H. J. Chatteway

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

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FOREST TREES OF THE ISTHMUS OF TEHUANTEPEC, MEXICO[1]

By LLEWELYN WILLIAMS

Field Museum of Natural History

The Isthmus of Tehuantepec comprises that section of the Republic of Mexico embracing the southern and eastern territories of the States of Veracruz and Oaxaca between the 94th and 96th meridian of longitude West. To the east are the plains of Tabasco and to the southeast the highlands of Chiapas. This region is one of the few instances where the extensive chain of mountains extending from north to south along the western shores of the American Continent is interrupted by plateau-like ridges of sufficiently low elevation to

[1] Based on field notes assembled while collecting botanical specimens for the Department of Botany, Field Museum of Natural History, during February–July, 1937.

permit easy communication between the Gulf of Mexico and the Pacific Coast. The distance between Coatzacoalcos (formerly called Puerto Mexico) on the Gulf coast and Salina Cruz in the southern extremity is 123 miles and, although its boundaries are rather indefinite, the approximate area of the entire region is 10,300 square miles.

The Isthmus may be properly divided into three definite vegetative zones, which correspond with the diversity of topography and climate, namely: (1) the coastal plain of Veracruz; (2) ridges and plateaus of the central part; and (3) the semi-arid zone of the Pacific Coast.

Coastal Plain of Veracruz

Contiguous to the Gulf of Mexico is a belt, 40–50 miles in width, of rich alluvial basins through which the drainage of the northern slopes of the Cordillera is discharged into the Gulf. The climate of this zone is hot, humid, and typically tropical, the mean annual rainfall ranging between 50 and 70 inches and the mean annual temperature from 68° to 86° F. Northerly winds prevail almost throughout the year and the rainy season lasts from July to December, although heavy rainstorms are frequent until March.

The principal basin draining this plain is that of the Coatzacoalcos River, which has its source in the highlands close to the border between Oaxaca and Chiapas, and flows for most of its length in a north-northeasterly direction. Of the numerous tributaries flowing into it, the largest and most important is the Uspanapa. Between the towns of Coatzacoalcos and Minatitlán the banks of the main river are low and frequently flooded. A tall, coarse grass, *Gynerium sagittatum* (Aubl.) Beauv., is especially common, and Mangrove forms thickets along the banks, in tidal lagoons and swamps. Between Hidalgotitlán and Jesus Carranza (formerly Santa Lucrécia), denoting the southern limit of the belt, the banks of the Coatzacoalcos are higher, steep limestone cliffs are common, and the low rolling hills, constituting most of the terrain, are covered with dense evergreen forests. Along the river banks much of the forest growth has been cleared for the cultivation of bananas, corn, sugar cane, and in former times for coffee plantations, though all of the last have since been abandoned.

To the east of the Coatzacoalcos River, as far as the peaks of San Martín and Pelón, terminating the Tuxtla range, there is a vast plain covered with scrubby growth and dense forest, frequently broken by savannas which form rich pasture land. In these clearings the most conspicuous trees are *Ceiba pentandra* (L.) Gaertn., distributed throughout most of the Isthmus and readily recognized by its massive grayish-white trunk and tall buttresses; the Fustic-tree, *Chlorophora tinctoria* (L.) Gaud.; and *Byrsonima crassifolia* (L.) DC. Extensive lagoons are also frequent, and along the border of these the most prominent species is *Lonchocarpus hondurensis* Benth., a dense, medium-sized tree with a profusion of dark purplish flowers appearing in February–March.

On the banks of the Coatzacoalcos, *Inga* spp. and Willow, *Salix chilensis* Molina, small or medium-sized, drooping trees, are particularly common. A short distance farther back, in cutover forest land or in abandoned corn or banana patches, are *Heliocarpus appendiculatus* Turcz., a small, slender tree with smooth, grayish bark often in small stands or mixed with *Cecropia mexicana* Hemsl., a medium-sized, slender tree with large, peltate leaves; *Ceiba pentandra* (L.) Gaertn.; *Cochlospermum vitifolium* (Willd.) Spreng., a slender tree, strikingly conspicuous when in full bloom on account of its large, yellow flowers, and with a thin-walled capsule; and *Schizolobium parahybum* (Vell.) Blake, a medium-sized, deciduous tree with showy, bright yellow flowers in long-panicled racemes, borne when the tree is leafless, and with thin, spatulate fruit. One of the most useful plants growing in wet thickets or forest near the river banks is the Mexican and Central American Rubber-tree, *Castilla elastica* Cervantes, a medium-sized tree with smooth, cylindrical, grayish-white trunk. It is easy to recognize because of the large narrow leaves, drooping abruptly and arranged in two rows on the branches. Its brightly colored fruit heads also make the tree conspicuous during May and June. In Chinameca and a few other places, the rubber, obtained by coagulating the milky sap exuding from the incised trunk, is employed for waterproofing clothing, shoes and hats.

The species is common in this zone and in northern Chiapas, especially between Salto del Agua and Palenque, where it was cultivated extensively several years ago, but is apparently absent on the Pacific Coast.

From early February until April the writer stayed at Fortuño, a large tract of forest land about fifty miles above Minatitlán and extending from the Coatzacoalcos to the Coachapan River. This mixed rain forest may be regarded as being typical of the zone. The most important timber tree in these forests is Mahogany, *Swietenia macrophylla* King, which grows as far south as Sarabia, in Oaxaca. Incidentally, the species grows in abundance on densely wooded slopes above Palenque, in northern Chiapas, in conjunction with Leche María, *Calophyllum brasiliense* Camb., var. *Rekoi* Standl., and the Chicle-tree, *Achras Zapota* L., both of which are tall trees with dense crowns. A large amount of Mahogany has been exported from the Isthmus to the United States and Europe, so that now one has to travel two miles or more from the river banks before encountering trees of appreciable size and in sufficient abundance for exploitation. The species is found in low, swampy areas or on dry slopes and, where no cutting has been done, it appears most frequently in belts. Wood obtained from trees growing on well-drained slopes is heavier and darker-colored than that found in alluvial patches and is generally known among local woodsmen as Caracolillo. In conjunction with Mahogany, the most useful trees are Cedar, *Cedrela mexicana* Roem., which seems to favor dry slopes, and Leche María, growing in all types of soil. The last-named wood is much esteemed for dugout canoes and general construction and, with Mahogany and Cedar, is exported to this country in appreciable quantities. These two species also appear to grow in zones or belts. In the Uvero region of Oaxaca, for example, Leche María is plentiful and its distribution extends eastward to Palenque, Chiapas, and beyond, but in most of these areas, especially around Palenque, Cedar is conspicuous by its scarcity or absence. Another valuable timber tree is the Primavera, *Tabebuia Donnell-Smithii* Rose, with long, smooth trunk, often up to 3 or 4 feet in diameter, and attains its best development on dry slopes or in rocky

areas. This species is rather scarce around Fortuño but is more abundant farther south, particularly in the neighborhood of Uvero, Oaxaca.

The most ubiquitous tree in these forests is *Dialium guianense* (Aubl.) Steud., known locally as Paque and found in all types of soil, often forming almost pure stands but usually mixed with other species. Its heartwood is dark purplish-brown, very hard, dense, and heavy and makes excellent props, posts, and railroad ties. Other species frequently encountered in this forest are *Calocarpum mammosum* (L.) Pierre, yielding a fruit with sweet but somewhat insipid pulp; *Guarea excelsa* H. B. K., a medium-sized or tall tree with moderately hard, tough, pinkish brown wood; *Enterolobium cyclocarpum* (Jacq.) Griseb., a large tree with wide-spreading, umbrella-shaped crown, distributed throughout the Isthmus and planted frequently for shade; *Andira Galeottiana* Standl., most often found in swampy forest; *Bursera Simaruba* (L.) Sarg., one of the most common trees of Central America, readily recognized by its smooth, greenish or reddish-brown bark, peeling off in small papery flakes; *Tabebuia pentaphylla* (L.) Hemsl., a medium-sized or large, deciduous tree with conspicuous white or purplish-pink flowers; *Lysiloma aurita* (Schl.) Benth., a massive tree with coarse, reddish-brown bark of large, curled scales; *Licania platypus* (Hemsl.) Fritsch, a handsome tree frequently growing in swampy areas, with dense foliage, which is bronze or red when young; and *Tipuana Lundellii* Standl., a large tree with smooth, cylindrical trunk and several tall buttresses, common in this area although not reported previously from southern Mexico.

Central Zone

The second or middle division is a belt of low, rolling hills, ranges, and plateaus through the central portion of the Isthmus, extending from the Jaltepec River on the north to within twenty-five miles of the Pacific Coast. This region is about forty miles in width on the west, gradually widening out towards the east to sixty or seventy miles, and presents a great diversity of vegetation. In this area the continuity of the high ranges and volcanic peaks, extending nearly the entire length

of the two American hemispheres, is interrupted at a point almost directly in the line of shortest communication between the two oceans. The elevated spurs and ridges traverse the country generally in an east and west direction. To the south are the hills of Xochiapa, joining the mountain ranges to the east and west, and divided by the Malatengo, Almoloya, and Chichihua Rivers. Between these hills and the summit pass at Chivela, the country is made up of elevated rolling plains, separated by low ranges of hills, known respectively as the plains of Xochiapa, Chivela, and Tarifa. These plateaus become more elevated as they approach the summit, where there is a pass, and also present a more uniform surface. They are bounded on the south by cerros, terminating in rugged limestone peaks at elevations of 1500 to 2000 feet above the Pacific, and form the connecting link between the high mountain chain of Oaxaca with the cordilleras of Chiapas, which continue through Guatemala.

To the north, in the immediate vicinity of Uvero, Oaxaca (altitude 90 feet), the terrain is composed of low rolling hills, covered with grass or thickets and gradually merging into dense, mixed forest similar in composition to that at Fortuño, in the coastal zone. On these open slopes the dominant species are *Apeiba Tibourbou* Aubl., a small tree which has a depressed-globose, black fruit, covered with long, sharp spines, and a white, spongy wood of peculiar laminated structure; *Cochlospermum vitifolium* (Willd.) Spreng.; and *Luehea speciosa* Willd., a medium-sized tree with an abundance of yellow or white flowers. Constituting the thickets we generally find small or medium-sized trees such as *Tabernaemontana arborea* Rose, *Gliricidia sepium* (Jacq.) Steud., *Vernonia patens* H. B. K., *Acacia globulifera* Saff., *Miconia* spp., *Belotia Campbellii* Sprague, *Cordia glabra* L., and *Didymopanax Morototoni* (Aubl.) Dcne. & Planch. In cutover forest land, conspicuous by their size and abundance, are *Cassia grandis* L., *Bursera Simaruba* (L.) Sarg., *Hymenaea Courbaril* L., *Schizolobium parahybum* (Vell.) Blake, and two new species, *Ormosia isthmensis* Standl., a tall, wide-spreading tree with a small, few-seeded pod and scarlet, bean-like seeds, and *Laplacea Williamsii* Standl., a tall tree known locally as Nanche-ahuatosa.

The forest is of the mixed type in which we find the Mahogany-Cedar association characteristic of the Fortuño tract, but this may properly be called the zone of Leche María. Certain species are more common here, however, than in the coastal plain of Veracruz, and among these may be mentioned: *Tabebuia Donnell-Smithii* Rose; *Zanthoxylum melanostictum* Schlecht and *Z. microcarpum* Griseb., medium-sized or large trees whose trunks are armed with stout, sharp spines; *Enterolobium cyclocarpum* (Jacq.) Griseb.; *Pithecolobium arboreum* (L.) Urban, a massive tree with broad crown and twisted, pendent, red pods containing black seeds; a species of *Pterocarpus*, a tall tree exuding a reddish-brown sap from the incised bark. In May, Encino Roble or Roble Serrano (*Tabebuia* sp.) is especially conspicuous in the forest because of the profusion of bright yellow flowers borne while the tree is leafless. Its dark greenish heartwood is extremely hard, heavy, strong, has an oily appearance, and the vessels are filled with lapachol. Near streams or swamps the most common species are *Pachira aquatica* Aubl., the fruit of which is large, ovoid, russet-brown, containing several large seeds surrounded by a white pulp; and *Pithecolobium scopulinum* (Brandeg.) Standl., a medium-sized, straggly tree. In open areas in the forest or along its margin, especially in slightly moist patches, the most prominent species is *Coccoloba Schiedeana* Lindau, a massive tree with short, bent trunk, and white flowers in long racemes.

South of Palomares there is a gradual diminution in the size and abundance of the vegetation. The village of Mogoñe appears to be the line of demarcation between the vegetation of the moist zone facing the Gulf of Mexico and that of the semi-arid Pacific Coast. Beyond Mogoñe, cacti form a distinctive character of the flora, growing in abundance on the plains and lower slopes of ridges, through to the Pacific Coast.

Almoloya is situated on an extensive plain, with an altitude of 390 feet, and surrounded by moderately high ridges and plateaus with an abundance of moisture from the heavy mists and fogs prevalent almost throughout the year. On this plain the vegetation is composed in the main of *Croton niveus* Jacq., a small tree or shrub with pubescence of silvery scales;

Chomelia spinosa Jacq., a shrub armed at the axils with long, stout spines; *Cordia cana* Mart. & Gal., a shrub 10 or 12 feet tall, with greenish-white corolla; *Jacquinia aurantiaca* Ait., a shrub or small tree distributed widely in southern Mexico, Central America, and the West Indies; *Calycophyllum candidissimum* (Vahl) DC., a medium-sized tree with smooth, reddish-brown bark and a profusion of white flowers which persist for a long time; and *Cassia emarginata* L., furnishing a hard, heavy, greenish-yellow wood. Perhaps the most unique species in this area is the Palma Estrella (*Beaucarnea* sp.). This is a small or medium-sized liliaceous tree, with swollen base and thick corky bark, growing in abundance among rocks at the foot of steep slopes. It is readily recognized by its numerous long, linear leaves clustered at the tips of the branches.

The upper slopes and summit of the ridges, and the plateaus extending between them, constitute the Pine-Oak zone. *Pinus Teocote* Schlecht. & Cham., known locally as Ocote, is found in small, pure stands on the summits at elevations of 800 feet or more. The tree attains a height of from 30 to 45 feet, and has a thick, deciduous, scaly bark exuding turpentine when cut. In rocky or gravelly areas, immediately below the Pine stands, are extensive tracts of Scrub Oak, represented by the following: *Quercus oleoides* Cham. & Schlecht., *Q. peduncularis* Née, *Q. perseaefolia* Liebm., and a fourth species, not yet identified. The trees range up to 15, seldom 25, feet in height. Growing abundantly in association with Oak, especially along the lower limits of the zone, is *Byrsonima crassifolia* (L.) DC., a tree or shrub up to 10 or 15 feet in height which yields a yellow, globose, edible fruit much esteemed locally and sold frequently in the markets. Also common are *Calliandra hirsuta* (Don) Benth., and *Croton repens* Schlecht., both of which are small shrubs.

Pacific Coast Plains

Beyond a narrow gap in the mountain range, known as the Chivela Pass, where the altitude is 735 feet, there is a sudden descent from the elevated tablelands of the central zone to semi-arid plains, forming the third and southernmost division.

These plains, principal of which are those of Tehuantepec and Tarifa, average about twenty miles in width and slope gradually from the base of the mountains to the Pacific Coast. Apart from the vegetation, a distinct change of climate accentuates the difference between this zone and that of the coastal plain of Veracruz. The mean annual rainfall is considerably less, ranging from 30 to 40 inches, and the mean annual temperature from 77° to 86° F. The vegetation throughout is scanty and low, composed almost exclusively of small, armed trees, shrubs, and cacti, and frequently broken by savannas. Several rivers drain these plains, of which the Tehuantepec is the most important, flowing into two extensive shallow lagoons, Laguna Superior and Laguna Inferior. A short distance to the west of the estuary of the Tehuantepec River is the Bay of Ventosa. A few miles west of this bay, situated in a deep indentation of the coast, is the town of Salina Cruz, sheltered from north winds by moderately high, sandy or gravelly ridges. These are poorly drained, the slopes covered with scrubby vegetation and the summits are almost barren.

The plain of Tehuantepec is typical of this zone. Of the species inhabiting the sandy plain the more common are *Caesalpinia coriaria* (Jacq.) Willd. and *C. eriostachys* Benth., both of them unarmed shrubs or small trees; *Haematoxylon Brasiletto* Karst., the freshly cut heartwood of which is deep orange in color but turns to dark red on exposure, and has long been utilized as a source of a red dye; *Chloroleucon tortum* Pittier, a low-branched, crooked shrub or small tree; *Pithecolobium dulce* (Roxb.) Benth., a small or medium-sized tree, nearly deciduous, very resistant to drought, and its bark yields a yellow dye; *Crescentia alata* H. B. K., a small tree with long, spreading branches and broadly winged petioles, resembling leaflets; and *Pereskia Conzattii* Britt. & Rose, a small, leafy tree with numerous long spines on the trunk and branches. Planted frequently for shade around homes, are *Ficus cotinifolia* H. B. K., a large tree with few, large, spreading branches and a trunk 3 feet or more in diameter; *Enterolobium cyclocarpum* (Jacq.) Griseb., which makes excellent shade because of its broad, umbrella-shaped crown; and *Moringa oleifera* Lam., a small tree with long, 3-angled cap-

sule, native of Africa and the East Indies but cultivated widely and naturalized in tropical America.

Along the seashore, in the vicinity of Salina Cruz, there is an abundance of *Conocarpus erecta* L., an erect or sometimes prostrate shrub or small tree, with leathery leaves and the fruit a cone-like head of small purplish green drupes. Growing abundantly in association with this species, but on somewhat drier areas, is *Celtis iguanaea* (Jacq.) Sarg., a shrub or small tree with long, clambering branches, armed with stout, recurved spines. On the sandy slopes and gently sloping plains, almost encircling the town and reaching to the seashore, the commonest species are *Croton ciliato-glandulosus* Ortega and *C. ovalifolius* West, small shrubs of wide distribution in tropical America; *Cordia brevispicata* Mart. & Gal., a small shrub, usually forming clumps, and with small, creamy-white flowers; *Casearia nitida* (L.) Jacq., a shrub or small tree with whitish branches and the greenish-white flowers in corymbs; *Acacia cymbispina* Sprague & Riley, a shrub or small tree armed with large spines and with a compressed or terete, brownish-black fruit; *Jacquinia aurantiaca* Ait., a shrub or small tree with smooth bark and the orange-colored flowers in corymbs; *Prosopis chilensis* (Molina) Stuntz, a shrub or tree, generally known as Mezquite, thriving in river valleys but often forming thickets on plains and mesas; *Casearia dolichophylla* Standl., a shrub or small tree with short-stalked leaves and yellowish or reddish, ellipsoid fruit; *Anona squamosa* L., a small tree with grayish bark, yielding a fruit of excellent flavor and highly esteemed; *Crescentia alata* H. B. K.; *Esenbeckia macrantha* Rose, a tree up to 18 feet in height, with small whitish flowers and a hard, woody capsule; *Stemmadenia mollis* Benth., a shrub or small tree distributed as far south as Ecuador; *Solanum salsum* Standl., a new species of small shrub; *Juliania adstringens* Schlecht., a low tree with broad, sessile leaflets and an astringent bark which furnishes a red dye; and *Jatropha aconitifolia* Mill., a tree up to 18 feet tall, armed with stinging hairs, whence the local name, Mala Mujer, and with prominent white flowers. Along streets and near homes, *Ceiba pentandra* (L.) Gaertn, *Ficus cotinifolia* H. B. K., *Coccoloba floribunda* (Benth.) Lindau, all massive,

wide-spreading trees, are planted frequently for shade and ornament; also *Delonix regia* (Boj.) Raf., a large tree, commonly known as Framboyán, native of Madagascar and tropical Africa, and extremely showy when in full bloom, when it is covered with a mass of scarlet or orange-red flowers.

In the vicinity of the Bay of Ventosa, a few miles east of Salina Cruz, common trees in dry areas are *Albizzia caribaea* (Urb.) Britt. & Rose, usually up to 40 feet in height, with wide-spreading, umbrella-shaped crown; *Coutarea latiflora* Moc. & Sessé, a small tree with fragrant white flowers; and *Cassia emarginata* L., attaining a height of 22 feet or more, its orange or pale yellow flowers in abundant, showy racemes. In swampy areas or along the margin of lagoons the most prominent species is *Parkinsonia aculeata* L., a slender tree, 15 feet or more in height, with small, deciduous leaflets, and the trunk and branches covered with smooth, yellowish-green bark.

THE AMERICAN WOODS OF THE ORDERS CELASTRALES, OLACALES, AND SANTALALES

By Samuel J. Record

According to Hutchinson (*Families of flowering plants*), the Celastrales, Olacales, and Santalales comprise a group of 19 families, perhaps descended from the Tiliales and Theales, and showing considerable affinity with the Escalloniaceae.

The Celastrales include 11 families as follows: Aquifoliaceae* (trees and shrubs of general distribution, but rare in Africa and Australia); Empetraceae (shrubs in north temperate and arctic regions and southernmost South America); Celastraceae* (trees, shrubs, or climbers, generally distributed); Corynocarpaceae (monotypic family of trees in Polynesia, New Caledonia, and New Zealand); Cyrillaceae* (shrubs and small trees from southern U. S. A. to Brazil); Cneoraceae (monotypic family of shrublets in the Mediterranean region and Canary Islands); Pandaceae (monotypic family in west tropical Africa; see *Tropical Woods* 20: 14–17);

Hippocrateaceae* (small trees and erect or scandent shrubs, pantropical); Icacinaceae* (pantropical trees and shrubs); Salvadoraceae (trees and shrubs in tropical Africa and the Mascarene Islands); Stackhousiaceae (monotypic family of small herbs from the Philippines to Australia and New Zealand.

The Olacales are considered more advanced types of the Celastrales and are divided into two families: Olacaceae* (trees, shrubs, and climbers of tropical and subtropical regions); Opiliaceae* (trees, shrubs, and climbers of tropical Asia and Africa, rare in tropical America).

The Santalales, mostly parasitic relatives of the preceding orders, include six families: Octoknemataceae (monotypic west African family of trees and shrubs; see Yale School of Forestry Bull. No. 31, p. 84); Loranthaceae* (mainly tropical shrubs parasitic on trees); Santalaceae* (tree, shrubs, and herbs, sometimes parasitic on trees or roots, widely distributed in tropical and temperate regions); Grubbiaceae (monotypic family of South African shrubs); Myzodendraceae (monotypic family of tropical South American undershrubs parasitic on trees); Balanophoraceae (mainly tropical and subtropical fleshy herbs, destitute of chlorophyll, and parasitic on roots).

The present study is part of a comprehensive survey of the woods of the western hemisphere, and is concerned primarily with the trees and large shrubs of eight families, which are indicated by an asterisk in the above lists. The timbers are of minor commercial importance, although several of them are used locally. Taken as a whole, the woods constitute a heterogeneous group, and this heterogeneity applies also to the larger families, especially the Celastraceae and the Santalaceae.

Aquifoliaceae

The Holly family is composed of four or five genera of shrubs and small to medium-sized trees, the principal genus being *Ilex*, with over 250 named species of very wide distribution in temperate and tropical regions of the world. *I. aquifolium* L. is the Holly so frequently mentioned in literature. The American Holly is *I. opaca* Ait., a small tree of the eastern United States whose glossy spiny leaves and bright red berries are used so extensively for Christmas greens. Both supply good woods noted for their chalky whiteness and long use for inlay, marquetry, and, when dyed black, for imitation Ebony.

There are many species of *Ilex* in tropical America, their combined range including the West Indies, Mexico, Central America, and South America to Paraguay; the genus is especially well represented in Brazil. Mate, the dried leaves of certain species, principally *I. paraguensis* St. Hil., is a highly important article of commerce, ranking fourth in value of Brazilian exports. An infusion, similar to that from ordinary tea leaves, is in daily use by millions of South Americans. The center of the industry is in Paraná, Brazil, where the small trees are propagated under the open canopy of the Paraná Pine, *Araucaria araucana* (Mol.) K. Koch. Argentina consumes about 100,000 tons of mate annually, most of which was imported from Paraguay and Brazil until recently, the local production (chiefly in Misiones) having developed from 9000 tons in 1924 to more than 80,000 tons in 1936.

Some *Ilex* trees attain commercial proportions in the Guianas, and there are reports of logs 30 feet long squaring 12 inches. The timber is little used locally and is inferior in texture and color to the Hollywood of commerce. The trees elsewhere are too small or too inaccessible to be of much use even locally except for medicinal or decorative purposes. Wood dull bluish-white or gray throughout. Odorless and tasteless. Rather hard and heavy, fine-textured, fairly straight-grained, easy to work, not durable in contact with the ground.

Pores very small, numerous, in short to long radial rows or clusters. Vessels with many-barred scalariform perforation plates; spirals frequently present; intervascular pitting rather fine, opposite to scalariform. Rays of two sizes, uniseriate with all cells upright or square, and multiseriate, 3 to 6, sometimes up to 10 cells, wide and 40 to over 100 cells high, the body cells procumbent; pits to vessels small, opposite or much elongated and parallel. Wood parenchyma rather sparingly developed in short tangential lines and diffuse; not distinct with lens. Wood fibers thick-walled, frequently with spiral thickenings; pits with distinct borders and narrow apertures. Ripple marks and gum ducts absent.

COMMON NAMES: Holly (U. S. A.); acebo, a. cubano, a. de sierra, a. hojas de mirte, pinsapo, vigueta naranjo, yanilla blanca (Cuba); briqueta, cuero de sapo, gongolin, guerrero, hueso prieto, macoucoua (P. R.); junco serrano, limoncillo, naranjillo (Mex.); casada (Br. H.); garlic-wood (Pan.); cardenillo, naranjuello (Col.); jaque negro, matías, punte (Venez.); kakatara, kakataraballi, kookerite-balli (?) (Br. G.); pavier blanc (Fr. G.); huito quiro (Peru); azevinho, caá-chi, caá-mi, caá-mina, caá-úna, cataúba do matto, cauminha, caúna, c. amargosa, chá do rio, congonha, cravo do matto, herva de anta, h. mate or matte, macucú, m. verdadeiro, mate, migueira, orelha de burro, o. mansa, pau macucú, vondeira (Braz.); caá, caá-ra, roble de Tucumán, yerba mate (Arg.); bacucú, caá, caá-guazú, caá-mi, caá-na, yerba mate (Par.).

CELASTRACEAE

The Staff-tree family comprises about 50 genera and 400 species of trees, shrubs, and woody vines of general distribution but of very little economic importance. There are a few species of large trees in the Indo-Malayan region, but the kinds used are small, supplying white wood of fine and uniform texture for carving, turnery, utensils, and combs.

There are about 25 genera in the western hemisphere, their combined range extending from central United States to Chile and Patagonia. One of the best known plants in New England is the Bitter-sweet, *Celastrus scandens* L., a twining shrub with attractive orange-colored berries. Many species of *Evonymus* (*Euonymus*) are planted for decorative purposes; they are mostly shrubs, although the American Wahoo or Burning-bush (*E. atropurpureus* Jacq.) and the European Spindle-tree (*E. europaeus* L.) are trees 20 to 25 feet high; the wood of the latter is used for small turned articles, such as manicure sticks, and for a fine grade of charcoal. Other arborescent genera in the United States are *Maytenus*, *Rhacoma*, and *Schaefferia* in southern Florida, and *Canotia* in Arizona and southern California. There are 16 genera of shrubs and small trees in Mexico, of which 10 extend across the northern border. The family is well represented in the

West Indies, but the plants are too small to furnish timber except for fuel or small articles. Of the 13 genera in South America, only two, *Goupia* and *Maytenus*, attain large dimensions and yield timbers of value, and the uses for these are entirely local.

The following description of the wood is based on American species of the following genera: (a) *Canotia*, (b) *Celastrus*, (c) *Elaeodendron*, (d) *Evonymus*, (e) *Goupia*, (f) *Maytenus*, (g) *Mortonia*, (h) *Pachystima*, (i) *Plenckia*, (j) *Rhacoma*, (k) *Schaefferia*, (l) *Torralbasia*, (m) *Wimmeria*, (n) unknown genus. Since there is much variation in anatomical details, the genera will be cited by letter.

Color yellowish or nearly white (d, g, h, l, n) to light to dark brown, with a reddish or purplish hue in the others. Odor and taste not distinctive. Mostly hard and heavy, sometimes only moderately so (a, d, h, l), with fine and uniform texture; occasionally coarse-textured, either rather soft (b) or dense (e). Growth rings often distinct; ring-porous or with tendency in certain species (a, b, g, h). Pores mostly very small to minute, but sometimes rather large (e); numerous or fairly so; occurring singly or in small multiples, clusters, or short radial rows, without definite pattern. Vessels generally with simple perforations, but scalariform plates characterize some genera (c, e); spiral thickenings sometimes present (a, d, h, i); pits small to minute, typically alternate; fibriform vessel members, with spirals, rarely present (d, h); vessels may compose ground mass of wood (b, h). Rays often decidedly heterogeneous, occasionally nearly homogeneous (a, d, l); varying in width from all uniseriate or partly biseriate (d, g, h, i, j, l, m, n) to distinctly 2-sized, the larger 3 to 6 cells wide (b, c, e, k), and in height from 1 to 15, less often up to 30, and occasionally to 50 cells; crystals common; pits to vessels very small to minute. Wood parenchyma ranging from apparently absent or very sparse (a, b, c, d, f, g, h, i, k), to moderately abundant, diffuse and in short tangential rows not distinct with lens (e, j) to abundant and forming distinct, irregular, often broken bands, 3 to 7 cells wide and usually one band per growth ring (l, m, n). Wood fibers (fiber-tracheids) with rather thin to very thick walls and, at least in part, with numerous, small to rather large, distinctly bordered pits; accompanied occasionally by irregular but distinct bands of thin-walled, septate, libriform fibers resembling parenchyma (c, f, i); spiral thickenings rarely present in fiber-tracheids (a, h). Ripple marks and gum ducts absent.

Schaefferia. Of the eight species, all but one are low shrubs growing in Mexico and the West Indies. *S. frutescens* Jacq., though often a shrub, attains tree size on favorable sites and is sometimes 35 to 45 feet high and 12 inches in diameter. Its range, which is the most extensive of the genus, is mostly

in the West Indies and southern Florida, but it occurs sparingly in southern Mexico, Colombia, and Venezuela. Its hard, heavy, fine-textured, bright yellow wood is said to have been used as a substitute for Boxwood (*Buxus*), but the quantity is too small to be a factor in the trade. (For detailed description see Yale Forest School Bul. No. 14, pp. 75–77.)

COMMON NAMES: Florida boxwood (U. S. A.); amansa guapo, boj de Persia cimarrón, guairaje (Cuba); jiba (P. R.); cabra (Dom. R.); balai de la montagne, bois capable, b. petit garçon, b. pin marron, petit bois blanc, p. garçon (Haiti); fruta de paloma, limoncillo (Venez.).

Wimmeria is a Mexican genus of six or seven species of shrubs and small trees, the largest being *W. concolor* Schl. & Cham., which occasionally attains a height of 40 feet and a trunk diameter of 12 inches. The timber is said to be used for railway crossties. The only wood sample available is of a smaller tree, *W. confusa* Hemsl. (Yale 9624); it is hard, heavy, fine-textured, reddish or purplish brown, with thin layers of nearly black parenchyma; it is not very attractive, but finds various local applications. The bark contains a white fiber.

COMMON NAMES: Acedilla, algodoncillo, cedilla, chapulizle, palo cadillo, pimientilla (Mex.).

Canotia, with a single species, *C. holacantha* Torr., is a sprawling shrub or shrub-like, leafless tree, sometimes 20 to 30 feet high with a stout trunk rarely 12 inches in diameter, occurring in dry mesas in the southwestern United States and perhaps in northern Mexico. Heartwood dark purplish brown, of medium density and texture, finely ring-porous. Not utilized except for fuel. Botanists disagree as to the classification of this plant, some referring it to the Rutaceae, others to a monotypic family, Canotiaceae. Nothing was found in the structure of the wood to exclude it from the Celastraceae.

Goniodiscus, with a single species, *G. elaeospermus* Kuhlmann, is a medium-sized tree of the State of Amazonas, Brazil, where it is known as Andirobinha, Cabeça de Cutia, and Mapiá. Its seeds contain a high percentage of oil which is the basis of a small local industry. (See *Tropical Woods* 36: 58.) The timber apparently is not utilized. No wood sample available for study.

Rhacoma (incl. *Gyminda* and *Myginda*), with about 15 species of shrubs and shrubby trees, occurs in the West Indies, southern Florida, Mexico, and Central America. The best known species are *R. latifolia* Sw. of the West Indies and *R. eucymosa* (Loes. & Pitt.) Standl. of Central America. Heartwood brown to dark brown, hard, heavy, fine-textured, apparently not utilized except for fuel.

Pores very small to minute, mostly solitary. Rays very heterogeneous, mostly 1 or 2, rarely 3 or 4, cells wide and less than 30 cells high. Wood parenchyma diffuse and in short tangential rows. Wood fibers with thick walls and very numerous minute bordered pits.

COMMON NAMES: Poison cherry (Bah.); hierba maravedí, jinca pata (Cuba); coral, cocorroncito, mala mujer, manto, maravedí, poison cherry, wild cherry (P. R.); managuatillo (Mex.); carbón, limoncillo (Br. H.).

Torralbasia, with a single species, *T. cuneifolia* (Wr.) K. & W., is a small Cuban tree, called Guairaje. Its yellowish, fine-textured, moderately dense wood is of no special utility. Wood parenchyma in broken bands of irregular width and spacing, distinct with lens. (*Material:* Yale 19302.)

Elaeodendron. The principal American species, if not the only one, is *E. xylocarpum* (Vent.) DC., a shrub or less often a tree usually less than 30 feet high in the West Indies, but in the Tres Marìas Islands off the west coast of Mexico, where it occurs scatteringly near arroyos, it develops a very crooked bole with a maximum diameter of 30 inches and a length of 20 to 60 feet. Timber pinkish brown, hard, heavy, tough, strong, fine-textured, and durable; seldom used, but suitable for railway crossties. The presence of scalariform perforation plates in the vessels serves to distinguish the wood from *Maytenus* and *Plenckia*, the other two genera characterized by parenchyma-like bands of thin-walled wood fibers.

COMMON NAMES: Laurel de costa, mate prieto, palo blanco, piñipiñi, roñoso, sangre de doncella (Cuba); corcorrón, coscorrán, guayarrote, marble-tree, spoon-tree, nut muscat (P. R.); mano de león (Mex.).

Plenckia, another genus with one species, *P. populnea* Reiss., is a shrub or erect little tree 20 feet high growing in southeastern Brazil. The hard, fine-textured, purplish brown

wood is utilized locally for small cabinet work, and the slender pliable branches for making wicker furniture. The wood is partly ring-porous, the larger pores being in a single row. Irregular bands of thin-walled wood fibers resemble parenchyma layers, though less distinct. (*Material:* Yale 32602; Imp. For. Inst. Oxford 9644.)

COMMON NAMES: Marmeleiro do campo, marmelinho do campo, marmelo do campo (Braz.).

Maytenus. There are over 100 named species, well distributed throughout Latin America, and while most of them are shrubs a few are medium-sized to large trees. The wood of the Cuban Nazareno Morado, *M. lineatus* Wr., is sometimes used by cabinetmakers. The Sombra de Toro of Argentina, *M. ilicifolia* Mart., is generally less than 20 feet high and 10 inches in diameter, but the wood serves for repairing furniture, vehicles, tools, and agricultural implements. The Maitén, *M. Boaria* Mol., is a well-known tree in Patagonia, and in the forests of the Río Negro reaches a height of 75 feet, though in other parts of its range it is usually less than 30 feet high and 15 inches in diameter, and on the cattle ranges is browsed down to a shrub. The wood, which is firm and elastic and does not split badly, is rather highly esteemed locally in all kinds of carpentry work and for making implements.

According to H. M. Curran (manuscript report), the Carne d'Anta (flesh of the tapir), *M. obtusifolia* Mart., is a common tree of the coast forests of the Bahia region of Brazil, where it occurs scatteringly, averaging rarely more than one or two trees per acre over large areas. It attains a height of from 75 to 100 feet and has a cylindrical bole, two to five feet in diameter, with little taper and without buttresses. The sapwood is white, but the heart is bright rose when first cut, though gradually fading upon seasoning. The logs are free of defects and are readily sawn into lumber, but thin boards have a tendency to warp badly if improperly dried. The wood is hard and heavy; sp. gr. (air-dry) 0.82, weight about 51 lbs. per cu. ft.; though not durable in contact with the ground, it finds many uses in rural carpentry and construction where not exposed. Material supplied to manufacturers in the United States has shown satisfactory working qualities, being well

suited for turnery, though with a slight tendency to champ on sharp cuts across the grain. Mechanical tests gave the following results (in pounds per square inch): modulus of elasticity (in bending), 2,551,300; fiber stress at elastic limit, 10,240; endwise crushing strength, 10,240.

The wood just described is fairly typical of the genus as a whole. Wood parenchyma is sparingly developed or absent, but in its place are laminations of septate fibers which appear to demarcate growth rings and show distinctly on tangential surface. The wood samples from Patagonia, if correctly named, are exceptions in that the septate fiber bands are absent and the vessels have spiral thickenings.

COMMON NAMES: Rockwood (Jam.); boje, carne de vaca, espinillo, nazareno morado, sangre de toro, tea (Cuba); cuero do sapo, bois flament (P. R.); acajou sauvage, bois formi (Haiti); aguabola, limoncillo, mangle, m. aguabola, m. dulce (Mex.); arizá, camarón, caney (Col.); cucharo, say (Venez.); kaiarineo (Br. G.); apiranga, cafésinho, carne d'anta, chuchuasca, pau de colher, coração de negro, sombra de tauro (Braz.); ivirá-yuquí, molle morotí (Par.); cangorosa, colquiyuyu, ibirá-yuquí, leña dura, lengue maitén, maitén, m. chico, m. grande, naranjillo, naranjito, quebrachillo, sal de Indus, sombra de toro, tapia, yucurira, yuqui-rá (Arg.); congorosa (Urug.).

Goupia, with two or three species of small to very large trees, is of common occurrence in the lower Amazon region and the Guianas and sparingly so in the hinterlands of Colombia. The best known species is *G. glabra* Aubl. which in British Guiana sometimes attains a height of 120 feet with a long trunk that will square 30 inches, while logs 60 feet long squaring 12 to 16 inches are common. When the trees are felled the stumps exude a gelatinous substance having a fetid odor; the fresh wood also has the same scent, but loses most of it upon drying. The timber is said to be suitable for heavy and durable construction and for furniture. Wood light reddish brown, darkening upon exposure. Sp. gr. (air-dry) 0.82 to 0.88; weight 51 to 55 lbs. per cu. ft.; texture rather coarse, feel harsh, grain variable, often irregular or roey.

Pores much larger than in other members of the family described; mostly solitary, fairly well distributed, without pattern; narrow pore-less zones ap-

parently demarcate growth rings. Vessel with few-barred scalariform perforation plates. Rays inconspicuous; uniseriates composed of vertically elongated cells, the others 3 to 5 cells wide with slender procumbent cells mixed with coarse square or upright cells. Wood fibers in definite radial rows; pits very numerous, large, distinctly bordered. Dark gum deposits abundant in all elements.

COMMON NAMES: Sapino (Col.); cabacalli, copi, copie, couepi, coupi, goupi, goupil, kabukalli, kaboekalli, koepie, kopie (Guianas); cupiúba, tento (Braz.).

Unknown genus. An unidentified tree, possibly representing an undescribed genus of the Celastraceae, was discovered in 1915 by Hugh M. Curran in the forests of the Rio Gongogy basin, Bahia, Brazil, where it is known as Coquilho and Farinha Seca. It attains a height of from 75 to 90 feet, with a trunk 18 inches in diameter at breast height and clear of branches for 45 feet. It has alternate leaves and winged fruits. The dense, fine-textured wood is light clear yellow with delicate, white markings produced by the parenchyma laminations.

The anatomy clearly indicates affinity with the Celastraceae and differs from that of all other families studied. The reason for considering it a new genus is that fruiting herbarium material (Curran 39; Yale 3956) has been studied but not recognized by taxonomists at the U. S. National Herbarium, N. Y. Botanical Garden, Arnold Arboretum, Gray Herbarium, Field Museum, University of Michigan, Kew Herbarium, Bot. Gart. et Mus. Berlin-Dahlem, and Jardim Botanico do Rio de Janeiro. Of these botanists the only one supporting the writer's suggestion that the plant belongs with the Celastraceae is Dr. A. C. Smith, of the New York Botanical Garden, who notes a close relationship to *Wimmeria*. Other families suggested are Combretaceae, Malpighiaceae, Rosaceae, and Violaceae. On the other hand, Prof. I. W. Bailey of Harvard University has recently studied two wood samples of the tree in question and writes: "The structure of these woods is so close to that of such genera as *Kokoona*, *Pleurostylia*, and *Pterocelastrus* that they might be species of these genera. In other words, the wood looks like that of a typical representative of the Celastraceae. I find, however, that the plant has a trilacunar node, whereas the Celastraceae are supposed to be characterized by a unilacunar node. This raises the question whether you may not be concerned with one of those cases of similar structures resulting from parallel development."

CYRILLACEAE

This is an American family of four genera and 19 species of shrubs and small trees with a combined range including southeastern United States, the West Indies, southern Mexico, and northeastern South America.

Cliftonia, with one species, *C. nitida* Gaertn. (=*C. ligustrina* Sims=*C. monophylla* Britt.), commonly known as Ironwood or Titi, is a tree occasionally 40 to 50 feet high, with a stout, often crooked or leaning trunk 15 to 18 inches in diameter, growing in swamps in the coastal region of southeastern United States. The wood, which is similar to that of *Cyrilla*, has no special uses except for fuel.

Purdiaea, or *Costaea*, with seven species of rather large shrubs, occurs in the mountains of Cuba, Colombia, and eastern Peru. *P. nutans* Planch. is said to attain a maximum height of 25 feet at elevations of 7000 to 8000 feet in Colombia. Wood not seen.

Cyrilla. Nine species have been described, the two most widely distributed being *C. racemiflora* L. of southeastern United States and *C. antillana* Michx. distributed from the West Indies to the Brazilian Amazon. They are shrubs or bushy trees, sometimes 35 feet high with a short trunk 10 to 14 inches in diameter, inhabiting shaded river bottoms and the edges of swamps. The spongy pliable bark accounts for the English name of Leatherwood. Although the wood is rather attractive and of good quality, there are no special uses, owing to the small size of the trees. Heartwood light to dark reddish brown, the most deeply colored specimens being rather oily; sapwood lighter, not very clearly demarcated. Luster rather low. Moderately hard and heavy, of fine and uniform texture, easy to work, finishing very smoothly; apparently durable.

Growth rings usually present. Pores small to minute, not distinct without lens; numerous, well distributed, infrequently in contact radially. Vessels

with scalariform perforation plates having many fine and very closely spaced bars; without spiral thickenings; intervascular pitting very fine, opposite to scalariform. Rays 1 to 4, in some species up to 8, cells wide and few to 25 or 30 cells high; heterogeneous, the interior cells of the larger rays slender and procumbent; pits to vessels very small, opposite or elongated and parallel. Wood parenchyma diffuse and in rather numerous short irregular tangential lines not distinct without lens. Wood fibers with very numerous distinctly bordered pits in both radial and tangential walls. Ripple marks and gum ducts absent.

COMMON NAMES: Bloodwood, burning-wood, ironwood, leatherwood, red titi (U. S. A.); southern leatherwood (P. R.); barril, clavellina, lirio de costa, llorona, palo de jutía, tranca de puerto, yanilla (Cuba).

Cyrillopsis, with one known species, *C. paraensis* Kuhlmann, is a small thin-barked tree of the lower Amazon region of Brazil. The wood (Yale 33826; Ducke 299) is decidedly unlike that of *Cyrilla* and *Cliftonia*. Heartwood brownish red, merging gradually into the sapwood, very hard, heavy, and compact; difficult to cut.

Pores small, near limit of vision; rather few, solitary, irregularly distributed without definite design. Vessels with simple perforations, without spirals; no intervascular pitting on tangential walls. Rays very fine, uniseriate or less often biseriate, up to 25 cells high; heterogeneous; pits to vessels large, elongated, and in scalariform arrangement, radially, obliquely, or vertically. Wood parenchyma in numerous, distinct, continuous or interrupted bands, 2 to 4 cells wide and 1 to 4 pore-widths apart, touching most of the pores but not including them, the cells all short; also sparingly vasicentric. Wood fibers with very thick walls and numerous distinct bordered pits; those next to vessels (vasicentric fiber-tracheids) not so thick-walled and with pits in several rows. Ripple marks and gum ducts absent.

HIPPOCRATEACEAE

A family of two genera, *Hippocratea* and *Salacia*, and over 150 species of small trees and shrubs, some erect but many scandent or twining, of wide distribution in the tropics, especially Africa and South America. A few species have edible fruits and many contain a non-resinous latex which yields a kind of rubber and may have commercial possibilities. (See *Bol. Min. Agr.*, Rio de Janeiro, 1934, pp. 29–31.)

The woods are practically useless, but some of them are of scientific interest because of their anomalous structure. The anomalies are of two principal types, the interrupted and the

concentric. The former characterizes certain species of *Hippocratea*, and the breaking of the cambial ring into several arcs results in the formation of unequal amounts of xylem and phloem, and the stem becomes more or less deeply grooved. In *Salacia*, after the stems have reached a diameter of 1 to 2 cm. the cambium dies and is replaced by new meristematic tissue which repeats the general structure of the young stem, giving rise to a coarsely laminated structure. Further distinctions between the two genera are: In *Hippocratea*, wood parenchyma is sparingly paratracheal and the rays widen outward, often through coalescence, becoming very large and conspicuous in old stems, whereas in *Salacia*, wood parenchyma is abundantly developed, varying from numerous fairly regular concentric bands at first to paratracheal and irregularly confluent in the outer part of larger stems, and the rays are very fine and inconspicuous.

Woods yellow to light brown, sometimes with a reddish hue. Odorless and tasteless. Texture medium fine to very coarse. Pores minute (especially near the pith) to large and distinct; rather few to numerous; mostly solitary; distribution variable, but without definite pattern. Vessels with simple perforations; without spiral thickenings; intervascular pitting sparse. Rays heterogeneous, the cells mostly small and procumbent or square in *Hippocratea*, larger and mostly upright in *Salacia*; crystals sometimes present; pits to vessels small, rounded. Wood fibers with moderately thick walls; pits abundant, distinctly bordered. Ripple marks and gum ducts absent.

COMMON NAMES: *Hippocratea:* Almendro, amansa guapo, bejuco de vieja (Cuba); bejuco prieto (P. R.); haquimey or jaquimey (Dom. R.); amandier des bois, liane blanc, l. mébi (Haiti); bejuco colorado, b. de piojo, chile de perro, chum-loop, cuanabichi, hierba del piojo, h. del puyo, mata-piojo, salbeets, tulubalam (Mex.); tie-tie (Br. H.); cucaracho, mata-piojo (Salv.); rabo de mona (Col.); fava de arara (Braz.). *Salacia:* Fruta de mona, garotillo (Pan.); bacupary, bochecha de velho, jasmim de beirada, laranja do matto, laranjinha do campo, macaco castanha, tuyué-tipi (Braz.).

ICACINACEAE

This family, with about 60 genera and 200 species of trees, shrubs, and woody vines, is widely distributed throughout the tropics, but is nowhere of much importance commercially.

There are 17 genera and about 50 species in Latin America, mostly small trees or shrubs, many of them rare and poorly known. The following general description is based upon specimens of the wood of *Calatola*, *Discophora* (*Kummeria*), *Emmotum*, *Mappia*, *Ottoschulzia*, *Poraqueiba*, and *Villaresia*.

Heartwood yellowish brown; sapwood pale yellow. Not highly lustrous. Odorless and tasteless. Moderately to very hard and heavy; texture fine to rather coarse; mostly not difficult to work, finishing very smoothly and taking a good polish; durability probably low; some specimens attractive when quarter sawed, owing to the prominent rays.

Growth rings poorly defined. Pores small to minute, the largest near limit of vision; usually numerous, but not crowded, well distributed, occurring singly or less often in radial multiples or little clusters. Vessels with exclusively or predominantly simple perforations in *Discophora* and *Mappia;* multiple in the others, the plates scalariform (sometimes reticulate) with numerous to very many bars; spiral thickenings absent; intervascular pitting rather fine, alternate to opposite. Rays heterogeneous and of two sizes, the uniseriate composed of upright cells, the others greatly variable in width and height, becoming larger outwards, sometimes suggesting Sycamore (*Platanus*), sometimes Oak (*Quercus*), and frequently interrupted by fiber layers or strands; crystals often present; ray-vessel pitting rather fine in *Calatola*, *Emmotum*, *Mappia*, and *Ottoschulzia*, coarse and irregular, often scalariform in *Discophora* and *Poraqueiba*, intermediate in *Villaresia*. Wood parenchyma reticulate, not distinct without lens, in *Calatola*, *Discophora*, *Ottoschulzia*, *Poraqueiba*, and *Villaresia;* in concentric bands and diffuse in *Mappia;* paratracheal, aliform and irregularly confluent in *Emmotum;* cells often disjunctive. Wood fibers not in definite radial rows; walls thick to exceedingly thick, in the latter case gelatinous; pits large, numerous, and distinctly bordered except in *Discophora* and *Mappia*, where they are small, rather few, and indistinctly bordered. Ripple marks and gum ducts absent.

Calatola, with three species, occurs from southern Mexico to northern Colombia. *C. mollis* Standl. is said to attain a height of about 65 feet in Pueblo, Mexico; *C. costaricensis* Standl., in Costa Rica and Panama, is a slender tree 25 to 40 feet high. No uses are reported for the timber, which is of somewhat lighter weight than that of the other American genera examined. The sapwood acquires a blue stain suggesting *Genipa*.

Pores numerous to abundant, very small to minute, nearly all solitary. Vessel perforation plates with very numerous, fine bars, often reticulate. Larger rays 2 to 6, usually 3 to 5, cells wide, and up to 100 or more cells high.

COMMON NAMES: Calarolazno, palo de tinto (Mex.); haguey (Pan.); venenito (Col.).

Discophora (*Kummeria*), with three species of small trees, is sparingly distributed in Panama, the Guianas, and Brazil. The only wood specimen available is *D. panamensis* Standl., collected by G. Proctor Cooper in Bocas del Toro, Panama (his No. 613; Yale 12246). Density medium; texture rather coarse and harsh.

Pores very small, numerous, in radial multiples or in clusters. Vessels very rarely with scalariform perforation plates. Larger rays 2 to 5, mostly 3 or 4, cells wide and up to 50, less commonly up to 100, cells high. Wood parenchyma very abundant, occupying about the same amount of space as the wood fibers; pits to vessels large and in scalariform arrangement. Wood fibers with exceedingly thick gelatinous walls.

