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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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THE WOOD OF *SYMPHONIA GLOBULIFERA*

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Symphonia globulifera L. f. is a forest tree of wide distribution in tropical America and tropical West Africa. It is best known in the New World, where it is found throughout Central America, parts of the West Indies, and northern South America. In most of its American range it attains commercial proportions and is regarded as an important secondary timber. Its utilization is hampered, however, by the fact that in the more accessible forests it is of scattered occurrence, while the localities of greatest abundance are usually swampy or otherwise unfavorable for logging operations.

The timber is used locally for a variety of purposes, but its export trade is undeveloped and there are only occasional

shipments of the logs to Europe and the United States, mostly from French Guiana and British Honduras. There is growing interest in the wood, however, and its numerous desirable properties, which compare favorably with Oak in many respects, warrant the attention of the timber industry.

Common Names

Tropical America.—Brazil: Anani or Anany, Gouandim or Gulandim, Mani or Manni, Oanani or Ounany, Peramán, Uanani. British Guiana: Buck-wax Tree, Kirimanni, Mani or Manni, Manniballi or Manni-balli. British Honduras: Chewstick, Corbán, Leche Amarilla, Mountain Cow, Waika Chewstick or Waika, Whykee, Wycot. Colombia: Machare. Costa Rica: Cerillo, Sambogum or Sambo Gum. Dutch Guiana: Mannie or Manie, Matagrie, Matakkie, Matatji, Tapoekin-mani. French Guiana: Bois Cochon, Mani or Manni, Manil, Moronobo or Moronoba, Parcouri-manil. Guatemala: Barillo, Leche Amarilla, Pimientillo, Varillo. Honduras: Barillo, Leche Amarilla, Varillo. Nicaragua: Leche Amarilla. Panama: Barillo, Bogum, Cerillo, Cero, Sambogum or Sambo Gum. Peru: Brea Caspi. Venezuela: Mani or Manni, Paramán or Peramán, Peramancillo. West Indies: Boar Wood, Bois Cochon, Doctor Gum, Hog Gum, Mawna, Palétuvier Jaune (Guadeloupe), Yellow Mangue (Trinidad).

Tropical West Africa.—General: Arguane, Doctor Gum, Gamboge, Hog Gum, Karamanni, Numgundo. Belgian Congo: Beta, Bolaka, Bolongo, Bulungu, Dibolongo, Kisonghia, Mangu-mangu, Mbela, Usempe, Usonghia.

Botanical Relationships

Symphonia globulifera L. f. (syn. *Moronobea coccinea* Aubl., *M. esculenta* Arruda) is one of the Guttiferae, a relatively large family of pantropical distribution and comprising about 40 genera and well over 1000 species of trees and shrubs, some of which produce edible fruits, others yield medicinal or industrial oils and resins, and a few are important for their timber. Among the better known members of the family are the Alexandrian Laurel of India or Palo María of the Philippines (*Calophyllum Inophyllum* L.), the Poon of India (*C. tomentosum* Wight), the Santa María of tropical America (*Calophyllum brasiliense* Camb.), the Butter Tree of West Africa (*Pentadesma butyracea* Sabine), the Gamboge Tree of Siam (*Garcinia Hanburyi* Hook. f.), the Bitter Kola of West Africa (*G. kola* Heckel), and two species that are cultivated throughout the tropics for their succulent fruits, namely, the Mammee Apple (*Mammea americana* L.) and the Mangosteen (*Garcinia mangostana* L.). The genus *Symphonia*, as now understood, is primarily an Old World group, and of the 18 known species 16 are indigenous to Madagascar and two, *S. gabonensis* Pierre and *S. globulifera*, occur in tropical West Africa.

The Tree

Symphonia globulifera is said to be of very limited occurrence in Guatemala (*19*), but somewhat more abundant in Honduras, where it is reported as frequent in the forests and wooded swamps (*21*). It is rather common in the forests of British Honduras (*23*), occurring in the intermediate forest type of the primary rain forest, in mixture with a large number of other species (*24*); the timber test specimens used in this study were collected from trees growing in the Stann Creek Valley, in the riverain Cohune bush on the flat, swampy, alluvial lands, and also in the primary advanced forest, where they were found on the foot hills at riverside, in mixture with Cohune and Monkey-tail Palms. In Panama, Cooper (*7*) reports the occurrence of the species in the Changuinola region of the Province of Bocas del Toro, which is typical of the banana area; there it was found in mixture with a large number of other species in the more or less marginal land (not good enough for bananas, but not swampy) and also scattered throughout the "cattival," so called because Cativo (*Prioria Copaifera* Gris.) makes up more than 75 per cent of the stand. The species grows in the rain forests of Venezuela, in the delta of the Orinoco River and in the region adjoining British Guiana, being one of the most common trees in the mixed hardwood and palm type (*8*). In the North West District of British Guiana scattered trees are found in the

swamps, which are characterized by the predominance of the Truli Palm (*28*, 1929). In French Guiana the tree grows scatteringly through the forest, except in the marshy regions where it sometimes forms almost pure stands (*10*); Benoist (*4*) reports that it is frequently abundant on river banks subject to daily inundation, and that in such situations the roots develop pneumatophores. There is little information available as to the habitat of the tree in Africa, but its range extends from French Guinea through Liberia, Ivory Coast, Gold Coast, and Nigeria to the Cameroons and the French Congo.

Symphonia globulifera usually does not grow more than 100 feet tall, though a maximum height of approximately 135 feet has been reported from French Guiana (*1*) and Panama (*20*). The trunks of mature trees attain a diameter of 20 to 30 inches, or in extreme cases of as much as 4 feet (*20*), and are long and straight, with gradual taper and little buttressing. The largest trees are likely to be hollow.

The bark has a thickness of 1 cm. or more; its surface varies in color from light gray to yellowish gray or light brown, and is rough, with vertical fissures breaking it up into small plates; the interior is brownish, fibrous, and adherent. It exudes a yellowish, resinous latex, which becomes black and of a waxy consistency when exposed to air and light.

The leaves are opposite and short-petioled, without stipules, oblong or lanceolate, obtuse or acute at the base, acuminate, thick, and glabrous, with numerous veins; 6–11 cm. long, 2–4 cm. wide. The flowers are globose and red, and are borne in umbelliferous groups on the short lateral twigs; pedicels 1.5–2 cm. long; with 5 sepals, as many petals, and numerous stamens which are united by their filaments in a tube swollen at the base. The fruit is an ovoid berry, fleshy and edible.

Description of the Wood

Sapwood 3–4 cm. or more in width in large trees; sharply defined; whitish, often with definite yellow to gray tinge. Heartwood grayish brown to yellowish or greenish brown, in occasional specimens marked with rather indefinite darker streaks; two distinct variations of wood are recognized in

French Guiana, namely, the gray, which is said to be produced by trees grown in the swamps, and the yellow, obtained from trees in the dry forest on the mountain slopes (*1*). Luster variable, pronounced in some specimens in proper light. Odor and taste not distinctive.

Wood rather hard and heavy; weight, air dry (based upon 20 test specimens from British Honduras), 40–48 lbs. per cu. ft. (See Table II for specific gravity values.) Grain mostly straight, although definitely interlocked in some specimens. Texture rather coarse.

Gross Anatomy

Growth rings absent or poorly defined, in some specimens indicated by unusual regularity of parenchyma lines or occurrence of relatively wide bands of wood fibers. *Parenchyma* abundantly developed and generally distinct, sometimes conspicuous, to unaided eye on cross section; commonly appearing in numerous concentric lines or bands, often wavy and confluent, which invariably contact the pores and at times (wider bands) completely envelop them; in some specimens more definitely aliform to confluent paratracheal, tending to form discontinuous and at times very irregular tangential bands; generally inconspicuous on longitudinal surfaces because of lack of color contrast with background. *Pores* rather few in number and regularly distributed throughout ground mass; variable from indiscernible or at limit of vision to fairly distinct, in the latter case appearing to unaided eye as fine pinholes; predominantly solitary, but occasionally to rather frequently in radial groups of 2 or 3, rarely more; generally completely closed with tyloses in heartwood. *Vessel lines* fine to commonly rather coarse; wider lines usually distinct to unaided eye, owing to more or less definite color contrast with background, or in some cases to definite luster of tyloses; bright yellow to greenish yellow deposits occasionally noted in vessels of some specimens. *Rays* variable from barely discernible to distinct to unaided eye (mostly fairly distinct) on cross section, numerous, commonly contacting pores on one side and frequently on both; generally not very distinct even with lens on tangential surface; variable from somewhat

lighter to decidedly darker than background on radial surface and usually distinct, producing fairly definite "silver grain" in heartwood.

MINUTE ANATOMY

Vessels: Pores few to moderately few[1] (2–10 per sq. mm. on transverse section). Very small to moderate-sized in tangential diameter in most specimens (predominantly small, within range of 50–100 μ); in some cases commonly rather large to large (frequently within limits of 275–400 μ). Vessel walls rather thin (up to 4–7 μ). Vessel members short to very long; end walls horizontal to moderately oblique; overlapping tips occasional to common, short to very short. Perforation plates exclusively simple. Intervascular pitting usually definitely alternate; pits of medium size, numerous and often crowded; borders generally rounded or more or less polygonal from crowding, and apertures narrow lenticular or somewhat oval, mostly horizontal, and included; more or less horizontally elongated pit borders, with extended, slit-like apertures, are of sporadic occurrence in some specimens. Heartwood vessels partially to completely closed by thin-walled, irregular tyloses; yellowish deposits present in small amounts in occasional specimens.

Wood Fibers: As seen on transverse section, fibers constitute from about half to decidedly more than half the ground mass, depending upon extent to which concentric bands of wood parenchyma are developed. Individual cells irregular in outline and usually in arrangement. Walls generally thick to very thick; mucilaginous fibers occasional to common in most specimens. Fiber pits simple and fairly distinct on all sections; moderately to rather abundantly developed in both radial and tangential walls; slit-like and usually vertically inclined in face view. As seen in macerated material, fibers range from very short to very long (mostly long); rather uniform in outline, with slightly enlarged median portions and gradually tapering, sharp-pointed ends.

Wood Parenchyma: Tangential bands variable in spacing

[1] The class designations applied to the abundance and size of the elements described in this section are those proposed by Chattaway (6).

and width in different specimens and to some extent in same sample (transverse section); moderately numerous (0–3 per mm. of radial width) to very numerous (5–8 per mm.); narrow (1–5, mostly 2–4, cells) to relatively wide (2–10, mostly 4–6 or 8, cells). Paratracheal parenchyma also sparingly developed on portions of pores and pore groups not included in tangential bands, occurring as isolated cells or at times forming broken sheaths, 1–3 cells wide. Diffuse parenchyma rather infrequent in bands of wood fibers. As seen on tangential section, parenchyma strands are chiefly 2–6, very predominantly 4, cells long (mostly 2 cells in one specimen). Individual cells occasionally to frequently subdivided into 2–8, mostly 4, chambers; small crystals rare to common in heartwood. Pitting between adjacent parenchyma cells sparsely developed in tangential walls; radial walls often somewhat disjunctive, with pits frequently to commonly arranged in more or less definite small groups of 2 to several (up to 5 or 6); similar group pitting also noted at times between wood parenchyma and ray parenchyma cells.

Rays: Moderately to very numerous (5–13 per mm. of width, on tangential section). Variable from extremely fine to moderately broad, or broad in occasional specimens; 3 or 4 cells wide in most cases, but in some samples predominantly to almost exclusively uniseriate and in others chiefly 4–6 or 7 cells wide. Extremely low to rather low (predominantly low), ranging from 1 cell to maximums of 40–92 cells high. Biseriate and wider rays seldom to commonly with uniseriate tips, predominantly short (not over 10 cells in length) in most cases; rarely to rather frequently fused vertically. Variable from predominantly homogeneous in some specimens to definitely heterogeneous in others; in great majority of cases transitional from homogeneous to weakly heterogeneous. In most samples marginal cells are frequently inclined to squarish, or at times slightly higher than wide, and interior cells are low and rather definitely elongated radially; in specimens with distinctly heterogeneous rays, one to several marginal rows of moderately upright cells flank the short and often squarish interior cells. Vessel-ray pit-pairs definitely half-bordered, generally rather small and somewhat variable and irregular

in outline; apertures of two general types, (1) narrow lenticular or somewhat oval, horizontally inclined, and definitely included (rather similar to intervascular pitting), and (2) relatively wide and irregular and more or less conforming to outline of border (both general types of pit apertures may be found in same specimen and even in same ray); in some specimens, pit borders are occasionally somewhat elongated and at times tending to scalariform arrangement; apertures conform to outline of border or are widely lenticular. Rays generally devoid of contents, except for rare occurrence of crystals, or small deposits of gum, noted in a few samples.

Material: Yale Nos. 2725 (C. R.); 2971 (Pan.); 3702* (Guat.-Hond.); 5386 (Fr. Guiana); 7558*, 7606, 8775, 8793 (Br. Hond.); 8869* (Guat.); 10106*, 10536* (Pan.); 10743* (Guat.); 12077* (Pan.); 12751 (Fr. Guiana); 13044* (Br. Hond.); 13616 (Venez.); 15648 (Hond.); 17160 (Col.); 17855* (Peru); 22104 (Braz.); 29832–29836 (Br. Hond.). (Asterisk denotes specimens collected with herbarium material.)

Mechanical Properties

Timber tests were made in the laboratory of the Yale University School of Forestry on 20 specimens of Waika Chewstick (*Symphonia globulifera*) from British Honduras.[2] These were received in the form of adzed bolts, approximately 4 inches square and 4 feet long, four from each of five different trees. The trees were felled and the samples taken out in the middle of October, 1933, and the bolts were shipped from Belize on December 6, 1933. The data pertaining to the source of the test specimens (Table I) were supplied by Mr. Pelley, under whose direction the material was collected.

