variable in width, sometimes all narrow, sometimes up to 7 cells wide (up to 12 cells wide in a species of *Petrea*, a liana); height usually less than 50, occasionally more than 100, cells; weakly to decidedly heterogeneous; crystals sometimes present; pits to vessels rounded and similar in face view to the intervascular and in part, in some genera, elongated and occasionally tending to scalariform arrangement. Wood parenchyma typically sparse and paratracheal, but abundant, aliform to confluent, in *Aegiphila;* sometimes finely terminal; pith flecks common in woods of low density. Wood fibers septate in many genera; pits numerous, small to medium-sized, more or less distinctly bordered. Ripple marks absent. No gum ducts seen.

Aegiphila, with about 140 species of low to high shrubs, small trees, and a few lianas, is of general distribution throughout tropical and subtropical America. The leaves are simple, deciduous, penni-nerved, generally opposite, sometimes ternate or verticillate; the flowers are small, of various colors, sometimes fragrant, and usually borne in terminal panicles or axillary cymes; the fruit is drupaceous, 4-lobed, the ectocarp usually dry but occasionally fleshy, juicy, and edible.

The largest trees reported for this genus are about 50 feet high and 10 inches in diameter, but most of the plants are of much lower stature, many of them only low straggling bushes. They are of little economic value. Some are planted for orna-

ment, some are reputed to have medicinal virtues, especially as a remedy for snake bite, and a few supply white, easily worked wood for making boxes, wooden shoes, and various small articles, and for interior framing. (See H. N. Moldenke's "Monograph of the genus *Aegiphila*," *Brittonia* 1: 245–477. 1934.) Study has been made of 27 wood samples of 17 species.

Wood white or cream-colored throughout, becoming brownish upon exposure. Luster low to medium. Odorless and tasteless when dry. Light and soft to moderately heavy and hard; texture coarse to rather fine; grain straight; easy to work, tough and strong for its weight; is perishable in contact with the ground. Of no commercial possibilities.

Pores barely visible without lens (140 to 215μ); rather few; solitary and in small multiples or clusters more or less concentrically arranged without being definitely ring-porous. Vascular pitting rather coarse (9 to 10μ). Rays 1 to 5, mostly 2 or 3, cells wide and commonly less than 50, sometimes up to 100, cells high; heterogeneous, frequently with tall upright cells; pits to parenchyma cells large and numerous; pits to vessels large, oval to elongated or boomerang-shaped. Wood parenchyma vasicentric to aliform and confluent, occasionally forming concentric bands with the pores. Wood fibers sometimes septate in part; pits numerous, medium-sized, with small borders.

COMMON NAMES: Goatwood, lard wood, spirit weed (Br. W.I.); guairo santo, guaro (Cuba); capaíllo (P.R.); bois cabril, b. de bouc, b. de fer, b. sendu, sureau gros (Fr. W.I.); hulub (Mex.); palo de zope (Salv.); vara blanca (Hond.); tabaquillo, zorrillo (C.R.); Juán de la verdad, wild jasmine (Pan.); saúco del monte (Col.); contra-culebra, totumillo (Venez.); moracooballi, wanini (Br. G.); bois de golette, b. tobaco, manabo (Fr. G.); lulu, tutumbo (Ec.); chirapa-sacha, fetoró-ey, huaca, ucullucuy-sacha, utcus (Peru); camaá, camará, cambará, carindiba, contra-cobra, cipó pitomba, pau de moquem, tamanqueiro, uruá-rana (Braz.).

Callicarpa, with about 135 species of low bushes, erect or subscandent shrubs, and some typically small trees, is most abundantly represented in the East Indies and Oceania. The American species, about 30 in number, have their center of distribution in Cuba, with extensions into southern United States, Mexico, Central America, and northern South America. The stems of some species are prickly; the leaves are simple, deciduous, and mostly opposite, often glandular or

with resinous dots, and fragrant; the flowers are generally very small, frequently fragrant, of various colors, and borne in axillary or super-axillary cymes; the drupaceous fruit is berry-like, with a fleshy exocarp usually very attractively colored. The plants have few uses except for decorative purposes. (See Moldenke's "Monograph of the genus *Callicarpa* as it occurs in America and in cultivation," *Fedde Rep. Spec. Nov.* 39: 288–317; 40: 38–131. 1936.) The following description is based on nine samples of six species.

Wood white or grayish brown throughout. Luster medium. Mostly of medium density and texture, straight-grained, easy to work; poorly resistant to decay. Of no commercial possibilities because of the small sizes available.

Growth rings present. Pores medium-sized (110 to 120μ), but not visible without lens; numerous but not crowded; solitary and in small multiples and little clusters, fairly evenly distributed. Vascular pitting fine (5 to 6μ). Rays 1 to 3, occasionally 4, cells wide and up to 50 or more cells high, the multiseriate parts generally less than 15 cells high; decidedly heterogeneous; pits to vessels small to medium-sized. Wood parenchyma very sparingly paratracheal; not visible with lens. Wood fibers septate in part; pits numerous, rather large.

COMMON NAMES: Beauty-berry, bunchberry, mulberry (Bermuda, French, or Spanish), sourbush, turkey berry (U.S.A.); filigrana (Cuba); capá rosa (P.R.); patzahuma-cachil, pukin, sacpukin, uvilla, zacpukim (Mex.); fruta de chacha (Guat.); vara del alcalde (Hond.); blackberry (Pan.).

Citharexylum (or *Citharexylon;* meaning fiddle wood), with about 60 species of shrubs and small to medium-sized, rarely large, trees, is widely distributed throughout tropical and subtropical America, exclusive of the Amazon basin. The leaves are simple, sometimes glandular, entire or toothed, opposite or ternate; the flowers are small, often fragrant, and borne usually in axillary or terminal spikes or racemes; the fruit is a small berry-like drupe with thin, juicy flesh, which in some species is edible.

The best known species is *Citharexylum fruticosum* L. (=*C. villosum* Jacq.), a slender tree commonly less than 30 feet high, growing in southern Florida and many of the Antilles. It has been known for 250 years or more in the British West Indies as Fiddlewood, said to be a corruption of the

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Wood white or grayish brown throughout. Luster medium. Mostly of medium density and texture, straight-grained, easy to work; poorly resistant to decay. Of no commercial possibilities because of the small sizes available.

Growth rings present. Pores medium-sized (110 to 120μ), but not visible without lens; numerous but not crowded; solitary and in small multiples and little clusters, fairly evenly distributed. Vascular pitting fine (5 to 6μ). Rays 1 to 3, occasionally 4, cells wide and up to 50 or more cells high, the multiseriate parts generally less than 15 cells high; decidedly heterogeneous; pits to vessels small to medium-sized. Wood parenchyma very sparingly paratracheal; not visible with lens. Wood fibers septate in part; pits numerous, rather large.

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name Bois Fidèle employed by the early French colonists in allusion to the strength and toughness of the timber and not, as is sometimes stated, because the wood was used for making musical instruments. Sargent (*Manual of the trees of North America*, p. 865) describes the wood as "heavy, exceedingly hard, strong, close-grained, clear bright red, with thin lighter colored sapwood," but there appears to be some mistake as to the color, for the specimens in the Yale collections have at most only a brownish heartwood which merges gradually into the sapwood. The tree is known in Cuba as Guayo Blanco, Palo Guitarro, and Roble Amarillo and, according to Roig (*Diccionario botanico de nombres vulgares Cubanos*, p. 340), the wood is white, hard, and compact, suggesting Oak.

The largest species appears to be the Iguanero of Panama, *Citharexylum macranthum* Pittier, a forest tree upwards of 100 feet tall, with a straight trunk 20 inches in diameter. Pittier says (*Contr. U. S. Nat. Herb.* 18: 4: 169): "This tree departs from all hitherto described species of the genus by the ternate leaves and racemes of the floral branchlets, the unusually large corollas, the stamens inserted well in the lower half of the corolla tube, and the very short pistil. It shares with *C. macradenium* Greenm. the pecularity of having very large glands at the base of the leaf blade. The core of the trunk is of a dirty yellow color. The wood is hard but tough, and little used." The Yale collections contain a wood specimen from one of the type trees (Yale 3020; Pittier 4199); its texture is coarser and the density much lower than in the West Indian species described above.

The Pombeira or Pau de Viola of southern Brazil, *Citharexylum cinereum* L., is said to be a common tree, sometimes of fairly large size, supplying some timber for general carpentry, crating, and slack cooperage. There are several other species in that general region. Best known in Misiones, Argentina, and in Uruguay is the prickly Tarumá or Tarumán, *C. montevidense* (Spreng.) Mold., a tree sometimes 50 feet high, with a stout bole supplying some moderately soft, easily worked lumber useful for boxboards and other purposes satisfied by a plain material of medium strength and poor resistance to decay.

The following description is based on a study of 25 wood samples of 14 different species and indicates a considerable range of variation within the genus.

Heartwood dull grayish brown or chestnut-brown, with a subdued golden luster. Odorless and tasteless. Moderately light and soft to very heavy and hard; texture fine to rather coarse; grain straight to roey or otherwise irregular; working properties good to fair; durability poor. Of no commercial possibilities.

Growth rings usually present, sometimes very distinct (ring-porous). Pores rather small to medium-sized (100 to 160μ), the largest barely visible without lens; rather few to numerous; solitary and in small multiples, often in more or less concentric arrangement, and sometimes with the larger pores zonate in early wood. Vessels with tyloses common to abundant; deposits of calcium carbonate occasionally present; pitting fine (5 to 6μ). Rays frequently only 1 or 2, sometimes up to 4, cells wide and variable in height up to 50 cells; heterogeneous; ray-vessel pitting medium, similar in appearance to intervascular. Wood parenchyma sparingly paratracheal and sometimes finely terminal. Wood fibers septate, at least in part; pits very numerous.

COMMON NAMES: Fiddlewood (Florida, B.W.I.); anacahuite, canilla de venado, collarette, guairo santo, guayo blanco, mangle de sabana, palo guitarro, penda, roble amarillo, r. de olor, r. de dulce (Cuba); cucubano, higuerillo, pendula, Susanna, old woman's bitter (P. R.); penda, pendula (Dom. R.); café marrón, mala mujer (Haiti); cotelette (Fr. W.I.); cutlet, Susanna (Trin.); aceitunillo, cacachila, chachalaca, chacalpezle, comida de cuervo, coral, iximché, naranjillo, negrito, orcajuela, palo de violín, panochillo, revienta-cabra, roble, r. amarillo, sac-xitch-ché, saúco hediondo, takakché, tepesi (Mex.); birdseed, pigeon-feed (Br. H.); café gigante, coralillo, cordoncillo, moco de pava, sogüilla, uva (Salv.); dama (C. R.); corimiente, iguanero, wild cherry, w. lime (Pan.); palo guitarro, pendare, pendula, totumilla (Venez.); pau de viola, pombeira, tarumán de espinho (Braz.); aguay-guazú, coronillo colorado, tarumá con espinas, tarumán espinudo (Arg.); espina de los bañados, naranjo de bañado, tarumá, tarumán, t. de espinas (Urug.).

Clerodendrum (or *Clerodendron*) is a pantropical genus with about 350 species and varieties of perennial herbs, erect or scandent shrubs, and small trees, rarely armed with spines.

There are comparatively few species native to tropical America, but several are cultivated for their ornamental flowers and some have become naturalized. The leaves are deciduous, simple, opposite or whorled, entire or variously dentate, sometimes punctate; the small to large and often beautifully colored flowers are borne in terminal or axillary cymes or panicles; the fruit is drupaceous, separating at maturity into 2 to 4 nutlets. The genus is of no commercial importance as a source of timber. Five samples of five different species have been studied.

Wood yellowish or whitish throughout. Luster medium. Without distinctive odor or taste. Moderately heavy and hard; texture rather fine; grain straight; easy to work; presumably perishable in contact with the ground.

Growth rings present, but not always well defined. Pores in lower medium size class (100 to 120μ), not visible without lens; rather numerous; solitary and in small multiples, well distributed. Vascular pitting fine (4.5 to 5μ). Rays 1 to 3, rarely to 5, cells wide and up to 50 cells high; heterogeneous, sometimes rather weakly so; pits to vessels large, oval to elongated or elbowed, tending to scalariform arrangement. Wood parenchyma sparingly paratracheal. Wood fibers septate, at least in part; pits numerous, medium-sized.

COMMON NAMES (both native and cultivated species): Clavellina espinosa, guardia civil, hiel de gallina, h. de perro, jamaiquina, magüira cimarrona, mil flores, palo sabonero, ramo de novia, roble guayo (Cuba); Danish flag, flor de muerto, jasmín hediondo, Santo Domingo, wild jessamine (P.R.); bocomelia, itzimte, metroceder (Mex.); muste (Guat.); ala de ángel, boca-amelia, bocamelia, martinica, ministeriosa, santa alda (Salv.); fucsia, milflor, verbena (C.R.); bleeding-heart, camella (Pan.).

Cornutia, with about a dozen variable species and several varieties of unarmed, pubescent or velvety, odoriferous shrubs and small trees, is of general distribution in tropical America except in the Amazon basin. The branches are stout, 4-angled, and brittle; the leaves are simple, entire or toothed, opposite, and deciduous; the small bluish or purplish flowers are typically in large terminal panicles, occasionally in axillary cymes; the fruit is a small globose drupe. The genus supplies no timber of value. The following description is based upon

one Ecuadorean specimen of *C. microcalycina* Pavon & Moldenke (Yale 22810; Rimbach 100) and seven samples representing *C. grandifolia* (Schlecht. & Cham.) Schau. (=*Hosta grandifolia* Schlecht. & Cham.) of Central America.

Wood pale brownish throughout. Luster medium. Odorless and tasteless. Moderately heavy and hard; texture rather fine; grain straight; easy to work; poorly resistant to decay.

Growth rings present. Pores medium-sized (180μ), but not distinct without lens; numerous; solitary and in small multiples and clusters, well distributed. Tyloses common. Vascular pits medium-sized (8 to 9μ). Rays 1 to 4, occasionally 5 or 6, cells wide and up to 80 cells high; heterogeneous; crystals common; pits to vessels large, oval to elongated and in scalariform arrangement. Wood parenchyma sparingly paratracheal. Wood fibers septate; pits very numerous.

COMMON NAMES: Salvilla (Cuba); penda (Dom. R.); fiddlewood, purple fiddlewood (Br. W.I.); bois cagne, b. care, b. cassau, b. cassave, b. cotelet quarré, b. de saban, b. de savane, mouri debout (Fr. W.I.); latche, pangagé, tzultesnuk, xoltexnuc (Mex.); matasano (Br. H.); flor lila, hoja de jope, h. de zope, latche (Guat.); cucaracho, zopilote (Hond.); azari, pavilla (C.R.); cuatro caras, palo cuadrado, morciélago, murciélago (Pan.); tuónculape (Col.); dona (Peru).

Duranta, with about a dozen species of shrubs and small trees, is of general distribution in tropical America except in the Amazon basin. The branches are often spiny and usually long and drooping or trailing; the entire or dentate leaves are opposite or verticillate; the small white, lilac, or purplish flowers are borne in terminal or axillary racemes; the fruit is a drupe, included in the calyx, and contains four nutlets. Some of the species are planted for ornament; the genus is not the source of commercial timber. The following description is based on one specimen each of four species.

Wood yellow or pale brownish throughout. Luster medium. Without distinctive odor; taste slightly bitter. Hard and heavy; texture very fine and uniform; grain straight; easily worked; poorly resistant to decay. Is suitable for small articles of turnery.

Growth rings present. Pores small (50 to 70μ), barely distinct with lens; numerous; solitary and in short to rather long multiples, well distributed. Vascular pits very small (4.5μ). Rays 1 to 3 cells wide and up to 90 cells high,

though usually much lower; heterogeneous, the marginal cells often tall; pits to vessels small, rounded. Wood parenchyma sparingly paratracheal. Wood fibers septate; pits numerous.

COMMON NAMES: Celosa, c. cimarrona, violetina (Cuba); azota-caballo, cuento de oro, lila, lluvia, pigeon berry (P.R.); bois jambette, maïs bouilli (Haiti); espino blanco, hombocoché, kampohoché, kanppocoché (Mex.); chulada, heliotropio (Salv.); pensamiento (Nic.); espino de paloma, varita de San José (Pan.); adonis, a. blanco, a. morado, garbancillo, guapante (Col.); fruta de paloma, limoncillo (Venez.); tala blanca (Arg.).

Lantana, with about 70 species of shrubs and undershrubs, rarely little trees, is widely distributed in tropical and subtropical regions of the world. Best known is *L. camara* L., usually a crooked, much-branched shrub, sometimes arborescent, but rarely over 15 feet high and three inches in diameter. It is usually armed with stout recurved prickles. On account of its rather showy flowers, the species has been introduced into most tropical countries and in some of them, as in Hawaii, has become a pest. The aromatic leaves are employed in native medicine. The following description is based on four samples of the woods of three species.

Heartwood absent from specimens; sapwood whitish or yellowish. Luster medium to rather high. Moderately hard and heavy; texture rather fine; grain fairly straight; easily worked. Of no commercial possibilities.

Growth rings present, sometimes with an initial uniseriate pore ring. Pores small to medium-sized (50 to 140μ), not visible without lens; rather numerous; with tendency to zonate, as well as diagonal, arrangement. Vascular pitting fine (4 to 6μ). Rays uniseriate and biseriate and up to 60, rarely 100 or more, cells high; decidedly heterogeneous; pits to vessels small and rounded in *Lantana alba* Mill., but large, oval to elongated and in scalariform arrangement in *L. camara*. Wood parenchyma sparingly paratracheal, narrowly vasicentric, or occasionally vasicentric-confluent to a minor extent. Wood fibers sometimes with a few septations; pits small, simple or indistinctly bordered.

COMMON NAMES: Wild sage (Florida); doñanica, filigrana, f. cimarrona, f. de piña, f. olorosa, f. salvia, té de costa (Cuba); coriaquillo, c. de Santa María, poley cimarrón, sage (P.R.); bonbonnier, herbe á plomb, mélisse marron (Haiti); alantana, alfombrillo hediondo, confite, c. negro, confituria, corona del sol, hierba de Cristo, ikilhaxiu, lampana, lantana, matizidilla, mora, orégano, orozuz del país, palabra de caballero, p. de mujer, peonía negra, petekin, siete colores, sonora, s. roja, tarepe, tres colores, uña de gato, xo-hexnuc, zapotillo, zarzamora, zicilhaxiu (Mex.); cinco coloraditos, c. negritos, comida de paloma, corronchocho, orégano del monte, salvia santa (Guat.); cinco negritos, juanilama (Hond.); chiligüe, cinco coloraditos, c. negritos, icaquito, santo negrito (Salv.); cinco negritos, cuasquito oloroso, toltolquelite (Nic.); jaral, jarilla, santo negrito (C.R.); hierba zorra, pasarín, San Rafaelito, wild mint, w. sage (Pan.); sorrito (Col.); bubita negra, cariaquito, c. blanco, c. colorado, c. de sabana, flor de duende, f. de sangre, maiz-zorro, romanceta (Venez.); camará, c. de cheiro, cambará, chumbinho roxo, herva cidreira, h. sagrada (Braz.); caburá-caá, camará, cambará, salvia morada (Arg.).

Lippia, with more than 100 species of herbs, shrubs, and small trees, is sparingly represented in Africa and widely distributed in America, especially in the tropical and subtropical regions. The leaves are opposite or ternate, usually dentate, often aromatic, frequently velvety; the small, bracted flowers are of various colors, and borne in spikes or heads; the fruit is drupaceous but dry, finally separating into two nutlets. The leaves are sometimes used for seasoning food or for medicinal purposes. The genus is of no value for timber. The following description is based on 12 wood samples of 10 species.

Heartwood brownish; sometimes rather sharply demarcated from the lighter sapwood. Luster medium. Odorless and tasteless. Hard and heavy to only moderately so; texture fine; grain straight to irregular; not difficult to work; durability probably low.

Growth rings usually present. Pores medium-sized (120 to 180μ), but not visible without lens; rather few to numerous; solitary and in small multiples, with tendency to zonate arrangement. Vessels sometimes with deposits of calcium carbonate. Vascular pitting rather fine (6 to 9μ). Rays 1 to 3, occasionally 4, cells wide and up to 40, commonly less than 25, cells high; heterogeneous; pits to vessels rather large, oval to elongated in some species, but smaller and more rounded in others. Wood parenchyma sparingly

paratracheal and sometimes narrowly terminal; pith flecks common. Wood fibers mostly with small, simple or indistinctly bordered pits.

COMMON NAMES: Cabradora, mint (southwestern U.S.A.); azulejo, filigrana, orozuz, o. de la tierra, salvia americana (Cuba); cape weed, cidrón, mejorana, orozuz, poley (P.R.); orégano, té Chino (Dom. R.); fleur la cigale, Marguerite (Haiti); agrito, altamisa, cabalyaxnic, canelilla, cedrón, damiana, epazote, epazotl, hierba buena, h. de la princesa, h. de mula, h. del Negro, h. dulce, h. Luisa, huele de noche, jaboncillo, jasminillo, jazmincillo, mirto, nacare, neuctixihuitl, orégano, orozuz, o. del país, palo de gusano, rosa de Castilla, salvia, s. poblano, sonora, tabaquillo, té de maceta, t. del país, t. del pan, tehuacán, topozana, vara blanca, v. dulce, xakilché, xoltenuuc, xtukuexiu (Mex.); cutujume, tatascamite, té cimarrón (Guat.); carbonero, corronchocho, lechuga de laguna, macahuite, orégano montés, salvia, s. santa, tamayagua, tatascame (Salv.); juanislama del monte, orozul (Nic.); caragre, juanilama, orégano, orozuz, salvia (C.R.); mastranto (Pan.); aloysia, cidrón, Luisa, oreganito macho, rosa-vieja, varilazo, vara de lazo, velita (Col.); amogre, orégano, oreganote, té negro, yerba Luisa (Venez.); cedroncillo, chichara-caspi, huicho-caspi, lauraimana (Peru); alecrim do campo, camará, capitão do matto, chá de frade, c. de pedestre, herva cidreira brava, h. c. do campo, murtinha italiana, pau lixa, salva do Brasil (Braz.); caá-yaguá, niño-rupá, poleo, tungaó-caá (Par.); azahar del campo, cama de niño, cedrón, c. del campo, niño-urupá, retamo (Arg.); azahar del campo, cama de niño, cedrón del campo, cidrilla, cidrón, favorita, garupá, Luisa, María Luisa, niño urupá, sauce limón, yerba cidrera, y. Luisa (Urug.).

Petitia, with two or three closely related species of unarmed trees and shrubs, is confined to the West Indies. Best known is *P. domingensis* Jacq. (=*P. Poeppigii* Sch.) which attains a maximum height of 70 feet and a diameter of 24 inches, though usually it is much smaller and sometimes only a shrub. Its large, opposite, entire leaves are dark green above and rusty beneath; the small, whitish, fragrant flowers are borne in axillary panicles; the fruit is a small, rounded, black drupe. The timber is of excellent quality and attractive appearance,

but the quantity now available is very limited. It is used locally for rollers in coffee-hulling mills, for making carts, and for posts, piling, and props. The figured material is suitable for fine furniture, brush backs, and turned articles. Eleven samples of two named species have been studied.

Heartwood light brown, more or less variegated or sometimes with handsome dark-colored waxy striping; not sharply differentiated from the sapwood. Luster medium to high. Odorless and tasteless. Very hard, heavy, tough, and strong; sp. gr. (air-dry) about 0.95; weight 59 lbs. per cu. ft.; texture rather fine; grain straight to roey or finely wavy; not difficult to work, taking a glossy finish; moderately durable in contact with the ground. Of very limited commercial possibilities.

Growth rings present. Pores medium-sized (120 to 180μ), but not individually distinct without lens; rather few to fairly numerous; solitary and in small multiples, well distributed. Vascular pits medium-sized (7 to 9μ). Tyloses abundant. Rays 1 to 3, occasionally 4, cells wide and variable in height to a maximum of 40 cells; mostly heterogeneous; pits to vessels rather large, rounded to elongated. Wood parenchyma sparingly paratracheal and occasionally finely terminal. Wood fibers sometimes septate; pits small.

COMMON NAMES: Bastard stopper (B.W.I.); guayo prieto, roble de olor, r. guayo (Cuba); capá amarillo, c. blanco, c. de sabana (P.R.); capá blanco (Dom. R.); bois d'sortie, chêne callebassie (Haiti).

Petrea (or *Petraea*), with about 35 species and varieties of shrubs, small trees, and woody vines, is widely distributed in tropical and subtropical America from the West Indies and northern Mexico through Central America to Peru, Bolivia, Paraguay, and southern Brazil. The leaves are deciduous, simple, opposite or whorled, sometimes very rough; the lilac, blue, or white flowers are borne in many-flowered, drooping, axillary or terminal racemes sometimes suggesting Wisteria; the fruit is a hard, 2-celled drupe inclosed in a winged calyx. (See Moldenke's "Monograph of the genus *Petrea*," *Fedde Rep. Spec. Nov.* 43: 1–48, 161–221. 1938.) Many of the species are cultivated for ornament. The wood is not used because of the small size of the plants. The following description applies particularly to specimens of *Petrea arborea* H.B.K. from Venezuela.

Heartwood pale orange-brown, not sharply demarcated from the yellowish or light olive sapwood; with distinct ray flecks on radial surface; has about the consistency of Maple (*Acer*). Luster fairly high. Odorless and tasteless. Moderately hard and heavy; texture medium; grain straight to finely roey; working properties good; probably poorly resistant to decay. Has no commercial possibilities.

Growth rings present, sometimes with an initial uniseriate pore-ring. Pores rather thick-walled; mostly small (60 to 125μ), not visible without lens; rather numerous; solitary and in pairs or small clusters, more or less diagonally or concentrically arranged. Vascular pits very small (4 to 4.5μ). Rays very numerous (16 per mm.); 2-sized, the uniseriates composed of upright cells; multiseriates 4 to 8, sometimes to 12, cells wide and up to 100 cells high, with definite stratum of low procumbent cells; brown gum abundant; pits to vessels very small, rounded. Wood parenchyma narrowly vascientric to vasicentric-confluent; also finely terminal. Wood fibers with numerous small bordered pits.

COMMON NAMES: Purple wreath, queen's wreath (Eng.); liane St. Jean (Haiti); lilac (Trin.); bejuco del caballo, comecate azul, estrella azul, opp-tzimin, piocha viejo, soltero, topopostillo, tortilla tostado del caballo, soltero, yoxop-tzimin (Mex.); colación, cuera de zapo, Santa Rita (Guat.); carbonero del monte (Hond.); adelfa, adolfina, lengua de vaca (Salv.); hoja chigüe (Nic.); choreque, raspa guacal (C.R.); bejuco de hajo, biurá, buirá, flor de la cruz, f. de mayo, Santa Lucía (Pan.); chaparrito, chaparro, jazmín azul, mamoncillo (Col.); María, penitente, Santa Lucía (Venez.); hajauballi saléroe, parapo (Sur.); flôr de São Miguel, f. de viuva, touca de viuva, viuvinha (Braz.).

Pseudocarpidium, with a few species of shrubs and little trees, is limited in distribution to Cuba and the Bahamas. The leaves are opposite, simple, entire or dentate and spine-tipped; the small bluish flowers are in axillary panicles; the fruit is lobed, slightly fleshy or dry. The type of the genus is *P. Wrightii* Millsp., a gray-barked little tree sometimes 20 feet high, with Holly-like leaves. In Gibara, Cuba, it is known as Chicharrón, a name applied elsewhere in the island to various hard-wooded trees, especially Combretaceae. The genus is not a source of timber. The following description is based on one authentic sample each of two species, namely,

P. Wrightii (Yale 16290; Bro. León 13307) and *P. avicennioides* (Rich.) Millsp. (Yale 16000; Bucher 5).

Color brownish yellow throughout, except near wound where it is olive-brown. Luster medium. Odorless and tasteless. Very hard, heavy, compact, tough, and strong; texture fine and uniform; grain straight to roey; not difficult to work, taking a high polish; resistance to decay probably low. Of no economic importance.

Growth rings present. Pores small (70 to 90μ), not distinct without lens; moderately numerous; solitary and in small multiples, fairly evenly distributed. Sclerotic tyloses present in *Pseudocarpidium Wrightii;* vascular pitting fine (5μ). Rays uniseriate or biseriate and up to 25 cells high; weakly heterogeneous; pits to vessels rather small, rounded. Wood parenchyma sparingly paratracheal and finely terminal. Wood fibers sometimes septate; pits numerous, medium-sized.

COMMON NAMES: Chicharrón, granadillo de costa, g. de Cuba, g. macho, yanilla blanca (Cuba).

Recordia is a Bolivian genus with a single known species, *R. boliviana* Moldenke. It is an unarmed shrub or small tree resembling *Citharexylum* in habit and general appearance, and apparently is endemic to the mountains of Santa Cruz. The leaves are opposite, finely serrate, densely pubescent below, mostly clustered at the tips of young twigs, and deciduous; the inflorescence is many-flowered, racemose, and terminal; the fruit is unknown. (See *Phytologia* 1: 4: 171–174, 1935.) There are no wood samples available for this study.

Rehdera, with three known species of unarmed shrubs or trees, occurs from Yucatán, Mexico, to Nicoya, Costa Rica. The leaves are opposite, entire, and triplinerved; the flowers are borne in short, drooping, axillary racemes; the drupaceous fruit is dry. The type of the genus is *R. trinervis* (Blake) Moldenke (=*Citharexylum trinerve* Blake=*C. macrocarpum* Standl.), a shrub or a tree sometimes 65 feet tall inhabiting low hills and river valley forests in southern Mexico, Guatemala, Salvador, Honduras, and Costa Rica. (See *Fedde Rep. Spec. Nov.* 39: 47–55.) The wood has not been studied.

COMMON NAMES: Sacuisilché, saquilzciché (Mex.); palo blanco (Guat.); llayo (C.R.).

Rhaphithamnus, with two species of spiny shrubs and small

trees less than 30 feet high, occurs in Chile and adjacent parts of Peru and Argentina. The leaves are deciduous, small, entire, and opposite or ternate; the sparsely-flowered purplish racemes are axillary; the fruit is a very fleshy 2-seeded drupe. (See Moldenke's "Monograph of the genus *Rhaphithamnus*," *Fedde Rep. Sp. Nov.* 42: 62–82. 1937.) The wood is not utilized because of the small size of the plants. The following description is based upon two Chilean samples of *R. spinosus* (A. Juss.) Moldenke (=*R. cyanocarpus* [H. & A.] Miers).

Wood pale grayish brown throughout; with slight greenish tinge in one specimen. Luster medium. Odorless and tasteless. Moderately heavy and hard; rather fine-textured; straight-grained; easily worked. Presumably poorly resistant to decay. Without commercial possibilities.

Growth rings distinct with lens; sometimes with uniseriate pore-ring in early wood. Pores rather thick-walled; small (75μ) diminishing outwardly to very small (30μ); fairly numerous; often in short radial multiples, well distributed. Vascular pits small (5μ). Rays very numerous (17 to 20 per mm.); 1 to 3 cells wide and up to 30 cells high; decidedly heterogeneous; uniseriates numerous and composed of upright and square cells, the others with stratum of procumbent cells and 1 to 7 marginal rows of square or upright cells; pits to vessels very small (3μ). Wood parenchyma sparingly paratracheal and in narrow irregular band demarcating growth ring. Wood fibers sparingly septate; pits small, very numerous, scattered.

COMMON NAMES: Prickly myrtle (Eng.); amyán macho, arrayán de espino, a. espinudo, a. macho, espino, e. blanco, e. negro, guayún, Juan bueno, rapú, repú, r. mayún (Chile); arrayán macho (Arg.).

Vitex, with about 70 species of unarmed shrubs and small to large trees, is widely distributed throughout the tropics, with a few representatives in temperate regions. The opposite, mostly deciduous leaves are digitately compound, with 1 to 7, mostly 3 or 5, entire leaflets; the white, blue, lilac, purplish, or red flowers are borne in axillary cymes or terminal panicles and in some species are very showy; the fruit is a drupe, in some instances edible.

The genus is the source of several valuable timbers. The Puriri of New Zealand, *Vitex lucens* T. Kirk, sometimes called New Zealand Teak, has been used so much for railway crossties, posts, and house blocks that the supply is almost exhausted. *V. altissima* L.f. is a large and important tree in southern and western India and Ceylon, finding numerous local uses where a strong and durable timber is required. The Philippine Molave, *V. parviflora* Juss., is widely distributed throughout the islands in second-growth and open primary forests, but the accessible supply of well-formed trees is now very limited; it is used for ship-building, especially for keels and ribs, and in house construction for sills, floors, window and door frames, and balusters.

American species also supply some good timbers, but they are not known to the export trade. *Vitex divaricata* Sw. is a tree 30 to 60 feet high and from 20 to 30 inches in diameter in the West Indies and extending into northern Venezuela; the wood is used locally for framework of houses, general carpentry, and in cabinet-work. There are several species in Central America. *V. Kuylenii* Standl., known in eastern Guatemala as Barabás or Barbás, is a tree sometimes 90 feet tall, with a well-formed bole 30 inches in diameter; the yellowish wood is moderately hard and heavy, works readily, and finishes smoothly, but is not utilized. In the same region is another species, probably *V. Cooperi* Standl., called Rajate Bién because of the ease with which the timber can be split; it is dull brown throughout or somewhat streaked, very easy to work, dries very slowly but without checking badly, and is employed locally for durable construction and general carpentry. A common tree in British Honduras and Yucatán, Mexico, is *V. Gaumeri* Greenm., sometimes 60 feet tall and 24 inches in diameter; it is very attractive when covered with panicles of small blue flowers. There are two or three other species in Mexico and at least two others in Panama, but they are of minor utility.

There are four or five species in Colombia and Venezuela, and the usual common name for them is Aceituno. Some are small trees but others attain heights of 75 to 100 feet and diameters of 2 to 3 feet. *Vitex columbiensis* Pitt. has a dark olive-brown wood of the type of Rajate Bién of Guatemala. *V. cymosa* Bert., which extends into the Amazon basin, is more yellowish and of a somewhat different texture, and some specimens are comparatively soft. Another Amazonian species

is *V. spongiocarpa* Ducke, said to be the largest representative of the genus in Brazil. Ducke says (*Tropical Woods* 31: 21) that it is especially remarkable "on account of the voluminous spongy mesocarp of its fruits, which, during the rainy season, float in the swamps of the upland forests, sometimes in abundance. The blossoming trees, crowned by their wide upward-raised inflorescences, suggest Teak (*Tectona grandis*) rather than the other Brazilian *Vitex* species." Its pale olive-brown heartwood merges gradually in the whitish sapwood; it is rather light, but firm and tough, saws somewhat woolly when fresh, and does not appear very durable. (For further description of the wood see *Tropical Woods* 31: 28–29.)

The southernmost species is *Vitex montevidensis* Cham., a tree sometimes 60 feet tall and 36 inches in diameter, growing in parts of Argentina and Uruguay. The fruit is edible and of an agreeable flavor. The heartwood of mature trees is of a dark olive-green color, easy to work, and durable; it is used locally in general construction, ship-building, and joinery.

The following description is based upon 46 specimens of 21 species of *Vitex* representing almost the entire American range of the genus.

Heartwood exhibiting various shades of brown, deepening upon exposure; sometimes oily looking; usually not sharply demarcated from the whitish, yellow, or pale brown sapwood. Luster low to high. Odor and taste absent or not distinctive. Density variable; sp. gr. (air-dry) 0.60 to 0.80; weight 37 to 50 lbs. per cu. ft.; texture rather fine to moderately coarse; grain usually straight, sometimes wavy; working properties good to excellent; holds its place well when manufactured; durability variable. A good timber for general purposes not requiring attractive figure or color. Some samples suggest Satinwood (*Zanthoxylum*), others have a superficial resemblance to *Cordia*.

Growth rings commonly present. Pores medium-sized to large (110 to 250μ), the larger barely visible without lens; fairly numerous; solitary and in radial pairs, evenly distributed or in some instances with more or less zonate arrangement. Tyloses abundant, sometimes thick-walled; some vessels in *V. spongiocarpa* with scalariform plates having numerous fine bars; vascular pits medium-sized (7 to 9μ). Rays 1 to 7, generally not over 5, sometimes only 1 or 2, cells wide and up to 30, occasionally to 50, rarely to 80, cells high; weakly to rather definitely heterogeneous; pits to vessels large, rounded in some species, more often oval to elongated and tending to scalariform arrangement. Wood parenchyma sparingly paratracheal; sometimes also finely terminal. Wood fibers mostly septate; pits numerous, rather small, simple or indistinctly bordered.

COMMON NAMES: Black fiddlewood, lizard wood (Br. W.I.); chicharrón, c. de costa, ofón, o. criollo, roble guayo, r. güiro (Cuba); higuerillo, pendulo blanco (P.R.); matta becerro, palo perrito (Dom. R.); bois de savanne, gri-gri (Haiti); bois lezard (Fr. W.I.); agua-malario, aguilote, ahuilote, atuto, coyotemate, negrito coyote, negro coyote, obalamo, tescialama, torete, ualama, uvalama, uvalano, valama, yaaxnic, yaxnic (Mex.); blue blossom, fiddlewood, monkey fiddle (Br. H.); barabás, barbás, jocote de mico, rajate bién (Guat., Hond.); cuaja, cuajada, quajado, yellow manwood (Pan.); aceituno, a. blanco, fruta de gonzalo, peronilla (Col.); aceituno, guaretaro, totumillo, t. negro (Venez.); hackiaballi (Br. G.); pechiche (Ec.); tahuari (Peru); jaramantaia, mammeira, María preta, tarumá cheiroso, t. da matta, t. do alagado, t. do igapó, t. frondoso, t. grande do campo, t. silvestre, t. tuira, velame do campo (Braz.); tarumá (Par.); tarumá de ley (Urug.); tarumá, t. duro, t. guazú (Arg.).

REVISION OF THE *MACROLOBIUM* SPECIES OF THE AMAZONIAN HYLAEA

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The genus *Macrolobium* Schreb. (Legum.-Caesalp.) contains more than 50 species which inhabit the humid tropics of South America and Africa, the division between the two continents being nearly equal. The great majority grow in the two hylaeas: that of Amazonia including the Guianas, and that of the Congo basin including Guinea. In South America there are a few species in countries adjacent to the hylaea, on the eastern foot of the equatorial Andes and on Trinidad; also one species grows in northern Venezuela, Colombia, and

Panama, and two in the more remote southeastern tropical Brazil, south of Bahia.

The Amazonian representatives of this genus are typically small or scarcely medium-sized trees, but in a few instances they are rather large or reduced to shrubs. All have beautiful foliage and small flowers with green calyx, white corolla, and purplish red stamens. *Macrolobium acaciaefolium*, the commonest and also the prettiest species, would be suitable for ornamental planting were it not for the fact that it requires flooded land for good development. The Amazonian species generally have bivalvate pods with elastic dehiscence. Some of the occupants of deeply flooded land, for example, *pendulum* and *palustre*, have dehiscent pods, whereas *acaiaefolium*, *multijugum*, and probably also the rare *flexuosum* have indehiscent pods adapted to water transport. The larger *Macrolobium* trees have a pale reddish brown heartwood that is good for carpentry though it is seldom used.

Macrolobium is, for the number of its species, perhaps the most important of all the plant genera represented in the "catingas" of the Upper Rio Negro basin; in number of individuals and principally as an element of the landscape it is far exceeded by the beautiful trees of *Eperua purpurea* and *E. leucantha*. Three *Macrolobium* species occur in the form of shrubs on sandy campinas, but two of them have also been observed in forests. No hylaea species can be considered a true forest tree, despite the casual occurrence of isolated individuals of some species in upland rain forest.

The dehiscence or indehiscence of the pod, as well as the number of the leaflets, has nothing to do with a subdivision of the genus into natural sections or subgenera. The above-mentioned species *acaciaefolium*, *multijugum*, and *flexuosum* have roundish and indehiscent pods and multijugate leaflets, while *brevense*, *Huberianum*, *gracile*, for example, with the same type of leaflets, have oblique-angled pods with dehiscent valves. The sections *Vouapa* and *Outea* cannot, therefore, be conserved. Furthermore, the species with unijugate and those with multijugate leaflets are bridged by a succession of intermediate forms, such as *palustre* and *montanum*.

The vernacular names of the Amazonian species of *Macrolobium* are Arapary for the common and widespread *M. acaciaefolium*, Arapary-rana (false Arapary) or Ipê for some others. The name Ipê, however, is only used in the Amazon estuary and coastal belt, and is also applied there to *Eperua* and sometimes to *Crudia*. In southern Brazil Ipê is the common name for *Tecoma* [*Tabebuia*] of the family Bignoniaceae, the Pau d'Arco of northern Brazil.

Synoptical Key to the Species

Leaflets 1-jugate (in one form of *M. punctatum* and in *M. palustre*, 1- or 2-jugate). Pod (so far as known) oblique, inclined, opening with elastic valves.

Racemes glabrous or very minutely tomentellous.

Leaflets broadly ovate or elliptic with shortly acuminated summit. Sutures of the pod not dilated..... 11. *M. arenarium* Ducke.

Leaflets obtuse or scarcely obtuse-acuminated.

Leaflets elongate-oblong 150–250 mm. long, their lateral nerves confluent into a very conspicuous marginal nerve. Pod with strongly dilated upper suture..... 1. *M. limbatum* Spr. ex Bth.

Leaflets oval- or oboval-oblong 50–80 mm. long, without a distinct marginal nerve.

Calyx segments obtuse, as long as the bracteoles. Pod with strongly dilated upper suture..... 2. *M. canaliculatum* Spr. ex Bth.

Calyx segments acute, shorter than the bracteoles. Pod unknown. 3. *M. palustre* Ducke.

Leaflets falcato-acuminated.

Calyx segments obtuse, as long as the bracteoles. Leaflets with rather long petiolules. Pod with strongly dilated upper suture. 5. *M. punctatum* Spr. ex Bth.

Calyx segments acute, unequal, shorter than the bracteoles. Leaflets subsessile or very shortly petiolulated.

Racemes densiflorous, pedicels scarcely up to 2 mm. long, bracteoles obtuse. Pod with dilated upper suture. 6. *M. suaveolens* Spr. ex Bth.

Racemes laxiflorous, pedicels up to 6 mm. long, bracteoles sharply acute. Pod shorter than in the allied species, its sutures not distinctly dilated..... 4. *M. pendulum* Willd. ex Vog.

Racemes rather densely tomentous or pubescent.

Leaflets long-falcato-acuminated. Bracts subpersistent; bracteoles rather acute, not thick. Calyx segments acute. Pod with strongly dilated upper suture..... 7. *M. chrysostachyum* (Miq.) Bth.

Leaflets shorter and more obtusely acuminated or obtuse.

Bracts small, early deciduous; bracteoles rather obtuse, never thick. Calyx segments acute. Pod with strongly dilated upper suture. 8. *M. bifolium* (Aubl.) Pers.

Bracts subpersistent; bracteoles very obtuse, thick. Calyx segments obtuse, broad. Pod incompletely described. Not seen. 9. *M. latifolium* Vog.

Leaflets broadly obovate, retuse. Pod unknown... 10. *M. retusum* Hub.

Leaflets 2–3-jugate, ovate or obovate.

Leaflets oblongo-obovate mostly with retuse apex. Racemes elongate, glabrous. Pod slightly oblique, sutures not dilated, valves with elastic dehiscence..... 14. *M. montanum* Ducke.

Leaflets ovate or elliptic, with acuminated apex. Racemes mostly elongate, densiflorous, tomentous. Pod oblique, inclined, sutures not distinctly dilated, valves with elastic dehiscence..... 12. *M. campestre* Hub.

Leaflets ovate or obovate with obtuse or retuse apex. Racemes (according to Aublet's drawing) short, laxiflorous, a little pubescent. Pod unknown. Not seen..... 13. *M. guianense* (Aubl.) Pulle.

Leaflets 4- (seldom 3-) to 12-jugate, with distinct nervures.

Leaflets broadly oval-oblong, 4-jugate, 40–60 mm. long. Racemes tomentellous; bracteoles about 12.5 mm. long, acute. Pod unknown. Not seen. 15. *M. discolor* Bth.

Leaflets shorter oblong, scarcely more than twice as long as broad, glabrous.

Leaflets 4- (sometimes 3-) jugate, obovate-oblong, the larger up to 50 mm. long and 25 mm. broad. Racemes tomentous; bracteoles acuminated. Pod oblique, inclined, apparently dehiscent.. 16. *M. microcalyx* Ducke.

Leaflets 5–7-jugate, subrectangular-oblong, the largest scarcely up to 45 mm. long and 20 mm. broad. Racemes glabrous; bracteoles obtuse. Pod unknown..... 17. *M. urupaense* Hoehne.

Leaflets narrowly oblong.

Leaflets 4–5-jugate, as well as the branchlets more or less pilosule. Racemes densiflorous, pubescent; bracteoles abruptly caudato-acuminated. Pod unknown..... 18. *M. caudiculatum* Ducke.

Leaflets 4–8-jugate, glabrous or less frequently subglabrous. Racemes very laxiflorous, glabrous; bracteoles very obtuse. Pod plane, right or oblique, indehiscent..... 19. *M. multijugum* (DC.) Bth.

Leaflets 8–12-jugate, pubescent. Racemes multiflorous, moderately dense, pubescent; bracteoles rather acute. Pod plane, obliquely falcato-obovate, probably indehiscent..... 20. *M. flexuosum* Spr. ex Bth.

Leaflets 10–50-jugate, narrowly oblong or linear-oblong.

Leaflets (chiefly beneath) and racemes rather abundantly pilose. Bracteoles acute. Pod oblique, inclined, elastically bivalvate. Little trees with slender stems.

Leaflets 10–20-jugate with obsolete nervures. Stipules elongate. 21. *M. gracile* Spr. ex Bth.

Leaflets 20–30-jugate with conspicuous nervures. Stipules small, setaceous with incrassate base..... 22. *M. debile* Ducke.

Leaflets glabrous or subglabrous.

Racemes with very conspicuous pubescence. Larger trees.

Leaflets with copious nervures.

Leaflets 15–27-jugate, subglabrous. Rachis of the leaves rather distinctly dilated between the juga, slightly winged. Bracteoles obtuse. Pod large, oblique, inclined, with elastic dehiscence. 23. *M. brevense* Ducke.

Leaflets 25–40-jugate, glabrous. Rachis of the leaves not winged. Bracteoles acutely acuminated. Pod unknown. Not seen. 24. *M. confertum* Gleason.

Leaflet nervures not conspicuous.

Leaflets ordinarily 20–30-jugate. Racemes short, seldom more than 40 mm. long. Pod erect, indehiscent..... 25. *M. acaciaefolium* Bth.

Leaflets 30–50-jugate. Racemes frequently 50 mm. long. Pod unknown. Not seen..... 26. *M. taxifolium* Spr. ex Bth.

Racemes glabrous or minutely pilosule.

Leaflets with dense nervures, 15–20-jugate, glabrous. Racemes with minute pilosity. Pod unknown. Not seen..... 27. *M. venulosum* Bth.

Leaflet nervures less conspicuous or null.

Leaflets 10–15-jugate, subglabrous, very strongly decrescent in size from the basal part of the leaf to the leaf summit, those of the highest pair excessively small. Stipules very caducous, not seen. Pod unknown. A rather large tree..... 28. *M. longipedicellatum* Ducke.

Leaflets 10–14- (sometimes 6–24-) jugate, glabrous, moderately decrescent in size from the base to the summit of the leaf. Stipules lanceolate, up to 10 mm. long, often persistent. Pod large, oblique, inclined, elastically dehiscent. Small tree with short slender stem. 29. *M. Huberianum* Ducke.

1. MACROLOBIUM LIMBATUM Spr. ex Benth.—Small tree growing in the upland rain forest, along brooks with blackish water and in other moist places, always on sandy soil. BRAZIL: Lower and upper Rio Negro, lower Madeira, and Solimões. PERU: Iquitos.

2. MACROLOBIUM CANALICULATUM Spr. ex Benth.—Small or medium-sized catinga tree of the upper Rio Negro region: Camanáos (Ducke H.J.B.R. 24063), upper Curicuriary (Ducke H.J.B.R. 35190), and Uaupés (Spruce 2781).

3. MACROLOBIUM PALUSTRE Ducke.—A small tree of the flooded banks of the Rio Macacuny, a small tributary of the upper Rio Negro near Cucuhy. Intermediate between *M. canaliculatum* and *M. pendulum*, but nearer to the latter. Herbarium specimens: Ducke H.J.B.R. 35193.

4. MACROLOBIUM PENDULUM Willd. ex Vog., Ipê (Amazon estuary and littoral of Pará), Arapary-rana (Obidos).—A small or medium-sized tree, frequent in the igapó and on flooded shores of lakes and sluggish rivers. Pará and Amazonas, westward to the Solimões (Foz do Jutahy).

5. MACROLOBIUM PUNCTATUM Spr. ex Benth.—A small tree or a shrub of campinas and catingas, on white sand with black humus. Pará: Campinas east and northeast of the Lake Faro. Amazonas: Campina da Ponta Negra near Manáos; catingas of the upper Rio Negro and tributaries (Curicuriary, Rio Uaupés), very frequent. The form BIJUGUM Ducke with often 2-jugate leaflets hitherto only in the catinga of Camanáos, upper Rio Negro (Ducke H.J.B.R. 35191).

6. MACROLOBIUM SUAVEOLENS Spr. ex Benth. = M. *Rondonianum* Hoehne.—The typical plant is a nearly medium-sized tree of moist places of the upland rain forest and moist catingas, rather widespread in the central, northern, and southern parts of Amazonia, but not frequent anywhere. Pará: Middle Tapajoz, Ducke Herb. Amaz. Mus. Pará 16912. Amazonas: Paraná do Ramos, Ducke H.J.B.R. 35194; Manáos, Ducke 489 and H.J.B.R. 35195; São Paulo de Olivença, Ducke H.J.B.R. 24065; Rio Uaupés, Spruce 2771 (cotype). Matto Grosso: Rio Juruena, Hoehne Herb. Mus. Nacional 2625 (type specimen of *Rondonianum*, perfectly identical with the type of *suaveolens*).—Var. PARVIFOLIUM Huber is a low form having smaller leaflets and thicker inflorescences with rather persistent bracts, occurring east of Lake Faro in moist places on sandy-humous campinas covered with an excessively dense shrub vegetation. Herbarium specimens: Ducke H.A.M.P. 8497 and 11697.

7. MACROLOBIUM CHRYSOSTACHYUM (Miq.) Benth.—Vernacular names, size, and aspect, as well as the habitat of the tree identical with those of *M. pendulum*. Pará and Amazonas: Estuary and lower Amazon; Rio Negro as far as the Venezuelan frontier, and Rio Uaupés. Northern Matto Grosso: Rio Ouro Preto affluent of the Pacanova. Cited from Surinam and British Guiana.

8. MACROLOBIUM BIFOLIUM (Aubl.) Pers. = *M. hymenaeoides* Willd.—Vernacular names and aspect same as those of *pendulum* and *chrysostachyum*, but the tree is always small or sometimes reduced to a shrub; inhabits igapós and banks of small forest streams, in some instances marshy spots of sandy campinas. Pará and neighboring part of Amazonas, from the Atlantic coast and estuary to Lake Faro and up to the middle courses of Tocantins, Xingú, and Tapajoz. Also collected in the three Guianas. Cited from Bahia.

9. MACROLOBIUM LATIFOLIUM Vog.—Bahia and Espirito Santo. Not seen. Bentham cites the species as collected by Martius in the flooded woods of Igarapé-mirim (Pará), but this locally needs to be confirmed by new collectors. The plant of the Breves Islands mentioned by Huber with this name is *M. biofolium* (H.A.M.P. 1892).

10. MACROLOBIUM RETUSUM Huber.—A shrub of the low catinga-like forest on rocky soil on the Cerro de Cupatí (a hill on the shore of the Caquetá between the lower cataracts, in the extreme southeastern part of Colombia near the Brazilian boundary). Ducke H.A.M.P. 12294.

11. MACROLOBIUM ARENARIUM Ducke.—A shrub of campinas with white sand and black humus. State of Pará: Campina do Perdido near Bellavista, Rio Tapajoz, Ducke H.A.M.P. 15831 and 17054, and H.J.B.R. 10916. State of Amazonas: Sandy campina at Rio Tarumá-mirí near Manáos, Ducke H.A.M.P. 12530.

12. MACROLOBIUM CAMPESTRE Huber, Ipê (Breves).—This species differs from the preceding in having 2- or 3-jugate leaflets and densely tomentous inflorescences. It is a low shrub in campinas, but in virgin forest it appears as a tree up to 25 m. high, with reddish brown bark and heartwood; it always grows on white sandy soil with black humus. All the

specimens existing in herbaria have been collected by me throughout the State of Pará from the region of the great estuary to the western limit; the shrubby form on campinas at the Rio Tocantins (Arumateua), near Gurupá, in the lower and middle Trombetas region, around Lake Mariopixy, and east and northeast of Lake Faro; the arboreal form near Belem do Pará and on the Breves Islands.

13. MACROLOBIUM GUIANENSE (Aubl.) Pulle = ? *M. pinnatum* Willd.—Not seen, but seems to be very near to *M. campestre* of French Guiana and Surinam.

14. MACROLOBIUM MONTANUM Ducke.—A small shrub, rather frequent in "campinarana" (false campina, a low shrubby wood) below the top of the Serra Pontada (a hill 300 m. high in the Jutahy region between Almeirim and Prainha, State of Pará); never observed in other localities. Herbarium specimens: Ducke H.J.B.R. 16947.

15. MACROLOBIUM DISCOLOR Benth.—A small tree of lower woods (catinga?) of the Guainia (Venezuelan upper Rio Negro), and, according to Gleason, of a savanna near Esmeralda (upper Orinoco).

16. MACROLOBIUM MICROCALYX Ducke.—A small or scarcely medium-sized tree which grows in marshy places with sandy-humous soil. Manáos, upland rain forest along brooks, Ducke H.J.B.R. 23298; Camanáos (upper Rio Negro), catinga, Ducke 34 and H.J.B.R. 23299.