Emmotum, with seven species, occurs from the hinterlands of Venezuela to central Brazil. *E. argenteum* Gleason is a slender shrub found at an elevation of 4800 feet on Mount Duida, Venezuela. *E. fagifolium* Desv. is a common tree in the eastern part of the State of Pará, where it is known as Marachimbé or Muirachimbé, but the only recorded use of the timber is for fuel. The only wood specimen at hand is from *E. holosericeum* Ducke, a rather large tree discovered near Manáos (Ducke No. 289; Yale 33816). Heartwood chestnut-brown, fairly lustrous; sapwood yellowish. Very hard and heavy, medium-textured, straight-grained, probably durable.

Pores small, numerous, mostly solitary. Vessel perforation plates with rather coarse, widely spaced bars. Large rays Oak-like, numerous, high and conspicuous on radial surface; interior cells narrow and procumbent, *mostly sclerotic*. Wood parenchyma not very abundant, scarcely distinct with lens; paratracheal, aliform, and irregularly confluent; cells not sclerotic. Wood fibers very thick-walled; pits large, very numerous, especially so when in contact with vessels.

Mappia, with seven species of shrubs and small trees, mostly of tropical Asia, is represented in America by two species. *M. mexicana* Rob. & Greenm. is a shrub in southern Mexico. *M. racemosa* Jacq. is a tree, occasionally 25 to 35 feet high, in the West Indies and Central America; it is usually crooked and bushy and its timber apparently has no special uses; the only known vernacular name is Palo de Caña (Cuba). Sapwood pale yellow; heartwood not seen. Rather

lustrous. Hard and heavy, of medium-fine texture, easy to work, finishing very smoothly.

Pores small to very small, fairly numerous, mostly in short radial multiples or in little clusters. Larger rays 3 or 4 cells wide and often more than 100 cells high. Wood parenchyma abundant, fairly distinct with lens; surrounding or in contact with the pores and in concentric bands spaced 2 to 4 pore-widths apart, also diffuse and in small detached patches. Wood fibers with very thick gelatinous walls.

Ottoschulzia, with three closely related species of small trees, is limited in its distribution to the West Indies. *O. rhodoxylon* Urban (=*Poroqueiba rhodoxylon* Urban) is a little-known endemic tree of Puerto Rico where the timber is used occasionally for making fancy articles of turnery. *O. cubensis* (C. Wr.) Urban (=*P. cubensis* C. Wright) grows in Cuba and is sometimes utilized for railway crossties; the name Rayo del Sol is given to it in Oriente Province in allusion to the figure produced by the rays on a cross section of the stem. *O. domingensis* Urban, of the Dominican Republic, has supplied a few logs for export to New York under the name of Palomino. The woods are practically identical and are suitable for brush backs, marquetry, small cabinet work, and turnery.

Color yellow or yellowish brown, with little contrast between heartwood and sapwood. Sp. gr. (air-dry) 0.80 to 0.85; weight 50 to 53 lbs. per cu. ft.; medium textured, straight grained; has high moisture content when fresh, but dries readily without serious checking and warping; brittle when dry and inclined to chip out when being worked.

Pores minute, not very numerous, mostly solitary, often with tendency to tangential arrangement. Larger rays very broad, occupying about a third of the cross section; producing silver grain on radial surface, but conspicuous only in proper lighting owing to lack of color contrast with background. Wood parenchyma in unevenly spaced irregular lines. Wood fibers with very thick gelatinous walls.

COMMON NAMES: Cocote or cogote del toro, frutón, rayo del sol (Cuba); palo de rosa (P. R.); palomino (Dom. R.).

Poraqueiba. There are three or four species in the Amazon basin, all small to medium-sized trees. The timber of *P. sericea* Tul. is used in Brazil to a limited extent for general carpentry and construction. Wood yellowish brown, hard and

heavy, medium-textured, not difficult to work; has attractive silver grain when quarter-sawed.

Pores small, some barely visible; rather few in some places to numerous in others; mostly solitary. Smaller rays mostly uniseriate and biseriate, few to 30 cells high; others widening outwards, Oak-like, often interrupted by fiber bands. Wood parenchyma finely reticulate, distinct under lens.

COMMON NAMES: Poraquebé (Fr. G.); mary, m. gordo, umary, u. amarello (Braz.); umari, u. amarillo, u. negro (Peru).

Villaresia. About 20 species have been described, several native to the Indo-Malayan region and Australia, but the majority inhabiting southern Brazil, Paraguay, Argentina, and Chile. The principal timber tree is the so-called Maple, *V. Moorei* F. v. M. of New South Wales, but the use is local. In South America the plants are small trees or shrubs and their value is in their leaves which are employed as a substitute for the true Mate or Paraguay tea, the produce of *Ilex*, a genus to which *Villaresia* seems to be fairly closely related. Wood yellow, hard, rather fine-textured, of good working qualities.

Pores very small to minute, rather few to numerous, sometimes in radial or diagonal rows. Larger rays variable from *Platanus* to *Quercus* types. Wood parenchyma fairly abundant, scarcely distinct with lens; in contact with vessels and reticulate.

COMMON NAMES: Congonha, c. verdadeira, gongonha (Braz.); maté, yapón, yerva de palos (Par.); caá-rá, caona, congonha, mboreví-caá, palo de anta, taruma de pantano, yerba (Arg.); guilli-patagua, narangillo (Chile).

Miscellaneous. No wood samples are available of the following South American genera and species: *Metteniusa* (*Aveledoa*), with three species of small to rather large trees; *M. nucifera* (Pittier) Sleumer in Venezuela where it is called Macagua and Urupagua; *M. edulis* Karst., a tree 20 to 25 feet high in the mountains of northern Colombia where it is known as Canchi; and *M. Tessmaniana* Sleumer in eastern Peru (see *Notizblatt* 13: 118; 359–361, Dec. 30, 1936). *Clavapetalum*, with two species of rather large trees; *C. surinamense* Pulle in the Guianas and *C. elatum* Ducke in the Amazon region where it is called Cubiú or Pau de Cubiú. *Dendrobangia boliviana*

Rusby, a Bolivian tree. *Humirianthera*, with two Amazonian species of shrubs with large rhizomes containing starch which, after repeated washing, can be used for food; the common names are Apolo, Mairá, and Mandioca-assú. *Leretia*, with three species of little trees in tropical Brazil. *Oecopetalum mexicanum* Greenm. & Thomps. in the mountains of southern Mexico. *Pleurisanthes Artocarpi* A. Baill., a French Guiana tree. *Poraresia anomala* Gleason, a shrub or little tree in northern Brazil. *Valetonia brasiliensis* (Valeton) Durand, a scandent shrub of Brazil.

Olacaceae

The Olax family consists of 22 genera and about 260 species of trees, shrubs, and a few woody vines; some of the plants are semi-parasitic. The timbers of certain species are highly esteemed locally, but they are of minor commercial importance. There are eight strictly American genera, namely, *Eganthus*, *Minquartia* (including *Endusa*), *Chaunochiton*, *Brachynema*, *Tetrastylidium*, *Cathedra*, and *Liriosma; Heisteria* and *Ptychopetalum* are limited to the tropics of America and Africa, while *Ximenia* and *Schoepfia* are pantropical. The following description applies particularly to the American species.

Woods yellowish, yellowish brown, or olive; not highly lustrous. Without distinctive odor and taste, except *Ximenia*, the heartwood of which is mildly fragrantly scented, at least when fresh. Moderately to decidedly hard and heavy; texture medium to coarse, with rather harsh feel; generally not difficult to work, finishing smoothly; durability variable.

Growth rings present or absent. Pores small to minute, numerous; mostly solitary in *Heisteria*, *Liriosma* and *Ximenia*, but commonly in short to long radial multiples or series, suggesting certain Euphorbiaceae in the others. Vessels with simple perforations except in *Minquartia* and *Heisteria;* spiral thickenings absent, but spiral striations are sometimes present; tyloses common; intervascular pitting typically fine to very fine and alternate, coarser in *Heisteria* and *Minquartia;* some of the pits to ray and wood parenchyma cells may be very large, the complements of the same size or several in a cluster that may easily be broken through in sectioning. Fibriform vessel members sometimes associated with vessels (*e.g.*, *Chaunochiton*). Rays 1 to 5, mostly 1 or 2, cells wide, few to 25, sometimes up to 50, rarely (*Heisteria*) up to 100, cells high; moderately to decidedly heterogeneous; frequently very coarse-celled; small crystals common; ray-vessel pitting variable from very fine to very coarse, two-sized in most cases, tending to scalariform in *Heisteria* and *Minquartia*. Wood parenchyma usually abundantly developed, typically reticulate, suggesting many Euphorbiaceae; paratracheal, aliform and confluent in *Schoepfia*, the cells in horizontal seriation; crystals sometimes present. Wood fibers with medium to very thick walls; pits variable from minute and simple or indistinctly bordered (*e.g.*, *Chaunochiton*, *Minquartia*, *Ptychopetalum*, *Schoepfia*) to large and distinctly bordered (*e.g.*, *Heisteria* and *Ximenia*). Gum ducts absent. Ripple marks in parenchyma layers and patches in *Schoepfia;* very fine, but distinct with lens.

Minquartia. Two species are recognized, namely, *M. guianensis* Aubl. (=*Secretania loranthoides* Muell. Arg.), ranging from Nicaragua to Ecuador, the Guianas and Brazil, and *M. punctata* (Radlk.) Sleumer (=*M. macrophylla* Ducke and *Endusa punctata* Radlk.) of the upper Amazon region. The woods are alike in appearance and properties. Regarding the first species in Panama, where it is commonly known to English-speaking people as Manwood or Black Manwood, Cooper says (*Tropical Woods* 14: 4):

"The tree is found in the hot lowland forests on both the Caribbean and Pacific watersheds, but it grows only on well-drained slopes and not on the low flat ground back of the Mangrove. Occasionally it is found on islands where the land rises abruptly from the sea. . . . The tree has low buttresses and the bole is somewhat squared or fluted and twisted, especially at the base. It grows to be three feet in diameter and occasionally 100 feet tall. The core often is hollowed out by ants, leaving a shell about a foot thick. . . . Black Manwood is highly valued for its durability and strength. It is fairly easy to cut with an axe or machete, but the interlocked grain makes it difficult to split. The texture is very fine and the wood takes a high lustrous polish. The sapwood is from 1 to 2 inches thick and yellow-tan in color, but the heart is a deep chocolate or olive brown. . . . As Black Manwood is scattered and difficult to locate in the bush it can never be considered as a commercial possibility. It should find use for walking sticks and special articles of turnery and inlay."

The uses of *Minquartia* timber are mainly for railroad and tram crossties, telephone poles, fence and house posts, and similar purposes requiring great strength and resistance to decay. Few woods equal its reputation for durability in con-

tact with the ground, but the scarcity of the trees and their poor timber form prevent commercial exploitation. (See *Tropical Woods* 8: 10.)

COMMON NAMES: Manwood, plátano (Nic.); manú, palo de piedra (C. R.); black manwood, criollo, manwood, palo criollo, urari, urodibe (Pan.); jewalidanni, mincoa (Br. G.); arata or aratta, aratahoedoe, arratawerie, baggie-baggie, konthout, kontoehoedoe, makka, tomopio, wanania (Sur.); bois agouti, b. incorruptible, mincouart (Fr. G.); acaiquára, a. da varzea, a. do igapó, acapú, acariúba, acary, a. coara, a. uba (Braz.); pechiche (Ec.); huacapú (Peru).

Heisteria. Of the 40 or more species, three occur in tropical West Africa, the others in tropical America, ranging from southern Mexico to Peru and the Amazon region of Brazil. They are all small trees, occasionally 35 feet high and 6 to 8 inches in diameter. Wood apparently not utilized. Color light to dark brown; lustrous on radial surface. Hard and heavy; sp. gr. (air-dry) 0.95; finishes very smoothly.

Rays of two sizes, the uniseriate low, all cells upright, the multiseriate often high (up to 100 cells); pits to vessels large and in scalariform arrangement. Pits in the wood fibers large and in short to long uniseriate rows. (For further details see *Tropical Woods* 15: 14.)

COMMON NAMES: Pate macho (Guat., Hond.); cresta de gallo, sombrerito (Salv.); manglillo (C. R.); ajicillo, naranjillo colorado (Pan.); cascarilla negra, huesito negro (Col.); atrete (Ec.); chuchuhuasha, cotoma masacey, huangana-caspi, huapa-caspi, huarmi-chuchuhuasha, moena or muena, platina caspi (Peru); klikli wete (Sur.).

Chaunochiton, with two or three species of medium-sized to large trees, is of infrequent occurrence from the Amazon region to Central America. The only specimen available for study is of *C. breviflorum* Ducke, which may be not specifically distinct from *C. Kappleri* (Sagot) Ducke (=*Heisteria Kappleri* Sagot); it was collected by Dr. Ducke from a tall tree near Manáos (his No. 121; Yale 22581). Sapwood yellowish or light olive; heartwood not seen. Fresh wood, according to collector, with a strong odor of hydrocyanic acid. Density medium, texture coarse, feel harsh, working properties good, durability apparently low.

Pores barely visible, mostly in rather long radial series. Long, abundantly pitted tracheids or fibriform vessel members in contact with ordinary vessels. Rays 1 to 3, rarely 4, cells wide and up to 25, sometimes to 50, cells high; cells very coarse, some square but mostly about twice as long radially as axially; some of the pits to vessels and vascular tracheids appear very large and round. Wood parenchyma coarse-celled, reticulate, distinct with lens; crystalliferous strands common.

Ximenia. Of the 10 or more species, the best known and most widely distributed is *X. americana* L., a spiny, semi-parasitic shrub or small tree rarely 30 feet high, inhabiting tropical and subtropical regions throughout the world, often forming coastal thickets. Its bark is used locally as a source of tannin, the plum-like fruits are edible and have the scent of hydrocyanic acid, and the seeds are rich in oil. The reddish-yellow wood is mildly scented and has been used to a limited extent as a substitute for Sandalwood (*Santalum*) to which it appears to be related. (See *Kew Bull. Misc. Inf.* 4: 175–177; 1935.) Heartwood orange or yellowish brown; sapwood yellow. Hard, heavy, and compact; sp. gr. (air-dry) 0.95.

Pores very small and numerous, mostly solitary, well distributed, though sometimes more abundant in early wood. Rays uniseriate or biseriate, few to 25 cells high; small crystals common; pits to rays very small, rounded. Wood parenchyma rather sparingly developed, diffuse or in short tangential or oblique lines; crystals often present. Wood fibers with thick walls and distinctly bordered pits.

COMMON NAMES: False sandalwood, hog plum, mountain plum, Spanish plum, tallow nut, t. wood, wild lime, w. olive, yellow sanders (Fla., B. W. I.); ciruelillo, ciruelo, c. cimarrón, jía manzanilla, yaná (Cuba); croc (Dom. R.); cerise de mar, macaby (Haiti); oranger des falaises, o. de montagne, prunier épineaux (Guad.) sea-side plum (Trin.); ciruelillo, kic-ché, xkuk-ché (Mex.); manzanillo (Guat., Hond., Salv.); cagalera (Hond.); pepe nance (Salv.); chocomico (Nic.); teu-krá (C. R.); caimito del monte, espino de brujo, limoncillo (Col.); manzana guayabo, m. del diablo, ligrito (Venez.); hevmassoli (Guianas); ambuy, ameixa, a. de espinho, ameixieira do Brasil, a. de espinhos, ameizero, espinheiro da ameixa (Braz.); albaricoque, albericoquillo, a. del campo, albarillo del campo, pata, p. del monte (Arg.).

Ptychopetalum. Seven species have been described, five occurring in tropical Africa and two in the Amazon basin. The

latter are slender trees less than 40 feet tall, with dark blue, plum-like fruits. Their principal use is for their roots, which supply a drug known as muira-puama, exported from Pará and Manaos. (See *Notizblatt* 11: 107: 623–626, Dec. 15, 1932.) Wood yellowish, very hard, of medium texture, rather harsh.

Pores very small, numerous mostly in radial multiples or small clusters. Vessels with small to minute pits. Small fibriform vessel members or tracheids associated with ordinary vessels. Rays mostly uniseriate, up to 50 cells high; decidedly heterogeneous; crystals common; pits to vessels mostly very small, some very large. Wood parenchyma finely reticulate; distinct with lens. Wood fibers with very thick walls and minute pits.

Liriosma, with 14 species of shrubs and small trees, is limited in its distribution to the Amazon basin. The plants apparently are poorly known, the only recorded vernacular name being Senimoro-ey (Peru). The woods are not utilized. Sapwood yellow, heartwood not seen. Of medium density and texture; not attractive.

Pores minute, mostly solitary, occasionally in short rows. Rays heterogeneous, coarse-celled, mostly 2 or 3 cells wide and up to 50 cells high; pits to vessels small to very large, sometimes in scalariform arrangement. Wood parenchyma finely reticulate, scarcely distinct with lens. Wood fibers with thick walls and fairly numerous bordered pits.

Aptandra. There is one species in tropical West Africa and three in the Amazon basin, all small trees of no importance for their timber. Sapwood yellow; heartwood not seen. Of medium density, rather harsh.

Pores small, near limit of vision, numerous, in radial multiples tending to oblique arrangement. Intervascular pitting very fine. Rays heterogeneous, coarse-celled, 1 or 2 cells wide and up to 25 cells high; pits to vessels mostly very small, some large. Wood parenchyma abundant, finely reticulate, not very distinct with lens; crystals present. Wood fibers with thick walls and rather few bordered pits.

COMMON NAMES: Castanha de cotia, quinquio, sapucainha (Braz.); pamashto, trompo-huayo (Peru).

Schoepfia. There are eight species in eastern and southeastern Asia and about 26 in Latin America. The combined range of the latter includes the West Indies, Mexico, Central America, and tropical South America. They are shrubs or small trees of no importance. Sapwood yellow; heartwood not seen.

Pores not visible without lens; solitary or in small multiples or clusters which are sometimes rather widely separated, sometimes (*e.g., S. parvifolia* Planch. from Mexico, Yale 1213) in irregular tangential arrangement producing an ulmiform pattern. Intervascular pitting very fine. Rays uniseriate or biseriate, up to 15 cells high; pits to vessels mostly minute, some rather large. Wood parenchyma paratracheal, aliform and confluent in narrow wavy bands, except in *S. parvifolia* where it unites the tangentially arranged pore groups; cells storied, producing fine ripple marks in local areas. Wood fibers with medium thick walls and minute pits.

COMMON NAMES: White beefwood, white wood (Bah.); boniatillo, cerillo, mije blanco (Cuba); palo fierro, tecolitillo (Mex.); sombra de armado (Hond.).

Miscellaneous. Wood specimens of the following Brazilian genera and species have not been available for study: *Eganthus Poeppigii* Van Tiegh. *Brachynema ramiflorum* Benth., a shrub or little tree less than 20 feet high. *Tetrastylidium*, with three species of medium-sized to tall trees, said to supply some structural timber, though not resistant to termites; common name Tatú. *Cathedra*, with five species of trees, probably all rare, judging from the absence of information concerning them.

OPILIACEAE

An unimportant family of eight genera and about 60 species of small trees and shrubs, sometimes climbing, widely disseminated in the tropics of the Old World and represented by one genus, *Agonandra*, in tropical America. The woods of *Lepionurus*, *Cansjera*, *Meliantha*, *Champereia*, and *Opilia*, of the tribe Opiliae, are unique in possessing cystoliths of calcium carbonate in some of the ray cells; these structures are apparently absent from the wood *Agonandra*, of the tribe Agonandreae.

Agonandra, with eight named species, is of infrequent occurrence from southern Mexico to northern Argentina and southern Brazil. The trees are all small, mostly 20 to 30 feet high, with a rather stout, sometimes fluted, trunk 10 to 15 inches in diameter. The timber is of good quality, but because of its small size and scarcity it is unknown on the market and the only recorded special uses are for chair frames and wheel spokes. Heartwood orange-yellow, with gradual transition to the pale yellow sapwood. Not highly lustrous. Odorless and

tasteless. Very hard, heavy, compact, and strong; texture fine, grain usually straight; not difficult to work, finishes very smoothly; more deeply colored material durable.

Growth rings often present. Pores small to very small, not distinct without lens; numerous, rather uniformly distributed, nearly always solitary. Vessels with simple perforations; walls without spiral thickenings, but often finely striate; intervascular pitting rare, very fine, alternate. Rays fine and inconspicuous; uniseriate or biseriate, rarely triseriate, and mostly less than 25, sometimes up to 50, cells high; homogeneous or nearly so; pits to vessels very small, circular. Wood parenchyma abundantly developed, finely reticulate, fairly distinct with lens. Wood fibers with thick walls; pits distinctly bordered, especially numerous and conspicuous when fibers are in contact with vessels. Ripple marks and gum ducts absent.

COMMON NAMES: Granadillo, margarita, maromero, palo del golpe, ravienta cabra, suelda con suelda (Mex.); caimancillo, hoja menuda (Col.); amarellão, marfim, pau d'alho do campo, p. marfim, p. m. verdadeiro (Braz.); meloncillo, pata, sombra de toro (Arg.).

LORANTHACEAE

The Mistletoe family includes about 36 genera and a great many species, almost all of which are shrubs parasitic on trees. Two genera of normal terrestrial plants are *Nuytsia*, with one species, a small tree in West Australia, and *Gaiadendron*, with six species of trees and shrubs in the mountains of British Guiana, Venezuela, Colombia, Ecuador, and Peru.

Gaiadendron. The only wood sample available is of *G. tagua* (H. B. K.) G. Don (=*Loranthus tagua* H. B. K.), collected by W. Gehriger at an elevation of about 8000 feet near Mucurubá, Meridá, Venezuela (his No. 291; Yale 33726). Sapwood white when fresh, becoming pale brown; heartwood not seen. Rather lustrous. Of medium-low density, fine-textured, easy to work; consistency about that of Alder (*Alnus*).

Growth rings present. Pores small to minute, not individually distinct without lens; not very numerous, irregularly distributed, occurring in short tangential rows or in clusters joined obliquely by parenchyma. Vessels with very short members and simple perforations; spiral thickenings absent, but pit apertures are spirally coalescent; pitting fine, alternate. Rays 1 to 6, mostly 3 to 5, cells wide and less than 25, but sometimes 50 or more, cells high; slightly heterogeneous, the cells rather large; pits to vessels small, nearly circular. Wood parenchyma abundant about pores and uniting pore groups irregularly; also reticulate, the short tangential lines being fairly distinct with lens. Wood fibers with rather thin walls and comparatively few, fairly large and distinct bordered pits. Gum ducts absent. Ripple marks present, the rays not storied; very fine, about 130 per inch, irregular, fairly distinct under lens.

COMMON NAMES: Tábano (Venez.); matopalo (Peru).

SANTALACEAE

The Sandalwood family consists of 29 genera and about 400 species of herbs, shrubs, and small trees, sometimes parasitic, of very wide distribution in tropical and temperate regions. The best known and most important genus is *Santalum*, of the East Indies, Polynesia, and Australasia. The use of the fragrant wood and oil of the Indian species, *S. album* L., is of great antiquity. Sandalwood of other species was discovered in Hawaii about 1790 and an important trade with China developed, being at its height between 1810 and 1825. The temporary prosperity enabled the first king to lead his people from barbarism to civilization in one generation, but at the same time it was almost their undoing, for it led to extravagance, oppression, and famine, which came to an end in 1840 with the almost complete exhaustion of a great natural resource. Plantations of the trees are now being made, but the seedlings will perish before the end of their first year unless their roots attach themselves by means of spongy sucking appendages (haustoria) to the roots of young trees of other kinds which serve as hosts.

There are four genera of Santalaceae native to South America, namely, *Myoschilos* in Chile and Patagonia; *Acanthosyris* in Bolivia, Brazil and Argentina; *Jodina* (*Iodina*) in Argentina, Uruguay, and Brazil; and *Cervantesia* in the mountains of Colombia, Ecuador, and Peru. They are at best only little trees, and their unscented timber is of no commercial importance. Owing to their many dissimilarities, the woods are described separately.

Acanthosyris. There are two or three species in southern South America, the largest being a tree occasionally nearly 40 feet high and 16 inches in trunk diameter in northern Argentina, and noted for its sweet fruit. Heartwood yellowish brown, sometimes with pinkish streaks; sapwood lighter. Without dis-

tinctive odor or taste. Moderately dense, of medium texture and rather irregular grain, of harsh feel, easy to work, finishing smoothly, inclined to warp; has about the consistency of Maple (*Acer*).

Growth rings fairly distinct. Pores very small, not individually distinct without lens; solitary or more often in short to rather long radial rows or multiples occupying most of the space between the coarse rays; numerous, well distributed, without pattern, though tending to tangential arrangement in early wood. Vessels with simple perforations; without spirals; pitting rather coarse, alternate to opposite. Rays distinct on cross section; conspicuous on radial; numerous, 1 or 2 pore-widths apart; nearly all multiseriate, up to 6 cells wide and 60 cells high; homogeneous to heterogeneous; pits to vessels variable from small and rounded to very large and irregular. Wood perenchyma in terminal bands, also sparingly paratracheal and diffuse; pits to vessels large, gash-like. Wood fibers with thick walls and rather few, very small, indistinctly bordered pits. Ripple marks and gum ducts absent.

COMMON NAMES: Sombra de touro (Braz.); cabo de lanza, guá-hé, ibá-hé-é, ibará-hú, quebrachillo, sacha-pera, sombra de toro hembra, yvá-hehé (Arg.); quebrachillo (Urug.); ybá-hehé (Par.).

Myoschilos, with one species, *M. oblongus* Ruiz & Pav., is a large shrub, usually growing in association with *Nothofagus pumilis* Poepp. & Endl. The roots and leaves are used medicinally. Wood nearly white, moderately hard, uniform-textured, of about the consistency of White Birch (*Betula alba* L.).

Growth rings distinct, as wood is nearly ring-porous. Pores minute, scarcely distinct with lens, in an indefinite band in early wood and extending radially in irregular zones. Vessels with simple perforations; without spirals; intervascular pitting rather coarse, tending to scalariform, the vessel walls usually so narrow as to accommodate only 1 or 2 rows. Rays very fine and inconspicuous; 1 to 3 cells wide and up to 15, sometimes over 30, cells high; heterogeneous, many of the cells square, all of them small; pits to vessels large, rounded or long-oval, 1 or 2 to each cross-field. Wood parenchyma not abundant; diffuse and in short tangential lines; pits to vessels mostly large and elongated. Wood fibers with rather thick walls and distinctly bordered pits. Ripple marks and gum ducts absent.

COMMON NAMES: Codocoypu, orocoipu, senna (Chile); heidelbeere, lengua-myrtula (Arg.).

Jodina (*Iodina*), with one species, *J. rhombifolia* Hook & Arn., is a tall shrub or a tree sometimes 25 feet high and 14 inches in diameter in Argentina, characterized by its rhombus-shaped leaves with three bristle tips. Oil from the seeds is

employed medicinally and the wood is used to a minor extent locally, mostly for fuel. Heartwood yellow, sapwood white. Hard and heavy; sp. gr. (air-dry) 0.77; weight about 48 lbs. per cu. ft.; texture medium-fine, grain irregular, working properties fair.

Growth rings present or absent. Pores very small to minute, very numerous, arranged in concentric bands or in very irregular, diagonal or zigzag patches suggesting certain species of *Rhamnus*, both types of arrangement in same specimen. Vessels with simple perforations; spiral thickenings distinct; pitting rather coarse, alternate. Rays nearly all multiseriate, up to 10 cells wide and 50, occasionally 75 to 100, cells high; somewhat heterogeneous, the cells all small, most of them procumbent, some square; pits to vessels small to large and irregular. Wood parenchyma sparingly paratracheal. Wood fibers with thick walls and rather few, very small, indistinctly bordered pits. Ripple marks absent.

COMMON NAMES: Sombra de touro (Braz.); peje, quebrachillo, quebracho flojo, quinchilín, quinchirín, sombra de toro, s. de t. macho (Arg.); sombra de toro (Urug.).

Cervantesia, with five species of small to perhaps medium-sized trees, is distributed from northern Colombia to Ecuador and Peru. The only wood samples available are of *C. colombiana* A. C. Smith collected by A. Dugand G. in the Department of Atlantico, Colombia, where the tree is known as Matamaiz. (See *Tropical Woods* 51: 12–14.) Sapwood yellowish, with a golden luster in proper light; heartwood not seen, but probably light brown (judging from knots). Without distinctive odor or taste. Hard and heavy; sp. gr. (air-dry) 0.68 to 0.80; weight 42.5 to 50 lbs. per cu. ft.; rather coarse-textured and harsh; fairly straight-grained; not very difficult to work, finishing smoothly, is probably not resistant to decay.

Growth rings sometimes distinct, owing to wider spacing or more orderly arrangement of parenchyma. Pores small, near limit of vision; fairly numerous, occurring mostly in well distributed radial multiples of 2 to 4. Vessels with simple perforations; without spiral thickenings; intervascular pitting fine, alternate. Rays visible on cross section, very distinct on radial; sometimes as wide as the pores and spaced 1 to 2 pore widths apart; 1 to 6 cells wide and variable in height to over 100 cells; homogeneous to heterogeneous, most of the cells being large and rather short, some of them square or occasionally upright; pits to vessels small to very large and irregular; large crystals of calcium oxalate common. Wood parenchyma abundant, but variable; sparingly developed about some of the pores, surrounding others and frequently confluent into irregular, broken to continuous bands, producing a

sort of ulmiform pattern as seen with unaided eye. Wood fibers not in radial rows; walls medium to thick; pits indistinctly bordered. Ripple marks and gum ducts absent.

One specimen (Dugand 563; Yale 27095) differs from the others in having parenchyma mostly limited to the vicinity of the pores and only occasionally forming bands. The density is much greater; sp. gr. (air-dry) 0.91; weight 57 lbs. per cu. ft.

Correction

In the article on *Argyrodendron* (*Tropical Woods* 51: 19), the abbreviation "var nov." should in each of the four cases, read *comb. nov.* Technically speaking these "new names" are not new "names," but are new "combinations," being transfers of the varietal epithet from one genus to another; for the same reason they should not be called new varieties ("var. nov."). —J. Burtt Davy.

THE YALE WOOD COLLECTIONS

Accessions

At the end of the calendar year 1937 the total number of catalogued wood samples in the Yale wood collections amounted to 35,018, representing 10,993 named species of 2652 genera of 228 families. There were 1288 accessions during the year. The largest contributions were from Mexico (476) and Tanganyika, Africa. The sources of all the wood samples received are as follows:

Africa: Imperial Forestry Institute, Oxford (*Belgian Congo*); Dr. C. R. Metcalfe, Kew Gardens (*Cameroons*); Dr. J. Mildbraed, Bot. Garten und Museum, Berlin-Dahlem (*Tanganyika*); Mr. D. Normand, Nogent-sur-Marne (*Madagascar*); Prof. L. Piccioli, Florence (*South Africa*); The United Africa Co., Ltd., Sapele (*Nigeria*).

Argentina: Imperial Forestry Institute, Oxford, Eng.

Australia: Imperial Forestry Institute, Oxford, Eng.; Mr. H. E. Dadswell, Council for Sci. and Ind. Research, South Melbourne.

Brazil: Dr. Adolpho Ducke, Jardim Botanico, Rio de Janeiro; Dr. F. C. Hoehne, São Paulo; Mr. B. A. Krukoff, New York.

Chile: Sr. E. L. Bernath, Santiago.

Colombia: Sr. A. Dugand G., Barranquilla.

Ecuador: Dr. A. Rimbach, Riobamba.

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

Honduras: Mr. R. Dawson, New Haven, Conn.

India: Mr. Alexander L. Howard, London, Eng.; Prof. L. Piccioli, Florence, Italy.

Japan: Prof. L. Piccioli, Florence, Italy.

Korea: Imperial Forestry Institute, Oxford, Eng.

Mexico: Mr. L. Williams, Field Museum of Natural History, Chicago, Ill.

Morocco: Imperial Forestry Institute, Oxford, Eng.

New Zealand: Mr. C. E. Foweraker, Christchurch.

Peru: Imperial Forestry Institute, Oxford, Eng.; Mr. D. H. Allen, New York.

Philippine Islands: Bureau of Forestry, Manila.

Poland: Imperial Forestry Institute, Oxford, Eng.

Sumatra: Mr. B. A. Krukoff, New York.

Trinidad: Imperial Forestry Institute, Oxford, Eng.

Uruguay: Dr. W. G. Herter, Montevideo.

U. S. A.: Imperial Forestry Institute, Oxford, Eng.; Mr. H. Hicock, Naugatuck, Conn.; C. H. Pearson and Sons, New York; Mr. Hermann von Schrenk, St. Louis, Mo.; Mr. M. L. Zigmond, New Haven, Conn.

Venezuela: Dr. H. Pittier, Caracas.

Sections for Microscopic Study

During 1937 there were added to the slide collections cross, radial, and tangential sections of 2623 specimens representing 1297 named species, 674 genera, and 23 families, making a total (after allowing for duplications) of 7858 specimens of 4437 named species, 2016 genera, and 198 families.

Some of these were prepared in the Yale laboratories; others were obtained by purchase or in exchange, the principal sources during 1937 being: Prof. R. H. Wetmore, Harvard University; Dr. L. Chalk, Imperial Forestry Institute, Oxford.

Specimens Distributed

There were distributed during the year 594 wood specimens, mostly for use in connection with specific scientific projects now under way or in preparation.

Systematic Anatomy

Berberidaceae. Dr. G. A. Diehl, Cincinnati, Ohio, 2 samples, 2 spp. *Berberis.*

Meliaceae. To Dr. D. A. Kribs, Mont Alto, Pa., 5 samples, 3 spp. *Khaya;* 14 samples, 4 spp. *Swietenia.*

Winteraceae. To Mr. Charles E. Foweraker, Canterbury University, Christchurch, and to Dr. K. M. Gupta, Beawar, Rajputana, India, 1 sample (stem and root) of *Drimys Winteri.*

Special Investigations

To Mr. K. A. Chowdhury, Forest Research Institute, Dehra Dun, India, 27 samples: Guttiferae (25), Podocarpaceae (2).

To Mr. J. D. Hale, Canada, 29 samples: Cephalotaxaceae (4), Cupressaceae (6), Cycadaceae (2), Gnetaceae (4), Pinaceae (7), Podocarpaceae (2), Taxodiaceae (4).

To Imperial Forestry Institute, Oxford, 98 samples: Araceae (1), Asclepiadaceae (1), Bombacaceae (1), Buxaceae (2), Calycanthaceae (1), Caprifoliaceae (1), Compositae (3), Leguminosae (6), Magnoliaceae (9), Melastomaceae (22), Myrsinaceae (7), Myrtaceae (13), Ochnaceae (1), Olacaceae (5), Onagraceae (1), Opiliaceae (1), Pandaceae (1), Platanaceae (1), Punicaceae (1), Rhamnaceae (17), Rutaceae (2), Sabiaceae (1), Thymelaeaceae (1), Tiliaceae (1).

To Kew Botanical Gardens, 5 samples of Eucryphiaceae.

To Prof. R. B. Thomson, University of Toronto, 9 samples: Cupressaceae (5), Pinaceae (2), Taxodiaceae (2).

To Prof. R. H. Wetmore, Harvard University, 240 samples: Aceraceae (1), Anacardiaceae (29), Bignoniaceae (1), Burseraceae (11), Buxaceae (3), Capparidaceae (1), Caricaceae (1), Cneoraceae (1), Cunoniaceae (13), Cyrillaceae (1), Dichapetalaceae (3), Euphorbiaceae (1), Juglandaceae (14), Leguminosae (1), Meliaceae (39), Olacaceae (1), Oxalidaceae (2), Passifloraceae (5), Polygalaceae (3), Rutaceae (82), Simarubaceae (16), Zygophyllaceae (11).

CURRENT LITERATURE

A leaf key to Florida broad-leaved trees, native and exotic, except palms. By Mary Franklin Barrett. Pub. by the author, 57 Union St., Montclair, New Jersey. Pp. 79; 6¼ x 9; 8 plates. Price $1.00.

This pamphlet contains dichotomous keys, based primarily on leaf characters, to 620 species of dicotyledonous trees, many of them tropical, growing in Florida. Supplementing the main key are many short ones for special groups and species. Various types of leaf forms and venation are illustrated by drawings.

Über die bisher unbekannte Heimat einer alten Gartenpalme, *Scheelea osmantha* Barb. Rodr. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 476–477; June 30, 1937.

Scheelea osmantha, a palm long known in cultivation, is a native of Tobago and Trinidad. A synonym is *S. Urbaniana* Burret, 1939.

Contribution a l'étude de la flore de la Martinique. By Daniel Privault. *Bull. Soc. Bot. France* (Paris) 84: 289–294; 1937.

A list of plants, including a few woody species, not reported previously from Martinique.

Forestry and the petroleum industry in Trinidad. By R. L. Brooks. Imperial Forestry Institute Paper No. 10. Mimeographed. Pp. 5; 1 fig. Oxford, 1937. Price 1s.

"This paper describes the methods adopted in Trinidad to solve the problem of minimizing the destruction of forests involved in the exploitation of mineral resources."

The vegetation of the Cape Region of Baja California. By Forrest Shreve. *Madroño* (Lancaster, Penn.) 4: 105–113; pl. 18, fig. 1 (map); October 1937.

The Cape Region and the adjacent mainland of Mexico differ in vegetation fully as much as in flora. The southern limit of desert is about three degrees farther south in Baja

California than on the mainland. The relationships of the flora of the Cape Region are apparently somewhat closer to Sonora than to Sinaloa. The flora of the mainland, over a comparable area, is much richer than that of the Cape Region, but the vegetation of the lowlands of the Cape is very much more diversified than that of the lowlands of Sinaloa and southern Sonora. In the latter region a single tree is everywhere strongly dominant, and its commonest associates are few as compared with the great variety of arborescent forms in the Cape forest.—P. C. STANDLEY.

Plants as indicators of climate in northeast Mexico. By CORNELIUS H. MULLER. *Amer. Midland Naturalist* (Notre Dame, Ind.) 18: 986–1000; ill.; November 1937.

Five major climatic types have been distinguished in a cross section of the Sierra Madre Oriental, Nuevo León, Mexico: Warm and arid, the vegetation characterized by growths of thorny shrubs, principally Mesquite, with *Yucca*, *Acacia*, Cacti; cool and semi-arid, with Manzanita, Sumac, Piñon, Maguey, scrub Oaks; cool and sub-humid, forests of Pine, Pine and Oak, pure Oak, and Oak and Hickory; cold and humid, a heavy subalpine forest, with Douglas Fir, Aspen, and Pines; cold and semi-arid, alpine meadows and stunted forests with shrubs of Gooseberry, Juniper, and Stone Pine, on the highest peaks (3600–3800 meters).—P. C. STANDLEY.

Catálogo de nombres vulgares y científicos de plantas mexicanas. By MAXIMINO MARTÍNEZ. Pp. 552; 4½ x 7. Mexico, 1937.

This important publication lists more than 13,000 vernacular names of Mexican plants, with Latin equivalents. It is by far the most important and comprehensive of several works dealing with the subject, and will be of inestimable value in various branches of botanical work. The names have been drawn from a wide variety of sources, by one who has wide knowledge of the Mexican flora. While some errors are noticeable in the Latin names, they are much less numerous than in most works of similar nature.—P. C. STANDLEY.

Studies of Mexican and Central American plants. IV. By C. L. LUNDELL. *Field & Laboratory* 6: 9–16; November 1937.

New species are *Aristolochia rhizantha* (San Luis Potosí, Mexico), *Protium multiramiflorum* (Brit. Hond.; local name Copal Colorado), *P. Schippii* (Brit. Hond.), *Carpodiptera Ameliae* (San Luis Potosí, Telcón; Brit. Hond., Mountain Pear). A British Honduras tree called Red Faisán and White Faisán, wrongly reported as *Calocarpum viride* Pittier, proves to be *Dipholis Stevensonii* Standl. *Lucuma Durlandii* Standl. and *L. hypoglauca* Standl. are reported from San Luis Potosí, Mexico.—P. C. STANDLEY.

On the identification of *Rhus filicina* Sessé et Moc. ex DC. By A. A. BULLOCK. *Kew Bull. Misc. Inform.* 8: 440–441; 1937.

The new name *Actinocheita potentillifolia* (Turcz.) Bullock is proposed for a Mexican plant, previously known as *Rhus potentillaefolia* Turcz. and *Actinocheita filicina* Barkley.

Contributions to the flora of tropical America. XXXII. Plantae Hintonianae. IV. Further notes on the genus *Bursera*. By A. A. BULLOCK. *Kew Bull. Misc. Inf.* 9: 447–457; 1937.

Notes are given upon various Mexican species of *Bursera*. New species are *B. dubia* (Guerrero), *B. fragrantissima* (Guerrero), *B. heteresthes* (Mexico, Guerrero), *B. inopinata* (Sonora, Chihuahua, Jalisco; local names Torote Copal, Torote Prieto). Vernacular names are reported also for previously published species: *B. confusa*, Copal, Guande; *B. Hintoni*, Tecomaca; *B. Tecomaca*, Guande; *B. trimera*, Quincanchiri.

A Mexican puzzle (*Yucca Howard-Smithii*). By WILLIAM TRELEASE. *Proc. Amer. Phil. Soc.* 78: 97–99; pls. A-C; October 1937.

Yucca Howard-Smithii is described (without Latin diagnosis) from the regions of Mexico City and Cuernavaca, where it is cultivated commonly. The local name is Izote.

Ein neuer *Styrax* aus Mexico. By L. Diels. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 508; June 30, 1937.

Styrax diplotrichus is a new species from Guerrero, Mexico.

New plants from the Yucatan Peninsula. By C. L. Lundell. *Bull. Torrey Bot. Club* 64: 547–556; November 1937.

New species of woody plants are *Coccoloba mayana* and *Acalypha Mortoniana* (Guatemala); *Ficus guajavoides*, *Phoebe longicaudata*, *Calliandra rivalis*, *Zanthoxylum nigripunctatum* (local name Prickly Yellow), *Trichilia erythrocarpa*, *Calyptranthes fluviatilis*, *C. O'Neillii*, *Eugenia cocquericotensis*, and *E. O'Neillii* (British Honduras). In addition, several generic transfers are made.—P. C. Standley.

Las superficies forestales de la Republica. By José Garcia Martínez. *Bol. Dept. Forestal y de Caza y Pesca* (Mexico) 3: 8: 127–140: 1 folded map; 1937.

The total forested area of Mexico is estimated to be 70 million acres, which is about 14.5 per cent of the total land surface. Sixty per cent of the forest occurs at elevations of from sea level to 500 meters; 15 per cent at 501 to 1000 meters; 9 per cent at 1001–1500 meters; 11 per cent at 1501–2000 meters. With respect to climatic zones, about 67.5 per cent of the forest occurs in tropical humid or sub-humid climate; about 24 per cent in temperate regions deficient in rainfall during the winter; the remainder in arid and semi-arid localities. The geographical distributions of five principal types of vegetation are shown on the map.

El balsamo de el Salvador. By Luis Alonso Hernández. *Revista de Agricultura Tropical* (San Salvador) 10: 20: 42–47; December 1936.

An interesting account of the history, properties, uses, and methods of collecting the resin from a leguminous tree, *Toluifera Pereirae* Baill. or *Myroxylon Pereirae* Oerst. Although the product is commonly called Balsam of Peru, its only commercial source has always been in the forests of Salvador.

Don Alberto M. Brenes y el descubrimiento de la quina en Costa Rica. By Manuel Quirós Calvo. *Ciencia* (San José) 9: 1: 3–7; ill; July 1937.

A brief account of the botanical work of Alberto M. Brenes of Costa Rica, and of his discovery, in the San Ramón region, of trees of *Cinchona pubescens* Vahl, the first record of the occurrence in a wild state of this genus outside South America.

Doscientas plantas medicinales de Costa Rica. IX. By Anastasio Alfaro. *Ciencia* 9: 1: 27; July 1937.

Part of an alphabetical list of plants used medicinally in Costa Rica, including various trees for which vernacular names are cited.

Flora of Costa Rica. By Paul C. Standley. *Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 18: 1: 1–398; map; 18: 2: 401–780; Oct. 12 and 20, 1937.

A systematic account of the flowering plants of Costa Rica, the present parts covering the families of the Engler sequence through the Myrtaceae. An introduction discusses briefly plant geography, relationships of the flora, and exploration, and includes a brief bibliography of works useful in study of Costa Rican plants. All native and cultivated plants are listed, with brief generic and specific descriptions in many cases. The largest family treated is the Orchidaceae, whose species are listed by Oakes Ames. Numerous new species are described.

Studies of American plants. VIII. By Paul C. Standley. *Bot. Ser. Field Mus.* (Chicago) 17: 227–284; Dec. 10, 1937.

Descriptions of new plants, chiefly tropical American, with notes on previously published species. Among new woody plants are numerous species of *Piper* from Guatemala and British Honduras (by Trelease), *Ulmus LeSueurii* (Chihuahua, Mexico), *Coccoloba chacoensis* (Bolivia), *Torrubia asperula* (Santa Catharina, Brazil), *T. Hoehnei* and *T. Loefgrenii* (São Paulo, Brazil), *Litsea Tharpiana* (Nuevo León, Mexico), 5 species of *Couepia* from Brazil, *Hirtella rasa* (Amazonian

Peru and Brazil), 8 species of *Licania* from Brazil, *Parinarium pilosum* (Amazonas, Brazil), *Ormosia isthmensis* (Oaxaca and Veracruz, Mexico; local name Colorín), *Coussarea mexicana* (Oaxaca), *Guettarda Duckei* (Brazil), *Ixora faroensis* and *I. Martinsii* (Brazil), *Pagamea Duckei* (Brazil), *Palicourea roraimae* (Brazil), *Psychotria chaponiana* and *P. Lawrancei* (Colombia), *P. Recordiana* (Ecuador), *P. Skutchii* (Guatemala), *Tocoyena hispidula* (Brazil). Several genera and species of trees are reported for the first time from Mexico.

Flora del Capiro (parte). By H. Daniel. Pp. 17; illustrated; Medellín, Colombia, November 1937.

An annotated list of some of the plants of Mt. Capiro, Antioquia, Colombia. Among woody species listed are *Baccharis trinervis* (local name Marucha), *Viburnum pichinchense* (Pitá), *Cinchona pubescens*, *Condaminea corymbosa* (Azuceno, Azuceno Cascarillo), *Duranta coriacea* (Guapante), *Oreopanax Trianae* (Cinco Dedos), *Tecoma spectabilis* (Chicalá, Cañaguate, Guayacán), *Cavendishia pubescens* (Uvito del Monte), *Miconia theaezans* (Nigüito), *Myrcia popayanensis* (Arrayañ), *Vismia acuminata* (Caparosa, Lance, Carate), *V. laevis* (Carate), *Clusia duca*, var. *Schlimiana* (Chagualito), *Rhus juglandifolia* (Chiraco, Caspicaracho, Caspi, Manzanillo), *Rapanea ferruginea* (Espadero), *Mauria ferruginea* (Chocho), *Weinmannia pubescens* (Encinillo).—P. C. Standley.

Die Höhenstufen der Vegetation in der Sierra Nevada von Santa Marta (Colombia). By William Seifriz. *Bot. Jahrb.* (Berlin) 68: 107–125; pls. 8; 1937.

A condensed account of the author's ascent of the Sierra Nevada de Santa Marta, Colombia, from the north slope, with notes concerning the vegetation, which shows conspicuous zonal arrangement. The belts tabulated, with the elevation and dominant plants of each are: coast, 0–60 meters: *Coccoloba uvifera, Acaciella Holtonii, Cephalocereus;* lower forest, 60–150: *Anacardium Rhinocarpus, Inophloeum armatum;* upper forest, 150–900: *Ficus, Cecropia, Nectandra globosa;* grassland, 900–1525: *Lasiacis procerrima, Ceroxylon,*

Fourcroya; subalpine slopes, 1525–3650: *Puya nivalis, Espeletia glossophylla;* paramo, 3650–4875: *Gnaphalium, Lupinus, Jamesonia;* high alpine slopes, 4875–5500: *Draba sanctaemartae, Cerastium glutinosum.* A bibliography of 17 entries is included.—P. C. Standley.

Plantae Duqueanae. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 489–500; June 30, 1937.

New species from Colombia are *Geonoma Molinillo* (vernacular names Palma Molinillo, Palma Bastón Amarillo), *Aiphanes Duquei* (Macanita Corocilla), *Erythrobalanus Duqueana* Schwz. (Roble Colorado), *Prunus Villegasiana* Pilger, *Vochysia Duquei* Pilger (Arracacho, Flor Amarilla), *Styrax Vidalianus* Sleumer. Vernacular names are reported also for a few older species.

Araliaceae andinae. By H. Harms. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 445–448; June 30, 1937.

New species are *Oreopanax hederaestrobilus* (Ecuador), *O. Jahnii* (Venezuela), *Schefflera Archeri* (Colombia), *S. blepharidophylla* (Colombia), *S. Vasqueziana* (Colombia).

Palmae neogeae. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 478–481; June 30, 1937.

Geonoma tenuis is described from Venezuela, and notes are published upon various species of American palms.

The tonka bean. *Bull. Imperial Institute* (London) 35: 3: 363–4; 1937.

"The tonka bean tree, *Dipteryx odorata* Willd., belonging to the natural order Leguminosae, is a large forest tree attaining heights up to 80 ft. and sometimes considerably more. Its principal native habitat is in Venezuela, but it also grows in Colombia and the Guianas and it is cultivated in Trinidad. It thrives on many kinds of soil, but does especially well on well-drained gravelly or sandy ones. Heavy waterlogged soil and impervious clay are unsuitable for it. It is stated to require a minimum annual rainfall of about 50 to 60 in., well

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distributed, though it will withstand a certain amount of drought.

"The tree can be propagated in several ways, the easiest being by seed, which should be sown at stake as the young plant does not transplant well. The seeds require about 6 weeks to germinate, and the tree generally takes from 7 to 15 years to come into bearing. When grown alone the best planting distance is generally considered to be about 50 trees to the acre, but the tree is also sometimes grown as wind-breaks, for example, with cocoa. The yield from any individual tree varies considerably from year to year, in fact it is sometimes stated that there is a regular alternation of good and bad years. The average yield in the case of full grown trees is about 10 lb. of beans per annum.

"The fruit, or seed pod, of the tree resembles a large plum and is pale brownish-yellow when ripe. The chestnut-colored seed is the tonka bean of commerce. The fruits are not gathered from the trees, but are picked up from the ground after they have fallen. They are spread out to dry till the pulp has shrivelled, after which the shell is easily cracked and the seeds removed. These are dried in the open and then cured. Curing consists in steeping the beans in strong rum for two or three days, after which the rum is run off and the beans left spread out till the spirit has evaporated, when they are ready to be packed for shipment. The beans contain an odoriferous substance called coumarin, and the effect of the curing process is to make part of the coumarin crystallize on their surface, imparting a characteristic 'frosted' appearance that is prized by users.