Upon their receipt in New Haven, the bolts were crib-piled and air-seasoned under cover for almost two years before being finished to standard timber test size (2 by 2 inches in cross section and of varying length, depending upon type of test). At the end of this seasoning period, the moisture content

[2] The author wishes to acknowledge his indebtedness to Messrs. J. B. Kinloch and Russell S. Pelley, of the Forestry Department, British Honduras, through whose coöperation the material used in these tests was secured.

TABLE I

Data on Source of Timber Test Specimens

Tree no.	Total height	Girth, breast high	Merchantable bole	Bolt designation	Height from ground	Quadrant	Remarks
	Feet	*Feet*	*Feet*		*Feet*		
				A	6	West	19 miles up Stann Creek Valley. 250 feet altitude.
				B	10	East	Foot of hills at riverside.
I	81	5.5	43	C	14	North	Gentle east slope. Sheltered on all sides. Primary advanced forest, with Cohune and Monkey-tail Palms.
				D	18	South	
				A	6	North	Same as for Tree No. I.
				B	10	South	
II	87	5.83	52	C	14	West	
				D	18	East	
				A	6	East	11 miles up Stann Creek Valley. 60 feet altitude.
				B	14	South	Flat swampy alluvial lands. Riverain Cohune bush.
III	87	6.25	48	C	22	West	
				D	30	North	
				A	6	South	Same as for Tree No. III.
				B	14	West	
IV	80	7.33	59	C	25	North	
				D	35	East	
				A	6	South	10 miles up Stann Creek Valley. 60 feet altitude.
				B	10	East	Flat swampy alluvial lands in narrow strip of riverain Cohune ridge along Black Creek at intersection of truck-pass.
V	98	7.4	58	C	14	West	
				D	18	North	

of the several test specimens was found to vary from 11.3 to 14.1 per cent. The methods of testing are those used by the U. S. Forest Service and conform to the standards adopted by the American Society for Testing Materials and approved by the American Standards Association (*2*). The various computed strength values were adjusted to a uniform moisture content of 12 per cent by means of the "exponential formula," devised by the Forest Products Laboratory, U. S. Forest Service (*11*, *15*, *27*).

The results of the tests on the air-dry material are summarized in Table II. The derived values are somewhat greater than those obtained by Pfeiffer (*17*) on the Matakki of Surinam, although the discrepancy may be explained, at least in part, by the consistently higher moisture content and the apparently somewhat lower specific gravity of the air-seasoned material tested by Pfeiffer.

Analysis of the data on the individual test specimens showed that the strength values for trees I and II (from the foothills at riverside, 250 feet elevation) were in rather close agreement, as were also those for trees III, IV, and V (from flat, swampy, alluvial lands, 60 feet altitude). The average values for the former pair were definitely higher than those for the other three trees (approximately 16 per cent greater in static bending and compression parallel to the grain, and about 10 per cent more in compression perpendicular to the grain). These differences are rather closely correlated with the variations in the density of the wood tested, the average specific gravity for trees I and II being approximately 8.5 per cent greater than the average of trees III, IV, and V. In the individual trees there was no apparent correlation between the strength of the wood and its position in the tree, although in the majority of cases the specimens taken at 6 feet from the ground were somewhat lower in strength and specific gravity than those obtained from higher up in the trunk.

In addition to the standard tests mentioned above, a series of toughness tests were conducted on the Waika Chewstick. These were made with the single-drop impact machine designed by the Forest Products Laboratory (*15*), on specimens 5/8 by 5/8 by 10 inches in size, tested over an 8-inch span. As a

TABLE II

RESULTS OF STANDARD TESTS ON AIR-DRY WAIKA CHEWSTICK

(Strength values adjusted to 12 per cent moisture content)

Kind of Test	No. of tests	*Maximum*	*Minimum*	*Mean*
A. Specific gravity:	60			
Air-dry* volume and weight		0.775	0.639	0.700
Air-dry* volume, oven-dry weight		0.692	0.573	0.622
Oven-dry volume and weight		0.737	0.605	0.660
B. Static bending:	20	*Pounds per square inch*		
Modulus of rupture		21,950	15,270	18,450
Fiber stress at elastic limit		15,590	9,240	11,200
Modulus of elasticity		3,183,000	2,020,000	2,642,000
		Inch-pounds per cubic inch		
Work to elastic limit		4.31	1.68	2.69
Work to maximum load		18.37	9.92	14.13
C. Compression parallel to grain:	19	*Pounds per square inch*		
Maximum crushing strength		12,460	8,590	10,040
Fiber stress at elastic limit		9,010	6,290	7,850
Modulus of elasticity		3,167,000	1,719,000	2,494,000
D. Compression perpendicular to grain:	20	*Pounds per square inch*		
Fiber stress at elastic limit		1,980	1,220	1,530
E. Hardness:	20 *	*Pounds to imbed 0.444" ball half its diameter*		
Radial		1,590	1,050	1,310
Tangential		1,600	1,050	1,330
End		1,980	1,400	1,680
F. Shear parallel to grain:		*Pounds per square inch*		
Radial	6	1,880	1,550	1,690
Tangential	10	2,310	1,500	1,850
Diagonal	9	2,220	1,660	1,890
G. Tension perpendicular to grain:		*Pounds per square inch*		
Tangential	4	840	490	620
Diagonal	6	850	520	680
H. Cleavage:		*Pounds per inch of width*		
Tangential	7	550	350	440
Diagonal	2	420	300	360

* At approximately 12 per cent moisture content; maximum range, 11.3 to 14.1 per cent.

means of affording a comparison between Waika Chewstick and some better known North American woods, toughness values are also included in Table III for Yellow Birch (*Betula lutea* Michx. f.), Sugar Maple (*Acer saccharum* Marsh.), and Pin Oak (*Quercus palustris* Muench.) (*15*).

TABLE III

Results of Toughness Tests

Species	Moisture content (percent)	Specific gravity (air-dry volume, oven-dry weight)	Face to which load was applied			
			Radial		Tangential	
			Number of tests	Toughness (inch-pounds per specimen)	Number of tests	Toughness (inch-pounds per specimen)
Waika Chewstick	11.7	0.62	16	160	15	156
Pin Oak	11.5	0.64	15	226	18	225
Sugar Maple	13.8	0.64	11	194	11	192
Yellow Birch	11.9	0.65	10	262	11	330

Technical Properties

The wood of *Symphonia globulifera* is somewhat harsh and splintery, but may be sawed, planed, or turned without difficulty. It can be nailed with a minimum of splitting, and holds both nails and screws well. It also finishes rather smoothly, polishes easily, and affords a satisfactory surface for the application and retention of glue, paint, and varnish. The wood, once it has been properly seasoned, shrinks and swells relatively little in response to changes in atmospheric moisture. The heartwood is moderately durable and resistant to insect attack.

The gray variety of wood from French Guiana is reported to compare favorably in technical properties with Russian Oak, and the yellow variety with British Oak (*1*). Demougeot (*9*, *10*) also likens the species to the European Oaks, stating that it compares favorably with them in working qualities and strength, and has a lower shrinkage potential.

Uses of the Wood

The timber of *Symphonia globulifera* is used locally throughout most of its range for a variety of purposes, and has occasionally been exported in small lots from tropical America to Europe and the United States. The reported uses include railway crossties, bridge timbers, boat keels, general construction purposes and carpentry, cooperage, cases and crates for shipping bananas, and rotary cut veneers for plywood. Because of its good finishing qualities and ease of fabrication it is also looked upon with favor for furniture, cabinet work, and interior and exterior finish, for which purposes the yellow variety is particularly recommended (*1*) owing to its more attractive color and susceptibility to a higher finish. Other suggested uses are for vat timbers, light fittings, flooring, and paper pulp.

Concerning the use of the wood for crossties, it is reported to be fairly durable and to hold well in track. However, it is stated that the heartwood tends to become brittle with age and to break under the pressure of the rolling stock, if not properly packed with ballast directly under the rails (*12*).

The use of the wood for cooperage is apparently still more or less in the experimental stage, at least in British Guiana (*28*, 1935), where it is being tried out as a substitute for the Gum staves at present used in the manufacture of molasses barrels. Demougeot (*10*) reports that it is especially suited for the construction of barrels of small dimensions. He remarks that it is of a finer grain and less permeable than Oak, and makes a more solid barrel. Containers of the native wood are stated to work less than those of Oak, last longer in service, and when stacked up empty, the staves are less subject to breakage and exhibit less shrinkage.

Experiments have been conducted at the Imperial Institute, London, on the paper-making characteristics of *Symphonia globulifera* from Trinidad (*3*). The results of these tests indicate that the wood produced "a well digested pulp which furnished a soft, opaque, bulky, brown paper, of fairly good strength. The pulp bleached fairly readily, and then furnished a pale cream-colored paper of similar character and strength

to that from the unbleached pulp." The paper was considered to be "suitable for book and printing purposes."

Uses of the Resin

The resin, which exudes from wounds made in the bark and roots, finds some use in both tropical America and Africa for medicinal and other local purposes, under such names as Nani (Fr. Guiana), Danani (Braz.), and Bolaka (Congo) (*26*). The term Doctors' Gum has also been applied to it in the West Indies and West Coast Africa. It is reported by various authorities as used by the natives of tropical America for such purposes as caulking boats and for fitting arrow heads to spears. As it burns without smoke or odor it is also used for impregnating cord for torches (*16*). Le Cointe reports (*13*) that in Brazil the resin serves in the preparation of a ship pitch and tar, called Cerol, suited for caulking small boats and as a substitute for shoemaker's pitch.

The medicinal use of the resin is reported chiefly from Africa (*14, 26*), although it is also said to be so used by the natives of Venezuela (*16*) and Honduras (*21*). It serves specifically as a vulnerary and diuretic, as a gout plaster, and as a substitute for Copaiba. It has also been reported (*26*) as a tonic and an efficacious balm in the healing of ulcers and abscesses; it is possible that the bark and leaves also possess certain of the properties of the resin.

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FOUR NEW TREES AND SHRUBS FROM ECUADOR AND COLOMBIA

By PAUL C. STANDLEY

Field Museum of Natural History

Three of the four new species of plants described here have appeared in collections received for determination from Professor Record. One, from Colombia, is based upon a collection made by Mr. Armando Dugand G. in continuation of his thorough exploration of the rich ligneous flora of the northern coast. The others, from Ecuador, were collected by the Rev. Luis Mille and Dr. A. Rimbach, both of whom have made collections that have supplied much interesting information about the flora of this country, which still is so little known botanically.

Bombax Millei, sp. nov.—Arbor alta, folia inter maxima, petiolo glabro 35 cm. longo; foliola 5 late elliptica vel obovato-elliptica 1–1.5 cm. longe petiolulata crasse membranacea 19–25 cm. longa 11–16 cm. lata integra apice late rotundata et abruptissime breviter acuminato-apiculata, acumine 1–1.5 cm. longo apice rotundato vel obtuso, basi acutiuscula vel subrotundata, glabra; pedicelli crassi lignosi minute tomentulosi 3 cm. longi; calyx late campanulatus truncatus 1.5 cm. longus 2.5 cm. latus, extus minutissime brunneo-tomentulosus, intus densissime pilis pallidis sericeo-pilosus; ovarium 2 cm. longum acutiuscule pentagonum apice breviter depressum, sparse tomentulosum vel glabratum; petala linearia 12 cm. longa valde revoluta extus dense tomentulosa; tubus staminifer 1 cm. longus supra basin dense albo-pilosus; stamina numerosissima circa 10 cm. longa, filamentis gracillimis glabris; capsula ellipsoideo-oblonga brunnescens laevis lucida circa 18 cm. longa, valvis crassis lignosis, lana brunnescente; semina subglobosa laevia 5 mm. diam. fusco-olivacea maculata.—ECUADOR: In regione tropica calida prope Guayaquil, September 1929, *Rev. Luis Mille* 868 (Herb. Field Mus., type).

Vernacular name, Beldaco. Described by the collector as a beautiful tree, whose soft "cotton" is used for various purposes.

Adenocalymna micradenium, sp. nov.—Frutex scandens glaber, ramulis crassiusculis ochraceis vel cinereis, novellis lenticellis parvis pallidis conspersis; folia longe petiolata trifoliolata, petiolo gracili 6 cm. longo, petiolulis 2–4 cm. longis; foliola (juvenilia) ovato-elliptica circa 8 cm. longa et 4.5 cm. lata, apice abrupte breviter acuminata, basi late rotundata vel subemarginata, membranacea, in sicco fusca, integra, interdum in statu juvenili

sparsissime lepidoto-glandulosa; flores racemosi, racemis laxis paucifloris circa 10 cm. longis, floribus magnis usque ad 6 mm. longe pedicellatis; calyx anguste campanulatus extus densiuscule minute lepidoto-glandulosus, tubo 7 mm. longo pallido viridi-costato truncato supra 5 mm. lato, dentibus subulatis carnosis viridibus 3–4 mm. longis; corolla purpurea 7 cm. longa extus glabra, parte basali tubi 8 mm. longa supra calycem abrupte expansa, ore tubi 1.5 cm. lato, lobis late rotundatis 2 cm. longis intus glabris.—COLOMBIA: La Mojama, May 1, 1934, *A. Dugand* 611 (Herb. Field Mus., type).

Vernacular name Bejuco de Ajo, but the collector reports that he detected in the plant no garlic odor, such as the name would indicate.