17. MACROLOBIUM URUPAENSE Hoehne.—A shrub or small tree of the Campos dos Urupás or Cataqui-Jamaim, on the northwestern edge of the plateau of Matto Grosso. I have seen a cotype, Kuhlmann Herb. Mus. Nacional 2029.

18. **Macrolobium caudiculatum** Ducke, sp. nov.—Arbor parva ramulis novellis pallide cinnamomeis breviter albido-pilosis. Stipulae brevissimae, lanceolatae, pilosulae. Foliorum rhachis anguste canaliculata albido-pilosula; foliola vulgo 4-juga rarius 5-juga, subsessilia, 20–70 mm. longa et 10–30 mm. lata, sat anguste oblonga vel anguste obovato-oblonga, basi oblique acuta inaequilatera, apice obtusa et saepius retusa at mucronulata, margine saepissime recurvo in maioribus fortius reflexo, mediocriter coriacea, supra nitida in siccis fuscescentia, subtus vix nitidula albida, crebre pennia-

nervia, in costa centrali infra et in margine utrinque versus basin pilosula, caeterum plus minus glabra. Racemi in speciminibus nostris ad 70 mm. longi cano-puberuli a basi densiflori, bracteis parvis lanceolatis pilosis cito caducis. Flores brevissime (1–2 mm.) pedicellati; bracteolae 6–10 mm. longae ovatae abrupte et tenuiter caudiculatae extus sat dense cano-puberulae, persistentes; calix brevis laciniis 4 parvis acuminatis membranaceis; petalum album longe (4–8 mm.) unguiculatum lamina parva conduplicata; stamina purpurea usque ad 18 mm. longa filamentis in dimidio basali sparsim pilosis; ovarium brevissime stipitatum vel subsessile, 5-ovulatum, utrinque secus suturas sat longe et dense patenter albo-pilosum. Legumen ignotum.

Habitat in silvula "catinga" altiore prope Igarapé Jurupary fluminis Uaupés partis infimae affluentem, in civitate Amazonas, legit A. Ducke 2–11–1932, Herb. Jard. Bot. Rio 24064.

I distributed some duplicates of the type with the name *M. discolor* Benth., but the latter species (according to the description) must have broader leaflets, different flower dimensions, a very diverse form of bracteoles and petal, and a long-striped and less pilose ovary. The abruptly narrowed extremity of the bracteoles, forming very thin tailets on the summit of the flower bud, characterizes our new species very well.

19. MACROLOBIUM MULTIJUGUM (DC.) Benth., Araparyrana (at Obidos, etc.).—A rather low or medium-sized tree of the igapó and flooded shores of lakes and slow rivers whose water is poor in sediment; pod indehiscent, adapted to transport by water. I have seen numerous specimens collected in the Brazilian States of Pará and Amazonas, from the littoral of Pará up to the Solimões, Madeira, middle Tapajoz, upper Rio Negro and Rio Branco, and Uaupés. The species is one of the most frequent in the Brazilian States of Pará and Amazonas, and is also reported from the three Guianas. A wood sample (Yale 39394; Ducke 347) with herbarium material has been sent to Yale.

20. MACROLOBIUM FLEXUOSUM Spr. ex Benth.—A small igapó tree whose pod is apparently indehiscent and adapted to

transport by water (like that of the preceding species). Upper Rio Negro basin, where I collected this species on a small affluent of the Curicuriary (H.J.B.R. 35186), having also seen a cotype from the Uaupés (Spruce 2593).—Var. *molle* Spr. ex Benth. is a form (not geographic) with denser pilosity, from the upper Rio Negro (São Gabriel, Spruce 2408, cotype examined) and Cassiquiare region.

21. MACROLOBIUM GRACILE Spr. ex Benth.—A slender-stemmed low tree or a shrub of the catingas of the Brazilian and Venezuelan upper Rio Negro region including the tributaries. I observed it at Camanáos (Ducke 33 and H.J.B.R. 23297) and compared cotypes of Spruce's collection (Uaupés 2659 and Cassiquiare 3410).

22. MACROLOBIUM DEBILE Ducke.—Very close to the preceding and with identical aspect, but differing in some botanical characters. Only known from Manáos where it is frequent in the undergrowth of the upland rain forest with sandy and humous soil, in marshy places along brooks. Herbarium specimens distributed: Ducke 14 and H.J.B.R. 20318.

23. *Macrolobium brevense* Ducke, Ipê.—A tree 25–30 m. high with reddish brown bark and light red-brown heartwood. Only known, hitherto, in a few individuals growing in the very damp forest of Breves (Amazon estuary), near a small campina with white sandy soil and black humus. Herbarium specimens: Ducke H.J.B.R. 16946.

24. MACROLOBIUM CONFERTUM Gleason.—Esmeralda, upper Orinoco, foot of Mount Duida. Not seen.

25. MACROLOBIUM ACACIAEFOLIUM Benth., Arapary (the true species of this vernacular name); in some places also known as Faveira (cataract region of the Tapajoz).—Normally a medium-sized tree but sometimes up to 30 m. high, with robust stem and laminate-splitting grayish brown bark; the light and porous pale reddish brown wood is good but seldom used. The most common species of the genus and probably the prettiest, with elegant and characteristic aspect when flowering, and typical of the landscape where it is plentiful. This is one of the few species with indehiscent pods adapted to water transport; it grows on flooded shores of lakes and sluggish rivers, frequently also on flooded campos,

throughout the whole hylaea of Guiana and Amazonia, reaching the State of Goyaz to the southeast. A wood sample (Yale 39387; Ducke 340) with herbarium material has been sent to Yale.

26. MACROLOBIUM TAXIFOLIUM Spr. ex Benth.—A small tree of the shores of the Guainia (Venezuelan Rio Negro). Not seen.

27. MACROLOBIUM VENULOSUM Benth.—A small tree of the lower woods (catinga?) of the Venezuelan Rio Negro (San Carlos). Not seen.

28. MACROLOBIUM LONGIPEDICELLATUM Ducke.—A rather large tree of the higher "catinga" (less dense forest in high places with sandy-humous soil) near São Paulo de Olivença, Rio Solimões. Herbarium specimens: Ducke H.J.B.R. 24067.

29. MACROLOBIUM HUBERIANUM Ducke.—A little tree or a large shrub, only observed in forest galleries along the rocky banks of the rapids of the streamlets which run through the Campos do Ariramba, shrubby savannas on the plateau east of the middle Trombetas. The weak stems droop gracefully over the water. Herbarium specimens distributed: Ducke Herb. Amaz. Mus. Pará 11354 and 11874, from the type locality; Ducke H.J.B.R. 10921, from trees cultivated at the Pará Museum.

LOCALITIES OF KRUKOFF'S COLLECTIONS OF WOOD SAMPLES IN THE AMAZON REGION

The wood samples collected by Mr. B. A. Krukoff on his various expeditions to the Amazon region and the adjacent State of Maranhão, Brazil, from 1931 to 1939 are deposited in several institutions, some of which do not have the corresponding botanical specimens nor the data as to the plants and the localities where they were collected. The present report has been compiled by Mr. Krukoff from the records kept at the New York Botanical Garden, and should be helpful to the technologists who study these woods.

There are about 40,000 hand samples, representing some 3400 individual trees (collecting numbers), all authenticated by herbarium specimens. The numbers on the woods are the same as those on the botanical specimens deposited in various

herbaria and are from time to time cited in taxonomic papers.

Botanical specimens have been identified by A. C. Smith (those of 1931–1933 by H. A. Gleason and A. C. Smith) at the New York Botanical Garden with the assistance of the following specialists: S. F. Blake and E. J. Alexander (Compositae); A. W. Exell (Combretaceae); R. E. Fries (Anonaceae); H. A. Gleason (Melastomaceae); I. M. Johnston and E. P. Killip (Boraginaceae); E. P. Killip and A. Ducke (Leguminosae); A. J. G. H. Kostermans (Lauraceae); B. A. Krukoff and H. N. Moldenke (Menispermaceae); H. N. Moldenke (Verbenaceae); C. V. Morton (Solanaceae); N. Y. Sandwith and B. A. Krukoff (*Strychnos*); N. Y. Sandwith and R. J. Seibert (Bignoniaceae); H. Sleumer (Flacourtiaceae); P. C. Standley (Moraceae, Nyctaginaceae, Rosaceae, and Rubiaceae); J. A. Steyermark and L. Croizat (Euphorbiaceae); and R. E. Woodson, Jr. (Apocynaceae). There remain unnamed a considerable number of specimens, particularly of the families Burseraceae, Lauraceae, Leguminosae, Meliaceae, Myrtaceae, and Sapotaceae. Approximately 160 new species already described on the basis of these collections are accompanied by the corresponding samples of woods.

The first (and complete) set of herbarium specimens of all collections is deposited with the New York Botanical Garden, where also the records of the identifications are being kept. The larger duplicate sets of authenticating specimens are deposited in the herbaria of the following institutions: Arnold Arboretum, Harvard University; Royal Botanic Gardens, Kew; Conservatoire et Jardin Botanique, Geneva; Botanisch Museum en Herbarium, Utrecht; Naturhistoriska Riksmuseet, Stockholm; British Museum (Natural History), London; Field Museum of Natural History, Chicago; Missouri Botanical Garden, St. Louis; University of Michigan, Ann Arbor; U. S. National Herbarium, Washington; Museum d'Histoire Naturelle, Paris; Botanisches Museum, Berlin-Dahlem; Departmento de Botanico, Museo de La Plata; Botanical Museum of the Academy of Sciences, Leningrad; Jardin Botanique de l'Etat, Brussels; University of California, Berkeley.

Various items of information pertinent to the work of the wood technologist and concerning each plant, such as its date of collection, habitat, height, diameter, etc., are available on the permanent labels attached to the herbarium specimens.

Supplementary lists of identifications are being sent from time to time from the New York Botanical Garden to the institutions in possession of sets of herbarium specimens, in which new identifications, changes, and corrections are incorporated as these are reported by taxonomists. Wood technologists who study these collections are invited to coöperate and to advise the Curator of the New York Botanical Garden if errors in determinations are detected.

Below are given the collector's numbers as they appear on the labels of herbarium specimens and on the wood samples, together with the localities where they were obtained. It should be noted here that not all of the collections of any series are represented by wood samples. This is because the collections were of a general botanical nature and included plants which either were not arborescent or which were of interest primarily to the plant taxonomist. The localities of the collections where no wood samples were collected are omitted from this report. All of the localities given are in Brazil, except those of the last expedition, which are in Bolivia.

THIRD EXPEDITION. 1931–1932

1014–1054: Basin of Rio Tapajoz, State of Pará; near Boa Vista, Fordlandia, on "terra firma."

1063–1101: Basin of Rio Tapajoz, State of Pará; in various localities along the upper Cupary.

1102–1227: Basin of Rio Tapajoz, State of Pará; on a plateau between the Rivers Xingú and Tapajoz, drained by a tributary of Rio Cupary.

1235–1268: Basin of Rio Tapajoz, State of Pará; near Boa Vista, Fordlandia, on "varzea" land.

1271–1284: Basin of Rio Solimões, State of Amazonas; municipality of Manicapurú, in vicinity of Lago do Italiano.

1286–1313: Basin of Rio Madeira, State of Amazonas; in vicinity of Calama, near the mouth of Rio Machado.

1314–1516: Basin of Rio Madeira, State of Matto Grosso; near Tabajara on the upper Machado.

1517–1567: Basin of Rio Madeira, State of Matto Grosso; near Angustura on Rio Machado.

1570–1693: Basin of Rio Madeira, State of Matto Grosso; near Jatuarana, on a plateau drained by creek Jatuarana (tributary of Rio Machado.)

Woods Collected by R. Froes, under the Direction of B. A. Krukoff, 1932–1933

1700–2024: Basin of Rio Maracassumé, State of Maranhão; in various localities.

Fourth Expedition. 1933

2028–2081: In various localities in the States of Maranhão and Goyaz, largely in the basins of Rio Grajahú and of Rio Tocantins.

4525–4621: Basin of Rio Juruá, State of Amazonas; in various localities along the River Juruá.

4622–5209: Basin of Rio Juruá, State of Amazonas; near mouth of Rio Embira (tributary of Rio Tarauaca), lat. 7° 30′ S., long. 70° 15′ W.

5210–5238: Basin of Rio Juruá, Territory of Acre; along the upper Jurupary (tributary of Rio Embira), lat. 8–9° S., long. about 70° W., all on "terra firma."

5239–5811: Basin of Rio Purús, Territory of Acre; near mouth of Rio Macauhan (tributary of Rio Yaco), lat. 9° 20′ S., long. 69° W.

5812–5862: Miscellaneous collections in various regions in the State of Amazonas and in the Territory of Acre (basins of Rio Purús, Rio Ituxi, and Rio Marmellos).

Fifth Expedition. 1934–1935

6034–6067: Basin of Rio Madeira, State of Amazonas; in various localities in the municipality of Manicore.

6068–6506: Basin of Rio Madeira, State of Amazonas; municipality of Humaytá, near Tres Casas.

6558–7044: Basin of Rio Madeira, State of Amazonas; municipality Humaytá, near Livramento on Rio Livramento.

7045–7232: Basin of Rio Madeira, State of Amazonas; municipality Humaytá, on a plateau between Rio Livramento and Rio Ipixuna.

7233–7272: Basin of Rio Madeira, State of Amazonas; municipality Humaytá, on the immediate shore of Rio Ipixuna.

7281–7290: Basin of Rio Madeira, State of Amazonas; municipality Humaytá, on a plateau between Rio Livramento and Rio Ipixuna.

Sixth Expedition. 1935–1936

7501–7910: In various localities in the States of Amazonas and Pará.

Seventh Expedition. 1936–1937

7911–8038: Basin of Rio Negro, State of Amazonas; municipality of Manáos, along road to Aleixo.

8039–8040: Basin of Rio Solimões, State of Amazonas; municipality of Manáos, on the Island of Paciencia.

8041–8604: Basin of Rio Solimões, State of Amazonas, municipality of São Paulo de Olivença, near Palmares.

8605–9121: Basin of Rio Solimões, State of Amazonas; municipality of São Paulo de Olivença, in a locality drained by creek Belem, at a distance of approximately 20 kilometers from the Colombian border.

9122–9124: Basin of Rio Negro, State of Amazonas; municipality of Manáos, along road to Aleixo.

Eighth Expedition. *Bolivia*. 1939

10720–10954: Department of La Paz, province Larecaja; in vicinity of Tuiri (near village Mapiri, on the left bank of Río Mapiri), elevation 489–750 meters.

10986–11288: Department of La Paz, province Larecaja; in vicinity of Copacobana (approximately 10 kilometers to the south of village Mapiri), elevation 850–950 meters.

The woods collected on the third and fourth Brazilian expeditions as well as the woods collected by R. Froes in 1932–1933, also from Brazil, were reworked and made into hand samples at the New York State College of Forestry, Syracuse University. The woods collected on the fifth expedition were reworked at the Section of Woods and Wood Technology, Smithsonian Institution, Washington. The entire collections made on the sixth, seventh, and eighth expeditions are at the Field Museum of Natural History, Chicago, with the exception of a special collection of samples of the various species of *Lonchocarpus* which are at the Yale School of Forestry, New Haven.

THE YALE WOOD COLLECTIONS

Accessions

At the end of the calendar year 1940 the total number of catalogued wood samples in the Yale wood collections amounted to 39,437, representing 11,362 named species of 2768 genera of 230 families. There were 1677 accessions during the year. The largest single contribution was from the Federated Malay States (820). The sources of all the wood samples received are as follows:

Andaman Islands (British India): Chief Forest Officer, Mr. E. L. P. Foster, Port Blair.

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

Australia: Mr. W. J. Hutchinson, New York City; Mr. M. R. Jacobs, Australian Forest Service, Canberra.

Brazil: Dr. Adolpho Ducke, Jardim Botanico, Rio de Janeiro; Mr. E. B. Ford (of the Geo. D. Emory Company) and W. J. Hutchinson, New York City.

Colombia: Purchasing Agent, Panama Canal Zone.

Costa Rica: Prof. H. E. Stork, Carleton College, Northfield, Minn.

Cuba: Mr. W. J. Hutchinson, New York City; Rev. Brother León, Colegio de La Salle, Havana; Dr. Juan T. Roig, Estación Experimental Agronomica, Santiago de las Vegas.

Ecuador: Mr. E. B. Ford (of the Geo. D. Emory Company) and Mr. D. M. Whitmore, New York City.

Hawaii: Bernice P. Bishop Museum, Honolulu.

British Honduras: Mr. J. B. Kinloch, Belize.

India: Mr. W. J. Hutchinson, New York City.

Federated Malay States: Mr. H. E. Desch, Forest Research Institute, Kepong, Selangor.

Mexico: Field Museum of Natural History, Chicago.

New Zealand: Mr. Chas. E. Foweraker, Christchurch; Mr. W. J. Hutchinson, New York City.

Nicaragua: Mr. W. J. Hutchinson, New York City.

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

Trinidad: Mr. W. J. Hutchinson, New York City.

U. S. A.: Arnold Arboretum, Harvard University; Dr. A. H. Graves, Brooklyn Botanic Garden; Dr. Chas. C. Harrold, Macon, Ga.; Mr. Henry Hicock, Prof. R. W. Hess, and Prof. H. J. Lutz, New Haven, Conn.; Southern Hardwood Producers, Inc., Memphis, Tenn.; U. S. Department of Agriculture, Washington, D. C.

Sections for Microscopic Study

During 1940 there were added to the slide collections, cross, radial, and tangential sections of 631 specimens representing 516 named species and 155 genera, making a total of 18,887 slides of 10,644 specimens of 6387 named species, 2595 genera, and 216 families. Most (479) of the new slides were prepared in the Yale laboratories; others were obtained by purchase or through exchange.

Specimens Distributed

There were distributed during the year 1210 wood specimens, making a total for the years 1928–1940 of 11,320, mostly for use in connection with specific scientific projects now under way or in preparation.

To The Carbide and Carbon Chemicals Corporation, New York City, 3 samples: Lauraceae (1), Lecythidaceae (1), Leguminosae (1).

To Mr. John S. Penny, University of Pennsylvania Botanical Laboratory, 5 samples: Cephalotaxaceae (1), Cupressaceae (1), Taxodiaceae (3).

To Sr. J. A. Pereira, São Paulo, Brazil, 2 samples of Leguminosae.

To Sr. Lino Tatto, Brazilian Forest Service, Niteroi, 1157 samples: Acanthaceae (1), Aceraceae (1), Amaryllidaceae (1), Amygdalaceae (6), Anacardiaceae (27), Anonaceae (7), Apocynaceae (43), Aquifoliaceae (2), Araliaceae (6), Araucariaceae (1), Asclepiadaceae (1), Avicenniaceae (2), Berberidaceae (1), Betulaceae (2), Bignoniaceae (22), Bombacaceae (27), Boraginaceae (15), Burseraceae (7), Buxaceae (3), Cactaceae (2), Canellaceae (2), Capparidaceae (4), Caryocaraceae (3), Casuarinaceae (2), Celastraceae (3), Cercidiphyllaceae (1), Cochlospermaceae (1), Combretaceae (24), Compositae (8), Connaraceae (2), Convolvulaceae (2), Cucurbitaceae (1), Cunoniaceae (4), Cupressaceae (10), Cyrillaceae (2), Dichapetalaceae (1), Dioscoreaceae (1), Dipterocarpaceae (22), Ebenaceae (7), Elaeocarpaceae (1), Erythroxylaceae (3), Euphorbiaceae (33), Fagaceae (10), Flacourtiaceae (12), Gesneriaceae (1), Gnetaceae (1), Guttiferae (28), Hamamelidaceae (4), Hernandiaceae (1), Hippocastanaceae (1), Humiriaceae (7), Icacinaceae (2), Juglandaceae (9), Lauraceae (44), Lecythidaceae (16), Leguminosae (277), Liliaceae (1), Linaceae (5), Lissocarpaceae (1), Loganiaceae (3), Lythraceae (4), Magnoliaceae (1), Malpighiaceae (7), Malva-

ceae (4), Marcgraviaceae (1), Melastomaceae (8), Meliaceae (58), Monimiaceae (3), Moraceae (40), Myoporaceae (1), Myristicaceae (17), Myrsinaceae (2), Myrtaceae (6), Nyctaginaceae (4), Nyssaceae (1), Ochnaceae (5), Olacaceae (10), Oleaceae (12), Opililaceae (2), Phytolaccaceae (1), Pinaceae (11), Piperaceae (5), Podocarpaceae (3), Polygalaceae (3), Polygonaceae (7), Proteaceae (7), Quiinaceae (3), Rhamnaceae (14), Rhizophoraceae (4), Rosaceae (7), Rubiaceae (39), Rutaceae (34), Salicaceae (3), Santalaceae (5), Sapindaceae (11), Sapotaceae (25), Saurauiaceae (1), Simarubaceae (10), Solanaceae (4), Sonneratiaceae (1), Sterculiaceae (10), Symplocacaceae (2), Taxaceae (1), Taxodiaceae (1), Theaceae (2), Theophrastaceae (2), Thymelaeaceae (1), Tiliaceae (15), Trigoniaceae (2), Triplochitonaceae (1), Ulmaceae (6), Verbenaceae (8), Violaceae (2), Vochysiaceae (9), Winteraceae (2), Zygophyllaceae (4).

To Mr. F. H. Taylor, Biological Laboratories, Harvard University, 13 samples: Cucurbitaceae (2), Flacourtiaceae (3), Goodeniaceae (2), Lacistemaceae (1), Passifloraceae (1), Violaceae (4).

To Dr. Oswald Tippo, University of Illinois, 30 samples of the Ulmaceae.

To Prof. R. H. Wetmore, Harvard University, 5 samples: Cucurbitaceae (2), Goodeniaceae (2), Passifloraceae (1).

RUDOLPH BLOCK COLLECTION OF WALKING STICKS GIVEN TO YALE

A unique and valuable gift has recently been made to the School, in the form of the 1400 canes which constitute the Rudolph Block Collection of Walking Sticks. This famous collection of woods was gathered from the four corners of the earth through the efforts of Mr. Block, who was known to thousands as Bruno Lessing, the author of the newspaper column, *Vagabondia*. The gift was made by the widow and children of Mr. Block, who died last April.

It was Mr. Block's expressed intent to make this primarily a collection of the interesting woods of the world, the use of walking sticks as the medium for presenting the varieties and

beauties of the specimens being distinctly a secondary feature. Moreover, the woods have been identified by Professor Record with as high a degree of accuracy as was possible under the circumstances. Among the 1400 sticks are representatives of 950 named species and about 550 different genera; there are eleven which could not be identified and sixteen that could be referred only to their families. The canes are all designed to permit the fullest appreciation of the wood and are admirably suited for display. A representative selection of 120 sticks has been placed on exhibition in Sage Hall.

The woods in this collection were obtained in crude form, some from timber dealers, but many more from foresters, explorers, and scientific institutions, as well as "friends, acquaintances, and random correspondents in all parts of the world." The assembling of the specimens was all done in less than four years. The finished canes and handles were fashioned from designs prepared by Mr. Block, the work being done by the best cane-makers, the most competent artisans in wood, metal, stone, and leather in this country and in Europe. The cost of the collection is estimated at $25,000.

Mr. Block employed many kinds of burls in making handles, and also made use of crotchwood and many other forms of grain, including curly, wavy, ribbon, and bird's-eye. One very unusual structure appears as a small inlay in one of the sticks; it is a cross section of Cipo Cruz (vine of the cross), with the pith showing as a perfect cross.

The collection had previously been on display at the United States National Museum in Washington and at the New York Botanical Garden.

CURRENT LITERATURE

Schmaltzia. By Fred A. Barkley. *Am. Midland Naturalist* (Notre Dame, Ind.) 24: 3: 647–665; November 1940.

"Further studies have convinced the author that this group should be considered as a genus, rather than a subgenus [of *Rhus*] as provisionally treated in his previous study of the group" (*Ann. Mo. Bot. Gard.* 24: 265–498. 1937). Thirty-four species and 14 varieties are enumerated.

Pseudosmodingium and Mosquitoxylum. By FRED A. BARKLEY and MERTON J. REED. *Am. Midland Naturalist* 24: 3: 666–679; 4 plates; November 1940.

"The present paper is a continuation of the studies in the Anacardiaceae begun by the senior author, and completes the treatment of the biological entity which comprises the *Rhus* complex for North America. . . . All the [five] species of *Pseudosmodingium* are limited, so far as recorded, to southern Mexico; *Mosquitoxylum* [with one species and one variety], being more widespread, occurs in Jamaica and from Mexico to Panama. The members of both genera are medium-sized trees whose branches are typically thick. . . . *Pseudosmodingium* is reported as containing an irritant poison affecting most people to a greater or lesser degree much as the effluvium of *Toxicodendron*. . . . They are of little economic importance. The wood of both is used locally for various purposes."

A revision of *Choisya*. By CORNELIUS H. MULLER. *Am. Midland Naturalist* 24: 3: 729–742; 7 figs.; November 1940.

Choisya H.B.K. (=*Astrophyllum* Torrey) is a genus of aromatic shrubs belonging to the family Rutaceae. In this revision there are recognized two subgenera: *Euchoisya*, with one old and one new species, and *Astrophyllum*, with four old and one new species. "*Choisya ternata* has been widely cultivated in the warmer parts of Europe and America. Since it is a very striking ornamental, it is exceedingly popular. Certain of the other species should make attractive dwarf shrubs, notably *C. dumosa* and *C. Katherinae*. These latter species, however, are all exceedingly narrow-leaved and bear their flowers on single pedicels clustered near the tips of the branches rather than in diffuse panicles."

Studies of Central American plants. I, II. By PAUL C. STANDLEY and JULIAN A. STEYERMARK. *Field Museum Botanical Series* 22: 4, 5: 221–321, 325–396; Sept. 30 and Oct. 31, 1940.

These papers are devoted principally to reports upon new or otherwise noteworthy plants of Guatemala obtained by two expeditions sent to that country by Field Museum during

1938–40. The second paper also includes descriptions of numerous new species and notes regarding rare plants from collections made recently in the Republic of Panama. No wood specimens were included in the collections.

Dalbergia pacifica is described (p. 237) as "another of the rather numerous Cocobola trees of Central America. . . . Its closest relative is *Dalbergia lineata* Pittier, of the Pacific coast of Costa Rica, with which eventually it may have to be united." It is interesting to note in this connection that according to Standley (*Flora of Costa Rica*, p. 532), *D. hypoleuca* Pittier is "probably not distinct from *D. lineata*" and "it may well be that *D. lineata* is merely a form of" *D. retusa* Hemsl.

"The genus *Dussia* Krug & Urban was described in 1892 and based upon a single species, *D. martinicensis*, of Martinique. Since that time the group has grown slowly until 10 species are listed for it, their range extending from southern Mexico to Haiti, Martinique, French Guiana, the Amazon valley of Brazil, and eastern Peru. All the species that we have seen—and that includes all of the published ones except *D. sanguinea* Urban & Ekman of Haiti and *D. Lehmannii* Harms of Colombia—are much alike in general appearance, so much so that if all had been collected in one limited area probably no one would have given them a second glance or suspect that more than a single slightly variable species was represented." The genus *Casbalia* Standley is reduced to synonymy under *Dussia*. (Pp. 340–341.)

"*Erblichia odorata* Seem. . . . has been a catch-all for the Mexican and Central American specimens of the genus that have gradually accumulated in American herbaria. As a result of our study . . . it has been found that the species described as *E. odorata* Seem. is a rare and local one restricted to Panama and Costa Rica, while the more commonly collected and more widely ranging plants of Mexico south to Honduras may be referred to two other species and one variety." (Pp. 351–357.)

The apocynaceous tree of British Honduras and Guatemala that was formerly identified by Standley with *Lacmellea edulis* Karst. of Colombia and later by Woodson (*Tropical Woods* 44: 22) with his *Zschokkea panamensis* has proved to

be *Zschokkea Standleyi* Woodson. "No South American material of *Lacmellea* is available to the writers, but they will not be surprised if ultimately *Lacmallea* and *Zschokkea* prove to be congeneric. That would be unfortunate since the name *Lacmellea* antedates *Zschokkea* and under the latter genus a good many species have been described." (Page 371.)

Two new genera of trees are proposed. *Orthion* in the Violaceae with two species formerly referred to *Hybanthus*. "The species of *Orthion* are not shrubs but tall trees, one of them attaining a height of 18 meters and a trunk diameter of 45 cm." *Bartholomaea*, a flacourtiaceous genus, "consisting of two well-marked species, is confined, so far as now known, to the coastal regions of northern Guatemala and of British Honduras. One of the species was described rather recently as a *Lunania*, principally, it seems, on account of the general appearance of its inflorescence, although the plant evidently is not closely related to that genus. . . . The most conspicuous character of *Bartholomaea* is found in the long-pilose seeds, which seem to be unique in the family. In this connection may be recalled the genus *Gossypiospermum*, referred by some others to *Casearia*, but in that the seeds are merely short-pubescent rather than long-pilose." (Pp. 249–252.)

Studies in the Boraginaceae. XV. By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* 21: 3: 336–355; July 1940.

An account of the 20 Mexican and Central American species of *Cordia* belonging to section *Pilicordia*, including diagnoses of nine new species.

The floristic significance of shrubs common to North and South American deserts. By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* 21: 3: 356–363; July 1940.

"In southwestern United States and Northern Mexico, in North America, and in Argentina and Chile and adjacent Bolivia and Peru, in South America, there are vast areas characterized by a low atmospheric humidity and a rainfall usually well under 20 inches annually. The climatic and edaphic conditions of these two regions are rather similar and so also is their general type of vegetation. Although some of

the plant-formations in the two areas are superficially similar, their component species are almost completely different. Speaking generally we may say that the two desert floras show differences that suggest a different origin and history. This is certainly not unexpected since they are separated by about 3500 miles of wet tropics and lie in different hemispheres.

"It is to be noted, however, that amid all the conspicuous differences between the two desert floras there are identities which indicate former connections and interchange. There are species growing in one desert area which have their closest relatives in the other; while there are actually some species which grow, in indistinguishable forms, in both of these far separated arid regions. Since the distinctive floras characterizing each of the American desert areas could have developed only under isolation, our problem is to try to understand how they could have maintained their differences when the presence of certain species indicated that the floras have had some connection."

"We have every reason for believing in the past existence of a widely distributed American desert flora. All the evidence indicates that, relatively isolated and free from competition, it has persisted in South America, while in North America, diluted by new xerophytes originating in the northern temperate lands it has been giving way before their competition. Here we have the explanation of the affinities that are shown by certain northern desert shrubs with the distant flora of southern South America. These shrubs are remnants of an old American desert flora which has found a haven in South America, but has been decimated in the more keenly competed desert terrains to the north."

Phytologia. Pub. by H. A. GLEASON and HAROLD N. MOLDENKE, N. Y. Botanical Garden. Vol. I, Nos. 12 to 14, October, November 1940.

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A new series of *Croton* from Colombia (p. 433), by L. Croizat.
Additional verbenaceous novelties (pp. 433–443), by H. N. Moldenke.
Noteworthy spermatophytes from Mexico and Central America (pp. 449–453), by C. L. Lundell.
Novelties among the American Verbenaceae (pp. 453–480), by H. N. Moldenke.

Young teak for paper-making from Trinidad. *Bull. Imperial Institute* (London) 38:3: 285–289; July–September 1940.

"In connection with the Teak plantations which have been established in Trinidad, it was desired to ascertain whether an outlet could be found for the young thinnings as a source of paper pulp. Material was therefore sent over by the Conservator of Forests in order that the necessary trials could be carried out at the Imperial Institute. The sample consisted of bundles of billets of about 2 ft. in length, cut from trees four and three years old respectively."

"The present investigation has shown that: (*a*) Young Teak wood is a short-fibred material which, from the point of view of paper-making, is similar to woods such as Aspen (*Populus tremuloides*) which find little outlet in paper-making except in the form of bleached soda pulps. (*b*) Both the 3-year-old and the 4-year-old wood are similar in chemical composition, fibre length, and paper-making properties. The wood contains a high percentage of cellulose. (*c*) Young Teak wood is readily digested by the soda process but does not yield an easily bleachable pulp. Efforts to obtain a bleachable pulp by the employment of more drastic cooking conditions reduced the yield and the strength properties of the pulp without producing the desired effect.

"It is not considered that young Teak thinnings would be a promising raw material for paper-making owing to the short length of the ultimate fibres and the difficulty experienced in producing an easy-bleaching pulp."

Studies of South American plants. IX. New and noteworthy species from the northern Andes. By A. C. Smith. *American Journal of Botany* 27: 7: 541–547; July 1940.

Twelve new species, mostly Colombian, are described in Monimiaceae, Vacciniaceae, Myrsiniaceae, and Compositae.

Noticias botánicas colombianas. 1. Un nuevo genero de palmas del Vuapés. 2. Sobre la identidad del caparrapí. By Armando Dugand. *Revista Acad. Col. Cienc. Exactas* (Bogotá) 3: 12: 392–395; 2 plates; Aug. 31, 1940.

The new palm is named *Cuatrecasea vaupesana* Dugand. The Caparrapí, a laureaceous tree whose oil is used medicinally, is determined as *Ocotea caparrapi* (Nates) Dugand (=*Nectandra caparrapi* Sandino-Groot ex Nates).

Demerara greenheart. Compiled by the Greenheart Lumber Co., Inc., 70 Wall Street, New York. Pp. 68 (photolithographed); 8½ x 11; 33 photos.

A useful advertising pamphlet containing much information compiled from authoritative sources regarding the properties and uses of Demerara Greenheart, *Ocotea Rodiaei*.

As espécies brasileiras de cacau (género *Theobroma* L.), na botánica systemática e geográfica. By Adolpho Ducke. *Rodriguesia* (Rio de Janeiro) 4: 13: 265–276; 7 plates; 1940.

An illustrated account of the Brazilian species of *Theobroma*. The key to the species is repeated in English and there is also the following summary: "The genus is spontaneous in tropical America, from the Amazonian hylaea to southern Mexico, nine species having been hitherto observed in Brazil. The trees occur in the undergrowth of the rain forest, on high soil, as well as on slightly flooded land. The flowers seem to be always entomophile; only those of *T. speciosum*, however, are conspicuous in color and have a perceptible smell. The pulp of all the species is edible, acid in *T. grandiflorum*, sweet in the others, having a strong and very agreeable scent in the last cited. The seeds of all the species can give chocolate, but only *T. cacao* is cultivated in Brazil for that use; the cultivated Amazonian trees can hardly be distinguished from the spontaneous ones. These trees may have the botanical name *leiocarpum* as a form, but not as an independent species as some authors think. The area of the spontaneous *T. cacao* includes the greater part of the hylaea, from the foot of the Andes eastward to the little Rio Branco northeast of Obidos, and, south of the Amazon River, to the Middle Tapajoz."

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Peumus nomen rejiciendum. _Cryptocarya_ nomen conservandum (Lauraceae). By GAULTERIO LOOSER. *Lilloa* (Tucumán, Arg.) 5: 2: 163–167; 1940.

The international Committee on Botanical Nomenclature has added the genus name *Cryptocarya* R. Br. (type species *C. glaucescens*) to the list of *nomina conservanda* as against *Peumus* Molina. Consequently the Chilean tree, known as Boldo, should no longer bear the botanical name *Peumus boldus* Molina. The correct designation for the lauraceous Peumo of Chile appears to be *Cryptocarya rubra* (Mol.) Skeels. The author suggests that the monimiaceous Boldo be called *Boldea boldus* (Mol.) Looser.

Revisión de las zigofilaceas argentinas. By H. R. DESCOLE, C. A. O'DONELL, and A. LOURTEIG. *Lilloa* 5: 2: 257–352; 16 figs., 21 plates, 2 maps; 1940.

A comprehensive systematic account of the genera and species of Zygophyllaceae growing in Argentina. There is one new combination, *Porlieria microphylla* (Baill.) D., O'D. & L. (=*Guaiacum microphyllum* Baill.=*Porlieria Lorentzii* Engl.)

Contributions to the flora of extra-tropical South America. I. By HAROLD N. MOLDENKE. *Lilloa* 5: 2: 353–440; 1940.

The first paper in this series is a partial report on the 5000-sheet B. A. Krukoff herbarium, mostly from Argentina, which was turned over to Dr. Moldenke for study and identification. Various families have been assigned to specialists and some of their reports are incorporated. Numerous new species are described and many new combinations are made, chiefly in the Verbenaceae.

New and critical Euphorbiaceae from eastern tropical Asia. By LEON CROIZAT. *Journ. Arnold Arboretum* 21: 4: 490–510; October 1940.

"In this paper is presented a selection of novelties, critical notes, and transfers chiefly dealing with Chinese species. *Breyniopsis* Beille is reduced to *Sauropus* Bl.; a discussion of what constitutes a *nomen provisorium* is given in the note

following the publication of *Croton Hookeri*, sp. nov. Lastly, notes on general issues of classification bearing upon *Euphorbia* in the Linnean sense appear in the treatment of *Chamaesyce pseudochamaesyce* (Fisch. & Mey.) Komar."

Records of Indo-Chinese plants. II. By E. D. MERRILL. *Journ. Arnold Arboretum* 21: 3: 364–391; July 1940.

"This paper includes various notes on nomenclature, some reductions of previously proposed species, records of a considerable number of others as new to Indo-China, including the first records of representatives of the genera *Tsuga* and *Itoa* (other than in the reduction of *Carrierea*) as occurring in that country, as well as the descriptions of seventeen presumably new species in *Bauhinia*, *Aspidopterys*, *Ilex*, *Meliosma*, *Homalium*, *Lagerstroemia*, *Vaccinium*, *Agapetes*, *Gentiana*, *Premna*, *Adina*, *Thladiantha*, *Ainsliaea*, and *Ligularia*."

Strength tests of _Grewia elastica_ Royle (syn. _Grewia vestita_ Wall.) By V. D. LIMAYE. *Indian Forester* 66: 4: 219–222; April 1940.

"*Grewia elastica* is a very strong, very hard, and extremely tough timber. In its strength qualities it is superior to Ash and only slightly below Hickory. It is easy to work both by hand and machine tools, turns very well and takes a good finish. Although somewhat refractory to kiln-seasoning, it can be seasoned with little degrade. It air-seasons well if proper care is taken.

"*Grewia elastica* is suitable for making hammer handles, handles for picks, 'phowrahs' and shovels and tool handles of all sorts. It is also suitable for picker arms and other parts of textile machinery, spokes of wheels, poles, agricultural implements, police battens, and generally for articles requiring great toughness with comparative lightness. For the manufacture of built-up tennis-racket frames, plies of *Grewia elastica* can be used to give adequate substitutes for making a variety of articles that are now made from Ash, Beech, Maple, and also Hickory."

Malayan timbers tested in a green condition. By A. V. THOMAS. *Malayan Forester* 9: 4: 149–196; October 1940.

Gives in tabular form the results of more than 30,000 tests on 33 native timbers. Figures on Teak and English-grown Oak and Scots Pine are included for comparative purposes.

The Oleaceae of New Guinea collected by L. J. Brass. By CLARENCE E. KOBUSKI. *Journ. Arnold Arboretum* 21: 3: 328–335; July 1940.

The plants are of three genera, *Jasminum*, *Ligustrum*, and *Linociera*. One new species is described, namely, *Linociera Brassii* Kobuski, a tree of 20 meters.

Plantae Papuanae Archboldianae. III, IV. By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* 21: 292–327; 511–527; July, October 1940.

The families dealt with in these two papers are respectively Barringtoniaceae and Meliaceae, and Zygophyllaceae, Sapindaceae, and Cornaceae. There are descriptions of 47 new species.

Timber utilization in Malaya. By H. E. DESCH and A. V. THOMAS. *Malayan Forest Records* No. 13, Kuala Lumpur, F.M.S., 1940. Pp. 75; 7¼ x 9¾; 10 text figs., 75 plates. Price 7s. 6d. postpaid.

This *Record* by two members of the research staff of the Malayan Forest Service originally appeared in serial form in *The Malayan Forester* and deals with the principal commercial woods of Malaya. It indicates how the less durable and many of the general utility timbers can safely be used for purposes hitherto strictly limited to the primary or natural durable woods and how maintenance costs can be kept to a minimum.

Timber buildings in the tropics. By H. E. DESCH. Kuala Lumpur: Kyle, Palmer & Co., Ltd., 1940. Pp. 42; 6 x 9¾; 13 figs. Price 3s. 6d.

This booklet is divided into two parts, the first dealing with problems connected with the utilization of timber in wooden buildings in the tropics, the other containing plans, specifications, and quantities of materials for laborers' all-timber dwellings.

Onderzoek naar de geschiktheid van Nederlandsch-Oost-Indische houtsoorten voor de fabricage van cellulose en papier. (With summary in English.) By K. BAHRFELDT and H. W. JAPING. *Tectona* (Buitenzorg) 33: 5: 323–376; 1940.

Gives the results of experiments with both coniferous and broadleaf timbers in the Netherlands East Indies with a view to the establishment of a pulp and paper industry there, particularly for the manufacturing of kraft pulp by the sulphate process. The present and future supplies of *Pinus Merkusii* and *Agathis* spp. are considered sufficient and it is believed that the foreign market necessary for the success of the undertaking can be found in Japan.

Notes on the Dilleniaceae and their allies: Austrobaileyeae subfam. nov. By LEON CROIZAT. *Journ. Arnold Arboretum* 21: 3: 397–404; July 1940.

"The discovery of *Austrobaileya* was one of the gratifying results of the expedition undertaken by S. F. Kajewski in Northern Queensland in 1929. In describing the new genus and its type species, *A. scandens*, C. T. White quoted Diels to the effect (*Contr. Arnold Arb.* 4: 29. 1933) that *Austrobaileya* is a genus of the Magnoliaceae very closely related to *Drimys*, and expressed his own disappointment at the condition of the available material.

"My first impression upon seeing *Austrobaileya* was that this plant is dilleniaceous, although it obviously differs from the majority of the Dilleniaceae in having lateral single or nearly single flowers. Upon dissection I learned that the theca of the anther has a structure not incompatible with that of the genera of this family, although the stamen as such can not be said to resemble that of *Austrobaileya*. . . . As the best solution available at present and in consideration of the fact that *Austrobaileya* can not be longer treated as a genus of Magnoliaceae, I elect *Austrobaileya* as the type of the Austrobaileyae, a new subfamily of the Dilleniaceae. . . . A careful study of the wood anatomy of this plant is desirable.

In view of the fact that it is a large scandent shrub it is possible, however, that its wood anatomy does not show its truest and nearest affinities."

The shrinkage of Australian timbers. 2. Shrinkage data for 170 timbers. By W. L. GREENHILL. Pamphlet No. 97, Council Sci. & Ind. Research, Melbourne, 1940. Pp. 48 (photo-lithographed); 6 x 9½.

"In this pamphlet shrinkage values for the more important Australian species are given in a form in which they can be readily used commercially. The laboratory method of making shrinkage tests is described and the application in practice of the results so obtained is discussed. The correlation between shrinkage and density amongst different Australian timbers is shown to be very small, and even within the one species the correlation of these two properties is not always significant." —*Author's summary.*

A study of the alkaline extraction of wood. I. The effects of hot alkaline treatments on *Eucalyptus regnans* F. v. M. By A. W. MACKNEY. Reprint No. 71, *Journ. Council Sci. & Ind. Research* (Melbourne) 13: 2: 115–128; May 1940.

"Although the alkaline treatment of wood samples has been utilized for various chemical investigations over a period of years, little systematic work in the field appears to have been attempted and no detailed information is available as to the nature of the constituents of wood that are removed or modified by this reagent. The present study may be regarded as introductory to a number of more detailed investigations, particularly in regard to the question of the composition of the total carbohydrate fraction of wood; it provides considerable information regarding three important determinations, *viz.*, lignin, holocellulose, and Cross and Bevan cellulose."

Contributions to the study of the cell wall. 2. An investigation of delignification using thin cross sections of various timbers. By H. E. DADSWELL and DOROTHIE J. ELLIS. Reprint No. 72, *Journ. Council Sci. & Ind. Research* 13: 2: 129–137; May 1940.

"Sections 18μ in thickness cut from several species were subjected to various methods of delignification, including several which are supposed to remove lignin only. At each stage of each process sections were removed and tested for lignin by staining methods and treatment with 72 per cent sulphuric acid according to the procedures already described. As the delignification process proceeded there was a corresponding change in the staining reaction until finally the stain indicated complete loss of lignin; this change in the staining reaction was accompanied by a corresponding reduction in the lignin as revealed by the treatment with 72 per cent sulphuric acid. These results were further evidence in favor of the botanists' contention that certain staining procedures do indicate 'lignified' tissue; it has been pointed out, however, that for staining work, sections of standard thickness should be employed and that these should be subjected to no pretreatment of any kind. There was no definite indication that cell-wall lignin was removed before or after the lignin of the so-called 'middle lamella' zone; all results pointed to simultaneous removal, although, of course, there is a much larger proportion of the lignin to be removed from the 'middle lamella' zone. When subjected to treatments employing aqueous or alcoholic sodium hydroxide, sodium sulphite, or aqueous ammonia, maceration of the sections occurred before complete delignification; on the other hand, when the solvents for chlorinated lignin were alcoholic solutions of ethanolamine or ammonium hydroxide, and alcoholic washes were used at each stage, the sections did not macerate, although all the lignin had been removed. The importance of further knowledge of the layers remaining and holding the cells together after the lignin had been completely removed has been emphasized."—*Authors' summary.*

The indigenous trees of the Uganda Protectorate. By WILLIAM J. EGGELING. Entebbe, Uganda, 1940. Pp. xxii + 296; 8¼ x 10; 74 line drawings, 42 plates, 1 map.

"Until quite recently our knowledge of the Uganda tree flora was very scanty, though a good deal of material had been sent to Kew from time to time by various collectors, and the

available material has been recorded in the *Flora of Tropical Africa* and in the *Kew Bulletin*. Since the publication of the *Flora* much new material has come to hand and now, thanks to Mr. Eggeling's steady and careful collecting, which has resulted in the finding of many new species, it is safe to say that this book contains as complete an account of the indigenous trees of the Protectorate as is at present possible. No doubt new discoveries will be made in the course of further explorations of the lesser known forests, but so much new information has been acquired by Mr. Eggeling that the publication of the book is fully justified.

"Descriptions of all the trees known to be native in Uganda are given and keys for their determination. The various woods, where known, are also described and their uses stated. The indices of vernacular and of trade names should prove very useful, especially as care has been taken to include only those vernacular names which are well authenticated. There is also an index to the genera and species described in the text."—*From Foreword by* ARTHUR W. HILL.

The American species of Hippocrateaceae. By A. C. SMITH. *Brittonia* (N. Y. Bot. Garden) 3: 3: 341–555; 12 figs.; November 1940.

"In this treatment, 12 genera and 115 species are recognized; I have found it necessary to describe two new genera (*Elachyptera* and *Hemiangium*) and 26 new species, while 52 new combinations and one new name are proposed. Of the 12 genera, three (*Hippocratea*, *Prionostemma*, and *Hemiangium*) are monotypic, four (*Elachyptera*, *Cuervea*, *Hylenaea*, and *Anthodon*) contain two or three species each, while the remaining five contain from nine to 30 species each."

Studies of the Icacinaceae. I. Preliminary taxonomic notes. By RICHARD A. HOWARD. *Journ. Arnold Arboretum* 21: 4: 461–489; 4 plates; October 1940.

"Morphological studies of the Icacinaceae are now in progress. These include studies of the wood and twig anatomy, nodal structure, pollen grain variations, as well as the leaf and flower structure. In the present paper I have presented some taxonomic notes required for the proper presentation of some of the anatomical findings which will be published in a following paper."

The genera considered are *Stemonurus*, *Urandra*, *Medusanthera*, *Citronella* (*Villaresia*), *Cantleya*, *Gastrolepis*, *Pleurisanthes*, *Oecopetalum*, and *Metteniusa*. There is a key to *Stemonurus*, *Urandra*, and some related genera. Many new combinations are proposed and there are descriptions of two new species, namely, *Citronella peruviana* and *Oecopetalum guatemalense*. The author "can offer no suggestion at this time concerning the proper position of" *Metteniusa* Karsten (=*Aveledoa* Pittier), but "it seems improbable that the Icacinaceae is the correct family for this genus." From a study of the anatomy of a limited amount of material the reviewer concluded (unpublished MS.) that "this genus rightfully belongs with the Icacinaceae and not with the Olacaceae or Opiliaceae."

The comparative morphology of the Icacinaceae. I. Anatomy of the node and internode. By I. W. BAILEY and R. A. HOWARD. *Journ. Arnold Arboretum* 22: 1: 125–132; 3 plates; January 1941.

"Our investigations of the Icacinaceae will deal successively with the gross anatomy of the node and internode, the histology of the tracheary elements, parenchyma, and rays of the cauline secondary xylem, and subsequently with the comparative morphology of the leaves, pollen, and flowers. The Icacinaceae were selected for study because they exhibit a wide range of structural specializations and constitute a family that needs critical revision from the taxonomic point of view. . . .

"The bulk of the putative icacinaceous genera—approximately 60—has been included in the Icacinoideae. Three genera only are referred to the subfamilies Lophopyxidoideae and Cardiopterygoideae. In view of the fact that *Lophopyxis*, *Cardiopteryx*, and *Pteleocarpa* are of questionable icacinaceous affinities, we shall defer consideration of these genera until later and confine our attention for the present to the Icacinoideae.

"Our discussions of the vascular structures of this subfamily are based upon the study of 50 genera and of more than

150 species. As will be demonstrated subsequently, such a representation of genera and species is adequate for blocking out the salient lines of structural specializations in the Icacinoideae."

"Engler's anatomical characterizations of four tribes of the Icacinoideae are discussed and the question is raised whether the Iodeae can be differentiated in all cases from the Icacineae by the suggested anatomical criteria. A study of the nodal anatomy of the Icacinoideae reveals the fact that there are two distinct categories of the Icacineae: (1) those characterized by trilacunar nodes and (2) those having unilacunar ones. Certain of the unilacunar Icacineae appear to be somewhat transitional in form and structure between the nonscandent, trilacunar Icacineae and the unilacunar Iodeae, Sarcostigmateae, and Phytocreneae in which a twining or climbing habit of growth is dominant."

The comparative anatomy of the secondary xylem and the phylogeny of the Eucommiaceae. By Oswald Tippo. *Am. Journ. Botany* 27: 9: 832-838; 4 photomicrographs; November 1940.

"Phylogenists usually assign the Eucommiaceae to the Hamamelidales or to the Urticales. The present investigation was undertaken to disclose anatomical evidence which might be used to support either of these two views on the relationship of this family.

It was found that anatomically the Eucommiaceae are much more nearly like the Ulmaceae than the Hamamelidaceae. Among the anatomical characteristics which separate the Eucommiaceae from the Hamamelidaceae and unite them with the Urticales are the following: The vessel elements have simple perforation plates, the woods are often ring-porous, the rays are heterogeneous II-B [Kribs' classification], the intervascular pitting is alternate, and latex is present. It is, therefore, concluded that the Eucommiaceae belong in the Urticales, near the Ulmaceae. Many features of the structure of the flower, as well as characteristics of the external morphology, support this view."—*Author's summary.*

Evolutionary significance of ring porosity in woody angiosperms. By S. G. Gilbert. *Botanical Gazette* 102: 1: 105–120; 12 photomicrographs; September 1940.

"With increasing use of wood anatomy in phylogenetic investigations, it is important to check carefully the principal lines of specialization in xylem structure. One of the best known features of gross anatomy is the arrangement of the elements, especially the large spring vessels in deciduous trees. It is generally considered that ring porosity represents a high degree of such specialization; but there has been disagreement as to whether such a structural modification has any marked evolutionary significance or represents merely an ecological adaptation. The present study attempted to settle this question and also to determine the direction and nature of such an evolutionary change with respect to angiosperm origin."

"Two methods were employed, one based on that of Jeffrey and the other on the correlation method of Bailey and his students. Both methods gave identical results, indicating that they are both valid in this type of problem. Data from the anatomy of the seedling, first annual ring, root, and reproductive axis show that diffuse porosity is the more primitive condition for trees which are ring-porous in the adult stem. A high degree of correlation has been shown to exist between ring porosity and the presence of structural features whose advanced nature has been generally conceded. These are the simple perforation of the vessel-segment end wall, the paratracheal distribution of wood parenchyma, and the presence of only simple pits on the wood fibers. The ray type does not show this correlation. From these data it is concluded that ring porosity is an advanced feature. The evidence indicates that this specialization took place early in angiosperm history and affords no proof for the existence of parallel lines of evolution. Ring porosity has probably developed as a response to the climatic conditions characteristic of the North Temperate Zone. These conditions are now peculiar to a wide but delimited region of the world, which also represents the modern range of the specialized type. Any morphological

considerations of this structural specialization are valid only within the limits of that range."

Wood anatomy as an aid to classification and phylogeny. By Paul A. Vestal. *Chronica Botanica* 6: 3: 53–54; 1940.

"It is becoming increasingly apparent that the ultimate system of classification of the angiosperms must be one based upon all known characters. Toward this end the results obtained from anatomical studies, approached from the point of view of phylogeny, have given striking results. The lines of specialization as seen by the anatomist have not been based on any of the present systems of angiosperm classification, but rather upon the phylogeny of specific elements and tissues within the plant as seen in their development from cambial tissue. Thus any suggestions which the anatomists may make will be unbiased and presented from a point of view which should interest the taxonomists."

"The anatomical method, while not final, certainly points to levels of development which are very important in the arrangement of a natural sequence. Definite anatomical trends and occasionally specific characters, if taken within a broad complex, aid in clearing the way for a more orderly arrangement of the families. Within a family the slight heterogeneity in the anatomy may be misleading, unless its phylogenetic background is known. Also, in comparing isolated families, homogeneity may indicate a level of development, rather than true relationship. To find the answer, an inclusive study of allied families must be made.