"The greater part of the world's supply of tonka beans are produced in Venezuela, but most of these, together with locally grown beans, are cured in Trinidad, whence they are shipped to the consuming countries, principally to the United States; only relatively small quantities come to the United Kingdom. The commercial value of tonka beans lies in the coumarin that they contain. Their principal use is in the tobacco industry, the powdered beans being mixed with tobacco in order to impart to it an agreeable odor. Extracts from the beans are used for various purposes in perfumery, whilst the powdered beans are used, with other materials, in perfume sachets. Extracts are also employed to some extent in confectionery."

Notas dendrológicas de Venezuela. By H. Pittier. *Bol. Soc. Venezolana Cienc. Nat.* (Caracas) 3: 423–436; 1937.

New species from Venezuela are *Celastrus meridensis*, *Maytenus floribunda*, *Myginda fasciculata*, *Cormonema retusum*, *Eschweilera monosperma* (vernacular name Hebrito), *Jugastrum Sifontesii*. A key is given for the genera of Lecythidaceae known from Venezuela.

Die Gattung *Paralyxia* Baill. By Fr. Markgraf. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 456–459; June 30, 1937.

Study of the type of *Paralyxia Schomburgkii* Baill. proves the genus is a valid one, closely related to *Aspidosperma*. The single species is *P. macrophylla* (M. Arg.) Mgf., based on *Aspidosperma macrophyllum* M. Arg.

Notes on tropical American Bignoniaceae. By N. Y. Sandwith. *Recueil Travaux Bot. Néerlandais* 34: 205–232; June 1937.

Miscellaneous notes, treating a large number of Bignoniaceae, chiefly of the Guianas. The paper is a valuable one because of its disposition of a quantity of names whose application has been obscure, and because of the realignment suggested for various groups. One new genus is proposed, *Potamoganos*, based on *Bignonia microcalyx* G. F. W. Mey.

Revision of the Lauraceae. II. The genera *Endlicheria*, *Cryptocarya* (American species) and *Licaria*. By A. J. G. H. Kostermans. *Recueil Trav. Bot. Néerlandais* 34: 500–609; figs. 1–5; November 1937.

As treated here, *Endlicheria* consists of 39 species, chiefly South American. New species are *E. Cocuirey* (Peru; local name Hioma Cocuir-ey), *E. gracilis* (Colombia), *E. metallica* (Amazonas, Brazil), *E. acuminata* (Amazonas, Brazil), *E. boliviensis* (Bolivia), *E. Poeppigii* (Peru), *E. debilis* (Peru). *Cryptocarya* is represented in America by 6 species, all South American.

Licaria Aubl. includes *Acrodiclidium* Nees, *Evonymodaphne* Nees, *Misanteca* Cham. & Schl., *Symphysodaphne* A. Rich., *Nobeliodendron* O. C. Schmidt, and *Chanekia* Lundell. Of 42 species recognized there are described as new *L. Quirirafuina* (Peru; local name Efuina Quirirafuina), *L. Cufodontisii* (Costa Rica), *L. excelsa* (Panama), *L. tenuifolia* (Colombia). Numerous new names are published in the three genera, and many vernacular names are listed. The genus *Dryadodaphne* Spencer Moore, placed by its author in Lauraceae, is referable to Monimiaceae, and synonymous with *Levieria*.—P. C. STANDLEY.

New plants mainly from western South America. By ELLSWORTH P. KILLIP. *Journ. Wash. Acad. Sci.* 26: 358–361; Sept. 15, 1936.

New species of trees are *Piratinera mollis* (Colombia) and *Inga caudata* (Amazonas, Brazil).

Meliaceae americanae novae. By H. HARMS. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 501–507; June 30, 1937.

From Brazil are described *Cabralea cauliflora, C. floribunda, C. macrantha, Trichilia Bradei, Guarea Borisii, G. cinnamomea, G. jatuaranana, G. rhabdotocarpa;* from Peru *Guarea leticiana* and *G. subsetulosa. Urbaneoguarea* is a new genus, based upon *Guarea sphenophylla* Urban of the Dominican Republic.

Rotenone-yielding plants of South America. By B. A. KRUKOFF and A. C. SMITH. *American Journal of Botany* 24: 9: 573–587; November 1937.

Ten species of South American rotenone-yielding plants are discussed in detail with reference to local names, distribution, economic importance, and specimens studied. Descriptions and comparisons of foliage are sufficiently complete to permit identification of sterile material. Notes of use to field workers are incorporated. Most of the species concerned are members of the leguminous genus *Lonchocarpus*, series *Fasciculati*, but *Derris amazonica* also is discussed. New species are *Lonchocarpus sylvestris* A. C. Smith (Amazonian Brazil and Peru; local names Timborana, Timbo, Timoata, Sacha Barbasco, Barbasco del Monte), *L. Martynii* A. C. Smith (British Guiana; White Haiari, A-ya), *L. utilis* A. C. Smith (Amazonian Peru, Ecuador, Brazil; Barbasco, Timu-ambi, Timu, Barbasco, Cube, C. de Almidón, Coñapi, Pacai, Timbo, T. Urubu, T. Verdadeiro, T. Macaquinho, T. Legitimo).—P. C. STANDLEY.

Wood anatomy of certain South American rotenone-yielding plants. By A. J. PANSHIN. *American Journal of Botany* 24: 9: 587–591; 10 figs.; November 1937.

Results of a companion study to that of Krukoff and Smith described above. "A critical analysis of data indicates a striking similarity in so far as the structure of xylem of the species described in this paper is concerned. The anatomical variations recorded were mostly those of size and frequency of different types of wood elements. However, these variations were in many cases no greater than those found in the sections of stem and root taken from different parts of the same plant. Since the number of specimens available from different plants of each species was in some cases small, it is impossible at this writing to ascertain whether the variations in size and number of xylem elements are sufficiently constant to provide a reliable means of separation for these closely allied species. The differences in color of root wood in some cases appear to be constant enough to be of aid in the field identification of these plants." *From author's summary.*

Su alcuni legnami brasiliani. By A. DE PHILIPPIS. *L'Alpe* (Milan) 24: 7: 268–276; 7 figs.

Contains descriptions, with photomicrographs, of eight Brazilian woods known under the generic common name of Araribá.

Resenha historica para a commemoração do vigesimo anniversario da Secção de Botanico e Agronomia annexa ao Instituto Biologica de São Paulo. By F. C. HOEHNE. Pub. by Secretaria da Agr., Ind. & Com., São Paulo, Brazil, April 1937. Pp. 166: 6½ x 9.

Contains a history of the Section and an account of the organization, research and publication, library and herbarium,

program for education and conservation, and a bibliography of plant descriptions and other papers by the author, who is Chief of the Scientific Service of the Section.

Resultados obtidos para algumas madeiras nacionaes. Pub. by Instituto de Pesquisas Technologicas, São Paulo, Brazil, 1937. P. 1; 21 x 21.

This table gives the results of tests on the physical and mechanical properties of timber specimens from 100 trees, representing 68 native species and 22 planted species (*Eucalyptus*), arranged in descending order of their sp. gr. (15 per cent moisture). The methods used are described in "Estudo dos caractéres physicos e mecanicos das madeiras," Bull. No. 8, Laboratorio de Ensaio de Materiaes, Escola Polytechnica de São Paulo, 1932.

Arvores fructiferas nas mattas da zona cacaueira. By Gregorio Bondar. *Rodriguésia* (Rio de Janeiro) 2: 8: 51–53; illustrated; 1937.

An account of some of the Brazilian species of *Pourouma*, which are occasionally cultivated for their edible fruit. They are known by the vernacular name Tararanga.

Flora of Peru. By J. Francis Macbride. *Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 13: 6: 2: 265–491; Oct. 29, 1937.

This instalment of the Flora of Peru treats the families Plantaginaceae to Calyceraceae, inclusive. The Plantaginaceae are treated by R. Pilger, Caprifoliaceae and Valerianaceae by E. P. Killip, Campanulaceae (including Lobeliaceae) by F. E. Wimmer. The majority of the species treated are herbaceous plants.

Neue andine Melastomataceen. II. By Fr. Markgraf. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 459–464; June 30, 1937.

New species are published from Andean South America in *Brachyotum*, *Meriania*, *Graffenrieda*, *Ossaea*, *Blakea*, and *Leandra*.

Die Formenkreis von *Aspidosperma quebracho-blanco* Schltd. By Fr. Markgraf. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 464–467; June 30, 1937.

A key is given for separation of *Aspidosperma quebracho-blanco* Schltd. and *A. horco-kebracho* Speg. Of the former, known in Argentina by the names Horco Quebracho and Quebrachillo Blanco, three forms are recognized, based upon fruit characters.

Los árboles indigenas de importancia económica del departamento de Resistencia (Chaco). By Teodoro Meyer. *Revista Argentina de Agronomía* (Buenos Aires) 4: 3: 153–167; September 1937.

An annotated list of 34 species of 16 families which are of greatest local importance for their timber.

Las puntuaciones orladas de *Cercidium praecox*. By Lucas A. Tortorelli and Carlos O'Donnell. *Revista Argentina de Agronomía* 4: 3: 197–201; 2 figs.; September 1937.

A description of the wood of *Cercidium praecox* (Ruiz & Pav.) Harms, a shrub or small tree known locally as Brea, with particular reference to the vestured pits of the vessels.

Revision of the Hawaiian species of *Euphorbia* L. By Earl Edward Sherff. *Ann. Mo. Bot. Gard.* (St. Louis) 25: 1–94; pls. 2–11; Dec. 27, 1937.

Euphorbia is represented in the Hawaiian Islands by 21 species, 18 of which belong to the section *Anisophyllum*, the majority of them endemic. Several species are shrubs or small or medium-sized trees.

Deuxieme note sur quelques plants des îlots de la mer de Chine. By F. Gagnepain. *Notulae Syst.* (Paris) 6: 35–36; map; June 1937.

A brief list of plants collected on the Paracels and other small islands of the Sea of China. There are listed 18 species, some of which are woody plants.

Deux Dilleniacées nouvelles d'Indochine. By F. GAGNEPAIN. *Notulae Syst.* (Paris) 6: 39–40; June 1937.

Dillenia Harmandii and *Tetracera kampotensis* are described from Laos and Cambodge.

Araliaceae Petelotianae. By H. HARMS. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 448–455; June 30, 1937.

From Indo-China new species are described in *Schefflera*, *Gilibertia*, and *Brassaiopsis*.

Contributions to the flora of Siam: Additamentum XLIV. *Kew Bull. Misc. Inf.* 7: 371–392; 1937.

New species are described by Fletcher in the genera *Planchonella*, *Palaquium*, *Madhuca*, *Diploknema*, *Payena*, *Sarcosperma*, *Huodendron*, *Ardisia*, and *Diospyros*.

Contributions to the flora of Burma. XIII. *Kew Bull. Misc. Inf.* 8: 436–440; 1937.

Among new species of woody plants described by C. E. C. Fischer are *Artabotrys multiflorus*, *Sloanea Parkinsonii*, *Symplocos Pochinii*, *Machilus shweliensis*, var. *Myai* (local name Saman Pun Ko).

Further revision of Rutaceae-Aurantioidieae of India and Ceylon. (Revisio Aurantiacearum. VIII.) By TYÔZABURÔ TANAKA. *Journ. Indian Bot. Soc.* (Madras) 16: 227–240; August 1937.

The author visited India and Ceylon in 1935 and 1936 to investigate the Rutaceae-Aurantioidieae, and also studied about 4650 herbarium sheets in 12 herbaria. The present paper presents some of the results of these investigations of the citrus group. New species and varieties are published in the genera *Glycosmis* and *Citrus*.

Timber tests: Meranti damar hitam (*Shorea resina-negra* Foxw.). By F. S. WALKER. *The Malayan Forester* 6: 4: 262–266; October 1937.

"The timber of *Shorea resina-negra* is relatively unimportant owing to its limited occurrence. It is little known on the local market because of the prejudice, encouraged by selective logging, against White Meranti. The absence of color is no doubt a real factor limiting its local popularity, but on account of the ease in working there should be no objection to the use of this timber for all structural purposes for which light Red Meranti is used. Sapwood must be rigorously excluded. Like all White Meranti the timber should be suitable for the purposes for which the Philippine White Lauan and Borneo White Seraya are used, *e.g.*, flooring, joinery, coachwork, parts of furniture, and decking. It would no doubt be as popular as other forms of White Meranti for the production of clean-looking plywood."

The genus *Neurocalyx* in Borneo. By H. K. AIRY-SHAW. *Kew Bull. Misc. Inf.* 5: 281–290; tabs. 1–2, pl. 9; 1937.

Neurocalyx (Rubiaceae) is a genus of shrubs represented in Borneo by 5 species, 2 of which are described as new.

Neue Palmen aus Neuguinea. V. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 468–475; June 30, 1937.

New species of palms are described from New Guinea in the genera *Ptychandra*, *Cyrtostachys*, and *Gronophyllum*.

Die Palmengattungen *Hydriastele* Wendl. und *Adelonenga* Becc. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 482–487; June 30, 1937.

Adelonenga is a synonym of *Hydriastele*. Seven species of the latter, one of them new, are recognized in Australia and New Guinea.

***Peekeliodendron*, eine neue Icacinaceengattung mit Schwimmfrüchten.** By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 509–512; June 30, 1937.

Peekeliodendron missionariorum is the type of a new genus of trees of the Icacinaceae. A short, detailed description is given of the wood anatomy.

The density of Australian timbers. Air-dry and green densities for a number of species. By W. L. GREENHILL. Reprinted from *Journ. of the Council for Sci. & Ind. Research* 10: 3: 241–250; August 1937.

"In Tables 1 and 2, green and air-dry densities are given for a number of different species, the air-dry figures for both reconditioned and non-reconditioned material being included. In addition to these true densities, basic densities and green moisture contents are listed. The number of different trees and the total number of samples tested are recorded in order to indicate the range of material. The results given in Table 1 are for [85] species of which at least eight samples have been tested, and the range within which 95 per cent of the material will fall has been estimated from standard deviations. The results given in Table 2 are based on a smaller range of material, and no attempt has been made, with such a limited number of samples, to estimate the range of values likely to be met in these [113] species."

Properties of Australian timbers. Part 2. Brown mallet (*Eucalyptus astringens*). By IAN LANGLANDS. Pamphlet 73, Council for Sci. & Ind. Research, Melbourne, 1937. Pp. 20; 6 x 9½; 4 plates.

"Brown Mallet has in the past been exploited entirely for its bark, which is one of the richest in tan among the raw materials used in the tanning industry. Reckless exploitation would have resulted in the practical extinction of this valuable bark within very few years, had not the Western Australian Forests Department begun its extensive planting operations in 1929. These plantations will ensure regular and continuous supplies in the future, and will no doubt lead to an increase in the demand for local and overseas use.

"It seemed desirable to find use for the timber, which up to now has not been utilized. Preliminary tests having indicated that it possesses some valuable properties, especially in toughness and bending, the tests described in this pamphlet were, therefore, carried out; the results show that the timber has definite possibilities. It is very interesting, in particular, to note the low shrinkage for such a dense timber, which will greatly assist in its utilization by reducing to a minimum defects due to seasoning. Its freedom from attack by Lyctus is another valuable property disclosed."—*From Foreword by* I. H. BOAS.

Contribution a l'étude des Euphorbiacées de Madagascar. By J. LEANDRI. *Notulae Syst.* (Paris) 6: 11–35; ill.; June 1937.

A key is given to the 15 genera of Euphorbiaceae of Madagascar, and the genera are discussed, with keys to the species and citation of collections, sometimes with vernacular names. New ligneous plants are *Thecacoris Perrieri*, *Glochidion lichenisilvae*, *Securinega Perrieri*.

Sur un *Brachylaena* nouveau exploité comme santal de Madagascar. By HENRI HUMBERT. *Bull. Soc. Bot. France* (Paris) 84: 203–209; 1 fig.; 1937.

Brachylaena microphylla (Compositae), a new species from southwestern Madagascar, known by the indigenous name Kilango, is a small tree whose fragrant wood has been exported clandestinely under the name Santal de Madagascar. The latter name is given also to *Santalina madagascariensis* (Rubiaceae), whose wood, known locally as Masonjoana, is exported to India, where it is used as incense in funeral ceremonies of certain religious sects, being sold at a high price. The wood of *B. microphylla* is said to be similar to that of the Madagascar *B. Merana* (vernacular name Merana), which is heavy (density about 1.1), fine-textured and uniform, easy to work, incorruptible, and useful for carpentry as well as railway crossties, etc. (See *Rev. Bot. Appl. et Agr. Trop.* 10: 590; 1930.)—P. C. STANDLEY.

A note on the South African species of *Ximenia* Linn. and their possible economic uses. By H. G. SCHWEICKERDT. *Bothalia* (Pretoria) 3: 179–182; 3 figs.; January 1937.

Recent interest in seeds of *Ximenia* as a source of oil have led the author to investigate classification of the South African species. Although the number of species is still somewhat uncertain, it is suggested, on the basis of structure of the in-

florescence, that the material be referred to two species and one variety.

A new species of *Pachystigma* Hochst. from Transvaal. By W. Robyns. *Bothalia* 3: 183–184; January 1937.

P. triflorum, a tree of 5 meters, is described as new from North Transvaal.

A revision of the South African species of *Brachylaena* R. Brown. By E. P. Phillips. *Bothalia* 3: 205–221; ill.; January 1937.

The genus *Brachylaena* (Compositae) consists of shrubs or trees. The nine species of South Africa are treated in detail, a map showing the distribution of each. *B. transvaalensis* Phillips & Schweickerdt, described as new, is a tree of 70 ft. with a bole up to three ft. in diameter; wood strong, elastic, durable in the ground; much used by natives for assegai handles; local names Vaalvos and M'pata.

An enumeration of plants collected in the Northern Transvaal. By A. A. Obermeyer, H. G. Schweickerdt, and I. C. Verdoorn. *Bothalia* 3: 223–258; map; January 1937.

A systematic list of plants collected by the authors in Northern Transvaal. Notes accompany many of the citations, and new species of woody plants are described in the genera *Crotalaria*, *Grewia*, and *Salvadora*.

The seed-drift of South Africa and some influences of ocean currents on the strand vegetation. By John Muir. Union of S. Africa, Dept. Agr. and Forestry, *Bot. Surv. Memoir* (Pretoria) 16; 1–108; ill.; 1937.

A detailed report upon seeds and other plant parts found in drift along the coast of South Africa, with suggestions as to its source, and the part played by drift seeds in the composition of strand vegetation. Strand vegetation along the tropical African coast from which the South African drift is probably derived is described, and there is a systematic list of strand plants of South Africa. The numerous illustrations of seeds

will be helpful for determination of such material collected also in other parts of the earth. The paper is an important and exceptionally interesting one, because of the interpretations by the author, and the long bibliography supplied. — P. C. Standley.

The taxonomic position of *Rhynchocalyx*. By T. A. Sprague and C. R. Metcalfe. *Kew Bull. Misc. Inf.* 7: 392–394; 1937.

The genus *Rhynchocalyx* was described by Oliver as a member of the Lythraceae, but was excluded from that family by Koehne in his monograph in the Pflanzenreich. Study of the plant by the present authors shows that it is properly referable to the Lythraceae, and is related to *Lawsonia*. It is native of Natal.

Notes on the flora of southern Africa. VII. By I. C. Verdoorn and H. G. Schweickherdt. *Kew Bull. Misc. Inf.* 9: 445–447; 1937.

Acacia barbertonensis Schweick. is described as new from Transvaal and Natal. The native name Lubibi is reported from Transvaal.

The savannah and mountain forests of South Karamoja, Uganda. By W. J. Eggeling. Imperial Forestry Institute Paper No. 11. Mimeographed. Pp. 14; 6 plates. Oxford, 1938. Price 2s 6d.

"This paper is based on observations made in South Karamoja in 1936 with a view to reporting on the distribution, character and composition of forests and savannah. . . . The possibilities of gum-tapping are discussed in an appendix. The photographs are by the author."

Beiträge zur Kenntnis der Tiliaceae. VI. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 487–489; June 30, 1937.

New species are *Grewia isochroa* (German East Africa) and *G. Chuniana* (Hainan, China).

Tropical African plants. XVI. By J. HUTCHINSON and J. M. DALZIEL. *Kew Bull. Misc. Inf.* 6: 333–341; 1937.

Latin diagnoses of species that were described in English only in the *Flora of West Tropical Africa*. Woody plants are represented by the genera *Strychnos*, *Olea*, *Schrebera*, *Clitandra*, *Carpodinus*, *Alstonia*, *Holalafia*, and *Baissea*.

Tropical African plants. XVII. *Kew Bull. Misc. Inf.* 8: 411–432; 1937.

Descriptions of new species, among which are *Cistanthera parvifolia* Moss (Kenya Colony; local names Mrunza, Papan, Muheru), *Teclea villosa* Taylor (Kenya Colony; Munderendu), *Canthium Tophami* Bullock & Dunkley (Nyasaland; mGalamasi), *Lasianthus seseensis* Taylor (Uganda).

Contributions a l'étude du genre *Pavetta*. Description de quatre espèces nouvelles du Congo Belge. By C. E. B. BREMEKAMP. *Bull. Jard. Bot. Brux.* (Bruxelles) 14: 305–311; 1937.

Four new species of *Pavetta* are described from Belgian Congo.

***Gymnostemon* A. et P., genre nouveau de la Côte d'Ivoire, voisin d'un endémique de Madagascar.** By A. AUBRÉVILLE and FR. PELLEGRIN. *Bull. Soc. Bot. France* (Paris) 84: 181–184; 1 fig.; 1937.

Gymnostemon Zaizou of Ivory Coast is the type of a new genus of Simarubaceae, related to *Perriera*. It is a tree, with the vernacular names Zaizou, Zalé, and Gouatoué.

The genus *Octolobus* Welw. By J. HUTCHINSON. *Kew Bull. Misc. Inf.* 7: 394–396; 1937.

Octolobus, of the Sterculiaceae, a group of small trees of West Africa, consists of four species, of which *O. angustatus* is described as new from Gold Coast. Its local names are Afinafi and Kobina-nua. The wood is hard, heavy, and yellow.

New trees and shrubs from tropical Africa. V. By H. DUNKLEY. *Kew Bull. Misc. Inf.* 9: 466–471; 1937.

New species, from Nyasaland unless otherwise indicated, are *Rinorea Burtt-Davyi*, *R. myrsinifolia* (local name Ngalango), *Garcinia mlanjiensis* (mTundiri, mSongwe), *Cleistanthus Milleri* (Northern Rhodesia; muSamvia), *Drypetes zombensis* (muNgunga), *Albizzia nyasica* (mPirakututu, mSilakukutu), *Lecanodiscus Vaughaniae* (Zanzibar), *Bersama zombensis* (mChinji; "good timber"), *Lannea Stuhlmannii*, var. *tomentosa* (Northern Rhodesia; muOnga, muBumbu), *Solanum Burtt-Davyi*.—P. C. STANDLEY.

A list of plants used in native medicine in Nigeria. By J. R. AINSLIE. Imperial Forestry Institute Paper No. 7. Mimeographed. Pp. 108; including indexes. Oxford, 1937. Price 5s.

An annotated list of medicinal plants, wild and cultivated, arranged alphabetically by genera, with one index to the diseases and treatments, another to the vernacular names of the species.

Three Nigerian timbers. Reprinted from *Wood* (London) December 1936, and issued by the Office of the Chief Conservator of Forests, Nigeria. Pp. 8; 9 x 12; 3 plates in color.

The timbers described and illustrated are African Whitewood (Obeche), *Triplochiton scleroxylon;* Agba, *Gossweilerodendron balsamiferum;* Opepe, *Sarcocephalus Diderrichii*.

Beschreibung tropischer Hölzer aus dem Urwalde Kameruns. By F. JENTSCH, E. APPEL, and E. SCHMIDT. *Zeitschrift für Weltforstwirtschaft* 4: 1: 37–45; 19 figs; October 1936; 4: 8: 515–524; 20 figs; May 1937.

The trees and woods described and illustrated are *Anantia chlorantha* Oliv., *Alstonia congensis* Engl., *Kickxia elastica* Preuss. (=*Funtumia elastica* Stapf), *Rauwolfia macrophylla* DC.; *Copaifera Tessmannii* Harms, *Daniella oblonga* Oliv. (=*D. Klainei* Pierre), *Oxystigma Mannii* Harms, and *Distemonanthus Benthamianus* Baill. The wood known to the trade as Bubinga is identified with *Copaifera Tessmannii* Harms. (For reference to earlier descriptions in this series see *Tropical Woods* 50: 53.)

Plantes ichthyotoxiques des colonies françaises contenant du roténone ou présumées en contenir. By AUG. CHEVALIER. *Rev. Bot. Appliquée & Agr. Tropicale* (Paris) 17: 565–586; 1937.

An account of various species of 10 or 12 genera of leguminous plants with reference to rotenone, an extract of value as an insecticide for agricultural crops.

Entstehungsursachen und Wirkung des Druck- und Zugholzes der Bäume. By E. MÜNCH. *Fortliche Wochenschrift Silva* 25: 44: 337–341; 25: 45: 345–350; 10 text figs., Oct. 29 and Nov. 5, 1937.

Results of a study of compression wood in conifers and tension wood in dicotyledons with reference to occurrence, characteristics, and probable causes.

A note on the meaning of the terms early wood and late wood. By L. CHALK. *Proc. Leeds Phil. Soc.* 3: 5: 325–6; 1937.

"It is suggested that the late or summer wood of ring-porous species is the equivalent of the whole ring in diffuse-porous species, and that the pore zone represents an additional, highly specialized tissue.

"The term early wood should imply early development in relation to the foliage and be limited to softwoods and ring-porous hardwoods."

The wood anatomy of the family Sterculiaceae. By M. M. CHATTAWAY. *Phil. Trans. Royal Soc. London* (Ser. B) 228: 554; 313–365; 3 pls., 34 text figs.; Nov. 22, 1937.

"The Sterculiaceae must be considered a rather advanced family; the genera all have storied structure, vessel members less than 550μ long, simple horizontal perforation plates, and alternate pitting.

"The vessels vary from narrow to wide in the different genera, and vessel diameter appears to have little systematic significance. A positive relation was observed between diameter and vessel-member length, but there is no relation between vessel-member length and vessel distribution.

"The size and frequency of the intervascular pitting is constant throughout each genus, with the exception of *Sterculia*, and the genera with the longest vessel members have the largest pits. Large simple pits between vessels and parenchyma cells, that occur in *Brachychiton* and *Sterculia* species, have been studied in detail.

"The fibres are libriform and non-septate throughout the family, except for the crystalliferous fibres in *Eribroma* and *Sterculia* species. There is a negative relation between vessel-member length and the relative amount the fibres have extended during differentiation, the greatest relative extension occurring in the woods with the shortest vessel members.

"The different forms of parenchyma are discussed, and the anatomical characters of the cells. The most advanced type of parenchyma in the family appears to be broad bands that include both metatracheal and paratracheal parenchyma. This form appears to represent the ultimate stage of two separate lines of development, one represented by the series diffuse—narrow metatracheal lines—broad metatracheal bands, and the other by the series vasicentric—aliform—confluent.

"The rays show very little difference in type throughout the family, and cannot be used, except in the case of *Heritiera*, to separate the genera, but sheath cells are slightly more regular in the woods with the longest vessel members and narrow lines of parenchyma, than in those with shorter vessel members and broad bands of parenchyma. The occurrence and development of sheath cells and the increase in the number of rays by splitting up of the larger rays has been studied in detail.

"Crystals are of frequent occurrence throughout the family, and appear to have little phylogenetic significance; they are, however, useful diagnostic features. Chambered parenchyma and crystalliferous fibres have been studied in *Eribroma* and *Sterculia* species.

"The taxonomic position of the genera is discussed and the following changes in classification suggested: *Sterculia pallens* Wall. to be transferred to *Firmiana; Brachychiton* and *Eribroma* again to be sunk in *Sterculia;* and the genus *Sterculia* to be subdivided into two subgenera."—*Author's summary.*

Forest bibliography to 31st December 1933. Parts I and II. Compiled and published by the Department of Forestry, Univ. of Oxford. Pp. 1–78 and 79–199; 7¼ x 9¾; Oxford, 1936 and 1937. Price (1) 5s; (2) 12s 6d.

"The systematic referencing of current forest literature was begun by the Oxford School of Forestry in 1920, and continued jointly by it and by the Imperial Forestry Institute after the establishment of the latter in 1924. At the outset the sole object of this work was to provide the staff and students with facilities for keeping in touch with the latest literature bearing on forestry, for which purpose a simple system of classification was devised.

"The work continued on this understanding for several years, during which there was never any intention of publishing the bibliography which was accumulating. More recently, however, in response to requests from various sources, it has been decided to publish the results as they stand and so make them available for general use. In consequence of this decision, it is now proposed to publish this bibliography in several parts, of which the present is the first. The bibliography comprises literature published to the end of 1933, and contained in the library of the Department of Forestry. Everything published on and after the 1st January, 1934, will be referenced under the decimal system of classification prepared by Dr. Flury and recently adopted by the International Union of Forest Research Organizations. The collating of this bibliographical system with the decimal system of classification is shown on page 1.

"The present bibliography comprises a fairly complete list of papers, bulletins and other matter published in English and a considerable amount of literature published in French and German. Few publications in other languages are represented unless they contain summaries in English, French or German. This literature is grouped under two heads (1) periodicals, (2) other publications. Books, and unpublished and confidential matter, are not included."—*From preface to Part I.*

The contents of the two parts are under the following headings: A. General forestry (by countries). B. Silviculture: General; Seed and seedlings; Natural reproduction; Artificial reproduction; Tending; Silvicultural systems; Notes on trees.

M.M.C

M. M. Chattaway

Price 35 cents

Yale University School of Forestry

TROPICAL WOODS

NUMBER 54 JUNE 1, 1938

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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, *Professor of Forest Products, Yale University.*

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NOTES ON THE PURPLEHEART TREES (*PELTOGYNE* VOG.) OF BRAZILIAN AMAZONIA

By ADOLPHO DUCKE

Jardim Botanico do Rio de Janeiro

The genus *Peltogyne* occupies an important place among the Amazonian hylaea trees on account of the number of its species, the frequence and often also the large size of the individuals, and the beautiful heartwood, which generally becomes purple or violet on exposure. Its geographical area covers a large part of tropical America, from Mexico (Acapulco) to Southern Brazil (São Paulo), but the center of distribution lies in Amazonia, principally in the middle northern part of this region, as in the case of many other caesalpinioid genera. Here, in the Brazilian part of the Rio Negro basin (with the Rio Branco), I found no less than nine species, while along the whole Amazon River, from Pará to Peru, only seven species have hitherto been observed. Ten species are known in the State of Amazonas, five in the State of Pará.

The type specimens of the species I have hitherto described are preserved in the Jardim Botanico do Rio de Janeiro. Cotypes have been largely distributed to the principal botanical institutions of America and Europe. Wood samples with herbarium material of eight species and one variety have been sent to Yale University School of Forestry.

Synoptical Key to the Species

Pod dehiscent, bivalvate, very oblique, rhomboidal or nearly triangular; the inferior suture widely curved; the superior suture with a narrowly dilated but not distinctly winged margin near the apex. Calyx tube 2–4 mm. long. Inflorescences (in the Amazonian species) composing few dense pyramidal panicles.

Ovary hirsute. Calyx with short stipes.

Vegetative parts entirely glabrous. Leaflets always falcate and acuminate. Flowers small, with short ferruginous tomentum and relatively short stamens ..... 1. *P. paniculata.*

At least the young vegetative parts with some pilosity. Leaflets more frequently obtuse. Flowers a little larger, with longer, thicker and more silky whitish indumentum and longer stamens..... 2. *P. pubescens.*

Ovary glabrous. Calyx with elongate stipes. Flowers large (for this genus). Panicles on special branches which rise a few meters above the crown of the tree..... 3. *P. paradoxa.*

Pod indehiscent, obovate or nearly orbicular; the inferior suture almost semicircular; the superior suture narrowly but distinctly winged near the apex. (*P. altissima* and *P. gracilipes* included tentatively, as their pods are still unknown.)

Calyx tube very distinct, 2–5 mm. long.

Ovary glabrous. Stipes of the calyx 1.5–3 mm. long.

Leaflets coriaceous, short acuminate. Panicles short, densely flowered; bractlets glabrous; flowers of medium size..... 4. *P. campestris.*

Leaflets thinner-coriaceous, short acuminate. Panicles more often (in leafless trees) composing large spacious distich-ramified inflorescences; bractlets thin-silky; flowers of medium size..... 5. *P. catingae.*

Leaflets scarcely subcoriaceous, long acuminate. Panicles on leafless branches, united in large and densely flowered inflorescences; bractlets thin-silky, soon deciduous; flowers rather large.... 6. *P. altissima.*

Ovary hairy.

Stipes of the calyx very short, not over 2.5 mm. long. Petals more or less oblong-obovate or oblong-spatulate, about as long as the calyx, 2–3 mm. broad.

Leaflets scarcely medium-sized, coriaceous. Panicles more or less pyramidal, laxly composed of small but dense racemes; bractlets silky; flowers small, with glandular petals..... 7. *P. micrantha.*

Leaflets generally large, not or thin-coriaceous. Panicles dense, more or less cymose or shortly pyramidal; bractlets more or less silky; flowers of medium size or rather large, with glandular petals. 8. *P. densiflora.*

Leaflets large, rigid-coriaceous. Panicles on leafless branches, subcymose or subpyramidal, densely flowered, with ligneous rachis; bractlets glabrous; flowers rather large, with glandular petals. 9. *P. rigida.*

Stipes of the calyx longer (3–5 mm.). Petals linear-spatulate, longer than the calyx but scarcely up to 2 mm. broad. Panicles commonly on leafless branches, united in a large, irregularly elongated inflorescence.

Young twigs distinctly pubescent. Leaflets very small, hard-coriaceous. Petals not glandular..... 10. *P. excelsa.*

Vegetative parts completely glabrous. Leaflets thin-coriaceous. Petals abundantly glandular.

Leaflets small. Petals a little longer than the calyx, excessively narrow (scarcely up to 1 mm. broad)..... 11. *P. Lecointei.*

Leaflets large. Petals much longer than the calyx, not so narrow (1.5–2 mm. broad)..... 12. *P. maranbensis.*

Calyx tube very insignificant. Flowers small, in lateral panicles.

Leaflets large, hard and thick, moderately acuminate. Flowers with short and thick pedicel and hairy ovary..... 13. *P. floribunda* (?).

Leaflets small, thin-coriaceous, rather long acuminate. Flowers with filiform pedicel and glabrous ovary..... 14. *P. gracilipes.*

1. P. PANICULATA Benth.—Widely distributed through Amazonia and Guiana. It seems to occur in at least two local forms. I have not seen the type collected by Schomburgk at the Rio Negro, but I compared authentic specimens cited in Bentham's monograph (Spruce 1959). I gathered similar material from two trees in the same region, above Massaraby (H. J. B. R. 23272) and near Santa Izabel (H. J. B. R. 35099, with wood sample 307; Yale 33834); the stems of both have grayish, roughened bark and brown heartwood (perhaps changing in color after a long time); some of their leaflets show

traces of a whitish substance which also appears in Spruce's specimens and which is identical with the thicker wax-like covering observed on the leaflets of *P. paradoxa*. These moderately high trees grew on the shore of the Rio Negro and in moist places of the upland forest.

The trees of the lower and the middle Amazon seem to be a local form of this species. The bark of the trunk is smooth and ferruginous, and the brown heartwood quickly changes on exposure to a pretty red-brown and eventually to brown-purple. This form grows in the upland rain forest where the trees reach a height of 30 m., sometimes 40 m. I found it in the middle courses of Xingú, Tapajoz (Herb. Amaz. Mus. Pará 16406), Jamundá (H. A. M. P. 11769) and Purús (H. J. B. R. 23845, and Ducke 11b; Yale cf. 20692), and along the lower Amazon near Obidos (H. A. M. P. 16816), Juruty Velho (H. J. B. R. 20303), Parintins (H. J. B. R. 23843, and Ducke 11a in Yale), and Manáos (H. J. B. R. 20302, and wood sample 11; Yale 20692). The vernacular names are PÁO FERRO, CORACY, and COATAQUIÇÁUA.

2. P. PUBESCENS Benth.—I have not seen the type collected by Schomburgk in the woods of the campos region of the Rio Branco, but I compared botanical material gathered in the same region by Ule, Kuhlmann (H. J. B. R. 3223), and myself (Caracarahy, 23844; Boa Vista, 35096). The always small trees are frequent in the campos regions, in the narrow forest fringe along the rivers, on less inundable places. I cannot find any constant morphological character to separate this species from *P. paniculata*, but the heartwood of *P. pubescens*, brown when cut, changes rapidly on exposure to a bright violet; because of that, the vernacular name is PÁO ROXO. The bark of the stem is grayish and not smooth.

3. P. PARADOXA Ducke, Arch. Jard. Bot. Rio 3: 95 (1922). —Hill forest in the campos regions north of the eastern part of the lower Amazon, from Monte Alegro to Macapá; very well known, on account of its strange aspect, under the vernacular name of COATAQUIÇÁUA (monkey-hammock). A rather high tree with slender stem, smooth ferruginous bark, and dark grayish violet heartwood.

4. P. CAMPESTRIS Ducke, Arch. Jard. Bot. Rio 1: 24 (1915),

3: 96 (1922).—A small tree, only known from two "campinas" (white sandy places with shrubby vegetation) situated near the lake of Faro and the Rio Trombetas, State of Pará. Heartwood dark violet.

5. P. CATINGAE Ducke, Tropical Woods 31: 13 (1932).— A medium-sized or rather large tree of the "catinga" of the upper Rio Negro and its affluent Curicuriary, in the cataract regions. Heartwood of a magnificent saturate violet-purple (wood sample, with herbarium material, 63; Yale 21007). Vernacular name: PÁO ROXO DA CATINGA.

6. P. ALTISSIMA Ducke, Bull. Mus. Paris 2: 4: 726 (1932).— A big tree, apparently 45–50 m. high, with robust cylindrical stem, smooth, ferruginous bark, and bright violet heartwood. Upland rain forest near São Paulo de Olivença, Rio Solimões, western part of the State of Amazonas.

7. P. MICRANTHA Ducke, Arch. Inst. Biol. Veget. 2: 39 (1935).—Small or medium-sized tree, frequent on the inundable banks of black-water streams in the upper Rio Negro region (lower Uaupés and Rio Curicuriary). Wood sample (162; Yale 22622) from the type tree (H. J. B. R. 23850) conserves its brown color, but others, cut from trees of the same species and locality, changed their color, after short exposure, to violet.

8. P. DENSIFLORA Spr. ex Benth.—The most common species in the eastern half of Amazonia, generally low and tortuous but sometimes rather tall, with heartwood becoming deep purple-violet on exposure; furnishes most of the Páo Roxo of the timber trade of Pará. This species is typical of the "igapó" and flooded banks of lakes and rivers that have little sediment in their water, and never occurs in true upland forest. It is actually known, with certainty, from the coastal zone of the hylaea westward to the Rio Madeira (as far as Matto Grosso) and the Rio Negro. (Wood sample, with herbarium material, 1; Yale 20682.)

9. P. RIGIDA Ducke, Tropical Woods 31: 13 (1932).—A medium-sized or rather large tree of swampy but not inundable places in the upland forest, rarely on the shores of the Rio Negro, around Manáos. Heartwood dark brown-violet after short exposure (wood sample 80, with herbarium material

of the type tree; Yale 21339). Some herbarium samples (H. J. B. R. 23274) have been erroneously determined and distributed as *P. densiflora*.

10. P. EXCELSA Ducke, Tropical Woods 31: 12 (1932).—One of the biggest trees of the upland rain forest below the cataracts of Camanáos, Rio Negro. Heartwood (on exposure) of a very beautiful and persistent bright violet (wood sample 62, with herbarium material from the type tree; Yale 21006). Vernacular name: PÁO ROXO DA TERRA FIRME.

11. P. LECOINTEI Ducke, Arch. Jard. Bot. Rio 3: 96 (1922).—Large upland forest tree with beautiful heartwood like that of *P. excelsa*. Obidos and Rio Tapajoz (State of Pará). Furnishes the highly esteemed PÁO ROXO DA TERRA FIRME of the timber merchants of Pará.

12. P. MARANHENSIS Huber ex Ducke, Arch. Jard. Bot. Rio 1: 25 (1915).—The type comes from Pedreiras, Rio Mearim, State of Maranhão. I recently gathered similar specimens in the upland forest near the Rio Novo, tributary of the Rio Jamary, basin of the Rio Madeira in the extreme northwestern part of Matto Grosso (H. J. B. R. 35097). It is a big tree (about 40 m.) with bright violet heartwood like that of the two preceding species and likewise named PÁO ROXO DA TERRA FIRME. (Wood sample, with herbarium material, 279; Yale 33806.)

13. P. FLORIBUNDA (H. B. K.) Benth.—I doubtfully identify with this species (described from the lower Orinoco) the Páo Roxo gathered by Kuhlmann on Serra da Cigana near Boa Vista, upper Rio Branco (H. J. B. R. 3860). The heartwood is dark violet.

14. **Peltogyne gracilipes** Ducke, sp. nov.—Arbor excelsa cortice brunneo-cinereo ligno interiore brunneo demum pulchre et saturate purpureo-violaceo, ramulis saepe lenticellosis, partibus vegetativis omnibus glabris. Foliola sat breviter petiolulata, 40–70 mm. longa, 15–30 mm. lata, falcato-oblonga, basi valde inaequilatera, apice mediocriter vel sat longe acuminata, tenuiter coriacea utrinque sat nitida et venulosa. Racemuli in paniculam divaricatam floribundam folia non multo excedentem dispositi, rhachidibus canopubescentibus, bracteis et bracteolis caducissimis non visis,

pedicellis filiformibus gracilibus 3–5 mm. longis, cano-pubescentibus, infra medium articulatis. Flores aperti albi, odorati; calix tubo discifero brevissimo, limbi segmentis 3–4 mm. longis ovatis extus tenuiter cano-sericeis; petala calicem parum excedentia ovali-oblonga, glandulosa; stamina petalis duplo longiora, glabra; ovarium breviter stipitatum, glabrum. Legumen ignotum.

Frequens in silva radicibus montium Serra Grande, in regione fluminis Rio Branco, Brasiliae civitate Amazonas, leg. A. Ducke 1–7–1937, Herb. Jard. Bot. Rio 35151, Ducke 518 et cum Iglino 331 (Yale 34095). Nomen vulgare: PÁO ROXO.

This new species cannot be mistaken for any other. It is one of the most frequent and largest trees in the forests which cover the lower slopes of the Serra Grande and the adjacent hills. The wood is one of the most beautiful of the genus.

THE AMERICAN WOODS OF THE FAMILY EUPHORBIACEAE

By SAMUEL J. RECORD

The Euphorbiaceae comprise about 285 genera and 7000 species of trees, shrubs, and herbaceous plants which are widely distributed over the world, though most abundant in the tropics. The outstanding product is Pará rubber, obtained from the latex of species of *Hevea*, especially *H. brasiliensis* (H. B. K.) Muell. Arg., now extensively cultivated in the Malayan Archipelago and to a less extent in other tropical countries. The latex of *Manihot Glaziovii* Muell. Arg. is the source of Ceará rubber, and the roots of *M. utilissima* Pohl supply a starchy substance for making cassava and tapioca. Castor oil is obtained from the seeds of *Ricinus communis* L., croton oil from species of *Croton* and *Jatropha*, and tung oil or Chinese wood oil from *Aleurites*. Various plants are sources of dyestuffs, poisons, resins, and ingredients of medicines, a few have edible fruits, and some are planted for decorative purposes. The woods are of comparatively little value.

Of the 57 woody genera in India, none produces first-class

timber, the best being *Bischofia javanica* Blume, which is widely distributed throughout the Indo-Malayan region. The most important tropical African member of the family is *Olfieldia africana* B. & H.f., a large tree with a very strong and durable wood generally known as African Oak, and formerly as African Teak because of its use as a substitute for Teak (*Tectona*) in ship construction.

There are about 65 arborescent genera in Latin America, but most of the trees are small, often scarcely more than shrubs. A few attain large dimensions, but their timber is of only local utility and almost wholly unknown to the export trade. *Hura crepitans* L. is one of the largest trees in the coastal region of Surinam, but persistent efforts for several years to market the timber in the United States, under the name of Rakuda, did not meet with success. From Cuba small logs of the attractively figured wood of *Gymnanthes lucida* Sw., known locally as Aite or Yaiti, are occasionally exported to New York and used for making fancy articles of turnery and backs of brushes and mirrors. The Walnut-like lumber of the Manchineel, *Hippomane Mancinella* L., is highly esteemed for furniture in Jamaica, but the supply is very limited. The reddish-brown timber of *Hieronyma alchorneoides* Fr. Allem. of South America is used locally for general and durable construction, but its appearance and technical properties are not of a high order. *Buxus*, the source of true Boxwood, formerly included with the Euphorbiaceae, has been made the type of a separate family, the Buxaceae. Woods somewhat resembling it in color, texture, and properties are to be found in the genera *Adelia*, *Bernardia*, *Lasiocroton*, *Leucocroton*, and *Securinega*, but the trees are too small to be important. The woods of *Cunuria*, *Glycydendron*, and *Bonania* appear to be excellent woods for furniture, but the trees are probably too scarce for commercial purposes. Some of the euphorbiaceous woods have exceptionally long fibers and presumably would be good for paper pulp, if available in sufficient quantity. Many species are soft-wooded and their timber, which would be suitable for boxboards, crating, and interior work if kiln dried promptly after cutting, is almost impossible to air-season in a humid climate without becoming badly stained or decayed.

From the foregoing statements it is obvious that the woods exhibit great diversity in appearance, properties, and structure. The following description applies particularly to American species. Heartwood variable in color, being clear yellow, or pale to dark brown or red, or light to dark olive; the darker kinds are usually dull, with an oily appearance. Sapwood may be sharply defined, or gradually merge in the heartwood, or apparently compose the whole stem. Odor and taste are absent or not distinctive in dry material. There is a wide range in density from light, soft, and spongy to very heavy, hard, and strong; in texture, from very fine to coarse; in working properties, from good to bad; in durability, from quickly perishable to highly resistant to decay.

Growth rings present or absent, frequently distinct. Pores variable in maximum size in different genera and specimens from minute to small (less than 100μ), medium-sized (100–200μ), large (over 200μ) to very large (over 300μ); very numerous to few; occurring singly, in small clusters, and in radial multiples or series, without definite pattern but with a more or less pronounced tendency to radial or diagonal arrangement of the solitary pores and groups; in some instances the pores at one or both ends of a series are considerably larger than the others. Vessels usually with simple perforations; scalariform plates characterize *Securinega neopeltandra* and sometimes occur in association with simple perforations, *e.g.*, *Drypetes*, *Hieronyma*, *Paradrypetes*, and *Securinega congesta;* spiral thickenings absent; intervascular pitting fine to coarse, typically alternate, but distinctly scalariform in *Cubanthus;* tyloses common, and in *Chaetocarpus*, *Cunuria*, *Pera*, and *Pogonophora* they are occasionally to predominantly sclerotic. Rays decidedly heterogeneous, with exception of *Celaenodendron*, *Hippomane*, *Hura*, and *Piranhea*, where they are nearly homogeneous; usually uniseriate or biseriate or occasionally triseriate, but maximum widths of 4, 6, or 8 cells are found in *Acalypha*, *Acidocroton*, *Hieronyma*, *Omphalea*, *Phyllanthus*, *Richeria*, and some specimens of *Aparisthmium* and *Securinega;* height usually less than 30 cells, but frequently up to 50; occasionally up to 100 or more in *Alchornea*, *Aparisthmium*, *Hieronyma*, *Phyllanthus*, *Sapium*,

and *Securinega;* cells with very thin to very thick walls, sometimes disjunctive (*e.g.*, *Lasiocroton*); crystals abundant in many genera, especially in those without crystalliferous parenchyma strands; ray-vessel pitting occasionally very fine (*e.g.*, *Amanoa*, *Celaenodendron*, *Drypetes*, *Savia*, and *Securinega neopeltandra*), frequently medium most often coarse to very coarse, tending to scalariform; some of the rays of *Anomalocalyx*, *Glycydendron*, *Hippomane*, and *Sebastiania pavoniana* contain small latex tubes. Wood parenchyma of three principal types; sparsely paratracheal in *Acalypha*, *Acidocroton*, *Phyllanthus*, and some species of *Securinega;* mostly metatracheal, diffuse or in short or anastomosing lines, usually 1 to 3 fiber-diameters apart, making a fine reticulum often barely distinct with lens in many genera; in numerous, often poorly defined, sometimes distinct, concentric lines or bands 1 to 3 pore-widths apart in many other genera; cells often sclerotic in *Chaetocarpus* and *Cunuria;* crystals abundant in many genera; pits to vessels often large and gash-like or elongated. Wood fibers with very thin to very thick walls, the latter typically gelatinous; rarely septate (*e.g.*, *Acalypha*); pits typically very small, with narrow, distinct to indistinct borders, or apparently simple, rarely rather large, with conspicuous borders (*e.g.*, *Hieronyma*). Ripple marks absent. Dum ducts absent, but radial channels, frequently large and suggesting decomposed leaf traces, observed in certain species of *Alchornea*, *Conceveibastrum*, *Croton*, *Euphorbia*, *Gavarretia*, *Mabea*, *Pera*, *Sapium*, and *Senefeldera*. Gum deposits common in all elements of the heartwood.

In summary, the outstanding features of most euphorbiaceous woods are as follows: Pores in multiples, with tendency to radial rows. Vessels with simple perforations and alternate pitting. Rays fine and inconspicuous, often uniseriate. Wood parenchyma reticulate or in concentric lines or bands, but rarely visible without lens and often difficult to see clearly with it. Wood fibers often very long, rarely septate, those with thick walls gelatinous, the pits minute, usually with small borders. Large radial channels present in several genera as in certain Apocynaceae. Crystals often abundant in either rays or wood parenchyma, occasionally in both. Ripple marks absent.

Acalypha, with about 430 species of trees, shrubs, or herbs, is widely distributed in the tropical and warmer regions of the world. The American trees are small or only medium-sized and are of no particular importance for their timber, which is yellowish or light brown and widely variable in density, from light and soft to moderately heavy and compact.

Pores very small, numerous, in short to long, sometimes doubled, radial series. Rays of two or three sizes, maximum width 5 cells, height 50 cells; pits to vessels moderately large, round to long oval. Wood parenchyma sparingly paratracheal, not visible with lens. Wood fibers septate; pits minute.