Tabebuia ecuadorensis, sp. nov.—Arbor, ramulis crassis pallidis lenticellatis glabratis prope apicem foliatis; folia longipetiolata trifoliolata, petiolo glabro usque ad 10 cm. longo, petiolulis 1.5–4 cm. longis; foliola elliptica 5–13 cm. longa 3–7 cm. lata acuta vel breviter acuminata basi rotundata vel obtusissima integra in statu adulto glabra subcoriacea; flores numerosi vel pauci ad apices ramulorum umbellato-aggregati, pedicellis crassis dense stellato-tomentosis vix 5 mm. longis; calyx anguste campanulatus 8–9 mm. longus extus dense stellatim furfuraceo-tomentosus, tomento brunnescente, lobis brevissimis late rotundatis; corolla flava 5.5–6.5 cm. longa venosa extus glabra, tubo intus laxe villoso, lobis late rotundatis 2–2.5 cm. longis undulatis; capsula longissima subteres fere laevis, circa 35 cm. longa, valvulis 1 cm. latis glabris; semina late alata, parte centrali late oblonga circa 8 mm. longa et 5–6 mm. lata.—ECUADOR: In sylvis tropicis prope Guayaquil, December 1934, *Luis Mille* 861 (Herb. Field Mus., type). Without locality, July 1893, *Eggers* 14936. In savannas and forests, coastal plain southeast of Guayaquil, *Dr. A. Rimbach* 62 (Yale 20755).

"Flowers in November and December, when without leaves or fruits. Flowers yellow. A large tree with dark brown, incorruptible heartwood. Very good for construction" (Rimbach). Vernacular name, Madera Negra. A relative of *Tabebuia rufescens* J. R. Johnston.

Psychotria Rimbachii, sp. nov.—Frutex 3-metralis, ramulis crassiusculis in sicco fusco-viridibus glabris vel minutissime pruinoso-puberulis, internodiis brevibus; stipulae caducae ferrugineae membranaceae, perfectae non visae, late ovatae apiculatae glabrae 5 mm. longae; folia opposita breviter petiolata crasse chartacea, petiolo crasso 5–7 mm. longo; lamina oblanceolato-oblonga 10–15 cm. longa 4–5 cm. lata acuta vel breviter acuminata, basi cuneato-angustata, lucida, supra glabra, nervis non elevatis, subtus pallidior, costa pallida crassiuscula prominente, nervis lateralibus utroque latere circa 9 angulo latiusculo valde adscendentibus arcuatis; inflorescentia terminalis cymoso-paniculata laxiuscule multiflora 3–4 cm. longe pedunculata, basi 3–5-radiata circa 5 cm. longa et aequilata, ramis divaricatis crassis glabris vel obscure minutissime puberulis, bracteis minutis deciduis, cymulis pauci-

floris, pedicellis crassis ad 4.5 mm. longis; hypanthium latum 1.5 mm. longum; calyx 1–1.5 mm. longus remote breviter atque irregulariter dentatus; corolla alba extus glabra, tubo crasso 4 mm. longo, lobis 5 fere aequilongis triangulari-oblongis obtusis intus minute papillosis patentibus, fauce glabro; stylus breviter exsertus; antherae semiexsertae; fructus globosus glaber 10–13 mm. diam.—Ecuador: Western cordillera above Balsapampa, alt. 2600 m., October 1934, *Dr. A. Rimbach* 238 (Yale 28652; type in Herb. Field Mus.).

A member of the subgenus *Mapouria*. Like so many representatives of that group, a species with no outstanding differential characters, yet not readily associable with any other species reported from Ecuador.

THE PROBLEM OF DIFFERENTIATING AND CLASSIFYING TRACHEIDS, FIBER-TRACHEIDS, AND LIBRIFORM WOOD FIBERS

By I. W. Bailey

Professor of Plant Anatomy, Harvard University

The definition and classification of tracheary cells and fibers should be based upon the study of the vascular plants as a whole, rather than upon the investigation of any particular group of plants. Therefore, terms used in describing the woods of dicotyledons should be correlated and harmonized with those employed in dealing with the tissues of other groups of vascular plants, *e.g.*, the monocotyledons, Gnetales, Coniferales, and Cycadales.

The imperforate tracheary elements of the gymnosperms fluctuate considerably in size and form, in the amount of elongation that occurs during tissue differentiation, in the thickness of their secondary walls, in the size, form, number, and distribution of their bordered pits, and in the shape and orientation of their pit apertures. Such morphological differences may be observed, not only in different and remotely related representatives of the gymnosperms, but also at times in different parts of the same tree. For example, in the secondary xylem of species having clearly defined growth layers, the tracheary cells of the earlywood commonly are large and thin-walled, and are provided with numerous conspicuous bordered

pits; whereas the corresponding elements of the latewood are smaller, have thicker walls, and are provided with a limited number of smaller pits having lenticular to slit-like apertures. In *Pseudotsuga*, *Pseudolarix*, *Larix*, and other representatives of the Coniferales, the walls of the tracheary elements of the latewood may at times become so greatly thickened as nearly to occlude the lumen, and the pits may be reduced to slit-like openings with minute borders. In passing from the first-formed to the last-formed parts of the growth layers there are various intermediate types of tracheary elements that are morphologically transitional between those in which the conducting function, on the one hand, and the mechanical function, on the other, are exaggerated.

Similar variations occur in the secondary xylem of the vessel-less dicotyledons, *Tetracentron* and *Trochodendron*. The imperforate tracheary elements of the earlywood are large and thin-walled and have typical bordered scalariform pitting, whereas the corresponding cells of the latewood are smaller, have much thickened walls, and are provided with a limited number of smaller, circular bordered pits having lenticular to slit-like apertures. As in the case of the Coniferales, intermediate types of tracheary elements occur in the central or transitional part of the growth layers.

Extensive investigations of the secondary xylem in a wide range of species and genera of the various families of dicotyledons indicate that where the vessel members most closely resemble thin-walled tracheids with scalariform pitting the imperforate elements of the ground mass of the wood commonly tend to be typical thick-walled tracheids. On the contrary, where the vessel members are highly specialized, *i.e.*, least tracheid-like in form and structure, the imperforate elements tend to have simple pits or pits with vestigial borders. Various intermediate or transitional conditions occur in other dicotyledons.

In the secondary xylem of the dicotyledons, as in that of the Coniferales and Gnetales, the available evidence suggests that where the conducting function of certain tracheary elements is strongly emphasized the mechanical function of the remaining tracheary cells tends to be exaggerated. Thus, in

the dicotyledons as a whole there is a graded series of imperforate cells, which extends from typical thin-walled tracheids at one end to fiber-like elements with simple pits at the other. The problem of differentiating and classifying the varied types of cells that occur in this graded series is by no means simple. At just what stage of the transitional series does a tracheid become a fiber-tracheid, or a fiber-tracheid a libriform wood fiber? How much emphasis should be placed upon variations in the size and form of cells, the thickness of the secondary wall, the size, number, and distribution of pits, the shape and orientation of pit apertures, or upon differences in the amount of elongation that occurs during tissue differentiation? The problem is further complicated by the fact that (in the sapwood) certain of the cells retain their living contents and may form starch; in other words, a storage function is superimposed upon the other functions of these cells.

The Nomenclature Committee of the International Association of Wood Anatomists has recommended (*Tropical Woods* 36: 1–12) that fiber-tracheids be differentiated from libriform wood fibers largely upon the basis of the presence or absence of a pit border. Such a distinction is simple and definite and has the practical advantage of being one that can readily be visualized and uniformly applied by various groups of investigators. Furthermore, from the point of view of the comparative anatomy of the vascular plants as a whole, *simple pits are characteristic features of bast fibers, cortical fibers, pericyclic fibers, and sclerenchymatous elements in general; whereas the pits of tracheary elements typically are bordered.*

Reinders (*Tropical Woods* 44: 33–36) objects to this distinction between fiber-tracheids and libriform wood fibers as unnatural, and advocates the use of a modification of Sanio's classification. If there actually are two discrete and easily recognizable categories of cells in the wood of dicotyledons, rather than a graded series of fluctuating forms, it should be possible to define them accurately and concisely and in terms that can be readily visualized and uniformly applied by different investigators. The definitions given are ponderous, as admitted by Reinders, and their various items either are qualified, and therefore indefinite, or are applicable under certain

circumstances only. At best, the definitions serve merely as a means of separating a group of elements that, from the point of view of the comparative anatomy of the gymnosperms and angiosperms, are typical thick-walled tracheids, from another group containing both transitional and truly fiber-like elements.

There appear to be *three* fairly distinct categories of dicotyledonous cells in question. Designating these A, B, and C, to avoid confusion in terminology, A includes thick-walled tracheids with pits of approximately the same size as those of the vessel members; B applies to transitional elements having pits with obviously reduced or vestigial borders; C embraces typical libriform fibers, characterized by simple pits. Reinders would bracket B and C under the general term libriform wood fibers, while the Committee considers A and B under the general designation of tracheids. Both agree that the elements in A are tracheids and those in C libriform fibers. It seems then that the best way to harmonize the two classifications is to define three more or less arbitrary types of elements and give each of them a specific name.

The cells of Class A seldom retain their living contents or form septa, while annular and spiral thickenings are of exceedingly rare occurrence in those of B and C. So-called gelatinous or mucilaginous layers occur in all three categories, but less frequently in A than in B and C. The number and the distribution of the bordered pits, whether more abundant on the radial than on the tangential walls, or *vice versa*, are highly variable characters in tracheids. All three types of elements fluctuate considerably in size and shape and in the amount of elongation that occurs during tissue differentiation, but those of A tend *on an average* to be larger than those of B and, particularly, those of C [1], and (with the exception of tracheids formed by the cambia of certain monocotyledons) to elongate less during tissue differentiation.

[1] Bailey, I. W., & W. W. Tupper: Size variation in tracheary cells. *Proc. Amer. Acad. Arts & Sciences* 54: 149–204; 1918.

Bailey, I. W.: The cambium and its derivative tissues. II. Size variations of cambial initials in gymnosperms and angiosperms. *Amer. Journ. Bot.* 7: 355–367; 1920. IV. The increase in girth of the cambium. *Amer. Journ. Bot.* 10: 499–509; 1923.

It should not be inferred from this, however, that elongation and a spindle-like form are essential attributes of fibers in general or reliable means for distinguishing fibers from tracheary elements. In other words, undue emphasis has been placed upon such vague terms as "fiberlike," "spindle-like," or "libriform" with implications of a relationship to bast fibers. A study of the comparative anatomy of the gymnosperms and angiosperms reveals the fact that in many species the bast fibers have relatively blunt or truncated ends and do not elongate extensively during tissue differentiation. Conversely, many tracheids have tapering or pointed ends and elongate considerably during tissue differentiation. Furthermore, it should be noted in this connection that if the fusiform initials of the cambium are to be referred to as "cambium fibers," and strands of parenchymatous cells as "parenchyma fibers," the term *fiber* becomes so vague as to be of little morphological significance. Storage of starch and internal septation certainly are not characteristic attributes of fibers or of sclerenchymatous elements in general. Nor are they evidences of a transition to parenchyma, as fundamental differences in their ontogeny and in the physico-chemical constitution of their secondary walls so clearly indicate. It is evident, accordingly, that the only reliable and constant criterion for differentiating tracheary elements from fibers is the presence or absence of a pit border.

How serious is Reinder's objection that according to the definitions of the Committee on Nomenclature both fiber-tracheids and libriform fibers occur within the same species or individual? Are such occurrences more bizarre and incongruous than the presence of both scalariform and porous vessel members within a single tree, of both storied and non-storied cambial initials, of both heterogeneous and homogeneous rays, or of both septate and non-septate libriform fibers? If libriform fibers are related to typical tracheids through graded series of transitional forms, one should expect to find, among the highly diversified families of dicotyledons, species and genera having transitions between tracheids and fiber-tracheids, and others having transitions between fiber-tracheids and libriform wood fibers. It is significant in this

connection that such plastic and variable forms are not eliminated by altering the classification either of the plants or of their constituent cells. Thus, if one adopts the Sanio-Janssonius characterizations of cells, one still encounters an association of fiber-tracheids and libriform wood fibers in certain species, genera, and families.

Any system of dividing a graded series of transitional forms into a limited number of specific categories must of necessity be more or less arbitrary, but such categories should be based upon clearly definable criteria. The recommendations of the Committee on Nomenclature afford such a means for distinguishing libriform wood fibers from tracheids. The definition of fiber-tracheid, however, is less definite and may not be interpreted in the same manner by all investigators. As a solution, the writer proposes that the tracheary elements in question be divided into two groups, largely on the nature of the pitting. The question then arises, should both groups be placed in the general category of fiber-tracheids or should this term be applied to only one of the groups?

In this connection it should be emphasized that if the imperforate tracheary elements of the Dilleniaceae, Theaceae, Hamamelidaceae, and many other dicotyledons are to be called fiber-tracheids, then the term should also be applied to the thick-walled tracheids of *Tetracentron* and *Trochodendron*, of certain species of *Drimys*, and of various representatives of the Gnetales and Coniferales. On the other hand, if the term fiber-tracheid is reserved for transitional elements with obviously much reduced or vestigial borders, *i.e.*, conspicuously smaller than the corresponding pits of the vessel members, then the tracheary elements of such plants as those listed above may be designated merely as thick-walled tracheids.

THE YALE WOOD COLLECTIONS

Accessions

At the end of the calendar year 1935 the total number of catalogued wood samples in the Yale wood collections

amounted to 31,820, representing 9661 named species of 2456 genera of 224 families. There were 3210 accessions during the year.