"There can be no serious consideration of a natural classification on the sole basis of vascular anatomy. It is essentially an auxiliary to taxonomy, but one that should not be neglected. In the final analysis the main value of this approach to classification lies in the use of a new set of facts, which, combined with all other known facts, may contribute to a more natural arrangement of the angiosperms.

"Future possibilities lie in extending this approach to other orders and families and in finding a suitable set of characters within the phloem, the root structure, and the primary body of the plant, which may give additional characters upon which to base a natural classification."

M. M. Chattaway

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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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NOMENCLATURAL NOTES ON ARALIACEAE

By A. C. SMITH

Curator of the Herbarium, Arnold Arboretum

While studying certain recent collections of Araliaceae from tropical America, the writer found it desirable to reconsider the generic nomenclature of the group, at least to the extent that this affects the North American species. The two cases which must be examined are those of *Gilibertia* R. & P. vs. *Dendropanax* Dec. & Planch. and *Sciodaphyllum* P. Br. vs. *Schefflera* Forest.

DENDROPANAX Dec. & Planch.

Many recent students, proposing new species in the group, have followed Harms (in Engl. & Prantl, Nat. Pfl. III. 8: 40. 1894) in accepting the generic name *Gilibertia* R. & P. rather than *Dendropanax*. This procedure is not acceptable under

the International Rules of Nomenclature unless *Gilibertia* R. & P. (1794) is conserved over *Gilibertia* J. F. Gmel. (1791); thus far such a conservation has not been made. The genus is pantropical in distribution, and the finally accepted name will affect many binomials; therefore, it is well to consider whether or not a proposal to conserve *Gilibertia* R. &. P. is desirable. In the Index Kewensis, its supplements, the Gray Herbarium cards, and the card index of the Arnold Arboretum, 84 binomials have thus far been referred to *Gilibertia* R. &. P. and 56 to *Dendropanax*. Of course, some of these binomials will fall into synonymy in any event, but we must consider whether or not the conservation of *Gilibertia* R. & P. will result in a substantial economy of new binomials. The acceptable North American species of the group are about 25 in number, all of them now having valid binomials in *Gilibertia*. Should the name *Dendropanax* be taken up (as must be done unless *Gilibertia* R. & P. is conserved), 11 new binomials will be required for the North American species. A casual survey of binomials in other parts of the world shows about the same situation: if *Dendropanax* is used, about one-third of the species will require new binomials, whereas if *Gilibertia* should be conserved, fewer name changes would be necessary.

Nevertheless, in view of the fact that binomials referred to the two generic names are not grossly overbalanced in the direction of *Gilibertia* (being merely 84 to 56), I doubt the advisability of adding this name to the list of conserved generic names. In order to serve its real purpose, this list should be extended with great caution. In the present case the use of *Dendropanax* (in accordance with the procedure indicated by the International Rules) will not cause a multiplication of binomials to such an extent, in the writer's opinion, as to warrant the addition of another conserved generic name. Below I record the essential generic synonymy of *Dendropanax* and propose the new binomials which are necessary among the North American species of the genus.

DENDROPANAX Dec. & Planch. Rev. Hort. IV. 3: 107. 1854. *Gilibertia* R. &. P. Fl. Peruv. Prodr. 50. 1794; non *Gilibertia* J. F. Gmel. (1791). *Wangenheimia* F. G. Dietr. Vollst. Lexic. Gaertn. 10: 536. 1810; non *Wangenheimia* Moench (1794). *Ginannia* F. G. Dietr. Nachtr. Vollst. Lexic. Gaertn. 3: 483. 1817; non *Ginannia* Scop. (1777).

Dendropanax gonatopodus (Donn. Sm.) A. C. Smith, comb. nov. *Gilibertia gonatopoda* Donn. Sm. Bot. Gaz. 55: 434. 1913.

Dendropanax leptopodus (Donn. Sm.) A. C. Smith, comb. nov. *Gilibertia leptopoda* Donn. Sm. Bot. Gaz. 57: 421. 1914.

Dendropanax Matudai (Lundell) A. C. Smith, comb. nov. *Gilibertia Matudai* Lundell, Phytologia 1: 372. 1940.

Dendropanax nervosus (Urb. & Ekman) A. C. Smith, comb. nov. *Gilibertia nervosa* Urb. & Ekman, Repert. Sp. Nov. 22: 93. 1925.

Dendropanax oliganthus (A. C. Smith) A. C. Smith, comb. nov. *Gilibertia oligantha* A. C. Smith, Brittonia 2: 251. 1936.

Dendropanax populifolius (March.) A. C. Smith, comb. nov. *Gilibertia populifolia* March. Bull. Acad. Belg. II. 47: 77. 1879.

Dendropanax Schippii (A. C. Smith) A. C. Smith, comb. nov. *Gilibertia Schippii* A. C. Smith, Brittonia 2: 252. 1936.

Dendropanax selleanus (Urb. & Ekman) A. C. Smith, comb. nov. *Gilibertia selleana* Urb. & Ekman, Ark. Bot. **20A**, no. 5: 32. 1926.

Dendropanax sessiliflorus (Standl. & A. C. Smith) A. C. Smith, comb. nov. *Gilibertia sessiliflora* Standl. & A. C. Smith, Ann. Mo. Bot. Gard. 27: 326. 1940.

Dendropanax stenodontus (Standl.) A. C. Smith, comb. nov. *Gilibertia stenodonta* Standl. Ann. Mo. Bot. Gard. 24: 196. 1937.

Dendropanax Swartzii (Fawc. & Rendle) A. C. Smith, comb. nov. *Gilibertia Swartzii* Fawc. & Rendle, Jour. Bot. 64: 158. 1896.

SCHEFFLERA Forst.

Harms (in Engl. & Prantl, Nat. Pfl. III. 8: 35. 1894) used the generic name *Schefflera* Forst. (1776) rather than *Sciodaphyllum* P. Br. (1756) for the large pantropical genus, a choice which has been followed by most writers, in spite of the fact

that *Sciodaphyllum* was adequately published under the International Code (see discussion by A. C. Smith, Brittonia 2: 253. 1936; also see discussion of the spelling *Sciadophyllum*, op. cit. 254). In 1936 I arrived at the conclusion that *Sciodaphyllum* should be used for the North American species. R. C. Schneider (Bull. Torrey Club 36: 643. 1909) had already pointed out that *Sciodaphyllum* could not be accepted as authentically published (*i.e.*, receiving a binomial) under the American Code until 1804, and had proposed to use the generic name *Actinophyllum* R. &. P. (1794; no binomial was applied to this until 1797). The name *Actinophyllum*, however, need not be considered, since *Sciodaphyllum* and *Schefflera* were both previously and adequately published under the International Code. The problem, as it concerns the North American species, entails a discussion of (1) whether or not *Sciodaphyllum* and *Schefflera* are identical concepts, and (2) if so, whether or not *Schefflera* should be conserved.

(1) *Schefflera* (J. R. & G. Forst. Char. Gen. 45. 1776) is based on *S. digitata* Forst. (op. cit. 46. *pl. 23*), a New Zealand species (see Forst. Fl. Ins. Austr. Prodr. 23. 1786; for description and synonymy see Cheeseman, Man. New Zealand Fl. 232. 1906). Although some authors have taken up segregate genera from *Schefflera*, the majority has been willing to follow Harms and consider the group as a generic unit of great variability and pantropical distribution. Examining representative species from both the Old and New World tropics, the present writer is unable to suggest a reasonable generic segregation which would result in the maintenance of both *Schefflera* and *Sciodaphyllum*.

(2) About 400 binomials have been referred to *Schefflera* and slightly more than 70 to *Sciodaphyllum* (or *Sciadophyllum*). If future writers continue to consider the two concepts synonymous (as seems likely), the name *Sciodaphyllum* must be used unless *Schefflera* is conserved. The preponderance of binomials in favor of *Schefflera* is so overwhelming that its conservation seems highly desirable. The name *Sciodaphyllum* has never been in common usage, while *Schefflera*,

as a name, is very well known and extensively used. The conservation of the latter, therefore, is herewith proposed and will be suggested to the next International Congress. The essential generic synonymy and the few necessary new binomials for North American species follow.

SCHEFFLERA J. R. &. G. Forst. Char. Gen. 45. 1776, nomen conservandum propositum. *Sciodaphyllum* P. Br. Hist. Jam. 190. *pl. 19, fig. 1, 2.* 1756. *Actinophyllum* R. &. P. Fl. Peruv. Prodr. 51. *pl. 8*, 1794. *Sciadophyllum* Reichenb. Consp. 145. 1828.

Schefflera Brenesii A. C. Smith, nom. nov. *Sciodaphyllum chartaceum* A. C. Smith, Field Mus. Publ. Bot. 18: 1562. 1938; non *Schefflera chartacea* Merr. (1915).

Schefflera nicaraguensis (Standl.) A. C. Smith, comb. nov. *Sciadophyllum nicaraguense* Standl. Jour. Wash. Acad. 17: 316. 1927.

Schefflera robusta (A. C. Smith) A. C. Smith, comb. nov. *Sciodaphyllum robustum* A. C. Smith, Brittonia 2: 254. 1936.—Originally based on a specimen collected by Brenes in Costa Rica, the species is now represented from Panama by *von Hagen 2025* (Chiriquí: Boquete Region, Cerro Horqueta, rain-forest, alt. about 2000 m.). The more recent collection differs slightly from the type by having the petiolules longer (to 20 cm. long), the leaflets broader (to 11 cm. broad), and the secondary nerves occasionally as few as 10 per side. The fruits of the Von Hagen specimen are about 5–15 per head at maturity, sharply 5-angled, about 3 mm. in diameter, with a thick stylar column about 1.5 mm. long, the styles shortly free and spreading at apex.

Schefflera troyana (Urb.) A. C. Smith, comb. nov. *Sciadophyllum troyanum* Urb. Symb. Ant. 5: 451. 1908. *Actinophyllum troyanum* R. C. Schneider, Bull. Torrey Club 36: 644. 1909.

Schefflera Seibertii A. C. Smith, sp. nov.—Arbor parva 4–5 m. alta, ramulis crasis (ut videtur apicem versus ad 1 cm. diametro) subteretibus striatis fuscis lenticellatis sparse ferrugineo-tomentellis mox glabris; petiolis crassis teretibus lenticellatis mox glabris ad 32 cm. longis, basi valde dilatatis,

ligula coriacea oblongo-lineari ad 10 cm. longa subacuta plus minusve persistente cinereo-sericea, foliolis 5 (in folio unico viso), petiolulis subteretibus gracilibus 2–8 cm. longis basi et apice incrassatis, laminis chartaceis glabris elliptico-oblongis, 15–19 cm. longis, 10–11 cm. latis, basi rotundatis vel leviter cordatis, apice cuspidatis (acumine 5–9 mm. longo acuto), margine integris vel leviter undulatis, costa supra acute elevata subtus prominente, nervis secundariis utrinsecus 7–9 arcuato-adscendentibus utrinque valde prominulis, rete venularum copiose anastomosantium utrinque prominulo; inflorescentia robusta composito-paniculata ad 50 cm. vel ultra longa, rhachi ramulisque robustis subteretibus striatis sparse fusco- vel ferrugineo-sericeis demum subglabris, ramulis pluribus ad 45 cm. longis bracteis papyraceis oblongo-linearibus 2.5–3.5 cm. longis sericeis caducis subtentis, pedunculis numerosissimis patentibus gracilibus puberulis 7–10 mm. longis; floribus 9–14 per umbellam, pedicellis gracilibus puberulis 3–4 mm. longis bracteis minutis subtentis; calyce cupuliformi circiter 1.5 mm. diametro minute 5-dentato; petalis membranaceis mox glabris in calyptram 1.5–2 mm. longam acutam connatis; filamentis gracilibus circiter 2 mm. longis, antheris oblongis circiter 1 mm. longis obtusis; disco carnoso annulari; stylis 5 in columnam carnosam conicam circiter 0.7 mm. longam cohaerentibus apice breviter liberis, loculis et ovulis 5.

PANAMA: Chiriquí: Chiriquí Lagoon Region, Chiriquicito, United Fruit Co., vicinity of Guarumo River, *Seibert 1553* (type, in herb. U. S. National Arboretum, nos. 99666 and 99667), Aug. 23, 1940 (small tree 4–5 m. high, in secondary growth; flowers greenish yellow).

The new species is related to *S. nicaraguensis* (Standl.) A. C. Smith, differing in its shorter and proportionately broader leaflets (which are merely cuspidate rather than conspicuously acuminate at apex, glabrous beneath, and with fewer secondary nerves), and in its more numerous flowers with longer pedicels.

AMERICAN TIMBERS OF THE MAHOGANY FAMILY

By SAMUEL J. RECORD

This highly important family (the Meliaceae), comprising about 40 genera and more than a thousand species of evergreen or deciduous trees and shrubs, is best represented in tropical and subtropical regions of America, Africa, and Asia, but extends into New Zealand and along the eastern coast of Australia. The leaves are alternate, rarely opposite, pinnately or digitately compound or sometimes unifoliolate or simple, and without stipules; the flowers are typically small and borne in terminal or axillary panicles; the fruit varies from a berry or a drupe to a dehiscent capsule with each cavity containing one to many seeds which sometimes are winged and imbricate in double rows. The bark is bitter and astringent.

The woods exhibit a wide range of variation in appearance and properties, but those of most commercial value are reddish in color, usually with a golden luster, sometimes fragrantly scented, of low to medium density, readily seasoned, easy to work, hold their place well when manufactured, and present an attractive and often beautiful figure. Included here are Mahogany (*Swietenia*), Spanish Cedar (*Cedrela*), and Andiroba or Crabwood (*Carapa*), of tropical America; African Mahogany (*Khaya*) and its allies (*Entandrophragma*), Tigerwood or so-called African Walnut (*Lovoa*), and Bossé (*Trichilia*), of West Africa; Red Cedar (*Toona* or *Cedrela*) and Rose Mahogany (*Dysoxylum*), of Australia; the Neem (*Azadirachta*), Persian Lilac (*Melia*), Redwood (*Soymida*), Chittagong (*Chickrassia*), and Toon (*Toona* or *Cedrela*), of India; and Calantas (*Toona* or *Cedrela*) of the Philippines. Several other genera are of local importance.

The American Meliaceae are of seven genera, namely, *Cabralea*, *Carapa*, *Cedrela*, *Elutheria*, *Guarea* (including *Ruagea*), *Swietenia*, and *Trichilia* (including *Odontandra*). *Elutheria*, with two species of trees, is said to grow in Peru, Colombia, and Venezuela, but it is presumably very rare as no recent collectors have reported it; no mature wood samples are available, but examination of a small twig indicates that

the wood is dense and fine-textured. *Guarea* and *Trichilia* are represented in the Old World, and some botanists include *Xylocarpus* with *Carapa* and *Toona* with *Cedrela*. The Asiatic *Melia azederach* L. is a shrubby tree widely planted for ornament in tropical and warm climates and has become naturalized in America from southeastern United States throughout the West Indies, Mexico, Central America, and parts of South America, being generally known as Bead Tree, Lilac, and Paraíso; it is distinguished from the other members of the family by its large doubly-pinnate leaves; the wood is ring-porous as in *Cedrela*, but the vessels in the late wood are small and clustered and have spiral thickenings. The following general description applies to native American woods of six genera.

Diffuse-porous, except in *Cedrela*. Pores small to large, being smallest in *Guarea* and *Trichilia* and largest (in part) in *Cedrela;* few to fairly numerous; solitary and, more often, in small multiples, well distributed. Vessels with exclusively simple perforations; spiral thickenings absent; gum plugs common; intervascular pitting fine to very fine. Rays uniseriate or locally biseriate in *Cabralea*, *Guarea*, and *Trichilia;* 1 to 5 cells wide in the others; up to 50, usually less than 25, cells high; mostly homogeneous in *Guarea* and *Trichilia*, more or less distinctly heterogeneous in the others, usually with single marginal rows of square or upright cells; crystals sometimes present; pits to vessels minute (*Swietenia*) to medium-sized (*Cedrela*). Wood parenchyma various; in distinct terminal or initial bands in *Carapa*, *Cedrela*, and *Swietenia;* in numerous very coarse concentric bands in *Cabralea;* in numerous, unevenly spaced, tangential or broken concentric lines or narrow bands in *Trichilia;* abundantly paratracheal and confluent into short to long bands in *Guarea;* more or less paratracheal in all genera and sometimes diffuse; crystals common. Wood fibers septate, at least in part, except in *Trichilia;* pits small, simple or indistinctly bordered. Ripple marks usually present in *Swietenia;* all elements storied. Vertical traumatic gum ducts known to occur occasionally in *Cedrela* and *Swietenia*. (For further details see *American Journal of Botany* 17: 8:724–738; 20: 10: 638–668.)

Cabralea, with about 40 species of shrubs and small to large trees, occurs in the southern part of tropical America, being most abundantly represented in central and southeastern Brazil. The common name is Cangerana in Brazil and Cancharana in Argentina and applies to a group of species, although the one generally referred to in the literature is *C. cangerana* Sald. This tree is usually of medium height, but with a large trunk upward of four feet in diameter. The bark

contains an aromatic resin and is bitter, hence is much used in local medicine. The leaves are large, with eight or more pairs of leathery leaflets; the small white fragrant flowers are borne in axillary panicles; the fruit is a dark red, 5-celled, ovoid, woody capsule about the size of a small marble, dehiscent at the apex, with each cell containing one or two seeds which are emerald-green before maturity. The wood exhibits considerable variation in color and density, but this is attributable more to the site and conditions of growth than to differences in species. The timber is highly esteemed locally as it has about all of the advantages of Cedar (*Cedrela*) coupled with greater firmness and strength. It is accordingly used for all sorts of construction, both interior and exterior, and for joinery, furniture, and sculpture. It is sometimes called Pau de Santo in Brazil because images of the saints are usually carved from Cangerana wood. By soaking the sawdust in water it is possible to obtain a red dye of some local utility. The supply of good timber is rather limited and is readily consumed by the domestic demand.

Heartwood typically dull red or maroon, with fine parenchyma markings; sometimes lighter colored, with purplish streaks; not always sharply demarcated from the pinkish sapwood. Without distinctive taste; with fragrant scent when fresh, but losing it eventually upon drying. Mostly of medium density, but variable; sp. gr. (air-dry) 0.65 to 0.85, av. about 0.70; weight 40 to 53, av. about 44, lbs. per cu. ft.; texture medium to coarse; grain generally straight, sometimes wavy; easy to work, finishing smoothly; holds its place well when manufactured; is rather brittle; dark-colored material highly resistant to decay and insects.

Growth rings absent or poorly defined. Pores medium-sized to rather large and readily visible; numerous but not crowded; mostly in small multiples, well distributed without pattern except as linked in part by parenchyma. Rays 1 or 2, sometimes 3, cells wide and rarely over 25, mostly less than 15, cells high; heterogeneous, the cells mostly squarish; no crystals seen; gum deposits abundant; pits to vessels small. Wood parenchyma very abundant, coarse-celled; in irregular tangential to fairly regular concentric bands 2 to 8 cells wide, associated with the pores but usually not completely surrounding them; crystals apparently absent; gum abundant. Wood fibers septate. Ripple marks absent. No gum ducts seen.

COMMON NAMES: Cajarana, cangerana, c. grande, c. mirim, canharana, canjarana, canxarana, cayarana, cedro cangerana, pau de santo (Braz.); cancharana, canxarana, cedro macho, chanchorena, chanchorona (Arg.); congerana (Urug.); cedrorá (Par.).

Carapa, with a few closely related species of evergreen trees, occurs in West Africa and in tropical America from the West Indies and Central America to Peru and Brazil. The African species, *C. procera* DC., is said to occur also in the West Indies and northern South America, but the best known and most widely distributed American tree is *C. guianensis* Aubl. The principal common names are Andiroba in Brazil and Crabwood in British Guiana. The tree is of limited occurrence in the overflow delta lands of the Orinoco in Venezuela and is very common in the Amazon flood plains and in the Guianas, sometimes growing in nearly pure stands. At its best it is said to attain a height of 170 feet and a diameter of six feet above the buttresses, and is often 100 feet tall and three feet through. It has very large pinnate leaves, with rather numerous leathery leaflets; the small white flowers are borne in axillary or terminal panicles; the fruit is a large globose dehiscent capsule containing several smooth pale brown angular seeds as large as a Horse-chestnut (*Aesculus*). These seeds are the source of an oil used industrially for making soap, and in order to protect the industry in the State of Pará, Brazil, felling of the trees for timber has been prohibited. The bark is employed to a minor extent in tanning and contains an alkaloid, carapina, of some medicinal application.

Crabwood is popular in British Guiana and is used there for furniture and all kinds of construction work. There is considerable difference in the quality of the wood, depending upon the locality of growth. Trees in Mangrove swamps are small and the timber is of such poor quality and splits so badly that it is not used commercially. Growth in riparian swamps is better, but the best timber comes from creek banks which are only periodically inundated. The last two kinds of Crabwood are sometimes referred to, respectively, as "lowland" or "white" and "upland" or "red," but such terms are

inaccurate as the species is rare on hillsides and the color variations of the wood are to be found in trees from the same site and even in the same tree. It is said that the presence of short longitudinal grooves in the surface of a peeled log is an indication of good quality. Tests on Crabwood at the Forest Products Research Laboratory at Princes Risborough, England, indicate the following: "Seasoning must be done carefully to avoid warping and checking. In the matter of strength, Crabwood compares favorably with Black Walnut (*Juglans nigra* L.). Straight-grained lumber finishes well, but roe-grained material requires considerable sanding to produce a smooth finish, owing to local tearing out of the fibers. Crabwood should be useful for such cabinet work as the carcassing in furniture suites, chair and table lengths, instrument cases, drawer linings and possibly drawer fronts, and for general hardwood joinery, such as shop fittings, display cabinets, and cupboards. Quarter-sawn material would appear to be particularly suitable for mouldings and also for plain and automatic square turning."

Attempts to establish a regular market for Crabwood lumber in the United States and England have not been successful, but with more attention to the quality of the timber exported this situation may be remedied. Brazilian material of the same species has been more favorably received and on this account Crabwood has recently been rechristened Empire Andiroba. J. F. Müller & Sohn, Hamburg, Germany, imported Brazilian Andiroba for the first time in 1938 and report that it is a firm and very usable wood which evidently can only be supplied in small quantities and diameters. In Colombia, according to Armando Dugand (*Tropical Woods* 31: 48), the timber, known there as Masábalo, is generally considered somewhat inferior to Albarco (*Cariniana pyriformis* Miers), but is acceptable as a substitute; shoemakers prefer it for the making of heel pieces.

The following information regarding the silviculture of *Carapa guianensis* in Trinidad is condensed from a report by R. C. Marshall (see *Tropical Woods* 27: 26): Tree not exacting as to soil and site, provided they are not too dry. Young plants produce taproots, but the tree tends to become surface-rooted.

Flowers about June. Fruit, which is about the size of a cricket ball and containing a dozen seeds, requires about a year to mature; falls throughout the year, though mostly at beginning of the rainy season. Seeds large and readily collected from under the trees; subject to insect damage and, therefore, should not be stored. High percentage of sound seeds germinate within six weeks. Early growth fairly rapid. For direct seeding, plant one or two seeds one-half inch deep in spots spaced five feet apart, without preliminary working of the soil. For transplanting, undercut the roots during rainy weather, leaving four or five inches of the taproot, and allow the plants to stand a few weeks until new roots are formed; in this way plants up to three feet high can be successfully transplanted. Young trees do best under partial shade; excessive cleaning should be avoided. Crappo coppices well when not too old. In plantations, a borer (*Hypsipyla grandella* Zell.) attacks the shoots and also infests the seeds toward the end of the dry season. Young trees are badly browsed by deer.

The continental range of *Carapa* extends as far north as British Honduras. The principal species is *C. guianensis*, but two others have been described, namely, *C. Slateri* Standl., of Panama and Costa Rica, and *C. nicaraguensis* C. DC., of Costa Rica and Nicaragua. Regarding the last, F. C. Englesing says (*Tropical Woods* 17: 29) that it is a large tree of the shady forest on low hills, its frequency of occurrence being about one tree per acre between the Rawawas and Kukalaya Rivers. Specimens collected for the Yale School of Forestry (Yale 1231; Englesing 47) were from a tree 100 feet tall, with a cylindrical trunk free of branches for 75 feet and 15 inches in diameter above the branched buttresses which extended to a height of six feet. The freshly cut sapwood is white near the bark, shading inwardly to pink; the heartwood is light sepia. The timber is used locally to some extent for constructing buildings. The heartwood of the type tree of *Carapa Slateri* (Yale 10157; Cooper & Slater 59; see *Tropical Woods* 10: 49) is lighter in color than most samples of *Carapa* and has a high golden luster, but this is probably not a specific character. In general the appearance of *Carapa* wood is dull and plain, but there are exceptions for all species and localities of growth.

The Central American trees are not abundant, but the timber is of the same type and useful for the same purposes as that from the Guianas and Brazil. Though usually of less attractive appearance than Mahogany, it should otherwise be fully as serviceable in plywood construction, particularly for motor boats.

Heartwood rather light to dark reddish brown; not always sharply defined from the pale brown or oatmeal-colored sapwood. Luster frequently low, sometimes golden. Odor and taste absent or not distinctive. Mostly of medium-low density, but firm and strong; sp. gr. (air-dry) 0.60 to 0.75; weight 37 to 47 lbs. per cu. ft.; texture rather coarse; grain generally straight, sometimes roey; technical properties fair to very good; takes paint and glue well; is durable.

Growth rings usually distinguishable. Pores medium-sized to large; fairly numerous; mostly in small multiples, rather evenly distributed. Rays 1 to 5 cells wide and up to 50 cells high; heterogeneous, with many of the cells squarish; gum deposits abundant; crystals common, usually large; pits to vessels very small. Wood parenchyma coarse-celled, variable in abundance; rather sparingly paratracheal and in concentric bands, typically 1 to 3 cells wide, irregularly spaced but usually appearing to limit growth rings; also more or less diffuse; gum abundant; crystals sometimes present, but not composing entire strands. Wood fibers frequently septate; walls variable in thickness, sometimes gelatinous. Vertical traumatic gum ducts rare. Ripple marks absent (present in *Xylocarpus*, an Old World genus sometimes included with *Carapa*).

COMMON NAMES: Najesí (Cuba); cabirma de Guiana (Dom. R.); bois rouge carapat (Guad.); crabwood, crappo (Trin.); bastard mahogany (Br. H.); caobilla, cedro macho (C.R.); bateo, cedro bateo, c. macho, saba (Pan.); masábalo (Col.); carapa (Venez.); caraba, crabwood (highland, lowland, upland, red, white), empire andiroba (Br. G.); ietjoenban karaäpa, kaäpa, karaba, kelaba, keraba, kerapa, krappa, Surinaamsch mahonie (Sur.); bois caille, cachipou, carapa, c. blanc, c. rouge (Fr. G.); figueroa, tangaré (Ec.); andiroba (Peru); andiroba, a. branco, a. do igapó, a. saruba, a. vermelha, andirova, angiroba, camaçari, nandiroba, yandiroba (Braz.).

Cedrela, in a restricted sense, comprises numerous closely related and doubtfully distinct species of medium-sized to

very large and important timber trees occurring in every country south of the United States except Chile. It has its counterpart in the *Toona* of Asia and Australia, a genus so closely related that some botanists merge it with *Cedrela*. The principal distinction is in the way the seeds are winged; there are no fundamental differences in their woods, which are more or less ring-porous, of a pinkish or reddish color, fragrantly scented, soft and easily worked, and highly resistant to decay and insects. Because of their fragrance, *Cedrela* trees and woods are generally known to English-speaking people as Cedar or Spanish Cedar and as Cedro to most Latin Americans. (The name Cedar was originally applied to species of *Cedrus*, a small group of coniferous trees growing in northern Africa and western and southern Asia.)

The first species, *Cedrela odorata* L., was described by Linnaeus in 1759 and was formerly credited with a much wider range than now. It is usually confused with *C. mexicana* Roem., but Alfred Rehder, of Arnold Arboretum, in a letter of May 28, 1937, says: "The two species are very close and, judging from the material in our herbarium, I am doubtful if they are really specifically distinct." The principal species of southern South America is *C. fissilis* Vell. So far as the woods of *Cedrela* are concerned they might well be of a single species, for although they exhibit considerable range in their properties, the differences observed could all be attributed to the age and conditions of growth of individual trees. The wood of young trees, especially of those of very rapid growth in the open, is less fragrant, of lighter color, and softer, though tougher, than that of old forest-grown trees.

In an account of the Peruvian Cedar by F. L. Herrera (*Revista Sudamericana de Botánica* [Montevideo, Urug.] 1: 21–27, 1934) it is stated that two forms of a single species are recognized, namely, Atoc-cedro, 50 to 65 feet high, growing along streams and producing fibrous, light-colored, porous, slightly scented wood, and Cedro Virgen, 80 to 100 feet tall, in hillside forests, supplying reddish, compact, highly resinous timber having a pungent odor, and much more highly valued for making furniture. Similar evidence as to the effect of site on the quality of the timber grown in Ecuador is given by M. Acosta Solís (*Tropical Woods* 57: 2. 1939), who says that Cedro "makes its most rapid growth in sheltered places where the air is very humid, . . . but the wood is too porous and light-colored to suit the furniture industry, particularly for use as veneer. On the other hand, timber produced in drier regions is denser and more deeply colored and therefore is in greater demand and more costly."

Under favorable conditions in the forest *Cedrela* attains stately proportions, often with heights of 100 feet or more and a straight cylindrical bole three to six feet in diameter above the substantial buttresses and free of branches for 40 to 60 feet. The large pinnate leaves have numerous entire leaflets and are deciduous; the small flowers are borne in panicles at or near the ends of the branches; the fruit is a woody capsule, much smaller and thinner-shelled than that of *Swietenia*, opening by five valves and liberating numerous small seeds, each with a papery wing at the lower end. The aromatic astringent bark is used medicinally as a tonic and febrifuge.

Cedrela supplies the most important timber for domestic use in tropical America. It is very easy to work, dries readily without warping or splitting, is strong in proportion to its weight, holds its place well when manufactured, and the better grades are attractive in color, grain, and odor, and are highly durable. The characteristic figure consists of a series of dark lines on a red background, but sometimes the wood is roe-grained and that of buttresses and burls is attractively figured. The denser kinds usually have a golden luster like Mahogany and are suitable for fine furniture and interior trim. Cedro serves almost every purpose for which lumber is needed in the tropics, but the principal use in the United States has been for making cigar boxes, as it was claimed that the volatile oil imparted a desirable aroma to the tobacco. Comparatively few cigars are now packed in Cedar boxes and log imports into northern countries have dwindled to a small fraction of their former volume. The principal defect in the lumber is the presence of too much gum, which may exude and discolor the surface. The tendency of oily vapors to condense on cold surfaces renders the lumber unsuitable for

the lining of cabinets or cases containing glassware or metallic instruments. Loss of a foreign market is not serious for the producing countries, for the available supply of good Cedro timber is scarcely sufficient for their local needs.

Cedrela trees are often planted along streets and sometimes for shade for coffee and cacao, but comparatively few forest plantations have been established and little has been done to assure natural regeneration. The following information regarding the silviculture is condensed from R. C. Marshall's report on his experience with *Cedrela mexicana* in Trinidad (see *Tropical Woods* 27: 25). The tree is at its best on rich, well-drained clay soils of the older territory formations in Trinidad and on igneous soils in Tobago; prefers calcareous soils in sheltered positions on slopes and hills; it is rather exacting in its requirements and highly intolerant of waterlogging. The root system is superficial. It flowers in July, and the fruit ripens the following April or May. Trees in the open bear fruit every year, those in the forest less frequently. Ripe pods should be collected from the tree and placed in the sun to open. Each pod contains about 40 seeds and there are about 16,000 seeds per pound. Germination is usually good, up to 90 per cent or so within a fortnight. From early sowing on good, well-drained soil, with side protection but full light overhead, seedlings attain a height of four feet, sometimes six to eight feet, the first year. Direct seeding is feasible, and sowing in strips two feet wide has given promising results. The seed should be covered lightly, if at all. Seedlings four feet high can be transplanted during the dry season when they are leafless; also at the beginning of the rains, if new growth is trimmed off. Cutting back to within a few inches of the ground has not given good results. Present indications are that Cedar should be grown in mixture with other trees which will give it the necessary side protection, and that an evergreen underwood is necessary to keep the soil in good condition. Natural regeneration is often possible by clearing around seed trees. Cedar does not coppice. Its principal enemy is the shoot borer.

Heartwood pink to red or reddish brown, sometimes with a purplish tinge, fairly uniform in a given specimen; sharply to

rather poorly demarcated from the pinkish to white sapwood. Luster medium to high and golden. Scent and taste distinctive and pleasant; very mild to pronounced. Density greatly variable; sp. gr. (air-dry) 0.37 to 0.75 (*Cedrela salvadorensis* Standl. being the heaviest tested at Yale); weight 23 to 47, av. about 35, lbs. per cu. ft.; texture rather fine and uniform to coarse and uneven; grain usually straight; some specimens are crisp under tools, others tough and fibrous; other properties as indicated previously.

Growth rings distinct; woods more or less ring-porous. Pores medium-sized to large; rather few, except in early wood of distinctly ring-porous specimens; solitary and in small multiples. Rays 1 to 5 cells wide and generally not over 25 cells high; heterogeneous, the marginal tiers low; gum abundant; crystals common; pits to vessels small, though about twice the diameter of those in *Swietenia*. Wood parenchyma coarse-celled; sparingly paratracheal and diffuse; also in distinct concentric bands few to 15 cells wide, usually rather widely spaced and apparently terminal or initial, sometimes crowded together locally; gum abundant; crystals common but not composing whole strands. Wood fibers usually septate; walls thin to thick. Vertical traumatic gum ducts sometimes present in compact peripheral rows; very distinct on longitudinal surfaces, particularly the tangential. Ripple marks absent.

COMMON NAMES: Cedar (cigar-box, Cuban, Jamaican, Spanish, West Indian, etc.), cedrela wood (Eng.); cedro (Span., Port.); cedro caracolillo, c. de ramazón, c. hembra, c. macho (Cuba); c. hembra (P.R.); cèdre (Haiti); acajou amer, a. femelle, a. rouge, cajou senti, cèdre acajou (Fr. W.I.); leli (Curaçao); calicedra, cedro chino, c. colorado, c. fino, c. hembra, c. liso, c. macho, c. oloroso, cobano, cuché, kuché, kuiché, kulché, nogal cimarrón, n. corriente (Mex.); cedro blanco, c. macho (Salv.); cedro real, yalam (Nic.); aluk, cedro amargo, c. blanco, c. colorado, c. cóbano, c. dulce, cóbano, rru-argá, rru-rrugá, rruk, runkrá, táali, tali, tirikrú, tirigú, uara-krá, uluk, uruk (C.R.); c. dulce, c. colorado (Pan.); cedro caoba, c. colorado, c. oloroso, c. real (Col.); cedro amargo, c. dulce (Venez.); red cedar (Br. G.); akkojaarie, akoejallie, ceder, c. hout, cedoe, cedre, kurana, samariehout, semmarie-apo (Sur.); acajou femelle, bois de cèdre, cèdra acajou, c. odorant, cedrel (Fr. G.); cedro colorado (Ec.); atoc-cedro, cedro colorado, c. virgen (Peru); acajú catinga, basákiva, cedro amarello, c. bordado, c. branco, c.

cheiroso, c. da varzea, c. rosa, c. roxo, c. vermelho, uenkutanema, yaporaissib (Braz.); cedro colorado, c. menotti, c. pinta, igary (Par.); cedro de Misiones, c. de Salta, c. obscuro, c. rojo (Arg.).

Guarea lends itself readily to the making of new species and already about 200 have been described. They range in size from shrubs to large trees and are mostly tropical American, though there are several in West Africa. The timber known commercially as Bossé is produced by *G. cedrata* (A. Chev.) Pellegr. (=*Trichilia cedrata* A. Chev.) of the Ivory Coast (see *Tropical Woods* 20: 10–14). Other species with similar wood occur from Liberia to the Belgian Congo.

The numerous American species are of minor importance for timber because of the small size or scarcity of the trees. Best known and most widely distributed is *Guarea trichilioides* L., or *G. guara* (Jacq.) P. Wils., usually a small or medium-sized tree, but sometimes over 100 feet tall, distributed from the West Indies and Central America to Argentina and southern Brazil. The equally pinnate leaves have 4 to 10 pairs of large pellucid-lined leaflets and continue for some time to produce new leaflets at the apex; the small white fragrant flowers are borne in axillary panicles; the fruit is a small globular apically dehiscent capsule with 2 to 4 cells, each containing a single seed inclosed in a scarlet aril. All parts of the tree have a musk-like scent. The powdered bark is used as an emetic and a hemostatic. The timber was formerly employed locally in the West Indies for the same general purposes as Mahogany (*Swietenia*), but the supply was never abundant and is now practically exhausted.

Heartwood pinkish to deep reddish brown; distinct but not sharply demarcated from the thick whitish or brownish sapwood. Luster rather low. Odor and taste very mild or not distinctive in dry specimens. Rather light to moderately heavy; sp. gr. (air-dry) 0.58 to 0.70; weight 36 to 44 lbs. per cu. ft.; texture medium; grain straight; easy to work, finishing very smoothly; is strong for its weight; deeply colored heartwood is durable.

Growth rings poorly defined. Pores small to large, mostly medium-sized; few to fairly numerous; solitary and in small multiples, well distributed.

Vascular pits very small, with coalescent apertures. Rays 1 or 2, occasionally 3, cells wide and few to 35 cells high; homogeneous to more or less heterogeneous; pits to vessels very small. Wood parenchyma abundant, suggesting certain Leguminosae; paratracheal and confluent into irregular bands of variable length and width, producing fine pattern on tangential surface; marginal crystalliferous strands often present. Wood fibers septate; pits small. Ripple marks absent. No gum ducts seen.

COMMON NAMES: *Guarea trichilioides:* Alligator wood, musk wood, wild akee (Jam.); guaragáo, yamagua, y. colorado, yamáo (Cuba); guaraguáo (P.R.); cabilma, cabirma (Dom. R.); bois rouge (Haiti); bois à balles, b. balle, b. pistolet, b. rouge de Dominique, pistolet (Fr. W. I.); bailador, bilibili, guanco, mestizo, trompete, trompillo, zambo-cedro (Col.); trompillo, trompito (Venez.); carababalli (Br. G.); bois balle, guaré (Fr. G.); latapi, l. caspi, requía (Peru); açafroa, bilreiro, camboatá, cangerana miúda, carrapeta, c. verdadeira, cedrão, cedro branco, c. rana, cedrohy, cedro-y, gitó, guaré, jatuaúba, j. branca, jitó, macaqueiro, marinheiro, pau bala, p. de sabão, taúva, yaguá ratai (Braz.); comboatá, c. blanco (Arg.). *Other species:* Guaraguadillo (P.R.); cedrillo, c. cimarrón, chichón de montana, chohalaté, guaraguao, nochocche, ocotillo blanco, trementino (Mex.); cramantee (Br. H.); cedrillo (Guat.); carbón (Hond.); quitacalzón (Salv.); prontolivia (Nic.); campano, caoba, cocora, sota-caballo, turubúk (C.R.); dorita, mamecillo blanco (Pan.); guacharaco de terra fria, guamo blanco, g. cimarrón, tigre (Col.); cabimbo, caóbano, cedrillo horcón, hojiancho, tortolito (Venez.); kufiballi (Br. G.); gomma, g. hout, jarre-ewé, joekoetoena, karaballi, kodjo oedoe, koejakè fehoeta, saffeka, siwaroewa (Sur.); paujil-ruru (Peru); trompillo del monte (Bol.); ataúba, camboatá, café branco, calcanhar de cotia, carrapeta, cayrana, cedrilho, ciricó, jatuaúba, j. preta, macaqueiro, marinheiro, pieto do pombo, tuaiussú, utuapoca (Braz.); cedrillo, guaimiré (Par.); cedrillo, c. blanco, guaimi-piré, guaré (Arg.).

Swietenia, the source of the original or true Mahogany, the premier cabinetwood of the world, occurs in southern Florida, the West Indies, Mexico, Central America, Colombia, Venezuela, and the upper Amazonian region. The leaves, which usually are evenly pinnate, have 2 to 6 pairs of leaflets; the small whitish or greenish flowers are borne in axillary pani-

cles; the fruit is an ovoid 5-valved capsule, 2 to 6 inches long, with a thick woody exocarp and much thinner leathery endocarp, the valves and seeds eventually falling away and leaving a 5-winged receptacle; the numerous seeds are imbricate in two rows in each cell and have a more or less quadrangular body and a terminal oblong wing.

The genus was described by Jacquin in 1760, and his single species, *Swietenia mahagoni*, was based on plate 81 in the second volume of Catesby's *Natural History of Carolina* which shows the fruit, leaves, and some withered flowers of a tree in the Bahamas. This was not the first binomial for the tree, however, as Linnaeus, the year before, had made the same illustration the basis for the name *Cedrela mahagoni*. About 1836, a second species, *S. humilis*, was described by Zuccarini from specimens collected in southwestern Mexico. It is distinguished chiefly by the fact that the leaflets are nearly sessile instead of having distinct petiolules, and the seeds are light brown instead of dark brown. A third species, *S. macrophylla* King, described in 1886, was based on trees grown in the Botanic Garden at Calcutta, India, from seeds reputedly from Honduras. It is distinguished from *S. mahagoni* by its appreciably larger leaves, flowers, fruits, and seeds. The first two species are of slower growth and have denser wood than *S. macrophylla*. These three species are fairly distinct and can be assigned definite ranges, namely, *S. mahagoni*, in the West Indies and southern Florida; *S. humilis*, in dry places along the Pacific Coast from southwestern Mexico to Costa Rica; *S. macrophylla*, in regions of abundant rainfall from the Yucatan Peninsula through Central America into Colombia and Venezuela, and also in Peru and extreme western Brazil.

Swietenia humilis is of very little commercial importance. A form of it, *S. cirrhata* Blake, was described by S. F. Blake (*Journ. Wash. Acad.* 10: 286. 1920) as a distinct species, but Standley says (*Tropical Woods* 21: 6: March 1930): "Blake, although admitting that their ranges overlapped, divided the Pacific Coast Mahogany into two species, chiefly on differences in the size of the leaflets, obviously not a character of great weight in distinguishing units. It was suggested, also, that the leaflets of *S. cirrhata* had longer and more slender

cusps than those of *S. humilis*. This, I think, is a matter of accident. In the young leaves the cusps are very long, but they are also fragile and soon are broken off by the wind. . . . One is forced to the conclusion that only a single species is represented and that we must regard the Mexican and Central American Mahoganies as referable to only two species, *S. macrophylla* of the Atlantic coast and *S. humilis* of the Pacific slope."

Three South American species of *Swietenia* have been proposed, but each has been based on specimens from a single tree and, for all practical purposes at least, may be considered mere forms of *S. macrophylla*. The first, a Venezuelan tree, was named *Swietenia Candollei* by Pittier in 1920, but in 1921 (*Bol. Com. & Ind.* 18: 585) he admits the inadequacy of his material and states that the only thing that may be affirmed at present is that the genus contains three fundamental types represented respectively by *S. mahagoni*, *S. humilis*, and *S. macrophylla*.

The rediscovery of Mahogany in the upper Amazon region in 1923 was followed by the description of two supposedly new species. *Swietenia Tessmannii* Harms (*Notizbl. Bot. Gart. Berlin-Dahlem* 10: 180. 1927) had as its basis some specimens from Yarina Cocha on the middle Ucayali and is distinguished by its author from *S. macrophylla* by the longer leaflet-petioles and the looser inflorescence. Macbride says (*Tropical Woods* 16: 50. December 1928): "It seems to me that the characters relied upon to separate these species [*S. Tessmannii*, *S. Candollei*, and *S. macrophylla*] are not convincing and not unlikely may prove to be relative in nature and valueless for purposes of classification." Equally unconvincing are the features distinguishing *S. Krukovii* Gleason & Panshin (*Am. Jour. Bot.* 23: 21. 1926), for the diagnosis is concerned chiefly with the size and shape of the upper two pairs of leaflets from a single specimen.

The original scientific discovery of Peruvian Mahogany was made in 1784 by Hipólito Ruiz, the eminent Spanish naturalist who was in charge of a botanical expedition to Peru and Chile during the years 1777–1788. In his account of the many plants found near Pozuzo, in the region drained by

the Río Pachita, a tributary of the Ucayali, appears a brief note on *Swietenia macrocarpa*, a tall tree with a large trunk and valuable wood" (see *Bot. Ser. Field Mus.* 21: 177. 1940). The next reference was in 1878, when Alphonse de Candolle (*Monographiae Phanerogamarum* 1: 723) identified as *Swietenia Mahagoni* ("*Mahogani*") the specimens collected by Ruiz 94 years earlier. The determination of the Peruvian species as *S. macrophylla* was made by S. F. Blake, at first tentatively on the basis of leaf specimens obtained at my suggestion by Georges H. Barrel, President of the Aguna Mahogany and Timber Company of Boston, on the Río Itaya, some 50 miles from its confluence with the upper Amazon (see *Tropical Woods* 6: 1. 1926). Two years later Blake wrote (*Tropical Woods* 14: 33): "This identification is now confirmed by the receipt of a nearly complete pod containing seeds, with portions of another, collected by Nanay, Río Amazonas, Peru, for Professor Record under direction of Mr. Barrel. . . . De Candolle's record undoubtedly belongs to the same species."

It should not be inferred from the foregoing discussion that the wood of *Swietenia macrophylla* is uniform throughout its wide distribution. On the contrary there is much variation in appearance, density, texture, and technical properties. The differences, however, which occur throughout the entire range are not appreciably greater than can be found within the boundaries of one small country, such as British Honduras and are therefore attributable to site and conditions of growth rather than to differences in species. For commercial purposes *Swietenia humilis* Zucc. can be practically ignored, and all of the Mahogany of continental North and South America can be considered as of one botanical species, *Swietenia macrophylla* King. Whether observed differences in the timber can be correlated with botanical varieties, forms, or races remains to be determined.

Mahogany is the most valuable timber tree in tropical America. Its use by European colonists and explorers dates back at least to the sixteenth century. According to George N. Lamb (*The Mahogany Book*, 2nd ed., pp. 8–10), "the earliest surviving use of Mahogany is that of a rough-hewn cross

preserved in the Cathedral of St. Domingo and bearing the legend: 'This is the first sign planted in the center of this field to mark the beginning of this magnificent temple in the year 1514.' The cathedral, completed in 1550, has much carved Mahogany woodwork, some of it considered the finest in the world, still in splendid condition after nearly four centuries in the tropics. Mahogany was early established as a ship-building wood and Cortez used it for the construction of ships for further voyages of discovery. . . . The first known European use of Mahogany was in the Escorial begun by Philip II of Spain in 1563 and completed in 1584. . . . The earliest use of Mahogany known in England was in Nottingham castle built in 1680."

No one knows when Mahogany was first introduced into England, but it was probably used in shipbuilding long before it became fashionable for furniture, its identity concealed under the non-distinctive name of Cedar. In an account of the trees of Bermuda about 1619 (see *The World Displayed*, London, 1760, Vol. 4, Chap. 12), the native Cedar is described as "firmer and more durable than any of its kind we are acquainted with and answers in every respect to Oak timber. It is therefore used in shipbuilding." Certain rooms in Nottingham castle were wainscoted and floored in 1680 with "Cedar wood," as shown by the original bill for the timber, but contemporary evidence of the hardness and beauty of the woodwork leaves no room for doubt that the wood was Mahogany. It was probably to avoid the confusion with other kinds of Cedar (*Cedrela* and *Juniperus*) that the English settlers began to use the name Mahogany, presumably a term of native origin. Its first recorded use is as "Mohogeny" in Ogilby's *America*, in 1671. Various spellings were subsequently used—Mohogony, Mohogany, Muhagnee, Mehogeny, Mehogenny, Mahagoni, Mahoginy, and Mahogany—the last mentioned appearing for the first time about 1724. The French name for Mahogany is Acajou, and this apparently owes its origin to the early practice of coating the ends of the logs with resin from the Acajou or Cashew tree (*Anacardium occidentale* L.).

The earliest mention of Mahogany ("Mohagony wood")

in an English newspaper appears to be in an advertisement in the *London Gazette*, February 22 to 25, 1702, regarding the sale of the cargoes of two prize ships. The first reference in the statistics of imports filed at the Public Records Office is for the year "Xmas 1699 to Xmas 1700" and pertains to a small lot of "Mohogony wood" from Jamaica. In an authoritative paper on *Early Imports of Mahogany for Furniture* (*The Connoisseur* [London] October and December 1934), R. W. Symonds says:

"Taking into consideration all the available evidence, I think it is permissible to state that Mahogany was employed in England from 1715 onwards for the making of tables, sometimes of gate-legged construction, but usually with straight round legs terminating in club feet or with the plain cabriole-shaped legs. Tables such as these were made in considerable numbers by many firms of London joiners and cabinet-makers and also by provincial furniture makers who lived in towns where a supply of imported Mahogany was available. Previous to 1715, Mahogany tables were only made sporadically owing to the cabinet-makers not being able to obtain a regular supply of the wood. . . .

"Mahogany overcame the difficulty of making table tops, owing to the large widths of the planks of this wood in comparison to Walnut. It was for this reason that Mahogany became at once popular with cabinet-makers. On its introduction, numerous new types of tables were designed, the construction of which would not have been possible in Walnut. These tables were not only made for the wealthy classes, but large numbers were produced of a plain character for the less well-to-do householder. Evidence in support of this last statement is to be found in the very large quantity of flap and tripod tables of a plain design that have survived. The number of the latter, however, has considerably decreased within recent years owing to the obnoxious habit of the furniture faker of carving up the plain example so that he can pass it off to the unwary collector, at a high rate of profit, as a period piece with the claw-and-ball feet. . . .

"It would appear from the contemporary information, cited from the statistics of imports, Sheraton's *Cabinet Dictionary*, and the *History of Jamaica*, that the first Mahogany to be imported into England in the early eighteenth century was Jamaican and, afterwards, Cuban. In the third quarter of the same century, Honduras Mahogany was imported. The reason for the cessation of any particular variety of Mahogany was because the trees near the coast having been felled, the traders sought another supply which was cheaper, owing to its being more easily porcurable. It was not so much a question of seeking wood of fine quality, otherwise exporters would have gone to the trouble and expense of transporting the better quality timber from the interior."

The following description of the Mahogany tree and of the different kinds of its timber appears in the *History of Jamaica*, 1774. "This graceful and valuable tree, which furnishes a constant share toward the annual exports from the island, grew formerly in great abundance along the coast; but, having been almost exterminated from those parts in process of time, it is at present found chiefly in the woodland, mountainous recesses, where vast quantities of it still remain, particularly in the uncultivated districts of Clarendon, and the leeward parishes. It thrives in most soils, but varies in its grain and texture. What grows in rocky ground is of small diameter, but proportionally of closer grain, heavier weight, and more beautifully veined. What is produced in low, rich, and moist lands is larger in dimensions, more light and porous, and of a paler complexion. This constitutes the difference between the Jamaica wood and that which is collected from the coast of Cuba and the Spanish Main; the former is mostly found on rocky eminences; the latter is cut in swampy soils, near the seacoast. The superior value of the Jamaica wood, for beauty of coloring, firmness, and durability, may therefore be easily accounted for; but, as a large quantity of balks and planks is brought from the Spanish American coasts to this island, to be shipped from thence to Great Britain, the dealers are apt to confound all under the name of Jamaica wood, which in some measure hurts the credit of this staple production. The tree grows tall and straight, rising often sixty feet from the spur to the limbs; the foliage is a beautiful deep green; and the appearance, made by the whole tree, so

elegant, that none would be more ornamental for an avenue or to decorate a plantation. It generally bears a great number of *capsulae* in the season. The flowers are of a reddish or saffron color; and the fruit, of an oval form, about the size of a turkey's egg. It is easily propagated from the seeds and grows rapidly. Some of them have reached to a monstrous size, exceeding one hundred feet in height, and proportionably bulky. One was cut, a few years since, in St. Elizabeth's, which measured twelve feet in diameter, and cleared to the proprietor about £500 currency. . . . We may imagine the plenty of it in former times here when it used to be cut up for beams, joists, plank, and even shingles. But it is now grown scarce within ten or twelve miles from the seacoast, and must every year become still scarcer, and consequently dearer, unless nurseries, or plantations, are formed of it in places where the carriage is more convenient for the market.

"In felling these trees, the most beautiful part is commonly left behind. The Negro workmen raise a scaffolding, of four or five feet elevation above the ground, and hack off the trunk, which they cut up into balks. The part below, extending to the root, is not only of the largest diameter, but of closer texture than the other parts, most elegantly diversified with shades or clouds, or dotted, like ermine, with black spots; it takes the highest polish, with a singular lustre, so firm as even to reflect objects like a mirror. This part is only to be come at by digging below the spur to the depth of two or three feet and cutting it through; which is so laborious an operation that few attempt it, except they are uncommonly curious in their choice of the wood, or to serve a particular order. Yet I apprehend it might be found to answer the trouble and expense, if sent for a trial to the British market, as it could not fail of being approved of beyond any other wood, or even tortoise-shell which it most resembles."