COMMON NAMES: Derrière gonflé, petit pompon (Haiti); chilibtux, hierba del cáncer (Mex.); chichicaste (Guat.); costilla de danto (Hond.); guasanillo, malva montañes, shuampa (Salv.); primavera (Nic.); salvia del monte (Col.); meona, tapacaminos (Venez.); chorão, rabo de macaco, tapiá-guassú (Braz.); canilla de venado (Ec.); pespita, yana ocuera, y. varilla (Peru).

Acidocroton, with 10 species of shrubs and trees, occurs in the West Indies. The wood is brownish, very heavy, hard, compact, and fine-textured.

Pores very numerous, small to minute, often in rather long radial series. Rays nearly all 3 to 5 cells wide and up to 50, rarely up to 100, cells high; crystals present; pits to vessels small, rounded. Wood parenchyma very sparingly paratracheal. Wood fibers with very thick gelatinous walls and minute pits. (*Material:* Yale 16262.)

COMMON NAMES: Diente de majá, rompe ropa (Cuba).

Actinostemon, with 34 species of trees and shrubs, occurs from the West Indies to southern South America. *A. lanceolatus* Sald. is said to be employed in Brazil for tool handles, interior work, and fuel. Recorded uses of other species are chiefly fuel and charcoal. The only specimen available is of *A. anisandrus* Pax (=*Dactylostemon anisandrus* Gris.) from Argentina. The wood is yellowish, fine-textured, and moderately hard.

Pores small, very numerous, mostly in radial multiples of 2 to 10. Rays uniseriate, occasionally biseriate, and less than 25 cells high; crystals present; pits moderately large, rounded. Wood parenchyma in concentric lines about 3 pore-widths apart, scarcely visible with lens. Wood fibers with moderately thick gelatinous walls and minute pits. (*Material:* Yale 32092, from Imp. For. Inst., Oxford.)

COMMON NAMES: Canella de veado, chifre de veado, laranjeira do matto (Braz.); larangeira do matto (Ur.).

Adelia, with 11 species of shrubs and small trees, often spiny, is distributed from Texas to Paraguay. The woods are yellow, fine-textured, and moderately to decidedly dense; that of *A. Ricinella* L. is of the Boxwood type. The structure is similar to that of *Lasiocroton*.

COMMON NAMES: Jiá, j. blanca, tarro de chivo (Cuba); escambrón, espinillo (P. R.); grenade marron (Haiti); chau, xtompac (Mex.); agajo, escambrón (Hond.); espino blanco, macagüite, tintorillo (Salv.); bagre (Col.); guayabo rosado, limoncillo, naranjillo, polegallo (Venez.); ñuatí-curuzú-morotí, tapiá-guazú-y (Arg.).

Alchornea, with about 60 species of trees and shrubs, is of pantropical distribution. The American trees are generally small, sometimes up to 65 feet high, with pale brown, light, soft, and perishable wood used locally to a limited extent for carpentry and crating.

Pores few to many, large to very large, mostly in radial multiples, sometimes in clusters. Rays mostly uniseriate, rarely biseriate, variable in height in different species, sometimes up to 100 cells; crystals present; pits to vessels very large. Wood parenchyma reticulate, barely visible with lens; pith flecks common. Wood fibers with thin walls and very small bordered pits. Radial channels present.

COMMON NAMES: Aguacatillo, baconá, chote (Cuba); dove wood (Jam.); achiotillo palo de catorro, yobillo (P.R.); bois crapaud, b. vache, grain d'or (Haiti); aguacatillo (Dom.R.); palo de puta, palo mujer (Mex.); canelito, cola de pava (Hond.); pochote, pochetón, tambor, tepeachote (Salv.); sauso or sauzo (Venez.); cassava wood (Br. G.); basra bèbè, kannekedie-ballie, kasaba hoedoe, kjeraporan, koereroe, mattoe groègroè, moetoesirian, naporan (Sur.); amor secco, boleiro, oeirana, tapiá, t. guassú, urucurana (Braz.); cocapano, mojaro, mojaris-caspi, yoco-chihua (Peru); mora blanca, guampita, tapiá-guazú-y (Arg.).

Alchorneopsis. There are two species of small trees, *A. portoricensis* Urb. in the West Indies, and *A. floribunda* (Benth.) Muell. Arg. in the Amazon basin. The pale brown wood is light, soft, woolly, and perishable.

Pores medium-sized, barely visible, few, in scattered radial multiples. Rays 1 to 3, occasionally 4, cells wide and up to 50 cells high; pits to vessels rather large, round, oval, or much elongated. Wood parenchyma rather finely reticulate; scarcely distinct with lens. Wood fibers with thin walls and numerous small but distinctly bordered pits.

COMMON NAMES: Palo de gallino (P.R.); atapilio, atapiripio, danlieba, gire-gire oemattoe, hegon bèbè, hororadihoro, ietoboro-balli, kanekediballi, kanoewaballi, kassabahoedoe, kassavehout, moe-toesirian, papantie-ie-apiesie, ware honne, wawa naton (Sur.).

Amanoa consists of nine known species of trees and shrubs, three of them African, five South American, and one in the Lesser Antilles. *A. grandiflora* Muell. Arg. of the Guianas also occurs in British Honduras where it grows in swamps and along streams, sometimes with a height of about 40 feet and a trunk diameter of 12 inches. The best known of the American species is *A. guianensis* Aubl., a medium-sized tree of the Guianas and Brazilian Amazon region, sometimes used locally for heavy and durable construction. The woods are reddish or purplish brown; moderately to very dense; difficult to work.

Pores medium-sized; not very numerous; mostly in short radial multiples. Rays uniseriate and biseriate, and up to 50 cells high; pits to vessels minute. Wood parenchyma abundantly reticulate, fairly distinct with lens; crystals present. Wood fibers with very thick gelatinous walls and minute pits.

COMMON NAMES: Konoliebie, kwatto mopierie, tapoeripa (Sur.).

Anomalocalyx, with a single species, *A. Uleanus* Ducke (=*Cunuria Uleana* Pax & Hoffm.), is a small to medium-sized tree of the central Amazon region. The wood is pale brown, of rather light weight, woolly, and not durable.

Pores medium-sized, visible, few, tending to radial arrangement. Rays uniseriate, up to 25 cells high; small latex tubes present in some of the rays; pits to vessels large, round to long oval. Wood parenchyma in fairly regular concentric lines about one pore-width apart, scarcely distinct with lens; crystals common. Wood fibers with thin walls and small bordered pits.

Aparisthmium *cordatum* (Juss.) Baill., the only species of the genus, is a small to medium-sized, deciduous tree, of rather common occurrence in the understory of the mixed hardwood forests on lowlands in tropical South America. According to L. Williams (*Woods of northeastern Peru*, p. 270) it is

abundant in the Peruvian Amazon region, but the timber is used only for fuel. The heartwood is dull brown, not sharply demarcated from the thick sapwood. It is tasteless and odorless when dry, but is said to have a spicy scent when fresh; of rather light weight, of fine and uniform texture, saws rather woolly but can be finished smoothly; probably not resistant to decay.

Pores small to medium-sized, fairly numerous, solitary or in short to rather long radial multiples. Rays generally uniseriate or biseriate, but up to 5 cells wide and more or less aggregated in one specimen (Yale 17391; Williams 645); up to 100 or more cells high; cells thin-walled; crystals present; pits to vessels very large and irregular. Wood parenchyma reticulate, scarcely distinct with lens. Wood fibers with thin walls and very small bordered pits.

COMMON NAMES: Koesoewe-oe-mattoe, mababallie, sauoero nani, tossie kojo (Sur.); rucurana (Peru).

Aporosella, with one or two species of small trees, is of limited distribution in Argentina, Paraguay, and southern Brazil. *A. Hassleriana* Chod. is said to reach a height of about 20 feet, with a spreading crown and stout trunk; the soft, reddish wood is of no utility.

COMMON NAMES: Ibirá-rembé-y, malcoc, yacaré-pitó (Arg.).

Bernardia, with about 40 species of shrubs, half-shrubs, and a few small trees, is most abundantly represented in southern Brazil, but the northern range includes the West Indies and Mexico. The wood of *B. dichotoma* (Willd.) Muell. Arg. (=*Adelia Bernardia* L.) from eastern Cuba has intermingling shades of orange and red, rather lustrous and waxy, very fine-textured, hard and heavy, finishing very smoothly; an attractive wood suitable for small articles of turnery. The wood of *B. microphylla* (A. Rich.) Muell. Arg. is canary-yellow, very fine-textured, of the Boxwood type.

COMMON NAMES: Cacapul (Cuba); oreja de ratón, palo de taruga (Mex.); waika ribbon (Br. H.).

Bonania, with 10 species of shrubs or little trees, sometimes thorny, occurs on the larger islands of the West Indies. The only wood sample available for study is of *B. cubana* A. Rich., collected by G. C. Bucher in eastern Cuba (Yale 16284). The heartwood is a beautiful waxy olive-brown with fine veining of deep green or black, very fine-textured, hard, heavy, not difficult to work, and capable of a very high natural

polish. It has no commercial possibilities, but is suitable for fancy articles of turnery.

Pores very small to minute, fairly numerous. Rays uniseriate, less than 25 cells high; pits to vessels small, rounded. Wood parenchyma in fairly regular concentric lines 1 to 2 pore-widths apart; crystals present. Wood fibers with thick gelatinous walls and minute pits.

Caryodendron, with three species of small trees, is distributed from Panama to Brazil. The wood is pale brown, light and fairly soft, rather fine-textured, perishable; said to be used sometimes to make charcoal for blasting powder.

Pores small to minute, rather few, mostly in multiples or clusters. Rays uniseriate, mostly less than 25, sometimes up to 50, cells high; pits to vessels rather small, rounded. Wood parenchyma in concentric lines about a pore-width apart; crystals abundant. Wood fibers with thin walls and small simple pits.

COMMON NAMES: Tacay (Col.); nogal de Barquisimeto, palo de nuez, taque (Venez.).

Celaenodendron, with a single species, *C. mexicanum* Standl., is a tree, rarely over 50 feet tall with a trunk diameter of 18 to 24 inches, occasionally larger, growing along the western coast of Mexico in the region of Mazatlán where it is known as Palo Prieto. It makes up about 90 per cent of the merchantable timber on María Magdalena Island, off the coast from San Blas, Noyarit, the area covered being about 16,500 acres. The timber is well known locally and highly appreciated for its great strength and long life; nearly all of the houses are roofed with it and it also serves for fence posts, railway crossties, and all sorts of heavy, durable construction. The heartwood is dark olive-brown, sometimes with alternating light and dark striping; has a waxy or oily appearance; rather sharply demarcated from the white sapwood; said to have a characteristic and agreeable scent when being worked; sp. gr. (air-dry) 1.07; weight 66 lbs. per cu. ft.; difficult to split, easy to cut, takes a very smooth finish but is not highly lustrous; not a cabinet or furniture wood.

Growth rings fairly distinct under lens. Pores minute, very numerous, mostly in radial rows. Rays uniseriate, occasionally biseriate, up to 40 cells high; somewhat heterogeneous to homogeneous; pits to vessels small, rounded. Wood parenchyma abundant, apparently terminal and also in numerous, wavy, tangential lines or narrow bands making an ulmiform pat-

tern distinct with lens; crystals abundant. Wood fibers small, with very thick gelatinous walls and minute pits. (For further details see *Tropical Woods* 14: 8–12.)

Chaetocarpus consists of eight species of trees or shrubs, of which there are three in Indo-Malaya, one in tropical West Africa, and four in South America. The wood of *C. Schomburgkianus* (O. Ktze.) Pax & Hoffm. is hard and heavy to decidedly so, rather fine-textured, finishing very smoothly, and said to be used for furniture in British Guiana.

Pores fairly large, rather few, usual arrangement. Sclerotic tyloses present in some of the vessels. Rays uniseriate or biseriate, up to 30 cells high; cells with very thick, abundantly pitted walls; blind pits common; pits to vessels rather large, rounded. Wood parenchyma in narrow, regular to irregular, concentric bands 1 to 3 pore-widths apart; cells sometimes sclerotic; crystals common. Wood fibers with very thick walls and minute pits.

COMMON NAMES: Boobooraballi or buburaballi, ruri? (Br. G.); basau botie-ie, boeloewé-balli, bokko bokkotakon, jappopalli, kantoballi, koesaljeppo, kwepiran, mammerieballi, mattoe swama, moraballi, toekoeleroe kanta, toepoeloe koesoliepo, tokovero kaumta, warakkajaroe harilaroe, witte apakwie-ie, w. djoebolletrie, w. djoebotrie (Sur.).

Cleidion is a pantropical genus with about 20 species of small to medium-sized trees or large shrubs, with four representatives distributed from Central America to Brazil and Peru. The yellowish brown wood is rather fine-textured, moderately light, woolly, perishable; local uses unknown.

Pores medium-sized, not very numerous, solitary or in multiples. Rays uniseriate, occasionally biseriate, and up to 50 cells high; pits to vessels rather small, rounded. Wood parenchyma in fine lines about a pore-width apart. Wood fibers with rather thick gelatinous walls and very small bordered pits.

Conceveiba. There are three or four species of trees in the Guianas and Brazil. Wood not seen.

COMMON NAMES: Bakhie-bakhie, harimenango, jawareran, koesoewé vemattoe, mababalli, mabi, necoehoeda, péierjan, talemo méréhé, wadiehie koro, witte hoedoe (Sur.).

Conceveibastrum *Martianum* (Baill.) Pax. & Hoffm., the only species of the genus, is a tree of the Upper Amazon. The yellowish brown wood is light but firm, medium-textured, and rather woolly.

Pores fairly large, few, solitary or in small multiples tending to radial or oblique arrangement. Vessels filled with tyloses in heartwood. Rays uniseriate, rarely biseriate, and less than 50 cells high; crystals present; pits to vessels large and irregular, tending to scalariform arrangement. Wood parenchyma finely reticulate, scarcely visible with lens. Wood fibers with thin walls and distinctly bordered pits. Large radial channels present.

Croton, with about 600 species of trees, shrubs, and herbs, is of pantropical distribution. There are over 400 American species, but the woody plants are mostly shrubs and small trees, occasionally up to 65 feet high and 20 inches in diameter. Some of the plants are fragrantly scented, some supply limited amounts of dyestuffs, resins, and medicines, and a few furnish timber for miscellaneous local purposes. The woods exhibit great variation in appearance and properties, ranging in color from yellowish or brown to almost black, in texture from very fine to medium, and in consistency from light and soft to hard and heavy. There is a corresponding range in the type of uses, from match sticks and boxboards to general carpentry and construction. The timber apparently has no commercial future.

Based upon a study of several specimens, the pores are small, rather numerous, in short to long radial rows. Rays uniseriate or biseriate, mostly less than 25 cells high; ray-vessel pitting fine, sometimes unilaterally compound; crystals abundant. Wood parenchyma not very abundant, variable, diffuse, and in irregular tangential or long narrow-aliform lines; crystals sometimes present. Wood fibers with thin to thick and gelatinous walls; pits minute.

COMMON NAMES: Aceitillo, ají de costa, anis cimarrón, caobilla, ceranio, clavellina le laguna, cuabilla, cuabo de ingenio, frailecillo cimarrón, guasima de costa, g. roja, romero de costa, verraco (Cuba); corcho, ortega menuda, pringamoza (P.R.); ardormida, fire bush, guayacancillo, lechecillo, maran, pepper bush, sage, soldier whip, yellow balsam, yerba, y. bellaca (Virg. Is.); bois blanc, b. cabritte, b. guêpes, copahy, feuille père, paobelia, romarin (Haiti); palo bellaco, p. berraco (Dom. R.); jeerba kareeta, j. kraabo, j. de seeroe, j. tsjoebaatoe (Dutch W.I.); árbol de sangre, canelillo, caobilla, chul, copalchí, cuanaxonaxi, cuate, dominguillo, ecbalan or ekbalam, enchiladora, encinillo, epaxihuitl, ezquahuitl, hierba de la cruz, h. del gato, h. del zorrillo, h. loca, icaban, ocotillo,

ortiguillo, palillo, palo muela, picosa, pinolillo, pozual or puzual, quina, q. blanca, robaldo, rosval, rubaldo, salvia, sangre de drago, sangregado, solimán, s. blanco, s. prieto, taangché, tlachinole, vara blanca, xa-balam, xic-gaban, xixim-coh, xonaxe, xunalixase, xunaxilase, yepaxihuitl (Mex.); sphereskutch, wild cinnamon (Br.Hond.); chacolote, chirca, ciega-vista, perescuch, sangre de drago (Guat.); barenillo, cascarilián, ciega ojo, c. vista, pela-nariz, quema-nariz (Hond.); copalchí (Nic.); artanto, cerro de la olla, copalchí, friega-plato, pan caliente, sasafrás, tostoncillo (Salv.); quizarrá copalchí, targuá, targuacillo, terré (C.R.); baquero, copalchí, coquillito, c. de cerro, sangrillo (Pan.); balsillo, barbasco montañero, berengeno, cascarilla, drago, jengibre arborescente, malabito, malambo, manteco, mosquiro, plateado, sangregao, sangro, tinte (Col.); amargosito, amargoso, barredero, canacanapire, carcanapire, c. macho, cáscara de lombrices, malambo, Matías, orejón, palo Matías, punta de lanza, quina blanca, sangre de drago, salvia muñeca, sarasaro, torco (Venez.); boko-boko wiwirie, koesapoelan, moeroewabbo, ojédiballi, smeri wiwirie, tassi, wakaladan hororodikoro, without (Sur.); adipate or adipati, alcamphoreira, caá-jussára, caixeta, cajuçara, capechingui or capixingui, casca gaivota, c. sacáca, castanheiro do brejo, catinga de porco, chá de periquito, cipo urtiguinha, curraleiro, gaivotinha, melmeleiro, mercurio do campo, pau caboclo, pé de perdiz, sacáca, sangue de drago, tapixingui, urucurana, velame do campo (Braz.); sangre de drago (Ec.); hingo-quiro, loro callo, l. micuna, moena, m. amarilla, ruma sacha, rucurana, sangre de drago, sangre de dragón, yuracsiprana (Peru); carurumi (Par.); sangre de drago, urucurá (Arg.).

Cunuria, with three species of large trees in the Amazon basin, has a dark brown, waxy, fairly lustrous, hard and heavy wood, which is not difficult to work, finishes very smoothly, and is attractive though without figure. It is suitable for furniture.

Pores large, not very numerous. Some sclerotic tyloses present in vessels of heartwood. Rays 1 to 3, occasionally 4, cells wide and up to 50 cells high; pits to vessels moderately large, mostly rounded. Wood parenchyma in numerous regular to wavy concentric lines or narrow bands usually about a pore-width apart, but occasionally much more widely spaced; distinct with lens; some of the cells sclerotic; crystals common. Wood fibers with thick gelatinous walls and minute bordered pits. (*Material:* Yale 21336; Ducke 77.)

COMMON NAMES: Cunurí (Venez.); ruri? (Br.G.); cunury (Braz.).

Ditta *myricoides* Gris., the only species of the genus, is a shrub or small tree of the West Indies. The wood is yellowish, of medium density, fine-textured, woolly, and of no special use.

Pores minute, scattered. Rays uniseriate, up to 25 cells high; pits to vessels round to elongated. Wood parenchyma finely reticulate, scarcely visible with lens. Wood fibers with moderately thick walls and very small bordered pits.

Dodecastigma *amazonicum* Ducke, the only species of the genus, occurs in the Brazilian Amazon region. The wood is grayish olive-brown, of medium density and texture, and saws woolly.

Pores medium-sized, barely visible, rather few to numerous, in pairs or short radial series. Rays uniseriate, up to 50 cells high; crystals present; pits to vessels rather large, tending to scalariform arrangement. Wood parenchyma in irregular lines about a pore-width apart, scarcely distinct with lens. Wood fibers thin-walled, with very numerous small bordered pits. (*Material:* Yale 20716; Ducke 35.)

Drypetes, with about 160 species, is widely distributed in the tropics of both hemispheres. There are about a dozen American species, with a combined range including southern Florida, the West Indies, Central America, and northern South America to the Amazon region. They are shrubs or small to medium-sized trees with light-colored, hard, heavy, tough, and strong woods used locally to some extent in rural construction, but chiefly for fuel and charcoal.

Pores medium-sized to minute, mostly in short radial multiples. Perforation plates occasionally scalariform in part. Rays 1 to 3 cells wide, usually less than 50, sometimes up to 100, cells high; crystals abundant; pits to vessels minute. Parenchyma finely reticulate, with occasional gaps apparently demarcating growth rings; some crystals present. Wood fibers with very thick gelatinous walls and minute pits.

COMMON NAMES: Florida plum, Guiana plum, whitewood (Fla., Bah.); chicharrón, c. espinoso, cuero duro, hueso, h. blanco, h. de costa, h. del monte, h. prieto, h. de tortuga, maco, ramón blanco (Cuba); cafeillo, hueso, h. amarillo, h. tortuga, palo blanco, p. de aceituna, p. de vaca blanca, varital (P.R.); bois côtelette, b. moussara, côtelette, laboue cochon (Haiti); bullhoof, b. macho (Br. H.); mula (Salv.).

Euphorbia consists of about 1600 species of herbs, shrubs, or small trees of world-wide distribution. They are of many forms and some of them resemble cacti. The woods, so far as studied, are light, soft, perishable, and practically useless.

Pores small to minute, not very numerous. Rays uniseriate or locally biseriate, less than 25 cells high; crystals common; pits to vessels large and gash-like. Wood parenchyma reticulate, scarcely distinct with lens; crystals present. Wood fibers with thin walls and minute pits.

COMMON NAMES: Cardón, sanguinaria (Cuba); bon garçon, candélabre, désaison, dezhomme, malnommé, poinsetta, romain (Haiti); sanguinaria (Dom. R.); bandera, bebeta, candelilla, chupire, cuitla-xochitl, liga, mala-mujer, mata-gallina, mulatilla, noche-buena, palo amarillo, p. colorado, p. de cucaracha, piñoncillo, puno-puno, sac-chacah, tenquanete, trompillo (Mex.); pastores, sapo (Nic.); barrabás, pastora (C.R.); lechero, sindarute, yuco (Venez.); gunapalu, koenaparoe, koenapoeloe, melki-wiwirie (Sur.); caá-cambuhy, coral, cumanan, maleiteira (Braz.); lechero (Arg.).

Garcia, with a single species, *G. nutans* Rohr, is a small to medium-sized tree growing in the West Indies, southern Mexico, Central America, and Colombia. There are no special uses for the wood, which is pale brown, of medium density, rather fine-textured, not difficult to work, though sawing rather woolly.

Pores small, rather few, solitary and in small multiples tending to radial arrangement. Rays uniseriate or biseriate, less than 50 cells high; crystals common; ray-vessel pitting coarse, often scalariform. Wood parenchyma finely reticulate. Wood fibers with rather thin walls and numerous small bordered pits.

COMMON NAMES: Huevo de gato (Salv.); avellano (Col.); pascualito, pepita del indio (Venez.).

Gavarretia *terminalis* Baill., the only species of the genus, is a shrub or little tree of the Amazon region. Wood dark brown, oily looking, of medium density and texture, rather woolly.

Pores rather large, visible, few, in rather widely spaced short to long radial series. Rays uniseriate, up to 25 cells high; crystals common; pits to vessels large and irregular. Wood parenchyma in fine, irregular, concentric lines about a pore-width apart; pitting often scalariform. Wood fibers with very small but distinctly bordered pits. Large radial channels present. (*Material:* Yale 31955; Ducke 228.)

Glycydendron *amazonicum* Ducke, the only species of the genus, is a large tree, sometimes 100 feet tall, in the high forests of the Amazon region, where it is called Mirindiba Doce. The moderately hard, rather attractive, somewhat waxy, orange-brown heartwood is sharply defined from its lustrous white sapwood.

Pores medium-sized, barely visible, not very numerous, unequally distributed. Rays mostly less than 50 cells high, the procumbent-cell parts biseriate; pits to vessels medium-sized, round to long-elliptical; small latex tubes present. Wood parenchyma in irregular, unevenly spaced lines or short to long narrow bands connecting but not including the pores and sometimes also in fairly uniform concentric lines, fairly distinct with lens. Wood fibers with moderately thick walls and minute bordered pits. (*Material:* Yale 21360; Ducke 101.)

Grimmeodendron, with two species of small trees, occurs in the larger islands of the West Indies. Wood not studied.

COMMON NAME: Manzanillo del morillo (Cuba.).

Gymnanthes, with 12 species of shrubs and small trees, is limited to the Caribbean region. Best known and most widely distributed is *G. lucida* Sw., which grows in southern Florida, the West Indies, southern Mexico, and British Honduras. Its maximum height rarely exceeds 30 feet, and its slender trunk, often irregularly ridged, is commonly less than 10 inches in diameter above the swollen base. The heartwood is attractively variegated olive and dark brown, sharply demarcated from the white sapwood. It is hard, heavy, and strong; sp. gr. (air-dry) 1.10 to 1.20; weight 68 to 75 lbs. per cu. ft.; texture very fine; not difficult to work, takes a high natural polish, is durable. The timber is in local demand for poles, posts, stakes, tool handles, and small articles of turnery. Occasional shipments of small lots of the logs are sent to New York and used for backs of brushes and mirrors, walking sticks and umbrella handles, and veneers for marquetry.

Pores very small to minute, numerous, solitary or in radial series. Rays uniseriate or locally biseriate, mostly not over 25, sometimes up to 45, cells high; crystals abundant; pits to vessels small, round. Wood parenchyma in irregular concentric lines, about a pore-width apart, and diffuse; barely visible with lens. Wood fibers with thick gelatinous walls and minute pits.

COMMON NAMES: Crabwood, poisonwood (Fla.); aceitillo, aité or aití, nagrona, yaité, y. bobo, yaitecillo, yaya macho (Cuba); baboncillo, yaití (P.R.); bois marbré (Haiti); granadillo, palo de tabaco (Dom. R.); bois vert, casse haches, colas, ebène vert, e.v. brune (Fr. W. I.); false lignum-vitae (Br. H.); branquilho, capixava (Braz.).

Hevea is by far the most important genus of the Euphorbiaceae commercially, as its latex is the source of nearly all of the world's supply of rubber. According to Ducke (*Arch. Inst. Biol. Vegetal* 2: 2: 220, Dec. 1935), the number of "good" species does not exceed twelve, distributed as follows: one in the State of Maranhão; two in the Guianas; two in Matto Grosso, Acre Territory, and Bolivia; four in the State of Pará; six in Peru; three in the Amazonian region of Venezuela; ten in the Brazilian State of Amazonas; eight in the Rio Negro basin; eight in the upper Amazon; and eleven in the triangle formed by the upper Amazon and Rio Negro. Some of the trees attain heights of 100 to 125 feet, the large cylindrical trunks with or without buttresses; others are small to medium-sized trees, and one is only a shrub. There are numerous varieties, forms, and hybrids. The tree producing the most and best latex and the only species cultivated in plantations is *Hevea brasiliensis* Muell. Arg. The timber of *Hevea* is pale brown, light in weight, brittle, medium coarse-textured, stains readily and is perishable when exposed in a humid climate. Accordingly it has few uses.

Pores mostly large, few and scattered, occurring singly or in radial multiples. Rays 1–3 cells wide and less than 30 cells high; interior cells procumbent, the marginal ones large and irregular; pits to vessels rather large, round, oval or elongated. Wood parenchyma abundant, reticulate and in irregular continuous narrow bands and lines. Wood fibers with thin walls and minute pits.

COMMON NAMES: Pará rubber-tree (Eng.); árbol de caucho, jacía (Venez.); hatti, sibi-sibi (Br. G.); mapalapa, rapparappa, seue joeballi (Sur.); messigné (Fr. G.); seringa, seringuera, s. amarella, s. barriguda, s. branca, s. chicote, s. da catinga, s. da terra firme, s. folha de maniva, s. itaúba, s. itaúbarana, s. legitima, s. pescoço de veado, s. preta, s. roxa, s. tambaqui, s. torrada, s. vermelha (Braz.); capí, conorí, jéve, j. debil fino, j. d. muerto, j. fino, seringa, s. mapa, s. mashan, s. rana, shiringa amarilla, s. del cerro, urco-seringa (Peru).

Hieronyma (or *Hyeronima*), with about 25 species of trees and shrubs, is extensively distributed in tropical America from the West Indies and southern Mexico to southern Brazil. The best known species is *H. alchorneoides* Fr. Allem., a large tree sometimes 100 feet tall, with a trunk 3 feet in diameter above the buttressed base, of common occurrence in the Guianas and Brazil. The strong, durable timber is used for posts, railway crossties, bridges, miscellaneous construction, and sometimes for furniture, but it is not exported.

Sapwood pinkish white; heartwood very dark brown or reddish brown, often exuding a blackish sap when freshly cut; luster low. Rather hard and heavy; sp. gr. (air-dry) 0.70 to 0.80; weight 43 to 50 lbs. per cu. ft.; texture medium to coarse, sometimes uneven; grain more or less roey; not easy to cut or split, finishes smoothly, requires care in seasoning to prevent warping, has rather high durability.

Pores rather large, often variable in abundance, sometimes zonately crowded, but usually not in actual contact with one another. Perforations predominantly simple; intervascular pitting rare. Rays of two sizes, the larger 3 to 6 cells wide and often 100 or more cells high; fairly distinct on radial surface, but not on others; pits to vessels very coarse; cell walls thick; gum deposits abundant. Wood parenchyma reticulate; crystals abundant. Fibers with moderately thick walls; pits numerous, rather large, distinctly bordered. Other species examined have smaller and evenly distributed pores.

COMMON NAMES: Cajuela (Cuba); cedro macho (P. R.); tapana, tapanare (Trin.); chac-te-cook (Br. H.); curtidor (Hond.); nancito (Nic.); pilón, Scotch ebo (C. R.); bully tree, palo chancho, pantano, pilón, zapatero (Pan.); aguacatillo, catatú, coral, florecillo morado, quindú canelo, torito, trompillo (Venez.); dalina, serdani, suradanni, surdina (Br. G.); ajono, ajowo, amapaia, anoniwana, katoelienja, makoeroerian, okotjo, piento-bolletrie, soeladan, soeradan, sorrodan, tapierin, tarroema, teloko-enoeroe, tokadie-ballie, troko-enoeroe (Sur.); aricurqua, marâ-gonçalo, orocurana, urucurana, u. de leite, u. mirim (Braz.).

Hippomane, with a single species, *H. Mancinella* L., is widely distributed in the Caribbean region. Though usually small, the tree is sometimes 65 feet high with a trunk 36 inches in diameter. Its latex is caustic to the skin and poisonous if taken internally. The wood, which is a lustrous yellowish

brown with markings of brown and black, suggesting Circassian Walnut, has long been appreciated in the West Indies for making good furniture, but is practically unknown to the export trade. Sp. gr. (air-dry 0.60 to 0.68; weight 38 to 43 lbs. per cu. ft.; texture fine and uniform; easy to work, finishes very smoothly, holds its place well when manufactured, and is durable.

Pores medium-sized, fairly numerous. Rays uniseriate or biseriate, less than 25 cells high; nearly homogeneous; latex tubes sometimes present; crystals numerous; pits to vessels small and rounded to narrow elliptical. Wood parenchyma in regular to wavy concentric lines 1 to 2 pore-widths apart; distinct under lens; crystals present. Wood fibers with medium thin walls and minute pits.

COMMON NAMES: Manchineel (Eng.); manzanillo (Span.); mancenillier (Fr.); penipeniche or pinipiniche (Cuba); árbol de la muerte (P.R.); pomme zombi (Haiti); hincha-huevos (Mex.); manzanillo de playa (Venez.); arvore da morte, caximduba, mancenilheira (Braz.); ficha (Peru).

Hura, with two closely related species of large trees, occurs from the West Indies and southern Mexico to northern Brazil. The Mexican species, *H. polyandra* Baill., differs from the more widely distributed *H. crepitans* L. in the structure of the stamens, but otherwise the two are practically indistinguishable and have the same properties. The branches and trunk are often provided with sharp spines. The latex of the bark is caustic and is sometimes used for stupefying fish. The fruits, which resemble little pumpkins, explode with violence upon drying and scatter the sections and wafer-like seeds in all directions. The English name of Sandbox-tree is derived from the early practice of hollowing out the immature pods and using them as containers of blotting sand.

The trees are of common occurrence in many places and the timber is used locally for common lumber for interior construction, carpentry, boxes and crates. They attain their best development on the low narrow reefs of the coastal plain near Paramaribo, Surinam, and form nearly pure stands estimated to yield from 6000 to 100,000 board feet per acre, averaging at least 25,000 feet over an area of 20,000 acres. The trees reach a maximum height of 200 feet, with a straight, fairly regular trunk free of branches for from 50 to 100 feet and sometimes

7 feet in diameter above the buttresses. The wood varies in color from a lustrous creamy white to yellowish brown or olive-gray, is light and soft, medium-textured, more or less woolly; sp. gr. (air-dry) 0.36 to 0.44; weight 23 to 27 lbs. per cu. ft.; easy to cut, takes stains and glues well. Some of the material is very attractively roe-grained, though figure is not pronounced except in crotches.

An effort to introduce the wood into the American market was made by Mr. W. L. Kann of Pittsburgh, Pa., beginning about 1923 and continuing until his death several years later. The timber, named Rakuda, was procured in Surinam and many practical tests were made to determine its suitability for plywood, panels, and furniture. The principal objection to it as a cabinet wood is that it is too light and soft to withstand marring, though it would appear to be well suited for less exacting uses.

Pores variable in different specimens, small to rather large, not very numerous. Rays uniseriate or locally biseriate; mostly less than 20 cells high; nearly homogeneous; pits to vessels large, rounded to gash-like. Wood parenchyma finely reticulate, fairly distinct with lens; crystals present. Wood fibers with thin walls and minute pits.

COMMON NAMES: Hura wood, possum wood, rakuda (U.S.A. trade); monkey's dinner bell, sandbox tree (Br. W. I.); haba, habillo, javillo, salvadera (Cuba); javillo, javarillo, milinillo (P. R.); sablier (Haiti); javillo, seda blanca (Dom. R.); bois du diable, pet du diable, sablier (Fr. W. I.); árbol del diablo, cuatatachi, haba, h. de indio, habilla, jabillo, ovillo, quauhtlatlatzin, quauhayohuatli, solimanché (Mex.); jabillo (C. Am., gen.); tetereta (Guat.); nune, tronador (Pan.); acuapa, arenillo, arenillero, castañeto, ceiba amarilla, c. blanca, c. de leche, c. lechosa, ceibo, habilla, mil-pesos, salvadera, trovador (Col.); ceiba blanca, c. habillo, habillo, jabillo, javilla (Venez.); possentrie, postentrie (Sur.); assacú, uassacú (Braz.); catahua, cataua, habilla, salvadera (Peru); ochohó (Boliv.).

Jatropha, with about 150 species of trees, shrubs, and herbs, often armed with stinging hairs, is extensively distributed in tropical Africa and America. The American species are chiefly useful as medicinal plants, and perhaps the best known is the Physic-nut, *J. Curcas* L., whose seeds have purgative

properties. The trees are small, with pale brown or nearly white, soft and spongy, coarse-textured, woolly, and perishable wood of no particular value.

Pores few, medium-sized to rather large, solitary or in small multiples. Rays uniseriate, sometimes biseriate, not over 25 cells high; crystals present; pits to vessels large to very large. Wood parenchyma finely reticulate, indistinct with lens. Wood fibers very thin-walled, with minute simple or indistinctly bordered pits.

COMMON NAMES: Frailecillo, frailejón, palo santo, peregrina, p. del Pinar, piñon, p. botija, primamoza, purga de fraile, sabrosa, seibilla, tártago, tíratíra (Cuba); physic nut, wild oil-nut (Jam.); higuereta cimarrona, piñón, tartago, tíratíra (P. R.); moussara, papaye sauvage, petit mapon (Haiti); juca cimarrona, piñon, pringa leche, tíratíra, yuca cimarrona (Dom. R.); cabalonga, chaya, chipché, coatli, drago, jiotillo, mala mujer, m. m. lisa, mata-muchachos, sangre de drago, sangregado, sangregrado, siclte, tecote prieto, telondilla, tlapalezpatli, tocote prieto, torote, t. amarillo, torotito, xcacal-ché, xkakalché (Mex.); chichicaste, c. de burro, piñón, tempate (Guat., Hond.); chaidra, chairo, chayo, copapayo, frailecillo, papayilla, ruibarbo, tempate (Salv.); chicaquil, coquillo, frailecillo, tapate, tempate (C. R.); árbol santo, coquillo, ortiga, pringamoza, ruibarbo (Pan.); florón de montaña, juquillo, piñón, pringamoza del monte, p. de saino, purga de fraile, túa-túa (Col.); emético vegetal, frailecillo, guaritoto, piñón, tartora, túa-túa (Venez.); oejedi, roode schijtnooten, schnijtnooten, weroeto (Sur.); batata do inferno, cansanção, c. de leite, flôr de coral, perna inchada, pião, p. roxo, pinhão, p. de purga, p. roxo, urtiga (Braz.); guaritoto, piñón (Peru); ortigón bravo macho, pinón, sacha-higuera (Arg.); mbaracayá-rai-nambí, pynó-guazú (Par.).

Joannesia, with two species of medium-sized to large trees, is limited in distribution to Brazil. *J. princeps* Vell. occurs in the eastern states and is cultivated in tropical regions of the Old World. It is a gnarly, drought-resistant tree with a trunk 15 to 25 feet long and 16 to 24 inches in diameter supporting a spreading crown with very large digitately compound leaves thickly tufted at the ends of the coarse twigs. The fruit is used as a purgative and for stupefying fish. The white or yellowish wood is very coarse-textured, light and soft, and of

poor quality but used locally for rough lumber. *J. heveoides* Ducke is a large tree, similar to the preceding, discovered along the Tapajoz River, a tributary of the Amazon, where it is called Castanha de Arára (Macaw Chestnut). It is remarkable chiefly for its huge fruits, as much as 8 inches wide, each containing three large seeds rich in fatty oil. Wood brownish, light, soft, coarse-textured, woolly.

Pores few, very large, solitary or in radial multiples. Rays uniseriate or occasionally biseriate, less than 30 cells high; pits to vessels large and irregular. Wood parenchyma finely reticulate, not visible without lens. Wood fibers with thin walls and very small bordered pits. (*Material:* Yale 22612; Ducke 152.)

COMMON NAMES: *J. princeps:* Andá assú, a. guassú, castanha de arára, coco de gentio, c. de purga, cotiero, fruta de arára, f. de cotia, indá assú, i. guassú, purga de cavallo, p. de gentio, p. dos Paulistas (Braz.). *J. heveoides:* Castanha de arára (Braz.).

Lasiocroton, with five species of shrubs and small trees, is limited to the West Indies. The clear, yellow, hard, heavy, very fine-textured wood might serve as a substitute for Boxwood, but the quantity is too small for trade purposes.

Pores very small to minute, rather numerous, in long rows. Rays uniseriate, less than 30 cells high; many cells disjunctive; crystals common; pits to vessels small, rounded. Wood parenchyma finely reticulate, scarcely visible with lens; cells often disjunctive. Fibers with thick walls and minute pits.

Leucocroton, with 16 species of shrubs and little trees, occurs in Cuba. The wood resembles that of *Lasiocroton*, but the wood parenchyma is in long, narrow, aliform and confluent lines distinct with lens.

Mabea, with about 40 species of trees and shrubs, is distributed from southern Mexico to southern Brazil, most of the species being Brazilian. Some of the woods are said to be light and soft, but those available for study are of medium density, brownish to olive-brown, somewhat oily-looking, useful for general construction perhaps, but not attractive.

Pores few, small to medium-sized. Rays uniseriate, less than 50 cells high; pits to vessels medium-sized, round to elongated. Wood parenchyma mostly reticulate, not tending to form concentric bands; not very distinct with lens. Fibers with moderately thick, gelatinous walls and minute pits. Large radial channels sometimes present.

COMMON NAMES: Nigüito (Venez.); bakaa poeirenga, baririe koli kakkekoro, koenbotassi, pajoelidan, pakjira emoeroe, wepe-lana-noe takalli, wepenjana atakarie (Sur.); canudo de pito, taquary, taquarizeiro (Braz.); aya-uma, manchuiga blanca (Peru).

Manihot, with 160 species of shrubs, small trees, and herbs, is widely distributed throughout tropical America. The most valuable species is *M. utilissima* Pohl, native of Brazil but extensively cultivated elsewhere for the meal, starch, and cassava or tapioca obtained from the tuberous roots. *M. Glaziovii* Muell. Arg. is the source of Ceará rubber, now of minor importance. The woods are light to dark brown, very soft, coarse-textured, perishable, and not utilized.

Pores rather large to very small in some specimens, in widely separated rows or clusters. Rays uniseriate, occasionally biseriate, few to 25 cells high; cells mostly square or upright; crystals present; pits large, irregular. Wood parenchyma abundant, paratracheal and long aliform, often confluent, also more or less diffuse; scarcely distinct with lens; crystals present. Wood fibers with very thin walls and minute simple pits.

COMMON NAMES: Yuca, y. agria, y. blanca (Cuba); cassada, cassava, manioc, tapioca (Jam.); juca (Dom. R.); ayotectli, cuacamote, c. dulce, cuadrado, guacamote, guh-yaza, huacamote, huacamotli, matorral, pata de gallo, tsin, xchachá, yuca, y. amarga, y. brava, y. cimarrona, y. del monte, y. dulce (Mex.); cassava, yuca (Br. H.); caxamote (Guat.); cassava, quiscamote, yuca (Hond.); caucho blanco, cerro de la olla (Salv.); yuca amarga, y. dulce, yuquilla (Venez.); alèpaipio, alesebie, alomie, alostiki, amoewanopo, arèsamoenè, jakopoekondrekasaba, kappasienjolo, koemakabo, koemè-repo, kolaroripio, komorepo, kwallabo, makkapo, oelanarè, oskiboe, pakoema, patakapio, piekieriepo, pittorolli, pulwapie, saniemè, seperalipo, sepiepabo, tapitjie, tapopirè, tapirin joepoe, tiana, tisiekiboe, tisiemoenè, tollokopo, topitjie, topitoe, towe sipio, walaloppo, walekopo, walemiepjo, wariri riepjo, wayaloepo, wolo-wolo, zoete cassave (Sur.); aipim, aipy, macaxera, mandioca, m. doce, m. mansa, maniçoba, maniva do campo, m. de veado, m. dos indios (Braz.); guaso mandió, higuerilla, mandió-guazú, mandioca brava, m. cimarrona (Arg.).

Maprounea, with four species of trees and shrubs, occurs in tropical Africa and South America, especially Brazil and the Guianas. The wood is pale brown, of medium density, and perishable.

Pores small or occasionally medium-sized, not very numerous, radially arranged. Rays uniseriate, rarely biseriate, mostly less than 25 cells high; crystals present; pits to vessels narrow elliptical. Wood parenchyma in irregular, narrow, concentric bands 1 to 3 pore-widths apart; fairly distinct with lens. Wood fibers with rather thin walls and minute pits.

COMMON NAMES: Awatie, dekie hatti, gingepan, ietjotono parapisi, kisi angoala, peihatti, pirapisi (Sur.); matadeira (Braz.); airána (Peru).

Nealchornea, with only one species, *N. yapurensis* Huber, is an upper Amazon tree with brownish wood of medium density, coarse texture, and low resistance to decay.

Pores visible, tending to radial arrangement. Rays uniseriate, less than 50 cells high; pits to vessels large, oval to much elongated. Wood parenchyma in fine concentric lines about a pore-width apart, fairly distinct with lens. Wood fibers with thin walls and small bordered pits.

Omphalea, with 17 species, mostly shrubs, rarely trees, is of pantropical distribution. The several American species have a combined range including the West Indies, Central America, and South America to Brazil and Peru. The trees are small, with very light, soft, perishable, yellowish wood of no value. Apparently the only uses for the plants are medicinal.

Pores medium-sized, few, in short to long multiples. Rays very coarse-celled; 1 to 3, occasionally 4, cells wide and usually less than 25, sometimes up to 50, cells high; crystals present; pits to vessels large and irregular. Wood parenchyma reticulate, not very distinct with lens; crystals present. Wood fibers with thin walls and minute simple pits. (*Material:* Yale 16294; Bro. León 13318, from Cuba.)

COMMON NAMES: Cobnut, popnut (Jam.); noisetier (Haiti); liane à l'anse, l. papaya (Mart.); castañete, chirán, hoja de queso, palo de jabón, p. de queso, p. shilán, tambor (Salv.); ana, baboennoot, baboenotto, mekoekwaire (Sur.); omphalier, ouabé (Fr. G.); cayaté, castanha de cayaté, c. de cotia, c. de peixe, c. purgativa, comadre de azeite (Braz.).

Ophellantha *spinosa* Standl., the only species of the genus, is a little tree, 15 to 20 feet high, growing in Salvador, where it is called Limoncillo. Wood not seen.

Paradrypetes *ilicifolia* Kuhlm., the only species, is a little tree of frequent occurrence along the Rio Doce in Minas Geraes and Espirito Santo, Brazil. It has opposite, hard, lustrous, toothed leaves and a long-conical crown that makes the tree attractive for decorative planting.

No wood specimen available for study, but according to Milanez (*Arch. Inst. Biol. Vegetal* 2: 1: 136), the pores are very small, numerous, solitary or in short radial multiples. Vessels with both simple and multiple perforations, the scalariform plates with 5 to 7 bars. Rays 1 to 4 cells wide and up to 50 cells high; heterogeneous, most of the cells square; crystals abundant; pits to vessels mostly elongated and in scalariform arrangement. Wood parenchyma in numerous irregular concentric lines or narrow bands 1 to 3 pore-widths apart. Wood fibers with very thick walls and minute simple pits. Gum deposits abundant in all elements.

COMMON NAMES: Ameixa, folha de serra (Braz.).

Pausandra, with nine species of small trees, occurs sparingly from Nicaragua, where it is called Jagua, to southern Brazil. The wood is pale brown, fine-textured, rather light to moderately heavy, not durable.

Pores very small, scattered, solitary or in small multiples. Rays 1 or 2, occasionally 3, cells wide and few to 30 cells high; interior cells conspicuously smaller than the marginal; crystals present; pits to vessels narrow-elongated. Wood parenchyma in concentric lines mostly one pore-width apart, sometimes more widely spaced; distinct with lens. Wood fibers with medium walls and minute pits.

Pera, with about 35 species of trees or shrubs, is distributed from the West Indies and southern Mexico to southern Brazil. The wood varies in color from light to very dark brown, in texture from fine to coarse, in density from medium to very high. The principal local uses appear to be house poles and fuel.

Pores small in some species to large in others; few, solitary or in usual multiples. Sclerotic tyloses sometimes present. Rays uniseriate, rarely biseriate, and less than 50 cells high; heterogeneous to homogeneous; crystals abundant; pits to vessels medium-sized, rounded. Wood parenchyma in concentric lines about a pore-width apart, distinct with lens; crystals abundant. Wood fibers with thick gelatinous walls; pits numerous, simple. Radial channels rarely present.

COMMON NAMES: Jiquí, yayabacaná (Cuba); casser rage, cotelle (Haiti); palo damaso (Dom. R.); granadillo ? (Guat.);

felí, wild olive (Pan.); arguaco, cucharo (Col.); cenícero (Venez.); ruri (Br. G.); hatsiballi, koen boevienga, peprehoedoe, pirikraipio (Sur.); pereiro, talá-caá (Braz.); machu sacha mapiche (Peru).

Phyllanthus, with about 480 species of shrubs, small trees, and annual or biennial herbs, is widely distributed in the tropical and subtropical regions of the world. The woods of the American species examined are pinkish brown with yellowish sapwood, rather fine-textured, and variable from soft to rather hard. No special uses known.

Pores small, numerous, in pairs or radial rows. Rays of two sizes, the larger ones 3 to 8 cells wide, varying in different species, and few to 100 or more cells high; crystals abundant; pits to vessels medium-sized to very large, rounded to elongated and in scalariform arrangement. Wood parenchyma sparingly paratracheal. Wood fibers with thin to thick and gelatinous walls; pits minute.

COMMON NAMES: Azulejo, a. bejuco, a. del monte, grosella cimarrona, grosellero cimarrón, guaicaje, lloron, mirobalanos émblicos, panetela, raspalengua, sangre de toro, yerba de la niña (Cuba); amortiguado, avispillo, higuerillo, higuillo, millo, palo de millo, siete-cueros, yaquillo or yuquillo (P. R.); rock bush, seaside laurel, snap plant (Jam.); derrière-dos, Espagnol marron, neige (Haiti); perico (Dom. R.); karkidaaki, lokki-lokki, Surinaam bitter (Dutch W. I.); kahyuo, xpbixtdon (Mex.); ciruello, monkey rattle, pixton, wild plum, xmabalche (Br. H.); guinda, nistamal, pimienta, pimientilla (Salv.); carillo (Nic.); chilillo, gallina (C. R.); jobitillo (Pan.); aceite, arito, barbancito, barbasco, barbasquillo, cedrito, chirrinchao, gabellón, garbanzo, llallo, madura-plátano, perla, pelolica, pinturero (Col.); barbascajo, cerezo agrio, chipito, lavandero (Venez.); kunaparu (Br. G.); ajakéballi, bita-wiwirie, boesi-kofi-tiki, djari-bita, finie-bita, hikoelitókong, man-bita, pomitji, popóno, walaballi (Sur.); arranca pedras, canabi, catuaba, compadre de azeite, conabi, conambi, conami, conanu, conaui, conavi, ginja, herva pombinha, perola vegetal (Braz.); asnac-panga, gallinaso-panga, quinilla del tahuampa (Peru); ibirá-rembé-y, lenteja, malcoc, sarandí tahuampa (Peru); ibirá-rembé-y, lenteja, malcoc, sarandí blanco (Arg.); pará-paray-mí (Par.); sarandí blanco (Ur.).

Piranhea *trifoliata* Baill., the only species of the genus, is a

tree of the Brazilian Amazon region, where it is known as Piranheira. The wood is dull olive-brown, oily-looking, very dense, and of medium texture. No local uses are reported and the timber apparently has no commercial possibilities.

Pores medium-sized, not very numerous, well distributed singly or in short radial multiples. Rays uniseriate or biseriate, less than 50 cells high; mostly homogeneous; pits to vessels rather small, rounded. Wood parenchyma very abundant in straight to wavy, concentric bands, 2–8 cells wide, which usually join but do not include the pores, and compose a third or more of the cross-sectional area; crystals numerous. Wood fibers with very thick gelatinous walls and minute pits.

Pogonophora, with one or two species of trees or shrubs, occurs in northeastern South America. The dark reddish brown, oily-looking wood is very dense, durable, difficult to work, though taking a high natural polish.