The outstanding contribution was the gift by Professor L. P. de Bussy, Director of the Commercial Museum of the Colonial Institute, Amsterdam, of 2215 (1879 different) specimens from the Koorders collection of Javanese woods made famous by the work of Dr. H. H. Janssonius in *Mikrographie des Holzes der auf Java vorkommenden Baumarten*, six volumes, 1903–1935. The woods were collected during the years 1888–1894 and many of them came from marked trees which were visited more than once, thus affording exceptional opportunity for obtaining complete herbarium material.

The sources of all the wood samples received are as follows:

AFRICA: Mr. C. Vigne, Assistant Conservator of Forests (*Gold Coast*); Dr. C. R. Metcalfe, Royal Botanic Gardens, Kew, England (*St. Helena*); Mr. D. Normand, Service des Bois Coloniaux, Paris (*Cameroons, Gaboon, Madagascar*); Dr. L. Chalk, Imperial Forestry Institute, Oxford (*Mauritius, Nigeria, Sierra Leone*); Mr. Hans J. Schlieben, through Bot. Museum, Berlin-Dahlem, Germany (*Tanganyika*).

AUSTRALIA: Mr. H. E. Dadswell, Melbourne; Mr. M. B. Welch, Sydney.

CEYLON: Mr. W. M. McNeill, Assistant Conservator of Forests, Colombo.

CHINA: Mr. Y. Tang, Fan Memorial Institute, Peiping; Dr. C. R. Metcalfe, Royal Botanic Gardens, Kew, England.

COLOMBIA: Mr. A. E. Lawrance, Bogotá; Mr. A. Dugand G., Barranquilla.

DUTCH GUIANA: Dr. H. A. Gleason, New York Botanical Garden.

ECUADOR: Dr. A. Rimbach, Riobamba.

FEDERATED MALAY STATES: Mr. H. E. Desch, Forest Research Institute, Kepong, Selangor.

HAWAII: Mr. C. S. Judd, Territorial Forester, Honolulu.

INDIA: Mr. K. A. Chowdhury, Forest Research Institute, Dehra Dun.

JAVA: Prof. de Bussy, Director, Commercial Museum of Colonial Institute, Amsterdam.

MEXICO: Dr. R. S. Flores, Progreso, Yucatan, through Field Museum of Natural History, Chicago.

NEW GUINEA: Mr. J. H. L. Waterhouse, Nodup, Raboul.

NEW ZEALAND: Canterbury University College, Christchurch.

PANAMA: United Fruit Company, Almirante.

PERU: Otis Astoria Company, New York.

PHILIPPINE ISLANDS: Mr. E. C. Childs, Norfolk, Conn.

TRINIDAD: Conservator of Forests, Port-of-Spain.

U. S. A.: Arnold Arboretum, Jamaica Plain, Mass.; Dr. A. H. Graves, Brooklyn Botanic Garden, Brooklyn, N. Y.; Mr. H. W. Hicock, Hamden, Conn.; Dr. H. F. Marco, New Haven, Conn.

Genera Added January 1—December 31, 1935

ACANTHACEAE
- Acanthus

AMARANTACEAE
- Iresine

ANACARDIACEAE
- Holigarna
- Melanochyla
- Microstemon
- Oncocarpus

ANONACEAE
- Griffithianthus
- Meiogyne
- Platymitra

APOCYNACEAE
- Diplorrhynchus
- Kopsia
- Orchipeda
- Strophanthus

ARALIACEAE
- Brassaiopsis
- Harmsiopanax
- Trevesia

BIGNONIACEAE
- Ferdinandia
- Memora

BOMBACACEAE
- Aguiaria
- Cullenia

BURSERACEAE
- Commiphora

CAPRIFOLIACEAE
- Dipelta

COMPOSITAE
- Psiadia
- Stoebe

CONNARACEAE
- Byrsocarpus
- Cnestidium

CUNONIACEAE
- Pseudoweinmannia

CUPRESSACEAE
- Diselma

DILLENIACEAE
- Tetracera

ERICACEAE
- Comarostaphylis
- Macleania

EUPHORBIACEAE
- Coccoceras
- Garcia
- Ostodes
- Podadenia
- Wetria

FLACOURTIACEAE
- Bergsmia
- Ryania
- Trimeria

HAMAMELIDACEAE
- Fortunearia
- Parrotiopsis
- Sinosmithiana
- Tetrathyrium
- Trichocladus

ICACINACEAE
- Tylecarpus

LAURACEAE
- Iteadaphne

LEGUMINOSAE
- Butea
- Calpurnia
- Crotalaria
- Martiodendron
- Ormocarpum
- Smithia

LILIACEAE
- Taetsia

LINACEAE
- Indorouchera
- Phyllocosmus

LORANTHACEAE
- Amylotheca
- Oryctanthus

LYTHRACEAE
- Lawsonia

MAGNOLIACEAE
Bubbia
MALPIGHIACEAE
Hiraea
MALVACEAE
Cephalohibiscus
MELIACEAE
Odontandra
MENTHACEAE
Hoslundia
Moschosma
MORACEAE
Craterogyne
MYRSINACEAE
Pimelandra
MYRTACEAE
Pseudoeugenia
NYCTAGINACEAE
Rockia
OLACACEAE
Endusa
PALMACEAE
Balaka
Clinostigma
Scheelea
Solfia
Teysmannia
Veitchia
Vitiphoenix
PASSIFLORACEAE
Crossostemma
Paropsia
RHOIPTELEACEAE
Rhoiptelea
ROSACEAE
Hagenia
RUBIACEAE
Abramsia
Cosmocalyx
Dorisia
Galiniera
Hypobathrum
Petunga
Prismatomeris
Rhytigynia
RUTACEAE
Afraegle
Araliopsis
Bauerella
Citropsis
Clausena
Hesperethusa
Lunasia
Paramignya
Poncirus
Teclea
SANTALACEAE
Eucarya
Osyris
SAPINDACEAE
Aphania
SAPOTACEAE
Diploknema
SOLANACEAE
Athenaea
STYRACACEAE
Bruinsmia
Melliodendron
Rehderodendron
Sinojackia
THEACEAE
Pyrenaria
THYMELAEACEAE
Peddiea
VIOLACEAE
Agatea

Sections for Microscopic Study

During 1935 there were added to the slide collections cross, radial, and tangential sections of 973 specimens, representing 483 named species, 260 genera, and 101 families, making a total (after allowing for duplications) of 5235 specimens of 2702 named species, 1176 genera, and 164 families. Most of the accessions were received in exchange for wood samples or other forms of cooperation, the principal sources in 1935 being: Mr. H. E. Desch, Forest Research Institute, Federated Malay States; Dr. L. Chalk, Imperial Forestry Institute, Oxford; Prof. R. H. Wetmore, Harvard University; Mr. R. A. Cockrell and Prof. W. W. Tupper, University of Michigan; Mr. P. Maheshwari, Agra College, India; Mr. L. Williams, Field Museum of Natural History, Chicago; Mr. H. D. Ingle, Canterbury University College, Christchurch, New Zealand.

Specimens Distributed

The total number of specimens distributed during 1935 was

1110, mostly for use in connection with specific scientific projects now under way or in preparation. (See *Tropical Woods* 41: 41.)

Systematic Anatomy

Anacardiaceae. To Dr. R. Kanehira, Imperial Forestry Institute, Fukuoka, Japan: 1 sample each of 9 species, 8 genera.

Apocynaceae. To Prof. F. R. Milanez, Rio de Janeiro, Brazil: 58 samples of 16 species of *Aspidosperma*.

Berberidaceae. To Dr. Geo. A. Diehl, Cincinnati, Ohio: 17 samples of 12 species, 3 genera.

Euphorbiaceae. To Dr. R. Kanehira: 1 sample each of 8 species, 6 genera.

Moraceae. To Prof. R. H. Wetmore, Harvard University, for graduate student formerly working under direction of Dr. R. H. Woodworth: 14 samples of 12 species, 5 genera.

Simarubaceae. To Dr. Irma E. Webber, Rubidoux Laboratory, Riverside, California, 3 samples of *Simaruba amara*.

Special Investigations

To Prof. I. W. Bailey, Bussey Institution, Forest Hills, Mass.: 14 samples of very dense woods, namely, 6 Ebenaceae, 6 Lecythidaceae, 1 Moraceae, 1 Zygophyllaceae.

To Dr. L. Chalk, Imperial Forestry Institute, Oxford: 33 samples of 11 families, namely, 1 Anonaceae, 1 Berberidaceae, 1 Bixaceae, 2 Bombacaceae, 2 Bretschneideraceae, 2 Campanulaceae, 3 Chenopodiaceae, 2 Chloranthaceae, 1 Cneoraceae, 4 Cochlospermaceae, 14 Leguminosae.

To Mr. H. E. Dadswell, Council for Sci. & Ind. Research, Melbourne, Australia: 1 sample of Gnetaceae, 2 Rhizophoraceae.

To Dr. N. A. Norton, U. S. Forest Products Laboratory, Madison, Wisconsin: 2 samples of *Fagara monophylla*.

To Prof. Juljan Rafalski, University of Poznań, Poland: 1 sample of *Aeschynomene hispida*.

To Mr. L. Williams, Field Museum of Natural History, Chicago: 3 samples of *Columbia*.

In addition to the above, 945 samples of 15 families, mostly

Apocynaceae (187), Boraginaceae (97), Malvaceae (31), and Rubiaceae (570), were sent to Prof. R. H. Wetmore, Harvard University, for sectioning in connection with a joint Yale-Harvard project.

CURRENT LITERATURE

El cedro: estudio botanico y agricola. By J. T. Roig. Circ. No. 79, Estación Experimental Agronomica, Santiago de las Vegas, Cuba. Pp. 31; 6 x 9¼; 7 plates; May 1935.

This interesting and useful publication forms part of a monograph on the Meliaceae growing in Cuba, both native and in cultivation. The tree under consideration is *Cedrela mexicana* M. J. Roem (syn. *C. Glaziovii* C. DC.; *C. occidentalis* C. DC. & Rose), known as Cedro (Cuba, Honduras, Colombia, Mexico), Cedro Cebolla (Panama), Cedro Amargo (Venezuela), Cedar (Trinidad and Tobago), Red Cedar (British Honduras), Acajou Rouge (Guadeloupe), and to the timber trade as Spanish Cedar and Cigar-box Cedar. The author explains the difference between this species and *Cedrela odorata* L., with which it is so often confused. He describes the wood, its properties, uses, and commercial importance, and explains how to establish and care for plantations, with data on rate of growth and financial returns.

Some new trees and shrubs from Mexico. By Alfred Rehder. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 16: 448–452; October 1935.

New plants described from Nuevo León are *Carya mexicana*, var. *polyneura*, *Litsea Muelleri*, *Amelanchier paniculata*, *Arctostaphylos novoleontis*, and *Menodora Muellerae*.

New plants from the Yucatan Peninsula. By Paul C. Standley. Reprinted from Carnegie Institution of Washington Pub. No. 461; pp. 49–91; Nov. 26, 1935.

This report covers 116 species of 39 different families, and is based on material obtained by several collectors. Most of the plants are trees or shrubs, many of them previously undescribed or incorrectly named, others not hitherto recorded for

the locality. Anatomists who are unable to separate the woods of *Maba* and *Diospyros* will be particularly interested in the following statement: "The family Ebenaceae as represented in America has been considered usually as divisible into two genera, *Diospyros* and *Maba*, both of which are represented even more abundantly in the tropics of the Old World. . . . The writer has for some time been of the opinion that the two groups should be united as the genus *Diospyros* [see *Tropical Woods* 13: 6], and this view is confirmed in a recent publication by R. C. Bakhuizen van den Brink, who has transferred to *Diospyros* all the Malayan species of *Maba* [see *Tropical Woods* 36: 63].

Palmae neogeae. VIII. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 303–305; 1935.

Paurotis Schippii is described from British Honduras; *Geonoma bella* from Amazonas, Brazil.

Arboles y arbustos notables o poco conocidos del Departamento del Atlantico. By Armando Dugand G. *Boletín de Agricultura y Ganadería* (Barranquilla, Colombia) 1: 4: 19–27; October 1935.

This is a second of the series of valuable contributions to the knowledge of the flora of northern Colombia, the first having appeared in April 1935. (See *Tropical Woods* 43: 27.) The author is a business man in Barranquilla, but he is intensely interested in botany and spends his spare time collecting herbarium and wood samples which are sent to the Yale School of Forestry. Cooperating in this work are Mr. Paul C. Standley, Field Museum of Natural History; Mr. E. P. Killip, U. S. National Museum; Rev. Brother Elías, Colegio Biffi, Barranquilla; and United Fruit Company. The species reported upon in this installment are: *Pterocarpus floribundus* Pittier (Sangregao, Grao Blanco), *Odontandra Karstenii* Tr. & Pl. (Mangle Dulce), *Ficus Dugandii* Standley (Higuerón), *Ouratea lucens* (H.B.K.) Engl., *Scheelea butyracea* (Mart.) Karst. (Palma de Vino), *Achatocarpus nigricans* Triana (Limoncillo, L. Moján, Moján), *Zizyphus angolito*

Standley (Angolito, Mondonguito), *Pittoniotis trichantha* Gris., and *Zanthoxylum Dugandii* Standley (Matijón).

Plantae novae colombianae: series altera. By José Cuatrecasas. No. 29, Trabajos Mus. Nacional de Cienc. Nat. (Ser. Bot.), Madrid, April 10, 1935. Pp. 46; figs. 19.

Among the new species described from Colombia are the following woody plants: *Siparuna Valenzuelae*, *Croton bogotanus*, *Hypericum Goyanesii*, *Besleria Delvillari*, *Crantzia Varelana*, *Eupatorium Celestini*, *Diplostephium Mutisii*, *D. tolimense*, *Baccharis capitoides*, *B. guascensis*, *B. ibaguensis*, *Loricaria colombiana*, *Gynoxis tolimensis*, *Senecio Carolitertii*, *S. Mutisii*.