Sheraton gives an account of Jamaican Mahogany in his *Cabinet Dictionary* (1803), and is chiefly concerned with three types, designated as Cuba, Spanish, and Honduras Mahogany. Cuba wood is "a kind of Mahogany somewhat harder than Honduras wood, but with no figure in the grain. It is inferior to Spanish wood, through probably the Cuba and

Spanish Mahogany are the same, as the island of Cuba is a Spanish colony. . . . That, however, which is generally distinguished by Spanish Mahogany is finer than that called Cuba, which is pale, straight-grained, and some of it only a bastard kind of Mahogany. It is generally used for chair wood, for which some of it will do very well." Regarding the Honduras variety, he says: "From this province is imported the principal kind of Mahogany in use amongst cabinet-makers, which generally bears the name of Honduras Mahogany, and sometimes Bay-wood, from the bay or arm of the sea which runs up to it. The difference between Honduras and Spanish wood is easily perceived by judges, but not by others unskilled in wood. The marks of the former are, as to size, its length and width, which generally run much more than in the latter wood. . . . The grain of Honduras wood is of a different quality from that of Cuba, which is close and hard, without black speckles, and of a rosy hue, and sometimes strongly figured; but Honduras wood is of an open nature, with black or grey spots, and frequently of a more flashy figure than Spanish. The best quality of Honduras wood is known by its being free from chalky and black speckles, and when the color is inclined to a dark gold hue. The common sort of it looks brisk at a distance and of a lively pale red, but, on close inspection, is of an open and close grain, and of a spongy appearance."

There have been various changes in the Mahogany industry since Sheraton's time, but the qualities of the timber and the reasons given for the differences remain about the same. The West Indian trade has greatly diminished, but commercial lots of logs are still exported from Cuba and the Dominican Republic and have an important place in the furniture trade. The use of tractors in Central America has made possible the logging of timber which previously was considered inaccessible, thereby adding materially to the area of merchantable forest, especially in the British Honduras region.

The comparatively recent discovery of commercial quantities of *Swietenia* in the upper Amazon region is of great importance to the industry, as it opens up a vast, though still undetermined, area of virgin forest containing Mahogany.

For the circumstances attending this discovery and the initial development of the trade the author is indebted to J. W. Massey, agent at Iquitos, Peru, for Booth & Company, Ltd., of London. He says that in 1921, when business was poor and shippers at Iquitos were looking for new articles to export, the firm of Israel & Company, Ltd., made a trial shipment of several kinds of hardwood logs to W. R. Grace & Company, New York. The results were disappointing, as the manufacturers reported that most of the woods were too difficult to saw. Some time later, while looking over some of the logs in a storage yard, Arthur Rushforth, a timber buyer, came across several that appeared to him to be genuine Mahogany. Upon learning their source, he went to Iquitos in June 1923 to investigate. He found that a shipment of 300 logs, believed to be Andiroba (*Carapa*), had been made three weeks before his arrival to C. Hernanadez e Hijos in Hamburg. A second lot of 250 tons, originally intended for the same destination, was purchased by Mr. Rushforth and consigned to New York as Andiroba. The true identity of the wood was subsequently established and commercial exploitation begun in 1924.

The known and probable distribution of Mahogany in South America is approximately as follows: In Venezuela, it extends from eastern Miranda westward to Calabozo and Guanare, thence around the northern end of Cordillera Merida to the Lake Maracaibo region, avoiding the dry coastal zone and elevations above 3000 feet (see *La Caoba Venezolana* by Pittier and Record, Caracas, 1921, p. 11). In Colombia, it is mostly in the upper valleys of the Magdalena and Cauca Rivers. According to M. Acosta Solís (*Tropical Woods* 60: 52), *Swietenia* is a component of the virgin forests in northwestern Ecuador. In Peru, Mahogany occurs east of the divide at elevations of 400 to 4500 feet and is in a belt of forest varying in width up to several hundred miles and extending from southern Ecuador through the Ucayali basin to the headwaters of the Tambo and Urubamba Rivers in the south (see *Tropical Woods* 30: 31). Eastward across the border in Brazil, there are commercial stands of Mahogany in the upper reaches of the Jarua and Purus Rivers, and large quantities of logs are floated down to Manáos for export either in the round or after manufacture into lumber. D. H. Allen, President of the Otis Astoria Corporation, New York City, writes that there are indications of a separate Mahogany timber belt of unknown extent along certain tributaries of the upper Madeira River in eastern Bolivia. He adds that apparently there is no genuine Mahogany in any part of the basins of the Rio Negro and Putumayo, or in the lower portions of the Jurua and Purus, or below the falls of the Madeira. The reputed discovery above the waterfalls of the Tapajoz and Xingu Rivers of old Indian canoes made of Mahogany implies an extension of the Bolivian belt across Matto Grosso, Brazil. While from the foregoing it appears that only fragmentary knowledge of the range of *Swietenia* in South America exists, enough is known to reassure anyone who fears that the supply of genuine, first-growth Mahogany timber is nearing exhaustion.

Little systematic effort is being made to provide for a future supply of the timber except in British Honduras where silviculture of Mahogany has been under way since the appointment of a Conservator of Forests in 1922. Three methods are being employed: (*a*) Underbrushing through the selected area to favor existing regeneration and to form a seeding felling. (*b*) Favoring existing regeneration in cut-over areas by following up the Mahogany operation and improving, by underbrushing, the regeneration occurring around the stumps. It was found that while regeneration is usually abundant around stumps during the first two years after the felling of the trees, it rapidly disappears thereafter as a result of competition in the bush. The abundant regeneration is thus saved by improvement during the first two years after the exploitation of the area, and the old trees are replaced by a large stock of seedlings which have every chance of coming to maturity. (*c*) "Taungya," or the planting of shifting-cultivation areas with Mahogany. This has been inaugurated among the Maya Indians of the south with excellent results. The natives do all the seed collecting, nursery work, and transplanting of seedlings and receive free rent of their land in return. The first method is intensive and can be used on small estates for the

establishment of a dense stock of Mahogany. The second is extensive and serves to replace the former Mahogany stock by large groups of regeneration over wide areas; the stock is not only replaced but greatly increased. The third converts worthless second-growth forest into blocks of what eventually will be almost pure stands of Mahogany.

In his notes on the silviculture of Trinidad trees (see *Tropical Woods* 27: 28), R. C. Marshall gives the following information regarding the two principal species of *Swietenia.* Honduras Mahogany, *S. macrophylla*, is a virtually evergreen tree, not very exacting as to soil condition and able to grow in fairly moist sites. The flowers appear in the rainy season, and the fruit ripens in the dry season. Germination is good and seedling growth is rapid. The seedlings are taprooted but are readily transplanted. Young trees are fairly tolerant of shade, but conditions for optimum growth call for full overhead light combined with side protection. It is too subject to disease and insect attack to be generally recommended for planting in Trinidad and pure crops of it should be avoided. It does not coppice well and young trees are rather sensitive to mechanical injury. As for West Indian Mahogany, *S. mahagoni*, which is believed not to be indigenous to Trinidad or Tobago, he says: "Trees in adjoining plots at St. Clair, aged approximately 30 years, gave an average girth of just over two feet for West Indian Mahogany, compared with over three feet for the Honduras variety. The height growth also was proportionately less. Owing to its slower rate of growth it has been but little planted of recent years and practically no information is available as to its silvicultural requirements. Information is needed as to whether it suffers as badly from disease as the faster-growing variety. If not, it may yet come into prominence."

Heartwood reddish, pinkish, salmon-colored, or yellowish when fresh, deepening with age to deep rich red or brown; surface of newly sawed lumber turns dark red upon exposure to the sun; sapwood yellowish or nearly colorless. Luster typically high, golden. Odor and taste absent or not distinctive. Variable in density from rather light, soft, and tough to heavy, hard, and brittle; sp. gr. (air-dry) 0.40 to 0.85; mostly

between 0.50 to 0.60 for *S. macrophylla;* weight 25 to 53 lbs. per cu. ft.; texture rather fine to coarse; grain straight to roey, wavy, or curly, often producing highly attractive figure; technical properties high to excellent.

Growth rings distinct, due to parenchyma bands. Pores medium-sized to large, readily visible; few to fairly numerous; solitary and in small radial multiples, evenly distributed. Vessels with dark gum plugs and sometimes, particularly in dense specimens, with white deposits; pits minute. Rays 1 to 5 cells wide and usually between 15 and 20 cells high, sometimes vertically fused; heterogeneous, with single marginal rows of square or irregularly upright cells; ray-vessel pitting very fine, sometimes unilaterally compound. Wood parenchyma in distinct concentric bands, usually widely spaced and apparently demarcating seasonal growths; also sparingly paratracheal and diffuse: crystals sometimes present. Wood fibers septate; walls thin to thick; pits very small. Ripple marks usually present; all elements storied; 45 to 55 per inch; uniform to very irregular. Vertical traumatic gum ducts occasionally present in compact peripheral row and filled with dark red gum; very distinct on longitudinal surfaces, particularly the tangential.

COMMON NAMES: Mahogany—Cuban, Honduras, Mexican, Panama, Peruvian, Spanish, West Indian, etc. (Eng., trade); caoba (Span., general); acajou (Fr.); mogno (Port.); mogano (Ital.); mahonie (Dutch); madeira, redwood (Florida, Bah.); caobilla, caoba de caracolillo, c. de clavo, c. de ramazón, c. hembra, c. lisa, c. macho (Cuba); chiculte, cóbano, flor de venadillo, gateado, palo zopilote, punab, rosadillo, tzopilotl, venadillo, zopilocuahuitl, zopilote, z. colorado, z. negro, zopilotl, zopilozontecomacuahuitl (Mex.); orura (Venez.) aguano (Peru).

Trichilia is closely related to *Guarea* and comprises over 200 species of shrubs and small to large trees widely distributed throughout tropical America and sparingly in western Africa and Madagascar. The leaves are commonly odd-pinnate, sometimes digitately compound or reduced to a single leaflet (*e.g., T. Karstenii* C. DC. = *Odontandra Karstenii* Tr. & Pl.), the leaflets entire or spiny-toothed and frequently with pellucid dots; the small greenish or yellowish flowers are borne in terminal or axillary panicles; the fruit is generally a small 3-valved, 3-seeded capsule, each cell containing a single seed surrounded by a red and showy aril.

The best known tree of the genus in central and southern Brazil and Argentina is the Catiguá, typified by *Trichilia*

catigua A. Juss. It is usually less than 45 feet high, with a short trunk rarely over 20 inches in diameter. The bark is the source of tannin, dyestuff, and ingredients of insecticides and medicines. The reddish or flesh-colored wood is moderately hard, easy to work, and used for about the same purposes as Birch (*Betula*) in northern countries.

The largest known representative of this genus is the Brazilian Pimentiera or Pau Rosa Branca, *Trichilia alta* Blake. H. M. Curran, who was the first to collect it, says: "This is a common tree of the Bahia coast forest where it grows in association with Jequitibá (*Couratari*), Pau d'Alho (*Gallesia*), Araça de Agua (*Terminalia*), etc. It occurs singly or in small groups, never in pure stands. Heights of 125 feet and diameters up to three feet are common, while the clear lengths are usually 40 to 50 feet. The trunks are of good timber form and have a thin black or slate-gray bark. The wood is not durable in contact with the ground and is little used, being probably unknown in the local markets. Tests made in the United States prove that it machines well, does not warp or check badly, and has good possibilities for flooring and as a substitute for Hickory." Tests on the mechanical properties made at the University of Michigan gave the following results: Sp. gr. (oven-dry) 0.71; weight (8.6 per cent moisture), 48.7 lbs. per cu. ft. Crushing strength parallel to grain, 7770 lbs. per sq. in. Bending: Modulus of elasticity, 1,840,750 lbs. per sq. in.; fiber stress at elastic limit, 11,990 lbs. per cu. in.

The Pracuúba da Terra Firme of Amazonian Brazil, *Trichilia LeCointei* Ducke, is described (*Arch. Jard. Bot. Rio de Janeiro* 3: 192) as a medium-sized to large tree, with a fine-textured, hard and compact, mildly scented timber susceptible of a high polish. Freshly felled wood is pinkish throughout but, upon drying, the heartwood deepens in color to bright reddish brown, very distinct from the sapwood. The timber is employed locally in construction and for the hafts of harpoons.

There are numerous species in northern South America, the West Indies, Mexico, and Central America, the two with the greatest range being *Trichilia havanensis* Jacq. and *T. birta* L. The timber is utilized in a small way for tool handles,

broomsticks, and interior construction. They are not likely to contribute to the export trade.

Heartwood mostly light reddish brown; distinct but not always sharply demarcated from the thick whitish or roseate sapwood; color of both becoming darker upon exposure. Luster medium. Odor and taste absent or not distinctive in dry material. Density widely variable; sp. gr. (air-dry) 0.55 to 0.80; weight 34 to 50 lbs. per cu. ft.; texture mostly medium; grain generally straight; working properties fair to good; durability rather low.

Growth rings usually poorly defined. Pores small to medium-sized; fairly numerous; solitary and in small multiples, well distributed. Rays uniseriate or locally biseriate; few to 30 cells high; homogeneous to more or less heterogeneous; pits to vessels very small. Wood parenchyma in numerous, unevenly spaced, fine, wavy, continuous or broken tangential or concentric lines or narrow bands in contact with one side of the pores or independent of them; sometimes terminal; crystalliferous strands common. Wood fibers not septate; walls medium to thick; pits very small. Ripple marks absent. No gum ducts seen. *Trichilia* differs from *Guarea* in having non-septate fibers and in the abundance and arrangement of parenchyma.

COMMON NAMES: Bariaco, cabo de hacha, guabán, jujubán, siguaraya (Cuba); broomstick, cabo de hacha, caracolillo, gaeta, guaita, guayavacón, jobillo, molinillo, palo de Anastasio, ramoncillo, retamo (P.R.); almendrillo, chicharrón (Dom. R.); bois arada, b. diou marron, dombou, Marie Jeanne, mombin bâtard (Haiti); acurel, obi (Trin.); cabo de hacha, cauache, choben-ché, cucharillo, estribillo, garbancillo, garrapatilla, ichbabach, ixbahach, kulimziz, limoncillo, xkulinsis, xpukusikil (Mex.); bastard lime, red cedar, sisím (Br.H.); barrehorno, limoncillo (Hond.); barredero, barrehorno, canelillo, canjuro, cedrillo, cola de pavo, jocotillo, ojo de muñeca, pimientillo (Salv.); matapiojo (Nic.); cedro cóbano, c. dulce, c. macho, urruca (C.R.); alfaje, alfajillo (Pan.); affaja, bagre, mangle blanco, m. dulce, manglesito, yayo, y. blanco, y. colorado (Col.); canalete, cazabito, cedrillo, cerezo macho, hayo blanco, marfil, mata-pollos, pan de trigo, pata de paloma (Venez.); ulu (Br. G.); caá-tigoa, camboatá, carrapeta, catiguá, c. graúdo, c. miúdo (Braz.); caá-vorobei, catiguá, c. blanca, c. colorado, c. puita, fe de gozo, guamirí, guatambú-y, mangacitara, palo anis, tapé-riguá (Arg.).

CURRENT LITERATURE

The woodlands of Bermuda. By J. S. BEARD. *Empire Forestry Journal* 19: 2: 258–263; 1 plate; July 1940.

A general account of the Bermuda islands, their climate, topography, soil, and other environmental factors, with observations on the tree floras and plant communities.

Sub-tropical maritime woodland is under the direct influence of the sea. Salt spray is carried up over the hills by gales and the vegetation has to bear constant desiccating sea winds. "This type occupies all well-drained land which has not been cleared for cultivation, pasture, or other purposes and is, therefore, confined to the areas of gray soil, poor dry rocky hillsides. The woodland takes the form of an almost pure stand of Cedar (*Juniperus bermudiana*) and may, therefore, be called the Cedar consociation. The abundance of Cedar is remarkable, flourishing as it does in masses all over the islands literally down to the water's edge. The well-wooded appearance of the islands seen from the sea is most striking. All man's activities through three centuries have not materially succeeded in reducing the tree in numbers and it comes up readily everywhere in gardens and waste ground. The tree has the usual habit and appearance of arborescent *Juniperus* species. The juvenile leaf-form is distinct from the adult. It flowers in March and berries are ripe in September. It does not coppice. In height and rate of growth the tree varies very considerably according to site. It is difficult to obtain any statistics of rate of growth, but the average annual ring-width appears to be about 1/16 of an inch and the height growth correspondingly slow. In the more favorable sites mature trees may attain 40 or 50 feet in height, but in exposed sites by the sea they will never be more than shrubs. The tree lives to a great age on inland sites and ancient trees may attain considerable girths, six feet or more, but the bole is always tapered and branchy. The sapwood is relatively narrow and yellow. The heartwood is a dark red-brown and so durable as to be reputedly everlasting. The wood has a very strong odor, similar to that of Western Red Cedar (*Thuja*), but more pronounced, a quality which gave the tree its name.

"The woodland is in form a fairly open stand of timber with grass or shrubs beneath. The Cedars have very thin crowns and cast little shade. Along the north shore and on the many islands of the Great Sound the Cedar grows practically pure, with only grass beneath. Elsewhere, associated species are found which may distinguish two sub-types, Cedar-Bay Grape along the south shore, and Cedar-Fiddlewood on the general inland sites. . . .

"The Cedar is now the only tree (other than fruit trees) on the islands yielding useful products, the utilization of Palmetto leaves for thatch, basket weaving, etc., having died out. The Cedar timber is highly prized for its aromatic qualities and great durability. At one time it was used for all joinery, buildings, and other woodwork in the Colony, including shipbuilding. Quite a fleet of locally built Cedar vessels was formerly maintained. Today, with cheap lumber easily imported from the United States and Canada, demand has declined since Cedar is always short-boled, branchy, and of small size in the log, not being a good proposition as a timber tree. It is, however, still in demand for certain kinds of joinery, for furniture and wood-carving and to some extent for firewood. It continues to command a good price. Cedar regenerates quite freely and is in no danger of being overcut and following the fate of the Yellow-wood. It could in fact stand a considerably heavier demand than the present one in spite of its slow growth.

"No attempt is being made in Bermuda to grow timber trees, either Cedar or other species. Cedar is allowed to come up naturally and if any Mahoganies or other foreign timber trees are put in, the intention is solely planting for ornament. The growth of Cedar is so slow that a timber plantation would be a doubtfully economic proposition; further, the islands are so small and have so heavy a population that land for this purpose could probably ill be spared. There do not appear to be any dangers in the present policy of relying upon imports for timber."

The Caribbean Forester. Pub. quarterly by Tropical Forest Exp. Sta., U.S.F.S. Río Piedras, Puerto Rico. Vol. II: 1, 2; 1–99; October 1940, January 1941.

CONTENTS OF No. 1.

CONTENTS OF No. 2.

New phanerogams from Mexico. IV. By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* 22: 1: 110–124; January 1941.

Descriptions of several new species and two new genera of herbs and shrubs in various families.

Studies in the Theaceae. VI. The genus *Symplococarpon* Airy-Shaw. By CLARENCE E. KOBUSKI. *Journ. Arnold Aboretum* 22: 2: 188–196; April 1941.

"In 1936, Bullock described a new species of *Eurya* from Mexico and gave it the name *Eurya Hintoni* after the collector, G. B. Hinton. The following year Airy-Shaw described a new genus, *Symplococarpon*, based upon *Eurya Hintoni* Bullock and three additional Hinton specimens from Mexico, the type species being *Symplococarpon Hintoni* (Bullock) Airy-Shaw. This outstanding new genus is characterized by an inferior or nearly inferior ovary, fruit resembling that of the genus *Symplocos*, and persistent bracteoles. Its nearest relative in the Theaceae is the genus *Cleyera*, with which it agrees in the arborescent habit, foliage, fasciculate long-pedicelled flowers, and anther structure."

The present paper contains additional generic information and an account of six species, four of which are described as new. Two of the new species are native to Costa Rica and one to Panama. All are small trees except *Symplococarpon multiflorum* Kobuski, which is said to attain a height of 75 feet and a basal diameter of three feet at an elevation of 1700 m. in the region of Zarcero, Costa Rica.

Caldasia. Edited by ARMANDO DUGAND, Director del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia, Bogotá. No. 1, Dec. 20, 1940. Pp. 88; 6¾ x 9½; 4 plates, 9 text figs.

This new series of scientific publications is named in honor of the noted Colombian naturalist and physicist, Francisco José de Caldas, 1771–1816. The editor, Armando Dugand, is well known to readers of *Tropical Woods* for his contributions to the knowledge of the tree flora of northern Colombia while a resident of Barranquilla. His particular botanical interests now are in the palms and the various species of *Ficus* and *Capparis*. The different numbers of *Caldasia* will be issued at irregular intervals and will contain papers on Colombian botany, geobotany, phytopathology, entomology, ornithology, and, eventually, geology and meteorology.

CONTENTS OF No. 1.

A comparative study of the wood structure of several South American species of *Strychnos*. By ROBERT A. COCKRELL. *Am. Journ. Bot.* 28: 1: 32–41; 2 plates; January 1941.

"The wood anatomy of 26 species of *Strychnos* obtained from tropical America was studied to ascertain if consistent structural differences existed that would permit of their identification. Detailed descriptions and numerical data were presented and the distinctive features of those species that could be identified on this basis were pointed out. Many of the species were so similar that it was impossible to formulate any reliable scheme for their identification."—*Author's summary.*

Lauraceas aromaticas da Amazonia brasileira. By ADOLPHO DUCKE. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 55–65; 10 plates.

The substance of this paper was published in *Tropical Woods* 60: 1–10, Dec. 1, 1939. The value of the contribution is enhanced by the reproductions of photographs of herbarium specimens of the principal species under consideration.

O genero *Mouriria* Aubl. na Amazonia brasileira. By ADOLPHO DUCKE. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 67–74.

An account of the 18 species of *Mouriria* known to occur in the Brazilian Amazon region. One, *M. collocarpa* Ducke, is described as new. They are small, medium-sized, or large trees for which the common local designations are Miraúba or Muraúba or, particularly in the lower Amazon, Socoró.

Apreçiacões sistemáticas sobre os frutos do genero *Carpotroche* (Flacourtiaceae). By J. G. KUHLMANN. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 93–96; 7 plates.

The fruits of the several Brazilian species of *Carpotroche* are illustrated and the principal distinguishing features are made the basis for a key. A new species, *C. babiensis* Kuhlm., known near Bahia as Canudo de Pito and Sapucainha, is described from fruit alone.

Observações sobre as celulas do lenho. (With abstract in English.) By F. R. MILANEZ. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 207-239; 19 plates, 2 text figs.

Gives the results of observations on the secondary xylem of nine different species. The subjects considered are the origin and distribution of tannoid substances; the genesis of starch grains and calcium oxalate crystals, particularly in wood fibers; and the development of tile cells in rays.

A flora do Curicuriari, afluente do Rio Negro, observado em viagens com a comissão demarcadora das fronteiras do setor oeste. By ADOLPHO DUCKE. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 389–398; 2 colored plates.

A short account of a visit to a region which, according to the original explorer, Richard Spruce, "offers as rich a field for the botanist as any in South America."

De von Martius aos ervanários da Bahia. By NARCISO SOARES DA CUNHA. Bahia, Brazil, 1941. Pp. 52; 6¼ x 9; 33 plates.

A contribution to a program commemorating the centenary of the publication of Martius' *Flora Brasiliensis*. The first part is largely concerned with Martius' addition to the knowledge of Brazilian medicinal plants. The second and larger part is an annotated check list of the medicinal leaves, roots, fruits, etc., sold by herbalists in the capital of Bahia. The vernacular names are listed alphabetically, with the scientific equivalents, the parts of the plant used, the purposes for which prescribed, and other items of interest. The illustrations include photographs of *ervanários* (which replace the old *casas de folhas*, closed by law) and numerous photomicrographs of drug plants.

Flora Brasílica. By F. C. HOEHNE. Pub. by Sec. Agr., Ind. e Com. de São Paulo, Brazil, February 1941. Vol. XXV, Fasc, 3, Nos. 128, 128a; pp. 1–100; 107 plates, 14 text figs.

A monograph of the genus *Machaerium* (including *Drepa-*

nocarpus), with descriptions, synonymy, vernacular names, and other information pertaining to 121 species, of which 107 are handsomely illustrated. There is a dichotomous key to the species; also 14 photomicrographs by J. Aranha Pereira showing cross and tangential sections of the woods of seven species.

Most of the species are scandent shrubs or small trees, but a few of them attain large size in eastern Brazil and are said to be the source of valuable timber commonly known as Jacarandá (various kinds), the name also applied to *Dalbergia*, particularly *D. nigra* Fr. Allem. The principal timber trees are *Machaerium brasiliense* Vog., *M. firmum* Benth. (the best of all), *M. incorruptible* Fr. Allem., *M. legale* (Vell.) Benth., *M. nictitans* (Vell.) Benth., *M. opacum* Vog., *M. stipitatum* (DC.) Vog., and *M. villosum* Vog.

Album floristico. By Francisco de Assis Inglesias. Pub. by Serviço Florestal, Rio de Janeiro, Brazil, 1940. Pp. 134; 9 x 11; 65 illustrations in color. Price 30 milreis.

A new and enlarged edition of an album of beautiful trees, the first edition appearing in 1932 (see *Tropical Woods* 32: 35). The colored plates are reproductions of paintings showing trees in bloom and each is accompanied by descriptive texts in Portuguese and English. "The main scope in this *Album*—I wish this to remain well defined—is to place under the immediate observance of the esthetes the beauties of Brazilian trees in order that the same can be moved out from the forests, where their magnificence is hidden, to our parks and gardens, streets and roadsides where the valuable co-operation of their colored glamor is required."

Contribución al conocimiento de las Mirtaceas del Paraguay. By C. Diego Legrand. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 105–119.

There are listed for Paraguay 36 species of the following genera: *Britoa* (1), *Blepharocalyx* (1), *Calyptranthes* (1), *Campomanesia* (3), *Eugenia* (13), *Myrceugenia* (1), *Myrcia* (3), *Myrciaria* (4), *Myrtus* (3), and *Psidium* (6).

Estado actual de la quinologia boliviana. By Martin Cardenas. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 121–133.

The quinine trees of Bolivia having characters of sufficient constancy to permit ready identification are given as *Cinchona asperifolia* Wedd., *C. australis* Wedd., *C. calisaya* Wedd., *C. calisaya* Wedd., var. *pallida* Wedd., *C. Humboldtiana* Lamb., *C. Josephiana* Wedd., *C. micrantha* R. & P., and *C. pubescens* Vahl.

Estudio histologico de las partes herbaceas de las especies de *Lonchocarpus* de la Argentina. By Clotilde C. Molle. *An. Prim. Reun. Sul-Amer. Bot. Rio de Janeiro 1938* 3: 241–263; 6 plates, 14 text figs.

Describes the anatomy of the young stem and the leaf of three species and one variety of *Lonchocarpus* growing in Argentina.

Los bosques sub-antarticos. By Joaquin Luis Alfonso. Reprinted from *Ingenieria Agronómica* 2: 10; 1940. Pp. 12; 8 x 11½; 6 half-tones.

An interesting description of the Patagonian forests, based largely on personal observations of the author, 1936–1939. There are detailed accounts of the eight principal forest trees, of which five are Antarctic Beeches (*Nothofagus*), the others conifers (*Araucaria*, *Libocedrus*, and *Fitzroya*).

Some new names in the Apocynaceae and Cornaceae and in various American groups. By Harold N. Moldenke. *Revista Sudamericana de Botánica* 6: 5/6: 176–178; 1940.

Parameria laevigata (A. L. Juss.) Moldenke "is the common tropical Asiatic plant known at present as *Parameria barbata* (Blume) K. Schum. This name goes back to the *Parsonia barbata* of Blume (1826), but A. L. Jussieu in 1806 proposed the name *Aegiphila laevigata*. The identity of Jussieu's plant has been in doubt for the past 133 years, chiefly because no one apparently took the trouble to look up and examine the type specimen."

"There is certainly no doubt in my mind that the genus

Cornus, as regarded by many botanists today, is actually an aggregate of several distinct generic elements. The true genus *Cornus* is typified by *Cornus mas* L., and contains the so-called Cornelian-cherries. The Cornels or Osiers represent the genus *Svida*, the Bunchberries represent the genus *Chamaepericlymenum*, the American Flowering Dogwoods represent the genus *Benthamidia*, and the Asiatic Flowering Dogwoods with their coalesced fruits represent the genus *Benthamia*."

New species of *Mallotus*. By FRANKLIN P. METCALF. *Journ. Arnold Arboretum* 22: 2: 204–208; April 1941.

Results of a study of some Chinese specimens of *Mallotus*. Four new species and one new variety are proposed and one new combination is made.

Studies of the Lauraceae. III. Some critical and new species of Asiatic *Lindera*, with occasional notes on *Litsea*. By CAROLINE K. ALLEN. *Journ. Arnold Arboretum*. 22: 1: 1–31; January 1941.

"The species treated herein represent only those difficult of recognition in the herbarium. No attempt has been made to make a complete citation of literature, for this was done in 1932 by Liou. Only supplementary and later publications have been noted where necessary. The *Litsea* species included are only incidental in clearing up certain species which have been confused with *Lindera*."

Timber tests. Merawan meranti (*Hopea sulcata* Sym.). *Malayan Forester* 10: 1: 29–34; January 1941.

"A notable feature of this timber is that it is stronger than other timbers of approximately equal weight. In comparison with Teak, Merawan Meranti is slightly less heavy, but is stronger as a beam and joist, stronger in shear, equal in shock-resisting ability, and slightly less hard. It is distinctly lighter in weight than Merbau, but although inferior in shock-resisting ability, shear, and hardness, it is stronger as a beam, or post. It is considerably superior in all mechanical properties to the strongest heavy Red Meranti, though much inferior to

the weakest Balau so far tested. Kapur, although 10 to 15 per cent heavier than Merawan Meranti, is very closely equivalent in all mechanical properties.

"Merawan Meranti is undoubtedly suitable for all forms of building construction and could be used for heavy constructional work. It would be necessary, however, to protect it from termites if timber were expected to last a long time when exposed to attack as, although Merawan Meranti is more than moderately durable, it is liable after some years to serious damage from termites. It possesses considerable resistance to fungal attack. When treated with creosote and diesel oil mixture, even if the absorption is comparatively low, this form of Merawan lasts very well and has so far proved a successful sleeper wood.

"It is unfortunate that the appearance of Merawan Meranti is usually spoiled by the attack of many pin-holes borers (ambrosia beetles), as it has the necessary qualities for a good flooring timber. It has no particularly decorative qualities to recommend it for furniture or panelling. It could be used for boat building and for road and rail vehicles, but not where especial shock-resisting ability was required."

Studies of Papuasian plants. I, II. By A. C. SMITH, *Journ. Arnold Arboretum* 22: 1; 60–80; 22: 2: 231–252; January, April 1941.

This series of papers discusses "certain groups of plants represented by the accumulated material in the herbarium of the Arnold Arboretum from New Guinea and the Solomon Islands. The larger part of the New Guinea specimens has been obtained by Mr. L. J. Brass, botanist of the Richard Archbold Expeditions, while the material from the Solomon Islands was chiefly collected by Mr. Brass and Mr. S. F. Kajewski. This series is expected to be supplementary to that of Drs. E. D. Merrill and L. M. Perry, 'Plantae Papuanae Archboldianae,' now appearing in the *Journal of the Arnold Arboretum*." The first paper is concerned with the Myristicaceae, the second with Monimiaceae. The genus *Isomerocarpa* is proposed to include *Daphnandra novoguineensis* Perk.

Plantae Papuanae Archboldianae. V, VI. By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* 22: 1: 32–59; 22: 2: 253–270; January, April 1941.

No. V includes a number of apparently new species and a few range-extentions which have appeared in the author's efforts to name the Rutaceae, other than the Aurantioideae, of the Archbold collections in New Guinea. No. VI deals with representatives of thirteen families with but a few specimens each.

Additions to our knowledge of the figs of New Guinea. By V. S. SUMMERHAYES. *Journ. Arnold Arboretum* 22: 1: 81–109; January 1941.

"In 1935, Diels (*Engl. Bot. Jahrb.* 67: 177–235) published an account, with analytical keys, of all the *Ficus* species recorded from the island of New Guinea and the neighboring Bismarck Archipelago, in which our knowledge of this genus was brought up to date. Since then several valuable collections of Figs made in New Guinea have been placed in my hands for study, resulting in the addition of many records to those given by Diels and the description of several new species. The notes here offered are based mainly on the collections of the first two Archbold Expeditions in 1933–4 and 1936–7, for the material of which I am indebted to the New York Botanical Garden and the Arnold Arboretum, respectively; a complete account is given of these two collections. There are also included a number of interesting records from the large collections made in Eastern Papua by C. E. Carr, some of whose specimens have not yet been worked out finally, and from sundry other collections."

The timber industry in the Territory of New Guinea. By J. L. D'ESPEISSIS. *Australian Forestry* 5: 1: 33–36; June 1940.

An account of the past and present timber industry in New Guinea and considerations for the future.

"The New Guinea Pine stands are situated in the inaccessible highland regions of the mainland. In the vicinity of Wau,

several small sawmills cutting in the best-known stand of Hoop Pine, Klinki Pine, and Cedar in the Territory, supply (due to the obvious restrictions imposed by air transport) only the gold-mining industry centered about Wau. It is hoped, however, following the construction of a road to the coast, to start an export trade in these timbers, to be run in conjunction with a planting programme on a scale sufficiently large to ensure a sustained yield.

"Meanwhile several light timbers from the readily accessible coastal forests are gaining popularity as softwood substitutes. Erima (*Octomeles sumatrana* Miq.), a light-weight, light-colored timber, is proving, when exported in the log, to be a fairly satisfactory general utility plywood proposition in Australia. . . . The Territory's better hardwoods, *i.e.*, Kamarere (*Eucalyptus deglupta* Blume) and Kuila (*Afzelia bijuga* A. Gray, syn. *Intzia bijuga* O. Ktze.), do not occur in sufficiently large stands to warrant export. If the existing stands are not conserved for local use (for there is a definite need for durable hardwoods), it will be found in a few years that we will have to import all our building timber from Australia—a quantity being already drawn from that source. European markets have not been thoroughly explored, but there are indications that it may be possible to market in the United Kingdom a certain quantity of Taun (*Pometia pinnata* Forst.) as hardwood flooring. However, for medium-class hardwoods, such as this (of which there is a plentiful supply) the Far Eastern and South African markets are worthy of investigation. . . .

"Amongst those timbers suitable for cabinet work, there is one outstanding species, namely, Laup, or New Guinea Walnut (*Dracontomelum mangiferum* Blume). The prospects of this species are particularly good. Owing to the inability of Queensland exporters to meet the overseas demand for the now very popular Queensland Walnut a new source of supply of this species, or a suitable substitute, is needed. This Territory is fortunate in having an excellent substitute for Queensland Walnut in Laup, or New Guinea Walnut. When carefully selected, it is a very handsome cabinet wood of almost equal value to Queensland Walnut. It is creating a considerable

amount of interest in Australia and also in the United Kingdom and the United States of America, where the demand for it is increasing rapidly. Walnut now forms the bulk of the timber exported from the Territory. The market for this timber is already made; all that need now be done is to take sufficient care to maintain a satisfactory export standard in order to keep it."

Contributions to the study of the cell wall. 3. The fibre-bonding materials and their importance in pulping. By H. E. Dadswell and Dorothie J. Ellis. Reprint No. 74, *Journ. Council Sci. & Ind. Research* 13: 4: 290–298; 2 plates; November 1940.

Experimental work described in this paper indicates that another material besides lignin is concerned in the bonding together of wood fibers and that both materials must be removed before the fibers will separate.

A new genus of Flacourtiaceae (Pangieae-Hydnocarpinae) from tropical Queensland. By C. T. White. *Journ. Arnold Arboretum* 22: 1: 143–144; 1 plate; January 1941.

Baileyoxylon, a new genus named in honor of Irving W. Bailey, with one known species, *B. lanceolatum* White, is a flacourtiaceous tree, up to 80 feet tall, common in rain forest in Ghurka Pocket (Atherton Tableland), Queensland. The new genus is apparently very close to *Trichadenia*.

Nomenclature of Australian timbers. By Standards Association of Australia. Trade Cir. No. 47, Div. of For. Prod., Com. Sci. & Ind. Research, Melbourne, 1940. Pp. 84; 6 x 9.

Lists of the proposed standard trade common names, other common names, standard trade reference names, and the botanical names. The standard trade reference names are botanical names (with authorship omitted) which are considered well enough established to be conserved. The current botanical equivalents are listed and are subject to modification, but the standard reference names are permanently fixed.

"This arrangement has been adopted to meet trade interests without interfering with the botanist's sphere of activity."

Afrikaanse bosboomname. By C. L. Wicht. *Journ. South African Forestry Assn.* 5: 41–61; 6 plates; October 1940.

An annotated check list of the Afrikaans names for South African trees.

Fibril behaviour as disclosed by shrinkage observations. By John M. Turnbull. *Journ. South African Forestry Assn.* 52: 62–72; October 1940.

"Shrinkage measurements taken on specimens of *Pinus patula* disclose a close inverse relationship between longitudinal and transverse shrinkage, indicating that their ratio is a function of fibril inclination. The ratio in drying from air dry to oven dry is found to double, thus suggesting a slight independent twisting in individual fibres, the implications of which in connection with spiral growth are discussed. A relatively high ratio along the longer radii of eccentric stems, it is contended, is associated with a tendency for pressure wood to develop on the side of stimulated growth. Density appears to exert no direct influence on the ratio. An analysis of the basic data is used in an attempt to explain how the moisture gradient across stems at fibre-saturation point is controlled. A suggested association between internal stress variations and fibril behavior is also discussed."—*Author's summary.*

A standard nomenclature for South African grown timbers. *Journ. South African Forestry Assn.* 5: 75–80; October 1940.

A list of proposed standard common names for 54 indigenous and 26 exotic species, prepared by the Timber Subcommittee of the South African Standards Association.

La foresta di Babbia. By Carmelo Sgandurra. *La Rivista Forestale Italiana* 2: 7: 32–43; four half-tones, 1 map; July 1940.

A general account of a large tract of Ethiopian forest and of plans for the utilization of the timber.

Budongo: An East African mahogany forest. By W. J. Eggeling. *Empire Forestry Journal* 19: 2: 179–190; 2 plates; July 1940.

"The Budongo forest in Uganda is described. In the introductory section information is given regarding situation, area, topography, climate, demarcation and survey, rights and privileges, working plan, permissible yields and actual fellings, history of exploitation, methods of extraction, markets and marketable timbers, forest fees and labor costs. A second section describes succession, structure, and composition, and gives figures of stem counts in different types of forest. In the final section the regeneration of Mahogany, *Chlorophora*, and *Maesopsis* is discussed. In the case of Mahogany, most success has been achieved by the line-group planting of large stripped plants."—*Author's summary.*

Modern trends in forestry with particular application to Uganda. *Empire Forestry Journal* 19: 2: 226–239; July 1940. Reprinted from *Uganda Journal* 7: 4.

"We have started our forestry so late that we have no exotic timber plantations or even-aged plantations of any sort except for fuel. For fuel, exotics have been planted because they provide the biggest bulk of firewood in the shortest possible time, approximately three times the volume given by indigenous forest in double the time. Clear felling is the most economical method of harvesting the fuel and, so far, the second rotations have given a bigger yield than the first. We do not know how long the soil will stand up to this treatment and continue to give us these large and quick returns, but the plantations have good herbaceous soil covers beneath the Gums and there are no signs of exhaustion yet. The costs of planting and tending are recovered with a small profit at the end of the second rotation, so, even if we have to allow the areas to revert to indigenous bush cover after the third rotation and plant up new ones, there will be no financial loss. . . .

"It may be asked why, if these exotic fuel plantations are so successful, exotic timber plantations should not be tried. The answer is that it takes too long to find out if a timber tree will grow successfully and healthily to maturity, and whether the timber it produces in conditions other than those of its natural home will be of the required quality. Small plots of Burma and Indian Teak were planted in Uganda with a view of obtaining this information in 100 years' time, but though they did very well for five years, at the end of ten years they look as if they will give us the negative information that they will not grow well in much less than 100 years.

"As Uganda possesses indigenous timbers suitable for practically every use to which timber can be put, it appears wise to manage our forests in order to produce a large annual yield of these. Any doubts about being able to produce good Teak and dangers of financial loss in doing so can be avoided by growing our own Muvule (*Chlorophora excelsa*) and similarly with all classes of timber. Uganda Musisi (*Maesopsis Eminii*) is an excellent substitute for Red Pine and can be grown easily by natural methods. Our Mahoganies provide both good general utility wood and ornamental joinery timber.

"We do not claim to have solved the problem of managing the indigenous forests yet, but we have made a hopeful beginning. It is only within the last eight years that serious attempts have been made to regenerate timber species, and they are necessarily on a very small scale yet. Natural forestry in forest types and under conditions which have not been studied before is not easy. In making a start the leads which nature has given are being followed. A good quality Mahogany forest contains only an average of two or three large Mahogany trees to an acre, but patches occur in which a very much richer mixture of these can be seen. It would appear that there is no inherent reason why more Mahogany to the acre cannot be grown over much larger areas of the forests, provided the general forest conditions are maintained. In some situations this can be done, after removal of the mature trees to sawmills, by assisting young natural seedlings which without help would be choked by weeds, smothered by creepers, or killed by heavy shade. . . . In other parts of our Mahogany forests there are practically no young Mahoganies to be found and these tracts are probably progressing

towards a different type of forest which is less economically valuable. In these, after the removal of mature merchantable trees, planting is carried out in groups in the gaps left by felling or in lines specially cut. The plants, which should be at least three feet high when planted, are tended in the same way as natural regeneration by weeding, cutting creepers, and reducing overhead shade as required. . . .

"There is one modern tendency which will have an important bearing on tropical forestry and will make our forests both more valuable and easier to manage. This is the improvement in and cheapening of the price of wood preservatives which is leading to a great increase in their use in the tropics. At present many timbers which grow in Africa are regarded as useless merely because they are highly susceptible to attacks by insects and fungi. Chemical preparations are available which will make these woods as durable as Muvule. When the use of preservatives becomes general in Uganda it will be possible to use a great deal of wood which is now regarded as useless, so automatically increasing the timber content of our forest. The inclusion of these species in fellings by sawmills will give foresters greater scope in the management of forests to obtain the conditions required for their improvement."

A comparison of forest- and plantation-grown African pencil cedar (*Juniperus procera* Hochst.) with special reference to the occurrence of compression wood. By E. W. J. Phillips. *Empire Forestry Journal* 19: 2: 282–288; 3 plates; July 1940.

"The examination was carried out on disks at different heights from four trees of *Juniperus procera* Hochst., two grown in exposed conditions in natural forest and two grown in a sheltered plantation. Compression wood was found to be much more prevalent in trees grown in exposed natural forest than in material from a sheltered plantation. Also its distribution was more definitely related to the direction of the prevailing wind in the former. The plantation-grown timber was generally less hard and dense and paler in heartwood color, but contained a larger proportion of sapwood.

Observations are included on the structure and formation of the growth rings in this tropical species of *Juniperus*."—*Author's summary.*

Notes on Empire timbers. By H. A. Cox. *Empire Forestry Journal* 19: 2: 292–294; July 1940.

"Of the number of West African timbers recently subjected to test, some have proved unsuitable even for commercial plywood in the earlier stages of the investigation, and, although some time must elapse before all the test work can be completed, it is deemed advisable to issue a short note on these, with reasons for their unsuitability:

"*Scottellia coriacea*, Odoko, from Nigeria. Logs of this species were of a size and shape suitable for peeling, but in cross-cutting to lengths suitable for the peeling machine it was found that they were particularly prone to develop extensive radial splits, some of which reached to the circumference of the log. This fault alone made peeling difficult, as the veneer tended to break across as it came off the peeler. The material used in the experiment has been shipped with the least possible delay after felling but, owing to the war, was longer in transit from Nigeria than would have been the case in peace time. On arrival it was found to be stained so deeply that the color of almost all the veneer was spoiled. This fault could, of course, be overcome by peeling in the country of origin immediately after felling, and drying off the veneer as quickly as possible. If the necessary plant were available on the West Coast for such a course to be followed, it is probable that a good grade 'commercial plywood' could be made. The numerous rays of appreciable size cause some splitting in thin veneers during and after drying.

"*Sterculia rhinopetala*, from Nigeria. This timber was found to be subject to pin-worm damage, and in addition to be very refractory in cutting. Close examination revealed the presence of a white mineral deposit in the pores. This was sufficiently hard to take the edge off the cutter and even to make notches in the cutting edge sufficiently deep to spoil the face of the veneer. By dint of much trouble in sharpening cutters and care in finding the most suitable settings of

pressure bar and cutter, it was eventually possible to cut veneers in thicknesses of 1/50, 1/28, and 1/16 inch. Subsequently sample sheets of plywood were made, but the grain was coarse and mainly open, and the appearance of the plywood so inferior as to put it into quite a low grade, such, for instance, as would be used in the making of tea chests. For these reasons further work on the timber was abandoned.

"*Ochrocarpus africanus*, Pegya, from the Gold Coast. . . . The logs were of good shape, but end shakes had developed after felling. A softening treatment of forty-eight hours was given, but even after this length of time the wood proved very refractory, spoiling the edge of the cutter very quickly. It was found that the vessels contained gum and also tiny deposits of a white mineral substance. The veneer as it came from the peeler split very badly, the splits starting along the large vessels. Several different settings of the cutter and pressure bar were tried, but it was not possible to get a smooth face and a reasonably 'tight' back. In making up the sample sheets of plywood, using a hot pressure method, there was marked exudation of gum from the pores, leaving the surface badly spotted."

The ontogenetic development and phylogenetic specialization of rays in the xylem of dicotyledons. I. The primitive ray structure. By Elso S. Barghoorn, Jr., *Am. Journ. Botany* 27: 10: 918–928; 17 figs.; December 1940.

"The present study of numerous structurally primitive dicotyledons shows that in the least modified ray condition there are multiseriate and uniseriate rays extending from the outer margins of the primary xylem. Many of the lower vascular plants, both living and fossil, viz., Bennettitales, Pteridospermae, and Cycadales also possess both heterogeneous multiseriate and high-celled uniseriate rays in the innermost as well as in the outermost secondary xylem. There is substantial evidence to indicate that multiseriate rays in the dicotyledons do not originate phylogenetically by the widening of uniseriate rays but, as in the lower vascular plants, extend outward from the primary body."

M. M Chattaway.

Price 30 cents

Yale University School of Forestry

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Yale University School of Forestry

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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THE FORESTS OF GUATEMALA

By PAUL C. STANDLEY

Field Museum of Natural History

Guatemala, the most northern of the Central American republics, has approximately the same area as Illinois. About one-third of the Republic is inaccessible by ordinary means of transportation, this third comprising principally the Department of Petén, the largest of the whole country. At present Petén is comparatively unimportant, since it scarcely is typical of Guatemala and is, in fact, a region quite apart and wholly unknown to most Guatemalans. Petén has been the object of several expeditions from the University of Michigan in the course of its investigations of the Mayan region, and Dr. C. L. Lundell has published a comprehensive account of its vegetation, which is closely related with that of other portions of the country, most of all with that of the banana region

of northern Guatemala, where considerable work has been done by Field Museum expeditions.

Guatemala's neighboring countries are Mexico on the north and west, British Honduras on the northeast, Salvador and Honduras on the southeast. It is bounded on the southwest by the Pacific Ocean and has a narrow outlet to the Caribbean Sea. Roughly the country may be divided into two general regions. Parallel with the Pacific coast extends a long series of volcanoes, part of the great Cordillera that runs from the western United States, in fact from Alaska, along the whole Pacific coast southward through Central America into Colombia, and farther southward into Peru and Chile. This part of Guatemala is characterized by numerous cone-shaped volcanoes, several of which are in more or less constant activity, particularly such peaks as Santa María in the Department of Quezaltenango, Fuego in Sacatepéquez, and Pacaya in Guatemala. One, Tajumulco, near the Mexican frontier, is the highest mountain of Central America.

While the southern part of Guatemala is volcanic in origin, the northern portions consist of sedimentary deposits, with the result that the two areas are very unlike in general appearance. The difference in geologic origin has a highly important influence upon the vegetation, which is widely dissimilar in northern and southern Guatemala. The northern departments, including those of Huehuetenango, Quiché, and Alta and Baja Verapaz, consist primarily of limestone mountains with some areas of metamorphic rocks, especially serpentine and schist.

Guatemala possesses an unusually varied flora, considering the small area involved. It is doubtless the richest flora of all Central America and in number of species must greatly surpass that of Costa Rica, a fact due primarily to the larger area and the greater variety of physiographic conditions.

The Guatemalan forests of greatest importance, and certainly of greatest interest, are coniferous. The conifers are confined, except for one species, to the higher mountains, mostly at 5000 feet or more. There are five Pines, a Red Cedar, the Guatemalan Cypress, the Guatemalan Fir, and the Bald Cypress of Mexico and Guatemala.

Bald Cypress (*Taxodium mucronatum*), although widely dispersed in Mexico, is known in Central America only from the Department of Huehuetenango, where it occurs about the capital and extends westward toward the Mexican border, probably up to the boundary of Chiapas. It is confined to the banks of the river, variously named according to the region through which it flows, that descends from Huehuetenango toward the Mexican border. The capital city of this department is called Huehuetenango, a term variously interpreted by Guatemalan philologists, but in the writer's mind there is no doubt that it derives from the Aztec word *ahuehuete*, the name given in Mexico to Bald Cypress. The tree is known in Guatemala as Sabino and is cultivated about Guatemala City and in other scattered localities. Trees of natural occurrence are few and grow only at the edge of the river or sometimes within its water. Seedlings are plentiful, but there is no indication that reproduction is rapid. *Taxodium mucronatum* does not produce the knees characteristic of the Bald Cypress (*T. distichum*) of the southeastern United States.

The Cuban Pine, *Pinus caribaea*, is confined to the north coast, chiefly in the Department of Izabal, where it descends to sea level, though it does not reach the seashore, as in British Honduras and Nicaragua. More often it grows on low mountains, as in the Department of Izabal, but near Virginia, former administrative center of the United Fruit Company, it invades the flats between the mountains. The Cuban Pine is a valuable timber tree in Florida and Nicaragua, but in Guatemala is of slight economic importance, though utilized for lumber when nothing better is available.

The handsome long and narrow cones of *Pinus ayacahuite* at once associate it with the White Pines of the United States. It is confined to the highest mountains, especially at about 10,000 feet, where it is a tall and stately tree, but too limited in quantity to be of great utility. Most of the land upon which it does occur belongs fortunately to the government, hence the tree cannot be cut.

The three other Guatemalan Pines are difficult to separate in the field or even in the herbarium. All are widely distributed

in the highlands where, with numerous Oaks, they dominate the vegetation. A single species may prevail over a wide area or two species may grow together. These continuous Pine forests are the conspicuous feature of all the middle highlands, where they prevail to a monotonous extent for many miles. They are of great local importance as a source of lumber. The logs are sawed by small local sawmills or quite as often by the Indians by hand. Especially in the neighborhood of Quezaltenango, one sees pine boards carried from the highlands to lower elevations on the shoulders or backs of men or even of women.

The Guatemalan Pines seem to be in a rather precarious state because of the attacks of fungi and insects and in many regions there are large numbers of dead or dying trees. One of the most spectacular diseases is a rust that covers the cones. About Cobán, especially after a shower, the cones are bright yellow as if gilded. Cones attacked by the larvae of a certain moth are of double or triple normal size.

Among coniferous trees, next after the Pines, the principal place is held by the Guatemalan Cypress, *Cupressus lusitanica* (*C. Benthamii* is a synonym). At the present time, after long influence by civilization, it is difficult to determine exactly where this tree is really native. It is now found in almost every part of the highlands, and even at lower elevations, and is native with certainty on the higher peaks. Cypress wood is valuable for many purposes, and on this account the trees have been planted widely. Often one comes upon what appears to be a natural Cypress forest, but upon closer notice it is found that all the trees are in rows! Cypress grows rapidly as compared with other local conifers, and is highly esteemed as a source of lumber, shade, and decorations for altars and fiestas. The finest Guatemalan forests extant are in the mountains of Tecpán, where the trees are being reduced rapidly, the larger ones being cut for the sawmill. The original natural range of the Cypress must have been somewhere about eight or nine thousand feet. At Totonicapán, for instance, Cypress is not found above this elevation, although elsewhere it ascends much higher. The tree has been recommended recently, and with justification, for planting in other parts of tropical America (see *Tropical Woods* 65: 1). In Guatemala it grows rapidly and flourishes at various elevations, and there is every reason to expect that it may be equally successful in remote areas. Normally the shape of the tree is more or less pyramidal, but there is a columnar form, best developed and wild on Santa María Volcano.

Most interesting in some respects of all coniferous trees of Guatemala is the endemic Fir, *Abies guatemalensis*, known locally as Pinabete. Formerly believed to be conspecific with the Mexican *Abies religiosa*, the Guatemalan tree is now considered a distinct species, although its exact range is not definitely known. It is a tree of rather limited distribution, confined to the western and central departments of Guatemala, extending eastward to Jalapa. In Totonicapán, Pinabete is associated with White Pine, but in the western departments its association is quite different, with Cypress.

The only other coniferous tree of Guatemala is Mexican Red Cedar, *Juniperus mexicana*. It is most abundant in the Sierra de los Cuchumatanes, Department of Huehuetenango, but is found also in Baja Verapaz, a region superficially different but geologically rather similar. In the Cuchumatanes, at an elevation of ten to eleven thousand feet, Red Cedar forms dense forests of considerable extent in pure stands or in association with Pines, many of which are dead or dying. This region is cold and humid throughout the year, the Cedar trees draped with abundant lichens, especially Usneas; thus the aspect of these highland forests is dreary in the extreme. Many of the trees are large for the genus, with thick though often crooked trunks, but little or no use is made of the wood because few people live in the immediate vicinity. Rather strangely, no Spanish name could be found for Red Cedar, but the local Indian name is Huitun (accent on the first syllable). About Santa Rosa Verapaz the Cedar trees observed by the writer are too few to be of importance. Here the inhabitants call them Ciprés, and insist that this is the common Cypress, which actually occurs in Verapaz only in cultivation.