Pores very small, solitary or in scattered multiples. Tyloses abundant in heartwood, sometimes sclerotic. Rays 1 to 3 cells wide and up to 50 cells high; cells thick-walled, abundantly pitted; pits to vessels narrow-elongated. Wood parenchyma sparingly paratracheal, occasionally extending in slender wings, more or less confluent; also in fine concentric lines or bands, occasionally two or three close together, sometimes apparently demarcating growth rings. Wood fibers with very thick gelatinous walls and minute pits.

COMMON NAMES: Hajokantoballi, pauarangdja, poripio, sibidan, hojokantoballi (Sur.).

Richeria, with six species of small trees, is distributed from the Lesser Antilles to Peru and southern Brazil. The wood is rather dull yellowish or pinkish, fairly coarse-textured, moderately hard, and not durable.

Pores medium-sized, rather numerous, solitary or in small multiples. Perforation plates occasionally reticulate. Rays 1 to 4 cells wide and up to 100 cells high; many cells disjunctive; pits to vessels very large and irregular. Wood parenchyma abundant, reticulate; cells often disjunctive; crystals common. Wood fibers with thick gelatinous walls and very small bordered pits.

Sapium, with about 100 species of trees or shrubs, is of pantropical distribution. There are many species in Latin America from Mexico and the West Indies to Uruguay. Most of the trees are small or medium-sized, but a few, such as *S. gigantеum* Pittier and *S. pleiostachys* K. Schum. of Central America and *S. Jenmani* Hemsl. of British Guiana, attain maximum heights of 90–115 feet, with a well-formed trunk sometimes 36 inches in diameter. The woods are light and soft to moderately so, whitish or yellowish, but staining readily, easy to work but sawing woolly, suitable for boxboards, interior construction, sabots, and paper pulp.

Pores variable, small to rather large, few to numerous. Rays uniseriate or biseriate, usually less than 25 cells high, occasionally much higher; crystals common, pits to vessels large, round to gash-like. Wood parenchyma reticulate, indistinct with lens. Wood fibers with thin walls and very small bordered pits. Radial channels sometimes present.

COMMON NAMES: Tallow tree (Fla.); gum tree, milkwood (Jam.); pinichi (Cuba); hincha-huevos, lechesillo, manzanillo, tabeiba (P. R.); bois brûlant, b. lait (Haiti); bois lait (Grenada); lengua de vaca (Dom. R.); hierba mala, h. de la flecha, higuerillo bravo, hincha-huevos, hiza, mago, magot, ohol negro, palo de la flecha (Mex.); leche de María (Br. H.); chilicuate (Guat.); chilamate (Salv.); ñipa, olivo, o. macho (Pan.); floral, lechoso, palo de leche, piñico (Col.); caucho de Apure, lechero, marfil, pascualitas, pepo (Venez.); kuina-ek, ky-cher, mabwa, swamp mabua, touckpong (Br. G.); alekosine, amanopora, jarre nona, jawahedan, komaakaran, maboewa djamaro, mabowaballi (Sur.); burra-leiteira, caucho, caximduba, curupita, curupicahy, leiteira, murupita, pau de bicho, p. de leite, seringarana, tapurú, t. da vargem, tartaruguinha (Braz.); caucho blanco, palo de leche (Ec.); caucho-mashan, gutta-percha, pampa-caucho (Peru); palo de leche (Par.); árbol de leche, blanquillo ?, curupí-caí, c.c. guazú, curupikí, ibirá-camby, i. -cambuí, lecherón, pega-pega, punuá (Arg.); árbol de leche, curupí (Ur.).

Savia, with about 25 species of trees and shrubs, is represented in Madagascar, South Africa, the West Indies, and Brazil. There are no special uses for the reddish brown, very hard, very fine-textured woods of the American species.

Pores minute, very numerous, in short to long radial series. Rays 1 or 2, locally 3, cells wide and few to 50 cells high; pits to vessels minute. Wood parenchyma fairly abundant, reticulate; crystals numerous. Wood fibers with thick gelatinous walls and minute pits.

COMMON NAMES: Ahorca-jíbaro, aretillo, carbonero de costa, hicaquillo, maco (Cuba).

Sebastiania, with about 90 species of shrubs, trees, or herbs, a few in the tropics of the Old World, is abundantly repre-

sented in Latin America, especially Brazil. The plants are the source of various products used in native medicine. The seeds of a Mexican shrub, *S. pavoniana* Muell. Arg. (=*S. Palmeri* Rose), are the famous "jumping beans," a common article in curio shops in southwestern United States; the larva of a small butterfly is responsible for the movement. The largest size reported for any American tree of the genus is about 50 feet in height and 14 inches in trunk diameter. The heartwood is variegated olive, sharply demarcated from the white sapwood; not very attractive; of medium density, fine-textured, easy to work, not highly durable. The timber finds various local applications and is said to make exceptionally good charcoal for metallurgical purposes and filters.

Pores very small to minute, numerous, in pairs, rows, or clusters. Rays uniseriate, locally biseriate, usually less than 25 cells high; crystals common; pits to vessels rather small, rounded; latex tubes present in some of the rays of *S. pavoniana*. Wood parenchyma in fuzzy lines or narrow bands about two pore-widths apart or more or less aliform and confluent; scarcely distinct with lens; crystals present. Fibers with thin to moderately thick walls, gelatinous in part; pits minute.

COMMON NAMES: Hierba de la flecha, kanchunup, mincapatli, palo de la flecha (Mex.); ridge white poisonwood (Br. H.); ibirákambi (Guianas); branquilho, capixava, sarandy (Braz.); amarillo, blanquillo, espina de arroyo, ibirá-camby, leche-leche, lecheroncillo, palo de leche (Arg.); blanquillo, palo de leche (Ur.).

Securinega. Only four wood samples of three species are available for study, and they are too dissimilar to be embraced in one description. All were collected with herbarium material.

S. congesta Muell. Arg., a shrub or small tree of eastern Peru (Yale 17843; Williams 2234), has lustrous purplish brown wood of fine and uniform texture.

Pores minute, very numerous, well distributed. Vessels with some scalariform perforation plates, the bars few and narrow. Rays mostly uniseriate, sometimes biseriate, occasionally 3 to 5 cells wide and upward of 100 cells high; pits to vessels elongated, often in scalariform arrangement. Wood parenchyma finely reticulate, barely visible with lens. Wood fibers with rather thin walls and minute pits.

S. Acidoton (L.) Fawcett or *S. Acidothamnus* Muell. Arg., a West Indian shrub, has a uniformly clear yellow, fine-textured, hard and compact wood of the Boxwood class.

Pores minute, very numerous, well distributed in short to rather long radial rows or multiples. Vessels with exclusively simple perforations. Rays of two sizes, mostly 3 to 5 cells wide and up to 50, rarely up to 100, cells high; crystals abundant; pits to vessels small to medium-sized, rounded. Wood parenchyma absent or very sparingly paratracheal. Wood fibers with thick, gelatinous walls and minute pits. (*Material:* Yale 4875; Leonard 2478, from Haiti. Yale 16317; Bro. León 13667, from Cuba.)

S. neopeltandra (Gris.) Urb. (=*Chascotheca neopeltandra* Gris.) is a small Cuban tree or a shrub with a pale yellow, dense, very fine-textured wood, also of the Boxwood class.

Pores minute, scarcely distinct with lens, very numerous, in short to long radial series. Vessels with exclusively scalariform perforation plates, the bars few and thick to numerous and thin; intervascular pitting minute. Rays uniseriate or locally biseriate; few to 100 cells high; crystals abundant; pits to vessels minute. Wood parenchyma apparently absent. Wood fibers with thick to very thick and gelatinous walls; pits minute. (*Material:* Yale 16679; J. G. Jack 5722, from Cuba.)

Senefeldera, with seven species of trees and shrubs, occurs in South America from Colombia to southern Brazil. The wood is dark orange-brown, streaked, waxy, hard, heavy, tough, strong, and fibrous.

Pores small, rather numerous, tending to radial aggregation with poreless strips between. Rays uniseriate and up to 50 cells high; some cells disjunctive; pits to vessels medium-sized, round to elongated. Wood parenchyma in very irregular lines or narrow bands several pore-widths apart and more or less reticulate; barely visible with lens. Wood fibers with thick walls and numerous, minute, bordered pits.

Tetrorchidium includes 10 species of trees and shrubs, four in tropical West Africa and six in tropical America, from the West Indies and Central America to Peru and southern Brazil. One of the largest trees is *T. rotundatum* Standl., of Honduras and Nicaragua. It attains a height of 100 feet, with slightly furrowed trunk 24 inches in diameter above the high buttresses. The timber is not utilized. The nearly white woods of the American species are all light, soft, woolly, and perishable.

Pores fairly numerous, medium-sized, barely visible. Rays uniseriate or biseriate and up to 50 cells high, occasionally taller; pits to vessels medium-sized to large, round to much elongated. Wood parenchyma reticulate, with tendency to formation of narrow concentric bands; not very distinct with lens. Wood fibers with thin walls and small distinctly bordered pits.

Key to the Genera

1 a. Parenchyma very sparse or apparently absent. Pores small to minute 2
b. Parenchyma not very sparse, usually abundant. Pores sometimes large 5

2 a. Wood fibers septate. Rays 1–6 cells wide, up to 50 cells high; procumbent cells few . . . . . *Acalypha.*
b. Wood fibers not septate. Rays up to 100 or more cells high 3

3 a. Rays 1 or 2 cells wide; procumbent cells few. Ray-vessel pitting very fine. Perforation plates scalariform . . . . . *Securinega* (in part).
b. Rays in part 3–8 cells wide. Perforations simple 4

4 a. Ray-vessel pitting very coarse. Many rays less than 3 cells wide; procumbent cells numerous . . . . . *Phyllanthus.*
b. Ray-vessel pitting rather fine. Few rays less than 3 cells wide; procumbent cells few . . . . . *Acidocroton.*

5 a. Parenchyma predominantly reticulate (as seen under lens) 6
b. Parenchyma not predominantly reticulate 24

6 a. Fibers with thin to very thin walls. Ray-vessel pitting coarse to very coarse 7
b. Fibers with medium to very thick walls 16

7 a. Pores small to very small, indistinct to invisible without lens 8
b. Pores medium-sized to large, visible without lens 10

8 a. Rays up to 100 cells high . . . . . *Aparisthmium.*
b. Rays not over 50 cells high 9

9 a. Crystals in rays only. Fiber walls thin. Wood firm . . . . . *Garcia.*
b. Crystals in both rays and parenchyma. Fiber walls very thin. Wood spongy . . . . . *Euphorbia.*

10 a. Rays 1–3, sometimes 4, cells wide 11
b. Rays uniseriate or locally biseriate 12

11 a. Parenchyma lines rather widely spaced, but very irregular and anastomosing; the cells small. Procumbent ray cells slender . . *Omphalia.*
b. Parenchyma lines closely spaced; the cells very coarse. Procumbent ray cells coarse and plump . . . . . *Alchorneopsis.*

12 a. Rays nearly homogeneous, with very few distinctly upright cells . *Hura.*
b. Ray decidedly heterogeneous, with few or no procumbent cells 13

13 a. Radial channels common 14
b. Radial channels absent 15

14 a. Ray cells flattened tangentially . . . . . *Alchornea, Conceveibastrum.*
b. Ray cells plump . . . . . *Sapium.*

15 a. Pores very large, few. Parenchyma reticulate throughout . . . *Joannesia.*
b. Pores medium-sized, fairly numerous. Parenchyma tending to form narrow concentric bands . . . . . *Tetrorchidium.*

16 a. Ray-vessel pitting very fine. Fiber walls very thick 17
b. Ray-vessel pitting medium to very coarse. Fiber walls medium to very thick 19

17 a. Pores minute; very numerous . . . . . *Savia.*
b. Pores medium-sized; not very numerous 18

18 a. Rays with many procumbent cells; up to 100 cells high; crystals abundant. Perforations multiple in part . . . . . *Drypetes.*
b. Rays with very few procumbent cells; up to 50 cells high; crystals absent. Perforations all simple . . . . . *Amanoa.*

19 a. Rays often 3 or 4 cells wide and 100 cells high; pits to vessels very large 20
b. Rays 1, sometimes 2, cells wide and not over 50 cells high; pits to vessels medium-sized. Pores very small. Fiber walls moderately thick 21

20 a. Pores solitary. Fibers with medium thick walls and conspicuous bordered pits . . . . . *Hieronyma.*
b. Pores often in multiples. Fibers with very thick walls and inconspicuous bordered pits . . . . . *Richeria.*

21 a. Pores mostly in long series. Ray and wood parenchyma cells conspicuously disjunctive. Wood yellow, of Boxwood class . . . . *Lasiocroton.*
b. Pores mostly not in long series. Ray and wood parenchyma cells not conspicuously disjunctive 22

22 a. Rays with many distinctly procumbent cells. Pores small. Wood of Boxwood class . . . . . *Adelia Ricinella.*
b. Rays with almost no distinctly procumbent cells. Woods not of Boxwood class 23

23 a. Radial channels sometimes present. Pores small. Wood oily, olive-brown . . . . . *Mabea.*
b. Radial channels absent. Pores minute. Wood yellowish . . . . . *Ditta.*

24 a. Parenchyma aliform, more or less confluent, sometimes terminal . . 25

b. Parenchyma in concentric lines or bands spaced 1–3 pore-widths apart 30

25 a. Rays 1–3 cells wide. Wood fibers very thick-walled. Pores medium-sized ..... *Pogonophora.*
b. Rays uniseriate or locally biseriate 26

26 a. Pores rather large in part. Fiber walls very thin ..... *Manihot.*
b. Pores all small to minute 27

27 a. Fiber walls thin to moderately thick ..... *Sebastiania.*
b. Fiber walls very thick 28

28 a. Rays up to 40 cells high, nearly homogeneous, without distinctly upright cells ..... *Celaenodendron.*
b. Rays less than 20 cells high, distinctly heterogeneous 29

29 a. Wood yellow, of Boxwood class ... *Leucocroton, Bernardia microphylla.*
b. Wood variegated orange and red, waxy ..... *Bernardia dichotoma.*

30 a. Fibers with very thick gelatinous walls. Sclerotic tyloses present in some genera 31
b. Fibers with thin to moderately thick walls. Sclerotic tyloses absent 38

31 a. Parenchyma 2–8 cells wide. Rays nearly homogeneous. Pores small ..... *Piranhea.*
b. Parenchyma 1 or 2 cells wide. Rays decidedly heterogeneous (except *Hippomane* and occasionally *Pera*) 32

32 a. Pores and multiples aggregated radially ..... *Senefeldera.*
b. Pores and multiples fairly evenly distributed 33

33 a. Perforations multiple in part. Rays often 3 or 4 cells wide; pitting frequently scalariform ..... *Paradrypetes.*
b. Perforations all simple. Rays 1 or 2, sometimes 3, cells wide; pitting rarely scalariform 34

34 a. Pores very small to minute, numerous. Ray-vessel pitting fine. Woods dark olive with black striping 35
b. Pores large or rather large, not numerous. Ray-vessel pitting medium to coarse. Woods brown 36

35 a. Parenchyma reticulate in part. Crystals in rays ..... *Gymnanthes.*
b. Parenchyma not reticulate. Crystals in parenchyma ..... *Bonania.*

36 a. Rays with very numerous crystals; homogeneous to very heterogeneous; pits to vessels medium-sized. Radial channels sometimes present. Parenchyma not sclerotic ..... *Pera.*

b. Rays without crystals; all very heterogeneous; pits to vessels rather large. Radial channels absent. Sclerotic parenchyma cells present 37

37 a. Parenchyma mostly uniseriate; many cells sclerotic. Rays rarely triseriate; cells very thick-walled. Sclerotic tyloses abundant. *Chaetocarpus.*
b. Parenchyma mostly biseriate; few cells sclerotic. Rays rather frequently triseriate. Sclerotic tyloses few ..... *Cunuria.*

38 a. Latex tubes present in some of the rays 39
b. Latex tubes absent. Rays heterogeneous 41

39 a. Rays nearly homogeneous, without distinctly upright cells; pits to vessels small. Wood olive-brown with black striping; moderately hard and heavy ..... *Hippomane.*
b. Rays decidedly heterogeneous, with both procumbent and upright cells 40

40 a. Rays 1–3 cells wide, up to 50 cells high; pits to vessels medium-sized. Parenchyma lines irregular. Fiber walls medium thick. Wood orange-brown, waxy ..... *Glycydendron.*
b. Rays uniseriate, up to 25 cells high; pits to vessels large. Parenchyma lines fairly regular. Fiber walls thin. Wood pale brown. *Anomalocalyx.*

41 a. Ray-vessel pit-pairs large, often distinctly elongated 42
b. Ray-vessel pit-pairs medium-sized, rounded 47

42 a. Rays of two distinct types; (1) uniseriate without procumbent cells; (2) uniseriate margins, and central biseriate or triseriate parts composed of procumbent cells 43
b. Rays uniseriate or locally biseriate; procumbent cells present, but not confined to biseriate parts 44

43 a. Pores mostly large ..... *Hevea.*
b. Pores very small ..... *Pausandra.*

44 a. Fibers thick-walled. Radial channels present. Pores rather large. Rays less than 25 cells high ..... *Gavarretia.*
b. Fibers thin-walled. Radial channels absent 45

45 a. Pores small to minute. Rays mostly less than 25 cells high; pits to vessels narrow-elliptical. Parenchyma bands 1–3 pore-widths apart ..... *Maprounea.*
b. Pores medium-sized. Rays up to 50 cells high; pits to vessels not narrow-elliptical. Parenchyma bands about 1 pore-width apart 46

46 a. Locally biseriate rays common..... *Dodecastigma.*
b. Locally biseriate rays uncommon..... *Nealchornea.*

47 a. Rays less than 25 cells high. Parenchyma band 2–3 pore-widths apart..... 48
b. Rays up to 50 cells high. Parenchyma bands about 1 pore-width apart..... 49

48 a. Parenchyma in definite lines about 3 pore-widths apart. Wood yellowish..... *Actinostemon.*
b. Parenchyma in poorly defined bands about 2 pore-widths apart. Wood variegated olive..... *Sebastiania.*

49 a. Fibers with moderately thick, gelatinous walls. Tyloses present. *Cleidion.*
b. Fibers with rather thin, not gelatinous walls. Tyloses absent. *Caryodendron.*

CURRENT LITERATURE

The American species of Passifloraceae. By ELLSWORTH P. KILLIP. *Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 19: 1–331; March 31, 1938.

A detailed monograph of American Passifloraceae, the present publication forming half of a volume devoted to the subject. The genus *Passiflora* is represented by 354 species, all of which are described in detail, with complete synonymy and citation of many vernacular names. The second and concluding part of the volume is in press and will be issued shortly.

Studio geobotanico dell'isola Hispaniola (Antille). By R. CIFERRI. *Atti Istituto Bot. Univ. Pavia* 4: 8: 3–336; figs. 1–45; colored map; 1936.

A detailed account of the geobotany of Hispaniola, based chiefly on field work in the Dominican Republic, *i.e.*, the eastern part of the island. The phytogeography is discussed in great detail, and the excellent halftones illustrate many aspects of the vegetation. More than 2500 Latin names of plants are cited and indexed. The principal portion of the paper is followed by a rather detailed English summary, a

bibliography, 10 pages of vernacular names, and a map illustrating the principal phytogeographic divisions.—P. C. STANDLEY.

Thrinax—the peaberry palms. By L. H. BAILEY. *Gentes Herbarum* (Ithaca, N. Y.) 4: 129–149; figs. 75–85; March 1938.

The genus *Thrinax* (with the synonyms *Porothrinax* and *Simpsonia*) consists of 10 species, ranging from southern Florida through the West Indies to Mexico and northern South America. All the species are described, with full synonymy, and several are illustrated.

A monograph of the genus *Petrea* (part). By HAROLD N. MOLDENKE. *Report. Sp. Nov.* (Berlin-Dahlem) 33: 1–48; Jan. 10, 1938.

As treated, the genus *Petrea* (Verbenaceae) consists of 36 species and varieties, ranging from northern Mexico to the West Indies, Paraguay, and Bolivia. Full descriptions and synonymy are given for all species.

Esquemas biotípicos y sinecias características de las regiones geográfico-botánicas de México. By I. OCHOTERENA. *Anal. Inst. Biol.* (Mexico) 8: 463–597; figs. 1–74; December 1937.

The author recognized as phytogeographic regions of Mexico the following: The littoral and dune region. The characteristically mesophytic tropical, from 150 meters in the east (400–500 meters on the west slope) to 800–1000 meters in average elevation, with the distinct subregion of Monte Mojino. The subtropical region which in some places reaches an elevation of about 2200 meters. The desert regions: of northern Sinaloa and western Sonora, and the very specialized one of the Baja California; the northern of Texan-Mexican; the southern, with species extensions in certain localities. The central plains. The Sierra Madre or forest region. The cold region, rather humid, of the high mountains. Characteristic plant associations of each of these regions are described in some detail. The numerous illustrations give some idea of

the varied plant life of Mexico, especially of the trees and shrubs.—P. C. STANDLEY.

The natural landscape of northwestern Chihuahua. By DONALD D. BRAND. *Univ. New Mexico Bull.* No. 316 (*Geol. Ser.* 5: 2). Pp. 74; 5 maps, 3 charts, 10 pls.; Nov. 1, 1937.

A descriptive account of the physiography, climate, biota, and hydrography of the northwestern Chihuahua, Mexico. Nine pages are devoted to a general account of the vegetation. The illustrations are of special interest because they illustrate so well the outstanding features of the vegetation.

Studies of Mexican and Central American plants. V. By C. L. LUNDELL. *Amer. Midland Naturalist* (Notre Dame, Indiana) 19: 427–432; March 1938.

The author rejects the generic name *Licaria* (Lauraceae), recently adopted by Kostermans, on the ground that it was based on sterile material of doubtful position, and maintains that the proper name for the genus is *Acrodiclidium*, under which seven new combinations are made. Among new species described, from Chiapas, Mexico, are *Trophis cuspidata*, *Indigofera Matudai*, *Pithecolobium Matudai*, *Eugenia siltepecana*, and *Hauya Matudai*. *Zanthoxylum atoyacanum* and *Paratbesis Matudai* are described from Vera Cruz.—P. C. STANDLEY.

***Castilla* or *Castilloa*?** By ALBERT F. HILL. *Bot. Mus. Leafl. Harvard Univ.* 5: 161–163; March 31, 1938.

The proper name for the genus containing the Mexican rubber tree is *Castilla* rather than *Castilloa*.

A contribution to the flora of Honduras. By T. G. YUNCKER. *Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 17: 287–407; pls. 1–18; Jan. 31, 1938.

A brief description of the vegetation of the region of Siguatepeque, central Honduras, with an annotated list of plants collected by the author. Many trees are recorded for the first time from the country. Among the woody plants described as new are numerous species of *Piper* and eight species of *Quercus*, by Trelease; *Verbesina vicina* and *Zexmenia perymenioides* by Blake; and the following by Standley: *Calliandra arborea*, *C. leucothrix*, *C. Yunckeri*, *Zanthoxylum limoniodorum*, *Picramnia locuples*, *Ilex hondurensis*, *Eugenia apodantha*, *E. Yunckeri*, *Blakea aeruginosa*, *Fraxinus hondurensis*, *Amphilophium pilosum*, *Anisomeria rudis*, and *Psychotria Yunckeri*.

Flora de Costa Rica. By PAUL C. STANDLEY. *Mus. Nac. Costa Rica Ser. Bot.* (San José) 1: 1–48; August 1937.

A Spanish translation of the *Flora of Costa Rica*, published in volume 18 of the Botanical Series of Field Museum of Natural History, with the addition of some new material. The groups covered in the present and first installment are Cycadaceae to Gramineae (in part).

Vocabulario de términos vulgares en historia natural colombiana. By HERMANO APOLINAR MARÍA. *Revista Acad. Colombiana* (Bogotá) 1: 4: 349–361; 1 colored plate; 1937.

A dictionary of Colombian names used in natural history, the present instalment covering the words Acónito to Alacrán, with 94 entries. Many of the names listed pertain to woody plants, about which much information is presented.

Plantae novae colombianae. By JOSÉ CUATRECASAS. *Revista Acad. Colombiana* 1: 4: 362–375; figs. 1–18; 1937.

Among numerous new plants described from Colombia are species of *Siparuna*, *Croton*, *Hypericum*, *Gonolobus*, *Besleria*, *Crantzia*, *Eupatorium*, *Diplostephium*, *Baccharis*, *Loricaria*, *Gynoxis*, and *Senecio*. Many of the new species are illustrated by excellent figures. The paper exhibits to good advantage the attractive form of the new quarto serial in which it appears. The *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales*, issued by the Colombian Ministry of Education, compares most favorably with similar publications from any other country of America or Europe, and in its typography and general appearance has few rivals.—P. C. STANDLEY.

Eine neue Araliacea aus Colombia. By H. HARMS. *Repert. Sp. Nov.* (Berlin-Dahlem) 43: 110; Jan. 10, 1938.

Schefflera elastichocephala is described from Colombia.

Zwei neue Arten der Gattung *Inga*. By H. HARMS. *Repert. Sp. Nov.* 43: 111–112; Jan. 10, 1938.

Inga Duquei is described from Colombia; *L. Schimpfii* from Ecuador. Local names are reported from Colombia for other species: *I. laurina* Willd., Churimo Frijol; *I. punctata* Willd., Churimo, Guavo Tamarindo; *I. densiflora* Benth., Guamo, Guavo Macheto.

Sobre la denominación de tres Bombacáceae de la costa caribe. By ARMANDO DUGAND. *Contr. Hist. Nat. Colombiana* (Barranquilla) 1: 1–6; March 25, 1938.

A new name is *Bombacopsis quinata* (Jacq.) Dugand, synonyms of which are *Bombax quinatum* Jacq., *Pachira Fendleri* Seem., and *Bombacopsis Fendleri* Pittier; the local Colombian names are Ceiba Colorada, C. Tolú, C. Tolúa, and Tolú. *Bombax septenatum* Jacq. has as synonyms *B. heptaphyllum* Jacq., *Pachira Barrigon* Seem., and *B. Barrigon* Dcne.; Colombian names are Majagua and Ceiba de Majagua. A synonym of *Ceiba pentandra* (L.) Gaertn. is *Bombax mompoxense* H. B. K., known in Colombia as Bonga, Ceiba, C. Bonga, and C. de Lana.

Algunas Leguminosas endémicas y de mayor distribución geográfica. By ARMANDO DUGAND. *Contr. Hist. Nat. Colombiana* 1: 7–13; March 25, 1938.

Notes upon various Colombian Leguminosae, all of which are described and annotated. Local names are reported as follows: *Dugandia rostrata* (H. & B.) Britt. & Kill., Rabo de Iguana de Agua, Iguanero de Agua; *Piptadenia speciosa* Britt. & Kill., Bocachico; *Arthrosamanea pistaciaefolia* (Willd.) Britt. & Rose, Guayacán Chaparro, G. Ciénaga; *Platymiscium pinnatum* (Jacq.) Dugand, new combination (*Amerimnon pinnatum* Jacq., *P. polystachyum* Benth., *P. urophyllum* Harms), Trébol, Trebo; *Lonchocarpus sanctae-*

marthae Pittier, Papo de Zamba, Papizamba, Papozambo, Majomo, M. Chicharrón.

Prof. Dr. Henry Pittier. Esbozo biográfico. By A. JAHN. *Bol. Soc. Venezolana Cienc. Nat.* (Caracas) 4: 30: 1–43; 2 portraits; 1937.

A biographical sketch of Henry Pittier, published on the occasion of his eightieth birthday. Included is a detailed account of his botanical explorations in Mexico and Central and South America, and an appreciation of his scientific achievements. A bibliography covering the years 1878–1937 lists 247 titles, a large proportion of which relate to tropical trees.

Ensayo sobre la clasificación de las especies venezolanas del género *Ficus*. By H. PITTIER. *Bol. Soc. Venezolana Cienc. Nat.* 4: 30: 44–80; 1937.

For Venezuela there are listed and keyed 28 species of *Ficus*. New are *F. longistipula*, *F. pascuorum*, *F. macrosyce*, *F. Ernestiana*, *F. tovarensis*, *F. floresina*, *F. turbinata*, *F. expansa*, *F. coronata*, *F. Iturbei*, *F. scabrida*, *F. palmicida* (vernacular name Matapalo), *F. glandulosa*, *F. guanarensis*, *F. Maitin* (Maitín), *F. ovalifolia*, *F. myriasycea*, *F. obovata*, *F. aureo-brunnea*, *F. rigidifolia*.

Notas dendrológicas de Venezuela. By H. PITTIER. *Bol. Soc. Venezolana Cienc. Nat.* 4: 30: 81–92; 1937.

New trees from Venezuela are *Calliandra porphyrea*, *Pithecolobium pulchellum*, *Macrolobium obtusum*, *Ormosia avilensis*, *O. tovarensis*, *Eschweilera macrocarpa*, *E. perumbonata*, and *Cybianthus nemophilus*.

Clasificación de los bosques. By H. PITTIER. *Bol. Soc. Venezolana Cienc. Nat.* 4: 30: 93–110; 1937.

A classification is proposed, accompanied by lists of species, mostly with vernacular names, of trees and other plants for each division of the Venezuelan forests. According to elevation, the vegetation is classified into the following divisions: *tierra caliente*, 0–1000 meters; *tierra templada*, 1000–2800

meters; *tierra fría*, 2800–3600 meters; *tierra gélida*, 3600 meters to the summits of the highest mountains. The forests are divided as follows: xerophilous, including cactus, thorn, and deciduous types; humid, divisible into rain and cloud forest; andine; Mangrove swamps and other halogenous formations.—P. C. STANDLEY.

Flora of Suriname (Netherlands Guayana). Edited by A. PULLE. Vol. 2, part 1, pp. 337–400; Vol. 3, part 1, pp. 305–336; Vol. 4, pp. 433–513. September 1937.

These three instalments of the admirable *Flora of Suriname* include much material relating to woody plants. In Volume 2 the families treated are Hernandiaceae, by A. J. G. H. Kostermans; Sapindaceae, by H. Uittien; Capparidaceae (part), by Johanna C. Went. In Volume 3 appear Passifloraceae, by E. P. Killip, and Ochnaceae (part), by C. Wehlburg. The part of Volume 4 includes the final portion of Myrsinaceae, by H. P. Bottelier, about 75 pages of additions and corrections to groups treated in earlier pages, and a final index to Volume 4, part 1.—P. C. STANDLEY.

Revision of the Lauraceae. III. The genera *Aiouea, Systemonodaphne, Urbanodendron, Mezilaurus;* additions and corrections to *Licaria* and *Cryptocarya*. By A. J. G. H. KOSTERMANS. *Recueil Trav. Bot. Néerland.* 35: 56–129; March 1938.

In continuation of his detailed and scholarly monograph of American Lauraceae, the author treats the genera named in the title. *Aiouea* includes 29 species, chiefly South American, with one in Costa Rica. *Systemonodaphne* and *Urbanodendron* have one species each, and *Mezilaurus* 8, all South American. Many vernacular names are cited. New species are *Aiouea angulata*, Colombia; *A. bracteata*, *A. acarodomatifera*, and *A. barbellata*, Rio de Janeiro; *A. truxillensis*, Venezuela; *A. demerarensis*, British Guiana, local names Wild Calabash, Wild Currant, Boradiea; *A. chapadaensis*, Maranhão. Several new combinations also are made.—P. C. STANDLEY.

Memoria sobre el estado de las quinas en general y en particular sobre las de Loja. By FRANCISCO JOSÉ DE CALDAS. *Revista Acad. Colombiana* (Bogotá) 1: 4: 326–333; map, table; 1937.

A report, written at Quito in March, 1805, by Caldas, member of the celebrated Mutis expedition to the northern Andes. A rather full account of the Cinchona industry of that period, especially as conducted in the region of Loja, Ecuador.

Monografía botánica de la Provincia de Imbabura. By JAIME BURBANO R. *Flora* (Quito, Ecuador) 1: 2: 23–39; October 1937.

A brief account of the Province of Imbabura, Ecuador, with notes on physiography, climate, and phytogeography. Three vegetational regions are represented: humid forest of the slopes of the cordilleras; interandine, the region of cereals; cold region of the paramos. Each of these is described in some detail with mention of many characteristic species.

Glosario de términos usados en anatomía de maderas. By LUCAS A. TORTORELLI. *Flora* 1: 2: 46–75; 5 pls.; October 1937.

A Spanish edition of the "Glossary of terms used in describing woods" adopted by the International Association of Wood Anatomists, together with resolutions and recommendations adopted at a conference of wood anatomists in Rio de Janeiro, Brazil, Sept. 21–28, 1936.

Breves anotaciones botánico-agrícolas de la Provincia de "Los Ríos." By WLADIMIRO VALAREZO UTURBURO. *Flora* 1: 2: 84–96; October 1937.

A brief account of botanical and agricultural features of the Province of Los Ríos, Ecuador, with a few notes regarding trees of the region.

Excursión botánico al páramo del "Angel." By M. ACOSTA SOLÍS. *Flora* 1: 2: 103–118; 11 plates; October 1937.

An interesting account of a journey to the Páramo del Angel, and detailed notes concerning vegetation of the paramo, with a brief list of the plants noted.

Galapagos observado fitologicamente. By M. Acosta Solís. Pp. 78; 7¼ x 10½; 30 halftones, 1 map; Quito, Ecuador, October 1937.

An illustrated report of the author's study of the vegetation on the Galapagos while a member of the Ecuadorean National Scientific Expedition to the archipelago.

Die Palmengattung *Syagrus* Mart. By M. Burret. *Notizbl. Bot. Gart. Berlin-Dahlem* 13: 677–696; Nov. 25, 1937.

The palm genus *Syagrus* consists of 43 South American species. New species, from Brazil, are *S. Hoehnei* (São Paulo) and *S. brachyrhyncha* (Pará).

Botanica e agricultura no Brasil no seculo XVI. By F. C. Hoehne. *Bibliotheca Pedagogica Brasileira*, Vol. 71. Companhia Editora Nacional, São Paulo, 1937.

A résumé of the earliest botanical information about Brazil as found in the works of sixteenth century authors from Hans Stade and Huldrich Schmiedel, whose botany is mostly confined to descriptions of American staple foods, to Gabriel Soares de Souza, whose account of the agriculture and botany of Brazil, as observed by him during a residence of forty years as a planter in Bahia, is the most important sixteenth century work on the subject. His *Tratado Descriptivo do Brasil em 1678* was first published in 1825 as Vol. 3, Part 1 of the series called *Collecção de Noticias para a Historia e Geographia das Nações Ultramarinas, etc.*, edited by the Real Academia de Sciencias de Lisboa. Martius, who has numerous references to it in his *Historia Naturalis Palmarum* and elsewhere, ascribed it as late as 1837 to Francisco de Cunha. Cultivated products, introduced and indigenous, the common wild fruits, various palms, more than a hundred trees, are characterized or described in the *Tratado* of Souza under vernacular names so well recorded that there is seldom much difficulty about their present-day identification.

Out of a dozen sixteenth century authors, three were not seen. Readers are recommended to search for the works of Padre Manuel de Moraes (1586–1651) whose *Classificação de Plantas Brasileiras* is said to have been published in Leipzig, date unknown, but was possibly destroyed by his former confrères when the author turned Calvinist.

The origin of the Coconut Palm and of certain varieties of banana are ascribed to the New World. *Colocasia antiquorum*, ordinarily attributed to the Indo-Malayan region, is said to be indigenous also in Brazil. An index to common and scientific names and a systematic list of the species mentioned form a useful part of the volume.—B. E. Dahlgren, *Field Museum of Natural History*.

Estudios morfológicos y etológicos en el género *Prosopis*. By Arturo Burkart. *Darwiniana* (Buenos Aires) 3: 27–47; pls. 1–6; December 1937.

A detailed account of the morphology of Argentine species of *Prosopis*, based chiefly upon observations of living plants. There is included a partial key to species, according to spine characters.

Las Verbenaceas cultivadas en Buenos Aires. By Nélida S. Tronocoso, *Darwiniana* 3: 49–57; December 1937.

Among Verbenaceae cultivated in Buenos Aires are woody plants of the genera *Lippia*, *Vitex*, *Lantana*, *Citharexylum*, and *Duranta*, for all of which synonymy and other information are cited.

Nota sobre la multiplicación vegetativa de *Pterogyne nitens*. By L. R. Parodi. *Revista Argent. Agron.* (Buenos Aires) 4: 305–307; 1 fig.; December 1937.

Pterogyne nitens Tul. (Leguminosae), native of southern Brazil, Paraguay, and northern Argentina, is known by the names Ybirá-ro, Guiaraó, Palo Rosa, Palo Mortero, and Tipa Colorada. It is a large tree whose red wood is utilized for carts, mortars for grinding maize, etc. Cultivated for ornament in parks of Buenos Aires and La Plata, it flowers, but seldom produces seeds. It may be propagated from pieces of the roots, which quickly produce new plants.—P. C. Standley.

Tanino. *M. A. N.* (Pub. Min. Agr. Nación Argentina), Buenos Aires, February 1938.

The extract of Quebracho industry had its beginning in Argentina in 1880, when a factory was installed in Corrientes and another in Santa Fe. There are now 23 modern establishments, employing 5425 persons. About 700,000 tons of wood were consumed in 1935 and the yield of extract was nearly 215,000 tons, or a little over 30 per cent of the raw product.

Maderas del delta del Parana. *M. A. N.*, March 1938.

"Approximately 80,000 hectares of the River Parana delta are dedicated to plantations of Poplars and Willows, which annually produce ten million square meters of soft timber, much preferred for the making of boxes for packing fruit, conserves, vines, beer, oil, liquid fuel, etc."

Estudios anatómicos en el leño de plantas tucumanas. By Horacio R. Descole and Carlos A. O'Donell. *Lilloa* (Tucumán, Argentina) 1: 75–93; 8 pls.; Dec. 27, 1937.

Wood structure is described and illustrated for the following plants of the flora of Tucumán: *Prunus tucumanensis*, *Ilex argentina*, *Crinodendrum tucumanum*, *Solanum argentinum*, *S. trichoneuron*, *S. foetidum*, *S. verbascifolium*, and *Basanacantha micracantha*.

Index de la flora dendrológica argentina. By Eduardo Latzina. *Lilloa* 1: 95–211; 14 pls.; Dec. 27, 1937.

For Argentina are listed 838 species of woody plants, the largest groups being Leguminosae (133 species), Compositae (41), Solanaceae (38), and Myrtaceae (36). There are included a long list of vernacular names, an extensive bibliography, and notes regarding size of trees, distribution, possible utilization, and properties of their woods. The paper will prove an exceptionally useful one for various purposes, and it is a good example of the high quality of the numerous contributions comprising the first volume of the new journal *Lilloa*, whose name commemorates the famous Argentine botanist, Miguel Lillo (1862–1931). In scientific value of its contents and in its typography this welcome new publication has no superiors among American botanical journals, and it is greatly to be hoped that the initial volume may be followed by a long series of other similar ones.—P. C. Standley.

Sobre propiedades físicas de una madera poco conocida en la industria; la del itín o barba de tigre (*Prosopis Kuntzei* Harms). By Eduardo Latzina. *Lilloa* 1: 213–233, 2 pls.; Dec. 27, 1937.

Itín, *Prosopis Kuntzei*, is a large tree of northern and western Argentina, noteworthy for its extremely hard, heavy, and durable wood. Physical properties of the timber are discussed in detail.

Calorimetría de maderas pertenecientes a especies existentes en la provincia de Tucumán. By Eduardo Latzina. *Lilloa* 1: 235–248; Dec. 27, 1937.

Results of an investigation of the fuel value of heartwood, sapwood, and bark of 55 species of 43 genera of trees indigenous to the Province of Tucumán, Argentina.

Algunos árboles indígenas cultivados en el departamento de Resistencia (Chaco). By Teodoro Meyer. *Lilloa* 1: 253–261; Dec. 27, 1937.

An annotated list, with vernacular names, of 19 Argentine trees cultivated in the Department of Resistencia, Argentina.

Anatomía comparada del leño de tres Simarubáceas argentinas. By Carlos A. O'Donell. *Lilloa* 1: 263–282; 3 pls.; Dec. 27, 1937.

Descriptions and illustrations of the wood anatomy of three Simarubaceae of Argentina: *Castela coccinea*, *Alvaradoa amorphoides*, and *Picraena palo-amargo*.

Sinopsis de las especies argentinas del género *Buddleja*. By Lyman Bradford Smith. *Lilloa* 1: 397–414; 1 pl.; Dec. 27, 1937.

Seventeen species of *Buddleja* native in Argentina are described, and a key is provided for their separation.

Plantae uruguayenses novae vel criticae. By W. G. HERTER. *Revista Sudamer. Bot.* (Montevideo) 5: 13–36; figs. 1–7; November 1937.

A large number of additions to the flora of Uruguay are listed. New species of woody plants are *Phyllanthus pseudoguayanensis* Hert. & Mansf., *Dodonaea arborea*, and *Matayba Melchioriana*.

Distribución de las Anacardiáceas del Uruguay. By J. CHEBATAROFF. *Revista Sudamer. Bot.* 5: 37–39; 2 figs.; November 1937.

Brief notes regarding local distribution of seven species of Anacardiaceae known in Uruguay. Maps illustrate the distribution of six species.

On the foreign fancy woods in Japan. (In Japanese.) By R. KANEHIRA. *Journ. Japanese Forestry Society* 20: 2: 56–66; 1938.

In olden times fancy woods reached Japan through the channel of Chinese merchants. The Chinese names, such as Hung-mu, Tsu-tan, Hua-li, and Tie-li-mu, for ornamental woods, and Chênsiang and T'an-siang for incense woods, are still used in Japan in the same Chinese characters, although at present these timbers are imported directly from the countries producing them. Many different botanical names have been applied to some of these woods, but according to the author, the correct designations are as follows:

Hung-mu is Red Sandalwood or Red Sanders, *Pterocarpus santalinus* L. f. It is imported in small, irregular pieces from India, at present in limited quantity and very highly priced, and is used for a part of the Japanese musical instrument called "syamisen." Tsu-tan, Red Wood or Rosewood, is of two different origins. One, from Siam and Cochin-China, is *Dalbergia cochinchinensis* Pierre; the other, from India, is *D. latifolia* Roxb. Hua-li, Pradu Wood, has been confused with Tsu-tan, and seems to comprise two kinds. One, from Siam, is *Pterocarpus indicus* Willd.; the other, exported from Madras, British India, is *P. Marsupium* Roxb. Hua-li resembles Tsu-tan, but the rays are uniseriate and the watery

extract is fluorescent, whereas in Tsu-tan the rays are 2 or 3 cells wide and the extract is not fluorescent. There are many varieties of Ebony on the Japanese market, but at present the most important kinds are Streaky Ebony, from Celebes, *Diospyros Rumphii* Bakh. (nom. nov. ined., syn. *D. utilis* K. & V.), and Green Ebony, from Siam, *D. mollis* Griff. Chênsiang is *Aquilaria* spp., and T'an-siang is *Santalum album* L.

Researches on tropical woods for the manufacture of pulp. I. Chemical composition of Philippine woods. (In Japanese, with English abstract.) By I. MIURA. *Cellulose Chemistry* (Tokyo) 13: 11: 442–446.

Gives the results of tests on 12 kinds of Philippine woods, seven of them Dipterocarps, with reference to their possible commercial value for pulp. Red Lauan, *Shorea negrosensis* Foxw., was found to have the highest content of cellulose and the least soluble matter.

Chemical compositions of "udonoki" and "tsuge." (In Japanese, with English abstract.) By I. MIURA. *Cellulose Chemistry* 13: 12: 494–495; 1937.

Analyses are given for two woods: Udonoki, *Pisonia umbellifera* (Forst.) Seem., of Micronesia, and Tsuge, *Buxus japonica* Muell. Arg., a kind of Boxwood from Miyake Island. The first is notable for its ash content (3.11 to 3.75 per cent); also its lignin content is higher and that of cellulose lower than in ordinary hardwoods growing in the temperate zone.

The cashew nut industry in western India. By W. J. JENKINS. *Bull. Imperial Institute* (London) 36: 1: 44–52; 1938.

An interesting account of the growing of the trees (*Anacardium occidentale*), harvesting of the fruits, preparing the nuts for market, and utilizing the by-products.

Palmae chinenses. By M. BURRET. *Notizbl. Bot. Gart. Berlin-Dahlem* 13: 582–606; November 25, 1937.

New species of Chinese palms are described in the genera *Rhapis*, *Calamus*, and *Wallichia*, and notes are given regard-

ing numerous older species. *Chuniophoenix hainanensis* is the type of a new genus, related to *Nannorhops*.

Palmiers d'Indochine nouveaux ou litigieux. By F. Gagnepain. *Notulae Syst.* (Paris) 6: 149–160; December 1937.

From Indo-China is described *Bejaudia cambodiensis*, a new genus of palms, related to *Plectocomiopsis* and *Myrialepis*. New species are described in the genera *Caryota*, *Korthalsia*, *Licuala*, *Pinanga*, *Plectocomia*, and *Rhapis*.

***Pandanus* nouveaux d'Indochine.** By F. Gagnepain. *Notulae Syst.* 6: 176–177; January 1938.

Pandanus leucocephalus and *P. fibrosus* are new species from Indo-China.

Fagacées nouvelles de l'Asie orientale. By Aimée Camus. *Notulae Syst.* 6: 178–185; January 1938.

Several new species of *Castanopsis* and *Lithocarpus* are described as new from Indo-China and China.

A synopsis of *Acmena* DC., a valid genus of the Myrtaceae. By E. D. Merrill and L. M. Perry. *Journ. Arnold Arboretum* 19: 1–20; January 1938.

Acmena in recent years has been confused with *Eugenia*, but is separable by seed and floral characters. A synonym is *Xenodendron* Laut. & Schum. The authors recognize 11 species, ranging from Burma and Southern China to Java, Philippines, and Australia, and suspect that others will be found among published *Eugenia* species. As new are described *A. caudata* (Dutch Borneo), *A. divaricata* (North Queensland), and *A. Dielsii* (Papua).—P. C. Standley.

New or noteworthy Indo-Chinese plants. By E. D. Merrill. *Journ. Arnold Arboretum* 19: 21–70; 3 figs.; January 1938.

Numerous additions to the flora of Indo-China are listed. New species are published in *Helicia*, *Illicium*, *Pseuduvaria*, *Fissistigma*, *Beilschmiedia*, *Polyosma*, *Pittosporum*, *Pygeum*, *Caesalpinia*, *Bauhinia*, *Munronia*, *Pentaphylax*, *Evonymus*, *Turpinia*, *Gomphandra*, *Allophylus*, *Meliosma*, *Rhamnus*, *Elaeocarpus*, *Tilia*, *Actinidia*, *Hartia*, *Cratoxylon*, *Casearia*, *Memecylon*, *Dendropanax*, *Agapetes*, *Vaccinium*, *Clerodendron*, *Wightia*, and *Mussaenda*.

A note on certain Malayan species of *Sindora*. By C. F. Symington. *Kew Bulletin* 73–79; 1 ill.; 1938.

Sindora Wallichii Benth. and *S. echinocalyx* Prain, considered synonyms by some authors, are both valid species. *S. parvifoliola* is a new species from Malay Peninsula, Sumatra, and Borneo.

The Malaysian species of the genus *Ixora* (Rub.). By C. E. B. Bremekamp. *Bull Jard. Bot. Buitenzorg* 3: 14: 197–367; December 1937.

An introduction discusses in some detail morphology of the genus, which consists of shrubs and trees. In the Malaysian Archipelago are represented 164 species, distributed among three subgenera and 13 sections. Keys are provided for recognition of the species, and there is full synonymy and description of each species. Numerous species are described as new.

Timber tests: Damar laut daun kechil (*Shorea Maxwelliana* King). By F. S. Walker. *The Malayan Forester* 7: 1: 30–34; January 1938.

"This is one of a group of a dozen species producing timber of the Balau grade. It is widely distributed throughout the Peninsula, but usually it is marketed with others of its group. The wood is very hard and heavy; weight (at 12 per cent moisture), 61 to 69 lbs. per cu. ft. It can safely be recommended for all heavy-constructional work, where great strength and durability are required, but it should be protected, either by metal sheathing or preservative, if used for marine piling. It is also suitable for railway sleepers, and telegraph and power-line poles. Timber for structural purposes should be carefully inspected owing to a tendency of the species to check when seasoning, a feature common to all Balau timber."

Beiträge zur Kenntnis der Flora von Borneo. Herausgegeben von Edgar Irmscher. *Mitt. Inst. Allgem. Bot. Hamburg* 7: 263–310; 1937.

Fifteen families of Borneo plants are treated by various authors, with descriptions of numerous new species and notes upon older ones. Among woody plants are new species, by E. D. Merrill, of *Xanthophytum*, *Myrioneuron*, *Coptosapelta*, *Greenia*, *Mussaenda*, *Lucinaea*, *Urophyllum*, *Gardenia*, *Tricalysia*, *Canthium*, *Ixora*, *Pavetta*, *Psychotria*, *Lasianthus*, *Saprosma*, and *Prismatomeris*.

Matériaux pour le flore de la Nouvelle-Calédonie. XLVII. Revision des Polygonacées. By A. Guillaumin. *Bull. Soc. Bot. France* (Paris) 84: 462–463; February 1, 1938.

There are species of six genera of Polygonaceae in New Caledonia. *Coccoloba* is represented by the introduced *C. uvifera*, and *Muehlenbeckia* by two introduced species.

Notes on the genus *Flindersia* R. Br. and the systematic anatomy of the important flindersian timbers indigenous to Queensland. By Ellwood S. Harrar. *Journ. Elisha Mitchell Sci. Soc.* 53: 2: 282–291; pls. 24–26; December 1937.

"According to White, *Flindersia* comprises 18 species of trees, only three of which occur naturally beyond Australian shores. The Queensland flora includes 14 or 15 species; these are widely scattered throughout the state, some occurring in the rain forests and others in much less humid regions. Economically the group is rather important and is especially noted for the very fine cabinet woods and structural timbers which it produces."

"This study has revealed that flindersian timbers possess numerous physical and anatomical departures of sufficient magnitude to permit of their specific identification. To facilitate comparisons, the significant properties of each have been noted and recorded in Table 1. A key for these woods, based on both their microscopic and macroscopic characteristics, also has been compiled."

"Based upon modern taxonomic concepts, *Flindersia* appears to be more closely related to the Rutaceae than to the Meliaceae. From the discussion just completed it is evident that a nearly parallel situation exists when viewed from the standpoint of wood anatomy. Neither the taxonomic nor anatomical characteristics point clearly to either of these two families, but rather appear to combine certain features of both. In conclusion the writer feels that the anatomical evidence gathered during this study lends further support to White's views [*Tropical Woods* 25: 18, footnote], namely, that *Flindersia* should be set up as a separate family, the Flindersiaceae."