Die Gattung *Purdiaea* Planchon (*Costaea* Richard, *Alloiosepalum* Gilg). By Fr. Mattick. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 395–401; March 31, 1935.

Costaea and *Alloiosepalum* are synonyms of *Purdiaea* of the Cyrillaceae. The genus consists of seven species, for which a key is provided. One species is Colombian, one Peruvian, the others Cuban.

De sawarie-noot, *Caryocar nuciferum* L., en enkele andere in Suriname in het wild groeiende noten. By G. Stahel. Reprinted from *De Indische Mercuur*, Nov. 6, 1935. Pp. 18; 5¾ x 8½; 13 plates.

A description of the tree and fruits with particular reference to the further development of the sawarie nut industry. The author is Director of the agricultural experiment station at Paramaribo.

Neue Arten aus Ecuador. By E. Werdermann. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 370–379; 1935.

New species of woody plants are *Iochroma puniceum*, *Acnistus floccosus*, *Cestrum Dielsii*, *C. tipocochense*, *Solanum phaephyllum*, *S. holosericeum*, and *S. cremastanthemum*.

Ericaceae novae. By Hermann Sleumer. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 478–486; June 30, 1935.

New species are *Leucothoe andina*, Peru; *L. Columbiana*, Colombia, *L. minensis* Glaziou, Minas Geraes, Brazil; *L. Niederleinii*, Santa Catharina, Brazil; *L. rivularis*, Minas Geraes; *L. Uleana*, Rio de Janeiro, Brazil; *Vaccinium crassivenium*, *V. yaoshanicum*, *Rhododendron cardiobasis*, South China; *Rhododendron loranthiflorum*, *R. luraluense*, *Vaccinium Whiteanum*, Papua.

Plantes nouvelles ou peu connues de la région amazonienne (VII[ème] série). By A. Ducke. *Arquivos do Instituto de Biologia Vegetal* (Rio de Janeiro) 1: 3: 205–212; 7 figs.; August 1935.

Contains descriptions of several new species and combinations, some of which were also published in *Tropical Woods* 43: 19–23 (Sept. 1, 1935). The others are *Saccoglottis reticulata*, *Lorostemon bombaciflorum*, *Bonyunia aquatica*, and *Platycarpum negrense*. *Lorostemon* is a new genus of a new subfamily Lorostemonoideae of the Guttiferae.

Plantes nouvelles ou peu connues de la région amazonienne (VIII série). By A. Ducke. *Archivos do Instituto de Biologia Vegetal* 2: 1: 27–73; 9 plates; September 1935.

Contains descriptions of 95 species and varieties, mostly new, of the families Cycadaceae, Rapateaceae, Moraceae, Olacaceae, Rosaceae, Leguminosae, Rutaceae, Vochysiaceae, Euphorbiaceae, Sterculiaceae, Bombacaceae, Guttiferae, Combretaceae, Lecythidaceae, Melastomataceae, Sapotaceae, Convolvulaceae, Rubiaceae, and Compositae. Two new genera are *Huberodendron* (Bombacaceae, tribe Matisieae) with two species, *H. swietenioides* (Gleason) Ducke and *H. ingens* Ducke; and *Tovomitidium* (Guttiferae) with two species, *T. speciosum* Ducke (*Tovomita speciosa* Ducke) and *T. clusiiflorum* Ducke.

Novo gênero de Melastomataceas. By J. G. Kuhlmann. *Arquivos do Instituto de Biologia Vegetal* 1: 3: 231–233; 16 figs.; August 1935.

A description of a new genus and species, *Merianthera pulchra*, shrub or small tree discovered along the Rio Pancas,

Espirito Santo, Brazil. The genus belongs to the tribe Merianieae of the Melastomaceae.

Novas especies botanicas da Hyléa (Amazonia) e do Rio Doce (Espirito Santo). By J. G. KUHLMANN. *Archivos do Instituto de Biologia Vegetal* 2: 1: 83–89; 7 plates; September 1935.

The author describes two new genera, namely, *Paradrypetes* and *Hydrogaster*, and seven new species of trees, namely, *Polygala (Acantocladus) pulcherrima* (Polygalaceae); *Paradrypetes ilicifolia* (Euphorbiaceae), vernacular names Ameixa and Folha de Serra, a small decorative tree with opposite leaves; *Meliosma palustre* (Sabiaceae); *Hydrogaster trinerve* (Tiliaceae), called Barriga d'Agua because of the accumulations of water in cavities in the trunk; *Carpotroche apterocarpa* (Flacourtiaceae); *Aspidosperma leucocymosum* and *Geissospermum excelsum* (Apocynaceae), vernacular name of the latter being Carapanaúba.

Anatomia de *Paradrypetes ilicifolia*. By FERNANDO R. MILANEZ. *Archivos de Instituto de Biologia Vegetal* 2: 1: 133–156; 16 plates.

The results of a microchemical and histological study of *Paradrypetes ilicifolia*, a new euphorbiaceous genus and species described by Kuhlmann. The first part is devoted to the anatomy of the vegetative organs, which is found to be in close agreement with that of the other Drypetinae. The second and much the larger part is concerned with the detailed structure of the fruit.

Os caracteres anatomicos das madeiras: sua variabilidade, interpretação e descripção. By ARTHUR DE MIRANDA BASTOS. Separata do *Boletim do Ministerio da Agricultura* (Rio de Janeiro), 1935. Pp. 30; 6¼ x 9; 27 text figs.

A concise, well illustrated manual of wood anatomy. The author is a member of the International Association of Wood Anatomists and the terminology and definitions he uses are in conformity with those proposed by the Association's Committee on Nomenclature. The drawings and photomicrographs, which are all of Brazilian woods, add greatly to the clarity of the text.

Timbós e rotenona: uma riqueza nacional inexplorada. By ADRIÃO CAMINHA FILHO. Pub. No. 1, Conselho Florestal Federal, Rio de Janeiro, 1935. Pp. 11; 6¼ x 9.

The name Timbó is commonly applied in Brazil to a group of plants, mostly leguminous lianas and shrubs, used by the natives as piscicides and known elsewhere as Barbasco, Cube, etc. The toxic principle, rotenone, has assumed commercial importance as an insecticide and the plants are being cultivated rather extensively in various tropical countries. This report summarizes the information on the subject, enumerates and briefly describes 21 kinds of Timbos, and makes suggestions for developing the rotenone industry in Brazil.

Two new melastomes of the Krukoff collection. By H. A. GLEASON. *Phytologia* (New York) 1: 174–176; September 1935.

Clidemia ferox and *Hormocalyx hirsutus*, a new genus of shrubs, are described from Amazonas, Brazil.

Legislação florestal. Segunda parte: Leis florestaes dos estados. By PAULO FERREIRA DE SOUZA. Pub. by D. N. P. V., Ministerio da Agricultura, Rio de Janeiro, March 1935. Pp. 412; 6¼ x 9.

The first part of this series contained the laws, edicts, and decrees pertaining to the forests of Brazil during the century preceding the establishment of the republic. (See *Tropical Woods* 40: 48–51.) The present part contains the laws of the different Brazilian states, and the third will be concerned with federal legislation and decrees.

Vermischte Diagnosen. II. By H. SLEUMER. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 205–209; Sept. 30, 1935.

Among the new species are *Heisteria amazonica*, Amazonas,

Brazil; *H. Duckei*, Manáos, Brazil; *H. iquitensis*, Brazil and Peru; *Olax pentandra*, Tanganyika.

Mutisieas argentinas nuevas o interesantes. By ANGEL L. CABRERA. *Notas del Museo de La Plata* (Buenos Aires) 1: 55–69; figs. 1–3; 1935.

Besides notes upon herbaceous Compositae of the tribe Mutisieae, the paper includes a synoptical key to the Argentine species of *Gochnatia*, for each of which brief notes are given. As new there are published *Cnicothamnus Lorentzi*, var. *azafran* (vernacular name Azafrán), *Moquinia argentina*, *Gochnatia Malmei*, and *G. palosanto* (Palo Santo).

La vegetación del Alto Uruguay. By B. RAMBO. *Revisto Sudamericana de Botánica* (Montevideo) 2: 108–110; October 1935.

The region studied extends from the mouth of the Pepery in Uruguay to the Chapecó, an area 200 km. long and 50 km. wide. The selva alta or high forest includes such trees as *Apuleia praecox*, Guarapiapunha; *Myrocarpus frondosus*, Cabriuva; *Enterolobium timbouva*, Timbouva; *Piptadenia rigida*, Angico; *Eugenia guabiju*, Guabijú; *E. durissima*, Batinga; *Cedrela fissilis*, Cedro; *Cabralea cangerana*, Cangerana; *Phytolacca dioica*, Umbú; *Cordia hypoleuca*, Louro; *Patagonula americana*, Guajuvira; *Cocos Romanzoffiana*, Gerivá; *Chorisia speciosa*, Paineira; *Jacaratia hendecaphylla*, Jacaratía; *Myrciaria jaboticaba*, Jaboticaba.

The selva baja or low forest includes *Actinostemon concolor*, Larangeira do Mato; *Urera baccifera*, Urtigao; *Sorocea ilicifolia*, Cincho; *Celtis membranacea*, Tala; *Pilocarpus Selloanus*, Pau de Cotia; *Chusquea* spp., Cressiuma; *Merostachys* sp., Taquara.—P. C. STANDLEY.

Additamenta ad floram Uruguayensem. By W. G. HERTER. *Revista Sudamericana de Botánica* 2: 111–128; October 1935.

A list of additions to the author's *Florula Uruguayensis*, 1930–33. All belong to the earlier families of the Engler sequence, ending with the orchids, and are consequently chiefly herbs, but there is included a list of cultivated woody plants of the Gingkoaceae, Taxaceae, Pinaceae, and Ephedraceae.

I generi e le specie delle palme gerontogee della tribù delle "Arecacee." By UGOLINO MARTELLI. *Nuovo Giorn. Bot. Ital.* (Firenze) 41: 693–723; 1934.

A tabular list of the Old World genera and species of the palms of the tribe Arecaceae, extracted from Becarri's final and still unpublished part of his account of Asiatic palms.

Notes on exotic forest trees in Ceylon. By W. M. MCNEILL. Colombo, Ceylon Govt. Press, 1935. Pp. 7; 6 x 9¾. Price 25c.

New species showing promise or being used either for the first time or more extensively since 1928, are: *Alstonia macrophylla*, *Araucaria Bidwillii*, *A. brasiliana*, *A. Cunninghamii*, *A. excelsa*, *Cupressus lusitanica*, *C. sempervirens*, *Eucalyptus diversicolor*, *Juniperus procera*, *Ochroma lagopus*, *Pinus patula*, *P. radiata*, and *Syncarpia laurifolia*.

Species with reputations as timber producers established by 1928 are: *Acacia melanoxylon*, *Callitris calcarata*, *C. glauca*, *Casuarina equisetifolia*, *Cupressus macrocarpa*, *C. torulosa*, *Eucalyptus citriodora*, *E. globulus*, *E. maculata*, *E. microcorys*, *E. paniculata*, *E. pilularis*, *E. regnans*, *E. robusta*, *E. rostrata*, *E. saligna*, *E. tereticornis*, *Grevillea robusta*, *Swietenia macrophylla*, *Tectona grandis*, and *Tristania conferta*.

Species that have failed or are unsuitable for extensive planting are: *Acacia decurrens*, *Castanospermum australe*, *Cupressus Lawsoniana*, *Pinus densiflora*, *P. halepensis*, *P. insularis*, *P. longifolia*, *P. pinea*, *P. taeda*, *Thuja plicata*, and *Widdringtonia Whytei*.

A preliminary study on the identification of the economic woods of China. By Y. TANG. *Sunyatsenia* 3: 1: 44–64; August 1935.

"An attempt is here made to present a key to the genera, and a list of the majority of the more important Chinese economic woods arranged according to their relative importance. The material is based upon the rich collections of authentically

determined timber specimens of about 2000 numbers belonging to about 300 genera and more than 400 species deposited in the Fan Memorial Institute of Biology, Peiping. . . . The tentative key involves the study of 45 species distributed among 24 genera in the Gymnospermae, and 84 species in 81 genera of the Angiospermae, bringing the total number of Chinese economic woods studied to 129 species distributed among 81 genera.

"For the sake of simplicity and easy use, features of microscopic nature are commonly avoided except in some instances where grouping by macroscopic features and physical properties are inadequate, as is the case with the woods of *Salix* and *Populus*, and most of the woods of the Gymnospermae. . . . In order to make this paper more useful, a list of the timber species which have been studied together with their scientific names, common names, and distribution is added. This list covers almost all the important genera but not all economic timber-producing species. Owing to the lack of an extensive survey of forest areas and timber markets throughout China, the present work, although of some practical use to foresters and timber users, should be regarded as being far from final, as amendments and much more thorough studies are necessary."

Anatomy of the xylem of *Sciadopitys*. By ALAN S. PEIRCE. *American Journal of Botany* 22: 10: 895–902; figs. 14; December 1935.

"The anatomy of the xylem of *Sciadopitys* has been found to be extremely simple and uniform, including, however, certain characters which distinguish it from the anatomy of the majority of conifers. The absence of intercellular canals and of any kind of wood parenchyma appears as the outstanding evidence of the simplicity and individuality of structure found in *Sciadopitys*. The pitting on the radial walls of ray cells is perhaps the best diagnostic character possessed by the genus. Ray tracheids are absent, suggesting a relationship with some members of the Taxodiaceae. Tracheid pitting is not so profuse as in the Pinaceae, although the resemblance favors this group more than the others. On the basis of wood anatomy, we may assume for *Sciadopitys* a somewhat distant relationship with but two coniferous families, the Pinaceae and Taxodiaceae."—Author's summary.