The plant formations of Guatemala are extremely diversified from one region to another, and it would be difficult to prepare a lucid and comprehensive description of the many

types of forest. Briefly, the principal divisions aside from the coniferous forests are: (1) the Mangrove swamps of the two coasts; (2) the relatively arid regions of the Motagua River and the Río Blanco, with the greater part of the Oriente (the eastern portion of Guatemala), which is rather sharply differentiated culturally from other parts of the country; (3) the mixed forests of the uplands of the central departments, whose climate is temperate or cold, with the year almost evenly divided into wet and dry seasons, the rocks chiefly of comparatively recent volcanic origin; (4) the mixed forests of the Pacific plains and *bocacosta*, the latter being the foothills of the main chain of volcanoes, the year divided into wet and dry seasons, but with plenty of moisture throughout the year in at least most of the *bocacosta;* (5) the rain forest of the Atlantic coast, where there is abundant rainfall through most of the year; (6) the region of Cobán, with all of Alta Verapaz and part of Baja Verapaz, and perhaps including some of Petén; and (7) the limestone plains of Petén.

Mention should be made of one area not visited by the writer, in northern Quiché, where Dr. Alexander F. Skutch found a Maple, *Acer Skutchii*, and a Sycamore, *Platanus chiapensis*, two trees that suggest a northern affinity for the forest. Such a relationship is emphasized by many shrubs and trees found in northern Quiché and Huehuetanango. In the latter department, for instance, *Fraxinus* is well represented, as in some other parts of Guatemala, and the Poison Ivy of the United States, *Rhus Toxicodendron*, occurs.

The rain forest of the Atlantic coast will not be discussed here. An account of the trees of the region has been published (*Tropical Woods* 7: 10–29) and, except for minor local variations in composition such as naturally are to be expected from one part of the coast to another, this humid forest is like corresponding ones of the Caribbean coast of southern British Honduras, Honduras, Nicaragua, Costa Rica, and Panama. Palms are abundant, especially the Cohune or Corozo, *Orbignya Cohune*. One of the dominant trees is *Brosimum terrabanum*, while *Pachira aquatica* is conspicuous and abundant in swamps. Ingas are plentiful in low ground. Perhaps the most celebrated tree of northern Guatemala is the Cow

Tree, *Couma guatemalensis*. During May 1939, it was observed to be plentiful on low hills just back of Puerto Barrios, within sight of the town. The abundance of bright pink flowers upon the nearly or quite leafless branches made the tall trees conspicuous from a distance.

Riding on the railroad from Puerto Barrios toward the capital, Guatemala, about 60 miles inland one emerges from the rain forest, near Gualán, and passes suddenly into a different area, the subarid Motagua Valley, bordered by low ranges of mountains, and with a much reduced rainfall. The vegetation recalls that of the Comayagua Valley of Honduras, and bears great resemblance also to that of certain parts of the Pacific lowlands of Mexico. With slight modifications the same type of vegetation covers much of the mountainous and hilly parts of eastern Guatemala, the Oriente. Isolated high mountains, some of them volcanoes, scattered through the Oriente support at higher elevations small areas of rain forest and coniferous forest, but at middle and lower elevations there are few or no tall trees, and much of the land is utilized for agriculture. True forests scarcely exist at lower elevations but there are great extensions on rocky or excessively dry soil of small trees and large shrubs, especially spiny ones.

Prominent elements of the vegetation are several tree-like cacti, organ cacti of the genera *Lemaireocereus* and *Cephalocereus*, and tall Opuntias. They often abound, and the first two are much used for hedges. Very conspicuous about Zacapa is the Manzanote, *Pereskia autumnalis*, a cactus with normal, broad leaves and in size and shape much like an apple tree. Leguminosae make up a large proportion of the arboreous vegetation. Among the more plentiful and typical trees are *Karwinskia Calderonii*, *Crescentia alata*, *Juliania adstringens*, *Bucida macrostachya*, *Ruprechtia Deamii*, *Lysiloma*, Acacias, *Apoplanesia*, several species of *Bursera*, *Spondias purpurea*, *Ceiba aesculifolia*, *Simaruba glauca*, and *Alvaradoa amorphoides*. The number of species is very large, and many other groups or species deserve mention quite as much as those cited.

Mangrove forests of the Guatemalan coasts are exactly like those occupying normally the coasts of Central America, Mexico, and South America, an association of *Rhizophora*,

Avicennia, *Laguncularia*, and *Conocarpus*, with occasional *Hippomane*, *Coccoloba Uvifera*, *Caesalpinia crista*, and other associated shrubs and small trees.

Guaiacum, Lignum-vitae, is common in the Zacapa area, but all the trees noted were small, and it is improbable that any important amount of wood is available. No lumbering operations take place in this general area, below the Pine forests, and the timber is used only for local miscellaneous purposes. Along stream beds of the Departments of Zacapa and Chiquimula an abundant and often large tree is one of the Bignoniaceae, *Astianthus viminalis*, called Chilca. Its foliage is rather willow-like, the showy, bright yellow blossoms similar in form to those of Catalpa.

Mostly north of the Motagua Valley lie the large Departments of Baja and Alta Verapaz. Vegetation of the former is of the general type occurring in the Motagua Valley, which in fact lies partly within Baja Verapaz. The mountains, few of which exceed 5000 feet, are covered at high elevations with rather open forest of Pine and Oak, with rare stands of Liquidambar.

The Department of Alta Verapaz, long celebrated among botanists for its exceedingly rich flora with many localized species, is large in area and almost surely has the largest flora of all Guatemalan departments. The region which centers about its capital, Cobán, consists principally of limestone hills and mountains. The rainfall is heavy and continues for most of the year. There is a common saying that at Cobán it rains thirteen months of the year!

Wide areas of Alta Verapaz have been cleared, for it is one of the great coffee regions of Central America. Much land formerly cultivated is abandoned and overrun with shrubby second-growth. In some respects this is fortunate, since because of the heavy rainfall erosion is rapid, cutting away the red clay and leaving only huge, jagged, limestone rocks. Along streams everywhere there is an abundant growth of trees and there are also extensive stands of forest still untouched, principally in places remote from modern transportation.

On slopes of the Cobán mountains the dominant tree is Pine, often with small numbers of Oaks, but the Oaks are replaced largely by *Liquidambar Styraciflua*. This tree appears

to have little economic importance locally, since trees are seldom cut for their wood, although sometimes they are tapped for balsam. It is strange to find this well-known tree of the southeastern United States so plentiful in Guatemala but it does, of course, extend considerably farther southward in Central America.

Liquidambar is not the only tree of northern affinities found in Alta Verapaz. One of the most abundant trees of stream banks is the Raxoch, *Acer serratum*, a close relative of northern Box-elder, and often associated with it is *Carpinus caroliniana*. Other northern genera represented are *Magnolia*, *Gelsemium*, and *Berchemia*. One of the best-known trees, abundant almost everywhere, is the Amché (spider-tree), *Rhus striata*, similar to the Poison Sumac of the United States and much feared for its violently poisonous properties. Amché trees usually are left when land is cleared because of the danger involved in cutting them.

Other common trees of Alta Verapaz are *Calocarpum viride*, the Ingerto, valued for its edible fruit; *Engelhardtia guatemalensis*, which in foliage, even to its red-tinged young leaves, much resembles Amché; *Billia colombiana* with masses of flame-colored flowers; and *Vochysia hondurensis*, *Erblichia xylocarpa*, *Hymenaea Courbaril*, *Protium Copal*, and *Perymenium*. The Chicle tree, *Achras Zapota*, probably extends into northern Alta Verapaz. One of the most abundant trees, easily recognizable from a distance because of the coloring of its leaves, is the Coyó, *Persea Schiedeana*, a relative of the Avocado. Alta Verapaz possesses a greater variety of palms than any other part of Guatemala, but most of them are confined to the lower elevations, toward Lake Izabal, a region whose flora is like that of the rain forest of the North Coast, in the Department of Izabal.

A tree much planted about Cobán is a Black Walnut, probably *Juglans pyriformis*. While it is said to be native in the mountains, probably it is an importation from Mexico. There are many handsome and very tall trees in the town of Cobán, as well as in nearby fincas.

The flora and forests of the Pacific tierra caliente, although containing many elements in common with Alta Verapaz and

the north coast, are distinct in important respects and include many species or genera absent in the latter. The tropical portion of the Pacific coast as a rule is not called *tierra caliente* in Guatemala but is divided into two parts, the *costa*, or plains and lowest hills, and the *bocacosta*, the lower, very humid mountain slopes, up to an elevation of 3000 feet or more.

The *bocacosta* is one of the two main coffee regions. It has an ample rainfall during a great part of the year but there is a well-marked dry season during the winter months of the North. Although much land has been planted with coffee, especially in the Departments of Quezaltenango and San Marcos, there is still a good deal of forest. Normally this consists of a dense stand of large broad-leaved trees with abundant undergrowth of shrubs and herbs, all of tropical groups. Only one or two species of Oaks occur, in contrast with the highlands and other parts of Guatemala. The variety of trees is great, and rarely is one species much more prominent than another. Among the commoner trees are Lauraceae (several genera), *Sloanea*, *Dussia cuscatlanica*, *Engelhardtia guatemalensis* (here called Palo Colorado), *Belotia*, *Erblichia xylocarpa* var. *mollis*, *Lonchocarpus*, *Billia colombiana*, few small palms, and Ingas.

In the *costa*, or plains, there is a more definite division into dry and rainy seasons, of about equal length. During the dry season it becomes very dry indeed, for many trees and shrubs lose their leaves and much of the herbaceous vegetation disappears. Essentially the vegetation is like that extending from Sinaloa in Mexico southward along the Pacific coast to western Panama. Much of the plains is devoted to grazing land and other parts to the cultivation of corn, sugar cane, cotton, and other crops. Despite this, large extents of land are covered with scrub forest and there are scattered areas throughout the coast of natural forest, the trees forming dense stands and often attaining a great height, with comparatively little undergrowth. In recent years extensive areas of the Pacific coast in the vicinity of the Río Bravo have been cleared for planting bananas, which are exported from the Atlantic coast, through Puerto Barrios.

As is usual along the Pacific coast of tropical North America, there seldom are pure stands of any one tree but the forest is mixed and normally composed of a large number of species. The more common genera or species represented are *Guaiacum; Cybistax Donnell-Smithii*, Primavera; *Ceiba pentandra*, as always, one of the giant trees; Matilisguate, *Tabebuia pentaphylla;* species of *Dalbergia; Triplaris americana; Cordia alliodora; Cedrela; Brosimum terrabanum;* Conacaste, *Enterolobium cyclocarpum; Hymenaea Courbaril; Hura;* Marío, *Calophyllum brasiliense*, var. *Rekoi; Quararibea; Pachira aquatica*, in wet lands only; *Homalium*, which often becomes a giant tree along streams; *Bombax ellipticum;* Castaño, *Sterculia apetala;* Caulote, *Guazuma ulmifolia; Ochroma; Cochlospermum vitifolium; Terminalia*, particularly plentiful between Retalhuleu and the coast, where there are close stands of towering trees; Tempisque, *Sideroxylon Capiri; Plumeria rubra*, in its wild, white-flowered form; *Godmania aesculifolia;* Madre de Cacao, *Gliricidia sepium;* Jiote, *Bursera Simaruba; Sickingia salvadorensis*, an abundant tree in many parts of the coast; Salamo, *Calycophyllum candidissimum;* Irayol, *Genipa Caruto; Bernoullia flammea*, seen only at San Sebastián, Retalhuleu, the region from which probably it was described originally; Sauce, *Salix chilensis*, but only along streams; Fustic or Mora, *Chlorophora tinctoria*, which nowhere was noted as very common; Amate, numerous species of *Ficus; Lonchocarpus;* the Central American Rubber tree, *Castilla elastica*, which is plentiful on both coasts; *Gyrocarpus americana*, which grows also far inland, as about Sacapulas in El Quiché; *Licania platypus* and *L. arborea; Lysiloma;* various species of *Acacia*, particularly those of the bullhorn type that grow profusely along open sandy stream beds; *Caesalpinia;* and Jocote, *Spondias purpurea.*

In low areas of the coastal plain there often are extensive thickets of a slender bamboo, and sometimes regular forests of Tarro, *Guadua aculeata*, a bamboo as large as the Asiatic *Bambusa vulgaris*. It is curious that the name Tarro, belonging properly to the spiny native *Guadua*, is sometimes transferred to the cultivated *Bambusa*, which is not spiny. The very thick stems of both bamboos are flattened and used to cover the sides of small houses.

In the Pacific coast there are numerous sawmills, some of which export lumber. I was informed in Retalhuleu and Mazatenango that the only woods exported at present to the United States were Primavera and Guayacán, but elsewhere I was told that Cedro (*Cedrela*), small amounts of Mahogany (*Swietenia humilis*), and other woods also were exported. There is no reason for believing that the quantity of lumber available for export from this region is of much importance. Small quantities of Cocobolo (*Dalbergia*) are available but commercially unimportant. It is worthy of note that in Guatemala the name Nogal, *i.e.*, Walnut, is given at times to *Dalbergia*, and it sometimes is stated that "Walnut" grows in the Pacific *tierra caliente*. Obviously, if any true Walnut (*Juglans*) is native in Guatemala, which is unlikely, it will be found not in the coast but in the uplands.

On the Pacific slope *Guaiacum*, Lignum-vitae or Guayacán, is confined to the immediate vicinity of the coast and only small amounts are available for export, although the wood is said to be in great demand. It is stated that it is hard to find trunks in good condition. Viewed from one side they seem thick and well-formed, but seen from the other side they are found to be hollow, and the trunk worthless. Along the coast below Mazatenango there are said to be extensive stands of fine Guayacán trees belonging to the national government, which will not permit them to be cut.

Just before the present war there was a demand from Europe, presumably for crates and packing cases, for wood of *Ceiba pentandra*, which is available in great amounts in most of the Central American *tierra caliente*. Some Ceiba wood was cut and cured for export but before it could be shipped the government imposed so high an export tax that shipment was impossible. Ceiba, often dominating the landscape, is one of the Central American trees most celebrated in local literature and legend.

The quantity of Mahogany on the Pacific coast must be scant, for I can not say positively that I have even seen a Mahogany tree in Guatemala. Honduras Mahogany, *Swietenia macrophylla*, grows along the Atlantic coast, but there also it seems to be scarce.

Balsa, *Ochroma*, has not been noted on the Atlantic coast of Guatemala although to be expected there. One species does appear along the Pacific plains. A few small trees were seen near Taxisco, Department of Santa Rosa in eastern Guatemala; a single tree was found along the road below Retalhuleu, in western Guatemala, in spite of the fact that lumbermen questioned there were unfamiliar with such a tree; while at Tiquisate, headquarters of the banana plantations of Mazatenango, there are rather ample stands.

There remain for consideration only the non-coniferous forests of the Guatemalan uplands. This area, commonly called in part Los Altos, extends from central Guatemala, about the Department of Guatemala, westward into the Department of San Marcos, adjacent to the Mexican border. As a matter of fact, the term Los Altos usually is restricted to the highest areas of the departments from Sololá or perhaps Chimaltenango westward. The greater part of the uplands, where forested at all, is covered with conifers or Oaks, but there are many local areas and some relatively extensive ones where neither Oaks nor conifers are dominant. In central Guatemala the upland forests are often rich in species, many of which are localized and endemic.

The upland forests of mixed trees are natural intrusions from lower elevations into the Pine-Oak forests that naturally occupy these highland regions. Such forests occur far eastward, close to the coniferous forests of the Oriente, but the writer has not studied them there. His observations apply to central and western Guatemala, from the Department of Guatemala westward to the Departments of Quezaltenango and San Marcos, and thus to the Mexican border.

In central Guatemala the upland forest has been studied in the Department of Guatemala, especially about San Juan Sacatepéquez and San Raimundo and on the Volcán de Pacaya, and farther westward in the Departments of Sacatepéquez and Chimaltenango, particularly on the slopes of the volcanoes of Agua and Acatenango. On Pacaya the forest is surprisingly like that of the volcanoes of Costa Rica, this being the only locality of Guatemala, except possibly the

region of Tactic in Alta Verapaz, that greatly resembles the Costa Rican mountains.

Mixed upland forest is found chiefly along streams, in barrancos below the proper Pine forest, or often at greater elevations on the volcanoes between the middle and upper Pine forests. It is a broadleaf forest of great diversity as to species and genera. In the central area, especially in the Departments of Guatemala, Sacatepéquez, and Chimaltenango, common trees of this association are *Ilex*, *Olmediella*, *Roupala*, *Heliocarpus* (perhaps only in second-growth), *Oreopanax xalapense*, called Mano de Tigre; *Arbutus xalapensis*, principally, however, in Pine forest, where often it is abundant; *Garrya laurifolia*, Palo de Hueso; several species of *Styrax* and *Clethra*, which may be either shrubs or moderately large trees; *Veronia*, *Podachaenium*, *Chiranthodendron*, *Chaetoptelea*, *Ostrya virginiana*, var. *guatemalensis*, *Alnus* (of which there are five species in Guatemala), *Phoebe*, *Nectandra*, and other Lauraceae; *Prunus* of several species, especially *Prunus Salasii*, called Carreto; *Piscidia grandifolia*, Palo de Zope, abundant about Antigua and Chimaltenango; *Spondias purpurea*, Jocote, which seems to grow almost anywhere except at the highest elevations; and *Euphorbia cotinifolia*, Yerba Mala, a shrub or small tree abundant in hedges about Antigua and elsewhere, where it is respected because of its poisonous properties.

Regions in which these trees grow have a mixed forest of such variable composition that it is difficult to list truly typical elements. *Ipomoea murucoides*, for instance, is a common tree about Antigua and Guatemala but not farther westward. Conspicuous because of its pale, generally whitish trunk and profusion of milk-white flowers, it is a most abnormal member of the Morning-glory family. Numerous other local trees confined to the central region could well be mentioned.

The upland forests, at 5000 to 9000 feet above sea level, extend westward into the Occidente. They are mostly coniferous, of types previously described, but there are large areas in which broadleaf trees predominate. One of the common trees of western Guatemala, especially in the Department of San Marcos, is *Acer serratum*, Palo de Vinagre. This Box-

elder is much planted on the white-sand mountains of San Marcos to prevent drifting and erosion of the loose white sand characteristic of this department. Although hard to believe, this white sand is claimed to be of recent origin, ejected from the volcanoes. It gives the impression of newly fallen snow, and on one of the chilly mornings (frequently it frosts and freezes in western Guatemala) one can easily believe that the mountains *are* covered by a light snowfall.

In the Occidente many of the mountains are forested with *Alnus* (Alizo), representing several species. Often Alder is associated with Oak, but frequently it constitutes almost pure stands. Alder forests are beautiful in spring when the old leaves have been shed and new ones are unfolding. At this season the forests have a fresh, green appearance exactly like those of the United States in spring time, and most untropical in appearance. As a matter of fact, they are not at all tropical for their elevation is seven to nine thousand feet.

In the western departments there are three species of Willow, the only ones growing south of Mexico. The common Willow of Central America, *Salix chilensis*, which extends through most South American countries, is the only Willow native south of Guatemala. The other Guatemalan species are *Salix Bonplandiana* and *S. taxifolia*, whose southern limit is in Guatemala. In an unusual formation in northwestern Guatemala, near Chinantla, all three species grow together in wide thickets along rivers.

While trees of these upland forests of the Occidente are greatly varied, a few deserve special mention. *Oreopanax Echinops* grows abundantly and conspicuously in the barrancos of San Marcos. Several species of *Buddleia* abound in San Marcos and Quezaltenango, where they sometimes form an important or at least a conspicuous element of the forest, largely because of the white under surfaces of their leaves. *Senecio salignus*, Chilca, a large shrub or small, bushy tree, is one of the characteristic arborescent plants of the uplands of the Occidente, where during the coldest winter months it often is the only plant in flower. Likewise tolerant of cold are the Elderberries, *Sambucus mexicana* and *S. oreopola*, both monotonously abundant in Quezaltenango and San Marcos.

In the latter department *Sambucus* is much planted to hold drifting sand. Elder trees are particularly plentiful on the Volcano of Santa María, where they form regular forests, the trunks contorted and sometimes prostrate for much of their length. The trees are by no means confined to the Occidente, but they are more abundant there than elsewhere.

Several trees of the central mountains are of some special interest, at least to the writer. *Chiranthodendron*, called Kanak or Mano de León, has a distinctive history. In preconquest Mexico it was highly regarded because of the curious flowers whose stamens resemble a small, outstretched hand with rather clawlike fingers. Only one tree was known then in Mexico, in Hidalgo, whence seeds were taken to the botanic garden of Mexico for propagation. In Guatemala the Hand-tree, far from being rare, dominates the humid forest on some of the volcanoes. Particularly on Acatenango there is a broad belt of trees below the Pine forest of the highest slopes. Many of the trees are real giants, with massive trunks crowded together. Seedlings are scarce in spite of the abundance of fallen seed pods everywhere in the forests. The tree is widely dispersed from Sacatepéquez westward along the volcanoes, and grows here and there even slightly north of the southern cordillera. It is believed that it had some religious significance among the ancient inhabitants, and today when land is cleared these trees often are left standing. Moreover, seeing them scattered in cultivated fields about Chichacastenango and Momostenango leads one to suspect that they may even have been planted by the Indians.

Manzanote, *Olmediella Betschleriana*, has long been known in Europe in cultivation but only within the past few years did its native habitat become known. To a Guatemalan this seems a joke, since in Guatemala City and Antigua there are few persons who do not see the trees in the course of the day, planted in most of the parks and along many of the streets, especially the finest avenues. Manzanote is a common tree in the humid forest of the volcanoes, extending far westward, very likely into Chiapas. In the forest it is a tall tree, normally with an irregular and rather narrow crown, so unimposing in appearance that one wonders why it ever should have been

transplanted. When established in the open, however, its form is altogether different, the crown rounded and exceedingly dense, the leaves much like those of Christmas Holly and very handsome. The street trees usually are trimmed and symmetrical. For ornamental planting Manzanote is highly to be recommended, and it might thrive in California in areas subject to only light frost.

Carreto, *Prunus Salasii*, known at present only from the mountain forests of central Guatemala, is another tree much planted locally in parks and streets, where it is certainly far more attractive than the too abundant lines of Trueno (*Ligustrum lucidum*). Its wood is said to be of good quality. The fruit, although large for a Laurel Cherry, is too bitter to be edible.

Such, in brief, are the principal forest formations of Guatemala. A more detailed picture, based upon data obtained by three expeditions of Field Museum, conducted by the writer and by Dr. Julian A. Steyermark, will be presented with the publication of the descriptive account of the flora of Guatemala now in preparation.

It goes without saying that the forests are of the very greatest importance to the life of Guatemala. This fact is recognized by the present progressive government, which has promulgated laws to control the use and development of the forests. Cutting of trees is regulated and the law is enforced in most localities. One who cuts a tree must plant several in its place. Trees standing near a road may not be cut. On public land they may be felled only under close supervision, and even then license seldom is given.

In many parts of the highlands there are extensive stands of planted Cypress, huge trees that at first glance resemble natural forest. There are many handsome avenues along roads, especially at Chimaltenango and San Marcos. Another planted tree that thrives all too well is a Eucalypt, whose removal often becomes a problem, since the wood is considered useless even for fuel. At a few places in the lowlands there have been limited plantings of Cedro, Mahogany, Brazilian Bracatinga, and other trees. In the Pacific *bocacosta* extensive plantings of *Cinchona* are being made. On a finca near Cobán

there is an instructive illustration of what may be done in growing Pine in that region. A whole mountainside was planted some 35 years ago with the local Pine, and the trees are now so large that the plantings have all the appearance of a thrifty natural forest.

In spite of government regulations and the best efforts of officials, destruction of the forest proceeds with sad rapidity, and in regions where one would think it dare not be continued. Guatemala is densely populated for the most part; the population increases rapidly, and there is pressing demand for new agricultural lands. Much of the land actually under cultivation is so steep or rocky that one marvels that it ever is planted. There is a common saying in the Occidente that the almost perpendicular cornfields are planted with a shotgun. The white-sand slopes of the Occidente are so steep and loose that sometimes the whole corn crop slides with the sand down the slope.

In the valley of Sija woody plants have been exterminated, so that at present the only available fuel is grass roots. Tortillas are not made because they require too much fuel; instead the people subsist on boiled *tamalitos blancos*, which need less fuel for their preparation.

The removal of the forest obviously increases erosion, and erosion is a menace in all the volcanic part of Guatemala. Perhaps the most vivid illustration of complete deforestation is seen on the steep slopes of the beautiful Volcano of Agua, facing Antigua, where hardly a tree remains, and deep barrancos have been gouged down the slopes. It was a sorry sight last winter to see the cutting of Alder forests on the slopes of the Volcano of Zunil, although Alder trees themselves have slight economic value and no great botanic interest. It is doubtful that the peas and cabbages planted on these sterile sand slides will compensate for the permanent damage that must result from the destruction of even these poor trees.

AMERICAN WOODS OF THE FAMILY BORAGINACEAE

By Samuel J. Record *and* Robert W. Hess

This family comprises about 90 genera and over 1600 species. They are chiefly rough-hairy herbaceous plants, widely distributed and most abundant in temperate regions, especially in the Mediterranean basin, central Asia, and western United States. Many of the topical species are upright or scandent shrubs or lianas, and some are trees. The leaves are simple and alternate, rarely opposite; stipules are absent; the flowers are borne in normal or in unilateral (scorpioid) cymes; the fruit is a drupe or of four nutlets. Some of the herbs, such as the Forget-me-not, Hound's-tongue, and Gromwell, are cultivated in gardens; a few trees (*e.g.*, *Cordia*) are planted in parks and along streets because of their attractive foliage and handsome fragrant flowers; and various kinds are of local account for their edible fruits and reputed medicinal properties of their leaves, flowers, or roots. The glutinous mesocarp of *Cordia* is used for bird-lime and glue. The most important genus for timber is *Cordia*, and the early Egyptians made extensive use of the wood of the Sebestan Plum, *C. Myxa* L., a medium-sized tree native to Egypt, Persia, Arabia, India, and the Malay Peninsula. The tropical American tree species belong to nine genera, namely, *Auxemma*, *Bourreria*, *Cordia*, *Ehretia*, *Lepidocardia* (not seen), *Patagonula*, *Rochefortia*, *Saccellium*, and *Tournefortia*. The two of value for their timber are *Cordia* and *Patagonula*, but only the former has possibilities for the export trade.

Heartwood typically light to dark brown, frequently streaked or variegated with olive, purple, or black; often sharply demarcated from the whitish sapwood. Luster usually golden in proper light, but sometimes obscured by parenchyma. Taste not distinctive, but some specimens, *e.g.*, *Cordia*, have a spicy fragrance. Density low to high; texture fine to coarse; grain generally straight; working properties and durability fair to excellent.

Growth rings present. Pores rather few to numerous; sometimes large in part, but mostly small to very small; solitary in *Rochefortia;* in ring-porous arrangement in *Auxemma* and *Ehretia* (in part); in ulmiform pattern in *Patagonula* and *Saccellium;* in small multiples and clusters, sometimes joined by parenchyma, in the others. Vessels often with meandering course as seen on tangential surface; typically with simple, wide-rimmed perforations; occasional foraminate plates also present in *Cordia;* spiral thickenings seen in small vessels of *Ehretia* (in part); tyloses common; intervascular pitting very fine to medium, alternate; pit apertures commonly extended and coalescent. Rays 1 to 4, sometimes to 8, cells wide and of variable heights up to 100 cells or more; not distinctly two-sized; homogeneous to decidedly heterogeneous; outermost marginal cells frequently peaked; sheath cells sometimes present, *e.g., Auxemma* and *Cordia;* crystals present or absent, sometimes numerous, gum deposits abundant in dark-colored woods; pits to vessels usually between very small and medium-sized, elongated (10 to 18μ) in *Tournefortia* (in part). Wood parenchyma finely reticulate in *Bourreria, Ehretia, Rochefortia,* and *Tournefortia;* paratracheal and aliform to confluent in the others; in some instances terminal; crystals present or absent, numerous in *Auxemma.* Wood fibers with thin to very thick walls; pits very small to medium-sized, simple to distinctly bordered. Ripple marks absent. Small vertical traumatic gum ducts occasionally present in *Cordia.*

Auxemma. Two species of this Brazilian genus have been described, of which the better known is *Auxemma oncocalyx* (Fr. Allem.) Baill. (= *A. Gardneriana* Miers), a small to medium-sized deciduous tree with its center of distribution in Ceará where it grows gregariously and rather abundantly in regions with distinct wet and dry seasons. The olive-like fruit is completely inclosed in a 5-winged bladder formed by the inflated calyx tube. The common name is Pau Branco (white wood), but the heartwood is dark-colored and resembles Black Walnut (*Juglans nigra* L.); its principal use is for fuel, but it is suitable for furniture and durable construction. The following description is based on a specimen collected by H. M. Curran in Ceará.

Heartwood chocolate or purplish brown, somewhat variegated, the surface fading to light brown upon exposure; distinct but not sharply demarcated from the yellowish white sapwood. Luster fairly high. Without distinctive odor or taste. Heavy, hard, and strong; sp. gr. (air-dry) 0.70; weight about 43 lbs. per cu. ft.; texture coarse; grain straight; easily worked, finishing very smoothly and attractively; is highly resistant to decay. A good timber, but presumably of no commercial possibilities.

Ring-porous. Large pores (up to 270μ) distinct in a ring or irregular zone in early wood; pores in other part of ring small to minute (50μ), becoming clustered. Vessel lines distinct; intervascular pitting very fine. Tyloses and gum deposits common, but not filling vessels. Rays 1 to 5, mostly 4, cells wide (uniseriates very few) and up to 80, mostly over 30, cells high; decidedly heterogeneous; sheath cells present; crystals numerous; pits to vessels very small (3 to 4.5μ), rounded. Wood parenchyma sparingly paratracheal, becoming narrow aliform and confluent in outer late wood; fairly distinct with lens; crystals numerous. Wood fibers thick-walled, septate in part. Structure much more like *Cordia* than *Patagonula.*

Bourreria (*Beureria* or *Beurreria*), with about 40 species of shrubs and small to medium-sized evergreen trees, occurs in the West Indies, southern Florida, Mexico, Central America, and northern Colombia and Venezuela. The trunks of the trees are usually sulcate or fluted; the fragrant white flowers are borne in terminal corymbose cymes; the fruit is a thin-fleshed drupe containing four bony nutlets. The timber is not utilized for any special purpose.

Two species reach the shores of southern Florida. One of them, *Bourreria revoluta* Meyers, is a large shrub; the other, *B. ovata* Meyers (= *B. havanensis* Hitch.), is a tree sometimes 50 feet tall with a scaly, buttressed trunk a foot in diameter. The most interesting species is the Huanita tree of Mexico, *B. huanita* (Llave & Lex.) Hemsl. (= *Morelosia huanita* Llave & Lex.), which ranges from Michoacán to Oaxaca and southward through Guatemala to Salvador. The flowers are an ingredient of a fermented beverage prepared from crude sugar and are also used for perfuming tobacco and flavoring sweetmeats and conserves. The tree was once the cause of a war. Moteczuma II wanted it for his celebrated botanical garden and, being unable to get it by peaceful means, sent an army to Tlaxiaco about 1496 and took some plants by force. According to some authorities the stock thus secured died before it could be planted, but other writers state that it lived and became one of the treasures of Moteczuma's gardens. (See *Tropical Woods* 28: 14, 24.)

Heartwood brown, with lighter streaks, merging gradually into the scarcely distinguishable sapwood. Luster medium. Odorless and tasteless. Hard and heavy to moderately so; texture fine; grain fairly straight; easily worked, finishing smoothly; durability fair. Has no commercial possibilities.

Growth rings distinct. Pores small (60 to 110μ, usually less than 100μ), not visible without lens; numerous but not crowded; solitary and in pairs, with tendency to diagonal or tangential arrangement, sometimes approaching ring-porous structure. Intervascular pitting very fine. Rays 1 to 5, mostly 3 or 4, cells wide (uniseriates few to fairly numerous) and up to 60, generally less than 30, cells high; more or less heterogeneous; pits to vessels very small (3 to 4.5μ). Wood parenchyma diffuse to finely reticulate. Wood fibers thick-walled, with numerous small bordered pits.

COMMON NAMES: Strong back, s. bark (Florida and Br. W.I.); agalla, árbol de la frutica, ateje de sabana, cagón, cateicito, curaboca, fruta de catey, frutica de catey, guazumillo, hierro de costa, h. de sabana, jaguagüita, raspalengua, roble agalla (Cuba); palo de vaca, roble guayo, spoon tree (P.R.); muñeco (Dom. R.); café marron, mapou gris (Haiti); bacalché, beheck, esquisuchil, flor de palomita, guiexoba, huanita, izquixochitl, jazmín de Tehuantepec, kakalché, opay, sacbayeck, yaga guiexoba, ytayucuine, yzquixochitl (Mex.); black fiddlewood, laurel, roble (Br. H.); roble, sombra de ternero (Guat.); esquinsuche, listón (Salv.); guisjoche (C.R.); uvito macho (Col.); flor blanca, f. de ángel, grimanso, guatacare, g. blanco, semeruco (Venez.).

Cordia, the most important genus of the family, includes more than 200 species of unarmed shrubs and small to large trees widely distributed in tropical and warm extra-tropical regions of the world. There are many American species with a combined range extending from southern United States to Argentina. All of the larger trees supply useful timbers, but only a few are of commercial value.

Botanists are not in agreement as to what constitutes this genus, and one has gone so far as to discard the name *Cordia* and distribute the species among separate genera (see *Tropical Woods* 36: 51). The available wood samples, though numerous, are not sufficient for a comprehensive systematic study. They range in color from grayish yellow or yellowish brown to dark brown variegated with black, in density from light, soft, and spongy to decidedly heavy and hard, and in texture from medium to very coarse and fibrous. The fibers often have a golden luster but this is masked by the dullness of the parenchyma cells so that the surface of the wood has a mealy appearance but with a rich sub-luster in proper lighting. The commercial timbers are of two general classes: (1) dark-colored and hard-wooded, typified by *Cordia Sebestena* L.; (2) light-colored and soft-wooded, typified by *C. alliodora* (R. & P.) Cham. The distinctions are not always pronounced and there is also some question as to the effect of age and site on the kind of timber produced by the same species.

Hard-wooded, dark-colored group.—Cordia Sebestena is a small tree, rarely 35 feet high, in southern Florida, where it is called Geiger-tree, and in the West Indies, the northern coast of South America and Yucatán, Mexico; it is often planted for ornament on account of its orange or scarlet flowers. The beautiful faintly scented heartwood is used locally for small cabinet work and articles of turnery, but the trees are too small and scarce to be of commercial importance.

A larger tree of the same general range is *Cordia Gerascanthus* L. (= *C. gerascanthoides* H.B.K.), which is often confused in the literature with "*C. Gerascanthus* Jacq." (= *C. alliodora*). It (or a closely related species) is at its best in Venezuela, where it is known as Canalete. Its variegated reddish brown, strong, readily-worked, durable timber is highly esteemed locally for joinery, furniture, and house construction. The most important species of the group in Guatemala, British Honduras, and Yucatán and Chiapas, Mexico, is *C. dodecandra* DC., a tree upward of 100 feet tall, with very rough leaves, orange-red flowers, and edible acid fruits. The timber is considered excellent for fine furniture and turned objects, but the supply is very limited. Other Mexican woods of this group have been identified as *C. elaeagnoides* DC. and *C. sonorae* Rose, both small to medium-sized trees. Some undetermined specimens of *Peterebí* from Argentina and Matto Grosso, Brazil, belong in this group, but others of that name are comparatively light and soft.

Heartwood tobacco-colored to reddish brown, with irregular dark brown or blackish streaks and variegations; with more or less of an oily or waxy appearance; rather sharply demarcated from the grayish or yellowish sapwood. Luster variable. Taste not distinctive; scent mildly fragrant, at least when fresh. Hard, heavy, and strong; sp. gr. (air-dry) 0.80 to 0.97; weight 50 to 60 lbs. per cu. ft.; texture medium and not always uniform; grain variable; not difficult to work, finishing very smoothly and attractively; holds its place well when

manufactured; durability high. Of limited commercial possibilities because of the scarcity of the timber, but suitable for brush backs, turned articles, and cabinet work.

Growth rings usually present. Pores medium-sized to large (130 to 250μ), mostly 140 to 180μ); rather few to numerous; solitary and in pairs and little clusters, well distributed or with local tendencies to diagonal arrangement. Intervascular pitting fine to medium. Tyloses and gum deposits abundant. Rays up to 5 or 6, sometimes to 8, cells wide (small rays few) and of various heights up to 100 or more cells; more or less distinctly heterogeneous; large interior cells and sheath cells sometimes present; crystals common; pits to vessels small to medium-sized (5 to 9μ, mostly 5 to 7μ) and rounded, or occasionally elongated (unilaterally compound pitting). Wood parenchyma paratracheal and occasionally to frequently confluent into bands of irregular width and spacing; fusiform cells common; sometimes finely terminal. Wood fibers with medium to very thick walls and small, simple or indistinctly bordered pits. Ripple marks absent. Very small vertical traumatic gum ducts rarely present.

COMMON NAMES: Anaconda, geiger-tree, sebestena (Florida); anacahuite, baría, b. carbonera, b. prieta, bomitel encarnado, cutiperí, platanillo, sebestena, varía, v. negra, vomitel colorado, v. encarnado (Cuba); aloe-wood, San Bartolomé, vomitel colorado (P.R.); coquelicot (Haiti); mapou (Dom.); amapa asta, a. boba, a. bola, anacuite, asta, baría, barl, bocote, bohom, bojón, cha-copté, coopté, copté, grisiño, gueramo, habeem, ocotillo meco, palo de asta, siricote, s. blanco, zac-copté (Mex.); ziricote (Br. H.); palo de asta (Guat.); canalete, c. prieta (Col.); canalete, candelo, no-me-olvides, pardillo negro, p. prieto (Venez.); loro negro, peterebí (Arg.); lauro pardo (Braz.).

Soft-wooded, light-colored group.—There are many species of trees and shrubs in this group, but apparently there are only two or three species of much importance for their timber. The most widely distributed is *Cordia alliodora* (R. & P.) Cham. (=*C. Gerascanthus* Jacq.), a medium-sized to large tree occurring in the West Indies and from southern Mexico to the southern edge of the tropics in South America. The forks of the young twigs almost always develop swellings which harbor fierce ants. The leaves are characterized by stellate pubescence in varying abundance and have a garlic-like odor when crushed. The fragrant white or yellowish corollas are borne in large panicles and remain on the tree almost unshriveled, finally serving as parachutes to the falling fruits. In Central America the usual name for the tree is Laurel, and two kinds are recognized, namely, Laurel Blanco and Laurel Negro, the names referring to the color of the heartwood. The latter might well be considered in a third group of soft, dark-colored woods, but after repeated failures to distinguish the two sorts in the forest the author has come to the conclusion that the differences noted are probably attributable to the age of the tree or to individual peculiarities. Laurel Blanco is light-colored throughout, is not scented, and though considered fairly resistant to termites it will not last long in contact with the ground. Laurel Negro has a nearly white sapwood and a rather dark, somewhat variegated, spicily scented, durable heartwood which suggests Walnut (*Juglans nigra* L.); it may prove to be *C. megalantha* Blake, as the one specimen available has the characteristic color. Both kinds are employed locally for general carpentry and construction, but the darker timber is preferred on account of its more attractive appearance and greater durability.

The usual Argentine name for timber of this group is Peterebí. The species is usually given as *Cordia trichotoma* (Vell.) Arrab. (=*C. frondosa* Schott=*C. excelsa* A. DC.=*C. hypoleuca* DC.), but is very closely related to *C. alliodora* and the differences are varietal rather than specific. The flowers are generally larger, the leaves more pubescent, and the twigs are rarely occupied by ants and are then never conspicuously deformed (see *Journ. Arnold Arboretum* 16: 1: 9). Castro (*Las maderas Argentinas*, p. 18) says that Peterebí or Loro Amarillo is found in Misiones and northern Corrientes, the trees being 50 to 80 feet high and about 20 inches in diameter. The lumber, which is easy to work and has a high luster, is used for general construction, door and window frames, and as a substitute for imported Oak (*Quercus*) for the manufacture of furniture. The following information is supplied by H. M. Curran:

"Peterebí is a symmetrical tree 100 to 125 feet high with a slender trunk usually 18 to 24 inches in diameter and free of branches for 40 to 50 feet. It is without buttresses, and the bark is dark brown and rough, suggesting Elm (*Ulmus*). The deciduous leaves are rather thin and about two inches long and one inch wide; the flowers are dark chocolate-brown and borne in great profusion at the extremities of the branches. Though nowhere abundant, this

tree is common in the forests of Misiones, Argentina, and in Paraguay and the adjacent region of Brazil. It occupies the sandy or clay loam in the vicinity of the rivers and the best stands rarely contain more than two or three trees per acre. The timber reaches the market in the form of squared logs and the total amount consumed annually is between 500,000 and 1,000,000 board feet. The wood, which is of a golden brown color, is considered one of the best furniture woods in Argentina."

There are several kinds of *Cordia* in Brazil, and in the southern part of the country they are generally known as Louro. In the Amazon region, the principal species is the Frei Jorge or Freijo, *Cordia Goeldiana* Huber, closely related to *C. alliodora.* According to Huber (*Bol. Mus. Goeldi* 6: 90), it is a large tree in the high forest along the right-of-way of the railway between Belem (Pará) and Bragança, and probably elsewhere. He says that the wood is highly appreciated, particularly for cooperage. In this connection an American consul reported in 1925 that its importation into Portugal for the manufacture of staves had declined owing to the poor quality of timber received and to the fact that it imparts a flavor to wines (see *Tropical Woods* 4: 11). Le Cointe (*L'Amazonia Brésilienne* 2: 25) says that the lumber is of good quality, easy to work, much used in Belem (Pará) for carpentry and joinery, and in place of Teak in naval construction.

Freijo has been on the United States market in small quantities for more than 20 years, and has been known as Brazilian or South American Walnut, Jenny Wood, and Cordia Wood. Karl Schmeig, New York manufacturer of fine furniture, has used this timber with success. He says (*Tropical Woods* 9: 1): "The Cordia Wood or Jenny Wood is proving highly satisfactory and, what is always a matter of concern to the manufacturer, the supply is adequate. This wood is of a neutral color, suggesting Chestnut, has about the same density as American Walnut, takes a stain very well, and, on account of its close texture and even grain, receives a soft patina finish with comparatively little effort. It is especially well adapted for interiors of club rooms, for bank fittings, and for furniture of Spanish design. For many purposes it satisfactorily replaces Oak. We recently built a complete room, including the furniture, of Cordia Wood and were gratified with the results."

Heartwood yellowish to brown, uniform or more or less streaked and variegated; light-colored material not clearly differentiated from sapwood, dark-colored distinct but usually not sharply demarcated; brown rays make lightest kinds oatmeal colored. Luster of best grades rich and golden when viewed in proper lighting. Without distinctive taste; dark specimens spicy-scented. Light and soft to moderately hard and heavy; sp. gr. (air-dry) 0.40 to 0.70; weight 25 to 44 lbs. per cu. ft.; texture uniform, medium to coarse; grain generally straight; easily worked, though sawing woolly when fresh; seasons readily, finishes smoothly when dry, takes glue well, and holds its place remarkably well when manufactured. An attractive timber worthy of greater consideration by consumers everywhere. The minute anatomy is not essentially different from that of the other group of *Cordia.*

COMMON NAMES: *Cordia Goeldiana:* Cordia wood, Jenny wood (U.S.A. trade); freijo, frei jorge (Braz.). *C. alliodora* and *C. trichotoma:* Prince wood, Spanish elm (Br. W.I.); baría amarilla, capá roja, palo de rosa del país, varía, v. colorada (Cuba); capá, capaw (P.R.); bois de cipre, b. de cype (Mart.); cyp, cypre (Trin.); amapa prieta, buhún, bojón, b. blanco, b. prieto, hormiguero, nopo, palo de rosa, p. de María, suchicahue, tambor (Mex.); bohun, laurel blanco, salaam, salmwood (Br. H.); suchah (Guat.); laurel, l. blanco, l. negro (C.A., gen.); laurel hembre, l. macho (Nic.); dze-uí (C.R.); canalete de humo (Col.); alatrique, canjaro, cautaro, pardillo, p. del monte (Venez.); brown silverballi, taparai (Br. G.); laurel (Ec.); árbol del ajo (Peru); louro, l. amarello, pau cacharro, urúa, uruasinho, uruazeiro (Braz.); louro (Urug.); afata grande, lapachillo, loro amarillo, peterebí, p. hú, p. saiyú (Arg.). *Other species:* Cocobey (Bah.); manjak (Grenada); anacahuita, ateje, a. amarillo, a. blanco, a. cimarrón, a. colorado, a de costa, a. hembra, a. macho, atejillo, hierro de costa, palo de rosa, saúco, tabaco, uva gomosa, varía blanca, vomitel, v. amarillo, v. blanco (Cuba); basora, b. prieta, black sage, capá cimarrón, cerezo, c. blanco, copillo, cupillo, manjak (red, white), moral, muñeco, palo de muñeco, p. de perico, saraguaso, s. prieto, saraguero (P.R.); capá prieto (Dom. R.); belle-belle, bois caparo, b. chique, b. soumis,

bonbon captain, chêne caparo, fleur dent, parésol, trois pieds (Haiti); cipre a griver, c. balanic, c. oranger, mahot noir, mapou blanc (Guad.); black sage, bois lay-lay, hairy lay-lay, manjak, mapoo lay-lay (Trin.); anacahuite, azota caballo, babosa, bohonché, bubo, chavarobo, gonguipo, gulabere, huaché, huazimilla, kopché, koxolxek, macahuite, oreja de ratón, San Juanito, tacotillo, valozo, vara prieta, vavos, xcopché, zazamil (Mex.); bastard salmwood, jackwood (Br. H.); coralillo, manuno upay (Guat.); cebito, cuaja-tinta, escoba negra, escobilla negra, manuno, tigüilote, t. negro, tihuilote, varilla negra, zompopo (Salv.); carne asada, cachalaco, sombra de ternero, tigüilote (Hond.); buriogre, b. amarillo, b. de montaña, cuaja-tinta, escoba negra, jigüilote, muñeco, nigüito, salvilla cimarrón, tigüilote, varilla negra (C.R.); goma, lengua de buey, muñeco amarillo, nigüito, paico, sabto, tigüilote, ubero, uvillo (Pan.); canalete de humo, caujaro, guácimo, g. nogal, guasco, muñeco, m. canalete, pata de gallina, solera, uvito, u. mocoso (Col.); aguacatico, baboso, basura prieta, candilero, cariaco, cariaquito, c. de sabana, c. negro, caujarito, caujaro, celedonia, guapalo, majañe negro, majao negro, pardillo blanco, tarare blanco (Venez.); ants' plant, yuwanarow (Br. G.); alatoeloeka, aloeko uonoré, anakara, anoemalatti, aratroeka, arowtroeka, arreuonoe, awali emoeloe, baka eoma, berg tafraboom, blaka oema, b. ivintje, boggi lobbi, danlieba, dokka dokoa, hoereuereroko, horowé jore lokko, h. j. roko, kaboejakoro diamaroe, kakoro, k. konokodikoro, makoeja pipa, manblaka oema, marribonsoehoedoe, mattoe toenbalobbi, omosé, tafelboom, tafraboom, toenbalobbi, waijanaka erepaloe, wakoekwa-tokon (Sur.); arbre parasol, montjoly, tiki topichi (Fr. G.); tigua balsosa (Ec.); almendrillo, añallio-caspi, bacurí, mote-mullaca, orcco-lauraimana, tahuampa-caspi (Peru); araticú, a. guazú, colita, gomita, mbuy-rembiú-guazú (Arg.); carbón (Chile); azaherero del monte (Urug.); achira-mourou, arvore de umbella, babosa branca, café do matto, carú-caá, catinga de barrão, cauarú-caá, cha de bugre, cha de frade, chapeu de sol, claraiba, jaguará murú, juruté, laranjeira do matto, María preta, mata fome, parapará, pau de formige, p. de jangada, pinchíricóto (Braz.).

Ehretia, with some 50 species of shrubs and small to large trees, is most abundantly represented in the tropics of the Old World, about 10 species occurring in the West Indies and from Costa Rica through Mexico to western Texas. *E. Austin-Smithii* Standl., which grows in the mountains of Costa Rica, attains a maximum height of 100 feet, with a trunk six feet in diameter at the base, but often dividing near the ground into several stems. The leaves are very rough and are used locally for scrubbing and scouring. *E. tinifolia* L., of the West Indies and Mexico, ranges in size from a shrub to a tall tree; it is often planted for shade, and has an edible fruit. The most northern species, *E. anacuna* (Berl.) Johnston (= *E. elliptica* DC.), of Mexico and the Texas borderland, is a shrub on barren soils but grows to a height of 50 feet and a diameter of 36 inches in river bottoms. It is frequently planted along streets, as it has a handsome dense-foliaged crown, panicles of small white fragrant flowers, and sweet edible fruits. The wood is used locally for tool handles, yokes, and the spokes of wheels.

Wood grayish brown throughout. Luster medium. Odorless and tasteless. Heavy and hard; texture rather fine; grain fairly straight; not difficult to work, taking a high polish; not very durable. Of no commercial possibilities.

Growth rings usually present. Pores usually up to medium-sized (120 to 180μ), the largest barely visible without lens; rather few; mostly in small clusters and multiples. *Ehretia anacuna* ring-porous; early-wood pores small (90μ); late-wood pores in multiples or small clusters tending to diagonal or dendritic arrangement. Small vessels sometimes with spiral thickenings. Rays 1 to 5, mostly 3 to 5, cells wide and up to 60 cells high; homogeneous to heterogeneous; pits to vessels small to medium-sized (5 to 8μ; not over 5μ in *E. anacuna*). Wood parenchyma finely reticulate. Wood fibers with numerous small bordered pits.

COMMON NAMES: Anama, anaqua, knackaway, nockaway, sugarberry, yara (Texas); quiebrahacha, roble prieto (Cuba); arrayán (Dom. R.); chêne noir, filière (Haiti); bois de rose noir (Guad.); anacahuite, anacua, anagua, bec, beec, capulín cimarrona, manzana, manzanillo, manzanita, nandimbo, roble, saúco (Mex.); guarlo, manzanita (Salv.); laurel (C.R.).

Patagonula. There are two species, namely, *Patagonula americana* L. and *P. babiensis* Moric, but only the first is at all well known. It is a medium-sized to large tree, sometimes 85 feet tall and 30 inches in diameter, growing in southern Brazil, northern Argentina, Paraguay, and Uruguay. After blooming, the five calyx lobes greatly elongate and provide wings for the small, pointed fruit. The timber, which is of excellent quality and attractive appearance, is so much in demand in Argentina that the available stands have been seriously depleted. The thick sapwood is used for making tool handles, oars, agricultural implements, yokes, and vehicles, and the Indians of Misiones prefer it for their bows. The variegated heartwood is highly esteemed for fine furniture, bentwood chairs, interior trim, and articles of turnery. Importation of chairs of the Vienna type has been greatly reduced through the establishment of local factories using timber from the Chaco forests. The common name in Argentina is Guayabí, and it is sometimes confused with the Guayabil of Salta (*Saccellium lanceolatum* H. & B.).

Heartwood usually variegated in various shades of brown to blackish purple; sometimes fairly uniform dark olive; distinct but not always sharply demarcated from the white to brownish sapwood. Luster medium. Odor and taste not distinctive. Hard, heavy, tough, and resilient; sp. gr. (air-dry) 0.80 to 0.95; weight 50 to 59 lbs. per cu. ft.; texture rather fine, uniform; grain fairly straight; fairly easy to work, taking a high polish; heartwood very resistant to decay. Not likely to become important for export because of the local demand.

Seasonal growth rings present but not distinct; darker bands sometimes regular enough to give appearance of true growth rings. Pores small (60 to 100μ), not individually visible without lens; thick-walled; numerous; mostly in pairs and small groups associated with parenchyma and arranged in numerous, narrow, irregular to fairly uniform, tangential or concentric bands in ulmiform pattern, distinct on tangential surface. Rays generally 2 to 4 cells wide and of various heights up to about 60 cells; homogeneous to more or less distinctly heterogeneous; marginal cells often peaked; pits to vessels small (4.5μ), rounded. Wood parenchyma abundant, paratracheal and confluent; visible to unaided eye. Wood fibers with simple or indistinctly bordered pits.

COMMON NAMES: Guayabí, g. blanco, g. crespo, g. morotí, g. negro, g.-rá, guayaibí, guayubí, guayabil (Arg., Urug.); ipê branco, guajuvira, g. branca (Braz.).

Rochefortia, with about eight species of shrubs and small trees, mostly armed with spines, is limited to the West Indies and Colombia. The timber is utilized to a limited extent locally for fence posts, articles of turnery, fuel, and charcoal.

Heartwood very dark brown, uniform or variegated; usually with a greenish yellow hue; has an oily or waxy appearance; rather sharply demarcated from the thin yellowish brown sapwood. Luster low. Without distinctive odor or taste. Extremely hard and heavy; sp. gr. (air-dry) 1.25; weight about 79 lbs. per cu. ft.; texture fine and uniform; grain fairly straight; not difficult to work, taking a glossy polish; very resistant to decay. Of no commercial importance because of small size.

Growth rings present. Pores small (75 to 80μ), not visible without lens; rather numerous; thick-walled; solitary; fairly evenly distributed. Gum plugs abundant in vessels. Rays 1 to 3 cells wide and up to 30, commonly less than 15, cells high; weakly heterogeneous; pits to vessels very small (3μ), rounded. Wood parenchyma very finely reticulate. Wood fibers with very thick walls and numerous small but distinctly bordered pits; gum deposits abundant.

COMMON NAMES: Carbonera, cerillo de costa (Cuba); juzo (P.R.); bois d'ébène (Haiti); bois vert (Guad.).

Saccellium. Three species have been described, namely, *S. brasiliense* I. M. Johnston (Matto Grosso, Brazil), *S. Oliverii* Britt. (Amazonian Bolivia), and *S. lanceolatum* Humb. & Bondpl. The last, which is the only well-known species, occurs in the Amazon drainage of northeastern Peru and from the mountains of southern Bolivia southward along the mountains of northern Argentina to Tucumán (see *Journ. Arnold Arboretum* 16: 2: 181–183). The branches are elongate and stiff; the evergreen leaves are distinctly lanceolate; the flowers are white or yellowish; the fruit is a small drupe inclosed by the accrescent calyx. Though usually a small tree, it sometimes attains a height of 65 feet and a diameter of 20 inches. The wood resembles that of *Patagonula* and is used to a small extent for general carpentry and furniture. Only one specimen is available (Yale 32601; Imp. For. Inst. 9629) and it is all sapwood.