Position systématique de *Pelea madagascarica* (Rutacées) et révision du genre *Humblotiodendron*. By Harold St. John. *Notulae Syst.* (Paris) 6: 125–129; December 1937.

The genus *Humblotiodendron* Engler consists of two species, *H. spathulatum* Engler, of the Comores, and *H. madagascaricum* (Baill.) St. John, of Madagascar (*Pelea madagascarica* Baill.). They are trees or shrubs of the family Rutaceae.

Contribution a l'étude des Euphorbiacées de Madagascar (suite). By J. Leandri. *Notulae Syst.* 6: 185–199; 2 figs.; January 1938.

An account of the genus *Phyllanthus*, as represented in Madagascar, most of the species being shrubs or suffrutescent plants.

Le genre *Breonia* de Madagascar. By A.-M. Homolle. *Bull. Soc. Bot. France* (Paris) 84: 457–462; February 1, 1938.

The genus *Breonia*, reduced by Baillon to a section of *Sarcocephalus*, is a distinct group. Twelve species are known from Madagascar, six of which are described as new.

Celastraceae novae vel melius cognoscendae. III. By Th. Loesener. *Notizbl. Bot. Gart. Berlin-Dahlem* 13: 563–581; November 25, 1937.

The genus *Campylostemon*, referred by some authors to Hippocrateaceae, is placed by the writer in Celastraceae. Ten

species are recognized and described, with a key, all native in tropical Africa. *Evonymus elaeodendroides*, with one variety, is described from Madagascar, and *Brexiella longipes* Perr. de la Bath. is transferred to *Evonymus* with the new name *E. acanthodonta*.—P. C. STANDLEY.

Neue Arten von der Insel Annobon. By J. MILDBRAED. *Notizbl. Bot. Gart. Berlin-Dahlem* 13: 697–705; November 25, 1937.

Among new species described from the island of Annobon are *Fagara annobonensis*, *Tristemma oreothamnos*, *Calvoa uropetala*, *Lachnopylis annobonensis*, *Pouchetia confertiflora*, and *Pavetta dermatophylla*.

Notes from the British Museum herbarium. By E. G. BAKER. *Journ. Bot.* (London) 76: 19–23; January 1938.

New woody plants are *Baubinia lambiana* (Borneo), *Lonchocarpus pallescens*, var. *pubescens* (North Rhodesia), and *Hibiscus sparseaculeatus* (Somaliland).

Eine neue Art der Gattung *Tessmannia* (*T. Burttii*). By H. HARMS. *Repert. Sp. Nov. Berlin-Dahlem* 43: 110–111; January 10, 1938.

Tessmannia Burttii is a new species from Northern Rhodesia.

***Euphorbia* (*Diacanthium*) *Deightonii*, a new succulent from West Africa, with brief notes on some allied species.** By LEON CROIZAT. *Kew Bulletin* 53–59; 1938.

E. Deightonii, a tree or shrub, is described from Sierra Leone.

Deux nouveautés de la Côte d'Ivoire. By A. AUBRÉVILLE and G. PELLEGRIN. *Bull. Soc. Bot. France* 84: 390–393; 1 fig.; February 1, 1938.

From Ivory Coast are described *Octoknema okoubaka* (local name Okoubaka) and *Cussonia bancoensis* (Ringhalla, n'Komi Popossi). The former, a large tree, is believed by native people to cause the death of all other trees growing near it.

Les espéces du genre *Detarium* (Leg. Caesal.) en A. O. F. By A. AUBRÉVILLE and JEAN TROCHAIN. *Bull. Soc. Bot. France* 84: 487–494; 1 fig.; February 1, 1938.

In west tropical Africa there are two species of *Detarium*, namely, *D. microcarpum* G. & P., a savanna species, and *D. senegalense* Gmel., a forest tree. *D. Heudelotianum* Baill. is merely a physiological race of *D. senegalense*.

Le bois de landa, *Erythroxylum* du Cameroun. By D. NORMAND. *Rev. Bot. Appl. & d'Agr. Tropicale* 17: 196: 883–889; 1 pl; December 1937.

Landa, *Erythroxylum Mannii* Oliv., is the only native species of the genus that develops into a large tree in the dense forests of tropical Africa. It sometimes has a well-formed trunk 65 feet long and 28 inches in diameter. The brownish wood is fine-textured, uniform, rather light and soft; sp. gr. (at 15 per cent moisture) 0.65, which is low for the genus. It is easy to work, very tough, and considered suitable for furniture-making and carpentry. Anatomical details and the results of timber tests are included.

A short history of *Rhus* to the time of Linnaeus. By FRED A. BARKLEY and ELIZABETH DUCKER BARKLEY. *Amer. Midland Naturalist* (Notre Dame, Indiana) 19: 265–333; figs. 1–27; March 1938.

A detailed account of prelinnaean literature regarding plants referred to the genus *Rhus*, with an indication of their position in modern taxonomic treatment. Many shrubs and trees of various parts of the earth are considered.

Notes historiques et souvenirs sur les acajous vrais. By AUGUSTE CHEVALIER. *Rev. Bot. App. & d'Agr. Tropicale* 17: 194: 709–724; October 1937.

Acajou is the French name for Mahogany timber, but there is some confusion in the early literature because the

same designation was also used for the Cashew, *Anacardium occidentale* L., a small tropical American tree cultivated for its fruit. It is considered likely that planks of *Swietenia* were called Acajou because they were varnished with a resin obtained from the bark of the anacardiaceous tree. Mahogany furniture made its appearance in France at the beginning of the 17th century. The West Indian species is *S. Mahagoni* (L.) Jacq., that of Mexico and Central America, *S. macrophylla* King; both are termed "Acajou vrai d'Amerique" (true Mahogany of America).

The name Mahogany ("Maagoni") was first applied about 1765, by Adanson, to the Senegal tree which, in 1789, Desrousseaux named *Swietenia senegalensis*. In 1830, Adrien de Jussieu described the African genus *Khaya* and transferred Desrousseaux' species to it, the name becoming *Khaya senegalensis* (Desr.) A. Juss. According to Chevalier, *K. senegalensis* is in reality the type of Adanson's genus *Mahagoni*, now considered a synonym for *Swietenia*. The first African Mahogany logs to enter the European market were shipped from Senagambia to Bordeaux about 1820.

Up to the beginning of the 20th century only one species of *Khaya* was known to science, but most of the Mahogany exported from Africa in the latter half of the 19th century came from the rain forests nearer the coast and eventually about a dozen species were described. The most important of these is *K. ivorensis* A. Chev., and according to the author it is now the only one exploited as "Acajou vrai d'Afrique" (true Mahogany of Africa).

An account is given of the discovery of different species, their importance and characteristics, and of the need for propagating the timber if a commercial supply is to be maintained.

The orientation of cellulose in the secondary wall of tracheary cells. By I. W. Bailey and Mary R. Vestal. *Journ. Arnold Arboretum* 18: 3: 185–195; 3 text figs.; pls. 206–208; July 1937.

"Crystalline aggregates of iodine may be induced to form within the elongated interstices of the cellulosic matrix of the secondary wall. These elongated crystals are oriented parallel to the long axis of the fibrils of cellulose and therefore of the micelles and chain molecules. The crystalline aggregates are so conspicuous and so clearly visible, microscopically, that it is possible not only to detect such major variations in orientation of the cellulose as occur in passing from layer to layer of the secondary wall, but also to observe such fluctuations in orientation as occur within the limits of a single layer. In the case of normal, 3-layered tracheids, fiber-tracheids, and libriform fibers, the orientation of the cellulose in the outer layer and in the central layer of the secondary wall fluctuates more or less from specimen to specimen, from cell to cell, and in different parts of the same cell. Although the orientation of the cellulose may deviate, at times, in the successively formed growth rings or lamellae of the central layer, there is no regular alternation of right-handed and left-handed helixes as hypothesized by various investigators. In the case of the large bordered pits of the earlywood of conifers, the cellulose has a circular orientation in the outer layer, but merely curves about the pits in the central layer. The less specialized types of dicotyledonous vessels resemble normal tracheids in having a 3-layered secondary wall, whereas the more highly specialized types have walls of a much wider range of complexity and structural variability, owing to fluctuations in the orientation of the cellulose."—*Authors' summary.*

The significance of certain wood-destroying fungi in the study of enzymatic hydrolysis of cellulose. By I. W. Bailey and Mary R. Vestal. *Journ. Arnold Arboretum* 18: 3: 196–205; 3 text figs.; pls. 209–210; July 1937.

"There are certain fungi whose hyphae perforate and move forward within the secondary walls of tracheary cells and fibers. The cavities produced by these fungi are of two geometric forms, *i.e.*, (1) cylindrical with conical ends or (2) biconical, and are of remarkably constant angularity, regardless of the particular group of gymnosperms or angiosperms in which they occur. It is evident that the enzymatic activity of these fungi progresses along two predetermined sets of planes, (1) oriented parallel to the long axis of the fibrils and

chain molecules of cellulose and (2) at an angle of from 20–25 degrees to this axis. These fungi evidently are ubiquitous forms which attack the vascular and fibrous tissues of the higher plants when they are cut and are exposed to the air. The fungi are so significant from experimental and physicochemical points of view that an effort should be made to isolate them, to grow them in pure cultures, and to determine their identity."—*Authors' summary.*

The structural variability of the secondary wall as revealed by "lignin" residues. By I. W. Bailey and Thomas Kerr. *Journ. Arnold Arboretum* 18: 4: 261–272; pls. 211–214; October 1937.

"In the wood of both gymnosperms and angiosperms, walls or layers which persist as coherent structural residues upon treatment with strong mineral acids usually give an intense coloration with phloroglucin-HCl; whereas those which disintegrate commonly do not, although they may give a strongly positive coloration with either the Mäule test or the chlorine-sodium sulphite reaction. Where the walls exhibit an intense coloration with the Mäule test, but tend to disintegrate into a finely granular residue upon treatment with 72 per cent sulphuric acid, it is possible to obtain coherent structural residues by first soaking sections in a solution of vanillin or some equivalent reagent. The structural patterns of the secondary walls of tracheids, fiber-tracheids, and libriform fibers are not constant for any particular species, but fluctuate more or less in different parts of the same stem and even, at times, of the same cell. Prevailingly concentric, dominantly radial, and various intermediate radio-concentric, structures occur in different parts of the stems of conifers and of many dicotyledons. In the case of coniferous tracheids, radial structural patterns are formed in parts of the stem and branches which are developing under the influence of geotropic stimuli. The so-called gelatinous fibers of dicotyledonous woods have a conspicuously radial or radio-concentric structure. There is some evidence to indicate that these fibers occur in parts of stems and branches that are developing under the influence of tropistic stimuli. Much additional

work remains to be done upon dicotyledons, in order to determine whether all normal fiber-tracheids and libriform fibers have a prevailing concentric structure, and whether all radial and radio-concentric structures of the secondary wall are due to tropistic stimuli.—*Authors' summary.*

The significance of comparative anatomy in establishing the relationship of the Hypericaceae to the Guttiferae and their allies. By P. A. Vestal. *Phil. Journal of Science* 64: 3: 199–256; 3 text figs., 9 pls.; November 1937.

"From this broad study certain salient facts stand out. Vascular anatomy may be of use as a taxonomic tool, especially within large complexes in indicating levels of development, and in the disposition of certain debatable groups. Correlations between dimensions, perforation plates and pitting of vessel members, pitting and dimensions of fiber-tracheids, and the type of rays, prove to be of particular phyletic import in this study. The groups logically fall into two major complexes, nearer the taxonomic treatment of Wettstein; namely, the Parietales and the Guttiferales, or that of Engler and Prantl's Parietales with its attendant subseries. The former is preferred. The treatment of Hutchinson does not fall in line with the observed anatomical evidence. The Dilleniaceae, Theaceae, and Flacourtiaceae are considered as possible groups within the complex form from which the other lines have radiated. The Canellaceae are considered as being more closely related to the Myristicaceae and the arboreal Ranales than to the above groups. The Hypericaceae on all available evidence would seem to be a logical outgrowth from the Guttiferae. It is a matter of personal opinion whether the group should remain as a part of the Guttiferae or be considered as a separate family."—*Author's summary.*

Salient lines of structural specialization in the wood parenchyma of dicotyledons. By David A. Kribs. *Bull. Torrey Botanical Club* 64: 4: 177–187; 2 plates; April 1, 1937.

"There is a high correlation between vessel type and wood parenchyma type; the evolutionary sequence being from the diffuse parenchyma type, the most primitive, through the

transitional diffuse-aggregate, vasicentric scanty, and metatracheal types, to the highly specialized vasicentric abundant types. An absence of wood parenchyma indicates a primitive condition. Terminal parenchyma is a specialization due to reduction. As woods become more highly specialized, the individual parenchyma cell parallels the development of the vessel element in that it becomes shorter and wider."

Compendium van de terminologie, nomenclatuur en systematiek der zaadplanten. By A. A. PULLE. Pp. 338; 4½ x 6¾; 286 text figs., 1 colored chart. Utrecht, 1938.

This little book is divided into three parts. The first deals in a systematic way with the terms used in botanical descriptions. The second is concerned with the principles and rules of nomenclature. The third and largest part contains concise descriptions of the families. In the words of the author (*Chronica Botanica* 4: 2: 109), "the classic division into Gymnospermae and Angiospermae has been given up. The Pteridospermae are fundamentally different from the Gymnospermae, *e.g.*, in the form of their leaves and the absence of a strobilus. I consider them equal in rank to the subdivision Gymnospermae. The same may be said of the group which formerly under the name Gnetales or Gnetinae used to be considered as a subdivision of the Gymnospermae, but which, in my opinion, are even farther removed from the Gymnospermae than the Pteridospermae. They have obtained here the rank of a new subdivision under the name Chlamydospermae. I have distinguished therefore four subdivisions of the Spermatophyta, namely, Pteridospermae, Gymnospermae, Chlamydospermae, and Angiospermae. . . .

"The subdivision Chlamydospermae has been divided into two orders, of which the order of the Gnetales includes the families of the Ephedraceae and Gnetaceae, whilst *Welwitschia* forms an order of its own.

"The division of the Angiospermae into orders does not deviate considerably from the usual one and on the whole agrees most with that given by Wettstein, especially as regards the Dicotyledons. The grouping of the orders, however, differs considerably."

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.

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NICARAGUAN PINE (*PINUS CARIBAEA* MOR.)

By GEORGE R. FAHNESTOCK AND GEORGE A. GARRATT

Considerable quantities of Pine timber have been shipped from the Central American Republic of Nicaragua into the markets of the United States and Great Britain and sold under the trade name of Nicaraguan Pine. This material is suited primarily for structural uses and, in the United States at least, is being distributed chiefly in the railroad and shipbuilding fields where it enters into direct competition with Longleaf Pine (*Pinus palustris* Mill.) as well as with Douglas Fir

Much of the information contained in this paper, including the strength values for unseasoned Nicaraguan Pine and Florida Longleaf Pine, is taken from a thesis prepared by Mr. Fahnestock, under the direction of Professor Garratt, and submitted to the faculty of the Yale School of Forestry in partial fulfillment of the requirements for the degree of Master of Forestry.—EDITOR.

(*Pseudotsuga taxifolia* Britt.). In the New York area, where interest in the Nicaraguan product has been heightened by the increasing scarcity of virgin Longleaf, especially in large sizes and long lengths, some difficulty has been experienced in marketing the imported timber because so little is known about its significant properties.

The object of the present study was to obtain pertinent data on the mechanical properties of Nicaraguan Pine, and a direct comparison of its strength with that of comparable Longleaf Pine from Florida. The investigation was made possible through the coöperation of Messrs. Leary & Co., lumber and timber merchants, of Brooklyn, N. Y.

The Resource

Nicaraguan Pine is considered to be botanically the same as the Slash Pine (*Pinus caribaea* Mor.) of the southeastern United States. The tropical range of this species includes the Bahamas, the Isle of Pines, and Central America from northern British Honduras (*2*) through eastern Guatemala (*8*) and Honduras (*4*) into Nicaragua.

The optimum development of the tree in Nicaragua is in the northeastern part of the country, between the Rio Grande, the southern limit of its commercial distribution, and the Rio Prinzapolca. The best stands are said to occur in a strip which is about 30 miles wide near the coast but tapers to about half that width at its western extremity some 55 miles inland. Over most of this commercial range it grows in scattered ridges, several thousand acres in extent, separated by savanna or "bush" land along the creeks and rivers. The stand is usually thin and has been estimated by one operator to average about 3,000 feet board measure per acre. The trees vary in height up to 100 feet and in diameter up to 30 or 40 inches, breast high, with occasional individuals exceeding these dimensions. The boles are often clear of branches to a height of 70 feet and have a moderate taper, about one inch in diameter for every 15 feet of length. The largest log so far reported was 38 inches in diameter at the small end and 40 feet in length. Timbers as long as 50 feet have been cut in small numbers, and pieces 40 to 45 feet long are regular stock in trade.

Insect injury commonly causes up to 30 per cent wastage of the butt log.

Exploitation.—There are now two mills operating in the Nicaraguan Pine region, one on the Rio Grande and the other near the mouth of the Prinzapolca. Their combined capacity is approximately 12 million board feet per year; their production in 1935 was nine million feet, in 1937 seven million. There is also a small mill on the Honduran border, but this cuts solely for the local trade.

Logs are furnished to the two export mills from separate woods operations, and use is made of caterpillar tractors, dual-wheel trucks and trailers, and other modern equipment. Board runways enable the trucks and trailers to cross wet ground. On one operation the trucks deliver logs direct from the forest to the mill; on the other it is necessary to raft the logs down the river for a distance of from 40 to 80 miles. Lack of sufficient depth of water at Prinzapolca harbor makes it necessary to raft the squared timbers and tow them to ships anchored a mile or more out. This exposure to sea water causes a superficial grayish discoloration of the wood and gives the timbers a distinctive appearance. Such lumber as is cut at the mills is usually air-dried for six to eight weeks, being end racked under sheds, and then loaded on barges for transportation to the ocean-going vessels. Boards are cut in thicknesses of one or two inches and in widths up to twelve inches. Flooring, siding, and ceiling are manufactured in a modern planing mill, which has an average daily capacity of 18,000 board feet.

Markets.—Most of the output is exported to Great Britain and the United States, although shipments are also made to St. Andrews Island, Kingston (Jamaica), Maracaibo (Venezuela), Trinidad, and ports in Costa Rica, and there is some local trade. The principal markets in the United Kingdom are at Liverpool, London, and to less extent, Glasgow. The New York area receives most of the timber exported to the United States, but some shipments have also been made to Boston and New Orleans. The New York orders are chiefly for beams 4 by 12, 6 by 12, and wider, and for squared timbers from 8 by 8 to 16 by 16 inches in cross section, and up to 50 feet long.

Some of the stock received in New York is resawed to make plank, but most of it is sold to the railroads and shipyards in the form of heavy timbers. In Great Britain the proportion of the material remanufactured is larger. The one specification applied to these export timbers is that they show heartwood on all four faces.

The Wood

Normal wood of the Nicaraguan Pine closely resembles that of the Yellow Pines, especially Longleaf and Slash, of the southeastern United States. The heartwood is reddish brown and distinct from the pale clear yellow sapwood. Resin ducts are numerous and generally prominent, especially in the light-colored sapwood and early-wood bands in the heartwood. The resin content of the heartwood is widely variable, but usually definitely higher than that of comparable Longleaf Pine, ranging up to 40 per cent or more of the dry weight of the wood. The resin imparts a pronounced odor to the timber and also materially increases its weight. The wood is straight-grained and rather coarse in texture.

A marked point of distinction between Nicaraguan Pine and the Slash and Longleaf Pines of the United States is found in the distribution of the late wood in the growth rings. In most of the Nicaraguan timbers examined the apparent growth rings were found to consist, not of a single band of early wood followed by one of late wood, but of several bands of each, varying considerably in number and thickness even in the same specimen. Usually there are two or more narrow preliminary late-wood bands, with a final wider band that appears to terminate the season's growth, but not infrequently the bands are so nearly the same width that it is difficult or impossible to decide where one growth ring leaves off and the next begins. Numerous instances were found, however, in which most or virtually all of the late wood of a season's growth was concentrated in a single wide band, with only minor separations (stratification) here and there.

In a relatively few instances dense late-wood bands were nearly or entirely absent, a condition which deserves further consideration, since Nicaraguan Pine of this character is so

distinct in appearance and physical properties from that in which well-defined late wood is present that it is more comparable to White Pine (*Pinus Strobus* L.) than to Slash or Longleaf. The heartwood is dull grayish yellow or grayish buff. The texture is essentially uniform throughout the wood, except for specimens which show a sporadic occurrence of narrow and discontinuous late-wood bands. The termination of growth rings is indistinct, often indiscernible. As would be expected, such a marked reduction in the proportion of late wood results in a conspicuous decrease in the density and strength of the wood, and a majority of such air-dry beams subjected to static bending failed with a brittle fracture, in distinct contrast to the simple or splintering tension failures produced in the other specimens. This relatively light, soft wood is best suited for general millwork and similar uses, and its elimination from structural grades is strongly recommended. The occurrence of wood of this type at the center of a significant number of boxed-heart timbers would seem to indicate that it is associated with excessively rapid growth in the early years of the tree's life, prior to the closing of the stand. However, in very rare instances it was found to comprise whole timbers, and it is difficult to conceive of trees so open-grown throughout their entire life as to produce only such low-density wood and still have a form which would warrant cutting them at all.

Inspection of an extensive stock of Nicaraguan Pine in the yard of one of the New York importers showed that in general appearance and freedom from defects the Nicaraguan timber compared favorably with the American Longleaf Pine also in stock there. Relatively few large knots were found on the surface of the timbers, which were also notably free from shake. The great majority of the pieces open up well when resawed. With regard to seasoning characteristics, the timbers appeared to be at least the equal of the Longleaf Pine; in fact, in the specimens of the two woods which were air-seasoned prior to cutting out test pieces, the Nicaraguan material seemed to be somewhat less subject to checking than the other. There is no available information on the durability of the Nicaraguan Pine heartwood, but the large resin content of

many of the timbers indicates a potentially high resistance to decay.

Mechanical Tests

Standard timber tests were made on soaked and air-dry specimens of Nicaraguan Pine and Florida Longleaf, which were cut from nominal 4 by 12 inch boxed-heart timbers selected from the regular stock of Leary & Co. The Florida material was included for purposes of direct comparison, since it is rather extensively used at present in the fields into which the Nicaraguan timber is being introduced. Fourteen Nicaraguan and 12 Longleaf timbers were taken, and from them were obtained 50 and 41 test blanks, respectively. Insofar as possible the test blanks from each timber were sorted into matched pairs, and one of each pair was submerged in water to bring it to an approximately green or unseasoned condition, and the other was seasoned under cover until thoroughly air-dry. After attaining the desired moisture contents, the blanks were finished to standard timber test size (2 by 2 inches in cross section and of varying length, depending upon type of test).

In selecting the timbers for testing, an effort was made to obtain as wide a variation as possible in the percentage of late wood and the number of growth rings per inch. In the case of the Nicaraguan Pine, which had not been required to pass any grade specifications, it was obvious that such an arbitrary method of sampling would probably produce relatively low average strength values for material of commercial quality, because of the inclusion of a disproportionate number of low density pieces in the relatively small sample. However, such sampling was considered desirable to assure a suitable range in derived values and an adequate representation of the lower extreme for whose elimination some system of grading obviously must be evolved.

The Florida test pieces were taken from "run of the mill" timbers of second growth, comparable to the bulk of the Longleaf Pine now being cut by small mills in the southeastern United States. This material, which had been graded as "merchantable" under the 1905 grading rules of the Southern

Pine Association, showed considerable variation in number of rings per inch (4 to 25) and in the percentage of late wood, as revealed on the ends of the pieces. However, in cutting out test blanks, none of the very rapidly grown wood from the center of the poorer timbers was selected, and none of the specimens tested had less than 30 per cent of late wood.

The methods of testing were those used by the United States Forest Service (*7*) and conform to the standards adopted by the American Society for Testing Materials and approved by the American Standards Association (*3*). The various computed strength values for the air-dry Nicaraguan and Florida Longleaf specimens were adjusted to a uniform moisture content of 12 per cent by means of the "equation method" or "exponential formula" devised by the Forest Products Laboratory of the United States Forest Service (*5, 7, 10*). Because of the resinous character of many of the test specimens, particularly those from Nicaragua, it was not practicable to determine the moisture content of the air-dry material by the ordinary oven-drying method; instead, a modification of the solvent extraction method (*9*) was employed, the moisture samples being reduced to chips and boiled in toluol to remove the water, which was caught in a graduated trap and measured directly, and also to extract the resin in the wood. The oven-dry weight of the resin-free wood was used as the basis for computing the moisture content values.

The results of the tests on the unseasoned (soaked) material are summarized in Table I, and those on the air-dry specimens in Table II. For the sake of comparison, the strength values obtained by the United States Forest Service for American-grown Slash and Longleaf Pines have also been included in both tables. The values derived for the individual specimens of both Nicaraguan and Florida Pine exhibited a marked variation in all strength properties; as was expected, however, owing to the lack of grading specifications, greater variability was exhibited by the Nicaraguan timber in nearly all cases. Thus, in modulus of rupture (static bending) and maximum crushing strength (compression parallel to grain), the highest values for Nicaraguan Pine were approximately two and a quarter (air-dry) to two and a half (unseasoned) times the

lowest, and about one-third (air-dry) to one-half (unseasoned) greater than the mean. As anticipated, the very low values obtained for the Nicaraguan Pine came from specimens having small percentages of late wood and low densities. In spite of the wide range in individual strength properties, however, the ungraded Nicaraguan timber was found to compare favorably with the Florida Longleaf Pine used in this study and with the United States Forest Service average values for Slash and Longleaf Pines. The averages for the ungraded Nicaraguan Pine listed in Tables I and II are in no instance less than 91 per cent of the corresponding values for the Florida timber, and in several properties (work to proportional limit in static bending, stress at proportional limit in compression perpendicular to grain, and hardness) they actually exceed those for the Longleaf Pine.

It is obviously unfair to the Nicaraguan timber, entirely ungraded and selected to show the widest possible range of variation in the proportion of late wood, to compare it directly with the Florida Longleaf Pine, none of which contained less than 30 per cent late wood and which had been graded under specified rules. In order to put the derived strength values for the two woods on a more comparable basis, it was considered advisable to apply some sort of a tentative "density rule" to the Nicaraguan Pine test pieces. The relatively slight variation in number of rings per inch in the Nicaraguan material, and the evident lack of correlation between ring count and both strength and density made this feature of very doubtful value for grading the species. Furthermore, in a large proportion of the specimens the limits of many of the growth rings are so ill-defined as to make accurate countings impossible. Ring count may possibly be employed in a general way to supplement other characteristics used in grading Nicaraguan Pine, but it cannot be considered as of major importance.

In distinct contrast to the ring count, the percentage of late wood, as indicated on the ends of the pieces, showed a marked variation even in the limited number of specimens tested, and on graphical analysis exhibited a very definite correlation with the density and derived strength values of the

wood. In order to place the imported timber on a comparable basis with the Florida Longleaf Pine, a minimum requirement

TABLE I

COMPARATIVE STRENGTH VALUES OF UNSEASONED (SOAKED) NICARAGUAN, LONGLEAF, AND SLASH PINE

Kind of Test	Nicaraguan Pine		Florida Longleaf Pine	U. S. Forest Service Tests*	
	Ungraded	Graded**		Slash Pine	Longleaf Pine
Specific gravity†	0.61	0.66	0.57	0.56	0.54
Static bending:	*Pounds per square inch*				
Stress at proportional limit	5,080	5,680	4,720	5,100	5,200
Modulus of rupture	8,550	9,490	8,650	8,900	8,700
Modulus of elasticity (thousands)	1,598	1,784	1,731	1,580	1,600
	Inch-pounds per cubic inch				
Work to proportional limit	0.92	1.03	0.91	1.02	0.95
Work to maximum load	8.0	8.4	8.3	9.5	8.9
Compression parallel to grain:	*Pounds per square inch*				
Stress at proportional limit	3,230	3,710	3,300	3,040	3,430
Maximum crushing strength	4,130	4,560	4,150	4,340	4,300
Compression perpendicular to grain:	*Pounds per square inch*				
Stress at proportional limit	830	960	690	680	590
Hardness:	*Pounds to imbed 0.444" ball to half its diameter*				
Radial	760	860	630	630††	590††
Tangential	790	900	660		
End	700	780	650	600	550

* Values taken from U. S. Dept. Agr. Tech. Bull. 479 (reference 7).
** For specimens having 30 per cent or more late wood.
† Based on green volume and oven-dry weight.
†† Average of radial and tangential values.

of 30 per cent late wood was established for the "graded" Nicaraguan material. Application of this rule to the test specimens resulted in the elimination of eight unseasoned

(soaked) and ten air-dry pieces and definitely increased the average values for all computed strength properties, as indicated in Tables I and II. The effectiveness of this rule may be judged by the fact that it eliminated all but two unseasoned and four air-dry specimens having strength values lower than the general average for the ungraded material.

The superiority of the "graded" Nicaraguan pine over the Florida Longleaf timber is apparent in all strength properties, but varies to some extent with the individual properties and between air-dry and unseasoned material. It is most marked in the values derived from tests in hardness and compression perpendicular to the grain, and least in compression parallel to the grain and for modulus of elasticity in static bending.

Practical Application of the Density Rule.—In order to check the practicability of applying a "density rule," based on the percentage of late wood, to large numbers of commercial-sized timbers, an inspection was made of several shipments of Nicaraguan Pine in the yard of Leary & Co. One difficulty immediately encountered was the often marked variation in the proportion of late wood in different parts of the end section of the same timber, generally resulting from the occurrence of rapidly-grown, low-density wood in the immediate vicinity of the pith, a condition prevailing in a considerable number of the boxed-heart timbers. In practically all instances, however, this central core was surrounded by a thick outer shell having a moderate to high proportion of late wood, thus rendering such timbers suitable for structural purposes when used entire. The grading of this material could be definitely facilitated in most cases by applying that part of the American Lumber Standard rules (*1*) which specifies that in dense Southern Pine the percentage of late wood shall be measured over the third, fourth, and fifth inches of a radial line from the pith.

When a timber of this type is resawed, however, the exposure of the low density wood on a surface that will be subject to severe stress may have a distinct weakening effect on the pieces, thus making it advisable to lower the grade if such material is to be used where high strength is an important

TABLE II

COMPARATIVE STRENGTH VALUES OF AIR-DRY NICARAGUAN, LONGLEAF, AND SLASH PINES
(Values adjusted to 12 per cent moisture content)

Kind of Test	Nicaraguan Pine		Florida Longleaf Pine	U. S. Forest Service Tests*	
	Ungraded	Graded**		Slash Pine	Longleaf Pine
Specific gravity†	0.66	0.68	0.65	0.61	0.58
Static bending:	*Pounds per square inch*				
Stress at proportional limit	9,450	10,350	9,640	9,800	9,300
Modulus of rupture	15,880	17,390	16,270	15,900	14,700
Modulus of elasticity (thousands)	2,131	2,430	2,340	2,060	1,990
	Inch-pounds per cubic inch				
Work to proportional limit	2.35	2.45	2.28	2.76	2.44
Work to maximum load	12.0	12.5	11.2	12.6	11.8
Compression parallel to grain:	*Pounds per square inch*				
Stress at proportional limit	5,980	6,540	6,350	6,280	6,150
Maximum crushing strength	8,390	9,100	9,050	9,100	8,440
Compression perpendicular to grain:	*Pounds per square inch*				
Stress at proportional limit	1,680	2,070	1,650	1,390	1,190
Hardness:	*Pounds to imbed 0.444" ball to half its diameter*				
Radial	1,180	1,410	1,080	1,010††	870††
Tangential	1,280	1,490	1,210	...	...
End	1,180	1,300	1,110	1,080	920
Maximum shearing stress:	*Pounds per square inch*				
Radial	1,720	1,830	1,740	1,730††	1,500††
Tangential	1,780	1,910	1,600		

* Values taken from U. S. Dept. Agr. Tech. Bull. 479 (reference 7).
** For specimens having 30 per cent or more late wood.
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Work to maximum load	12.0	12.5	11.2	12.6	11.8
Compression parallel to grain:	*Pounds per square inch*				
Stress at proportional limit	5,980	6,540	6,350	6,280	6,150
Maximum crushing strength	8,390	9,100	9,050	9,100	8,440
Compression perpendicular to grain:	*Pounds per square inch*				
Stress at proportional limit	1,680	2,070	1,650	1,390	1,190
Hardness:	*Pounds to imbed 0.444" ball to half its diameter*				
Radial	1,180	1,410	1,080	1,010††	870††
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Maximum shearing stress:	*Pounds per square inch*				
Radial	1,720	1,830	1,740	1,730††	1,500††
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** For specimens having 30 per cent or more late wood.
† Based on air-dry volume and oven-dry weight.
†† Average of radial and tangential values.

consideration. A further disadvantage of resawing such timbers is that the resulting pieces, especially if narrow and less than two inches in thickness, are likely to warp upon drying. In this connection, Koehler (*6*) has found that Southern Yellow Pine stock containing a rapidly grown central region surrounded by denser material may crook, bow, and twist badly as the result of the differential shrinkage associated with the two types of wood. One apparent solution of these difficulties in the case of Nicaraguan Pine would be to resaw only those pieces which exhibit approximately uniform density and rate of growth over the entire end sections. Such timbers appear to be abundant enough to meet the demand for resawed stock.

A second difficulty encountered in applying a "density rule" to Nicaraguan Pine timbers results from the common occurrences of pieces having more or less widely scattered and narrow bands of late wood whose total width is very difficult to estimate accurately. Grade specifications should be developed to separate such material from that in which there are wide, well-defined bands of late wood. Those who have tested the wood or handled it in any quantity are able to separate Nicaraguan Pine timbers and lumber into two groups, placing that with definitely scattered late-wood bands into a subordinate class from the standpoint of density and strength. The real trouble is that no exact grading rule or practice has been devised, especially to take care of the material of intermediate character, and where segregation has been attempted it has been dependent primarily on the experience and judgment of the inspector. On the face of it, this reliance on personal opinion allows too much opportunity for bias and too much latitude for disagreement between buyer and seller. Furthermore, it must be emphasized that the strength of the material with scattered but definite amounts of late wood is still well within the limits of variation in strength values for the general run of Longleaf Pine. However, this statement does not apply to pieces obviously deficient in late wood and, if the amount falls below 20 per cent, such timber should not be placed in the same class with Longleaf Pine and with the rest of the Nicaraguan material. Ordinarily, it should be

quite easy to distinguish this lowest quality both through ocular estimate of the percentage of late wood and by the lighter color, more even texture, and relative softness of the wood.

As the result of an extensive examination of the commercial timbers, the following three tentative grades are suggested for the classification of Nicaraguan Pine intended for structural use:

"*Firsts*": Hard and dense timber, often high in resin content; late wood 30 per cent or more, mostly localized in wide, dark bands clearly distinguishable from the lighter colored early wood; width of late-wood bands readily estimated; growth rings distinct, usually five or more to the inch.

"*Seconds*": Moderately dense and hard timber, often high in resin content; late wood 20 to 30 per cent, in more or less widely spaced, relatively narrow bands, generally darker than early wood and distinct, though with amount often difficult to estimate; growth rings frequently indefinite, apparently four or more per inch; general color of wood deep yellow to brown.

"*Thirds*": Relatively light and soft timber, of rather uniform texture, and generally low in resin content; late wood less than 20 per cent, usually in widely separated, poorly defined bands nearly as light in color as the early wood; growth rings almost always indistinct, apparently five or less per inch; general coloration lighter than that of superior grades, often with a dull grayish hue.

A tally was made of 200 heavy timbers of Nicaraguan Pine to determine the relative amounts of the three grades in the commercial stock on hand. The inspected timbers were selected at random in two courses along the full length of one main alley in the storage yard. Of the sticks examined, 147 (73.5 per cent) were classified as "firsts" and 53 (26.5 per cent) as "seconds." This ratio of highest quality to intermediate material was in close agreement with the three to one ratio previously estimated by the yard foreman for all of the Nicaraguan Pine timbers he had handled. No "thirds" were found in the sample tallied, but several pieces seen elsewhere

in the yard belonged in this classification. The distinctive appearance of this low quality material, especially on freshly

TABLE III

COMPARATIVE STRENGTH VALUES OF DESIGNATED GRADES* OF NICARAGUAN PINE

	Unseasoned Specimens			Air-dry Specimens†		
	Firsts	Seconds	Thirds	Firsts	Seconds	Thirds
Specific Gravity: Based on—						
Green volume and oven-dry weight	0.67	0.58	0.44	....	....	....
Air-dry volume and oven-dry weight	....	....	....	0.68	0.62	0.52
Static bending:	*Pounds per square inch*					
Stress at proportional limit	5,990	4,600	3,090	10,600	8,400	7,510
Modulus of rupture	9,870	7,960	5,460	17,710	14,890	12,160
Modulus of elasticity (thousands)	1,728	1,606	984	2,462	1,873	1,620
	Inch-pounds per cubic inch					
Work to proportional limit	1.13	0.75	0.55	2.54	2.06	1.97
Work to maximum load	8.4	8.4	5.9	13.0	12.1	9.6
Compression parallel to grain:	*Pounds per square inch*					
Stress at proportional limit	3,790	3,040	1,750	6,560	5,450	4,850
Maximum crushing strength	4,700	3,880	2,750	9,140	7,780	6,530
Compression perpendicular to grain:	*Pounds per square inch*					
Stress at proportional limit	1,050	670	400	2,060	1,340	1,110
Hardness:	*Pounds to imbed 0.444" ball to half its diameter*					
Radial	870	750	390	1,440	920	740
Tangential	930	750	420	1,530	1,030	770
End	800	670	450	1,340	1,020	900
Maximum shearing stress:	*Pounds per square inch*					
Radial	...	...	...	1,860	1,620	1,510
Tangential	...	...	...	1,940	1,620	1,490

* See text discussion for grade distinctions.
† Values adjusted to 12 per cent moisture content.

cut surfaces, should make its elimination at the mill a simple matter. Inspection after shipment is definitely more difficult,

owing to the discoloration of the surfaces of the timbers after they have been exposed to sea water during rafting.

On the basis of this tentative quality classification of Nicaraguan Pine for structural use, the timber test specimens were segregated into the three suggested grades and the derived strength values averaged for each group. The results are summarized in Table III, which clearly indicates the superiority in strength of those specimens classified as "firsts" and the marked deficiency of the "thirds" in all properties.

It should be borne in mind that this discussion of the strength and grading of Nicaraguan Pine has been concerned only with the use of the material for structural purposes. It is obvious that for general millwork and other uses, for which a relatively light, soft, and easily worked wood is desirable, the material classified as "thirds" will actually be superior to the denser and stronger wood. While the proportion of this low-density stock included in past shipments into the New York area is very low, such timbers should not be included in structural grades. It would seem that wood of this quality might more profitably be manufactured into suitable products for local consumption or for distribution to neighboring Central American markets.

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STANDARDIZATION OF TERMS FOR VESSEL DIAMETER AND RAY WIDTH

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Introduction

In a previous paper (*2*) an account was given of the distribution of mean fibre length and mean vessel member length in different species of the Angiosperms, and suggestions were put forward as to the best means of standardizing the terms of size relating to these features. The definitions there proposed have since been adopted by the International Association of Wood Anatomists (*4*), and the author has been encouraged to carry out a similar investigation of vessel diameter and ray width. These features, however, present a rather different problem owing to their importance under conditions that preclude accurate measurement.

The descriptive classes for vessel diameter and ray width are primarily intended for use with a lens or with the naked eye, and the classes serve as a scale by which size is measured rather than as a means of converting figures into terms of size, as was the case with vessel member length and fibre length. It is common practice, for example, to select suitable woods to represent each class and to measure vessel diameter and ray width by comparison with this standard set. It is obvious that numbers would serve just as well as words as labels for the classes and that the limits of the classes should be determined primarily by their suitability as divisions in a scale of measurement rather than as convenient definitions of conventional terms.

The main object of this investigation has been to provide

a sound theoretical basis from which to judge the scales used in existing systems of classification, particularly the classes proposed by Chattaway (*3*) in 1932, as these appear to be the most widely used. It was found that the scales used by Chattaway are in such close agreement with the theoretical requirements derived from the distributions that they can be accepted almost without change. The descriptive terms applied to the classes are less satisfactory.

Methods

Measurement of vessel diameter may be made in several ways. For this investigation the tangential diameter was chosen in preference to radial because it is observed that where vessels occur in radial groups the tangential diameter is apparently less influenced by distortion than the radial; during recent visits to other laboratories the author found a general tendency to favor the tangential diameter on these grounds.

It is well known that the mean of a series of observations is liable to less fluctuation through chance observation than the maximum, and for this reason it was preferred as the expression of the size of the elements of individual samples. In the great majority of species examined the mean of each sample was obtained from measurements of 100 individual vessels; in a few cases only 50 measurements were available. Every vessel was measured, irrespective of whether it formed one of a group or not, along narrow radial strips, so as to include as many growth rings as possible. The total number of species investigated was 134. Ring-porous woods were not included, as the highly specialized pore-zone is not strictly comparable with diffuse-porous wood and usually requires a separate description.

No measurements of mean ray width were made, as such figures are both laborious to collect and seldom used. Instead, 150 species were selected at random from the slide collection at the Imperial Forestry Institute, and measurements were made, on each, of the widest part of the largest ray on the tangential section. Care was taken to avoid rays surrounded by parenchyma, as there is often a marked swelling of the ray as it passes through such tissue.

The Distribution of Vessel Diameters and Ray Widths throughout the Dicotyledons

The frequency distributions of the measurements of vessel diameter and ray width are given in Table I.

TABLE I

Distribution of Species

Class	Frequency (%)	
	Vessel diam. (Mean)	Ray width (Max.)
0– 39μ	9.0	34.0
40– 79μ	39.0	41.4
80–119μ	25.0	12.7
120–159μ	12.0	4.0
160–199μ	10.0	3.2
200–239μ	1.5	0.0
240–279μ	2.0	0.0
280–319μ	2.0	2.0
320–359μ	0.5	0.7
360–399μ	....	1.3
400–439μ	....	0.0
440–479μ	....	0.0
480–519μ	....	0.7

Both of these frequency distributions are positively skewed (see Fig. 1), and are similar in type to those previously obtained for vessel member length and fibre length (*2*). Regrouping of the figures into logarithmic classes gives approximately symmetrical curves. The central tendency of the distribution in each case is therefore better represented by the median than by the mean.

It will be observed that, although the two distributions are very similar in the lower parts of their ranges, the maximum is much higher for ray width than for vessel diameter. This difference is in reality even more marked than is shown by the figures, for, if a special search is made, species can be found with rays of over 1500μ, whereas a special search for woods with large vessels does not add appreciably to the maximum

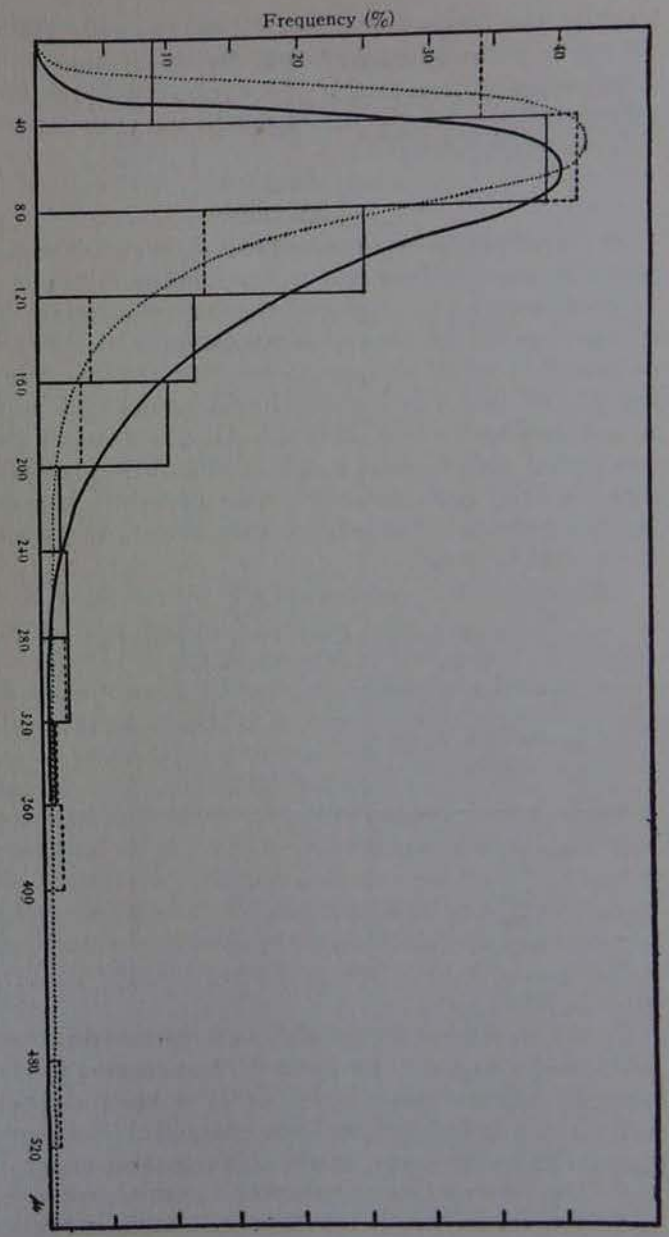

Fig. 1. Distribution of vessel diameters and ray widths
Solid lines = mean tangential diameter of vessels.
Dotted lines = maximum ray width.

given in the table. The difference between the two distributions can probably be explained partly by the fact that the measurement in one case is of a single cell and in the other a tissue, and also by the use of means for vessel diameter and maxima for ray width.

Discussion

In existing systems of classification, such as those of Beekman (*1*) and Chattaway (*3*), the classes are not equal but increase in range as the size of the feature increases. The form of the distributions described above suggests that a logarithmic increase would be appropriate, and it is therefore interesting to find that existing classifications conform very closely to a logarithmic scale. In Table II, Chattaway's classes are contrasted with a series in which the difference between the logarithms of each successive pair of values is a constant,[1] the series being arranged, for comparison, to give a middle class of 50 to 100μ.

TABLE II

Comparison of Chattaway's Classes with a Logarithmic Scale

Logarithmic scale for classes	Chattaway's scales for classes	
	Vessel diam.	Ray width
12.5μ	....	*15μ*
25μ	*30μ*	*30μ*
50μ	50μ	50μ
100μ	100μ	100μ
200μ	200μ	200μ
.....	*300μ*	....
400μ	400μ	400μ

Where Chattaway's figures differ from those of the theoretical scale they are shown in italics. It will be seen that for ray width there is almost complete agreement between the two scales. For vessel diameter there is the same essential agreement, but Chattaway inserts an extra division at 300μ. The total range is also adequately covered by Chattaway's classes. It is possible that for ray width an additional class might with advantage be added for the exceptional woods with rays far in excess of 400μ, but this is not essential, as such rays could be better described in terms of millimetres.

[1] For example, log 12.5+K=log 25; log 25+K=log 50, etc.

Considered as scales of measurement, therefore, Chattaway's classes agree very closely with theoretical considerations, and no major changes seem desirable. It is suggested that the value of 30μ might with advantage be changed to 25μ. For vessel diameter 25μ lies half way between Chattaway's value of 30μ and Beekman's (*1*) 20μ for the lowest division.

The terminology adopted by Chattaway for describing her classes is less satisfactory in so far as it lacks consistency and is not uniform with that adopted for vessel member length and fibre length. Whether uniformity is sufficiently important to justify change in a system that is in common use, is a matter of opinion.

The centering of the classification is in complete agreement with that suggested by the frequency distribution.[2] On the other hand, with the terminology as it stands, it is not always easy to remember how many classes separate one from another. For example, for vessel diameter, "small" is separated from "large" by two classes, "moderate-sized" and "rather large," while for ray width, "fine" is separated from "broad" only by "moderately broad." Also, the largest class for vessel diameter is "very large" while the corresponding class for ray width is "extremely broad."

It so happens that the number of classes is the same both in Chattaway's classes for vessel diameter and ray width, and in

[2] The median for ray width is 53μ, and Chattaway separates her "fine" from her "moderately broad" class at 50μ. For vessel diameter the comparison is less easy, owing to the method of measurement on which the distribution is based. The median of 85μ implies that the middle of the distribution can be represented by a wood whose mean diameter, measured in the same way as in this investigation, is about 85μ. By plotting the means against the maximum values recorded it has been estimated that a wood with a mean of 85μ may be expected to have a maximum value of about 150μ. Chattaway's class of "moderate-sized, 100 to 200μ" thus appears to be correctly placed if applied to maximum diameter.

those adopted for vessel member length and fibre length. It would thus be very simple to adopt a uniform system of terminology throughout, and in the author's opinion this would be worth while. To do so would involve a slight departure from theoretical considerations in the case of ray width, in so far as the "medium-sized" class, with limits of 50 to

TABLE III

SUGGESTED CLASSES AND TERMS FOR MAXIMUM VESSEL DIAMETER

No.	Diameter	Description
1	Up to 25 [30]μ	Extremely small
2	25 [30]–50μ	Very small
3	50–100μ	Moderately small [small]
4	100–200μ	Medium-sized [moderately-sized]
5	200–300μ	Moderately large [rather large]
6	300–400μ	Very large [large]
7	Over 400μ	Extremely large [very large]

TABLE IV

SUGGESTED CLASSES AND TERMS FOR MAXIMUM RAY WIDTH

No.	Width	Description
1	Up to 15μ	Extremely fine
2	15–25 [30]μ	Very fine
3	25 [30]–50μ	Moderately fine [fine]
4	50–100μ	Medium-sized [moderately broad]
5	100–200μ	Moderately broad [broad]
6	200–400μ	Very broad
7	Over 400μ	Extremely broad

100μ, would lie almost wholly above the median, 53μ. This would be of little practical importance and would not outweigh the advantages of securing complete uniformity.

CONCLUSIONS

The classes and definitions given in Tables III and IV are put forward for consideration as a basis for standardizing the terms of size used for describing vessel diameter and ray width. Both are intended primarily for macroscopic work and are therefore based on maximum dimensions. The numerical limits of the classes are almost identical with those proposed by Chattaway, but some changes have been made in the terminology. Where any change has been made, Chattaway's figures or terms are shown in brackets. The classes have been given numbers, as this has been found to be a convenience for recording.

SUMMARY

The distributions of the mean tangential diameters of the vessels of 134 species and of the maximum ray widths of 150 species are described. Both are very similar and are positively skewed. These distributions are used as a theoretical basis by which to judge existing systems of classification.

The numerical values of the classes proposed by Chattaway in 1932 are in very close agreement with theoretical requirements and only one minor alteration is suggested. Some changes in the terms used to describe the classes appear desirable in order to achieve uniformity.

ACKNOWLEDGMENTS

I am indebted to Mr. B. J. RENDLE and Mr. S. H. CLARKE, of the Forest Products Research Laboratory, Princes Risborough, for helpful criticism.