Palmae malesicae. IV. Rattans described in Blanco's Flora de Filipinas. By C. X. FURTADO. *Gardens' Bulletin, Straits Settlements* (Singapore) 8: 321–338; Oct. 28, 1935.

A discussion of the species of *Calamus* described by Blanco in the work mentioned.

The phytogeographical relationships between Botel Tobago (Kôtôsyô) and the Philippines on the basis of the ligneous flora. By RYÔZÔ KANEHIRA. *Bull. Biogeographical Soc. Japan* (Tokyo) 5: 4: 209–212; June 1935.

"Botel Tobago Island lies on the southeast of Formosa at about 49 miles from Taitô, its area being about 139 square km. It is only 40 miles from the Batan Islands of the Philippines and is a part of the same volcanic line which extends from Luzon, Babuyan, Batan, Botel Tobago, and Kasyôtô (Samasna) and further north to Kizan Island near Keelung. . . . Through the field work of various botanists, the flora of Botel Tobago has become remarkably well known. . . . It seems clear that the ligneous flora of Botel Tobago is more closely allied with that of the Philippines than with Formosa. . . ."

"Sasaki published a table showing the percentage of Botel Tobago species and their occurrence in different regions. . . . The Formosan elements are more strongly represented than those of the Philippines, but Sasaki gives no exact explanation of this table. The following interpretation is provided:

"When Continental China, Formosa, Botel Tobago Island, and the Philippines were connected in the Tertiary, the Asiatic elements invaded Botel Tobago more strongly than the Philippine elements, Formosa acting as a bridge. The northward extension of Philippine types may have been limited by climatic condition, but unstable geologic condition may have been a factor. Doubtless the northward flowing ocean currents along the east coast of the Philippines and the eastern side of Formosa was a factor to be considered. While

Botel Tobago was apparently separated from Formosa before Formosa became separated from Continental China, there still remained a connection with the Philippines through an isthmus or a row of contiguous islands thus providing the opportunity of certain intermigrations between Botel Tobago and the Philippines, but not at this time permitting Formosan-Philippine intermigrations."

On the flora of Micronesia. (In Japanese, with résumé in English.) By Ryôzô Kanehira. *Bull. Biogeographical Soc. Japan* 5: 4: 233–262; 2 text figs.; 1 map; 4 plates; June 1935.

"The flora of Micronesia is more closely allied to New Guinea than that of the Philippines. The high percentage of Micronesian-Philippine species as compared with Micronesian-New Guinea is due to the fact that most of the species are widespread in the Indo-Malaysian region. These elements doubtless entered Micronesia when the Philippines were connected with the Asiatic continent and Australia in the early Tertiary and immediately preceding times. Hence a line of demarcation between Micronesia and the Philippines may be indicated and this should be connected with the Weber's line, originally proposed by Pelsneer (1904), extending between Timor and Australia northward through the Molucca Passage into the Pacific Ocean west of Obi, Ternate, and Halmaheira. The fact that there are four genera that extend from the Philippines to Celebes, New Guinea, and eastward into Micronesia apparently indicates that the Neo-Wallace line proposed by Dickerson and Merrill is correct."

On the distribution of *Pandanus* and the geographic relationships of the Micronesian species. By Ryôzô Kanehira. *Bull. Biogeographical Soc. Japan* 6: 2: 11–18; 1 map; 4 plates; September 1935.

"The Pandanaceae comprise three genera, *Pandanus*, *Frecynetia*, and *Sararanga*. . . . *Pandanus* is the largest genus in the family. It extends to the west as far as Africa and Madagascar, occurring in India, Ceylon throughout Malaysia to northern Australia and eastward through Melanesia and

Polynesia, extending to the northeast as far as Hawaii and in western Pacific reaching the Riu-kiu and Formosa, southeastern China and Indo-China. . . . The total number of *Pandanus* species approximates 380."

"Micronesia lies within the area of distribution of four large sections of *Pandanus*, namely *Keura*, *Bryantia*, *Hombronia*, and *Lophostigma*. *Keura* is represented by 34 species and 10 varieties, *Bryantia* by six species and one variety; *Hombronia* and *Lophostigma* by one species each. *Acrostigma* will undoubtedly be found in Micronesia when the islands are more completely explored. The abundance of Micronesian species of *Keura* may indicate that this particular part of the world is the center of origin and distribution for this particular group."

An enumeration of Micronesian plants. By Ryôzô Kanehira. *Journ. Dept. Agr., Kyushu Imp. Univ.* 4: 6: 237–464; 1 map; Nov. 30, 1935.

"The present work is an enumeration of all plants known from Micronesia, not only from Japanese Mandate Territory but including also those of Guam, for Guam is geographically a part of the region. It thus serves as a general compilation covering the entire Micronesian flora. It includes 1219 species of plants representing 142 families and 616 genera, of which 456 species and eight genera are endemic in the region, while the manifestly introduced species number 230."

Nova species generis Duabangae ordinis Sonneratiacearum. By R. Knuth. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 121; June 30, 1935.

Duabanga borneensis, a new species, is a tree of Sarawak.

Palmae malesicae. III. Notes on some Malaysian Calami. By C. X. Furtado. *Gardens' Bulletin, Straits Settlements* (Singapore) 8: 241–261; June 24, 1935.

There are discussed 17 species of *Calamus*, eight of which are new, two of these being from Celebes, the others from Borneo.

Notes on Malayan Dipterocarpaceae. III. By C. F. Symington. *Gardens' Bulletin, Straits Settlements* 8: 265–292; pls. 16–28; Oct. 28, 1935.

Twelve species of *Shorea* and *Hopea* are illustrated and described or discussed in detail, with citation of synonymy, collections studied, and other data. New species are *Shorea ochropbloia* Strugnell, vernacular name Seraya Batu; *S. Foxworthyi* Symington, Balau Bukit; *Hopea apiculata* Symington, Resak; *H. resinosa* Symington, Merawan Mata Kuching, Boyan; *S. inaequilateralis* Symington, Maior, Semaior, Semayur; *S. albida* Symington, Meraka Paya, Seringawan; *S. ochracea* Symington, Lon, Majau, Raruk; *S. scabrida* Symington, Meraka Telor.

Palmae malesicae. V. Notes on some Malayan *Daemonorops*. By C. X. Furtado. *Gardens' Bulletin, Straits Settlements* 8: 339–367; pls. 37, 38; Oct. 28, 1935.

Besides notes upon various previously published species of *Daemonorops*, the following new ones are described: *D. brachystachys*, vernacular name Atap Chuchur (Kelantan); *D. calothyrsus* (British North Borneo); *D. confusus* (Sumatra); *D. lasiospathus* (Johore and Borneo); *D. longipedunculatus* (British North Borneo).

Sclerosed tyloses of *Elateriospermum tapos* Bl. By Robert A. Cockrell. *Papers of the Michigan Academy of Science, Arts and Letters* 20: 31–32; 1 plate; (1934) 1935.

A short description, accompanied by three good photomicrographs, of thick-walled tyloses in the vessels of a wood sample (Yale 12660) of *Elatiospermum tapos*, a euphorbiaceous tree of the Federated Malay States. Two other samples of the same species from Sumatra contained only a few, thin-walled tyloses. The author mentions the occurrence of sclerosed tyloses also in species of *Gymnacranthera* (Myristicaceae), *Ligustrum* (Oleaceae), and *Artocarpus*. The reviewer can extend this list to include certain species of the following: *Manotes* (Connaraceae); *Pera* (Euphorbiaceae); *Urandra* (Icacinaceae); *Eusideroxylon*, *Mespilodaphne*, and *Ocotea* (Lauraceae); *Hebepetalum* (Linaceae); *Brosimum* and *Piratinera* (Moraceae); *Eugenia* (Myrtaceae); *Cassipourea* (Rhizophoraceae). All of the foregoing are very dense woods.

The wood anatomy of the North Sumatran "djeroek oetan," a supposed new genus of Rutaceae allied to *Murraya*. By Robert A. Cockrell. *Papers of the Michigan Academy of Science, Arts and Letters* 20: 33–36; 1 plate; (1934) 1935.

A description and three photomicrographs of the wood of an unclassified rutaceous tree which apparently belongs to the Hesperesthusinae of the subfamily Aurantioideae.

Neue Palmen aus Neuguinea. II. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 309–348; 1935.

New species are described in the genera *Livistona*, *Licuala*, *Calamus*, *Orania*, *Areca*, *Calyptrocalyx*, *Ptychandra*, *Heterospathe*, *Cyrtostachys*, *Gulubia*, *Leptophoenix*, and *Actinophloeus*. A list is given of 10 species of *Linospadix*. The new genus *Paralinospadix* consists of 17 species, one new, the others referred previously to *Linospadix*. Another new genus, *Brassiophoenix*, consists of a single species.

Über eine neue Gattung der Malvaceae Papuasiens, *Cephalohibiscus Peekelii* Ulbrich nov. gen., n. sp. By E. Ulbrich. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 494–500; June 30, 1935; illustrated.

Cephalohibiscus Peekelii is a new genus of Malvaceae from New Ireland, New Guinea, and Bougainville Island. It is a shrub or tree of 5–8 meters, related to *Thespesia*. (See *Tropical Woods* 44: 21.)

Flora of southeastern Polynesia. III. Dicotyledons. By Forest B. H. Brown. Bernice P. Bishop Museum Bull. No. 130 (Bayard Dominick Expedition Pub. No. 22), Honolulu, Hawaii, Apr. 30, 1935. Pp. 386; 7 x 10; 9 plates; 70 text figs.

In 1921–22 the author spent 17 months in an intensive survey of the Marquesas as botanist of the Bayard Dominick

Expedition of the Bishop Museum. With his own important collections and field notes as a nucleus he has extended his studies to all the botanical material assembled at the Museum during the course of various surveys of southeastern Polynesia. His first publication of the series, on the Monocotyledons (Bull. 84), appeared in September 1931 (see *Tropical Woods* 29: 39–41), and was followed in December by one on the Pteridophytes (Bull. 89), which was largely the work of his wife, Dr. Elizabeth D. W. Brown. The treatises are carefully prepared, excellently printed, and well illustrated with photographs and drawings. They contain a great wealth of material of interest to students in various botanical fields, including, of course, that of wood anatomy, as Dr. Forest Brown was one of the founders of the International Association of Wood Anatomists.

Matériaux pour la floré de la Nouvelle-Calédonie. XXXIX. Revision des Protéacées. By A. Guillaumin. *Bull. Société Botanique de France* (Paris) 82: 274–283; 1935.

The Proteaceae are represented in New Caledonia by the following genera and species, for all of which keys are provided: *Beauprea* (11 species, including *B. penariensis*, n. sp.), *Kermadecia* (7), *Rhopala* (3), *Stenocarpus* (19; *S. acaciaefolius*, *S. Balansae*, *S. dumbeensis*, n. spp.), *Grevillea* (13, with a new variety), *Knightia* (2).

Contribution à la flore des Nouvelles-Hébrides. Plantes recueillies par M. et Mme. Aubert de la Rüe en 1934 (Phanérogames). By A. Guillaumin. *Bull. Société Botanique de France* 82: 346–354; 1 map; 1935.

The New Hebrides are the region of the world least known botanically. The collection here reported upon includes specimens from the island of Ambrym, from which no plants were known previously. The briefly annotated list contains numerous woody plants. *Maesa Aubertii* and *M. ambrymensis* are described as new, and a key is provided for separating the eight species of *Maesa* known from the New Hebrides.—P. C. Standley.

Tests on small clear specimens of green karri (*Eucalyptus diversicolor*). By Ian Langlands. Div. of For. Prod. Reprint No. 27 from *Journ. Council for Sci. & Ind. Research* (Melbourne) 8: 3: 228–230; August 1935.

"The tests show that the cross bending strength of the green clear wood of Karri is 39 per cent stronger than that of Canadian Douglas Fir, 48 per cent stronger than that of U. S. Douglas Fir, and 36 per cent stronger than that of English Oak. Since the strength of any piece of commercial timber is largely affected by the defects present, and since Karri as a species is very free from injurious defects, it will be seen that, for structural purposes, much higher working stresses can be used than are required for the other species enumerated, resulting in a reduction in the size required for any particular purpose."

The properties and uses of kauri (*Agathis australis*). By Alex R. Entrican. Leaflet No. 26, N. Z. State Forest Service, Wellington, Aug. 12, 1935. Pp. 14; 6 x 9.

A comprehensive report on the tree (forest form and habits, distribution and supplies, types and stands) and the lumber (production and manufacture, grading, properties, utilization).

"New Zealand Kauri ranks as one of the most generally useful softwoods in the world and has figured prominently in the international wood trade for over a century. In yielding flawless timber of exceptionally large size the tree is unsurpassed by any other known species, and although the extensive virgin forests of the early European occupation have been severely depleted the remaining stands are being placed under a system of forest regulations whereby a sustained yield of this valuable softwood will be assured.

"Owing to its evenness of texture and ease of working, to its small shrinkage and ability to stay put, to its medium density and excellent strength properties, and to its high durability, the timber is able to meet the most exacting use requirements. Its uses range from all classes of building and general construction to ship-building, car and wagon con-

struction, tank and vat manufacture, military bridging, the production of dairy and agricultural machinery, and to engineering pattern work, etc."

Disarticulation of the branches in *Eucalyptus*. By A. J. Ewart. *Annals of Botany* 49: 195: 507–511; 1 fig., 1 pl.; July 1935.