Heartwood said to be variegated dark brown; sapwood pale brownish, with fine stripes or markings due to higher luster of wood-fiber zones. Odorless and tasteless. Hard and moder-

ately heavy; easy to work, finishing smoothly; heartwood said to be highly durable. Apparently without commercial possibilities, at least for export.

Growth rings present. Pores small (60μ) to very small; very numerous and crowded together into distinct wavy, broken, or uniform concentric bands as wide as or wider than the intervening fiber layers (ulmiform pattern). Rays 1 to 3, mostly 3, cells wide and up to 35 cells high; weakly heterogeneous, the marginal cells peaked; pits to vessels small (5μ), rounded. Wood parenchyma paratracheal, mostly confined to the margins of the pore-bands. Wood fibers with very thick walls and small simple or indistinctly bordered pits.

COMMON NAMES: Guayabil, g. negro, guayibil (Arg.).

Tournefortia, with about 100 variable and poorly defined species of woody vines, erect or scandent shrubs, and a few small trees, is of pantropical distribution, but most abundantly represented in tropical America. The leaves are typically broad; the small white or yellowish flowers are borne in scorpioid cymose spikes or racemes; the small drupaceous fruits contain four nutlets. The only reported uses of the plants are in local medicines. The following description of the wood of trees is based on samples of *T. glabra* L., *T. gnaphalodes* (Jacq.) R. Br., *T. racemosissima* Krause, and *T. rugosa* Willd.

Wood pale brownish throughout, except about wounds, where it is chocolate-brown. Luster medium. Rather hard and heavy; texture fine and uniform; grain straight; easy to work, taking a glossy polish; is presumably perishable in contact with soil. Of no commercial possibilities.

Growth rings present. Pores small to medium-sized (80 to 180μ); not very numerous; mostly in scattered small multiples and clusters. Intervascular pitting medium (6 to 8μ). Rays 1 to 3 cells wide and up to 40, commonly less than 20, cells high; decidedly heterogeneous, most of the cells upright or square; pits to vessels large (10 to 18μ), rounded to long-oval. Wood parenchyma diffuse or very finely reticulate; fusiform cells abundant. Wood fibers with small but distinctly bordered pits.

In *Tournefortia hirsutissima* L., a stout scandent shrub with hairy stems, the structure appears to be normal, contrary to report of Crüger (*Bot. Zeitung* 1851, p. 468) that it has deep furrows filled with phloem tissue. In the older parts of the stem, the pores are of two distinct sizes, the largest (215 to 270μ) readily visible and nearly all solitary, the others small to very small and arranged in long, frequently compound, radial multiples, either alone or associated with one or more large pores. Ray-vessel pitting rather coarse and irregular. Wood parenchyma diffuse, sparingly paratracheal, and finely terminal. This description applies also to specimens of *T. bicolor* Sw. and *T. cuspitata* H.B.K.

COMMON NAMES: Soldier bush (Bah.); alhucema de costa, balsamillo, bejuco cayaya, cayaya, inciensio de costa, i. de playa, nigua, n. de paredón, romero de costa (Cuba); bejuco de nigua, b. masa, chiggernit, mata de nigua, nigua, n. peluda, pringamoza, té del mar, temporana (P.R.); nigua, n. peluda (Dom.R.); kallaba, liane chique (Haiti); chacnichmax, confite coyote, hierba del burro, h. del negro, h. del zapo, h. rasposa, ortigüilla, perlas sicimay, tlachichiona, topoya, tlepatli, xulkin (Mex.); frutilla, tirica (Nic.); maíz de gallo (C.R.); lágrimas de San Pedro (Col.); pesso (Ec.); herva de jaboty, h. de lagarto (Braz.).

CURRENT LITERATURE

The comparative anatomy of the secondary xylem of five American species of *Celtis*. By MARY JOSEPHINE COX. *American Midland Naturalist* (South Bend, Ind.) 25: 2: 348–357; 6 photomicrographs; March 1941.

"The present study deals with the wood anatomy of five American species of the genus *Celtis* (Ulmaceae), *i.e.*, their specific anatomical characters and the variation of these. All members of the genus *Celtis*, of which there are more than 60 species, are either shrubs or trees which are found throughout the temperate zones and the tropics. The species investigated are: *C. mississipiensis* Bosc., *C. Selloviana* Mig., *C. Swartzii* Planch., *C. triflora* Ruiz. ex Mig., and *C. occidentalis* L. Whereas six specimens of *C. occidentalis* from as many localities in the north temperate zone were studied, only one specimen of each of the four other species was available. These specimens were secured from the wood collection of Harvard University and from the School of Forestry, Yale University."

"From the material studied the writer concludes that two species, *C. occidentalis* and *C. mississipiensis*, cannot be distinguished from one another on the basis of their anatomical

structure. However, these two temperate zone species differ from the three tropical species studied by being ring-porous and having spiral thickenings, whereas the latter are diffuse-porous and lack spiral thickenings. The percentage of solitary pores is also a great deal higher in the tropical species. Very little difference is found between *C. Selloviana* and *C. Swartzii*. *C. triflora* can be distinguished from the other tropical species, *C. Selloviana* and *C. Swartzii*, by the presence of septate wood fibers, the only species studied in which they are found. The six specimens of *C. occidentalis* revealed very little variation, the most apparent difference being in the percentage of distribution of pore clusters and solitary pores."

The Caribbean Forester. Pub. quarterly by the Tropical Forest Exp. Sta., U.S.F.S. Rio Piedras, Puerto Rico. Vol. II: 2: 101–146; April 1941.

CONTENTS

Los pinares de la Republica Dominicana. (With summary in English.) By CARLOS E. CHARDÓN. *Caribbean Forester* 2: 3: 120–131; April 1941.

"The Pine forests of the Dominican Republic cover an approximate area of 7500 square kilometers in the mountainous interior of the country, and constitute the largest existing reserve of useful lumber in the Antilles. Within this area are found the highest peaks in the Antilles, one of these, La Pelona, reaching 3168 m. above sea level. . . . The limits of the Pine forests of the central mountains can be drawn as an irregular line on the north, starting at the Loma de la Cabrera

on the Haitian frontier some miles south of Dajabón and running eastward by Monción, San José de las Matas, and Jánico to a point northwest of and near La Vega. In the east, the last solid block of Pines is that in the triangle formed by the Río Yuna, the Duarte highway, and the town of Maimón, where the Pine drops down to an elevation of 150 meters above sea level. In the south, the Pines disappear close to the Río Banilejos and their boundary continues west to the Haitian frontier north of Bánica. On the west, the Pine forests continue across the Haitian frontier. Pine forests were seen in the Sierra Bahoruco, the southern range of the Republic, but little is known of their extension. . . . Based on a stumpage price of $5.00 per M bd. ft., and estimates of six trees per tarea (1600 tareas = 1 square kilometer)and an average of 125 board feet per tree, the 7200 K^2 of the central mountains plus 300 K^2 in the Sierra Bahoruco would represent a value in Pine timber of approximately $43,000,000."

Plantae Mexicanae. X. By RICHARD EVANS SCHULTES. *Bot. Mus. Leafl. Harv. Univ.* 9: 9: 165–198; 9 plates; May 1, 1941.

An account of 26 new or critical species of 19 families collected in northeastern Oaxaca, Mexico. A new collection of *Pinus strobus* L., var. *chiapensis* Martínez, represents a considerable extension of the range northwestward from the previously known localities in western Chiapas. The tree in Oaxaca is tall, has a straight and smooth trunk, is very distinct from the other Pines of the region, and occurs in "an extensive forest which is a pure stand of this variety."

"An examination of the collections of *Ochroma* from Mexico indicates that the slight characters which Rowlee used to separate the West Indian *Ochroma pyramidale* [= *O. Lagopus* Sw.] from *O. concolor* break down. . . . The specimens which have been called *Ochroma concolor* differ somewhat from the true *O. pyramidale* of the West Indies, but the differences are trivial and deserve no more than varietal status." The author accordingly proposes the name *Ochroma pyramidale* (Cav.) Urban, var. *concolor* (Rowlee) R. E. Schultes, for "a clearly distinct geographical variety centering around southern Mexico and Guatemala."

The tree mentioned by Williams (*Tropical Woods* 53: 6) as *Laplacea Williamsii* Standl. is identified with *L. semiserrata* (Mart. & Zucc.) Combessedes. The species occurs in the lowland tropical forests of eastern Oaxaca.

Bumelia eloxochitlensis R. E. Schultes & C. Conzatti is a tree about 25 feet high similar in habit to *Dipholis salicifolia* (L.) A. DC., but armed with small woody spines. The small fruits are borne in great abundance and are "reported to be sweet and mucilaginous and to possess diuretic properties if eaten in quantity. The tree is known by the Spanish names Tempiste and Zapotillo Bravo, and by the Mazatec name Ya-ntsin-tsu."

El palo amarillo (*Euphorbia fulva* Stapf o *Euphorbia elastica* Altam. and Rose). By JUAN ZINSER. *Mexico Forestal* 19: ¾: 40–42; March/April 1941.

Palo Amarillo is a yellow-barked tree 25 to 35 feet high growing in poorly accessible places at altitudes of 5000–6000 feet in Michoacán, Guanajuato, Jalisco, and eastern México, in the Republic of Mexico. The latex contains 18–20 per cent of rubber and about 40 per cent of resin. The rubber is of good quality and the resin makes excellent varnish, but it is only recently that satisfactory methods have been devised for separating the two components of the resin. Plantations are recommended, as the tree is readily propagated from cuttings and makes rapid growth. A secondary product is the seeds which contain about 30 per cent of a drying oil.

Euphorbia fulva is frequently confused with *E. calyculata*, known locally as Chupiri or Tencuanete, which is much inferior as a source of rubber. Distinguishing features of the two species are given.—MARY RECORD.

On the island origin of the endemic trees of the British Guiana peneplain. By T. A. W. DAVIS. *Journal of Ecology* (London) 29: 1: 1–13; 1 map; February 1941.

"The situation, topography, and climate of British Guiana are briefly described. The distribution of the principal climatic and edaphic associations (excluding the swamp vegetation or hydrosere) is discussed, and the influence of climate on the distribution of certain species is indicated. The prevalence of endemism in the Guiana flora is shown by analyzing the local and general range of forty of the commonest trees; the erratic distribution of a few of them is discussed.

"The geological history and geology of the country are examined; it is shown that the peneplain formed the bed of a shallow sea as recently as late Tertiary times, and that this sea was studded with volcanic islands; also that the peneplain was elevated to its present level perhaps as recently as the Quaternary age.

"The conclusions reached are: (1) that the endemic trees of the peneplain originated where they are found today; (2) that they were saved from destruction, during the last period of subsidence of the land, on volcanic islands now represented by hills; (3) that they thence recolonized the plain on its elevation to its present level; (4) that the evidence is insufficient to decide whether they were evolved on the plain itself before the last period of subsidence, or on the hills when they were islands during some earlier epoch, though the latter view is favored."

Mededeelingen Nos. 71–78 van het Botanisch Museum en Herbarium van de Rijks Universiteit te Utrecht. Extraits du *Recueil des Travaux botaniques Néerlandais*, Vol. 36–37, 1939–40.

Critical remarks on the Suriname species of the genus *Securidaca* (pp. 677–685, 4 figs.), by A. J. P. Oort.

A botanical analysis of the late Pleistocene and Holocene profile in the Rhine Delta (pp. 686–696, 2 figs.), by F. Florschütz and F. P. Jonker.

New or noteworthy Euphorbiaceae from Suriname (pp. 697–704, 2 figs.), By J. Lanjouw.

Some notes on a collection of aquatic phanerogams from the Netherlands West Indian islands and from Venezuela and Colombia (pp. 705–708), by S. J. van Ooststroom.

Un nouvel herbier de Fusée Aublet découvert en France (pp. 133–170, 4 plates), by J. Lanjouw and H. Uittien.

On *Urophyllum* Wall. (Rubiaceae) and its nearest allies (pp. 171–197), by C. E. B. Bremekamp.

A monograph of the genus *Pleiocarpidia* K. Sch. (Rubiaceae) (pp. 198–236), by C. E. B. Bremekamp.

The genus *Paravinia* Korth. (Rubiacae) in Borneo and Celebes (pp. 237–278), by C. E. B. Bremekamp.

O problema florestal do Nordeste. By VASCONCELOS SOBRINHO. *Bol. Secretaria de Agr., Ind. & Com.* (Recife, Brazil) 6: 2: 146–156; October 1940.

Consideration of the forestry problems of northeastern Brazil, particularly Pernambuco, and a proposed program for the state forest service.

O pau-brasil na historia nacional. By BERNARDINO JOSÉ DE SOUZA. *Brasiliana*, Ser. 5, vol. 162. Companhia Editora National, São Paulo, 1939. Pp. 267; ten halftones; one color plate.

An historical account covering more than three centuries of exploitation of the once important dyewood which gave origin to the name of Brazil. The work includes a chapter by Dr. Arthur Neiva on the botany of the Brazil-wood tree, *Caesalpinia echinata* Lamarck, the Ibirapitanga first described and illustrated by Piso and Marcgrav in 1648. This chapter consists of notes and comments on the descriptions of the tree by botanists and chroniclers and on the source of confusion in nomenclature noted by all who have had any special contact with the subject, and not unusual in respect to tropical woods. Even Martius made a contribution to this by citing the name Pau Brasil also for *C. peltophoroides* Benth. Incidentally, as in the discussion of Brasiletto, the matter of complications is not entirely cleared up. The type of *C. brasiliensis* Linn., of "tropical America," is apparently not known to exist.

According to Southey, the term Bersil dates in records from 1085 A.D., and the form Brazile from the year 1128, as applied to a dyewood from the islands of Malaya, one of the articles of commerce of the Red Sea. There is no doubt that this was Sappan wood, *C. Sappan* L., the Brasiletto of India, that was then called Bois Brésil, or Páo Braz. After several centuries of use for the Indian dyewood, the name Páo Braz was applied, as a matter of description, also to the similar dyewood found in the New World. Almost as soon as the first cargo of this reached Portugal (1503) the new "Terra de Santa Cruz" began to be called "Costa de Páo Brazil." The exploitation of the wood was declared a royal monopoly of the Portuguese crown. For a long time this dyewood was the most valuable product obtained by Portugal from its American possessions. It was sold abroad by Portugal, first in the Netherlands, then in England, and as late as the first part of the nineteenth century its delivery, then directly from Brazil, and sale at auction in London continued to furnish funds for the diplomatic representation and for the service of the foreign debt of Brazil in the British capital.

Judging by the large quantities of the dyewood exported legally for the account of the government, first of Portugal and then of Brazil, also as contraband by French and other nationals, the tree must have been very abundant originally. It was found in the open and often scrubby forests of the coastal region from Rio de Janeiro to Rio Grande do Norte. Avoiding the denser forest formations, such as of Rio Doce, it extended to many places far inland, existing in Minas and reported as far west as Goiaz, but it was not gathered far from the coast. Until the importation of cargo animals, and of slaves from Africa, transportation had to be on the backs of Indians. The tree was apparently most abundant in Pernambuco and adjacent states, and the wood still continues to be known as Pernambuco wood. Those engaged in the work of gathering and shipping the wood were commonly referred to as "brasileiros," a term which later came to designate any and all inhabitants of the coast and of the country as a whole, and is now proudly used by the Brazilians in referring to themselves.

Over the greater part of its former area Pau Brasil is now well on the way to extinction. It is said to be most abundant not far from Niteroi and elsewhere in the state of Rio, and in places in the south of Bahia and in Alagoas. The wood is at present of historical importance chiefly. It is said to be especially esteemed for violin bows.—B. E. DAHLGREN, *Field Museum of Natural History*.

Naming the cultivated rubber tree *Siphonia Ridleyana*. By O. F. COOK. *Journ. Wash. Acad. Sci.* 31: 2: 40–65; 1 fig.; Feb. 15, 1941.

"As indicated in *Science* (85: 406–407. 1937), historians of the rubber industry are seriously misled by confusion among

the names of different trees in South America. The usual designation of the cultivated rubber tree is *Hevea brasiliensis*, but this is ambiguous on account of being borrowed from two other rubber trees. The generic name *Hevea* was transferred from a tree found by La Condamine in 1736 on the Pacific coast of Ecuador, and the specific name *brasiliensis* from a tree that Humboldt and Bonpland collected on the upper Orinoco in 1800. The generic name *Siphonia* has historic warrant for replacing *Hevea*, as will be explained. The specific name *Siphonia Ridleyana* is suggested to commemorate the discovery by Henry N. Ridley of the method of extracting the rubber-bearing latex of this tree, which may be reckoned among the major events of history."

La posición sistematica de *Diclidanthera* Mart. By CARLOS A. O'DONELL. *Lilloa* (Tucumán, Argentina) 6: 1: 207–212; 2 plates; 1941.

Diclidanthera, with four described species of subscandent shrubs and small trees, occurs in British Guiana, Peru, and Brazil. The stem structure is anomalous, the included phloem being in concentric, more or less anastomosing, bands. Taxonomists have not been in agreement as to the proper place for the genus, but according to the author it belongs with the Polygalaceae and is very closely realted to *Moutabea*.

O côco babaçú e o problema do combustivel. By S. FRÓES ABREU. (2nd ed.) Rio de Janeiro, 1940. Pp. 94; 6¼ x 9; 16 plates.

The first edition of this important work on the Babassú Palm was published in 1929 and a good account of it by B. E. Dahlgren appeared in *Tropical Woods* 24: 40–41, Dec. 1, 1930.

Notes on Old World Hippocrateaceae. By A. C. SMITH. *Am. Journ. Botany* 28: 5: 438–443; May 1941.

"Preliminary study of Papuasian and Pacific species of the family Hippocrateaceae indicates that their separation into the two traditional genera, *Hippocratea* and *Salacia*, must be reconsidered. For some of the species previously referred to *Hippocratea*, the new genus *Loeseneriella* is proposed; *Hippocratea indica* Willd. is transferred to *Pristimera*. New species are added to the genera *Salacia* and *Salacicratea*, while the subgenus *Dicarpellum* of *Salacia* is raised to generic rank."—*Author's summary*.

Journal of the Arnold Arboretum (Jamaica Plain, Mass.) 22: 3: 297–456; July 1941.

CONTENTS

Les forêts et l'exploitation forestière au Congo. Le déboisement, l'erosion et le reboisement. By R. THOMAS. *Bull. Agric. du Congo Belge* (Brussels) 32: 1: 91–111; March 1941.

An account of the forests of the Belgian Congo with reference to their exploitation, the erosion of the soil following denudation, and measures of control and restoration.

***Derris* et *Lonchocarpus*, insecticides végétaux.** By F. FALLON. *Bull. Agric. du Congo Belge* 32: 1: 112–125; 2 figs.; March 1941.

A report on two related leguminous plants whose roots are the source of an important insecticide, rotenone, and suggestions for the culture of the plants in the Belgian Congo.

Les légumineuses insecticides. By Em. Tilemans. *Bull. Agric. du Congo Belge* 32: 1: 126–193; 4 figs.; March 1941.

An account of rotenone-producing plants with reference to their taxonomy, culture, commerce, chemistry, and utilization. The bibliography contains 303 references.

The comparative morphology of the Icacinaceae. II. Vessels. By I. W. Bailey and R. A. Howard. *Journ. Arnold Arboretum* 22: 2: 171–187; 6 plates; April 1941.

"A study of the vessels reveals salient irreversible trends of structural specialization in the Icacinaceae which parallel those that occur in other families of the dicotyledons. These lines of phylogenetic specialization tend in general to be more or less closely correlated and may be utilized in differentiating the Icacinoideae into successive levels of increasing structural modification."—*From authors' summary.*

The comparative morphology of the Icacinaceae. III. Imperforate tracheary elements and xylem parenchyma. By I. W. Bailey and R. A. Howard. Journ. Arnold Arboretum 22: 3: 432–442; 3 plates; July 1941.

"Although the phylogenetic modifications . . . are not perfectly synchronized in all cases, the differentiation of the Icacinoideae into three groups upon the basis of differences in vessel structure serves to segregate the imperforate tracheary elements and the wood parenchyma into three general levels of increasing morphological specialization."

Following a discussion of the terminology of wood parenchyma distribution, the authors adopt the following basic terms; apotracheal (Chalk)—diffuse, banded, terminal; paratracheal (Sanio)—scanty, abundant, abaxial, vasicentric. Transitional types are recognized, but not specifically named.

"In *Sarcostigma* and at times in certain of the Phytocreneae the strands of wood parenchyma tend to be replaced by curious septate fusiform parenchymatous elements; true septate fibers do not occur in the secondary xylem of the Icacinoideae."

Origin and development of the uniseriate ray in the Coniferae. By Elso S. Barghoorn, Jr. *Bull. Torrey Bot. Club* 67: 4: 303–328; 24 figs.; April 1940.

This study reviews previous research and gives new cytological details concerning the origin and development of ray tissue in the primary and secondary body in the Coniferae.

"In the first-formed secondary xylem of coniferous stems most rays extend from the interfascicular segments of the stele. In the stem the rays are very low at the beginning of secondary growth; in the root they are considerably higher. This fundamental difference in height at the origin accounts, in part, for the greater abundance of ray tissue in the root than in the stem. In the secondary body of the Coniferae the majority of new rays are formed by initials which originate at the apex or sides of fusiform initials. The ray initials originate most commonly as isolated cells not associated in vertical series. The segmentation of fusiform initials also occurs. The cambial initials which give rise to the so-called radial plates of the phloem of certain conifers may also enter into the formation of xylem and phloem rays."

Various ways are described in which the increase and decrease in the height of rays are accomplished. Cytological study is made of the various methods of the origin of rays in the secondary body. This is a highly complex process, involving extensive nuclear movements in the fusiform initials. Photographs and diagrams illustrate origin of ray initials by division at the ends or on one side of fusiform initials. The behavior of the phragmoplast would appear to be of particular interest in such cases, but in hundreds of sections, though fixed at the time of most rapid cell division, no division figures were seen.—Robert Bloch, *Yale Dept. Botany.*

The ontogenetic development and phylogenetic specialization of rays in the xylem of dicotyledons. II. Modification of the multiseriate and uniseriate rays. By Elso S. Barghoorn, Jr. *Amer. Jour. Bot.* 28: 4: 273–282; 17 figs.; April 1941.

Anatomical evidence and methods of statistical correlation have shown that in the vessels of dicotyledons and in the

rays of the mature secondary xylem there are distinct trends of phylogenetic specialization. The first paper of this series dealt with origin and cellular development of the basic and least modified types of ray structure, and the relation of their ontogeny to their phylogeny. It was shown that phylogenetic specialization of rays involves the suppression of either the multiseriate or uniseriate rays as well as extensive changes in the morphology of their cells.

In both roots and stems more or less extensive variations of ray structure occur in successive stages of secondary growth. A study of these indicates that phylogenetic specialization may be accelerated in different parts of the secondary xylem and in relation to other structures of the secondary body. The variations which normally occur during ontogeny render the height and width of rays of doubtful value in the identification of woods.

"In species in which uniseriate rays have been eliminated from the outer secondary xylem, either multiseriate rays only, uniseriate rays only, or both uniseriate and multiseriate rays together may be present in the early stages of development. In species which have eliminated multiseriate rays from the outer secondary xylem the rays in the inner secondary xylem are uniseriate only.

"The elimination of multiseriate or of uniseriate rays may involve a trend from the heterogeneous to the homogeneous condition. In many cases, however, phylogenetic specialization produces large, thin-walled, heterogeneous, exclusively multiseriate rays. Similarly, the loss of multiseriate rays may give rise to exclusively uniseriate rays, composed solely of vertically elongated cells. Extensive vertical elongation of ray initials to produce high-celled multiseriate or uniseriate rays is phylogenetic as well as ontogenetic and is frequently correlated with increasing structural specialization, reduction in cambial activity, and a tendency toward the loss of rays.

"The 'aggregate ray' is a highly specialized structure which occurs sporadically throughout the families of dicotyledons. The uniseriate ray in the dicotyledons is not homologous with similar ray structures in the lower vascular plants. It is the product of parallel phylogenetic trends which have diverse points of origin."—Robert Bloch, *Yale Dept. Botany.*

The ontogenetic development and phylogenetic specialization of rays in the xylem of dicotyledons. III. The elimination of rays. By Elso S. Barghoorn, Jr. *Bull. Torrey Bot. Club* 68: 5: 317–325; 14 figs.; May 1941.

This study shows that in a wide range of unrelated families of dicotyledons ray tissue may be completely eliminated from the secondary xylem.

"The absence of rays is a highly specialized condition, associated with reduction of cambial activity and in many cases with a tendency toward the herbaceous habit of growth. The rayless condition also occurs in many plants possessing anomalous secondary thickening. The elimination of rays is accomplished phylogenetically by the transformation of ray initials to fusiform initials. Conspicuous reduction, though rarely complete absence of rays, may result in plants which have undergone dwarfing or extensive modifications in relation to xerophytic or otherwise unfavorable environments. In these cases the formation of ray initials is suppressed in the cambium. Phylogenetically, the elimination of rays is initiated in the early rather than in the later stages of development of the secondary xylem. The tendency for loss of rays is extended, phylogenetically, into successively later stages of ontogeny until the woody cylinder is devoid of ray tissue."

Variability in wood structure in roots of native Ontario conifers. By M. W. Bannan. *Bull. Torrey Bot. Club* 68: 3: 173–194; 18 figs.; March 1941.

A study of the secondary xylem in roots of *Thuja*, *Tsuga*, *Abies*, *Larix*, *Picea*, and *Pinus*, to determine the structural variability in different habitats and in different parts of the root system. The bearing of this variability upon the identification of coniferous woods, both living and fossil, is discussed.

"A fine-textured, stem-like wood was found in the roots of small trees, in the upper side of buttress roots of mature trees, about the periphery of the largest lateral roots, in roots exposed by soil erosion, and in vertical roots deep in the soil. An open wood with large early-wood tracheids and little

development of late wood was observed in the first one or two centimeters of growth in the distal parts of lateral roots located in the top few inches of soil.

"The diameter of the tracheids varied greatly in different parts of the root system, the greatest range being noted in *Larix*, the least in *Thuja*. No consistent relationship was discovered between tracheid size and soil moisture.

"The distribution of resin ducts was exceedingly variable. Ducts were most numerous in injured material, fewest in apparently unharmed specimens, for instance certain vertical roots penetrating deep into uniform sand. In such roots (*Picea glauca*) resin ducts were usually scarce, large areas of the wood possessing neither vertical nor horizontal ducts.

"The height and distribution of rays varied greatly, both in different parts of the root systems and in different conifers. In general, the rays were highest and least numerous in the distal parts of lateral roots and lowest in vertical roots. The range of variation within the root system of a single tree was greatest in certain Abietineae, least in *Thuja*."

Plant forms, the law of mass action and the production of alkaloids, cyanogenetic and organic sulphur compounds. By James B. McNair. *Am. Journ. Botany* 28: 3: 179–184; March 1941.

"There is a greater concentration of electrolytes in the leaf tissue fluids of herbs than of trees. According to the law of mass action, a greater abundance of ions containing electrolytes should lead to an increase in compounds containing these electrolytes. Perhaps more sulphur and nitrogen in herb leaf fluid than in tree leaf fluid would lead to a greater abundance of compounds containing these substances in herbs than in trees.

"Sulphur compounds in essential oils are found only in herbs; the amounts of these compounds are increased by sulphur fertilizers on poor soils but not by nitrogenous fertilizers. Cyanogenetic glucosides are nitrogenous compounds. These are found in four times as many herb families as tree families. The amounts of these compounds are often increased

by nitrogenous fertilizers, although the amounts are also influenced by other factors. Alkaloids are nitrogenous compounds. They are found in three times as many herb families as tree families. The average molecular weights of alkaloids are far greater in herbs (307) than in trees (191). Nitrogenous fertilizers may increase the amounts of alkaloids, especially on poor soils, although the amounts are also influenced by other factors, such as the genetic strain of the plant, the chemical structure of the alkaloid, its function in the plant, etc.

"These three types of compounds which are more abundant in herbs than in trees may be influenced in their formation by the law of mass action. This deduction applies only to such plants are are predisposed to the formation of the three types of compounds discussed."—*Author's summary.*

Das Holz als Rohstoff. By Reinhard Trendelenburg. München/Berlin: J. F. Lehmans Verlag, 1939. Pp. 435; 6½ x 9½; 108 text figs.

A comprehensive and thorough account of the origin, properties, and uses of wood which should prove valuable to investigators and students of the biological, forest-botanical, and technical sides of the subject. An introduction into the methods and terminology of forestry is given in the first two chapters, which also discuss the importance of wood, its distribution and various uses. Chapters follow dealing in detail with the histological and chemical composition of wood, the development and structure of the stem, the porosity of wood, and the influence of humidity on its various properties. The density of wood and the factors which influence it are discussed extensively, and exact data are given for a number of important (mostly European) wood types. A useful survey and description of the many chemical and industrial uses of wood are given in the concluding chapters. The volume contains numerous original illustrations and tables as well as an extensive bibliography, and indices for the names of authors, wood types and subjects.—Robert Bloch, *Yale Dept. Botany.*

Penetration of the walls of wood cells by the hyphae of wood-destroying fungi. By PHIMISTER PROCTOR, JR. Bul. No. 47, Yale School of Forestry, New Haven, 1941. Pp. 31; 6 x 9; 22 plates. Price 50¢.

"The object of this investigation was to determine the manner in which the hyphae of wood-destroying fungi penetrate the cell walls, whether by chemical action or mechanical force or by the concurrent action of both agencies."

"From evidence obtained, it is concluded that the penetration of the walls of wood cells by the hyphae of wood-destroying fungi is accomplished by (1) the secretion of enzymes at the tips of penetrating hyphae and (2) the total, local dissolution of the cell wall by enzymic activity in advance of actual passage through the cell wall. Thus, penetration is effected through a preformed passage without actual contact between the hypha and the penetrated cell wall, with the possible exception that contact with the cell wall at the very first point of penetration may be the stimulus which initiates enzymic activity. In all cases of penetration observed, the tip of the hypha was preceded by a cavity of significant proportion. This is clearly shown in the photomicrographs.

"Careful examination of hundreds of bore holes, some with polarized light, failed to disclose evidence of any kind that mechanical force is an instrumentality in the penetration of the cell walls of wood, although it must be admitted that the evidence is of a negative nature."

Wood anatomists will be interested in the technique (use of Karo corn syrup as a mounting medium, making photomicrographs by ultra violet light, etc.) and in the excellent illustrations showing details of wood structure at high magnifications. The original manuscript of this publication was submitted as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Yale University.

M.M. Chattaway

Price 35 cents

Yale University School of Forestry

TROPICAL WOODS

NUMBER 68 DECEMBER 1, 1941

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Yale University School of Forestry

TROPICAL WOODS

NUMBER 68 December 1, 1941

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 PHYSICAL PROPERTIES OF MODERN CABINET WOODS—I. HARDNESS

By ELLWOOD S. HARRAR

School of Forestry, Duke University

Down through the years from the massive stylings characterizing the early Italian Renaissance and Jacobean periods to the delicate and graceful motifs of the contemporary classics, only a few of the world's many really fine woods have been accorded the enviable rank of cabinet timbers. In fact, history records that for more than 300 years wood-working artisans used little else than Walnut, Rosewood, Satinwood, and Mahogany. The exquisite creations of such masters as Chippendale, Duncan Phyfe, and the Adam brothers were made almost exclusively of Mahogany, while craftsmen of the

Queen Anne, William and Mary, and Colonial periods, on the other hand, exhibited a marked preference for Walnut. Indian Rosewood and Ceylon Satinwood were held in high esteem by several master craftsmen of both the 18th and 19th centuries. A few other woods such as Ebony, Beech, Birch, Maple, Pear, Cherry, and Oak are also to be identified with certain of the period creations, but in most instances their use was never extensive, nor did they ever attain the same great popular acclaim.

The past two or three decades have witnessed a tremendous evolution in the fabrication of many kinds of furniture and, as a result, a new form of styling, "The Modern," has become firmly established in the trade. New adhesives, improved gluing methods, the development of more efficient veneer-cutting machinery, together with the gradual disappearance of old and often unfounded prejudices against built-up stock have occasioned the exploitation of over 100 new or comparatively unknown ornamental woods. For the great majority of them, little or nothing is known of their physical and mechanical mannerisms other than that they possess pleasing hues and figures, that they work readily under tools, and that they can be successfully cut into thin sheets of veneer and subsequently glued into panel stock.

Recognizing that there is a dearth of technical information relating to modern cabinet timbers and that there is a real need for data of this sort, a series of studies has been initiated to ascertain certain of their more pertinent characteristics. This paper, the first of a series, reports the results of a study dealing with the comparative hardness of 85 foreign and domestic woods more or less commonly used in the American furniture industry.

The hardness of a wood is usually conceived as its ability to resist indentation. Thus, it may also be used conservatively as an indication of a wood's resistance to marring, abrasion, and possibly even its wearability. The usual measure of the hardness of a wood is the load necessary to embed a 0.444-inch steel ball to half its diameter. Such a value is commonly expressed in pounds and is used primarily for purposes of comparison. Thus, if the resistance to indentation

of a given timber is 750 pounds and that of a second is only 250 pounds, then the first wood is three times as hard as the second.

The current series of hardness tests was conducted in accordance with the generally recommended procedures set forth by the American Society for Testing Materials. (Standard methods of testing small clear specimens of timber. A.S.T.M. Designation D143–27, 1927.) All of the tests were made on clear, kiln-dried lumber in an Olsen Universal Testing Machine. The specimens were chosen at random from stock boards obtained from numerous sources. Ten pieces, each 3 inches wide, 15 inches long, and 1 to 1½ inches thick, were used for each wood examined. Five of these were cut from edge-grain boards, the others from flat-grain stock. Every specimen was subjected to ten random punches, so that there were in all 100 hardness determinations (50 on the flat, 50 on the quarter) for each species. The final hardness value given for each wood listed in the accompanying table is actually the average of the 100 tests on the two faces. In no case were there differences of sufficient magnitude between the two to record them separately. For further purposes of comparison the hardness of each wood is also indicated in percentage of American Black Walnut.

The moisture content of each sample was determined at the time of testing, and the variation among all woods examined was found to be less than 3 per cent. The specific gravity determinations are based upon oven-dry weight and volume for each of the species examined.

For aid in obtaining sufficient quantities of the various materials tested, the writer is particularly indebted to Penrod, Jurden & Clark Co.; I. T. Williams & Sons; Wood Mosaic Co.; and A. Constantine & Sons, Inc.

RESULTS OF TESTS ON CABINET WOODS

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Aboudikro (Ivory Coast) *Entandrophragma cylindricum?*	4.9	0.61	1205	96
Alder, Red (West. U.S.A.) *Alnus rubra*	5.2	0.47	835	67
Allacede (Phil. Is.) *Wallaceodendron celebicum*	4.4	0.56	965	77
Almon (Phil. Is.) *Shorea eximia*	5.8	0.59	885	71
Amaranth (Trop. America) *Peltogyne paniculata*	5.6	0.74	2050	163
Amarello (Brazil) *Plathymenia reticulata*	5.5	0.78	1885	150
Andiroba (Trop. America) *Carapa guianensis*	6.4	0.70	2160	172
Araçá (Brazil) *Terminalia* aff. *januarensis*	4.7	0.54	1280	102
Ash, Japanese *Fraxinus mandschurica* and/or *F. Sieboldiana*	5.2	0.49	930	74
Ash, Silver (Australia) *Flindersia Schottiana*	4.6	0.56	1305	104
Ash, White (2nd growth) (U.S.A.) *Fraxinus americana*	5.3	0.61	1710	136
Aspen (Maryland planted) *Populus canescens*	4.8	0.40	545	43
Avodiré (W. Africa) *Turraeanthus africana*	5.8	0.48	860	68
Ayous (W. Africa) *Triplochiton scleroxylon*	6.0	0.39	475	38

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Beech, American (U.S.A.) *Fagus grandifolia*	6.1	0.61	1385	109
Birch, Black (U.S.A.) *Betula lenta*	4.7	0.64	1620	129
Birch Yellow (U.S.A.) *Betula lutea*	5.2	0.60	1560	124
Blackbean, Australia *Castanospermum australe*	4.8	0.63	1400	111
Blackwood, Australian *Acacia melanoxylon*	4.2	0.66	1580	126
Bossé (W. Africa) *Guarea cedrata*	4.8	0.53	920	73
Boxwood, Indian *Buxus sempervirens*	4.6	0.99	3220	256
Bubinga (W. Africa) *Copaifera* aff. *Tessmannii*	4.6	0.72	2235	178
Butternut (U.S.A.) *Juglans cinerea*	6.3	0.37	560	44
Capomo (Trop. America) *Brosimum Alicastrum*	5.2	0.59	1430	113
Cherry, African (W. Africa) *Mimusops Heckelii*	4.8	0.73	1415	112
Cherry, American black *Prunus serotina*	6.2	0.53	1170	93
Cocobolo (Cent. America) *Dalbergia retusa*	5.7	1.06	3860	307
Ebony, Macassar (Dutch E.I.) *Diospyros macassar*	6.1	1.15	5030	400

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Fir, Douglas (old growth, yellow) *Pseudotsuga taxifolia*	5.7	0.41	650	52
Framerie (W. Africa) *Terminalia ivorensis*	6.0	0.37	500	40
Gaboon (W. Africa) *Aucoumea Klaineana*	4.8	0.42	565	45
Garapa (Brazil) *Apuleia praecox*	4.7	0.67	1235	98
Gonçalo Alves (Trop. America) *Astronium fraxinifolium*	5.1	1.09	2410	191
Greenheart (Br. Guiana) *Ocotea Rodiaei*	6.0	0.78	1310	104
Guapinol (Trop. America) *Hymanaea courbaril*	5.3	0.84	2815	224
Gum, Sweet or Red (U.S.A.) *Liquidambar styraciflua*	5.8	0.47	865	69
Hackberry (U.S.A.) *Celtis occidentalis*	5.1	0.54	2025	81
Harewood, English *Acer pseudoplatanus*	4.8	0.51	1125	89
Holly, American *Ilex opaca*	6.0	0.61	1140	90
Iroko (W. Africa) *Chlorophora excelsa*	5.6	0.53	1070	85
Koa (Hawaii) *Acacia koa*	6.2	0.59	1205	96
Kokko or Koko *Albizzia Lebbeck*	5.8	0.61	1170	93

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Lacewood (Australia) *Cardwellia sublimis*	5.6	0.47	785	62
Lauaan, Red (Phil. Is.) *Shorea negrosensis*	5.6	0.60	970	77
Laurel, California *Umbellularia californica*	5.3	0.53	1310	104
Laurel, East Indian *Terminalia tomentosa*	5.8	0.90	3160	251
Limba (W. Africa) *Terminalia superba*	5.4	0.66	1075	85
Mahogany (Colombia) *Swietenia macrophylla*	5.2	0.51	1050	83
Mahogany (Cuba) *Swietenia mahagoni*	5.4	0.68	1370	109
Mahogany (Cuba, St. Jago) *Swietenia mahagoni*	6.3	0.71	1620	129
Mahogany (Peru) *Swietenia macrophylla*	5.9	0.51	985	78
Mahogany (San Domingo) *Swietenia mahagoni*	6.0	0.60	1145	91
Mansonia (W. Africa) *Mansonia altissima*	5.3	0.71	1620	129
Maple, Australian *Flindersia Brayleyana*	6.1	0.69	1385	110
Maple, Bird's eye (U.S.A.) *Acer saccharum*	5.4	0.62	1305	104
Maple, Curly (U.S.A.) *Acer saccharum*	4.8	0.56	1210	96

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Maple, Hard, Rock, or Sugar (U.S.A.) *Acer saccharum*	6.1	0.63	1390	110
Movingui (W. Africa) *Distemonanthus Benthamianus*	4.8	0.71	1415	113
Narra (Phil. Is.) *Pterocarpus indicus*	4.7	0.62	1200	95
Oak, American red (2nd growth) *Quercus* spp. (mixed)	5.3	0.62	1380	110
Oak, American white (2nd growth) *Quercus* spp. (mixed)	5.9	0.68	1470	118
Oak, English brown (old growth) *Quercus robur*	5.7	0.51	685	55
Orientalwood (Australia) *Endiandra Palmerstoni*	5.3	0.67	1355	108
Padouk, African *Pterocarpus Soyauxii*	6.1	0.82	1870	149
Padouk, Andaman *Pterocarpus dalbergioides*	5.8	0.85	1905	151
Paldao (Phil. Is.) *Dracontomelum dao*	5.6	0.73	1300	103
Palosapis (Phil. Is.) *Anisoptera thurifera*	6.1	0.57	900	71
Pearwood (Europe) *Pyrus communis*	5.4	0.66	1305	104
Peroba, White (Brazil) *Tabebuia peroba*	5.4	0.59	1035	82
Poplar, Yellow (U.S.A.) *Liriodendron tulibifera*	6.2	0.42	465	37

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Primavera (Cent. America) *Cybistax Donnell-Smithii*	4.8	0.56	895	71
Redcedar, Eastern (U.S.A.) *Juniperus virginiana*	5.6	0.46	675	52
Rosewood, Brazilian *Dalbergia nigra*	5.7	0.72	2130	169
Rosewood, East Indian *Dalbergia latifolia*	5.0	0.80	2385	190
Rosewood, French (Madagascar) *Dalbergia Greveana*	5.9	0.84	3000	238
Sapele or Sapeli (W. Africa) *Entandrophragma cylindricum*	6.2	0.57	930	74
Satinwood, Ceylon *Chloroxylon Swietenia*	5.4	0.79	2315	184
Satinwood, West Indian *Zanthoxylum flavum*	5.9	0.71	1780	141
Satiny, Red (Australia) *Syncarpia Hillii*	6.1	0.55	910	72
Sycamore, American *Platanus occidentalis*	5.4	0.42	580	46
Tabasara (Trop. America) *Prioria Copaifera*	4.4	0.48	685	54
Taku (Trop. America) *Diplotropis guianensis?*	4.8	0.80	1880	141
Tanguile (Phil. Is.) *Shorea polysperma*	4.7	0.57	1090	86
Tigerwood (W. Africa) *Lovoa Klaineana*	4.3	0.54	885	70

Species	Moisture content (*Per cent*)	Specific gravity (*Oven-dry wt. and vol.*)	Av. and Comp. Hardness	
			Av. of 100 tests on 10 pcs. (*Pounds*)	Compared to Black Walnut (*Per cent*)
Tulipwood, South American (Brazil) *Dalbergia* aff. *variabilis*	5.7	0.94	3460	275
Walnut, American black *Juglans nigra*	5.8	0.60	1260	100
Walnut, Circassian *Juglans regia*	4.8	0.54	1090	87
Yuba (Australia) *Eucalyptus obliqua*	6.0	0.65	1035	82
Zebrawood (W. Africa) *Macrolobium* Sp.	5.4	0.74	1745	139

ALTERNATIVE NAMES

Afara = Limba
Afara, Black = Frameria
Akume = Bubinga
Ampira = Framerie
Angsena = Narra
Anyaran = Movingui
Apaya = Avodiré
Apopo = Tigerwood
Aprono = Mansonia
Arere = Ayous
Ayan = Movingui
Banuyo = Allacede
Beaverwood = Hackberry
Bois de rose = Tulipwood
Buruta = Satinwood, Ceylon
Cabiuna = Rosewood, Brazilian
Cambala = Iroko
Camwood = Padouk, African
Carapa = Andiroba
Cativo = Tabasara
Cedron = Bossé
Coromandel = Ebony, Macassar
Courbaril = Guapinol
Crabwood = Andiroba
Cudgerie = Ash, Silver
Dao = Paldao
Dibetore = Tigerwood
Duali = Palosapis
Emri = Framerie
Floresa = Tabasara
Gateado = Garapa
Gedunoha = Aboudikro
Greywood = Harewood, English
Guarea = Bossé
Jacarandá = Rosewood, Brazilian
Jobillo = Gonçalo Alves
Juniper = Redcedar, Eastern
Kambala = Iroko
Laredo = Capomo
Laurel, Australian = Orientalwood
Lega = Kokko
Lovoa = Tigerwood

Makore = Cherry, African
Malabar = Rosewood, East Indian
Maple silkwood = Maple, Australian
Marblewood = Ebony, Macassar
Mersawa = Palosopis
Namba = Cocobolo
Oak, African = Iroko
Oak, Silky = Lacewood
Oak, Tasmanian = Yuba
Obeche = Ayous
Obobo = Bossé
Ofun = Mansonia
Ogechi = Capomo
Ojoche = Capomo
Okoume = Gaboon
Okpo = Ayous
Okwen = Bubinga
Oloko = Iroko
Opruno = Mansonia
Oroko = Iroko
Owawa = Ayous
Pearwood, Nigerian = Bossé
Plane, American = Sycamore, American
Purpleheart = Amaranth
Ramón = Capomo
Rosewood, African = Bubinga
Rosewood, Madagascar = Rosewood, French
Tamo = Ash, Japanese
Teak, African = Iroko
Tiaong = Tanguile
Walnut, Australian = Orientalwood
Zebrano = Zebrawood

NOTE ON BRAZILIAN CORK

By P. L. BUTTRICK

The major portion of the world's cork supply has always come from the countries surrounding the western Mediterranean, the islands within it, and lands fronting the Atlantic of the Iberian Peninsula and northwest Africa. The forests of this region, though tending to decline in both area and productivity, have been able to supply the world's increasing needs. Consequently little attempt has been made to develop other sources of supply either by introducing the true Cork Oak (*Quercus suber*) into other parts of the world, or by exploiting other trees known to produce cork, or by exploration for trees which may be capable of such production.

So far as the United States is concerned, the present war has cut off European and African supplies, except for occasional shipments from Portugal, which the misfortunes of war may terminate over night. Cork being necessary for many industrial and some military purposes, independent of its traditional use as a bottle stopper, it is now rationed under American priorities regulations. Consequently there is a good deal of interest in possible non-Mediterranean sources of supply. A few such sources exist but they have figured

little or not at all in international trade. A species of cork-producing Oak (*Q. variabilis* or *Q. serrata*) grows in Japan and is said to occur also in Manchuria, but is so restricted in range that Japan herself has been a cork importer. At least one species of *Eucalyptus* (*E. Fergusoni* and/or *E. paniculata*) is also known to produce cork suitable for industrial use, but so far as the writer knows it has not been exploited commercially. Possibly there are other trees which might be able to produce commercial cork which have never come to the attention of either the forester or the industrialist.

It has long been known that a kind of cork is available in south-central Brazil which is used locally for insulation, the major industrial use of cork. Not much has been published regarding either the tree, the character of the country in which it grows, or the quality of the cork. The species has been identified as *Kielmeyera coriacea* Mart. (family Guttiferae), but more than one species may be involved. The local name is Pau Santo or Pau Santo do Cerrado. The tree is not botanically related to Oak (*Quercus*), and is rather small and crooked, though its natural bark resembles that of the true Cork Oak. The present practice is to cut down the trees when they are 6 to 8 inches in diameter and strip the bark from them. The stumps sprout readily and a period of four to five years is said to be required for regrowth between stripping. As in the case of Cork Oak, the first stripping or virgin cork is suited only for grinding and therefore useful only for insulation. Whether strippings can be made from living trees and crops of secondary cork subsequently grown is not known.

The cork-producing region of Brazil is in dry areas of the northern part of the Province of Minas Geraes, which lies about 100 miles back from the coast and north of Rio de Janeiro, and in the central portions of the provinces of Goyaz (Goiás) and Matto Grosso from 500 to 1000 miles inland. The province of Matto Grosso seems to be supplying the present demand, which is confined to two small insulation plants, one of which apparently is Brazilian owned and is located at São Paulo.

The Pau Santo is said to be the most abundant tree in the extensive, low, savannah-like, mixed hardwood forests locally

called *cerrados*. These cerrados cover thousands of square miles, but only the fringes have been drawn on for cork and these are the only parts where any organized transportation systems exist. The bark is now brought to market in São Paulo and Rio de Janeiro by rail. Extensive exploitation of the back country will require large capital investment and organization. Since the present production is only about 8000 tons per annum and the American demand is somewhat over 100,000 tons it is probable that a good deal of American money would have to be spent to increase the Brazilian output to meet North American needs.

FORESTS OF THE VENEZUELAN GUIANA

By Llewelyn Williams

Field Museum of Natural History

That section of southern Venezuela bounded by the Orinoco River on the north and west and by Brazil and British Guiana on the south and east has been described as one of the largest and among the most interesting of the little explored areas of South America. Several naturalists have visited or traversed the territory at different times, but few have penetrated for any considerable distance into its interior, especially in the middle and upper reaches of the Orinoco basin, and we still lack precise information regarding the flora and the composition of the forests that cover the greater part of its area. I made my first visit to the Guiana early in 1939 and devoted several months to the study of the forests and savannas of the lower and middle Caura (see *Tropical Woods* 62: 1–20. 1939). I continued these investigations during the months of March to June of the following year in widely separated areas of the Orinoco basin, and the following observations are based upon material and data collected at that time.

From Ciudad Bolívar to Lower Paragua

Ciudad Bolívar, formerly called Angostura (meaning the narrows), stands on the slope of an eminence rising from the

right bank of the Orinoco, at the point where this great river narrows to a width of little more than half a mile. Although it is the capital of the State of Bolívar and the largest center (pop. 25,000) in the entire Guiana, nevertheless few overland routes connect it with the hinterland. One of these is the road leading to the southeast to the diamond mines of the Pao, over which, in former years, there was considerable traffic in balata exploited in the forests of the middle Caroní. On the outskirts of Ciudad Bolívar is the Morichal, alluding to the abundance of Moriche palm, *Mauritia flexuosa*, in the slightly undulating terrain. In addition, several trees flourish in the sandy soil and these include Algarrobo, *Hymenaea courbaril*, recognized by its corpulent trunk, the broad umbrella-shaped crown, and the reddish brown, indehiscent pod; the blue-flowered Pedrero, *Vitex capitata*, deriving its common name from its habit of growing in rocky areas; the wide-spreading Camoruco, *Sterculia apetala*, with yellow flowers in axillary panicles, large chestnut-like seeds, and having the inside of the carpels covered with stiff hairs which penetrate the skin, causing much irritation; also *Combretum fraguli-folium* and *Connarus venezuelanus*, common along the road-sides. Cultivated as ornamentals around homes are *Pelto-phorum inerme*, its irregular crown covered in April with yellow flowers; the soft-wooded, lactiferous *Plumeria rubra*, known locally as Amapola; and *Ixora coccinea*, native of the East Indies and noted for its bright red flowers. Woody climb-ers frequent in this Morichal are *Abrus precatorius*, with even-pinnate leaves and partly scarlet and partly black seeds, and *Securidaca diversifolia*, *Pleurotoma variabilis*, and *Rourea Grossourdyana*.

Beyond the Morichal the road continues for several miles over an extensive plain drained by a number of small streams — Marianta, Claro, Tocoma, and Araisamo. The sandy or gravelly soil is covered with clumps of low, coarse grass, and here also abound mixed, open stands of Alcornoque, *Bowdi-chia virgilioides*, Curata, *Curatella americana*, and Chaparro Manteca, *Byrsonima crassifolia*, species generally associated with the savanna. Thereafter the terrain becomes more rugged, broken by several short ranges—Tocoma, Arismagua,

Caraqueño, and Albadones—with an altitude varying between 1360 and 2300 feet, and huge boulders of black granite line the roadside. At Santa Barbara, about half way between Ciudad Bolívar and the Paragua, there is a noticeable change in the topography as well as in the vegetation. Extensive green, treeless plains, reminiscent of panoramic landscapes of temperate boreal regions, come into view. These stretches, as flat as a table, are broken by narrow belts of Moriche palm, favoring low, moist patches or along ditches with slow-moving current. Often clinging to the upper part of its trunk and to the fronds is a species of vanilla, *Vanilla fragrans*. In association with this handsome palm grow tall grasses capa-ble of withstanding long drought and furnishing succulent pasturage during the dry months; also a slender, densely prickly shrub, *Mimosa somnians*, and *Vismia latifolia*, a shrub 1.5m. high exuding a pale reddish resin, giving rise to its com-mon name Sangrito. Along the banks of the larger streams are stands of gallery forest composed of medium-sized trees, mostly deciduous, and these continue up the slopes of the low ranges flanking the plains. As we proceed southward the flat stretches change almost imperceptibly into rolling savannas covered with brown grass, an occasional straggly tree or an isolated Moriche palm. At El Cristo the savanna is super-seded by an extensive stand of gallery forest which extends eastward towards the Paragua River.

The Lower Paragua

We pitched camp in the middle of an open plain about two miles south of the village of La Paragua, on the left bank of the river of the same name and at the point where it turns sharply to the east to flow into the Caroní. Formerly called Barceloneta, La Paragua figured two or three decades ago as an important center for the collecting of balata in the Ca-marata region of the middle Caroní, but since this forest product is no longer exploited in this region the few inhabit-ants devote their efforts to cattle-raising.