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3. CHATTAWAY, M. M.: Proposed standards for numerical values used in describing woods. *Tropical Woods* 29: 23–25; 1932.

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CURRENT LITERATURE

The *Calyptrogyne-Calyptronoma* problem—the manac palms. By L. H. Bailey. *Gentes Herbarum* (Ithaca, N. Y.) 4: 153–172; figs. 86–100; April 1938.

The genus *Calyptronoma* Griseb. (a synonym is *Cocops* O. F. Cook) is shown to be distinct from *Calyptrogyne*. Three new names are made for South American species. In the Antilles four species occur, all of which are described. *C. quisqueyana* is a new species from Hispaniola, where it is called Quisqueya.—P. C. Standley.

Native bactrids of the Greater Antilles. By L. H. Bailey. *Gentes Herbarum* 4: 173–184; figs. 101–110; April 1938.

The *Bactris* group of palms is represented in the Greater Antilles by *Bactris jamaicana*, a new species from Jamaica, and two species of *Aiphanes*.

The *Copernicia* puzzle in Jamaica. By L. H. Bailey. *Gentes Herbarum* 4: 185; April 1938.

A Venezuelan palm, *Copernicia tectorum* Mart., was reported from Jamaica in 1864 by Grisebach. Investigation reveals that this report, on the basis of a description (1725) by Hans Sloane, includes a mixture of *Thrinax* and probably *Bactris* material, and the genus *Copernicia* is still unknown in Jamaica.—P. C. Standley.

Yuccas of the southwestern United States. Part I. By Susan Delano McKelvey. Published by the Arnold Arboretum of Harvard University, Jamaica Plain, Mass., 1938. Pp. 150; 80 pls.

The first part of a monograph of the genus *Yucca* as represented in southwestern United States, including also much information upon species of Mexico. The present volume treats 11 species of the sections *Sarcocarpa* and *Clistocarpa*, the former segregates *Clistoyucca* and *Samuela* being reduced to synonymy. The monograph is one of the most elaborate and comprehensive ever published of any group of American plants, and apparently one of the most thorough and satisfactory in every respect. It is based upon a vast amount of field work by the author and upon equally intensive studies in herbaria and literature. The many half-tone illustrations are almost as beautiful as the plants themselves and reproduce vividly the characters of this strange group of American plants.—P. C. Standley.

Further studies in southwestern oaks. By Cornelius H. Muller. *Amer. Midland Nat.* (Notre Dame, Ind.) 19: 582–588; May 1938.

Four new species of *Quercus* are described from Chihuahua, Mexico, and three from the United States.

Contributions to the flora of tropical America. XXXV. Plantae Hintonianae. VII. Further notes on the genus *Bursera*. By A. A. Bullock. *Kew Bulletin* 163–168; 1938.

Additional notes are given upon the distribution of numerous Mexican species of *Bursera*, with a few vernacular names.

Some undescribed species from Mexico and Guatemala. By Ivan M. Johnston. *Journ. Arnold Arboretum* 19: 117–128; April 1938.

New species of woody plants, from Guatemala unless otherwise indicated, are published in the genera *Prunus*, *Dussia*, *Brongniartia* (Mexico), *Acalypha*, *Sarcococca* (an Asiatic and Malaysian genus of Buxaceae, unknown previously in America), *Ilex*, *Sloanea*, and *Buddleia*.

Two new species of *Erythrina* from Central America. By B. A. Krukoff. *Phytologia* (New York) 1: 286–289; May 1938.

Erythrina Folkersii Krukoff & Moldenke is described from British Honduras and Guatemala; *E. neglecta* Krukoff & Moldenke from Guatemala and Panama. *E. Eggersii* Krukoff & Moldenke is a new name for *E. horrida* Eggers, not Moc. & Sessé.

A synopsis of the Labiatae of the Guianas. By Carl Epling. *Kew Bulletin* 187–196; 1938.

Five genera of Labiatae are represented in the Guianas, the only large group being *Hyptis*. *H. arborea* Benth., of

British Guiana, is noteworthy in the family in being a tree as much as 15 meters tall.

Phanérogames nouvelles de l'Amérique méridionelle. By R. Benoist. *Bull. Soc. Bot. France* (Paris) 84: 632–639; April 1, 1938.

New species of ligneous plants, from Ecuador unless otherwise mentioned, are *Oreopanax simplex*, *O. Puma-maqui*, *Chuquiraga conferta*, *Barnadesia vestita*, *Jungia mitis*, *Centropogon mojandensis*, *C. minensis*, *C. nebularum*, and *Lucuma Batten-Poollii* (Amazonas, Brazil).

Die Gattungen *Coumarouna* Aubl. und *Taralea* Aubl. By A. Ducke. *Notizbl. Bot. Gart. Berlin* 14: 120–127; March 30, 1938.

The genus *Coumarouna* (synonym *Dipteryx* in part) consists of about 12 species. A key is provided for distinguishing the nine species known from Brazil, which are listed with synonymy and brief notes. *C. trifoliolata* is a new species from Amazonas, known as Cumarú and Sarrapia. *Taralea* consists of five species, three of them Brazilian.

Mangrove. By Fernando Silveira. *Rodriguésia* (Rio de Janeiro) 3: 131–154; 8 ills.; 1937.

A discussion of the composition of Mangrove swamps, with special reference to those of Brazil. Undoubtedly there is an analogy between all Mangrove swamps. Ecologically and phytologically those of all parts of the earth are similar, the dominant species in all belonging to the same families and even to the same genera. This similarity is explained by the fact that the fruits are dispersed by water. There is included a discussion of the economic importance of Mangroves, and many vernacular names are cited for Brazilian plants of this association.—P. C. Standley.

Diversidade dos guaranás. By Adolpho Ducke. *Rodriguésia* 3: 155–156; 3 pls.; 1937.

The plants furnishing guaraná of Brazil and cupana of Venezuela, a stimulating drug, have been referred to two

species, *Paullinia cupana* H.B.K. and *P. sorbilis* Mart. The latter is better treated as a variety, *P. cupana*, var. *sorbilis* Ducke, distinguished chiefly by the form of the fruits.

Floração da primavera. By Leonam de Azeredo Penna. *Rodriguésia* 3: 203–209; 1937.

A list of plants flowering in Spring in Rio de Janeiro. Many vernacular names of woody plants are cited.

Two new species of *Plenckia*. By C. L. Lundell. *Phytologia* (New York) 1: 284–286; May 1938.

Plenckia integerrima (Argentina) and *P. microcarpa* (Paraguay and Minas Geraes, Brazil) are described as new.

Facies de "El Monte" en la Sierra de la Ventana. By Alberto Castellanos. *Lilloa* (Tucumán, Argentina) 2: 5–11; 1 fig., 1 pl.; May 15, 1938.

A detailed description of a plant association found along the Arroyo Cerro Colorado in the Sierra de la Ventana, Argentina. The principal species are *Gourliea decorticans*, *Schinus dependens*, *Condalia lineata*, *Berberis ruscifolia*, *Clematis campestris*, and *Lycium ciliatum*.

La disposición estratificada de los elementos leñosos en la *Cascaronia astragalina*. By H. R. Descole and C. A. O'Donnell. *Lilloa* 2 23–30; 2 plates; May 15, 1938.

A well illustrated description of the wood of *Cascaronia astragalina* Gris., an Argentine tree locally known as Cascarón and Tipa Blanca, with particular reference to its storied structure. This adds another to the long list of Papilionaceae with ripple marks.

Neuva ensayos de gasificación de maderas del país. By Eduardo Latzina. *Lilloa* 2: 185–249; May 15, 1938.

A report on experiments with 10 Argentine woods as a source of gas for motor fuel. Considerable information is included regarding the distribution, abundance, common names, and various properties of the timbers. The species tested are *Astronium Balansae* Engl., *Bulnesia Sarmientii*

Lor., *Bumelia obtusifolia* R. & S., *Gleditsia amorphoides* (Gris.) Taub., *Patagonula americana* L., *Peltophorum dubium* (Spreng.) Taub., *Prosopis Kuntzei* Harms, *P. ruscifolia* Gris., *Schinopsis Balansae* Engl., and *S. Lorentzii* (Gris.) Engl

On Mr. Bock's collection of plants from Masatierra (Juan Fernández), with remarks on the flowers of *Centaurodendron*. By C. Skottsberg. *Medd. Götesborgs Bot. Trädgård.* 12: 361–373; 30 figs.; 1938.

Brief notes on rare species of the Juan Fernández Islands, with a detailed description of the flowers of *Centaurodendron*, an endemic genus of Compositae.

La fabricatión de sillas de tipo "Viena." *M. A. N.* (Pub. Min. Agr. Nación Argentina), Buenos Aires, April 1938.

"Employing a wood called Guayaibí [*Patagonula americana* L.], from the Chaco forests, a pattern of Vienna chair is made in the Argentine. Some of the factories are each able to make up to 1000 dozen chairs monthly and supply the demands of the local market. Consequently the importation of this article has been greatly reduced."

Arboles forestales coniferos de Chile. By E. L. Bernath. *Maderil* (Buenos Aires) 10: 117; 4–8; 4 photos; March 1938.

A Spanish rendition of the author's "Coniferous forest trees of Chile" which appeared in *Tropical Woods* 53: 19–26, Dec. 1, 1937.

The American species of Myristicaceae. By A. C. Smith (with the collaboration of R. P. Wodehouse). *Brittonia* (New York) 2: 393–510; figs. 1–9; May 2, 1938.

The Myristicaceae of America are represented by five genera and 73 species, all of which are described, with complete synonymy, vernacular names, and much additional information. New species are *Compsoneura excelsa* (Costa Rica), *C. Mutisii* (Colombia), *Dialyanthera Lehmannii* (Colombia), *Iryanthera crassifolia* (Amazonian Peru and adjacent Brazil), *Virola macrocarpa* (Colombia), *V. Duckei*

(Amazonas, Brazil), *V. nobilis* (Panama), *V. Malmei* (Matto Grosso, Brazil). Several new combinations also are published. —P. C. Standley.

Studies of new or noteworthy tropical American plants. III. By Harold N. Moldenke. *Phytologia* (New York) 1: 273–284; May 1938.

New species are *Avicennia Tonduzii* (Costa Rica), *Hyperbaena solimoesana* (Amazonas, Brazil). A new genus of Menispermaceae, *Ungulipetalum*, with a single species, *U. filipendulum*, is based on *Cocculus filipendula* Mart.

Additional notes on *Aegiphila*. IV. By Harold N. Moldenke. *Phytologia* 1: 289–304; May 1938.

New locality and collector records are reported for numerous species of *Aegiphila*, and the species are listed for each country in which the genus is represented.

Studies of the American flora. By Julian A. Steyermark. *Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 17: 411–443; figs. 26–27; May 27, 1938.

The new genus *Mortoniodendron* Standl. & Steyerm., Tiliaceae, is based upon *Sloanea anisophylla* Standl., a tree of Panama. New Euphorbiaceae, from Brazil unless otherwise indicated, are published in the genera *Conceveiba*, *Mabea* (Colombia, Peru, and Brazil), *Richeria*, and *Drypetes*.

Some Rubiaceae of southeastern Polynesia. By F. Raymond Fosberg. *Occas. Papers Bishop Museum* (Honolulu) 13: 245–293; 15 figs.; Nov. 5, 1937.

New species are published from southeastern Polynesia in *Ixora*, *Psychotria*, and *Coprosma*. There are numerous notes regarding old species, and several descriptions of new varieties.

Further notes on *Vaccinium* of Hawaii. By C. Skottsberg. *Medd. Göteborgs Bot. Trädgård.* (Göteborg, Sweden) 12: 145–151; 4 figs.; 1938.

Systematic notes upon *Vaccinium* species of Hawaii. One new form is described.

Florae siamensis enumeratio. A list of the plants known from Siam with records of their occurrence. By W. G. CRAIB. Edited by A. F. G. KERR. Vol. 2, pt. 4, pp. 311–393. Bangkok, May 1938.

A continuation of an enumeration of the plants of Siam, the present instalment covering the families Vacciniaceae to Styraceae. The citations embrace synonymy, local and general distribution, and vernacular names. No descriptions are included.

Contributions to the flora of Siam. Additamenta XLVII, XLVIII, XLIX. *Kew Bulletin* 98–106, 127–133, 199–209; 1938.

Barnett describes four new species of *Quercus*, seven of *Lithocarpus*, and one of *Castanopsis*. Kerr publishes six new species of *Linociera* and one of *Myxopyrum*. New species are described by Fletcher in the genera *Callicarpa*, *Premna*, *Gmelina*, *Glossocarya*, *Hymenopyramis*, *Sphenodesme*, and *Congea*.

On the Indo-Chinese species of *Syzygium* Gaertner. By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* 19: 99–116; April 1938.

Fifty-one species of *Syzygium* are listed for Indo-China; eight are described as new, and numerous new names are published, chiefly transfers from *Eugenia*.

Observations on the growth of *Poeciloneuron indicum*. By KADOMBI KRISHNASWANEY. *Indian Forester* 64: 4: 212–223; pls. 16–17; April 1938.

Poeciloneuron indicum Bedd., locally known as Balagi, is one of the most important timbers of the Ghat forests of Mysore, India, and for the past 15 years has been the principal source of poles for high-power transmission lines in that country. From the standpoint of the wood there are two varieties, one with dark red heartwood which forms early in life and merges gradually into the sapwood, the other with nearly black, Ebony-like heartwood, which is slower in forming, more sharply demarcated, and denser. The paper

contains the results of field observations on the growth and silvicultural characters of the tree which were made during the two years the author was in charge of operations in the evergreen forests of Mysore.

Timber tests: Keladan (*Dryanobalanops oblongifolia* Dyer). By F. S. WALKER. *The Malayan Forester* 7: 87–91; April 1938.

"Keladan is a well established vernacular name for trees of *Dryobalanops oblongifolia* Dyer. The timber is often mixed indiscriminately in the trade with that from *Dryobalanops aromatica* Gaertn. under the name Kapur, although Chinese carpenters in Singapore are said to be unwilling to accept Keladan at Kapur prices. A full scale test of Kapur has been made and it was thought advisable to carry out a similar test on Keladan because a pilot test on two planks suggested it might be distinctly inferior to true Kapur in mechanical strength."

"The mechanical tests on Keladan show that it can safely be included with Kapur for constructional work, although it is definitely inferior in strength. For uses in which an attractive appearance is important, *e.g.*, for furniture, Keladan needs more careful grading than Kapur before acceptance. Timber of both species is particularly suitable for flooring. The higher percentage of sapwood in Keladan, because of the smaller size of the trees, will seriously reduce the conversion factor. Care in seasoning is required, but no distinction between Keladan and Kapur in this respect is called for."

Kiln-seasoning treatments of teak and their effects on its wearing qualities as flooring. By R. A. G. KNIGHT, A. R. DEAN, and F. H. ARMSTRONG. For. Prod. Res. Record 23, Dept. Sci. & Ind. Research, 1938. Pp. 14; 6 x 9¾; 5 pls. Price 7d, postpaid, H. M. Stationery Office, London; 20 cents, British Library of Information, 270 Madison Ave., N. Y.

"In this country, the kiln-seasoning of Teak (*Tectona grandis*) has always been conducted with considerable caution. No doubt the relatively high value of the timber has

been largely responsible for this, but along with the practice has grown the belief that none but mild treatments can be applied to this species without seriously impairing its many excellent qualities.

"This *Record* describes the effects on the timber of a wide range of kiln treatments, and proceeds to indicate the real difficulties that are likely to be encountered in the accelerated drying of the species."

"An account is given of six kiln-seasoning experiments on Teak strips 4 inches wide by 1 inch thick, in which the temperatures used ranged from 45° (113°F.) to 95°C. and at 45°–60° C. (140° F.) (varying).

"It is concluded that the principal factor influencing the choice of drying schedule is the characteristic variation of moisture content in the timber as received in this country, since splitting, warping, shrinkage, etc., are not affected by the particular treatment, and color, though changed in the kiln, quickly reëstablishes itself on exposure to light and air. The floor-wearing qualities of the Teak were not affected by the use of kiln temperatures of 95° and 45°–60° (varying)."

Botanical results of the Archbold Expeditions. IX. Notes on the vegetation of the Fly and Wassi Kussa rivers, British New Guinea. By L. J. Brass. *Journ. Arnold Arboretum* 19: 174–190; map; pls. 221–223; April 1938.

A broad outline sketch of the vegetation of the area described in the title, with brief descriptions of the principal plant communities.

The wood structure of some Australian Rutaceae, with methods for their identification. By H. E. Dadswell and Audrey M. Eckersley. Bull. 114, Council for Sci. & Ind. Research, Melbourne, 1938. Pp. 32; 6 x 9½; 10 pls.

"In this Bulletin the results obtained in the examination of the wood structure of 23 different species of Australian Rutaceae have been set out. Particular attention has been paid to the species of the genus *Flindersia*, since valuable commercial timber is derived from all of them. The results of the examinations have been summarized for each species in a description

which covers the habit and distribution of the tree, the general properties of the timber, the wood anatomy, and a few notes on uses. Photomicrographs showing the finer details of structure and low-power (10 ×) photographs of the end sections of the various woods have been included. A summary of the wood structure of the Australian Rutaceae has been prepared and a key for the identification of these timbers developed."—*Authors' summary.*

Collapse and its removal. Some recent investigations with *Eucalyptus regnans*. By W. L. Greenhill. Pamphlet 75, Council for Sci. & Ind. Research, 1938. Pp. 29; 6 x 9½; 5 text figs., 3 pls.

"A theoretical discussion is given of the causes of collapse and its removal by reconditioning. A special box has been designed for reconditioning experiments and a procedure devised to distinguish collapse from normal shrinkage. Using 1-in. by 4-in. by 1-in. samples, preliminary experimental investigations have been made of the effect of various kiln-drying schedules and of the effect of certain preliminary heat treatments of green material on the occurrence of collapse and on its removal. The results of these investigations are given and discussed. The results of tests made to determine the effect of the moisture content of collapsed timber and of the temperature of reconditioning on its response to treatment are also described. Finally, some indication is given of the relation between results obtained with small samples such as those used in these investigations and with boards, 10 inches long."—*Author's summary.*

Grading studies in "ash" eucalypts. By R. F. Turnbull, A. J. Thomas, and F. E. Hutchinson. Pamphlet 76, Council for Sci. & Ind. Research, 1938. Pp. 36; 6 x 9½; 1 map.

"Studies on Mountain Ash (*Eucalpytus regnans*), Alpine Ash (*E. gigantea*), Obliqua (*E. obliqua*), and minor associated species have been carried out in 38 sawmills distributed throughout the commercial range of these timbers in New South Wales, Tasmania, and Victoria. The conversion and uses of these Ash Eucalypts are briefly described, and factors

influencing their grading are discussed. Natural characteristics of quality in mill-run timber are determined quantitatively from data on 91,000 pieces (708,000 super. feet) of sawn timber.

"Present grading practice is observed to lack uniformity. The actual definition of grades varies between mills and between consuming interests, and the actual grading practised varies even more widely than the grade specifications. This is attributed to the fact that the grade prescriptions as originally drafted have proved unnecessarily stringent, but, instead of revising the specifications, the trade has tacitly accepted the alternative of liberalizing their interpretation. As a result, the actual standard acceptable to the market is nowhere definitely stated or clearly defined.

"The grade distribution in the mill-run output of boards is gauged in reference to a specification suggested by the Standards Association of Australia as an Australian standard. The effects of various modifications to this specification are determined from the data on the natural characteristics of the timber.

"Maintaining that, under the aegis of the Standards Association, grading rules can be most readily promulgated, the authors, working within the framework of Standards Association grades, proceed to develop a set of specifications which would maintain uniformity in use value with standards issued for milled products of other species and would express the present trade practice that seems to be giving satisfaction in the trade. The first specification covers sawn boards and planks. It is a basic specification governing all material of potential finishing quality, and from it specifications for milled products are developed. The second specification prescribes a minimum standard for approved scantling." —*Authors' summary.*

Une essence forestière tropicale à propager le tamarin des hauts (*Acacia heterophylla* W.). By MARCEL RIGOTARD. *Revue Internationale du Bois* (Paris) 5: 53: 161–165; May 1938.

The Tamarin des Hauts is a beautiful timber tree growing in the mountains of Reunion. The wood is brown, figured like Mahogany, moderately dense (sp. gr. 0.65), easy to work, and is well adapted to the making of fine furniture as well as for durable construction.

La collezione botanica fatta dall'Ing. Edgard Taschdjian nell' Impero Etiopico nel 1935–36. By EMILIO CHIOVENDA. *Malpighia* (Bologna) 34: 485–539; 1937 (?).

An annotated list of plants collected in Ethiopia, vernacular names being cited for many species. Among those described as new are *Dalbergia Sciadendron* and *Ficus brachypoda*, var. *scioana* (local name Scheolla).

Two new Acacias of Zululand. By J. GERSTNER. *Journ. S. Afr. Bot.* (Kirstenbosch, S. Afr.) 4: 55–59; 2 figs.; April 1938.

Acacia grandicornuta is a new species of Natal and Zululand. The Zulu name is umZingampondo. It is closely related to *A. robusta* Burch., whose Zulu name is umNgamanzi. *A. barbertonensis* Schweickerdt also is illustrated and described. Its Zulu names are uBibi and uSagu.

Variation in strength of pine timbers. By JOHN M. TURNBULL. *S. Afr. Journ. Sci.* (Johannesburg) 33: 653–682; March 1937.

Strength is a function of density and depends upon the proportion of summer wood which, in turn, depends on the tree's age rather than on rate of growth. Hence with stems of the same diameter, in comparable circumstances, the youngest will contain the lightest wood and the oldest the densest. Conversely, the average density of even-aged stems of varying diameter will tend to be constant.

"The function of spring wood is organic and its development proceeds until the amount of tissue formed is adequate to the performance of its allotted function; whereas summer wood is a residual development which continues so long as external conditions are propitious. The one is internally, the other externally, controlled. . . . The summer-wood zone tapers in ascent and eventually vanishes when it meets the pith, that is, at the tip of the current year's leading shoot. It

follows therefore that spring wood formation ceases as soon as height growth terminates, and, conversely, that summer wood can be formed only during the dormancy of height growth. This should hold good both during the period of main height growth and during temporary resumptions in response to adventitious stimuli, in the latter case producing the phenomenon of double and multiple rings. The contact between spring and summer wood in any ring therefore marks the cessation of height growth, while the spring wood in so-called 'false' rings indicates a temporary resumption thereof. The obvious inference that can be drawn from this is that, provided the size of the cells is constant, summer-wood ratio will vary directly with taper. But taper is correlated with rate of diameter growth, of which . . . summer-wood ratio is independent. Reconciliation of the two hypotheses is possibly dependent on the results of histological research."

Die Flora des Namalandes. XII. By PAUL RANGE. *Repert. Sp. Nov.* (Berlin-Dahlem) 43: 262–271; April 15, 1938.

A continuation of former lists of the flora of Namaland, Africa, the families covered being Crassulaceae to Compositae of the Engler sequence.

Dr. Carisso's botanical mission to Angola. By A. W. EXELL. *Jour. Bot.* (London) 76: 121–134; May 1938.

A running account of the author's visit in 1937 to Angola, with a general description of the geography and vegetation of regions visited. There are numerous references to important trees of the country.

Notes on African *Rubi* in the Kew Herbarium. By C. E. GUSTAFSSON. *Kew Bulletin* 177–187; 1938.

One new species and four varieties of *Rubus* are described from the mountains of Africa, with extensive notes on older species.

Conspectus florae angolensis. Vol. I, fasc. 1. Ranunculaceae–Malvaceae. Edited by LUIZ WITTNICH CARRISSO. Prepared

by Instituto Botanico de Coimbra (Portugal) in collaboration with the British Museum; published by Agência Geral das Colónias, Lisbon, Jan. 30, 1937. Pp. ix–xxiv, 1–176; 6½ x 9½; map of Angola.

"In 1927 a botanical mission to Angola was organized by the Botanical Institute of the University of Coimbra. When I made an attempt, in collaboration with my friend F. A. Mendonça, after our return to Portugal, to classify and arrange the material that we had collected, it was soon evident that a complete reorganization of the Angolan herbarium at Coimbra was necessary. The names of hundreds of specimens, representing nearly all the species of the Angolan flora, had to be verified, undetermined specimens identified, and the nomenclature brought up to date. The problems which arose necessitated an amplification of the scope of the work to include a critical revision of the Angolan material, not only in the Lisbon Herbaria (Faculty of Science and Colonial Garden), but also abroad, particularly in London (British Museum and Kew) and Berlin. The result is the work which we are now starting to publish.

"The undertaking, conceived along the lines indicated, was beyond the resources of the Coimbra Botanical Institute alone; the fact that part of the work had to be completed outside Portugal in itself necessitated some form of collaboration; and the importance of a work of this nature imposed on us the obligation of seeking scientific assistance from one of the great botanical centers of Europe. In the end the work went far beyond the simple arrangement of a herbarium and came to be a summary of our knowledge of the flora of Angola; as such it seems to merit publication.

"The necessary collaboration was obtained at the British Museum, an institution particularly well adapted for this through its wealth of material and the invaluable work which its botanists have done on the flora of our great colony. . . . The present publication consists of the results of this collaboration. I am convinced that it is a work of real utility for African botany, and I do not conceal an intense satisfaction that I have been able to contribute to its realization."—*From editor's preface.*

Note sur quelques *Sarcocephalus* africains. By AUGUST CHEVALIER. *Rev. Bot. App. & d'Agr. Tropicale* (Paris) 18: 199: 176–190; pls. 6–7; March 1938.

A descriptive account of four old and one new species and three new varieties of *Sarcocephalus* occurring in West Africa.

De quelques bois utiles du Gabon. By FRANCOIS PELLEGRIN. *Bull. Soc. Bot. France* (Paris) 84: 639–645; April 1, 1938.

A systematic list of vernacular names of trees of Gaboon. *Monopetalanthus Heitzii* (local name Andoung) and *Calpocalyx Heitzii* (Miamai) are described as new.

Sur des plantes médicinales ou utiles du Mayumbe (Congo Belge) d'après des notes du R. P. Wellens (1891–1924). By E. DE WILDEMANN. Acad. Roy. Belgique, Sec. Sci. Nat. & Med. (Brussels) 1: 4: 1–97. Price 17 f.

An annotated check list of the medicinal and otherwise useful plants of the Belgian Congo based upon notes made by the late R. P. Frédéric Wellens.

The African Lauraceae. I. By A. J. G. H. KOSTERMANS. *Bull. Jard. Bot. l'État Bruxelles* 15: 1: 73–108; pls. 5–9; June 1938.

Contains full descriptions, with references, common names, uses of the timber, and other valuable information, of four species of *Ocotea*, one of *Hypodaphnis*, and six of *Cryptocarya*.

Kolonialforstliche Mitteilungen. Band I, Heft 1. Edited by FRANZ HESKE. Pub. by Inst. ausländische & koloniale Forstwirtschaft, Tharandt-Dresden, May 1938. Pp. 1–282; 7 x 10; 194 illustrations.

This first part of the new series of *Mitteilungen* from the Institute includes the reports presented at the installation of courses in colonial forestry at Tharandt in December 1937. The subjects, which are well presented and profusely illustrated with maps, graphs, charts, and photographs, are as follows:

Einführung in die Standortsverhältnisse des tropischen Westafrika unter besonderer Berucksichtigung von Kamerun, by Wilhelm Grosskopf, pp. 4–37; 18 figs.

Überblick über die Waldverhältnisse Westafrikas, by Franz Heske, pp. 38–40; 1 map.

Über den Tropenwald Westafrikas, by J. Mildbraed, pp. 41–52; 9 photos.

Einführung in die Biologie des tropischen Waldes, by Friedrich Tobler, pp. 53–74; 28 photos.

Einiges über topographische Aufnahmen auf Riesen, by R. Hugershoff, pp. 75–80; 8 figs.

Ziele und Wege der tropischen Kolonialforstwirtschaft, by Franz Heske, pp. 80–114; 19 photos by Forstassessor Polchau.

Erschliessung der Tropen, von einem deutschen Pflanzer von heute aus gesehen, by R. Schlubach, pp. 114–120.

Praktische Lösung der verschiedenen Aufgaben eines Kolonialforstwirtes in Westafrika, usw., by W. Wiech, pp. 120–127.

Aufgaben der Forstwaltungsorganisation in den Tropen, by D. K. F. Johannsen, pp. 127–137.

Hamburgs Einfuhrhandel mit überseeischen Hölzern im Spiegel von drei Jahrhunderten, by Joh. Friedr. Müller, pp. 138–150.

Tropische Waldnutzung und Bestimmung der Holzart am stehenden Stamm, by Eduard Appel, pp. 151–163.

Botanik und koloniale Holzforschung, by Bruno Huber and Eberhard Schmidt, pp. 163–169; 32 photomicrographs.

Holzschutz in den Tropen, by W. Bavendamm, pp. 169–174.

Chemische Nutzungsmöglichkeiten des afrikanischen Waldes, by H. Wienhaus, pp. 175–179.

Zellstoff aus Kolonialhölzern, by W. Mühlsteph, pp. 179–184; 8 photomicrographs.

Schirmbaum, *Musanga Smithii* R. Brown, by Ernst Polchau, pp. 185–221, 30 photos, etc.

Über Methoden und Ergebnisse ertragskundlicher Untersuchungen im tropischen Regenwald, by Franz Grünwaldt, pp. 222–227.

Gesundheitsprobleme in den Tropen, by Dr. Haupt, pp. 227–234.

Bescreibung tropischer Hölzer aus den Urwalde Kameruns, by F. Jentsch, E. Appel, and E. Schmidt, pp. 235–245; 22 photomicrographs, etc. (Woods described are *Andira inermis* H.B.K., *Pterocarpus Soyauxii* Taub., *Chrysophyllum africanum* A. DC., and *Xylopia striata* Engl.)

Physikalische und mechanisch-technische Untersuchungen deutsch-kolonialer Hölzer, by Leop. Vorreiter, pp. 245–258; 11 graphs, etc. (Results of tests on *Rhizophora mangle* L.)

Über einige ausländische Versuche und Erfahrungen auf dem Gebiete des tropischen Waldbaues, by Dr. Francke, pp. 259–270; 8 figs.

Rundschau, pp. 270–282.

On the nomenclature of three species of *Caesalpinia*. By J. E. DANDY and A. W. EXELL. *Journ. Bot.* (London) 76: 175–180; June 1938.

A review of the history of three species of *Caesalpinia* that

have sometimes been referred to a separate genus, *Guilandina*. *C. Crista* L. is found to be the proper name for the species usually known as *C. Nuga* (L.) Ait. f.; *C. Bonduc* (L.) Roxb. that for the plant recently known as *C. bonducella* (L.) Fleming or *C. Crista* L.; *C. major* (Medic.) Dandy & Exell is the proper name for the species usually known as *C. Bonduc* Roxb.—P. C. STANDLEY.

Amarantaceen-Studien. By K. SUESSENGUTH. *Repert. Sp. Nov.* (Berlin-Dahlem) 44: 36–48; May 31, 1938.

Notes upon Amaranthaceae from various continents, a few of them woody plants, with special notes upon the genera *Charpentiera* and *Deeringia*.

Résistance et structure microscopique des bois. By P. JACCARD and A. FREY-WYSSLING. Bericht 36, Assn. Suisse pour l'Essai des Matériaux, Zürich, May 1938. Pp. 32; 8¼ x 11¾; 25 text figs.

This contribution is in three parts, the first two (in French) by Jaccard, the third (in German) by Frey-Wyssling. The first (pp. 3–8) deals with variations in the strength of wood of different kinds and conditions and the behavior of the fibers in rupture. The second is concerned with the lignification of wood, including the structure and chemical composition of the cell walls, influencing factors, tyloses, and mineralization. The third gives the results of a study of "lignostone" (Beechwood compressed to about twice its natural density) and the general effect of excessive pressure on the cells. In moist wood failure begins in the middle lamella, in dry woods the first apparent failure is in the secondary wall.

Statik und Dynamik des schraubigen Baues der Zellwand, besonders des Druck-und Zugholzes. By ERNST MÜNCH. *Flora* (Jena) n.s. 32: 357–424; 12 text figs.; 1938.

A valuable contribution to the knowledge of spiral structure of the cell wall with particular reference to compression and tension wood; includes a review of the literature on the subject.

M M Chittaway

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School of Forestry

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LAMINATED SPRUCE AND GREENHEART BEAMS

By ALBERT G. DIETZ

Instructor in Building Engineering and Construction, Massachusetts Institute of Technology

Different grades and species of wood exhibit markedly divergent strength properties. Speaking very generally, the heavier and denser species are stronger and stiffer and hence more desirable from an engineering standpoint than are the lighter varieties; however, these denser species grow more slowly, are more sought after, and are more expensive. Similarly, the best grades of any species are most scarce but most desirable.

But the great strength that is afforded only by the denser species and the best grades is needed in only comparatively small portions of many structural members, such as beams, whereas the balance could well be composed of weaker ma-

terial. The author is, therefore, conducting some tests on composite beams, using two different types of assembly. The first type consists of combined low-grade and high-grade pieces of the same species, the second type of combined relatively weak and strong species. In the second category fall several small beams made up of ordinary eastern North American Spruce and Greenheart. This combination was selected as representing a great range of structural properties, Spruce being weak in comparison to the high density and strength of Greenheart.

Theoretical Considerations

Since the maximum fiber stresses in a beam subjected to bending occur at the top and bottom edges, it follows that the strength of a wooden beam depends primarily on the condition of the fibers at those edges. Imperfections near the center of the beam's depth have little effect upon its strength because the fiber stresses there are very small. This, of course, refers only to tension and compression and not to shear. Further, the strength of any beam of a given size and condition is governed by the inherent structural properties of the wood itself as is illustrated by the fact that a Longleaf Yellow Pine or a Douglas Fir beam is stronger than a similar beam of White Pine.

It would seem, then, that a composite beam using comparatively thin outer laminations of high-grade, strong species and cores of poorer grade, weaker species ought to possess approximately the same strength as a solid piece of the better material.

Another factor to be considered is that wood is stronger and possesses a higher modulus of elasticity in tension than in compression. Laminations on the tension side of a composite beam, therefore, should not have to be as thick as those on the compression side. In either case the thicknesses of the laminations should be so proportioned that the outer edges of the laminations and outer edges of the core reach their ultimate fiber stresses at the same time. These relative thicknesses depend not only upon the relative strengths of core and laminations but upon the ratios of their moduli of elasticity as well.

Design Procedure

Before the test beams could be designed it was necessary to determine the compressive and tensile strengths and moduli of elasticity of the Greenheart. In addition, the bending strength of the Spruce cores had to be ascertained. Test pieces for direct tension and direct compression were therefore cut from the Greenheart stock and the strengths and moduli of elasticity measured. The bending strength of the Spruce cores was estimated, using the grading procedure developed by the U. S. Forest Products Laboratory. Because the Spruce cores would be subjected to typical bending action whereas the Greenheart laminations would be in practically direct tension or direct compression, the bending modulus of elasticity of Spruce was determined instead of its separate moduli in tension and compression. These tests indicated the following relative values:

Tensile strength and tensile modulus of elasticity of Greenheart were both nearly one and one-half times the corresponding compressive values. Tensile laminations, therefore, would be two-thirds the thickness of compressive laminations.

Estimated modulus of rupture of Spruce was approximately one-fourth the ultimate compressive and one-sixth the ultimate tensile strength of Greenheart. Bending modulus of elasticity of Spruce was from one-third to one-fourth the compressive and tensile moduli of elasticity, respectively, of the Greenheart.

Balanced beam design, therefore, called for compression laminations to be one-quarter and tension laminations to be one-sixth the depth of the core.

Description of Test Beams

Neither Spruce nor Greenheart was especially selected for superior properties. The Spruce was a non-structural grade of the type commonly stocked for light framing such as found in dwelling houses. Greenheart showed occasional small knots, some cross grain, and fairly numerous checks.

Two sets of three small beams were made up. For sake of comparison one set had all laminations of the same thickness,

the other set had bottom laminations two-thirds the thickness of the top laminations.

Cores were cut out of stock two-by-fours dressed down to a three-inch depth. Top laminations were all three-quarters inch thick, bottom laminations were either three-quarters or half-inch thick. Lengths varied from five to five and one-half feet.

Commercial water-resistant casein glue and ordinary clamping procedure were employed. After standing one or two days, clamps were removed and all beams dressed down to a width just under one and one-half inches.

Tests

Beams were tested under a single concentrated center load applied at the rate of one-tenth inch per minute. Deflection readings were taken at 200-pound intervals until well past the proportional limit, after which the load was carried to failure. Following are the results, expressed in pounds per square inch:

Laminations:	
Average ultimate compressive strength	15,500
" " tensile "	23,000
" compressive modulus of elasticity	4,000,000
" tensile " " "	5,800,000
Core:	
Estimated modulus of rupture	4,000
Average bending modulus of elasticity	1,400,000
Beams:	
Average apparent modulus of rupture	14,600
" " " " elasticity	2,500,000

There was no consistent difference in the behavior of the two sets of beams. The highest single strength value, in fact, was shown by a beam with thin bottom lamination, and the lowest single value by one with thick bottom lamination.

In every case but one, failure originated on the compression side, tension failure occurring after the compression lamination had buckled. The one exception was a shear failure in a faulty glue line.

Discussion and Conclusions

All beams exhibited much greater strength and stiffness than would comparable beams of solid Spruce even if the latter

were perfectly clear. (*Wood Handbook*, Forest Products Laboratory, p. 53.)

Modulus of rupture compared favorably with that to be expected from the strongest and best North American timber, and modulus of elasticity was higher than that of any species.

Increasing the thickness of the bottom lamination apparently does not increase the strength of the beam. It appears, as a matter of fact, that these laminations could be still thinner.

Shear, naturally, is still a maximum in the center, in the weaker Spruce core. However, consideration of the transformed moment of inertia of the laminated beam shows that shear tends to spread out more uniformly over the cross section and therefore reduces the intensity somewhat at the neutral axis.

Although, of course, more tests would be required for precise results, it is seen that strong and stiff beams can be made up of comparatively small amounts of dense species combined with fairly large proportions of considerably lighter, poorer-grade material.

Acknowledgment

The author is indebted to Mr. Stuart Huckins of the Geo. McQuesten Company, Boston, for supplying the Spruce and Greenheart used in these tests.

What is the Scientific Name for Greenheart?

By S. J. R.

The commercial Spruce referred to in the preceding paper may be any one or a mixture of two or three species of *Picea*. In the case of Demerara Greenheart, however, we are dealing with a single well-known species, though its exact designation is a problem. The tree was first described as a species of *Nectandra* and later transferred to *Ocotea*, where taxonomists now agree it belongs, though disagreeing as to whose species was transferred and as to the spelling of the specific epithet. Here are some examples showing the confusion existing in literature on the subject.

In the first volume of *Index Kewensis* the name *Nectandra Rodioei* Hook. is given preference over *Nectandra Rodiei* Schomb., but the change in generic status is recorded in the first supplement as *Ocotea Rodiei* Mez (=*N. Rodiei* Schomb.). The name in general use in the British Guiana Forestry Department and the Forest Products Research Laboratory at Princes Risborough is *Ocotea Rodioei* Mez. The editor of the *Kew Bulletin* presumably approves *Ocotea Rodioei* (Schomb.) Mez (*e.g.*, 1936, p. 529), but Holland (*Overseas plant products* 1937, p. 68) uses *Ocotea* (*Nectandra*) *rodiaei*. Usage in three well-known English books on woods is as follows: Boulger (*Wood*, p. 176), *Nectandra Rodioei* Schomb; Stone (*Timbers of commerce*, p. 176), *Nectandra Rodioei* Hook. (syn. *N. Rodier* Schomb.); Howard (*Timbers of the world*), *Nectandra Rodioei* Hook. Pittier (*Plantas usuales de Venezuela*, p. 398) says that the name for British Guiana Greenheart is *Ocotea Rodiei* (Hook.) Mez. Among Netherlands writers, Pfeiffer (*De houtsoorten van Suriname* 1: 174) uses "*Nectandra Rodioei* Hook. f. (syn. *Ocotea Rodiei* Mez, *Nectandra Rodier* Schk. en *N. rodioei* Schomb.)," while more recently Kostermans (in Pulle's *Flora of Suriname* 2: 258) gives *Ocotea Rodiaei* (Rob. Schomb.) Mez (syn. *Nectandra Rodiaei* Rob. Schomb.).

NOTE ON *CALATOLA VENEZUELANA* PITTIER

By Llewelyn Williams

In February 1937, through the efforts of Dr. Henry Pittier, a tract of forest land of approximately 100,000 hectares in the State of Aragua, Venezuela, was set aside by presidential decree as a national park. It extends from the coast to a few kilometers north of Maracay and is proving a fertile collecting region, as numerous new or little known species are being discovered within its limits.

A tree, locally known as Orosul, is a new species in the interesting family Icacinaceae and has been named *Calatola venezuelana* Pittier (Bol. Soc. Venez. Cien. Nat. 4: 33: 360–362. 1938). This is the first record of the occurrence in Venezuela of a genus having a previously known range from southern Mexico through Central America into northern Colombia. Its description is as follows:

Evergreen tree, attaining a height of 17–20 m.; crown irregular, usually narrow and dense, with dark green foliage; trunk rather twisted and compressed, 40 cm. or more in diameter at the base, without limbs for 4–5 m. and without buttresses; bark 1 cm. thick, dark reddish brown, rough, fissured. Leaves alternate, petiolate; petiole terete, 1.5 cm. long, subwinged; lamina broadly ovalate, up to 20 cm. long and 12 cm. wide, acute or oftentimes unequal at base, abruptly acuminate or broadly rounded at apex, lustrous dark green and glabrous above, reticulate. Flowers unknown. Fruit an ovoid or subglobose drupe, 4.5–6.5 cm. long and 3.5–4.5 cm. in diameter, the epicarp moderately thick, fleshy, and deciduous, the mesocarp bivalved, woody, dehiscent, the suture prominent and the valves with numerous, irregular, sharp crests over the entire surface; seed solitary, white, of firm consistency; nut 4–6 cm. long and 3–4 cm. in greatest width; fruiting period from end of August to October.

The tree, although not striking enough in appearance to attract special attention, is easy to recognize by its curious fruits, which often are abundant on the ground and are noticed immediately because of the sharp crests, suggesting walnuts in appearance. The species has so far been found only in the national park, at altitudes of 950 to 1150 m., in association with such trees as *Palicourea perquadrangularis* Wernham and *Gyranthera caribensis* Pittier. It is reported to grow also in the vicinity of the Colonia Tovar, but no specimens are available to verify this.

There are three other species of *Calatola*. Standley (Trees and shrubs of Mexico, p. 689) describes *C. mollis* Standley as a tree about 20 m. high growing at altitudes of 650–900 m. The type was collected in 1913 at Zacatlán, Puebla, Mexico, and the vernacular names given are Calatola and Calatolazno for the tree, and "nuez de calatola" for the nuts and "colas de ratas" for the spikes. The type of *C. laevigata* Standl. was collected in Cafetal San Carlos, Cerro Espino, alt. 800 m., Oaxaca, Mexico, and its local name is Palo de Tinta.

The third species is *C. costaricensis* Standley (Journ. Wash. Acad. Sci. 16: 416. 1926), a tree 6–15 m. or more high with smooth, but scaly, bark. It is known in Costa Rica as Durazznillo, Palo de Papa, Palo Azul, or Erepe; in Panama as Haguey; in Colombia as Venenito. The tree is said to grow in the moist forest of the central region of Costa Rica, at alti-

tudes of 1500 to 2000 m., but according to information received recently from Mr. C. H. Lankester it occurs at much lower levels in the Sarapiquí Valley, and Pittier, in 1891, collected the fruits for the first time in the Savegre Valley, where the elevation does not exceed 200 m. Thus, it can be safely stated that the species is found at altitudes between 200 and 2000 m.

The old leaves of *Calatola* often have a bluish cast while still on the tree, and when dried turn bluish black. The unripe fruit exudes a blue coloring material when compressed or dried, and the inner bark turns dark blue upon drying. Pittier states that the nuts of *C. costaricensis* have a sweet and agreeable flavor but later leave a bitter sensation and produce violent pains, nausea, and vomiting, although the roasted seeds have no harmful effects and are much esteemed by the people living on the slopes of the volcanoes Barba and Poas. According to Standley, they are also ground into coarse meal from which is made a kind of tortilla, the flavor resembling those prepared with grated cheese. The seeds of *C. mollis* are said to have vomitive-purgative properties.

The wood of *Calatola venezuelana* is creamy white throughout when freshly cut, but within 24 hours it begins to assume a grayish tone, finally turning a purplish blue after several days of drying in a cool room, although this color bleaches out to a light brown when exposed to strong sunlight. Moderately lustrous. Without distinctive odor or taste. Of medium weight and hardness; specific gravity (air-dry), 0.74; moderately fine-textured, straight-grained; strong, easy to work, susceptible of a fairly smooth finish, does not check when exposed to air and sunlight, and appears to be immune to insect attacks. Suitable for carpentry and interior work, though not used locally on account of its scarcity.

Growth rings indicated by narrow zones lacking parenchyma or by some variation in the depth of color; width 1–4 mm. Pores near limit of vision, moderately numerous to numerous, but not crowded; usually solitary and irregular in outline, sometimes in short multiples, uniform in size and without definite arrangement. Vessel lines appear as fine scratches, somewhat darker than the other elements; lustrous tyloses frequently present; perforation plates scalariform; pitting coarse, often opposite. Rays in part readily visible but not conspicuous; of a grayish color and rather distinct on radial surface; 1 to 4 cells wide, the cells large and perceptible with lens; heterogeneous, with many of the cells upright; pits to vessels large, elongated, with tendency to scalariform arrangement. Wood parenchyma well developed, appearing in the form of numerous, very fine lines almost indistinguishable with lens on moistened cross surface, without definite order but most often extending tangentially between the rays. Wood fibers with thick walls and distinctly bordered pits. Ripple marks and gum ducts absent. *Material:* Williams No. 10118, from type tree.

In general, the macroscopic and microscopic characters of the wood agree with those of other members of this genus. Comparison was made with three samples of *C. costaricensis* Standley, one collected recently by Alexander F. Skutch between the volcanoes Poas and Barba in the Central Cordillera of Costa Rica, at an altitude of 1680 m., another collected in 1928 by G. Proctor Cooper at Bocas del Toro, Panama (Yale 11964), and a third from Colombia obtained in 1932 by R. Espina and J. Giacometto (Yale 20291). There is little superficial difference between the Venezuelan species and these samples except that the purplish tone is more intense in the former and the texture is somewhat finer. In the Costa Rican wood the pores are visible to the unaided eye and more numerous.

AMERICAN WOODS OF THE FAMILY LOGANIACEAE

By Samuel J. Record

The Loganiaceae comprise more than 30 genera and about 460 species of woody vines, erect shrubs, small to medium-sized trees, and some herbaceous plants, generally distributed in tropical and subtropical parts of the world, sparingly so in temperate regions. One of the shrubs commonly planted for decorative purposes is the Butterfly Bush (*Buddleia*). The alkaloids strychnine and brucine are obtained from the silvery coin-like seeds of *Strychnos nux-vomica* L. of southern India. The seeds of the Clearing-nut tree, *S. potatorum* L. f., another Indian species, are not poisonous; on the contrary they are used to clear muddy water, the albumen precipitating suspended matter. The family is negligible as a source of commercial timber, although a few species in the Indo-Malayan

region and Africa furnish some lumber for local construction and carpentry. The American trees of the family are all small and are of six genera, namely, *Antonia*, *Bonyunia*, *Buddleia*, *Pagamea*, *Potalia*, and *Strychnos;* they are valueless for timber.

Wood light to dark brown, or gray. Luster generally low. Mostly odorless and tasteless, sometimes bitter. Variable in density and texture, but generally hard, heavy, and fine-textured. Pores sometimes medium-sized to large in the climbers, mostly small to minute in the erect trees and shrubs; diffuse-porous, except some species of *Buddleia;* pores usually numerous, solitary or in pairs or in short to rather long radial rows, well distributed without distinctive pattern except in some species of *Buddleia* and *Strychnos*. Vessels typically with simple perforations; occasionally with spiral thickenings; pits very small to medium-sized, vestured, alternate. Rays heterogeneous, often decidedly so; most of them uniseriate or biseriate, sometimes 3 to 5 cells wide; often very low, sometimes up to 25, infrequently to 50, cells high; considerably wider and taller in some species of *Strychnos;* fusiform rays containing phloem bridges present in *Bonyunia* and *Norrisia;* crystals sometimes present; pits to vessels very small to moderately large. Wood parenchyma sparingly to abundantly developed; sometimes in narrow to wide, continuous or broken, closely to widely spaced, concentric bands. Wood fibers with thin to very thick walls; occasionally septate; pits small, simple or with borders of varying degrees of distinctness. Ripple marks and gum ducts absent. Strands of included phloem characterize *Antonia*, *Bonyunia*, *Logania*, *Norrisia*, and *Strychnos* (see *Tropical Woods* 50: 16).

Antonia, with one species, *A. ovata* Pohl, a small tree or a shrub, occurs in the Guianas and Brazil. There is no wood sample in the Yale collections, but according to Solereder (*Systematic anatomy of the dicotyledons*, p. 546), the genus is very closely related to *Norrisia* and has strands of included phloem and wood fibers with bordered pits.

COMMON NAMES: Hariraroe thoeraroe, ipoentrie, kasabahoedoe, kasave, licahout, melassiehoedoe, paloeloipio (Sur.).

Bonyunia. There are five named species of shrubs and little trees, of which three are known only on Mount Duida (Venezuela) and Mount Roraima (British Guiana), one on the open plains of eastern Brazil, and one, *B. aquatica* Ducke, inhabits swamps in the upper Rio Negro valley, Amazonas. The only wood sample available is of this last species (Yale 31951; Ducke 224). The sapwood is creamy white; heartwood probably yellow-brown. Odorless and tasteless. Rather dense, hard, fine-textured, easy to work, finishing smoothly, does not appear durable.

Pores very small, mostly in radial multiples of 2 to 8, evenly scattered. Vessels without spirals; pits very small. Rays mostly uniseriate and less than 10, sometimes up to 25, cells high; fusiform rays with radial phloem strands present, scattered, visible with lens; pits to vessels very small. Wood parenchyma in tangential or interrupted concentric bands of variable spacing and containing tangentially flattened strands of phloem. Wood fibers with moderately thick walls and numerous small but distinctly bordered pits.

Buddleia, with about 100 species of shrubs and little trees, is widely distributed in tropical and subtropical America and Asia and in South Africa. The wood is of normal structure, pale brown, hard, heavy, and fine-textured.