"The process of disarticulating the branches, although comparable with the typical mode of disarticulation of deciduous foliage leaves, is carried out in a different manner. The deciduous leaf, strictly speaking, is thrown off before the leaf is quite dead and the formation of an abscission layer at the base of the leaf is simply the last act in the life of the leaf. The abscission of the leaf is due to the formation of this special layer of cells at its base. In the case of the disarticulating branches the branch dies long before it is thrown off, and this death of the lateral branches may be due either to the high light requirements of the foliage in taller Eucalypts or may be due to the top of the tree exercising a greater pull on the water travelling up the main trunk. Some time after the lateral branches have died, the period varying from one to three years, the branches will be found to have come loose, and by working them to and fro they will come away from the main stem, showing a rounded base covered by dark gum and often bringing with them a little sliver of bark, but without its being necessary to break the wood at the base of the branch. The base has, in fact, been eaten away and replaced by a soft layer of gum containing no wood fibers or organized structural elements. Evidently, therefore, the tree is able to produce and concentrate at the base of the branch a lignase or other enzyme which slowly dissolves the wood at the base of the branch and converts it into a layer of gum. In natural conditions the branches slowly work free and ultimately fall from the tree aided by the wind and their own weight. The length of time to disarticulate a branch depends mainly on its size. It is rarely that a tree is able to disarticulate a branch more than one inch in thickness at its base, and to disarticulate a branch of this size usually takes at least three years. During this period the disarticulating base of the branch may be left 2 or more inches below the outer surface of the bark with the butt buried ¼ to ¾ in. in the later layers of wood, the depth depending on the time required to dissolve the base of the branch and upon the rate of growth of the wood on the main trunk. After the branch has fallen it may leave at first a hole in the surface of the wood which ultimately is filled up by the activity of the surrounding cambium, but if the branch is a large one, or if the tree has been damaged by bush fires, the cambium may grow over the cavity superficially, leaving a gum pocket in the wood. . . . It is difficult to say what stimulus gives rise to the production of this slow-acting lignase enzyme at the base of the branch. No evidence of any such action can be detected while the branches are alive, so that the stimulus for the production of enzyme is apparently due to some reaction between the dead wood of the branch and the living wood or cambium of the tree. Various attempts have been made to extract an enzyme from the bases of disarticulating branches which would be capable of dissolving wood outside the plant. No success has, however, been obtained, possibly because the enzyme is either very small in amount or because its action is so slow as to make test-tube experiments difficult."

"Attempts were made to produce artificial disarticulation by driving pegs of coniferous and *Eucalyptus* wood into the trunks of Eucalypts which naturally disarticulate their branches. A large number of experiments of this kind were made on seven species of *Eucalyptus*. The pegs after one and two years showed no signs in any case of becoming loosened, and on withdrawing and examining them no distinct signs of any solution of the wood at the base of the peg where it passed through the cambium layer could be perceived. Apparently it is not possible to produce artificially the conditions set up in a living tree."

Flacourtiaceae novae. II. By Hermann Sleumer. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 474–478; June 30, 1935.

New species are *Casearia multinervosa* White & Sleumer, New South Wales and Queensland; *Paropsia Schliebeniana* Sleumer, German East Africa; *Poggea ? ovata* Sleumer, Ger-

man East Africa; *Xylosma Ruizianum* Sleumer, Peru; *X. Terrae-Reginae* White & Sleumer, Queensland; *X. Tessmannii* Sleumer, Peru, vernacular name Supai Kasha.

Exotics in Mauritius. By G. N. Sale. Rept. to British Empire Forestry Conference, South Africa, 1935. Govt. Printer, Port Louis, 1935. Pp. 12; 6 x 9½.

Contains four annotated lists of exotic trees, *viz.*, established extensively in forests; successful on a small scale; successful in hedgerows and gardens, but not found in forests; not successful in the forest.

"Exotics are of peculiar interest in Mauritius owing to the highly specialized character of the indigenous species which made up the climax type during the period when the Island was isolated, uninhabited, and with a very limited fauna. The most important trees were very storm firm, extreme shadebearers, highly exacting as to soil conditions, and remarkably slow-growing. The extensive fellings in the eighteenth and nineteenth centuries changed the soil conditions; fast growing exotics colonized the black areas and such indigenous forests as had been disturbed, and practically confined the successful natural regeneration of indigenous species to small and remote areas. Plantation work commenced in 1875 and, because of the difficulty of establishing indigenous species, exotics were almost entirely used."

Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. VIII. By J. Mildbraed. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 380–388; March 31, 1935.

Among the new species are two shrubs of the Thymelaeaceae, *Peddiea puberula* and *P. subcordata* Domke.

Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. IX. By J. Mildbraed. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 501–523; June 30, 1935.

New woody plants from Tanganyika are: *Capparis orthacantha* Gilg, *Acacia Joachimii* Harms, *A. Schliebenii* Harms,

Brachystegia Schliebenii Harms (vernacular name Miobokuba), *Afrormosia Schliebenii* Harms (Mbanga), *Platysepalum inopinatum* Harms (Mhalamalo), *Dalbergia acariaeantha* (Mkulangombe), *Erythrina Schliebenii* Harms, *Hugonia arborescens* Mildbr. (Napokano), *Dichapetalum Schliebenii* Mildbr. (Mkawaia), *Drypetes sclerophylla* Mildbr. (Mdedele), *Ricinodendron gracilior* Mildbr. (Mtene), *R. Schliebenii* Mildbr., *R. viticoides* Mildbr. (Mkangaula), *Sterculia Schliebenii* Mildbr. (Mputempute). Vernacular names are reported also for old species: *Xylia africana* Harms (Mbaba), *Pseudoprosopis euryphylla* Harms (Litoha), *Baphia macrocalyx* Harms (Chindambi), *Millettia makondensis* Harms (Kipelemende), *M. Stuhlmannii* Taub. (Mpande), *Dalbergia elata* Harms (Kigea, Msesa), *Dichapetalum macrocarpum* Engl. (Kikwaia), *Aphania senegalensis* Radlk. (Mguena).—P. C. Standley.

Forest trees and timbers of the British Empire. III. Fifteen South African high forest timber trees. By L. Chalk, M. M. Chattaway, J. Burtt Davy, F. S. Laughton, and M. H. Scott in coöperation with the Forestry Dept., U. of S. A. Oxford University Press, 1935. Pp. 103; 6 x 9¼; 13 figs.; 17 plates. Price 7s. 6d.; (U.S.A.) $2.50.

This publication maintains the high standard of the two previous numbers of the series begun in 1932. A few changes have been introduced, mainly to accommodate the larger amount of information available concerning the silviculture of the species and the properties and utilization of the timber. The wood specimens studied were for the most part collected for the purpose by the South African Forestry Department and accompanied by herbarium material from the same trees. There are some departures from the previous methods of measuring cell dimensions and these are explained in an appendix.

The introduction (pp. 9–14) contains an account of the South African high forests with reference to their distribution, composition, and environment. The fifteen species described in detail are of eleven different families, as follows: *Gonioma kamassi* E. Mey. (Apocynaceae); *Curtisia faginea*

Ait. (Cornaceae); *Cunonia capensis* L. and *Platylophus trifoliatus* D. Don (Cunoniaceae); *Apodytes dimidiata* E. Mey. (Icacinaceae); *Ocotea bullata* E. Mey. (Lauraceae); *Ekebergia capensis* Sparrm. and *Ptaeroxylon obliquum* (Thunb.) Radlk. (Meliaceae); *Rapanea melanophloeos* (L.) Mez (Myrsinaceae); *Ochna arborea* Burch. (Ochnaceae); *Olea laurifolia* Lamk. (Oleaceae); *Podocarpus latifolius* (Thunb.) R. Br., *P. Henkelii* Stapf, and *P. falcatus* (Thunb.) R. Br. (Podocarpaceae); *Faurea Macnaughtonii* Phillips (Proteaceae). For each species there are drawings of the foliage, inflorescence, and details of the floral parts; photographs of the tree, and photomicrographs of the wood.

Notes on the flora of southern Africa. VI. *Kew Bulletin of Miscellaneous Information* 204–208; 1935.

New woody plants are *Toddaliopsis Bremekampii* Verdoorn and *Ficus Smutsii* Verdoorn.

Die Flora des Namalandes. VIII. By Paul Range. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 256–280; Sept. 30, 1935.

An enumeration of the flora of Namaland, the families treated being the Verbenaceae to Compositae of the Engler sequence.

Notes on the flora of Angola. I. By A. W. Exell. *Journ. Bot. Brit. & For.* (London) 73: 227–228; August 1935.

New woody plants are *Ritchiea Youngii* Exell and *Caloncoba angolensis* Exell & Sleumer.

Une essence forestière de l'île de la Réunion: le tamarix des hauts (*Acacia heterophylla* W.). By Marcel Rigotard. *Revue Internationale du Bois* (Paris) 2: 18/19; 541–551; June–July 1935. Also in *Revue Internationale des Produits Coloniaux* (Paris) 6: 116/117; 250–260; August–September 1935.

A detailed account from the standpoint of both the botanist and the forester of an important timber tree of Reunion, which very closely resembles the *Acacia Koa* A. Gray of Hawaii.

Les essences de Madagascar. By L. Lavauden. *Revue Internationale du Bois* (Paris) 2: 18/19: 531–540; June–July 1935. Also in *Revue Internationale des Produits Coloniaux* (Paris) 6: 118; 309–318; October 1935.

A general account of the principal timbers of Madagascar, both native and introduced.

Les *Rubus* africains de l'herbier du Jardin Botanique de l'Etat a Bruxelles. By C. E. Gustafsson. *Bull. Jardin Bot. Bruxelles* (Brussels) 13: 267–276; 2 pls.; June 1935.

A list is given of the African species of *Rubus* represented in the Brussels herbarium. *R. Ledermannii* Engl., var. *serrulatus* is described as new from Belgian Congo, its vernacular name being Busuni. Other species for which local names are reported are: *R. pinnatus* Willd., var. *afrotropicus* Engl., Akuakua (Belgian Congo); *R. inedulis* Rolfe, Mokere (Belgian Congo).

A propos de médicaments indigènes congolais. By É. de Wildeman. Extract from *Mémoires* pub. by Institut Royal Colonial Belge (sec. Sci. nat. et med.) vol. III, Brussels, 1935. Pp. 127; 6½ x 10.

A detailed account of the medicinal plants used in native medicine in the Congo. At the end (pp. 113–127) is an alphabetical list of the vernacular and scientific names of the plants mentioned in the text.

Les bois des îles et des colonies dans l'ameublement. By A. Fréchet. *Revue Internationale du Bois* (Paris) 2: 18/19: 521–530; June–July 1935. Also in *Revue Internationale des Produits Coloniaux* (Paris) 6: 116/117: 261–270; August–September 1935.

An interesting account in the form of historical references to the introduction and early use of many of the best known cabinet woods.

Les bois coloniaux dans la décoration. By H. L. MICHON. *Revue Internationale des Produits Coloniaux* 6: 118: 281–292; 2 pls.; October 1935.

An account of the use of French colonial woods for the interior decoration and furnishing of shops, bank buildings, ocean liners, etc. The woodwork of the S. S. "Normandie" is described and illustrated.

La sinonimia delle palme gerontogee della tribù delle Areceae. By UGOLINO MARTELLI. *Nuovo Giorn. Bot. Ital.* (Firenze) 42: 17–88; 1935.

The paper is an index of the generic and specific names of Old World palms of the tribe Areceae, with an indication of their reference when considered to be synonyms.

What are the largest trees in the world? By HARRY D. TIEMANN. *Journal of Forestry* (Washington, D. C.) 33: 11: 903–915; 5 figs.; November 1935.

"Information on the dimensions of trees that were felled or destroyed long ago is unreliable, and original recorded data of the largest trees have in many cases been lost or exist only in memory. Frequently heights were estimated by eye or guessed at. Citations of pre-existing trees from 400 to 500 feet in height are often fabulous; and the tallest living tree of unquestioned and authenticated measurement is a Coast Redwood (*Sequoia sempervirens*), 364 feet. The conclusion must be drawn, however, that judging by well established diameters of vanished trees, in comparison with living or known trees, heights of 400 feet might often have been exceeded in the past, especially in the case of the *Eucalyptus;* but no absolute confirmation exists to-day, as in no case are authenticated original measurements available. . . .

"In height, the outstanding species of living trees to-day are the Redwoods (*Sequoia gigantea* and *S. sempervirens*), the Eucalypts (especially *Eucalyptus regnans*), and the Douglas Fir (*Pseudotsuga Douglasii*). In basal diameters, the Sierra Redwoods or Bigtrees are preëminent as a class, although certain individual specimens of several other species in other parts of the world exceed them, and in times past they may have been outclassed by the Eucalypts. As to volume, supremacy appears to lie between the Bigtree of California and the Kauri (*Agathis australis*) of New Zealand."

Whiff numbers. By E. C. CROCKER and L. F. HENDERSON. *The Technological Review* 36: 5: 171–2; 1 chart; February 1934.

"Working subjectively, Linnaeus, followed by Zwaardemaaker, decided that there were nine odor classes: ethereal, aromatic, balsamic, ambrosial, alliaceous, empyreumatic, repulsive, and nauseating. These classes were not necessarily components of odors, but kinds selected with a view of making description and classification easier and more exact. Several other workers have extended this type of classification, especially to include the odors of the chemical laboratory as well as those of nature. Others were more fantastic and poetic and at least one author devised a system wherein odors were spaced by intervals, and had octaves, after the analogy of a musical scale. The German experimenter, Henning, decided that there were probably only a relatively few kinds of small nerves, each responding to a part of each odor more or less as the taste buds in the mouth do to true tastes. He decided that there were six fundamental concepts or odor components: spicy, flowery, fruity, resinous, burnt, and foul, and did an immense amount of work in classifying odors of all kinds according to this arrangement.