The dominant plant formation in the lower Paragua is the savanna which, as elsewhere along the southern bank of the Orinoco, may be regarded as a natural prolongation of the

Llanos. Contrary to the descriptions given by the early botanists, the savannas are not always, as we have already observed, vast green prairies devoid of trees, but they should be considered as a unit of vegetative formations distributed over an area of variable topography and soil conditions, in part with perennial moisture, but differing mainly by virtue of the kinds of trees or other plants that compose or dominate any given area. In the region under discussion we find within a relatively small zone two general types of savannas, distinguished as follows:

Fresh-water savannas.—These are adjacent to rivers, streams, or inland lagoons and are completely submerged during the rainy season, but when the waters recede the vegetation, especially the grasses, soon becomes green. An example of this type is the *estero*—areas along the margin of lagoons in open savannas, which dry up during a period of long drought, though the soil is permanently and sufficiently moist to support a woody vegetation. One of the most constant trees in the estero is Carutillo Rebalsero, *Duroia Sprucei*, 6–8m. high, with a fairly dense, often cone-shaped, crown of erect branches and bearing a reddish brown, globose fruit. Other woody species, mostly of low stature, inhabiting the margin of lagoons are *Erythrina glauca*, recognized by its cylindrical, lineal pod; *Symmeria paniculata*, *Ouratea caracasana*, *Panopsis suaveolens*, *Ruprechtia tenuiflora*, *Pithecolobium latifolium*, *Macrolobium discolor*, and *Myrtus calophylla;* also a species of *Swartzia*, noted for its dense, durable wood used for posts of corrals. The Mistletoe family is amply represented by *Phoradendron Perroteti*, *P. crassifolium*, *P. venezuelense*, and *P. quadrangulare;* also *Phthirusa pyrifolia* and *Oryctanthus florulentus*.

There is another type of estero wherein the margin of lagoons in open savanna is completely devoid of trees, and the only woody species inhabiting the dark-colored soil are the slender armed shrubs, *Mimosa pigra* and *M. somnians*. It is to be noted that the Moriche palm is conspicuously absent from these moist areas or at most is represented by only a few, widely scattered specimens. But we do find on rare occasions another palm, namely the straggly Camuare, *Desmoncus orthocanthus*, bearing pinkish red fruits and armed with strong, sharp spines capable of inflicting severe flesh wounds. These sites are also inhabited by several herbaceous species, such as *Eichornia azurea*, *Galactia* sp., *Bulbostylis lunata*, and *Lycopodium alopecuroides*, and such grasses as *Rynchanthera grandiflora*, *Eriocaulon Humboldtii*, and *Rynchospora globosa*.

Inland savannas.—These occupy the summit of hillocks and areas beyond the reach of seasonal floods. These are characterized by a well-drained sandy soil overlying marl beds and are covered throughout with a low grass growth, dried up and of a light brown color during the dry months of January to April. Two main types of inland savannas may be distinguished. The first of these is the open savanna, where ligneous species are limited to a few low shrubs, such as the *Casearia inaequilatera*, commonly known as Tortolito, *Byrsonima verbascifolia*, *Psidium guineense* and *P. parviflorum*, and a species of *Solanum*. But the vegetation is predominantly herbaceous, composed in great part of *Eriosema rufum*, *E. crinitum*, *E. simplicifolium*, *Indigofera lespedezioides*, *I. pascuorum*, *Buchnera palustris*, *Desmodium pachyrrhizum*, *Eupatorium amygdalinum*, *Ipomoea aturensis*, *Melochia hirsuta*, *M. graminifolia*, *Rynchospora cephalotes*, *Grimaldia hispidula*, *Plumbago scandens*, *Pavonia speciosa*, *Borreria suaveolens*, and *Galactia* sp. On exposed sites formerly occupied by habitations one usually finds *Cassia moschata*, with brilliant yellow flowers and long, cylindrical, brown pods filled with small, dark seeds; the armed Cardón de España, *Euphorbia edulis*, believed to have been introduced by African slaves during the period of the Spanish colonization; and the Ponopinito, *Pedilanthus tithymalioides*, with few, thick, dark green leaves yielding an abundance of acrid, caustic latex used locally in medicine. Small islands, *cestiaderos*, composed of Mango, *Mangifera indica*, and Poma Rosa, *Jambosa vulgaris*, form a welcome shade for cattle grazing on the exposed savanna.

The other type of inland savanna contains scattered shrubs and low twisted trees, such as Manteco Sabanero, *Byrsonima coriacea*, Manteco Merey, *Byrsonima coccolobaefolia*, Curata, *Curatella americana*, and Alcornoque, *Bowdichia virgilioides*.

The whole picture is practically filled with coarse grasses, swept by fires in the dry season, leaving the intervening spaces to be reoccupied by suffrutescent plants with persistent rootstocks, later by weeds and the same grasses as before. This resurrection is not due entirely to seeding, but can be ascribed in part to the fact that the majority of the bush grasses have perennial underground stems, which, once given occupation, are difficult to dislodge. Assisted by the recurrent fires, which kill off the seeds of broad-leaved trees, these coarse grasses have everything in favor of their natural progress of predominance.

In addition to the ligneous species already cited, other trees occasionally found in certain areas of the inland savanna include Lechero, *Sapium aucuparium*, of medium size, with few branches and reddish flowers; Cojoba or Yopo, *Piptadenia peregrina*, at times up to 15m. in height; and the deciduous Cacho de Venado, *Godmania aesculifolia*, 10–12m. tall, with long, spirally-twisted pods. One of the most frequent shrubs is the Manirito, *Anona Jahnii*, at times up to 3m. high and with edible fruit.

Gallery forest.—The watercourses intersecting the savannas are flanked by belts of forest of variable width and often extending for a considerable distance away from the streams to form a dense canopy. These streams may become dry during a long period of drought, but the verdure remains because the moisture in the soil persists long enough to maintain a non-deciduous type, although savanna fires may reach to their margin. The gallery forest, while of a distinct vegetative type, is closely associated with the savanna. Viewed across an open plain it appears from a distance as a dark line, at times sinuous and irregular, of small or medium-sized trees with dark foliage. In parts a promontory of trees juts out in the savanna, elsewhere a grass-covered hillock is almost surrounded by forest, or a small patch of open savanna, known locally as *garceta*, is surrounded by thickets. It is difficult to account for this well-defined line of demarcation between the gallery forest and the savanna. It cannot be for lack of moisture, the topography is almost identical, and altogether the conditions are similar. One is inclined to the conclusion that

the gallery forest at one time covered a much greater area and has been pushed back gradually by the agency of man. Following the primitive system of the Indians, the natives clear a small patch of virgin forest for the planting of corn, rice, and mandioca. Before the first rains begin to fall in late April or early May the fallen tree trunks, herbs, and grasses are burned, leaving the ground clean and ready to plant. This clearing, *conuco*, is kept under cultivation for two or perhaps three years, after which period the soil is exhausted. The conuco is then abandoned and soon is covered with weeds and fast-growing trees, so that the virgin forest is unable to regain its lost territory.

Typical shrubs along the margin of the gallery forest are *Casearia aculeata*, *Faramea occidentalis*, *Hirtella racemosa*, *Callistylon arboreum*, *Miconia aplostachya*, and *Helicteres guazumaefolia*. This is also the habitat of a wide variety of woody climbers, many of them belonging to the Trumpet-creeper family and with brilliantly colored flowers. Of these the most common are *Phryganocydia corymbosa*, *Securidaca orinocensis*, *Martinella* sp., the armed *Smilax cumarensis*, *Rourea Grossourdyana*, *Paullinia fuscescens*, *Clitoria arborescens*, *Connarus* sp., *Passiflora vitifolia*, *Paragonia pyramidata*, *Cassia oxyphylla*, *Heteropteris laurifolia*, and *Dioclea guianensis*.

Of the trees flourishing along the border of the gallery forest the more conspicuous are *Jacaranda filicifolia*, its crown covered in February–March with large clusters of deep bluish flowers; *Xylosma Benthamii*, a small, twisted, armed tree; the slender, deciduous *Cochlospermum vitifolium*, with prominent yellow flowers; *Tapirira guianensis*, with panicles of small, pale yellowish flowers and known locally as Patillo; *Bauhinia mollicella*, a small straggly armed tree, Urape, with white flowers, and an unarmed species, *B. Benthamiana*, seldom more than 5m. high; *Machaerium angustifolium*, 17m. or so tall, usually with a narrow crown and fluted trunk, its twigs and branches armed with short, sharp spines in 2's or 3's; *Platymiscium pinnatum*, known as Roble and furnishing a durable wood esteemed for posts and general construction; *Xylopia grandiflora*, known in the vernacular as Fruta de Burro; a species of *Peiranisia*, with a rough, grayish bark; the

Quiripiti, *Clusia minor*, readily distinguished by its fleshy leaves and pale pinkish, fragrant flowers; *Genipa americana*, its globular, grayish to light brown, indehiscent fruit yielding a bluish black indelible dye employed by the Indians for painting their bodies; the common Hog Plum or Jobo, *Spondias mombin; Poponax flexuosa*, Cañafístolillo, usually growing isolated in open patches; Yopo, *Piptadenia peregrina*, the pulverized seeds of which are inhaled as a narcotic by the Piaroa Indians of the upper Orinoco; *Apeiba tibourbou*, its discoid black fruit covered with numerous flexible spines; *Andira surinamensis*, known as Pilón, furnishing a hard, heavy wood employed locally for general construction and to make mortars for crushing corn; and *Vismia ferruginea*, up to about 5m. in height. The only palm worthy of note is the Corozo, a species of *Acrocomia*. It attains a height of up to 12m., and the upper half of its trunk is armed with numerous sharp, black spines 10cm. or so long and arranged in bands.

Penetrating into the interior of the gallery forest we find that the trees are generally of taller stature than those along the margin. One of the trees forming the upper canopy is the Palo de Aceite or Currucai, *Copaifera pubiflora*, often 20m. or more in height and attaining its best development in low moist areas or along river banks. Its cylindrical trunk is moderately straight, up to 1m. in diameter, clear of limbs for about half the entire height and distinguished from surrounding trees by its smooth, light brown or yellowish bark. The dehiscent pod is dark brown when mature and the single seed is enveloped in a white aril. The oily exudation tapped from the lower part of the trunk has a limited local use as a medicine. Another common tree in this formation is *Pterocarpus podocarpus*, with a wide-spreading crown of stout limbs and, like other species of this genus, the incised bark exudes an abundance of blood-red juice (whence the local names Drago or Sangre de Drago) that soon hardens into a dark reddish brown resin. On well-drained, densely wooded slopes grows the Cedro or Cedro Colorado, *Cedrela* sp., attaining great height, with the erect, columnar trunk measuring 1m. or more in diameter. But the most unusual member of the gallery forest south of La Paragua is the Capa Tabaco, *Couratari Martiana*. It is a rare, deciduous tree, 30m. or so tall, with a fairly small crown, a straight, columnar trunk clear of limbs for three-fourths the entire length. Its inner bark separates into thin laminas when beaten, and these are said to be used by the Indians of the upper Paragua for rolling cigarettes. The fruit is its most characteristic feature, being a mottled brown, woody capsule (pyxidium), suggesting an elongated pipe-bowl, with a long stopper-like plug flattened on three sides and the operculum closing the opening; at maturity the plug falls out, at the same time releasing the seeds adhering to its sides. Another tree almost equally as tall is the Cuajo, *Virola sebifera*, with an irregular crown and a round, fairly straight trunk; its bark secretes a sticky resin. The fruit is a dehiscent, monospermous, brown capsule, the seed being enclosed in an oily, reddish aril. The lactiferous Cojón de Verraco, *Stemmadenia grandiflora*, attains its best development in fairly open patches. Its white wood is easy to work and is esteemed locally for canoe paddles.

The understory of the gallery forest is composed of Tocorito, an unidentified species of *Lonchocarpus*, the bark of which has a peculiar odor and when macerated is employed as a fish-poison; *Casearia sylvestris*, with slender, arcuate or erect branches; Rosa de Montaña, *Brownea latifolia*, common on shaded, well-drained slopes, usually close to the margin of the forest, has a smooth, greenish bark and bears large, bright red flowers in conspicuous, head-like clusters upon the branches and twigs; Guarataro or Pedrero, *Vitex capitata*, commonly found in drier areas; Aceituno, *Agonandra brasiliensis*, upwards of 12m. in height, with a small, round crown, a straight trunk and a thick, rough, light brown bark; and Ánime, *Protium insigne*, at times reaching to the upper canopy, its crown dense and irregular, the cylindrical, unbuttressed trunk having a diameter of up to 1m. and the brownish bark when incised exuding a whitish, strongly fragrant resin. Sites where the virgin forest had been cleared for cultivation and later abandoned are usually occupied by Yagrumo, *Cecropia riparia;* Alatrique, *Cordia bicolor*, with an irregular crown and a trunk often bifurcating near the base; and *Pyrtocarpha triflora*, a straggly tree 6 or 7m. tall. Of the woody

vines, the most noteworthy, from an economic standpoint, is the so-called Barbasco, a species of *Lonchocarpus* closely resembling the *L. nicou* of the Amazonian forests. The roots contain an active principle, rotenone, employed in this country and Europe in the manufacture of certain types of insecticides, and when macerated have a wide local use as fish poison.

Of the palms in the gallery forest, a species of *Astrocaryum* inhabits low, seasonally flooded areas or banks of streams, and there is also a *Bactris*, known locally as Coquito or Corocillo, which attains a height of 6–8 m. and is armed with sharp, black spines about 5 cm. long. But the tallest and most common palm is the Carata, *Sabal mauritiaeformis*. It is at its best in fairly humid patches, often forming small stands; it can be easily spotted from afar by its small crown and the grayish, slender trunk elevating up to 20 m. The small, globular, black fruits form large pendent racemes and the fan-shaped leaves are much esteemed locally for thatch.

As an example of the type of vegetation lining the banks of streams draining the gallery forest, let us consider the Surama, a minor tributary of the Paragua. The trees are mostly straggly, with short, twisted trunks and elongated branches, so that in parts the vegetation has the appearance of being very dense. At the foot of banks, completely submerged during the rainy period, grows the Tapara, *Crescentia amazonica*, with a much ramified trunk and bearing comparatively small, ovoid fruit with a hard shell, mottled green turning to dark brown at maturity. The legumes are represented here by the Guamo Blanco, *Inga ingoides*, up to 10 or 12m., and the Guamo Rebalsero, *Inga spuria*, of approximately the same height. On high banks grows the Santa María, *Triplaris caracasana*, a medium-sized tree with narrow crown composed of elongated branches arising along the entire length of the trunk. A characteristic tree of moist areas is *Cathedra caurensis*, of small stature, with dense foliage and small, yellowish flowers, while the Cubarro, a small armed palm with tapering trunk, favors densely-wooded, well-shaded areas. Of the woody vines along the banks the most common is *Connarus venezuelanus*, with dense, pendent clusters of pinkish red

capsules; also Parcha de Culebra, *Passiflora vitifolia*, with large, pinkish flowers; and the semi-scandent, armed *Solanum molle*. The most distinctive palm in the dense growth along the banks is the scandent Camuare, *Desmoncus orthocanthus*, reaching up to the branches of the tallest trees. The terminal portion of the rachis is long and whip-like, armed with stout, refracted, very sharp spines. The flexible stem is split by the Indians for making baskets, trays, and a long cylinder, *sebucán*, by means of which they express the poisonous juice out of cassava roots. A common plant in open swamps or at the mouth of quiet streams is the araceous Rabano, *Montrichardia arborescens*, 2–3m. high, with hard prop roots supporting the solid stem. In the more shaded areas grows the Guachamacá, *Bonafousia tetrastachya*, a shrub with white flowers and furnishing an abundance of latex, said to be highly poisonous.

Following the banks of the Paragua, we find that the vegetation consists in parts of a narrow belt of forest running parallel with the course of the stream and beyond which there is a grassy plain, elsewhere the savanna extends without interruption to the edge of the water. Along the low banks the Guayabo Rebalsero, *Myrtus calophylla*, forms long, unbroken stands. It measures 10m. or less in height, its dark brownish trunk being smooth and slender, the flowers white, and the small fruit black. Here also we encounter *Matayba scrobiculata*, a shrub 1m. high, bearing panicles of small pale yellowish or greenish flowers; *Amaioua corymbosa*, 6–7m. tall, its fruit lustrous dark brown; *Pera bicolor*, upwards of 10m. in height, the trunk much branched and the flowers pinkish; Coco de Mono, *Eschweilera Spruceana*, with a moderately dense, narrow crown; also such shrubs as *Miconia aplostachya* and *Casearia aculeata*, while the most frequent woody vines are *Heteropteris laurifolia* and *Davilla aspera*, the latter distinguished by its rough leaves and paniculate flowers with yellow caducous petals.

In open patches close to the bank grows a species of Tonka-bean or Sarrapia, *Dipteryx trifoliata*. It attains a height of 10m. or more, the irregular crown is composed of fairly erect branches and the trunk, measuring about 50cm. in diameter, is divided near the base. The ovoid fruit is yellowish brown,

darkening at maturity, and the light brown seeds, enveloped in an edible pulp, do not emit the fragrance characteristic of the Sarrapia Real, *Dipteryx adorata*. Another species, *Dipteryx punctata*, is cultivated on a small scale at La Ceiba, on the right bank of the Paragua. When planted it is a wide-spreading tree, seldom more than 15m. tall, with a very dense, rounded crown of dark green foliage, and flourishes in light sandy soil. The flowers appear in September–October and the fruit is harvested during February–April, the fragrant brown seeds being exported through Ciudad Bolívar where they command a good price.

Opposite the village of La Paragua is the estuary of the Aza, an affluent rising in the savanna of Manuspa, to the southeast. Both banks of this stream are flanked by rolling grass-covered savannas, merging gradually into the highlands of the middle Caroní. The vegetative composition of the gallery forest and savanna here varies but little from what I have already described. However, we do find certain woody species that seem to be confined to the area east of the Paragua. An example of this is the Purguo, *Manilkara* sp., a medium-sized or tall tree inhabiting densely wooded, well-drained slopes. Its trunk is straight, columnar, measuring up to 1m. in diameter, and clear of limbs for about half the entire height. This tree is said to have been very abundant at one time throughout this region, but the careless and primitive method of felling the tree to extract the latex for balata resulted in widespread destruction, so that fully-developed, adult specimens are now difficult to find. Low, moist, well-shaded areas are inhabited by Guanábana Cimarróna, *Anona montana*, about 18m. high, with narrow crown; Arahueque, *Coccoloba caurana*, also of medium size, its leaves large and coriaceous, its trunk much ramified from near the base; and *Licania Turiuva*, furnishing a hard, durable wood with dark brown heart surrounded by a pale yellowish sap. Herbaceous species along the sandbanks include *Coutoubea ramosa*, *Merramia quinquefolia*, *Eupatorium amygdalinum*, *Diodia hyssopifolia*, *Melochia parviflora*, and *Vernonia argyropappa*. Of the Loranthaceae, *Oryctanthus florulentus* is particularly frequent and among the legumes, the climbing Parcha de Culebra, *Passiflora foetida*, favors well-shaded, moist areas.

A still more pronounced variation in topography is found at San Mateo, about half way between the village of La Paragua and San Pedro, close to the Caroní. At this point the low, densely wooded banks of the main stream are abruptly interrupted by rounded, almost bald hills rising 500 or 600 feet above the general elevation of the surrounding country. On the sandbanks grows a species of *Cyperus;* also *Axonopus aurens*, *Imperata brasiliensis*, and *Glinus radiatus*. The Solanaceae are represented by Hierba Mora, *Solanum nigrum*, Huevo de gato, *S. subinerme*, and the scandent *S. asperrimum*. A species of *Psidium* forms long, continuous stands, its elongated branches reaching down to the surface of the water. Among the woody vines in the dense growth we find *Heteropteris laurifolia*, *Symmeria paniculata*, and *Dioclea reflexa*, the latter known among the natives as Ojo de Zamuro, in allusion to its large, partly dark brown and partly black seeds. In the closed forest skirting the river and extending inland for a short distance grows the Guatacaro, *Beurreria cumanensis*, a medium-sized tree with a narrow crown of few branches and fragrant white flowers; Ánime or Tacamahaco, *Protium insigne; Amanoa grandiflora*, 12m. or more in height; *Pithecolobium pistaciaefolium*, with a much-twisted, short trunk; and *Cathedra caurensis*, usually associated with the periodically-flooded forest or *rebalsa*. Two trees in particular form the understory, namely the ubiquitous Rosa de Montaña, *Brownea latifolia* and Quassia, *Quassia amara*. The last-named attains a height of 5m. or more, has a smooth, grayish bark, a whitish wood, crimson flowers, and pinnate leaves with winged petioles. Its wood, bark, and leaves contain an intensely bitter principle, *quasin*, of tonic properties and formerly used as a febrifuge. The most common palm on dry, wooded slopes as well as in low, moist areas is the corpulent Cucurito, *Maximiliana* sp., with fronds 3m. or so in length; its oily fruit is much sought by pigs.

In thickets along the margin of this forest abound *Myrcia caracasana*, a shrub with reddish fruit; the Fruta de Paloma, *Randia aramata;* Anoncillo, *Rollinia resinosa;* and Guayabo, *Eugenia* sp., a tree 8m. high, with narrow crown. The dry, rocky slopes are inhabited by several trees and shrubs, includ-

ing a species of *Cassia*, of moderate height with open crown, a slender, round trunk, yellow flowers, a greenish heartwood, and a white sapwood. The epiphytic Copei, *Clusia rosea*, is the tallest tree in this growth, often exceeding 25m. in height, and its wood and fruit exude an abundance of sticky, yellow latex. Other trees favoring these steep slopes are Laurel, *Nectandra rectinervia*, with a moderately flat crown, arcuate branches, a slender round trunk, and clusters of dark brown fruit; and *Matayba guianensis*, a small or medium-sized tree frequent along the margin of gallery forest. Around the summit of these hills are large outcrops of black granite, and the gravelly soil is covered by a few herbs and wiry grasses. The only ligneous species flourishing among the boulders is the Caparosa, *Palicourea rigida*, with rigid, metallic leaves and erect panicles of yellow flowers.

Ciudad Bolívar to El Palmer

After terminating the botanical studies in the lower Paragua, a brief excursion was made overland to El Palmar, in the region of the Yuruary south of the delta of the Orinoco. For the first 40 miles a wide, newly constructed gravel road leads through broad savannas from Ciudad Bolívar as far as Caruachi, at which point vehicles have to be ferried on barges across the Caroní. Like the Icabare, Carrao, Antabares, and Paragua, the Caroní has its source in the western region of the Sierra Pacaraima. Beyond the Caroní the road is rocky and in poor condition, despite the heavy traffic passing over it daily between Ciudad Bolívar, San Felix, and the famed gold fields of Guasipati, El Callao, Tumeremo, and El Callao in the eastern part of the Guiana. To the south of the Orinoco is the Sierra Imataca, the principal mountain range in northern Venezuelan Guiana, having its origin in the west in the foothills between San Felix and Upata, and extending eastward to the cerro El Terror, in the lower Orinoco. Its slopes are heavily wooded, in contrast with the dry, barren appearance of the savannas reaching up to the foothills.

El Palmar is a small agricultural center a few miles from the southern boundary of the Territory of the Delta Amacuro. The soil is fertile and admirably suited for the growing of rice, but in recent years the production of this commodity has

diminished considerably since most of the land workers find it more profitable to work in the adjacent gold-mines. Despite the fact that El Palmar is located in the torrid zone, the climate is agreeable, the average temperature being 45° F. The heaviest rains fall during April to July, followed by a dry period until occasional light showers begin in November and last through January and February.

Trees cultivated as ornamentals in the parks and around habitations include the Carapa, *Carapa guianensis*, said to be common in the overflow delta lands and in the forests of the Imataca range, its seeds yielding a non-drying oil used locally as an illuminant and for making soap; the lactiferous Amapola, *Plumeria rubra;* and the Araguaney, *Tabebuia chrysantha*, conspicuous when in bloom, the dense terminal clusters of brilliantly yellow flowers appearing almost throughout the dry months.

In thickets skirting the village flourish the armed Reventadera, *Solanum hyporrhidium;* Bretónica, *Melochia parvifolia;* Escoba, *Erythroxylon cumanense;* and Cariaquito Negro, *Cordia globosa*. On sites formerly tilled and now abandoned appears the epiphytic Matapalo, *Ficus prinoides*. Adjacent to the village are small areas of rocky savanna land where the vegetation is sparse, consisting largely of herbaceous species, such as Cachicamo, *Buchnera virgata;* Raíz de Zamuro, *Indigofera lespedezioides;* Oreja de Tigre, *Eriosema rufum;* Generala, *Clitoria* sp.; while *Ambrosia cumanensis* grows in humid patches along the margin of lagoons. Shrubs are few in these open areas, being mostly *Miconia alata* and *M. albicans*. The small savannas are surrounded by open stands, *islotes*, of low trees, many of which are armed. One of the commonest of these is the Quiebrahacha, *Pithecolobium tortum*, usually about 5m. high, with a spreading, almost flat crown; its hard wood is employed locally for fence posts. Another tree of the same genus is Tahuapire, *P. lanceolatum*, with twigs and branches armed with long, sharp spines; its wood is employed for purposes requiring durability. In association with these we find the taller Bosúa, *Zanthoxylum* sp., also armed; several species of Guamo, *Inga scrobiuscula*, *I. villossima*, and *I. ingoides;* Copei, *Clusia minor;* Majomo, *Lonchocarpus velutinus*,

10–20m. high, with pinnate leaves and showy purplish flowers in paniculate racemes; the armed Pata de Vaca, *Bauhinia mollicella;* Alatrique, *Cordia glabra*, up to 16m. high, its edible, reddish or deep pinkish fruit borne in large clusters and maturing in April; Tocorito, *Casearia sylvestris*, a twisted tree of medium stature, bearing small, axillary, white flowers; Cazabito, *Neea Spruceana vel aff.*, up to 10m. tall; Pellejo de Indio or Indio Desnudo, *Bursera Simaruba*, recognized by its copper-brown bark peeling off in papyraceous layers, revealing the deep green young bark; *Casearia mariquitensis*, 6–7m. high, with white flowers disposed along the entire length of the twigs; and Sangrito, *Croton gossypifolius*, a small tree with a grayish, smooth bark exuding a deep reddish resin. The most prominent shrubs forming the undergrowth of this formation are Punteral Blanco, *Casearia aculeata; Callistylon arboreum*, with white petals and brown pods, the latter up to 16cm. in length; Escoba, *Hybanthus* sp., 1–2m. tall, with pale bluish flowers; Piacoyure, *Jacquinia revoluta*, the ground bark and leaves of which are used for stupefying fish; and Tua-tua Morada, *Jatropha gossypiifolius*, favoring rocky or sandy soil.

Esteemed for their fruits and planted around the many small huts in these savannas are Nispero, *Achras Zapota*, furnishing a heavy, hard, dark red wood, a latex which is the source of chicle, and bearing fruit of a sweet, agreeable flavor; Cautaro, *Cordia alba*, of medium size and with whitish or pale yellow flowers; Merecure, *Couepia guianensis*, with coriaceous, alternate leaves and an elongate-ovoid drupe, the oil-containing seed enveloped in a sweet pulp; Ciruelo, *Spondias purpurea*, with few, thick, long branches, the old ones bearing small panicles of red or purple flowers which mature into fruit of a pleasant, acrid flavor; and above all, for its fragrant beans used commercially for imparting aroma to tobacco, the Sarrapia, *Dipteryx polyphylla*, seldom more than 12 or 15m. tall when cultivated in the open, but said to attain greater dimensions and to be abundant in the forests of the Imataca.

Proceeding towards the rounded foothills to the north, the forest gradually becomes more solid and dense until it finally merges with the high forest on the slopes of the Imataca range. Along the roadsides and in thickets flourish the San

Jose, *Jacaranda filicifolia*, with showy blue flowers in large panicles; Carnestolenda, *Cochlospermum orinocense*, distinguished by its conspicuous yellow flowers; Clavelino, *Caesalpinia pulcherrima*, with large leaves and numerous showy yellow flowers; Fruta de Burro Negro, *Guatteria* sp., 15m. or so tall, with irregular crown of fairly dense foliage and moderately straight, unbuttressed trunk. The most common lianas are *Hippocratea volubilis*, *Paullinia fuscescens*, *Stigmaphyllon fulgens*, and *Phryganocydia corymbosa.* Continuing to La Puchima, one of the several foothills of Imataca, we find that its slopes are covered with a fairly dense, unbroken forest of medium stature. Among the unusual trees encountered here are Cozoiba, *Rheedia Madrona*, at times up to 18m. in height, with a straight, round trunk which furnishes a pale pinkish wood with a yellow sapwood; the rather infrequent Nírgua, *Zizyphus angolito*, at times 25m. tall, with a pale yellowish to white fruit containing a single seed surrounded by an edible pulp with a sweet flavor; Pardillo Negro, *Terminalia obovata*, which may be regarded as typical of the flood-free forest; Trompillo, *Capparis* sp., with a spreading crown of few, elongated branches, a large, ovoid, long-stalked, pendent fruit, and wood having a fetid odor. The most distinctive tree in certain well-wooded, dry areas is the Quina Amarilla, *Cusparia trifoliata*, which at times forms almost pure stands of considerable extent. It seldom exceeds a height of 10 or 12m., has a narrow crown and a slender trunk branching close to the base. The yellowish inner bark has a bitter taste and was formerly exported through Upata and Ciudad Bolívar for use as an ingredient of Angostura bitters; it is still used locally on a small scale as a febrifuge. One of the tallest trees here is the Purguo, *Manilkara* sp., with dense, irregular crown and a straight, columnar trunk clear of limbs for half its entire height. In low, open, humid patches and along rocky banks of streams grow *Stylogyne turbacensis*, a small tree (5–6m.) with a black fruit and a red peduncle; Naranjillo, *Bravaisia integerrima*, 12m. or more in height, with short trunk, the white flowers appearing in April, the fruit a 4-seeded oblong capsule; Toco, *Crataeva tapia*, with spreading crown and a short, fluted trunk; Higuillo, *Ficus angustifolium*, 8–10m. tall, with few,

spreading branches; Rosa de Montaña, *Brownea latifolia;* Chaparro de Agua, *Cupania latifolia*, up to 15m. tall; also Cuajo, *Virola surinamensis*, a corpulent tree often exceeding 25m. in height, which sometimes appears in the open along banks of stagnant pools.

Upper Orinoco

The nine-day voyage along the Orinoco from Ciudad Bolívar to the *raudales* of Atures, the limit of navigation by small steamers and sailboats, has often been described and need not concern us here. Puerto Ayacucho (alt. 320 ft.), formerly called El Perico and now the capital of the vast and mostly unexplored Territory of Amazonas, is situated on the right bank of the Orinoco, immediately below the rapids (of Atures), mentioned by Humboldt and Bonpland in the accounts of their memorable travels in that region at the beginning of last century. On the opposite bank, which is Colombian territory, gentle slopes of green savannas, interrupted by large outcrops of black granite, reach down to the river. Although no precise meteorological statistics are available, it may be safely stated that the rainfall is much heavier in this territory and the dry season shorter than in the lower reaches of the Orinoco basin. The summits of the surrounding hills and ranges appear to be enveloped in a constant mist, but the heat in the savannas at times is trying, and mosquitoes and sandflies first begin to make their presence known in considerable numbers.

Rapids of Atures.—On the southern outskirts of the town there is a sharp pointed hillock, El Perico, elevating up to about 500 feet. Where vegetation can get a foothold in the gravelly soil covering its flanks grow tough wiry grasses (*Paspalum carinatum*, *Andropogon Selloanum*, *Leptocorypheum lanatum*) and a few herbaceous plants, especially *Rynchospora tenerrima* and *Polygala angustifolia;* also a dwarfed shrub, *Psidium parviflorum*. From the summit of this hill the view of the rapids is magnificent; huge boulders of fantastic shape strew the river-bed, rearing above the seething, swirling torrent.

Among the commonest trees along the banks of the Orinoco at this point are the Melero, *Combretum frangulifolium*, usually

5m. or less in height; the somewhat straggly Arepito, *Macrolobium flexuosum;* Coco de Mono, *Gustavia calycaris*, 15m. or so high, with round, erect trunk without buttresses; the corpulent Chigo, *Campsiandra comosa*, recognized by its large, chocolate brown, dehiscent pods; *Pithecolobium pistaciaefolium*, a small tree with narrow crown, usually in sandy patches submerged at high floods; also *Pithecolobium latifolium*, *Ouratea caracasana*, and a shrub, *Cassia oxyphylla*.

Representative of herbaceous plants growing in the savanna flanking the rapids are *Sipanea pratensis*, *Eriosema simplicifolium*, *Bulbostylis capillaris*, *B. lanata*, *Piriqueta cistoides*, *Fimbristylis* sp., *Adiantopsis radiata*, a new species of *Escobedia* (*E. savannarum*), *Sisyrinchium iridifolium*, *Declieuxia fruticosa*, *Centrosema* sp., *Rynchospora tenerrima*, *Phaseolus gracilis*, *Cuphea serpyllifolia*, and *Eriochrysis cayennensis*. Along the margin of the exposed granite rocks grow a variety of shrubs, including *Chalepophyllum pungens* (a new species), *Rudgea marginata vel aff.*, *Myrcia acuminata*, *Erythroxylon Williamsii* (also a new species), and *E. impressum*.

The savanna is drained by the Bagre, a small rocky stream flowing into the Orinoco near the outlet of the rapids. Its low banks are flanked by a fairly dense forest with an undergrowth of such shrubs as *Myrcia aplostachya*, *Clidemia rubra*, *Mimosa microcephala*, *Psychotria capitata*, *Palicourea fastigiata*, *Faramea orinocensis*, *Rudgea cornifolia*, *Randia armata*, and a species of *Torrubia*. The most common trees found in this periodically-flooded forest are *Eugenia pubescens*, with twisted trunk and white, very fragrant flowers; *Tabebuia pentaphylla*, its large, pale pinkish flowers appearing in April–May; a species of *Parinarium*, 6–8m. high, with a dark brown heartwood and a reddish sapwood; *Sickingia tinctoria*, known locally as Paraguatán, measuring 4–5m. in height, with whitish, strongly fragrant flowers and light-colored wood which soon turns pink on exposure to air; *Calophyllum brasiliense* with a reddish fruit, the single large seed enclosed in a white aril; *Connarus Patrisii*, known in the vernacular as Pico de loro, its bark secreting a small quantity of reddish resin, the yellowish sapwood well defined from the pinkish heart; *Byrsonima nitidissima*, of small stature, its crown

rounded or umbrella-shaped; *Cynometra parvifolia*, called Menudito in reference to the small leaflets, its trunk bifurcated close to the base and supplying brownish to almost black heartwood much used for posts; *Cathedra caurensis*, often found elsewhere in periodically-flooded forest; *Coccoloba guianensis*, a small tree or at times a mere shrub, with pale yellowish flowers arranged in spikes; and an unidentified tree, Brasil, often 25m. high and forming the upper canopy, with twisted trunk and a grayish bark exuding a small amount of dark brown resin.

Since the rapids of Atures are not navigable, even for small canoes, the only way to reach the upper reaches of the river is along a gravel road, repaired about two decades ago, which runs almost parallel with the right bank of the main river and thus obviates the necessity of negotiating some 40 miles of the most difficult and most dangerous waterway of the entire Orinoco system. Beyond the Bagre this road leads through grass-green savannas, interspersed with rounded black rocks, some of them 200 or 300 feet high. Many boulders of enormous proportions lie sprinkled about in the most irregular manner, and in spots there are outcroppings of ledges of quartz. The tops of the rounded granite hills are hard and glazed, glistening in the sunlight as if covered with a coat of ice. The few stunted trees among the rocks are mainly the deciduous Zapatero, *Peltogyne pubescens*, with an open, irregular crown, and hard, durable purplish heartwood well defined from the light-colored sapwood; a new species of Matapalo, *Ficus ayacuchensis*, small and twisted; *Bursera orinocensis*, 3 or 4m. tall; and above all the Picatón, *Aspidosperma* sp., up to 12m. high, with an irregular crown of few branches, and a round slightly inclined trunk supplying a brownish timber said to be used for house posts. The most typical palm among these rocks is the unarmed Coquito, *Syagrus* sp., 5–8m. in height. Among the herbs we find *Bernardia Jacquiniana*, *Comalia nummularioides*, and a species of *Eryngium*, while the most common climbers are *Cassytha filiformis*, *Dioscorea scabra*, and *Heteropteris laurifolia*.

About four miles to the south of Puerto Ayacucho is the Catañapo, a turbulent stream of clear, cold water rising in the nearby Cerro Sipapo. Not far up this stream is a village of

Piaroa Indians, who come down occasionally to Puerto Ayacucho to trade fruits, curare, and furs for cloth and other necessities. Along the rocky banks of the Catañapo grows a sedge, *Cyperus surinamensis;* several species of grasses, including *Panicum exiguum*, *P. cayennense*, and *Paspalum constrictum;* also Cacho, *Strychnos guianensis*, a woody vine on shrubs and low trees; while climbing along rocks is *Quiina rhytipodes*. In moist patches in the adjacent savanna abounds a tall herb, *Buettneria jaculifolia*, with whitish flowers; also *Dichromena* sp., and *Perama galioides*.

A short distance beyond the Catañapo is Atures, indicated on most maps though today not a single hut or other vestige remains to mark the site of this one-time capital of the Territory of Amazonas. The road continues through flat or slightly sloping, well-watered savannas covered with lush growth of grass. In the forest fringing this grassland the Seje palm, *Jessenia bataua*, elevates above the crowns of even the tallest trees; it has a slender light gray stem and bears large racemes of fruit that is rich in oil.

Along the low banks near the estuary of the Sanariapo, above the rapids of Atures, grow *Panicum discrepans*, *Desmodium adscendens*, *Cyperus cuspidatus*, and *Bulbostylis commiferta*. Close to the river and along the margin of granite ledges are several shrubs or small trees, the commonest being *Pithecolobium latifolium*, *Turnera acuta*, *Aphelandra Deppeana*, *Remijia longifolia*, *Palicourea obscurata*, and *Vismia latifolia*. A prominent tree here is the Arepito, *Macrolobium flexuosum*, about 12m. high, with spreading crown and a round, slightly twisted trunk. The most unusual trees are two slender aquatic legumes, one a species of *Pithecolobium*, 6–8m. high, with long white filaments, the other an unidentified *Drepanocarpus*, with a chocolate-brown, curved pod. Both trees grow in the middle of the river where they are almost completely submerged at high water and are most abundant at the point where the Sanariapo flows into the Orinoco.

A large canoe, *piragua* or *falca*, was obtained to travel southward from the Sanariapo to El Ratón, below the estuary of the Vichada. Where the water was deep the current was frequently so strong that little headway could be made by

the four oarsmen either by rowing or by poling the heavy boat. The muddy river is dotted with a number of islands and extensive sandbanks or flat ledges of rock reach down to the edge of the water. The country becomes wilder, the savannas or scattered growth being replaced by an unbroken high wall of tangled verdure. No habitations dot this part of the river. Apparently the Indians, in common with other South American tribes, seek the smaller streams to establish their semi-permanent villages, living in small groups along the upper reaches of the Parguaza, Catañapo, Sanariapo, etc., and rarely visit the main stream.

The Island of El Ratón.—Within 10 hours we reached El Ratón, the largest island in this territory, inhabited by about 100 souls, congregated mostly in a small village on the eastern bank. The heat was intense and oppressive, even the cooler nights bringing but little respite, and it rained frequently. In the early morning a thick mist rose slowly from the water, to be wafted and disappear above the tree tops. A walk around the clearings adjoining the village disclosed an obscure trail, zigzagging through a dense humid forest for about a mile to open into a savanna. In the thickets along the margin of this forest grow such herbs as Gengibrillo, *Heliconia cannoidea;* Conopia, *Renealmia aromatica;* Tabaquillo, *Aegiphila intermedia;* and *Wulffia baccata*. Shrubs found in the same habitat include *Palicourea obscurata*, *Psychotria Hoffmanseggiana*, and *P. vichadensis*, while of the climbers mention should be made of *Passiflora quadriglandulosa*, *Davilla brasiliana*, and a species of *Combretum*. Trees favoring open margins are Guayabo, *Psidium Sprucei vel aff.*, often aquatic; Palo de Escoba, *Eugenia* sp., up to 12m. and furnishing a hard, durable timber used locally for the construction of huts; and an unnamed dilleniaceous tree, Curáme, measuring 8–10m. in height and having dense foliage.

The island of El Ratón is significant in that it coincides with the northern limit, at least in the upper Orinoco, of the genus *Hevea*, represented here by two species. The first of these is *Hevea Benthamiana*, known locally as Caucho, Caucho Fino, and Shiringa or Seringa. Measuring up to 30m. in height, it forms the upper canopy of closed forest and is gen-

erally found not far from the river banks, where it composes small stands, *estradas* or *seringales*. Its trunk is erect, columnar, approximately 60cm. in diameter, without buttresses, free of limbs for about three-fourths the entire height, and terminating in a small crown. The light green capsule is said to attain maturity in March. The brownish bark when incised exudes an abundance of sweet, cream-colored latex, which two or three decades ago was a rich source of rubber. The other species, *Hevea pauciflora*, known among the natives as Caucho Morichalero or Caucho Colombiano, is scarcer and grows in more open forest, usually in moist patches where palms flourish. This is a smaller tree, upwards of 16m., also with a rather small crown of slender branches and a straight, round, unbuttressed trunk 20–60cm. in diameter. The sticky white latex flowing from the wounded light gray bark is considered inferior to that of *H. Benthamiana*, and was formerly used as an adulterant of the latter. In association with the Caucho Fino, and of equal stature, abound the Tacamahaco, *Protium trifoliatum*, its light-colored wood having an aromatic odor; an unidentified lactiferous tree, Billo, with yellow sapwood and light brown heart; Anoncillo, *Duguetia quitarensis*, up to 17 or 20m.; Pata de morrocoy, *Helicostylis tomentosa*, at times elevating up to 20m.; the latex-yielding Higuerote, *Ficus Ernestiana;* also *Myrtus calophylla*, *Sloanea sinemariensis*, and *Dipteryx punctata*. The lower story is composed of *Cordia bicolor*, *Myrcia* sp., and *Aparisthmium cordatum*. The undergrowth is dense, with an abundance of low shrubs and many ferns, the latter including *Trichomanes vittaria*, *T. pinnata*, *T. cristatum*, and *T. arbuscula;* also *Diplasia Karatasifolia* and a bromeliad Maya, *Bromelia Karatas vel aff.*

Savanna of El Ratón.—Beyond this dense, humid forest the island is traversed north and south for almost its entire length by a narrow savanna, said to have supported some years ago a large herd of cattle. The prevailing vegetation consists of *Bulbostylis junciformis*, *Scleria scabra*, *Trachypogon ligularis*, *Axonopus aureus*, *Panicum cervicatum*, and *Clitoria simplicifolia*, as well as a few low shrubs. Along the margin of the forest skirting this open area grow Trompillo or Cupana, *Matayba guianensis*, 4m. or more in height; an unnamed

apocynaceous tree, Platanote, 20m. or so tall, its rough bark exuding a fair abundance of latex; Cuajo de Tierra Firme, *Iryanthera Hostmannii*, of medium size, with a narrow crown and a straight, cylindrical, unbuttressed trunk; Canuto de Paloma, *Tapirira guianensis*, also of medium size and with a short, much ramified trunk; Copey, *Tovomita stigmatosa*, a twisted tree about 10m. high; and a species of *Trattinickia*, a small tree (8m.), with irregular crown and small, reddish flowers in terminal panicles. Among the shrubs are Miel de Pajarito, *Erythroxylon testaceum*, and Romadizo, *Siparuna guianensis*, 2–4m. high, with yellow fruit and spicy wood.

Middle Orinoco

Caicara region.—Situated on the right bank of the main river, Caicara is one of the principal calling stations for sailboats and small launches plying between Ciudad Bolívar, San Fernando de Apure, and the upper Orinoco. It is also an important center for the gathering of tonka-bean in the forests of the Caura, Cuchivero, and as far west as the Parguaza.

Along the low banks of the Orinoco the most frequent shrubs here are Melero, *Combretum frangulifolium*, at times up to 5m. in height; Aristín, *Mimosa pigra;* and Guayabo Rebalsero, *Psidium* sp. One of the commonest herbs is the sticky Manzanillo, *Egletes viscosa*, with white flowers. In open muddy patches close to the edge of the water grow *Passiflora misera* and *P. foetida, var. orinocensis*, both known locally as Parcha. Here also we find the semi-scandent Huevo de Gato, *Solanum molle*, and *Rourea glabra*, a woody vine with pale reddish or yellow fruit. Wooded areas subject to seasonal floods are inhabited by Palo de Agua, *Ouratea* sp., with a narrow crown of erect branches; the Morichalero, *Neea Spruceana vel aff.*, 7–8m. tall; Pendanga, *Eugenia* sp., recognized by its smooth, light brown bark peeling off in thin layers; and Coco de Mono, *Gustavia calycaris*, its other vernacular name, Rosa de Muerto, alluding to the fetid odor of the dry fruit.

In thickets adjacent to the town the predominant ligneous species are Guarataro, *Vitex orinocensis, var. minutiflora*, of small or medium stature, its trunk often divided near the base; *Stylogyne turbacensis*, a shrub or small tree; *Buchenavia capitata*, with pendent, yellowish green fruit borne singly or in pairs; and Yagrumo, *Cecropia riparia*, up to 12m. in height and of wide distribution throughout the Orinoco basin.

Commencing less than a mile to the south of the town are small stretches of flat savannas. In places these green pastures are open; elsewhere there are isolated specimens of Pilón, *Andira retusa*, a corpulent tree with dense, subrounded crown and a short trunk which furnishes a hard and durable timber employed for posts and general construction; the widely distributed Algarrobo, *Hymenaea Courbaril*, and Salado, *Vochysia* sp., up to 25m. tall, with yellow flowers in erect spikes, the wood pale yellow. Stands of bush forest are also common in this savanna and are composed of *Erythroxylon cumanense* and *E. impressum*, small twisted trees known as Jaillito; Guácimo Blanco, *Guazuma ulmifolia, var. tomentosa*, its fibrous bark being used locally for cordage; Bosúa, *Erythroxylon* sp., its trunk armed with sharp, conical spines; Cruceto Real, *Strychnos Fendleri*, 6m. or more in height, the bark yellowish and smooth, the branches armed with sharp spines, paired and opposite; *Drepanocarpus inundatus*, about 3m. tall, and the rough bark exuding an abundance of viscid, dark red resin; Barba de Tigre, *Randia armata;* Guaica, *Combretum Jacquinii*, a woody vine armed with spines up to 2.5cm. long; Caujaro, *Cordia cuneiformis*, a tree of small stature, with flat crown and a dark red fruit; *Phyllanthus acidus*, 7m. high, its crown dense and spreading, the trunk divided from the base; *Protium heptaphyllum*, of medium stature and exuding an aromatic resin from its incised bark; and *Apuleia molaris*, 6–7m. high, with long, pendent branches and a round, twisted trunk. Along the margin of this formation grow Manteco Merey, *Byrsonima coccolobaefolia*, a small spreading tree with a short, inclined trunk; also such shrubs as Caicanapire, *Croton glandulosus;* Manirito, *Anona Jahnii;* and Tapa Culo, *Casearia mariquitensis*. Open areas in this woody formation are inhabited by the Palma Real, *Copernicia tectorum*, more commonly known as Palma Llanera. It is especially abundant in the Llanos north of the Orinoco and attains a height of 10–12m. The fan-shaped fronds are employed for thatch and the dark brown fruit is borne in large clusters.

Proceeding to the southeast for a few miles we enter extensive treeless plains dominated by long stands of Moriche palm, similar in type to those of the lower Paragua region. In sandy soil close to streams abounds the Estroloja, *Aristolochia nummulariifolius;* in low, humid patches shaded by the Moriche palm we find the herbaceous *Ernstia cordifolia;* while a species of *Pavonia* grows in open, dry areas. This type of terrain extends for a considerable distance as far as the *hacienda* El Tigre, close to the left bank of the Cuchivero River.

The most significant feature of the savannas of El Tigre is the abundance of the Coroba palm, a species of *Scheelea*, growing in small stands or as isolated specimens. Its kernel is rich in oil, which is used locally for cooking, and during the month of May bands of Panare Indians may be seen roaming the savannas in search of the mature fruit. Another palm, the armed Macanilla, *Astrocaryum* sp., flourishes along open banks of streams. The herbaceous vegetation in this savanna is abundant and varied and among the more common species we find *Sisyrinchium scabrum*, *Setaria geniculata*, *Eriosema simplicifolium*, *Andropogon Selloanus*, *Leptocoryphium lanatum*, *Buchnera palustris*, *Bulbostylis tenuifolia*, *B. junciformis*, *B. capillaris*, *Panicum versicolor*, *Hymenocallis lobata*, *Lippia betulifolia*, *Sipanea biflora*, *Sorghastrum setosum*, *Paspalum carinatum*, *P. subciliatum*, *Piriqueta cistoides*, *Scleria microcarpa*, *Ipomoea aturensis*, and *Dorstenia tubicena*. Among the shrubs scattered with the Coroba palm are *Appunia tenuiflora*, *Miconia albicans*, *Palicourea fastigiata*, *Psychotria horizontalis*, and *Rondeletia pubescens*.

The banks of streams draining these savannas are flanked by narrow belts of moderately tall, dense forest. Its upper canopy is composed of Querebere, *Couepia ovalifolia*, a tree with ovoid, pendent fruit; Guamo Chigo, *Campsiandra comosa*, with a flattened, dark brown fruit up to 35cm. in length; Arepito, *Macrolobium discolor;* and Ciruelito, *Simaba orinocensis*, with irregular crown, inclined trunk, and dark yellow wood. Trees of smaller stature growing in association with these are Santa Lucía, *Phyllanthus nobilis*, yielding a pinkish wood; Coco de Mono, *Eschweilera* sp., upwards of 8m.

in height; and Coloradito, *Ouratea caracasana*, with stiff, coriaceous leaves and fragrant, whitish flowers. The Salado, *Vochysia* sp., a tree at times 18 or 20m. tall, attains its best development in open areas a short distance away from streams.

To the south and southeast the savannas are flanked by rounded hills merging into the high ranges of the middle and upper Cuchivero. Their steep, rocky slopes are heavily wooded. The lower limit of these forests, adjacent to the savannas, are composed of Café Negro, *Isertia parviflora*, a tree about 8m. in height, with a hard, heavy wood of light brown color; Guamo, or Maya of the Panare Indians, *Inga ingoides*, up to 16 or 20m. tall, favoring moist, well-shaded areas; Trompillo, *Guarea Guara*, also of fairly tall stature, with round, unbuttressed trunk; Caramacate Blanco, *Homalium racemosum*, 25m. or more in height, its crown often narrow; Limoncillo or Espuela de Gato, *Casearia aculeata*, a small armed shrub with bluish black fruit; Paraguatán, *Sickingia tinctoria*, its fragrant, white flowers appearing in May–June; and Brusquillo Blanco, *Coccoloba bolivarana* (a new species), a tree about 8m. high, growing in rocky areas, with a trunk ramified from the base, and bearing a juicy, lustrous black fruit. One of the most interesting plants found in this forest is the Mancahua (Panare), *Strychnos cogens*, a woody vine reaching up to the branches of the tallest trees. Its thin, brownish bark has a bitter taste and is employed by the Panare Indians for the preparation of *curare*, the poison applied to the tips of darts and arrows. Along the margin of their rice and corn patches, these Indians also cultivate, for use as fish poisons, the Barbasco Caicareño, *Phyllanthus brasiliensis*, a shrub 3m. or so tall, only the crushed leaves of which are said to be employed, and the Manarito, *Tephrosia toxicaria*, for its toxic roots. Growing among the large boulders at the foot of these slopes are Mandingo, *Roupala complicata*, also called Horca or Carne Asada in reference to the reddish brown color of the heavy heartwood; Poincigue, *Zizyphus mauritiana*, a low tree with small, pale yellowish flowers, its twigs and branches armed with recurved spines; and Palo de Mono, *Neea Spruceana vel aff.*, about 6m. in height and with much-twisted branches.

By the middle of June the rainy season had advanced with such rapid strides that further field work was almost impossible. Vapor hung over the forest like a pall for several days at a time. After steady downpours, the tributaries of the Orinoco, as well as the main stream, would leave their banks to flood the country for several miles inland. This made travel through the forest and savannas difficult and often involved much delay in crossing streams. Consequently we decided to proceed downstream to Ciudad Bolívar, thence overland through the Llanos and along the coast road to Caracas, arriving there in the middle of July.

AMERICAN WOODS OF THE FAMILY FLACOURTIACEAE

By SAMUEL J. RECORD

Botanists are not in agreement as to the limits of this pantropical family. According to Gilg (*Pflanzenfamilien*, 2nd ed., 21: 377), it comprises about 84 genera and over 800 species, mostly shrubs and small to medium-sized trees. Hutchinson (*Families of flowering plants*, pp. 161–2, 166) distributes the genera among three families, namely, the Flacourtiaceae, Samydaceae, and Passifloraceae. From the standpoint of wood anatomy it appears advisable to follow Gilg's classification, though two genera (*Ancistrothyrsus* and *Peridiscus*) seem rather out of place. The plants have simple, alternate leaves; a few have edible fruits and some are sources of tanning materials and drugs, oils, and resins of more or less medicinal value. The seeds of *Taraktogenos Kurzii* King, of the Far East, furnish the Chaulmoogra oil used in the treatment of leprosy. The only commercial timber is the so-called West Indian Boxwood (*Gossypiospermum*) obtained almost entirely from the Maracaibo Lake region of Venezuela. There are about 275 species of 30 genera native to tropical America. The following description of the wood is based on a study of 142 specimens of 71 species of 23 genera.

Heartwood pale to sulphur yellow, light brown, or reddish; in most instances unattractive; demarcation from sapwood usually gradual, sometimes sharp. Luster medium to high.

Odor and taste absent or not distinctive. Hard, heavy, and strong to moderately so; texture typically fine; grain often straight; generally easy to work, taking a very smooth finish; durability usually low.