Diffuse-porous, with all pores very small to minute and in pairs or short radial rows; ring-porous, with single row of small pores in early wood and numerous minute pores, sometimes in ulmiform pattern, in late wood. Vessels sometimes with distinct spiral thickenings; pits medium-sized, alternate. Rays 1 to 3 cells wide and up to 25 or 30 cells high; heterogeneous, many of the cells square; pits to vessels medium large, oval to elongated. Wood parenchyma sparingly paratracheal; not distinct with lens. Wood fibers with moderately thick walls and numerous minute, simple or indistinctly bordered pits.

COMMON NAMES: Tabaco cimarrón (Cuba); azafrán, azafrancillo, azafranillo, cargolinán, escobilla, golondrilla, hierba de las escobas, lengua de vaca, mispatle, quimixpatli, salvia, tepoja, teposana, tepoza, tepozán, tepozancillo, tepozu, tepuza, topozán, tzompantle (Mex.); salvia santa, s. sija (Guat.); salvia, salviona (Salv.); hoja de salbe (C.R.); tabaquillo (Pan.); salvia blanca, tabaco del monte (Col.); hoja de queso, mata de queso, queso, salvia de páramo, Santa María (Venez.); barbasco, calção de velho, calças de velho, camará, cambará, cardeal, tingui da praia, vassoura, vassourinha, verbasco do Brasil (Braz.); quishuar (Peru); mirto (Par.); pañil (Arg.).

Pagamea, with several species of shrubs and small trees in

the Amazon basin, is referred by some authors to the Rubiaceae. The only wood specimen available is of *P. macrophylla* Spruce collected by Adolpho Ducke (Yale 20704; Ducke 20). It is of normal structure, the heartwood dark olive-brown with yellowish streaks, the sapwood pale brown, rather sharply differentiated. Odorless and tasteless when dry. Hard, heavy, tough, strong, and probably durable.

Pores small, solitary or in radial multiples. Vessels with very fine, alternate pitting. Rays decidedly heterogeneous; 1 to 3 cells wide and up to 35 cells high; pits to vessels very small. Wood parenchyma in short to long, irregularly spaced tangential or broken concentric bands, 2 to 5 cells wide. Wood fibers with thick walls and small but distinctly bordered pits.

Potalia, with one species, *P. amara* Aubl., is a shrub or little tree rarely over 15 feet high occurring throughout the Amazon basin. The only wood sample in the Yale collections was obtained by L. Williams in eastern Peru (Yale 17730; Williams 1936). It is of normal structure, very hard and heavy, and fine-textured.

Pores minute, barely visible with lens, rather few, solitary or in small radial multiples. Vessels with small, alternate pits. Rays uniseriate, less than 25 cells high; very heterogeneous, most of the cells being upright; pits to vessels small. Wood parenchyma in numerous, fairly regular, concentric lines or bands 2 to 4 cells wide, distinct with lens. Wood fibers with very thick, gelatinous walls; pits minute, simple or indistinctly bordered.

COMMON NAMES: Anabi (Braz.); sacha-mangua (Peru).

Strychnos, with over 100 species of woody vines and erect shrubs and small to moderately large trees, is of pantropical distribution. Most notorious of American species is *S. toxifera* Benth., which ranges from Brazil to Costa Rica and is a source of curare, reputed to be one of the deadliest of poisons. According to Standley (*Contr. U. S. Nat. Herb.* 27: 302), "curare is obtained from the bark and roots. Introduced into the circulation in minute quantities it paralyzes the motor nerves almost instantly and soon causes death. It has been employed extensively by the South American Indians for poisoning their arrows, especially those shot from blow-guns, and it is reported that similar use of the plant is made by the Indians of Panama." The woods are gray or yellow, hard, heavy, strong, rather coarse-textured, and are not utilized. Included phloem

is in cylindrical strands, surrounded and sometimes linked together by parenchyma.

Pores variable in size, number, and arrangement, often in oblique groups with parenchyma. Rays variable in size in different species, sometimes up to 10 cells wide and up to 80 cells high; chambered procumbent cells containing crystals often present. Wood fibers with thick walls and few to numerous simple or inconspicuously bordered pits. No radial phloem strands observed. (See *Tropical Woods* 50: 16.)

COMMON NAMES: Manca-montero, mata-montero, zarza cimarrona (Cuba); cabalonga de Tabasco, mata-perros, veneno del diablo (Mex.); chicoloro, luch-maax, snakeseed tietie (Br.H.); guaco (Hond.); guacal or huacal de mico, guacamico or huacamico (Salv.); canjura, fruta de murciélago (Pan.); cruceta real, curare, mavacure (Venez.); rouhahamon (Sur.); apui-rana, quassia, quina de cipó, q. do campo, urare, urareúva (Braz.); cunshu-huayo (Peru); casia amarga, coyón de gallo, espuelo de gallo, nuatí-curuzú, té amargo (Arg.).

CURRENT LITERATURE

The distribution of important forest trees of the United States. By E. N. MUNNS. Misc. Pub. 287, U. S. Dept. Agr., Washington, D. C., April 1938. Pp. 176; 9 x 11½; 170 maps. For sale by Supt. of Documents, price 35c.

A book of maps showing the botanical distribution in the United States and, in some instances, in Canada and Mexico, of 170 species of trees.

Elephant trees. By CYRUS S. PERKINS. *Cactus & Succ. Journ.* (Pasadena, California) 10: 20–21; ill.; August 1938.

A popular account of *Elaphrium microphyllum* and *Pachycormus discolor*, as found in northwestern Mexico and southwestern United States.

A monograph of the genus *Petitia*. By HAROLD N. MOLDENKE. *Repert. Sp. Nov.* (Berlin-Dahlem) 42: 229–251; November 25, 1937.

The genus *Petitia* (Verbenaceae) consists of three species and one variety, all West Indian. *P. diamentensis* is described as new from Cuba.

The evolution of vegetation survey and rural planning in British Honduras. By N. S. Stevenson. *Empire Forestry Journal* 17: 1: 9–26; 8 plates; 1938.

"Prior to the initiation of forestry in 1920, the interior of British Honduras was virtually unknown except to a small section of the inhabitants engaged in the collection of forest produce. Throughout the Colony's history economic circumstances had favored forest exploitation to the neglect of agricultural development and, as such exploitation had been selective and exhaustive in character, the need for a broader productive economy was beginning to make itself felt. The article traces the progress made since that time in accumulating data on vegetation, soil, topography, and latterly climate, and describes the evolution in survey methods from the first rapid reconnaissances to the more elaborate ecological surveys now carried out with topo Abney and trailer tape. The mestizos of the North, who are 'natural ecologists' with a vegetation-type terminology of their own, have become highly proficient in such work. The objective at the outset was the investigation of forestry possibilities, but the knowledge accumulated has proved of much wider usefulness in relation to the general problems of rural development, and the value of vegetation types as indicators of soil quality has grown steadily more apparent. Vegetation survey has enabled better control of shifting cultivation, so that valuable forest is sacrificed to a less extent to this activity, and has shown where and how permanent agriculture can best be established. Communications can be planned to open up the more fertile lands, the location of which was previously unknown, and causes of erosion can be traced. Close coöperation has been maintained throughout with the agricultural and other departments concerned, and the forest staff have come to regard themselves as members of an organization engaged on the general problem of rural development, forestry being only one facet of its activities."—*Author's summary.*

Flora of Costa Rica. By Paul C. Standley. *Bot. Ser. Field Mus.* (Chicago) 18: 3: 783–1133; July 29, 1938.

A further portion of a descriptive flora of Costa Rica, two parts of which have already appeared. The families treated in the present instalment are Melastomaceae to Orobanchaceae, inclusive. Numerous new species of trees and shrubs are described.

Dendrología y gilología de Colombia. By Santiago Cortés. *Revista Acad. Colomb. Cienc.* (Bogotá) 2: 60–66; 2 colored pls.; 1938.

Notes upon Colombian plants of various families, with citation of local names and remarks upon economic uses.

Especies y variedades de las Cinchonas de la "Quinología de Bogotá." By José Triana. *Revista Acad. Colomb. Cienc.* 2: 67–103; 17 pls.; 1938.

An interpretation by Triana of the *Cinchona* species described and illustrated by the botanist Mutis in a manuscript that has remained unpublished for more than a century. Triana's account, of course, likewise has remained unpublished for many years, and the text is therefore rather ancient than modern as regards taxonomy. It is, however, of great sentimental and historic as well as taxonomic interest. The plates are beautifully executed and the drawings are excellent. —P. C. Standley.

Arboles para sombrio y forraje. By Cirro Molina Garces. *Revista Acad. Colomb. Cienc.* 2: 6: 273–278; 1938.

A full account of the Samán or Campano, *Samanea saman* (Jacq.) Merrill, with reference to its classification, origin, utilization, and the chemical composition of the seeds and pulp.

Vermischte Diagnosen. V. By H. Sleumer. *Repert. Sp. Nov.* (Berlin-Dahlem) 42: 257–267; November 25, 1937.

New species are *Psammisia caudatula* (Colombia), *P. debilis* (Colombia), *P. fallax* (Colombia), *P. multijuga* (Colombia), *Siparuna Mexiae* (Ecuador), *Chaunochiton angustifolium* (Amazonas, Brazil), *Ouratea Campos-Portoi* (Brazil), *Symplocos Bradei* (Costa Rica), *S. Herzogii* (New Guinea), *S. melanochroa* (Peru), *S. morobeensis* (German New Guinea), *S. pycnophylla* (Venezuela), *S. Stewardii* (China).

Una nueva especie colombiana del género *Eschweilera*. By ARMANDO DUGAND and HERMANO DANIEL. *Contr. Hist. Nat. Colombiana* (Barranquilla) 2: 1–2; Sept. 15, 1938.

Eschweilera antioquensis, a new species, is a tree of 10 meters from the Department of Antioquia, Colombia. The vernacular name is Coco de Mono.

Eine interessante neue *Hyospathe*-Art von Venezuela. By M. BURRET. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 137–138; March 30, 1938.

Hyospathe Pittieri is a new palm from Venezuela.

Notes on the Acanthaceae of Surinam. By C. E. B. BREMEKAMP. *Recueil Trav. Bot. Néerland.* 35: 130–176; ill.; March 1938.

Explanatory notes regarding the treatment of the family in Pulle's *Flora of Suriname*. Included is a discussion of subfamilies and tribes of Acanthaceae, and a key to Surinam genera and species based on pollen characters. A number of new species are published and there are extensive and often important notes upon nomenclature of older species.—P. C. STANDLEY.

Flora of Suriname (Netherlands Guayana). Edited by A. PULLE. Vol. 4, part 2, pp. 1–256; Amsterdam, 1938. Price f8.

The families treated in this important work are: Bignoniaceae (pp. 1–86), by N. Y. Sandwith; Compositae (87–165), by Joséphine Th. Koster; Acanthaceae (166–252), by C. E. B. Bremekamp; Plantaginaceae (253–254), and Myoporaceae (255–256), by J. Lanjouw.

Neue Arten aus Ecuador. Compiled by L. DIELS. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 25–44; March 30, 1938.

New species of woody plants by various authors are described from Ecuador in the genera *Piper*, *Coussapoa*, *Phthirusa*, *Brownea* (*B. Herthae*; local names Clavellino, Aloche, Clavelín), *Tovomita*, *Conostegia*, *Blakea*, *Miconia*, *Fuchsia*, *Vitellaria*, *Columnea*, *Alloplectus*, and *Schlegelia*.

Neue Apocynaceen aus Südamerika. VII. By FR. MARKGRAF. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 128–132; March 30, 1938.

New species from Brazil are *Aspidosperma acanthocarpum* (Amazonas; local name Carapanauba), *Galactomorpha petiolata* (Rio Negro), *Prestonia Pickelii* (Pernambuco), and *Odontadenia Duckei* (Amazonas).

Anatomia do lenho de *Ampelocera glabra* Kuhlmann. By FERNANDO R. MILANEZ. *Archivos Inst. Biol. Vegetal* (Rio de Janeiro) 3: 2: 211–215; 2 plates; August 1937.

A description of the wood of a new species of *Ampelocera*, a tree sometimes 65 feet high, with an angled or somewhat grooved trunk, occurring in Espirito Santo and Minas Geraes, where it is known as Mentira and Vareteiro da Matta Virgem. The yellowish wood is of indistinctly storied structure and the vessels contain deposits of calcium carbonate as in *Phyllostylon*.

Plantes nouvelles ou peu connues de la région Amazonienne (Xe série). By A. DUCKE. *Archivos Inst. Biol. Veg.* 4: 1: 1–64; pls. 1–5; June 1938.

Numerous new species are described from Amazonian Brazil in the genera *Couepia*, *Inga*, *Pithecolobium*, *Parkia*, *Dimorphandra*, *Tachigalia*, *Macrolobium*, *Bauhinia*, *Dicymbe*, *Recordoxylon*, *Aldina*, *Swartzia*, *Ormosia*, *Andira*, *Sacoglottis*, *Vantanea*, *Vochysia*, *Qualea*, *Erisma*, *Emmotum*, *Sloanea*, *Lueheopsis*, *Mollia*, *Ouratea*, *Carpotroche*, *Mimusops*, *Couma*, *Aspidosperma*, *Maripa*, *Crescentia*, *Schlegelia*, *Retiniphyllum*, and *Kotchubaea*. There are also many notes upon older species. Keys are given for separation of the Amazonian species of *Parkia*, *Sacoglottis*, and *Vantanea*, and the Brazilian genera of the relationship of *Bowdichia* and *Ormosia*. *Petaladenium urceoliferum* is a new genus of Leguminosae, related to *Clathrotropis* and *Ormosia*. There are especially full enumerations of the Linaceae and Vochysiaceae of Amazonia. The author considers that *Manilkara* Adans. should be reduced to synonymy under *Mimusops*. *Einsteinia* Ducke (Rubiaceae) is reduced to synonymy under *Kotchubaea*. Vernacular names are

listed as follows: Umiry, *Humiria balsamifera* Aubl., *H. floribunda* Mart.; Achuá, *Sacoglottis excelsa*, var. *glabriflora* Ducke; Uchy Pucú, Uchy, *S. Uchi* Huber; Uchy Curúa, Uchy Corôa, *S. verrucosa* Ducke; Cumatê-rana, *S. heterocarpa* Ducke; Saracura-mirá, *Ampelozizyphus amazonicus* Ducke; Maparajuba, Massaranduba, *Mimusops inundata* Ducke; Sorva da Catinga, Cumá de Catinga, *Couma catingae* Ducke; Carapanaúba, *Aspidosperma aquaticum* Ducke; Cuia Pequena do Igapó, Cuia Maracá, *Crescentia amazonica* Ducke.—P. C. STANDLEY.

Anatomia do lenho de *Aspidosperma aquaticum* Ducke. By FERNANDO R. MILANEZ. *Archivos Inst. Biol. Vegetal* 4: 1: 65–70; 3 plates; June 1938.

A description of the wood of a new species of *Aspidosperma*, a small tree, rarely 40 feet high, with a deeply sulcate trunk sometimes 12 inches in diameter, growing in swamps in the Amazonian region where it is known as Carapanaúba. Some of the vessels contain stone-cell tyloses and the ray and wood parenchyma cells in the vicinity may also be sclerosed. (For list of genera with similar tyloses see *Tropical Woods* 45: 40.)

On crystalliferous strands. By F. R. MILANEZ. *Archivos Inst. Biol. Vegetal* 4: 1: 79–85; 2 plates; June 1938.

Crystals occur in the vertical elements of dicotyledonous woods as follows: (1) In short cells composing a part, half, or all of a normal wood parenchyma strand. For these three types of strands Milanez proposes the terms merocrystalliferous, hemicrystalliferous, and holocrystalliferous, respectively. (2) In septate wood fibers, as in *Ruprechtia*. The author considers these to be of very rare occurrence and believes that a long series of crystal chambers, which together have the shape and length of a wood fiber, is really a series of individual cells composing a parenchyma strand. Since such a strand is longer than its cambial initial, as inferred from the length of vessel members and ordinary parenchyma strands, he suggests a change in the definition of wood parenchyma (No. 100 in I. A. W. A. *Glossary of terms used in describing woods;* see *Tropical Woods* 36: 8) to include these elongated forms.

Cincoenta e uma novas espécies da flora do Brasil e outras descrições e ilustrações. By F. C. HOEHNE. *Arq. Bot. Estado de São Paulo* (n.s.) 1: 1: 1–38; 45 plates, 10 of them in color; August 1938.

There are described 51 new species from various parts of Brazil. Among woody plants are species of *Mimosa*, *Bauhinia*, *Dalbergia*, *Machaerium*, *Ciccus*, *Microlicia*, *Didymopanax*, and *Symplocos*. The numerous fine plates, some reproduced in color, are worthy of special mention.

A "capansa" no Acre. By ADOLPHO DUCKE. *Archivos Inst. Pesq. Agron.* (Pernambuco, Brazil) 1: 20–22; 2 ills.; March 1938.

Euphorbia capansa is described as new from the Acre region, Amazonas, Brazil. It is a shrub that has figured in literature under the name *Bothriospora corymbosa* Hook. f. (Rubiaceae), and has the reputation of being highly poisonous.

Annaes da primeira reunião de anatomistas de madeira, realizada em Setembro de 1936, Rio de Janeiro, Brazil. *Rodriguesia* 3: 11: 305–384; 1937.

An account of eight sessions of the convention of wood anatomists in Rio de Janeiro, Sept. 21–28, 1937 (pp. 305–318), is followed by the papers (complete or in summary) which were presented:

Importance of the study of wood anatomy (pp. 319–322), by Samuel J. Record.

Identification de maderas argentinas por el examen microscopico de sus elementos (summary, pp. 323–324), by Lucas A. Tortorelli.

Los ravos infrarojos y su aplicación en la microfotografia de maderas (summary, pp. 325–326), by Lucas A. Tortorelli.

Estudo do lenho do "pau mulato" pelo método da parafina (summary, pp. 327–328), by Fernando R. Milanez.

Un methodo seguro de identificação das madeiras (pp. 329–332, five plates), by Arthur de Miranda Bastos.

Pau e não páo (pp. 333–335), by Arthur de Miranda Bastos.

As relações de estructura anatomica do lenho com as propriedades physicas e mecanicas e os usos das madeiras (pp. 337–341, four plates), by José Aranha Pereira.

Os methodos de identificação anatomica como auxiliar do commercio exportador de madeiras (pp. 343–348), by Luis Augusto de Oliveira.

O que or Brasil precisa fazer para transformar sua riqueza florestal num objecto de exportação estavel (pp. 349–356), by Antonio Reis.

Traços biographicos de Samuel James Record, Professor da Universidade de Yale (pp. 357–371), by Paulo Ferreira de Souza.

Estudio fitográfico del Rincón de Viedma (Bahía de Samborobón). By EMILIO J. RINGUELET. *Revista Fac. Agron. La Plata* (Buenos Aires) 21: 15–186; ill.; 1938.

A detailed account of the phytogeography of a region of the eastern coast of the Province of Buenos Aires, Argentina, including a systematic list of 173 species of plants. The vegetation consists chiefly of herbs and shrubs, only three small trees occurring: *Celtis tala*, *Acacia cavenia*, and *Tamarix parviflora*, the last introduced.—P. C. STANDLEY.

Las coníferas indígenas de la Republica Argentina. By GUILLERMO COVAS. *Revista de la Facultad de Agronomía* (Buenos Aires) 21: 201–223; 2 plates; 1938.

An excellent summary of the information available concerning the 10 coniferous species native to Argentina, mostly in the Patagonian region. They are of seven genera and three families, as follows: PODOCARPACEAE: *Saxegothaea conspicua* Lindl., a tree 20 m. high and 1 m. in diam., called Maniu or Mañiú; *Dacrydium Fonckii* (Phil.) Benth., a shrub about 50 cm. high. *Podocarpus andinus* Poepp., a tree rarely over 7 m., known as Lleuque; *P. nubigenus* Lindl., a large tree called Mañiú; *P. Parlatorei* Pilg., a tree 20 m. by 1.5 m., called Pino, and exploited locally for its soft, reddish timber. ARAUCARIACEAE: *Araucaria araucana* (Mol.) C. Koch (=*A. imbricata* R. & P.), a tree up to 50 m. in height, local name Pehuén, English name Monkey Puzzle; *A. angustifolia* (Bert.) O. Kuntze (=*A. brasiliana* Parl.), the Curiy or Pino, commercially the most important coniferous species in South America, being the source of Paraná Pine in southern Brazil. CUPRESSACEAE: *Fitzroya cupressoides* (Mol.) Johnston (=*F. patagonica* J. D. Hooker), a tree up to 50 m., known as Alerce (Larch). *Libocedrus chilensis* (Don) Endl., the Chilean Cedar or Ciprés, a tree usually not over 20 m. by 1.5 m., rarely up to 30 m. by 2.5 m.; *Pilgerodendron uviferum* (Don) Florin (=*Libocedrus uvifera* [Don] Pilger=*L. tetragona* [Hook.] Engl.), a tree up to 40 m., with the local names Cedro, Ciprés, Len, and Ten.

Technologia de maderas Argentinas. By LUCAS A. TORTORELLI. *Maderil* (Buenos Aires) 11: 121: 19–24; 7 figs.; July 1938.

Contains numerous suggestions for the use of certain native Argentine species in place of costly exotic timbers. Following are a few examples: As a substitute for the Venezuelan Boxwood he proposes Palo Blanco (*Calycophyllum multiflorum* Gris.), Palo Amarillo (*Phyllostylon rhamnoides* [Poiss.] Taub.) which is the same as the Baitoa of Dominican Republic, and Guatambú (*Aspidosperma olivaceum* Muell. Arg.); the three species grow in northern Salta and also in Jujuy, Chaco, Formosa, and Misiones. Closely related to Lignum-vitae (*Guaiacum*) and having similar properties and uses is the Palo Santo (*Bulnesia Sarmientii* Lor.). The Guayacán (*Caesalpinia melanocarpa* Gris.) could replace the violet Ebony (*Diospyros*) of Indo-China. In the category of Ash (*Fraxinus*) Argentina has Guayabí (*Patagonula americana* L.) and Tarco (*Jacaranda acutifolia* Humb. & Bondpl.), while the Mora Amarilla (*Chlorophora*) is as attractive as Satinwood. Instances are cited of the value of wood anatomy in distinguishing timbers which are often confused in the trade but have different properties.

Les Bambusées di Rio Grande du Sud. By JEAN DUTRA. *Revista Sudamer. Bot.* (Montevideo) 5: 145–152; 3 figs.; June 1938.

Seven species of bamboos are listed from Rio Grande do Sul, Brazil; *Chusquea tenella* Nees (local names Taquari, Putinga), *C. ramosissima* Lindm. (Cresciuma), *C. acuminata* Doell (Caará), *C. Meyeriana* Rupr. (Caará), *Bambusa riograndensis* Dutra, sp. nov. (Taquarussú, Taquara Brava), *Merostachys Burchellii* Munro (Taquara Mansa, Taquara Lixa), and *M. anomala* Dutra, sp. nov.

Observaciones fitogeográficas en la región de Tambores (Uruguay). By JORGE CHEBATAROFF. *Revista Sudamer. Bot.* 5: 159–170; 2 figs.; 1 pl.; June 1938.

An account of the vegetation of the region of Tambores, northern Uruguay, with an elevation of about 275 meters. Characteristic trees are *Lithraea molleoides*, *L. brasiliensis*, *Schinus Molle*, *S. lentiscifolius*, *Xylosma ciliatifolium*, *Banara*

umbraticola, *Quillaja brasiliensis*, *Ocotea Arechavaletae*, *Myrrhinium rubriflorum*, *Eugenia pungens*, and *Carica quercifolia*.

New or noteworthy plants from temperate South America. By Ivan M. Johnston. *Journ. Arnold Arboretum* 19: 248–263; July 1938.

New species of woody plants are described, chiefly from Chile and Argentina, in the genera *Margyricarpus*, *Adesmia*, *Porlieria*, and *Schinus*. There are also notes upon nomenclature in these and other groups.

Apocynaceae. By Robert Everard Woodson, Jr. *N. Amer. Flora* (New York) 29: 103–192; July 11, 1938.

A monographic account of the Apocynaceae of North America, including West Indies. The family is represented by 46 genera, a few of which are introduced. The principal groups of trees and shrubs are *Tabernaemontana* (13 species), *Stemmadenia* (13), *Plumeria* (6), *Himatanthus* (1), *Aspidosperma* (4), *Cameraria* (2), *Tonduzia* (3), *Strempeliopsis* (2), *Cufodontia* (3), *Plumeriopsis* (1), *Thevetia* (5), *Rauwolfia* (12), *Vallesia* (8), *Lacmellea* (1), *Zschokkea* (1), and *Couma* (1).

***Struthanthus* et *Phthirusa* envisagés comme congénériques.** By Charles Baehni and J. Francis MacBride. *Candollea* (Geneva) 7: 287–290; December 1937.

Study of the characters previously used for separating *Struthanthus* and *Phthirusa* leads to the conclusion that the latter should be reduced to synonymy, with *Dendropemon*, *Lipotactes*, *Peltomesa*, *Passowia*, and *Triarthron*. Three South American species of *Phthirusa* are transferred to *Struthanthus*.

Die Gliederung der Flacourtiaceae-Prockiinae Gilg. By Hermann Sleumer. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 45–52: March 30, 1938.

A new disposition is made of the subtribe Prockiinae of the Flacourtiaceae, with a key for separation of the genera: *Prockia*, *Hasseltia*, *Neosprucea*, *Banara*, *Hasseltiopsis*, and *Pineda*. *Hasseltia floribunda*, var. *nicaraguensis* is described from Nicaragua. *Neosprucea* is a new name for the genus *Spruceanthus* Sleumer, not Verdoorn. *Banara axilliflora* (Amazonas, Brazil) and *B. Tessmannii* (Peru) are new species. *Hasseltia costaricensis* Standl. is transferred to *Banara*. *Hasseltiopsis* is a new genus, consisting of *H. dioica* (*Hasseltia dioica* Sleumer) of Mexico and Central America, *H. leucothyrsa* (Peru), and *H. albomicans* (Colombia).—P. C. Standley.

Mechanical properties of certain tropical woods, chiefly from South America. By William Kynoch and Newell A. Norton. Bull. 7, School of Forestry & Conservation, Univ. of Michigan, Ann Arbor, 1938. Pp. 87; 6 x 9; 3 figs. Price 25c.

"This bulletin presents the results of a series of tests on the mechanical properties of nearly 40 tropical woods, chiefly South American. The tests have been under way for several years at the University of Michigan in coöperation with the Tropical Plant Research Foundation and the Wood Industries Division of the American Society of Mechanical Engineers. For most of the species these are the first tests of the kind ever to be made. While the data are not sufficiently comprehensive to be conclusive, they are of moment as giving the first scientific basis for judging the probable value of these particular tropical woods for industrial use, and as pointing to further investigations which should be made."

"The timbers herein dealt with are, for the most part, among the better-known woods of their respective countries of origin. Following a general survey in various parts of tropical America by foresters of the Tropical Plant Research Foundation, arrangements were made for the collection of the material for testing by responsible and properly qualified agencies or persons. The timbers from Brazil and from British Guiana were collected by the government forest authority in each country. With regard to the Venezuelan consignment, decision as to the woods to be included was based on a field study by the forester of the Foundation in coöperation with the authorities of the state of Yaracuy. Collection was carried out under the supervision of an official of the state, who included four additional timbers in the selection. The material of Cativo, Iroko, Mahogany, and the Philippine woods was

furnished by industrial concerns. The logs from British Guiana were accompanied by herbarium material, which was submitted to the New York Botanical Garden for identification. Each log collected was carefully numbered at the time of cutting. After arrival in the United States a sample from each was submitted to Professor Samuel J. Record, Yale University, who checked the identity of the specimen so far as is possible from study of the gross and anatomical characteristics of the wood."

Identification of Corean woods. By NOBORU YAMABAYASHI. (In Japanese.) Bull. 27, Forest Exp. Station, Keijo, Japan, 1938. Pp. 484; 7½ x 10½; 60 plates showing 372 photomicrographs, 3 plates with 111 drawings.

Though this publication was designed for Japanese students, the wealth of excellent illustrations with captions in English makes it highly useful to all wood anatomists, as almost every type of structural variation is shown. At the end is a Japanese rendition of the *Glossary* adopted by the International Association of Wood Anatomists, making the eleventh language in which it has appeared, the others being English, French, German, Dutch, Swedish, Portuguese, Spanish, Russian, Georgian, and Chinese.

The Myrtaceae of China. By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* 19: 191–247; July 1938.

The Myrtaceae of China are referable to 12 genera, some of which are represented only by cultivated plants. The largest genus is *Syzygium*, with 45 species, several of which are described as new.

Monographie der Gattung *Hydnocarpus* Gaertner nebst Beschreibung und Anatomie der Früchte und Samen ihrer pharmakognostisch wichtigen Arten (Chaulmugra). By HERMANN SLEUMER. *Bot. Jahrb.* (Stuttgart) 69: 1–94; 4 pls.; July 8, 1938.

A monograph of the genus *Hydnocarpus* (Flacourtiaceae), economically important as a source of chaulmoogra oil, employed in the treatment of leprosy. There are recognized 43 species, a number of which are described as new. An extensive bibliography is included.

A new *Eugenia* from Assam. By KALIPADA BISWAS. *Kew Bulletin* (London) 262–264; ill.; 1938.

Eugenia assamica is described as new.

Irosin *Schefflera*. By A. D. E. ELMER. *Leafl. Philip. Bot.* (Manila) 10: 3637–3648; May 28, 1938.

Four new species of *Schefflera* are described (without Latin diagnoses) from Luzon, Philippine Islands, and notes are published upon older species. It is impossible to condemn too strongly the author's practice of citing his own unpublished names, thus burdening synonymy in this paper with five useless synonyms, which commemorate nothing more than their author's errors.—P. C. STANDLEY.

New or noteworthy trees from Micronesia. XX. By RYÔZÔ KANEHIRA. *Bot. Mag.* (Tokyo) 52: 235–241; figs. 69–72; May 1938.

Trees reported from Micronesia are *Pandanus dubius* Spreng., *P. tetrodon* (Gaud.) Balf. f., *Embelia palauensis* Mez, *Premna integrifolia* L., *Vitipremna novae-pommeraniae* (Warb.) Lam, *Melastoma polyanthum* Blume, *Finschia micronesica* Kaneh., comb. nov. (=*Helicia micronesica* Kaneh.).

Miscellaneous notes on Loranthaceae. 16–18. By B. H. DANSER. *Blumea* (Leiden) 3: 34–59; May 2, 1938.

New species from eastern New Guinea are described in the genera *Amylotheca*, *Amyema*, *Sogerianthe*, *Korthalsella*, and *Notothixos*. There are also many notes, nomenclatorial or systematic, upon previously published species.

Two new Lecythidaceae and two new Apocynaceae from Malaysia. By W. J. LÜTJEHARMS and S. J. VAN OOSTSTROOM. *Blumea* 3: 95–105; 2 figs.; May 2, 1938.

New species from Sumatra or Amboina are *Barringtonia flagellata*, *B. confusa*, *Tabernaemontana inaequalifolia*, and *T. carinata*. There are also extensive notes on some older species.

A new species of *Ixora* from Enggano (Sumatra). By C. E. B. BREMEKAMP. *Blumea* 3: 106–107; May 2, 1938.

Ixora engganensis is a new species from Sumatra.

Haplolobus celebicus, nov. spec. (Burseraceae). By H. J. LAM. *Blumea* 3: 111–113; ill.; May 2, 1938.

Description of a new tree from Celebes.

Studies in phylogeny. On the phylogeny of the Malaysian Burseraceae-Canarieae in general and of _Haplolobus_ in particular. By H. J. LAM. *Blumea* 3: 126–158; May 2, 1938.

The Burseraceae comprise three tribes which show an increasing differentiation from west to east, and have their centers of distribution in America (Protieae), Africa (Bursereae), and Asia to Australia-Polynesia (Canarieae). An eastward migration of the family is probable. The easternmost tribe comprises five genera, *Scutinanthe*, *Canarium*, *Santiria*, *Dacryodes*, and *Haplolobus*. The tribe is discussed from the standpoint of probable migration, based upon geological and general evidence.—P. C. STANDLEY.

The genus _Myoporum_ in the Netherlands Indies. By S. BLOEMBERGEN. *Blumea* 3: 179–182; May 2, 1938.

Myoporum is represented in the region indicated by a single species, *M. papuanum* Kränzl., known only from northern New Guinea.

Revision of the Sarcospermataceae. By H. J. LAM and W. W. VAROSSIEAU. *Blumea* 3: 183–200; May 2, 1938.

The genus *Sacrosperma* Hook. f., including the synonyms *Bracea* King and *Apoia* Merrill, has been placed in the Sapotaceae, but has been shown previously by the senior author to constitute a distinct family. The family and single genus consist of six species, distributed in Sikkim, Assam, Upper Burma, Siam, southwestern China, Sumatra, and at various places in Malaysia.—P. C. STANDLEY.

Notes on Malayan Dipterocarpaceae. IV. By C. F. SYMINGTON. *Gard. Bull. Straits Settlements* (Singapore) 9: 319–354; pls. 17–27; March 31, 1938.

New names and species are published in the genera *Dipterocarpus*, *Hopea*, *Shorea*, *Parashorea*, and *Vatica*, and there are extensive notes regarding older species of these and other genera.

Additions to the flora of Borneo and other Malay islands. VI, VII, VIII. By H. N. RIDLEY. *Kew Bulletin* 110–123, 173–176; 1938.

New species are described in the genera *Adinandra*, *Calophyllum*, *Casearia*, *Garcinia*, *Homalium*, *Kayea*, *Merremea*, *Ternstroemia*, and *Xanthophyllum*. Notes regarding older species include new species records for the region covered.

Additions to the flora of Borneo and other Malay islands. IX. By H. N. RIDLEY. *Kew Bulletin* 221–242; 1938.

New species are described by various authors in the genera *Durio*, *Sterculia*, *Tarrietia*, *Buettneria*, *Brownlowia*, *Pentace*, *Microcos*, *Elaeocarpus*, *Dichapetalum*, *Kurrimia*, *Solenospermum*, *Kokoona*, *Salacia*, and *Hippocratea*.

Elaeocarpaceae novae. Decades 1–2. By R. KNUTH. *Repert Sp. Nov.* (Berlin-Dahlem) 44: 124–132; June 30, 1938.

Twenty new species of *Elaeocarpus* are described from Borneo.

Malayan timbers and timber problems. By H. E. DESCH. *Malayan Forester* 7: 2: 47–61; 4 plates; April 1938.

An interesting popular account of the principal Malayan timbers and the problems involved in their utilization.

Regeneration of Klang mangroves. By F. S. WALKER. *Malayan Forester* 7: 2: 71–76; 2 plates; April 1938.

After 17 years' experience with different silvicultural systems in the Mangrove forests of Klang, the best results appear to be obtained by the shelterwood system with clear felling and planting of blanks. The choice of species and planting methods are discussed.

Timber tests: Punah (_Tetramerista glabra_ Miq.) By A. V. THOMAS. *Malayan Forester* 7: 3: 137–141; July 1938.

"This species has been reported from Malaya, Borneo, Sumatra, and adjacent islands. It is a typical member of coastal Dipterocarp swamp forests and, in the Peninsula, is most abundant along the west coast where there are some-

times as many as two or three trees of commercial size per acre. It is quite commonly sawn in the mills in Singapore, supplies being obtained from neighboring islands of the Netherland Indies. The vernacular Malay name Punah is used in Malaya and the Netherland Indies, but the Chinese sometimes refer to it as Sha Lei."

"Punah dries fairly rapidly but needs care in seasoning to avoid splits and cupping. The tendency to splitting makes it a somewhat unsuitable wood for box-making, although nails hold well. It is not an easy wood to polish. It is, however, easy to work and it is usually remarkably free from defects, including sponginess. Previous tests have shown that it is not particularly durable in contact with the ground, owing to its susceptibility to termite attack, but it seems to be quite resistant to fungi and there is considerable evidence to indicate that it is immune to attack by boring beetles. It would seem to be a very suitable wood for rafters, purlins, ceilings, flooring, and all general building construction not in contact with the ground."

Two Queensland Ixoras. By F. Raymond Fosberg. *Journ. Bot.* (London) 76: 233–237; August 1938.

Ixora queenslandica and *I. biflora* are described as new.

Brittle heart and its relation to compression failures. By H. E. Dadswell and I. Langlands. *Empire Forestry Journal* 17: 1: 58–65; 1 plate; 1938.

"Brittle heart has been defined as that central portion of the tree which is extremely brittle and of comparatively low strength. Two distinct forms or stages are apparent: the obviously decayed central portion of over-mature trees, and an area of brittle wood in the center of the tree often very difficult to distinguish from neighboring tough wood and which may or may not be accompanied by visible rot. From the point of view of the efficient utilization of the timber, the second form is the more serious since it occurs more frequently and is usually difficult to detect. In many cases there is no obvious decayed central portion and no apparent indication of the presence of brittle wood."

"These tests showed that the brittleness of timber could be divided into two main categories, that associated with broken fibres, and that not associated with broken fibres. The indications were that this second type of brittleness was due to low density, to cell arrangement, or to the inherent properties of the wood, but apparently was not related to position within the tree. On the other hand, brittleness accompanied by broken fibres was only found in the wood from near the center or from the inside of the tree, and this brittle wood was always surrounded by distinctly tougher wood from which no broken fibres were isolated. Brittleness associated with broken fibres has therefore been considered synonymous with brittle heart, and broken fibres may be taken as an indication of brittle wood. Necessarily there are degrees of brittleness, and broken fibres are often found in small quantity, but when more than 10 per cent of the fibres present are definitely broken the wood from which the material for maceration was obtained may be considered to be brittle."

"Bienfait has suggested that minute compression failures are the first stage in the formation of gross compression failures. . . . Certainly minute failures have been observed in close proximity to gross failures, but no merging of minute into gross has been observed. Whereas the minute failure is a failure in the cell wall itself, that is, an actual failure of the layers of the wall, the gross failure is more in the nature of a buckling or crumpling of a large number of fibres. . . . From the evidence available the most satisfactory explanation for the various properties of brittle heart and consequently minute compression failures appears to be incipient decay. This would account for the abnormal distribution of the brittle wood, the gradual extension of brittleness with age, and the observed variation in physical and mechanical properties. While admitting the validity of the arguments brought forward by Rendle against such a suggestion, there is not at the present time a more satisfactory alternative. Work on the decay side of the problem is being carried out by the preservation section of this Division and results will be published in due course. It is conceivable, however, that the presence of heart rot or incipient decay in the center of the tree is a

secondary effect and not the primary cause of the brittleness and the minute compression failures."

Forest policy in South Africa. By J. H. Van Wyk. *Empire Forestry Journal* 17: 1: 44–50; 2 plates; 1938.

The bases of the present forest policy are: "The natural forest resources of the Union of South Africa are altogether insufficient for the country's timber requirements. The supplies of timber from external sources are not always assured in times of emergency. Afforestation to increase the productiveness of large areas of land, including drift sands, which otherwise would remain little more than waste land. Development and utilization of forests to provide employment in valuable local industries. The protection of forest resources and natural flora of the country as well as water supplies."

Die Flora des Namalandes. XIII. By Paul Range. *Repert. Sp. Nov.* (Berlin-Dahlem) 44: 101–114; June 30, 1938.

A statistical study of the composition and relationship of the flora of Namaland. This consists of 1646 species, including 16 Pteridophyta, 1 Gymnospermae, 284 Monocotyledoneae, 735 Dicotyledoneae-Archichlamydeae, and 610 Dicotyledoneae-Metachlamydeae. The largest families are Compositae (239 species), Aizoaceae (142), Leguminosae (95), Scrophulariaceae (89), Asclepiadaceae (78), Gramineae (125), Liliaceae (94). Trees are poorly represented, the most common ones being *Acacia horrida* and *A. giraffae*. The paper includes a list of collectors in the region, and an index of localities.—P. C. Standley.

African pencil cedar. Studies of the properties of *Juniperus procera* Hochst. with particular reference to the adaptation of the timber to the requirements of the pencil trade. For. Prod. Res. Record 24, Dept. Sci. & Ind. Research, 1938. Pp. 9; 6 x 9¾; 3 figs. Price 20 cents, British Library of Information, 270 Madison Ave., N. Y.

"It is some years since the wood of the African Pencil Cedar (*Juniperus procera* Hochst.) was introduced to supplement the diminishing stocks of the American Pencil Cedar (*J. virginiana* L.). Botanical relationship and structural similarity of the woods indicated that the former timber should give an equally good pencil product as the latter, but in practice it was found that the public considered that the African wood did not whittle as easily as the American and that in manufacture it exhibited more warp than the latter."

This publication summarizes the results of tests on softening the wood by steaming and by impregnating with an emulsion of rapeseed oil, and on reducing the loss from warp by culling unsuitable stock and controlling the drying of the remainder.

The vegetation of Rhodesian Manicaland. By H. B. Gilliland. *Journ. S. Afr. Bot.* (Cape Town) 4: 73–99; pls. 12–35; July 1938.

A detailed description of the vegetation of the Manicaland area of Rhodesia, with chapters upon the inhabitants, geology, topography, drainage, and climate. The vegetation zones recognized are the muPfuti, at 2000–3500 ft., characterized by *Brachystegia* sp.; muTsatsa, at 3500–5000 ft.; and the mountain, above 4500 ft. The excellent illustrations give a good idea of the general features of the vegetation.—P. C. Standley.

Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. XIII. By J. Mildbraed. *Notizbl. Bot. Gart. Berlin-Dahlem* 14: 94–117; March 30, 1938.

New species of ligneous plants from Tanganyika are described by various authors in the genera *Vepris*, *Combretum*, *Syzygium*, and *Mimusops*.

Notes from the British Museum herbarium. By E. G. Baker. *Journ. Bot.* (London) 76: 237–238; August 1938.

New woody plants are *Albizzia Eggelingii*, from Oubangui-Chari; *Erythrina Eggelingii*, Uganda; *E. caffra*, var. *mossambicensis*, Portuguese East Africa.

The African Lauraceae. I. By A. G. H. Kostermans. *Bull. Jard. Bot. Bruxelles* 15: 73–108; pls. 5–9; June 1938.

The African Lauraceae are treated monographically in

great detail, with full citation of synonymy, vernacular names, complete descriptions, keys to species, etc. The genera discussed in the present paper are *Ocotea* (4 species), *Hypodaphnis* (1), and *Cryptocarya* (6).

Gold Coast timbers. Published in connection with the Gold Coast exhibit at the Empire Exhibition at Glasgow, Scotland, 1938. Pp. 27; 7 x 10; 11 colored plates, 1 map.

The timbers described and illustrated in natural color are: Avodire (*Turraeanthus* sp.), Dahoma (*Piptadenia africana*), Danta (*Cistanthera papaverifera*), Denya (*Cyclodiscus gabunensis*), Guarea (*Guarea* sp.), Idigbo (*Terminalia ivorensis*), Makore (*Mimusops Heckelii*), Mansonia (*Mansonia altissima*), Obeche (*Triplochiton scleroxylon*), Opepe (*Sarcocephalus Diderrichii*), and Sapele (*Entandrophragma cylindricum*).

Following are extracts from the introduction. "The general development of a country such as the Gold Coast implies the replacement of forest by farm, and this is proceeding; it is expected, however, that the situation will become stable in the near future with a permanently protected forest area of approximately 7000 square miles. . . . Unlike the forests of the temperate climates, which may be composed of only a few species, those of the Gold Coast contain 300 or more wood-producing species in mixture. Trees of individual species, therefore, are often widely scattered, and a comparatively large area produces only a few of any particular kind. . . . Despite the limitations which have been mentioned, considerable quantities are exploitable, and it has been estimated that there is an annual exportable surplus of five million cubic feet of merchantable timber of all kinds in the Gold Coast. Stabilization is expected to occur at about the three million cubic foot mark. The annual export of Mahogany alone approaches a figure of one million cubic feet."

Connaraceae. By Gustav Schellenberg. *Pflanzenreich* (Leipzig) 4: 127: 1–326; ill.; May 31, 1938.

A detailed systematic account of the Connaraceae of the world. The family is divided into two subfamilies, and one of the subfamilies into five tribes. Twenty-four genera are recognized, the largest being *Connarus*, with 121 species. *Santaloidella* is a new monotypic genus from Congo. A special index at the end of the volume lists the numerous vernacular names.

The classification of tropical woody vegetation-types. By J. Burtt Davy. Imperial Forestry Institute Paper No. 13, Oxford, 1938. Pp. v+86, mimeographed. Price 2s. 6p.

"This paper is based on one presented to the annual general meeting of the British Ecological Society, held at Cambridge on January 6th, 1938, for the purpose of obtaining a discussion on the nomenclature of *mature* or *apparently stable* vegetation communities in the tropics. At that meeting the Society agreed to refer the matter to its Council for the appointment of a committee to consider and report upon the stabilization of names and terms; such committee has since been appointed.

"To obtain a correct understanding of the types of vegetation, much more information is required as to the climatic and edaphic factors controlling each of the plant formations occurring in tropical countries, and the floristic composition of their several associations. The field observations of forest officers on the characteristic features of the vegetation communities in the areas under their control would be helpful in delimiting such communities and deciding what nomenclature to apply to them.

"With the object of eliciting such information and making it available for consideration by the committee, the original paper has been re-written, and its scope enlarged. . . . After pointing out the need for fuller descriptions, more precise definitions, and greater uniformity in the nomenclature of tropical forest communities, and discussing the classifications adopted by Schimper, Warming, Chipp, and Champion, suggestions are offered for consideration, in an effort to standardize the names of certain apparently mature and integrated tropical vegetation communities. The synonymy has been correlated as far as circumstances have permitted."

The morphology of the flowers of the Juglandaceae. I. The inflorescence. By Wayne E. Manning. *Amer. Journ. Bot.* 26: 407–419; ill.; June 1938.

A study of the morphology of the flowers of Juglandaceae,

with a proposed possible evolutionary series. Six genera are recognized: *Platycarpa*, *Engelhardtia* (including *Oreomunnea*), *Alfaroa*, *Pterocarya*, *Juglans* (including *Wallia*), and *Carya*, all of which are illustrated.

Über den Anteil von Fasern, Gefässen, und Parenchym am Aufbau verschiedener Hölzer. By Bruno Huber and Gerhard Prütz. *Holz als Rob- und Werkstoff* (Berlin) 1: 377–381; 6 figs.; July 1938.

The various tissues of wood (fibers, rays, vessels, parenchyma) were measured with the aid of an integrating device, "Sigma" (Feuss, Berlin), principally on cross sections along 4 to 6 diagonal lines making an angle of from 45° to 60° with the annual rings. From the values so obtained the volumes occupied by the different tissues were calculated. Coniferous woods have fiber volumes of over 90 per cent and ray volumes of under 10 per cent. In hardwoods the fiber volume varies between 28 per cent and 75 per cent, and the combined volume of ray and wood parenchyma tissue ranges from 10 and 63 per cent, being particularly high in many tropical woods. The vessel volume of many tropical woods is below 10 per cent, whereas in middle European hardwoods it is between 15 and 30 per cent. The physiological significance of the high parenchyma content and low vessel volume of tropical woods remains unknown. The theoretical and practical significance of these values to papermaking qualities and to strength are discussed with particular reference to variation between species and between temperate and tropical woods.—Arthur Koehler.

Commercial mahoganies and allied timbers. By B. J. Rendle. For. Prod. Res. Bull. 18, Dept. Sci. & Ind. Research, 1938. Pp. vi + 46; 6 x 9¾; 10 plates, 1 map. Price 65 cents, British Library of Information, 270 Madison Ave., New York.

"The aim of this publication is to answer some of the inquiries concerning Mahogany and allied timbers which have been addressed to the Forest Products Research Laboratory from various quarters of the timber-using industry. An attempt has been made to summarize in a convenient form such information as will be useful to timber-importers, merchants, architects, and manufacturers and users of timber."

"In considering what species may properly be included under the general heading of Commercial Mahoganies it has been decided to err on the generous side and admit a number of timbers which are not generally known as Mahogany but which are nevertheless included in the same commercial class. The main emphasis is on the timbers of this class which are of present importance to the United Kingdom market, or which are likely to be so in the near future. As the timbers of the Mahogany family, Meliaceae, have special claim to be considered, some of these have been included even though they are not usually classed as commercial Mahoganies. In addition, and to increase the usefulness of the book, reference has been made to certain other timbers which are liable to be confused with or are commonly substituted for genuine Mahogany. Of course, there are several other inferior woods which may be sold as flagrant imitations of Mahogany in cheap manufactured articles, but consideration has been confined to timbers which may reasonably be included in the Mahogany class on the ground of either botanical relationship, quality or custom of the trade.

"In the following pages the term 'true Mahogany' refers to the product of *Swietenia*, the original Mahogany of the West Indies and Central America, as distinct from those timbers of the same botanical family which are commonly known by the name of Mahogany suitably qualified to indicate the country of origin. The mention of other timbers under the name of Mahogany of one kind or another does not necessarily imply that they are all fairly entitled to those names; but for purposes of reference it is necessary to record them, together with other trade names in general use."

Timbers of the empire. *Wood* (London) 3: 5; May 1938.

The May issue of that most attractive magazine, *Wood*, is dedicated to the timbers of the British Empire, the occasion being the Empire Exhibition at Glasgow, Scotland. There is a supplement on Nigerian timbers, with five woods shown in natural color and six others described; also a forest map and a

short article by J. R. Ainslie, Chief Conservator of Forests. Richard Waite (pp. 236–242) summarizes the characteristics of the principal softwood and hardwood timbers of the Empire; there are excellent pictures of many of them, also a map indicating their source, and a large data sheet giving common and scientific names, origin, sizes available, weight, color, strength values, uses, and comparative workability. Other copiously illustrated articles are "Extraction and transport" (pp. 243–246); "Wood at the Empire Exhibition, Glasgow" (pp. 247–254); "Home-grown timbers" (pp. 255–259); "In the woods of eastern Canada" (pp. 261–263); and short accounts of the timber resources and development in Australia, Canada, India, Burma, New Zealand, and South Africa (pp. 267–275).

Forest bibliography to 31st December 1933. Part III. C. Forest Protection. Compiled and published by the Dept. of Forestry, Univ. of Oxford, 1938. Pp. 200–247; 7¼ x 9¾. Price 12s. 6d.

The first two parts of this valuable bibliography were published in 1936 and 1937, respectively (see *Tropical Woods* 53: 64). The references to forest protection in Part III are listed under the following headings: 1. Man—demarcation, offences. 2. Animals, including bird and game preservation. 3. Atmospheric influences—frost, insolation, wind, hail, snow, etc. 4. Fire. 5. Weeds, including phanerogamous parasites, climbers, etc. 6. Other agencies—floods, swamps, shifting sands, avalanches, landslips, reclamation works, drainage, chemical fumes, shelter belts, shade trees, etc. 7. Fencing, including hedges.

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