Growth rings present or absent, rarely distinct. Pores mostly small to minute, in a few woods medium-sized in part; variable in abundance from few to (commonly) numerous or very numerous; solitary and in small multiples or groups or in short to long radial rows, well distributed without pattern except for a tendency to radial arrangement because of the closely spaced rays. Vessels either with all perforations simple or with some to most of them multiple; scalariform plates with few to many bars predominate in *Carpotroche*, *Hasseltiopsis*, *Peridiscus*, and *Tetrathylacium;* both simple and scalariform types may occur together about equally in *Arechavaletaia*, *Azara*, and *Hasseltia*, but there is a preponderance of simple perforations in *Mayna*, *Ryania*, and *Zuelania* in part; spiral thickenings observed only in *Azara*, *Olmediella*, and *Xylosma*, striations in some species of *Casearia* and *Zuelania;* thin-walled tyloses fairly abundant in *Ancistrothyrsus* (sometimes also sclerotic), *Lindackeria*, and *Peridiscus;* pitting of two principal types: (1) coarse, the intervascular frequently opposite, the vessel-ray often scalariform, in *Ancistrothyrsus*, *Arechavaletaia*, *Azara*, *Carpotroche*, *Hasseltia*, *Hasseltiopsis*, *Lindackeria*, *Olmediella*, *Peridiscus*, and *Tetrathylacium;* (2) fine to very fine, the intervascular typically alternate, the vessel-ray frequently unilaterally compound, in *Banara*, *Casearia*, *Gossypiospermum*, *Hecatostemon*, *Homalium*, *Laetia*, *Lunania*, *Prockia*, *Ryania*, *Samyda*, *Xylosma*, and *Zuelania*. Rays very numerous, sometimes with only one or two rows of fibers between them and often composing half the volume of the wood; infrequently not over two cells wide (*e.g.*, *Peridiscus* and a few species of *Casearia*), but commonly of two sizes, the multiseriate up to 15, though usually not over 5, cells wide and greatly variable in height, sometimes up to several hundred cells; decidedly heterogeneous; multiseriate parts composed of either square or procumbent cells or both together; uniseriate rays and ray margins composed of square and upright cells (sometimes locally biseriate without increase in width) and variable in height from 1 to 50, occasionally to 150, cells; vertically fused rays common; sheath cells sporadic; perforated cells (by-pass vessel members) of frequent occurrence throughout the family; rhombohedral crystals often abundant, frequently 2 to 4 in apparently (but not actually) chambered upright cells; pits to vessels of two principal types: (1) medium-sized to large, either rounded or elongated and in scalariform arrangement suggesting Violaceae; (2) small to very small, often unilaterally compound and almost entirely so in *Ryania*. Wood parenchyma absent or very sparingly paratracheal, except in *Ancistrothyrsus* (irregularly paratracheal, short aliform, and diffuse) and *Peridiscus* (reticulate); crystalliferous strands observed in *Olmediella* only. Wood fibers with rather thin to exceedingly thick walls, usually with a gelatinous inner layer; gelatinous and non-gelatinous fibers may be intermixed or separately zonate; septate except in *Ancistrothyrsus* and *Peridiscus;* finely chambered and crystalliferous in *Banara;* pits typically

small and indistinctly bordered, but large and distinctly bordered in *Ancistrothyrsus* and *Peridiscus* (apparently communicating only with ray and wood parenchyma cells). Ripple marks absent. No gum ducts seen.

Ancistrothyrsus *Tessmannii* Harms, the only species, is a slender scandent shrub of the Amazon region of Brazil and eastern Peru (see *Notizbl. Bot. Gart. Berlin-Dahlem* 11: 146–9, 598–600). It belongs to the section Paropsieae which, according to Hutchinson, should be referred to the Passifloraceae. The inflorescence is provided with peculiar hooks like those in *Hugonia* (Linaceae). The wood is yellowish, hard, and coarse-textured. The following description is based on a specimen (Yale 33817; Ducke 113) collected by Adolpho Ducke near Manáos.

Growth rings present. Pores large and small together; rather few; solitary and occasionally in small multiples and clusters. Vessels with simple perforations; pits opposite, large; tyloses present, sclerotic in part. Rays of two sizes, the uniseriates few to 50 cells high, the multiseriates 2 to 10 cells wide and 25 to 150 cells high; cells square to oblong, not distinctly procumbent or upright; crystals numerous; pits to vessels short-oval and medium-sized to elongated and sometimes unilaterally compound. Wood parenchyma fairly abundant; in very irregular arrangement—paratracheal, short aliform, in short metatracheal lines, and diffuse. Wood fibers not septate; walls moderately thick; pits numerous, very large, distinctly bordered.

Arechavaletaia *uruguayensis* Speg., the only species, is a shrub or little tree in the mountain forests of Uruguay (see *Revista Sudamericana de Botanica* 3: 105–109). The following description is based on a small specimen (Yale 34146) obtained by Dr. W. G. Herter from a tree growing in the botanical gardens of Montevideo. The wood (sapwood) is brownish, rather dense, and fine-textured.

Growth rings distinct, due to band of denser, flattened fibers. Pores very small; very numerous; solitary and, more often, in radial multiples of 2 to 8, fairly uniformly distributed. Vessel perforations simple or multiple (scalariform), the latter with one to few bars; pits mostly large, more or less opposite. Rays of two sizes, the uniseriates up to 50 cells high, the multiseriate 2 to 4 cells wide, with low to very high uniseriate margins and often vertically fused; heterogeneous, without typical procumbent cells; crystals abundant; pits large, elongated, and tending to scalariform arrangement. Wood parenchyma apparently absent. Wood fibers septate, gelatinous.

Azara, with about 20 species of shrubs and little trees, is confined to the southern Andes and Juan Fernandez Island.

The flowers are highly scented and certain species are cultivated on that account. The pale brown, fine-textured wood has no special uses. It is said to have a bitter taste, but this is not noticeable in the specimens of three species available for this study. The following description applies particularly to two samples of *A. microphylla* Hook. f. and one of *A. serrata* R. & P.; exceptions for *A. fernandeziana* Gay are noted at the end.

Growth rings present, with tendency to ring-porous condition in *Azara microphylla*. Pores small to very small; very numerous (140 to 220 per sq. mm.); mostly in short to long radial multiples. Vessels with spiral thickenings in *A. microphylla;* perforations about equally divided between simple and multiple (scalariform type with few bars). Rays of two sizes, the uniseriates up to 25 cells high, the others with a median part 3 to 5 cells wide and 20 to 30, sometimes to 50, cells high, and low to fairly high uniseriate margins, occasionally vertically fused; sheath cells of sporadic occurrence; crystals fairly common; pits to vessels irregular in form, some small to medium-sized and orbicular, but mostly large, elongated, and in scalariform arrangement. Wood parenchyma absent or very sparingly paratracheal. Wood fibers septate; walls thick and gelatinous in *A. serrata*, moderately thick in *A. microphylla*.

A specimen (Yale 27426) of *Azara fernandeziana*, collected and determined by Dr. Carl Skottsberg, differs in structure as follows: Growth rings indistinct. Pores 25 to 35 per sq. mm. Vessels with exclusively simple perforations; all pits very small to minute. Rays without crystals; pits to vessels numerous, subcircular, very small. Wood fibers thin-walled, only occasionally septate.

COMMON NAMES: Aromo, chinchin, corcolén, corrollea (Chile); chinchin, duraznillo (Patagonia).

Banara, with about 30 species of small trees, occurs throughout most of tropical America. The largest size reported is for *B. bernardinensis* Brig., which is said to attain a height of 50 feet and a diameter of a foot in Misiones and Formosa, Argentina. The eight wood samples studied are of four species, namely, *B. guianensis* Aubl., *B. mollis* Tul., *B. nitida* Spruce, and *B. Roigii* P. Wils. The yellowish, hard, fine-textured woods are apparently little used.

Growth rings absent or poorly defined. Pores small to very small in *Banara Roigii*, up to medium-sized in the others; numerous (25 to 60 per sq. mm.); solitary and in short to long radial multiples, well distributed. Vessels with simple perforations; pits small, alternate. Rays of two sizes, the uniseriates rarely over 15 cells high, the others with a median part composed of definitely procumbent cells 3 to 5 cells wide and commonly less than 25 cells high, with

low to high uniseriate margins of square or upright cells; crystals abundant in upright cell-series; ray-vessel pitting fine to unilaterally compound. Wood parenchyma sparse; often crystalliferous. Wood fibers septate, frequently containing crystals.

COMMON NAMES: Guayo blanco, machete (Cuba); cadenillo (Venez.); bimiti joelèkoko, moembo etase poeté, piekien fouroe dioifi (Sur.); lacre branco (Braz.); borracho sisa, galgaretama, linque, machin-mangua, machu-mangua, oco cireyda, okuchi huasi, ratan-caspi, raya-caspi, tamararu, tamanara, teareo (Peru); Francisco Alvarez, ibirá-obi-rá, mbavi (Arg.).

Carpotroche, with several closely related species of small to moderately large trees, is distributed from Guatemala to southeastern Brazil and Peru. The aril-like covering of the seeds is edible and the kernels are the source of an oil sometimes used in the treatment of leprosy. The bark is rich in tannin. The yellowish or pale brown wood is fine-textured, hard, tough, and strong and is used locally to a limited extent for general construction in protected places and for fuel and charcoal. The following description is based on authentic samples of *C. longifolia* (P. & E.) Benth. and *C. platyptera* Pittier; the woods of *C. subintegra* Standl. and *C. amazonica* Mart. are treated separately.

Growth rings mostly poorly defined. Pores small to minute; numerous to very numerous (40 to 60 per sq. mm.); mostly in short to long multiples, radially arranged because of the close spacing of the rays. Vessels with scalariform plates having 8 to 20 bars; pits small to medium, opposite, with tendency to scalariform arrangement. Rays of two sizes, the uniseriates up to 50 cells high, the others 2 to 8 cells wide and up to several hundred cells high, without typical procumbent cells; sheath cells sporadic; pits to vessels mostly in scalariform arrangement. Wood parenchyma absent or very sparse. Wood fibers septate.

A specimen (Yale 12271; Cooper 638 type tree) of *Carpotroche subintegra* and one (Yale 33759; Dugand 468) of *C. amazonica* have numerous pores (70 to 110 per sq. mm.), simple perforations, somewhat coarser intervascular and vessel-ray pitting, and sparse wood parenchyma. Some of the vessels in *C. amazonica* are filled with abundantly pitted, moderately thick-walled tyloses appearing in longitudinal sections like short-celled parenchyma strands.

COMMON NAMES: Sucte (Guat.); achotillo crespo, morrocoy, tablón (Col.); taparaime (Sur.); cacao branco, canudeiro, canudo de pito, fruta de babado, f. de comona, f. de cotia, f. de lepra, f. de macaco, f. de sapucainha, mata-piolho, papo de anjo, pau canudo, p. d'anjo, p. de cachimbo, p. de cotia, p. de lepra, ruchuchú, sapucainha (Braz.); cacaoillo blanco, huira-huayo, sapote de mono (Peru).

Casearia. This large genus of shrubs and small trees is of pantropical distribution, there being about 25 species in Africa and Madagascar, 65 in the region from China to Australia, and about 70 in tropical America, especially in Brazil. The most widely distributed species is *C. sylvestris* Sw., a shrub or a little tree rarely over 30 feet high, with rough bark, slender branches, and small white flowers in axillary clusters; its fine-textured, hard, yellowish brown wood has no special uses. The American species as a whole are of minor importance and supply few useful products. The woods exhibit considerable range in color, density, texture, and properties. A few indicate a close relationship to the West Indian Boxwood, but most of them are brownish or reddish and without particular merit. They are of no commercial promise because of their poor timber form. The following description is based on 45 specimens representing 18 American species.

Growth rings present, but not always distinct. Pores small to very small; numerous to very numerous (either from 40 to 70 or from 60 to 150 per sq. mm.); some solitary, but mostly in short to long multiples and radially arranged between the closely spaced rays. Vessels with simple perforations; pits typically minute to very small, rarely up to medium-sized. Rays greatly variable in different species; sometimes uniformly narrow, 1 or 2, locally 3, cells wide and usually not over 25, sometimes up to 60, cells high; more often of two sizes, the multiseriates in many instances not over 5 cells wide and up to 60, rarely over 100, cells high, but occasionally up to 7, sometimes to 10, cells wide and very high (300 to 400 cells); cells of multiseriate parts definitely procumbent in about half of the species examined; uniseriate margins often higher than the uniseriate rays; vertical fusions common; crystals common to abundant; ray-vessel pitting fairly uniform, fine or unilaterally compound. Wood parenchyma absent or very sparse. Wood fibers septate; walls thin to medium, occasionally thick and gelatinous in part.

COMMON NAMES: Cafecillo cimarrón, cafeillo, c. cimarrón, cafetillo, cuero de sapo, falcon, palo blanco, raboratón, sarna de perro (P.R.); aguedita blanca, a. dulce, a. macho, grasimilla del Pinar, jía brava, j. colorada, j. peluda, j. prieta, j. morada, raspalengua, rompe-hueso, sarna de perro, sarnilla, s. cimarrona, yaná (Cuba); café cimarrón, c. de gallina, chicharrón, limoncillo, palo blanco, p. de yagua, yagua (Dom.

R.); castor, piquant arada, p. carré (Haiti); geelhout, paaloe de Bonaire (Curaçao); cafetillo, capulincillo, chililló, ciruela, crementinillo, garrapatilla, guayabillo, iximché, pochitoquillo, palo de piedra corteño (Mex.); paletilla, wild sage (Br. H.); guacuco, guayabillo, manocarpo, vara blanca, xiliché (Guat.); escambrón, manocarpo, sombra de armado, vara blanca (Hond.); barredera, canjurillo, canjuro, chililló, come-culebra, cuculmico, limoncillo, palanco, raspa-lengua (Salv.); cerillo, cerito, huesillo, matacartago, puipute, raspalengua (C.R.); cerillo, comida de culebra (Nic.); caraña, comida de loro, corta-lengua, mauro, palo de la cruz, raspalengua (Pan.); cuchillo, limoncillo, mahajo, peloto, vara blanca, v. de piedra, anime, huesito, h. blanco (Col.); limoncillo, macapiritú, machacomo, naranjillo, palo Bonaire, punta de ral (Venez.); alawatta-moereroe, bassakandra, bastard kopie, bimiti jorelsko, boschkoffie, kibidan, kiebiehiedan, knorye, koembetadde, kojara tokon, kwassie-kwassie-tikie, manalliballi, marisiballi jotoh, tamoipio, zwart parelhout (Sur.); rompehato (Ec.); achu-caspi, capanca, chiric-sanango, cuipe-ey, espina cacha, espino del demonio, espuela casha, fortuga caspi, huactana, limón caspi, llajas, naranjilla, oje de tucunare, sasishy-ey, sishi-co-ey, supai-cashi, supiecacha, tambor huactana, titibeguisi-ey, tortuga-caspi, uchu-caspi, uchu-mullaca, ullu-mullaca, usico-ey (Peru).

Gossypiospermum, a recent segregate from *Casearia*, is the only American genus of the Flacourtiaceae that produces timber of commercial importance. Two species are recognized. *G. paraguariense* Rehder (= *Casearia gossypiosperma* Briquet), a slender tree with a straight, smooth trunk, sometimes a foot in diameter, and said to have a yellowish, hard, brittle wood, is native to Paraguay and northern Argentina. Its commercial possibilities are unknown.

Gossypiospermum praecox (Gris.) P. Wilson (= *Casearia praecox* Gris. = *C. eriophora* Wr. = *G. eriophorum* Urb.) is a small to medium-sized tree of Dominican Republic, Cuba, the Maracaibo Lake region of Venezuela, where it is commonly called Zapatero, and in eastern Colombia. The timber which has been on the markets of the United States and Europe for half a century or more under the name of West Indian

Boxwood, is almost exclusively of Venezuelan origin, with occasional small lots of logs from Cuba. The wood was first described (1880) under the name of *Aspidosperma Vargasii* DC. (fam. Apocynaceae), next (1904) as *Tabebuia* (*Tecoma*) *pentaphylla* B. & H. f. (fam. Bignoniaceae), and finally (1914) as *Casearia praecox* Gris. The identification of the wood with *Gossypiospermum* was made by the author in 1932 (see *Tropical Woods* 32: 4).

Zapatero is by far the most important Boxwood of commerce and has very largely replaced Turkish Boxwood (*Buxus sempervirens* L.) for all purposes except the finest engraving blocks. The logs, which are well-formed, round, and smooth, are from 6 to 12, occasionally up to 18, inches in diameter, and from 9 to 12 feet long. The normal consumption in the United States is between 2000 and 2500 tons annually, the logs averaging about 10 per ton. They are shipped without removal of the bark, which is reddish brown to grayish, often flaking off irregularly, and containing intercellular canals from which a dark gummy substance exudes when freshly cut. The principal use of the timber is for the manufacture of precision rules. Other purposes are veneers for cabinet work and marquetry, engravers' blocks, articles of carving and turnery such as combs, spoons, shuttles, and spindles for silk mills, jewelers' burnishing wheels, and (ebonized) for handles of cutlery, keyboards, piano keys, and inlay. (For further details see Record and Garratt's *Boxwoods*, Bul. 14, Yale School of Forestry, 1925.)

Wood lemon-yellow to nearly white, mostly uniform, with little or no difference between heart and sapwood; blue stain common in logs that have been stored in a warm humid atmosphere. Luster high. Odor and taste absent or not distinctive. Sp. gr. (air-dry) 0.80 to 0.90; weight 50 to 56 lbs. per cu. ft.; hard and compact; of very fine and uniform texture; grain generally straight; easy to carve and turn, finishing very smoothly and taking a high natural polish; splits more readily than real Boxwood (*Buxus*); is poorly resistant to decay.

Growth rings present, owing to terminal layer of flattened fibers. Pores very small, rounded; very numerous (100 to 250 per sq. mm.); solitary and,

more often, in short, occasionally long, radial multiples. Vessels with simple perforations; without spirals; pits very small to minute, often crowded, the slit-like apertures tending to coalesce spirally. Rays of two sizes, the uniseriates 1 to 25 cells high, the others with a median part composed of procumbent to squarish cells, 2 to 5, mostly 3, cells wide and up to 60, commonly less than 25, cells high, with uniseriate margins one to many cells high; irregular rhombohedral crystals common in both procumbent and upright cells. Wood parenchyma absent or very sparse. Wood fibers septate; walls thick, often gelatinous; pits with slit-like, vertical apertures.

COMMON NAMES: *Gossypiospermum paraguariense:* Catiguá-oby, mbavy (Arg.). *G. praecox:* Boxwood—Maracaibo, Venezuelan, or West Indian (U.S.A. trade); India boxwood (England); westindisches Buchs (Germ.); buis d'Amérique, b. des Antilles (France); agracejo, a. del monte, jía, j. del monte (Cuba); palo blanco (Dom. R.); agracejo, cuchillo (Col.); lima, limoncillo, manzanito de montaña, manzano, marfil, naranjillo, sapatero, zapatero, z. de Maracaibo (Venez.)

Hasseltia, with three species of shrubs and small trees, is distributed from Central America to Venezuela and southward in the Andes Mountains to Peru. The wood is cream-colored, of medium density, fine-textured, and easy to work, but has no special uses. The following description applies to specimens of *H. floribunda* H.B.K., *H. lateriflora* Rusby, and *H. laxiflora* (Benth.) Eichl.

Growth rings rather poorly defined by band of flattened fibers. Pores small to very small; very numerous (60 to 200 per sq. mm.); mostly in short, occasionally long, radial multiples, evenly distributed. Vessels usually with simple perforations, sometimes also with scalariform plates; pitting very fine. Rays 1 to 3 cells wide and of various heights up to 60 cells or more; some of the cells definitely procumbent; crystals abundant, often in upright cell-series; pits to vessels more or less elongated and in scalariform arrangement. No wood parenchyma seen. Wood fibers septate, rather thin-walled.

COMMON NAMES: Muñeca (Nic.); raspalengua (Pan.); pié de paloma (Venez.); okuchi-huasi, tamamara, ratón-caspi (Peru).

Hasseltiopsis, with three species of trees, occurs from southern Mexico to Colombia and along the Andes Mountains to Peru. According to Sleumer (*Notizbl. Bot. Gart. Berlin-Dahlem* 14: 121: 49–52), *H. leucothyrsa* Sleumer attains a height of 50 to 100 feet in eastern Peru and *H. albomicans* Sleumer is 40 to 85 feet tall near Bogotá, Colombia. The only species of which wood samples are available is *H. dioica* (Benth.) Sleumer (= *Banara dioica* Benth. = *B. mexicana* Gray = *Hasseltia mexicana* [Gray] Standl. = *H. pyramidalis* Hemsl.). It is a small tree, rarely up to 45 feet in height, with a smooth thin-barked trunk 15 inches in diameter, and is apparently limited to southern Mexico and northern Central America. The wood is cream-colored, sometimes with brownish stripes, fairly hard and heavy, fine-textured, rather cross-grained, and splintery. There are no known uses other than for fuel.

Growth rings terminated by a band of flattened wood fibers. Pores small to very small; very numerous (80 to 100 per mm.); mostly in short, sometimes in long, radial multiples. Perforation plates typically scalariform with one to several bars, occasionally reticulate; simple perforations sometimes present also; pitting variable from scalariform to opposite or nearly alternate. Rays 1 to 3, sometimes 4, cells wide and up to 60 or more cells high; multiseriate parts composed of definitely procumbent cells; crystals abundant, not confined to upright cell-series; pits oval to elongated and in scalariform arrangement. Wood fibers septate; walls rather thin.

COMMON NAMES: Pochitoquillo (Mex.); chichimi, quina (Guat.); guatuso (Hond.).

Hecatostemon *dasygynus* Blake, the only species, is a small Venezuelan tree known locally as Lagunero. The only authentic specimen of the genus available (Yale 10342; Pittier 12341) has bright yellow, hard, fine-textured wood. The tree apparently is too small and rare to be useful.

Growth rings present. Pores nearly all very small; very numerous (65 to 115 per mm.); mostly in short to long multiples tending to radial arrangement between the closely spaced rays. Perforations simple; pitting alternate, very fine. Rays 1 to 6, sometimes to 8, cells wide; uniseriates composed of upright cells and up to 30 cells high; the others with a median part generally 5 to 8 cells wide and up to 150 cells high, the cells nearly all square or oblong, occasionally procumbent, uniseriate margins often high; crystals scattered; ray-vessel pitting fine to unilaterally compound. Wood parenchyma rather sparingly paratracheal. Wood fibers septate; mostly with moderately thick walls, gelatinous in part.

Homalium, with upward of 150 species of trees and shrubs, is widely distributed in the tropics, especially in Africa. The several American species, all of the section *Racoubea*, occur in the West Indies, southern Mexico, Central America, and northern South America. Some of the Indo-Malayan species are large trees with durable and useful timbers, but those in

America are small and of no value. The excellent Venezuelan timber called Angelino was formerly supposed to be of this genus, but it is a species of *Ocotea* (Lauraceae). The following description is based on one specimen each of *H. guianensis* (Aubl.) Warb. from British Guiana, *H. racemosa* Jacq. from the Amazon region, and *H. trichostemon* Blake from southern Mexico.

Growth rings poorly defined by flattened fibers. Pores small to very small; numerous (30 to 55 per sq. mm.); solitary and in short multiples, or occasionally in long multiples in *Homalium guianensis;* evenly distributed. Vessels with simple perforations; pits alternate, small to minute. Rays 1 to 3, sometimes 4, cells wide and up to 60 or more cells high; cells of multiseriate parts procumbent; vertical fusions common; crystals common to abundant, often in upright cell-series; ray-vessel pitting unilaterally compound to scalariform. No wood parenchyma seen. Wood fibers septate; walls moderately thick, sometimes gelatinous.

COMMON NAMES: White cogwood (Jam.); cerezo, coracolillo, tostado (P.R.); acoma blanc, a. sauvage, acomat, acouma, bois d'acouma (Fr. W.I.); corazón de paloma (Dom. R.); palo de piedra (Mex.); trebo (Col.); caramacate, marfil, naranjillo (Venez.); conageddiballi (Br. G.); bita hoedoe (Sur.); bois d'acouma, mavavé, mavévé, racoube de la Guiane (Fr. G.).

Laetia, with 10 to 15 species of shrubs and small trees, occurs in the West Indies, Mexico, Central America, and in South America to Brazil and Peru. The largest specimens rarely exceed 30 feet in height and 10 inches in diameter. The yellowish or brownish woods are rather fine-textured, tough and strong, but not durable. They have no special uses. The following description is based on samples of *L. americana* L., *L. apetala* Jacq., *L. procera* (P. & E.) Eichl., *L. suaveolens* Benth., and *L. ternstroemioides* Gris.

Growth rings absent or poorly defined. Pores typically small to very small and fairly numerous (30 to 40 per sq. mm.), but medium-sized to large and few (5 to 10 per sq. mm.) in *Laetia procera;* solitary and in short, occasionally long, radial multiples. Vessels with simple perforations; pits alternate, typically very small, with coalescent apertures. Rays in *L. apetala* and *L. procera* 1 to 5, sometimes to 8, cells wide, the uniseriates up to 60 cells high, the others much higher (max. over 300 cells) with interior cells procumbent; elsewhere 1 to 3, infrequently 4 to 5, cells wide, the uniseriates up to 25 cells high, the others up to 90, with few distinctly procumbent cells; crystals usually abundant in upright cell-series; ray-vessel pitting fine to very fine or unilaterally compound. Wood parenchyma sparingly paratracheal in *L. procera* and *L. suaveolens;* not seen in the others. Wood fibers septate; walls thick to very thick, occasionally gelatinous (*L. apetala*).

COMMON NAMES: Guagnací, mamoncillo, ranillo, raspalengua (Cuba); guácima, trompillo (Venez.); warakaiaro (Br. G.); agamoe kamma, aletepe, aloekoejoeroe, aroekoejoeroe, basra kopie, brakkahatti, jakarawa-sorroballijepo, kabisie, kasapa erepalli, majapo werie, mania-powerie, maré oelang, sabanapau, waikarra, wajakajaro, warakajaharoe, warakajaro (Sur.); bois Jacquot, b. lamende, b. Marie (Fr. G.); timaréhua (Peru); casinga cheirosa, muirapucú, resinouso, teareo (Braz.).

Lindackeria includes about a dozen species of trees and shrubs, half of them in tropical Africa, the others in America from southern Mexico to Brazil. The best known of the six American species is *L. laurina* Presl (= *Oncoba laurina* [Presl] Warb. = *Mayna laurina* [Presl] Benth.), a small to medium-sized tree, sometimes 50 feet high and 12 to 14 inches in diameter, with a range from southern Mexico through Central America into the mountains of western Colombia. The woods of the various American species are yellow-brown, hard, heavy, and fine-textured; they have no special uses. The following description applies to specimens of *L. laurina*, *L. maynensis* P. & E., and *L. paraensis* Kuhlm.

Growth rings absent to fairly distinct. Pores very small; numerous to very numerous (30 to 80 per sq. mm.); solitary and in short to long radial multiples, evenly distributed. Vessels with simple perforations; thin-walled tyloses common; pitting medium, alternate to opposite. Rays 1 to 3, infrequently 4, cells wide; uniseriates up 25, sometimes to 50, cells high; the others with wider part composed of square or oblong cells usually less than 30, sometimes up to 100, cells high, and having typically high uniseriate margins; sheath cells of sporadic occurrence; crystals absent or few; pits to vessels orbicular to elongated and in scalariform arrangement. No wood parenchyma seen. Wood fibers septate; walls medium to thick.

COMMON NAMES: Achiote (Guat.); hugro, ugro (C.R.); carbonero, guavo cimarrón, uvre (Pan.); caracana, huacapú, lluicho-caspi, quinilla colorado (Peru).

Lunania, with about a dozen species, mostly small trees, is distributed sparingly in the West Indies, Mexico, Central

America, and through northern South America into the Amazon basin. The largest tree reported is 45 feet tall, with a trunk free of branches for 25 feet. There are no special uses for the hard, fine-textured, yellowish-brown wood. The following description applies to specimens of *L. cubensis* Turcz. and *L. cuspidata* Warb.

Growth rings indicated by radially flattened fibers. Pores small to very small, varying considerable in same specimens; fairly to very numerous (30 to 80 per sq. mm.); solitary and in short to long multiples, evenly distributed. Vessels with simple perforations; pitting alternate, very fine. Rays 1 to 3 cells wide and up to 100 or more cells high, the interior cells infrequently procumbent; crystals abundant, often in vertical cell-series; ray vessel pitting varying in same sample from very fine to unilaterally compound and scalariform. No wood parenchyma seen. Wood fibers septate; walls medium.

COMMON NAMES: Palo campeche, p. negro, pimiento (Cuba); charapa-huatana, palo negro, piña-quiro, rumo-caspi (Peru).

Mayna, with seven or eight species of shrubs and little trees, is of fairly common occurrence in the Amazon region and northward in the Guianas and Colombia. The wood is similar to the preceding in appearance and properties. The following description applies to samples of *M. echinata* Spruce and *M. suaveolens* (K. & T.) Warb.

Growth rings demarcated by narrow layer of non-gelatinous fibers. Pores very small; numerous to very numerous (45 to 100 per mm.); solitary and in short to long multiples or chains, fairly evenly distributed. Vessels with simple perforations, sometimes in association with scalariform plates having one to several bars; pits about medium-sized, alternate to opposite, occasionally elongate. Rays 1 to 4, sometimes up to 6, cells wide and greatly variable in height up to about 200 cells; procumbent cells absent; crystals absent or few; pits to vessels oval to elongated and in scalariform arrangement. No wood parenchyma seen. Wood fibers septate; mostly with thick gelatinous walls.

COMMON NAMES: Cacáo branco, canudo de pito (Braz.); congo-caspi, huira guayo, h. huara, sapote de mono, s. yacú, shamshu huayo (Peru).

Olmediella *Betschleriana* (Goepp.) Loes., the only species, is a rare plant of central Guatemala. Paul C. Standley gives the following account of its curious history (*Tropical Woods* 32: 17); "The tree or shrub has been in cultivation in Europe for 75 years or more, but there, apparently, it seldom flowers. Its origin has been unknown. Because of the Holly-

like form of the handsome leaves it was first described as a species of *Ilex*. Rippa, who observed it in cultivation at Naples, described it as a new genus, *Licopolia*, disregarding the earlier name *Olmediella* of Baillon, who had referred the plant, fantastically enough, to the Moraceae. According to Loesener and Gilg, the genus is most closely related to *Dovyalis*, a group represented most extensively in Africa. It is altogether unexpected to discover such a genus in America, since there are no other close relatives in the western hemisphere. . . . Sr. García Salas [Director of Agriculture of Guatemala] has supplied complete specimens of the tree, including mature fruits, which are irregularly rounded, strongly depressed, 6 cm. or more in diameter and about 3.5 cm. high, and have a hard thick shell. The tree, which is reported to be a handsome one and well worthy of more extensive planting, is said to be cultivated frequently in the parks and plantations of central Guatemala. The first specimens sent were obtained at the Finca La Cienaguilla, San José Pinula, elevation 1600 meters, and the tree is reported as native in the mountains in that general region. Other specimens were collected at Antigua and along the Boulevard La Reforma in Guatemala City. It is worthy of note that in the larger trees the leaves are entire; in the younger ones they have numerous spinose teeth and thus are strongly suggestive of those of the evergreen Hollies. The vernacular name is Manzanote." The pale brown, lustrous, fine-textured wood is not utilized because of its small size and scarcity.

Growth rings poorly defined. Pores very small to medium-sized; numerous (40 to 60 per sq. mm.); solitary and in small, infrequently long, multiples, fairly well distributed. Vessels with simple perforations; fine spiral thickenings present; pits opposite, large, occasionally elongate. Rays 1 to 5, sometimes 6, cells wide; the uniseriates less than 35 cells high; the others with multiseriate parts composed of procumbent cells up to 80 high, with uniseriate margins up to 50 cells high; sheath cells of sporadic occurrence; crystals abundant, often in upright cell series; pits to vessels large, rounded to elongated and in scalariform arrangement. Wood parenchyma sparingly diffuse; crystals present. Wood fibers septate in part; walls rather thin to thick and gelatinous.

COMMON NAMES: Cumbo de cerro, manzana, manzanote (Guat.).

Peridiscus *lucidus* Benth., the only species, is an apparently rare tree of the Brazilian Amazon region, where it is known as Pau Santo. The specimen studied (Yale No. 22573) was collected near Manáos by Adolpho Ducke, who says the tree is small, although in the original description the species is said to attain large size along the Brazil-Venezuela border. It has large, smooth, leathery, entire, alternate leaves and clusters of small white flowers in the axils. There is some doubt as to its taxonomic position, and its anatomy is unlike that of the other Flacourtiaceae, except the Paropsiae, which some botanists include with the Passifloraceae. The heartwood is of a dull sulphur-yellow color, and sharply demarcated from the sapwood, which in this specimen is dark brown. It is hard, heavy, and fine-textured. No special uses are known.

Growth rings indistinct. Pores small to medium-sized; fairly numerous (15 to 30 per sq. mm.); in short to rather long radial rows. Vessels typically with many-barred scalariform perforation plates; thin-walled tyloses present; intervascular pit-pairs large, rounded, opposite, and mostly in few vertical rows. Rays narrow and not conspicuous; uniseriate or biseriate, very numerous, only 1 or 2 fiber-rows apart; very high, often appearing continuous throughout tangential sections; heterogeneous, the cells mostly large and square; pits to vessels large, rounded to elongate and parallel. Wood parenchyma fairly abundant, diffuse and reticulate; scarcely visible with lens. Wood fibers with very thick gelatinous walls and minute cavities; nonseptate; pits large, distinctly bordered, apparently to ray and wood parenchyma cells only.

Prockia, with 10 species of shrubs and little trees, occurs throughout tropical America. The best known and most widely distributed species is *P. crucis* L., a shrub or a tree sometimes 35 feet high. The wood, which is of a light clear yellow color, hard, and very fine-textured, appears suitable for many of the same purposes as the West Indian Boxwood (*Gossypiospermum*), though it is not available in large enough sizes to compete with that timber.

Growth rings present or absent. Pores small to very small; very numerous (80 to 100 per sq. mm.); mostly in short to long radial multiples between the closely spaced rays. Vessels with simple perforations; pits alternate, small to minute. Rays 1 or 2, sometimes 3, cells wide; uniseriates up to 15, sometimes to 25, cells high, the others up to 70 cells high, with or without definitely procumbent cells; crystals common, often in upright cell-series; ray-vessel pitting fine. No wood parenchyma seen. Wood fibers septate; walls rather thin to thick and gelatinous.

COMMON NAMES: Guácima de costa, guacimilla (Cuba); huesito (Col.); guácima de montaña, huesito (Venez.); cuiteleiro (Braz.); charapilla, uchpú-aguajillo (Peru).

Ryania (or *Patrisia*), with 10 species of shrubs and little trees, occurs in northern South America and the Amazon basin. The wood specimens studied have coarse and conspicuous rays suggesting Myrsinaceae, though lacking the resinous cell complexes or cysts. The following description applies to samples of *R. pyrifera* (Rich.) U. & S., *R. sauricida* Gleason, and *R. speciosa* Vahl.; they exhibit considerable variation in structure.

Growth rings distinct to very poorly defined. Pores small to very small intermixed; very numerous (50 to 80 per sq. mm., up to 140 in *Ryania speciosa*, where the pores are locally crowded tangentially); mostly in short to long radial multiples. Vessels with simple perforations, with rare tendency to formation of few-barred scalariform plates; pits alternate, small to very small, flat-oval, with coalescent apertures. Rays coarse-celled, of two or three sizes; uniseriates usually low, sometimes up to 50 cells; biseriates and triseriates infrequent; multiseriates mostly 5 to 7 cells wide in *R. sauricida*, 4 to 15, generally over 5, cells wide in the others, and very high (several hundred cells); crystals common to fairly abundant; ray-vessel pitting irregular, unilaterally compound, sometimes scalariform. Wood parenchyma absent or very sparingly paratracheal. Wood fibers septate; walls thin to thick, sometimes gelatinous.

COMMON NAMES: Ciezo, guaricamo (Venez.); capança, matacachorro, malacalado (Braz.).

Samyda, with 10 species of shrubs and small trees up to 35 feet high, is limited in its distribution to the West Indies and southern Mexico. The wood is yellowish, very hard, fine-textured, and of the West Indian Boxwood (*Gossypiospermum*) type. The trees are too small to supply timber of commercial importance. The following description applies to samples of *S. macrantha* P. Wils. and *S. rosea* Sims of the West Indies.

Growth rings terminated by layer of flattened non-gelatinous fibers. Pores subcircular; very numerous (130 to 180 per mm.); solitary and in short to long multiples, evenly distributed. Vessels with simple perforations; pits alternate, very small to minute, the apertures coalescent. Rays 1 to 3 cells wide and up to 75 cells high, without definitely procumbent cells; crystals present but not abundant; ray-vessel pitting very fine with tendency to be unilaterally compound. No wood parenchyma seen. Wood fibers septate; mostly gelatinous.

COMMON NAMES: Rosa cimarrón (Dom. R.); casser sèche (Haiti); wild guave (Virg. Is.); aguja de tórtola, puus mucuy (Mex.).

Tetrathylacium, with four species of small trees sometimes 30 feet high and a foot in diameter, is distributed from Costa Rica to Peru. The specimens available are of *T. Johansenii* Standl. of Colombia and *T. macrophyllum* P. & E. of Peru. The woods are yellowish, fine-textured, moderately hard and heavy, tough and strong, but apparently not utilized.

Growth rings poorly defined. Pores small; fairly numerous (25 to 45 per sq. mm.) in *Tetrathylacium Johansenii*, but very numerous (55 to 100 per sq. mm.) in *T. macrophyllum;* solitary and in short, occasionally long, multiples, evenly distributed. Vessels typically with scalariform perforation plates having few to many fine bars; pits alternate to opposite, mostly small, occasionally elongate. Rays 1 to 3, sometimes to 5, cells wide; the uniseriates up to 30 cells high, the others up to 100 cells or more, with only a few distinctly procumbent cells; crystals common to abundant; pits large, oval to elongate and parallel. No wood parenchyma seen. Wood fibers septate; walls sometimes gelatinous.

COMMON NAMES: Anonilla, llaja, mulla-huayo (Peru).

Xylosma (or *Myroxylon*) includes about 20 Asiatic and 40 American species of trees and shrubs, often with axillary thorns. The bark contains tannin and the fruit is sometimes the source of dyestuff. The woods studied are yellowish, roseate, or brownish, fine-textured, and moderately hard and heavy; they are little used except for fuel. The following description is based on specimens of seven species.

Growth rings poorly defined. Pores small to very small; fairly to very numerous (25 to 145 per sq. mm.); solitary and in small multiples often radially arranged between the closely spaced rays. Vessels with simple perforations; spiral thickenings rarely present; pits typically alternate, small to minute. Rays 1 to 3, sometimes up to 6, cells wide; uniseriates usually less than 25, infrequently up to 50, cells high, the others up to 150 cells high, commonly with a rather low median part composed generally of procumbent cells; crystals common to abundant, frequently in upright cell-series; ray-vessel pitting variable, sometimes unilaterally compound to scalariform. Wood parenchyma apparently absent to sparingly paratracheal. Wood fibers septate; walls frequently gelatinous.

COMMON NAMES: Palo de candela, p. colorado, roseta (P.R.); huesillo, hueso de costa, h. espinosa, h. de sabana (Cuba); piquant rosie (Haiti); corona santa, coronilla, huichichiltemel, junco, malacate, manzanillo (Mex.); agua

de árrea (Salv.); mata-cartago, puipute (C.R.); jobo de lagarto, needlewood, roseto (Pan.); aguja de árrea, corona, espino de cabra, puyón, quemacho (Col.); cunshi-cashán, diablo-casha, supai-caspi (Peru); auiba, auiuva, auui-uva, espinho de Judeu (Braz.); espino de corona (Urug.); caravánuatí, coronillo, c. blanco, espino colorado, e. de cabra, e. de corona, espinillo amarillo, irá-puitá, inkerí-rá, nuatí-puitá, quillay, yucaráo, yuguayú, yuquerí-rá (Arg.).

Zuelania, with three or four species of small to medium-sized trees, occurs in the West Indies, southern Mexico, and Central America. *Z. Roussoviae* Pittier of Panama is a deciduous tree 30 to 75 feet tall, with a gray-barked trunk occasionally 20 inches in diameter. A gum, called "caraña," is obtained from incisions in the bark and reputed to have medicinal virtue. The wood is yellow, fine-textured, hard and heavy, but is not used for any special purposes, presumably because of its scarcity. *Z. guidonia* (Sw.) Britt. & Millsp. occurs throughout the range of the genus. It is said to attain a height of 100 feet in Cuba and is similar to the preceding in its wood and resin. The timber is used locally to a minor extent for interior construction and carpentry.

Growth rings poorly defined. Pores small to very small; rather to very numerous (20 to 70 per sq. mm.); solitary and in short, occasionally long, multiples, evenly distributed. Vessels with simple perforations in *Zuelania Roussoviae*, but with tendency to formation of scalariform plates in *Z. guidonia;* pits alternate, very small. Rays 1 to 4, mostly 2 or 3, cells wide and up to 150 cells high; interior cells procumbent to squarish; crystals present but not abundant; ray-vessel pitting fine to unilaterally compound. No wood parenchyma seen. Wood fibers septate; walls rather thin to thick, sometimes gelatinous.

COMMON NAMES: Guaguasí (Cuba); cachiman marron (Haiti); campanillo, manzanillo, manzano, tamay, tepecacao, volatín (Mex.); water wood (Br. H.); palacio, sangre de playa (Hond.); caraño (Pan.).

CURRENT LITERATURE

The principal timbers of Jamaica. By CHRISTOPHER SWABEY. Bull. No. 29 (n. s.), Dept. Sci. and Agr., Kingston, 1941. Pp. 37; 6 x 9¾; 1 text fig., 1 map. Price 6d.

The principal part (pp. 12–33) of this useful work is a descriptive list of the Jamaican timbers arranged alphabetically by common names. This is followed by a classified list of timber uses and the districts in which the trees grow.

The author is experiencing the usual trouble in trying to correlate native and scientific names. "Not only are different names applied to the same tree in different districts but the same name is applied to whole groups of trees and to entirely different trees in different districts. This is particularly evident in the Sweetwoods (Lauraceae), the Bulletwoods (Sapotaceae), and the Rodwoods (Myrtaceae)."

The Caribbean Forester. Pub. quarterly by the Tropical For. Exp. Sta., U.S.F.S., Río Piedras, Puerto Rico. Vol. II: 4: 147–198; July 1941.

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Studies of American spermatophytes. I. By CYRUS LONGWORTH LUNDELL. Ann Arbor: Univ. of Michigan Press, September 1941. Pp. 66; 6 x 9; 5 text figs.

"Although the botanical exploration of Mexico and Central America has progressed steadily during the past four decades, there still remain large regions, such as the interior of Chiapas, which have scarcely been touched. Until recently very little has been known about the flora of any part of the state of Tabasco. Although Yucatán has been worked extensively by resident and visiting botanists, the xerophytic coastal zone as well as areas of relict deciduous forest in the interior needs further intensive exploration. New plants are brought to light by every collection of importance. Additional material, even of many well-known species, is necessary for their reinterpretation. Along with critical notes and necessary transfers, 56 novelties are now described; most of these are from the Yucatán Peninsula and the highlands of Chiapas."

The most conspicuous example of "reinterpretation" of a well-known species is the proposal (p. 36) to segregate a form of *Swietenia macrophylla* which the author designates *S. belizensis*. It "is distinguished from the closely allied *S. macrophylla* King by its fewer and smaller membranaceous cuspitate-acuminate leaflets, by the smaller flowers, and by the acute rather than acuminate teeth of the staminal tube. In *S. macrophylla* the staminal tube is conspicuously constricted above at base of the teeth; no constriction is evident in *S. belizensis*." The common name in British Honduras is given as Broken Ridge Mahogany. Perhaps it might be well for the reviewer to explain that "broken ridge" is a local term in British Honduras for any of the transition stages between swamp or Pine forests and advanced rain forest and has no reference to altitude; "ridge" is probably a corruption of reach.

British Honduras. Abridged report of the Forest Department for the year ended 31st December, 1940. By NEIL S. STEVENSON. Govt. Printer, Belize, 1941. Pp. 5; 8 x 12½.

A few items of particular interest to the reviewer are as follows:

"The widespread death of Pines has apparently stopped in most areas. Aerial reconnaissance showed that in the Mountain Pine Ridge in particular at least three-quarters of the Pine stand had been destroyed, but there was no opportunity

to attempt to assess the effect of this loss of soil cover on the sheet erosion which is definitely of importance on this watershed."

"Twelve species were added to the Silkgrass graveyard. No preservatives have been used and it was reported that seasoning alone did not appear to have any deterrent effect on decay except in the case of *Calophyllum* and *Symphonia*. Species so far resistant to termites, ambrosia beetles, and decay are Cortez, *Tabebuja chrysantha;* Mylady, *Aspidosperma megalocarpon;* Sapodilla Macho, *Achras chicle* and *Licania hypoleuca;* and Verde Lucero [*Esenbeckia*]. Termite and pinworm resistance was good in *Calophyllum*, *Simaruba*, *Vochysia*, *Zanthoxylum*, and *Dialium*."

"Chicle bleeding by the gouge method was successfully continued in Freshwater Creek Reserve giving most useful information on yields per tree and per acre and a net return of ten cents per lb. of gum produced as compared with ordinary royalty of six cents per lb."

Estudios sobre plantas andinas. II. By José Cuatrecasas. *Caldasia* (Bogota, Colombia) 2: 13–27; 14 figs., 2 plates; Aug. 15, 1941.

Descriptions of 11 new species of *Weinmannia*, based for the most part on specimens collected by the author at elevations of 6000 to 8000 feet in the Andean region of Colombia. All are trees from 25 to 50 feet tall. The principal characteristics are well illustrated.

El genero *Capparis* en Colombia. By Armando Dugand. *Caldasia* 2: 29–54; 5 figs.; Aug. 15, 1941.

A systematic account of 19 species and one form of *Capparis* which are known to occur in Colombia. They are shrubs or small trees of common occurrence on the litoral and other dry regions of the country. The author supplies a key for the separation of the different species and this is followed by citations of specimens examined, vernacular names, synonymy and notes. Three species are described as new.

The Caura Valley and its forests. By Llewelyn Williams. *Geographical Review* 31: 3: 414–429; 10 text figs.; July 1941.

An illustrated account of the author's explorations in the lower and middle Caura region, a poorly known and thinly populated part of Venezuela south and east of the Orinoco. (See also *Tropical Woods* 62: 1–20.)

Exploraciones botanicas en la Peninsula de Paraguaná, Estado Falcón. By Francisco Tamayo. Extract from *Bol. Soc. Venez. Cien. Nat.* No. 47, Caracas, Venezuela, 1941. Pp. 90; 6½ x 9; 10 plates.

An account of the vegetation of the Paraguaná Peninsula of Venezuela based largely upon the author's explorations in 1938–39, but taking into account the work of earlier investigators, notably Karsten in 1850 and Curran and Haman in 1917. Following an illustrated description of the plant formations (pp. 1–44), there are short lists of the small animals, insects, and parasites collected and a long annotated list (pp. 47–78) of the plants, giving common and scientific names, occurrence, and uses.

Flora Brasilica. By F. C. Hoehne. Pub. by Sec. Agr. Ind. e Com. de São Paulo, July 1941. Vol. XXV, Fasc. 3, Nos. 126, 127; pp. 1–39; 40 plates, 1 text fig.

Contains descriptions and plates of 38 species and several varieties of *Dalbergia* and six species of *Cyclolobium* growing in Brazil. There is very little information about the timbers which, for the most part, are unknown to scientists although Rosewood, Kingwood, and Tulipwood have been familiar to cabinet-makers of Europe and United States for a long time.

Sinopsis de la flora del Cuzco. I. Parte sistemática. By Fortunato L. Herrera. Lima, Peru, July 4, 1941. Pp. 528; 7 x 9½; 13 text figs.

A catalogue of the families, genera, and species of plants known to occur in the Department of Cuzco, Peru. Of the Angiospermae there are 27 families, 129 genera, and 320 species of Monocotyledoneae and 104 families, 464 genera, and 1250 species of Dicotyledonae. The appendix includes descriptions of new species and varieties of plants, mostly herbaceous. There is a check list of the vernacular names and their scientific equivalents.

Importancia económica de la explotación racional de los bosques de araucaria del sud. By LUCAS A. TORTORELLI. *Maderil* (Buenos Aires) 13: 156: 11–16, 25–27; June 1941.

An account of the forests of Araucaria or Pehuen, *Araucaria araucana* (Mol.) Koch, with particular reference to their commercial possibilities.

Meliaceae, Akaniaceae. By HERMANN HARMS. Engler and Prantl's *Die natürlichen Pflanzenfamilien* (2nd ed.) 19b, I. Pp. 183; 36 figs.; 1940.

The Akaniaceae, with a single genus and species, *Akania Hillii* Hook. f., the Horse-radish tree of Australia, takes up only three pages of this book, the remainder being devoted to the Meliaceae, commonly known as the Mahogany family. The author recognizes 51 genera and lists them under four subfamilies as follows:

CEDRELOIDEAE: *Cedrela*, *Toona*, *Cedrelopsis*, and *Pteroxylon*.

SWIETENIOIDEAE: *Khaya*, *Soymida*, *Entandrophragma*, *Chukrasia*, *Pseudocedrela*, *Schmardaea* (*Elutheria*), *Swietenia*, and *Lovoa*.

MELIOIDEAE: *Carapa*, *Xylocarpus*, *Turraea*, *Naregamia*, *Nurmonia*, *Munronia*, *Cipadessa*, *Pterorhachis*, *Nymania*, *Vavaea*, *Melia*, *Azadirachta*, *Trichilia*, *Heynea*, *Walsura*, *Ekebergia*, *Owenia*, *Lansium*, *Reinwardtiodendron*, *Aphanamixis*, *Amoora*, *Guarea*, *Urbanoguarea*, *Leplaea*, *Ruagea*, *Synoum*, *Pseudocarapa*, *Aglaia*, *Turraeanthus*, *Chisochiton*, *Clemensia*, *Megaphyllaea*, *Didymocheton*, *Cabralea*, *Dysoxylum*, *Rhetinosperma*, *Anthocarapa*, *Epicharis*, and *Sandoricum*.

About 1400 species have been described, the largest genera being *Aglaia* (250 to 300 spp.), *Trichilia* (230), *Guarea* (170), and *Dysoxylum* (over 100). There are 22 genera with only one or two species each. Among the latter are *Schmardaea* (*Elutheria*) *microphylla* (Hook.) Karsten, a shrub or little tree in the Andean region from Ecuador to Colombia and Venezuela, and *Urbanoguarea spenophylla* (Urb.) Harms (= *Guarea spenophylla* Urb.), a shrub in the mountains of Dominican Republic; no wood samples from the main stems of these species are available for study, and the same applies to

Ruagea, a group of 17 Andean species segregated mostly from *Guarea*.

In regard to the number of species of *Swietenia*, Harms says that while seven have been described perhaps the number should be reduced to three, *S. Mahagoni*, *S. macrophylla*, and *S. humilis*. As for *S. Candollei* Pittier and *S. Tessmannii* Harms, "vielleicht sind beide Arten mit *S. macrophylla* King zu vereinigen," and *S. Krukovii* Gleason "wird genau mit *S. macrophylla*, *S. Tessmannii*, und *S. Candollei* verglichen." This is gratifying to the wood anatomists who contend that there are only three distinct species of *Swietenia* (see *Tropical Woods* 66: 20–22).

Zur Ontogenie des Xylems in Stengeln mit sekundärem Dickenwachstum. By A. FREY-WYSSLING. *Berichte Deutsche Bot. Ges.* 58: 4: 166–181; ill.; May 1940.

On the basis of ontogenetic studies of xylem formation and review of literature, the author discusses the meaning of the terms protoxylem, metaxylem, and secondary xylem. Generally, *protoxylem* is differentiated before the stem elongates, and consists of narrow tracheary elements which are passively stretched later; *metaxylem* is associated with the period of elongation, and consists of extremely long elements; *secondary xylem*, consisting again of short, broad elements, which become fused into vessels, is formed at the end of the elongation period when cambial activity sets in.

The fact that in the metaxylem of various plant forms a considerable variety of conducting elements occurs serves as an example to demonstrate the difficulties which are encountered when an attempt is made to interpret these developmental terms in strictly anatomical definitions. Thus in the metaxylem of the root and the stem of monocotyledons and herbaceous dicotyledons pitted tracheary elements occur, but in types with early secondary thickening growth this is not the case previous to cambial activity, such as in the stems of woody dicotyledons and gymnosperms, *e.g.*, *Caryocar nuciferum* and *C. butyrosum*.

The submicroscopical spiral structure of primary membranes postulated by Preston was not confirmed by the author.—ROBERT BLOCH, *Yale Dept. Botany*.

The identification of coniferous woods by their microscopic structure. By E. W. J. PHILLIPS. *Journ. Linnean Soc. Bot.* 52: 343: 259–320; 46 figs., 1 map; April 1941.

According to the author, the present paper is intended primarily for the wood technologist who has access to a representative wood collection.

Some of the keys to the identification of coniferous timbers already published are based on material too limited, or on only a very small number of species. Moreover all the published keys are of the dichotomous type, and consequently the features of any particular woods have to be examined in a fixed order.

In the first part of this paper a 'multiple-entry' key card is described (Clarke, 1938); the features are recorded by clipping the card opposite the appropriate holes; on inserting a mounted needle or other suitable appliance into a pack of species cards through any perforation, cards which have been clipped opposite this hole fall out. In dealing with a sample for identification this process is repeated for a succession of characters selected in any order, but with chief regard to the more striking features of the sample. The features employed were selected after extensive investigation, and are illustrated and described. Data on over one hundred of the more important tree species of forty genera are given in tabulated form suitable for ready reference and for transference to key cards.

In the second part of the paper, the composition, distribution, and wood anatomy of the seven families of the Coniferae are briefly dealt with, and under each genus the diagnostic features and methods of identifying the individual species are indicated with particular reference to timber-producing species. Some discrepancies in the existing botanical classification are apparent from this anatomical study.

A select bibliography on coniferous wood anatomy is added, and also a combined index and check list, and three excellent photographic plates.—ROBERT BLOCH, *Yale Dept. Botany.*