"The writers set out to study the sense of smell in an academic way, and chose Henning's system as most plausible and workable. They decided, however, after many experiments, that that system did not express fundamentals as well as it might, although in principle it seemed correct. The final result of their work was a system even simpler than Henning's, which was described in the *American Perfumer* in August 1927. This system is premised upon the existence of only four kinds of smell-sensation nerves in the human nose, detecting fragrant, acid, burnt, and caprylic components.

"*Fragrant* is strong in the odor of most flowers, spices, and fruits, and in some animal secretions such as musk, ambergris, and civet.

"*Acid* is the sharp character notable not only in volatile acids, but in chemically neutral materials such as turpentine and camphor, and in alkalies like ammonia.

"*Burnt* is a character all too well-known to cooks—prominently present in creosote, tars, and so on, as well as in skunk, beaver, fox, and many other animal odors, and roasted coffee.

"*Caprylic* or goaty is the character poignantly present in rare cheeses, illuminating gas, and rancid grease, very evident in many animal odors, including perspiration, and moderately represented in many odors classed as pleasant.

"We went a step further and represented the amount of each component present in a given odor by a digit such as 1, 4, or 7, based on 8 as the strongest that the particular character ever attains in any known odor. If these digits are arranged in a standard order, it becomes possible to represent any odor as a four digit number, as: 6523 for the odor of the damask rose, where 6 is fragrant, 5 is acid, 2 is burnt, and 3 is caprylic. Similarly derived, the odor of the purest ethyl alcohol is 5301, and oil of wintergreen 8442. With the aid of a set of 'standards' it has been found possible to get good agreement between operators in assigning odor numbers and in using the number system in practical perfume and flavor experimentation.

"A recent development has made possible the approximate placement of all kinds of odors, with respect to each other, on a single plane chart. This is possible since a large proportion of the odors one is interested in have nearly equal fragrant and acid values, respectively, but may vary widely in their burnt and caprylic components, which, consequently, define the odor characters. In this chart the odors are placed with respect only to their burnt and caprylic components, but this is fairly accurate, since the fragrant values of most odors are about 6, and the acid values about 4. Having built such a chart, we were struck by the approximate placement of all the flowery odors in a narrow area, and similarly, the placement of the resinous, fruity, and other odor types, as shown by the type groupings."

Stability of tree names. By J. Burtt Davy. *Quarterly Journal of Forestry* 30: 1: 52–54; January 1936.

"At the Sixth International Botanical Congress, held at Amsterdam, from September 1st to 7th, 1935, two proposals embodying the principle of the conservation of specific names (*nomina specifica conservanda*) were offered: one by Mr. J. Adams, Botanist, Central Experimental Farm, Ottawa, Canada; the other by Prof. R. S. Troup, on behalf of 38 forestry departments, institutions, and individuals interested in the conservation of long-used names of trees and other plants of economic interest.

"Before the Congress met in open session, the Permanent Bureau of Nomenclature had considered the various proposals on nomenclature sent in to the Congress, and had rejected these two among many others, the first by 7 against and 4 in favor, and the second by 6 against and 2 in favor [3 not voting]. Dr. Sprague and other members of the Permanent Bureau recommended, however, that the principle involved should be discussed inasmuch as it was one that 'intimately concerned workers in applied botany.' This was agreed to, but after discussion the Congress rejected the principle by 208 votes against, and 61 in favor.

"Mr. Ramsbottom, Keeper of Botany, British Museum (Natural History), South Kensington, then suggested that a reasonable compromise would be to draw up a list of names of economic plants, as sanctioned by an International Committee, *i.e.*, drawn up according to the International Rules. Separate lists could be printed in the Appendix to the Rules if asked for by the interested section of botanists. Fixity of specific epithet, he pointed out, not specific name, is what is really wanted; to fix specific names (the generic name and specific epithet) would not be in the interests of taxonomy. Dr. Rendle suggested the addition of a proviso that 'this list may remain in use for a period of ten years.' These suggestions were then proposed as a motion, which was accepted by the Congress.

"The following special Committee for the Nomenclature of Economic Plants was appointed to deal with the list: J. Burtt Davy, Imperial Forestry Institute, Oxford; F. J. Chittenden, Royal Horticultural Society, London; A. W. Exell, British Museum (Natural History), South Kensington, London; P. J. Eyma, University of Utrecht; H. Harms,

Botanisches Museum, Berlin-Dahlem; B. P. G. Hochreutiner, Professeur au Collège Supérieur, rue St. Victor 10, Geneva; A. Rehder, Arnold Arboretum, Jamaica Plain, Massachusetts, U.S.A.; W. Robyns, Jardim Botanique de l'Etat, Brussels; Miss M. L. Green, The Herbarium, Royal Botanic Gardens, Kew, was appointed Honorary Secretary of this committee.

"While it is to be regretted that the Congress did not see its way to accept the principle of the conservation of specific names which are well-established in use, even though they may not be the oldest under the International Rules, the compromise effected is a step in the right direction. It places the responsibility for the interpretation of the Rules as it affects the names of forest trees, upon an International Committee. This opinion will have the weight of authority behind it. Being International, the Committee will be able to co-ordinate the names of forest trees grown both in Britain and on the Continent. . . .

"A list which is stabilized for ten years will probably remain in permanent use; it will have cleared the ground of a lot of doubtful synonyms which have caused much of the uncertainty as to the validity of names. Although the list to be prepared and published is to be according to the 'International Rules,' this does not mean that names which have recently been resurrected to replace well-established ones, are necessarily valid under the Rules. Each case will have to be examined on its merit. . . .

"As it is important that the Committee should get to work as soon as possible, the writer will be glad to receive lists of tree names which are in doubt, or about the validity of which there may be question."

Yale University School of Forestry

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ANATOMICAL INTERRELATIONSHIPS OF THE TAXODIACEAE[1]

By ALAN S. PEIRCE

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Few anatomical studies of a systematic nature embrace the exotic species as well as those of commercial importance. Among the early investigations into systematic conifer anatomy, those of Nakamura (1883) and Burgerstein (1908) are worthy of note. The former described 20 species and submitted a key; the latter presented a key to 31 coniferous genera based on existing reports, some of which were his own. The work of Gothan (1905) was perhaps the most outstanding contribution to the identification of fossil gymnosperms, while Penhallow (1907) is better known for his treatment of the living forms. Jeffrey (1903) gave us a classic description of the vascular anatomy of *Sequoia*, of which the phylogenetic implications are still widely accepted. Fujioka (1913) and Iwaki (1918) engaged early in the description of oriental woods, but the most complete records yet published on these woods are those of Kanehira (1921a, 1921b, 1926). A recent compilation of existing anatomical data appeared in the form of a key to living and fossil coniferous woods (Slyper, 1933). Embracing the commercial species of America are the recent manuals of Record (1934) and Brown and Panshin (1934).

[1] Part of a dissertation submitted to the Graduate School of the University of Illinois in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

It was deemed that the relationships of the Taxodiaceae were certain to be greatly elucidated by a thorough study of the anatomy of all of the commonly recognized species listed by Pilger (1926). The present paper has arisen from such a study of 31 specimens having the following taxonomic distribution: *Sciadopitys verticillata* Sieb. & Zucc. (3), *Sequoia gigantea* (Lindl.) Decne. (3), *S. sempervirens* (Lamb.) Endl. (2), *Taxodium distichum* (L.) Rich. (3), *T. ascendens* Brongn. (1), *T. mucronatum* Tenore (2), *Glyptostrobus pensilis* (Stount.) Koch (3), *Cryptomeria japonica* Don (4), *Athrotaxis selaginoides* Don (2), *A. laxifolia* Hook. (1), *A. cupressoides* Don (1), *Taiwania cryptomerioides* Hayata (3), *Cunninghamia lanceolata* (Lamb.) Hook. (2), and *C. Konishii* Hayata (1).

The terminology employed in this work is almost wholly that approved by the International Association of Wood Anatomists (1933).

Description of Taxonomic Characters

A descriptive treatment of the taxonomic characters employed in the construction of a diagnostic key is of the utmost importance to its successful manipulation by others. The descriptions of the principal characters featured in the subsequent matter follow; one new term, "indenture," is submitted in the belief that the character possesses a sufficient degree of value through its clearness and constancy.

Ray tracheids. The criterion of the writer in adjudging ray

tracheids was a severe one: observation of a distinct pit border in section was required before the tracheidal nature of the cell in question was admitted. Nevertheless, ray tracheids were definitely observed in *Sequoia gigantea* (Fig. 1).

Transverse walls of ray cells. The transverse, or horizontal, walls of the cells in the ray may be either smooth or equipped with primary pit-fields in various degrees of frequency. The former condition is illustrated in *Sequoia* (Figs. 1, 11), while in *Taiwania* (Fig. 12) occasional primary pit-fields are observed.

Tangential walls of ray cells. These walls, commonly referred to in the literature as terminal, end, or vertical, may likewise be smooth or possess primary pit-fields. The former condition is a constant feature of the Taxodiaceae (Figs. 2, 3). The counterstain crystal violet often reveals a multitude of fine plasmodesma (Fig. 5).

Indenture. This new term is employed to indicate the abruptly thin portion of the transverse wall of a ray cell at the point of juncture with the tangential wall. Indentures are illustrated in Figure 3; their absence is shown typically in *Sequoia* (Fig. 2).

Ray structure and height. The structure of rays is of little importance in the identification of members of this conifer group, and only the extremes can be used to advantage. The highest ray observed in this investigation was found in *Taxodium distichum*, a completely uniseriate ray of 60 cells. The frequency and extent of the biseriate condition is illustrated in *Sequoia* (Fig. 4); the multiseriate ray is rarely found in the Taxodiaceae and is then quite likely to be a traumatic response.

Transverse walls of wood parenchyma cells. The occurrence of the strand type of wood parenchyma in abundance in this family renders the sculpture of their transverse walls of great diagnostic importance. Moreover, the conditions encountered are almost universally of generic occurrence. The walls may be smooth and relatively thin, as in *Cunninghamia* (Fig. 6). When pits are present the secondary wall is somewhat thicker and the simple pits are large and coarse (Figs. 7, 8).

General Features of Taxodiaceae

Normal ray tracheids absent, rarely present in *Sequoia*. Transverse walls of ray cells ½–4μ thick, smooth or with primary pit-fields; tangential walls ½–2μ thick, always smooth; indentures present or absent; radial walls ½–3μ thick; apertures of the pits on the tracheid side of the crossfield small-elliptic, horizontal to diagonal, borders narrow and paralleling the long axis (except for the distinct variants in *Sciadopitys* and *Glyptostrobus*). Tracheid pitting biseriate to multiseriate in early wood, rarely uniseriate; spiral secondary thickenings absent; crassulae present and usually abundant.

Ray height variable, maxima ranging from 10 to 60 cells; rays occasionally partly biseriate, the number of extra cells varying from one to the entire height of the ray; ray cells circular, long-elliptic, or hexagonal in cross section; ray cells rarely resinous.

Wood parenchyma abundant (except absent in *Sciadopitys*), scattered or occasionally somewhat banded tangentially; transverse walls entire or coarsely pitted; intercellular canals absent. Tracheids rectangular in cross section; transition gradual to abrupt. Radial diameter of early tracheids usually 35–100μ; tangential diameter, usually 35–90μ. Radial diameter of late tracheids usually 6–24μ; tangential diameter, 30–75μ. Wall thickness of early tracheids, 1–5μ; of late tracheids, 2–12μ, usually 5–10μ.

Key to the Genera

1a Generally but one large bordered pit on the tracheid side of the crossfield; aperture large, elliptic, diagonal in early wood, slitlike in late wood; wood parenchyma normally absent. . . . . *Sciadopitys.*

1b Generally from two to five small pits on the tracheid side of the crossfield; apertures small-elliptic or circular; wood parenchyma normally present. 2

2a Crossfield pits normally in two tiers, occasionally three, irregularly distributed. . . . . *Glyptostrobus.*

2b Crossfield pits ranging from two to five, normally in one horizontal series (except opposite the higher marginal ray cells) 3

3a Pitting on transverse walls of wood parenchyma cells abundant and coarse; walls of late tracheids often 8–12μ thick. . . . . *Taxodium.*

3b Pitting on transverse walls of wood parenchyma cells wholly lacking or rare and inconspicuous; walls of late tracheids seldom over 8μ thick.. 4

4a Indentures regularly present and pronounced..... 5
4b Indentures either absent or inconspicuous..... 6

5a Crossfield pits in early wood often without borders; transverse walls of wood parenchyma cells occasionally with slight thickenings..... 7
5b Crossfield pits normally possessed with borders; transverse walls of wood parenchyma cells universally smooth..... *Taiwania.*

6a Rays low, seldom exceeding 12 cells in height; partly biseriate rays rare, percentage of biseriate cells in such rays low..... *Athrotaxis.*
6b Rays intermediate to high, often attaining 24–30 cells in height; partly biseriate rays common, percentage of biseriate cells in such rays often as high as 75 per cent..... *Sequoia.*

7a Transverse walls of ray cells 2–3μ thick; indentures prominent throughout the growth ring; ray cells circular in cross section, or equipped with diagonal corners..... *Cryptomeria.*
7b Transverse walls of ray cells 1–2μ thick; indentures prominent only in early wood; corners of ray cells in cross section prominently arched inwards..... *Cunninghamia.*

Descriptions of the Genera

Sciadopitys

Ray tracheids absent; transverse walls of ray cells ½–¾μ thick, smooth; tangential walls ½–1μ thick; radial walls ½–¾μ thick; normally but one bordered pit on the tracheid side of the crossfield (Fig. 9), aperture diagonal, large and elliptic in early wood, slit-like in late wood; indentures absent; ray cells non-resinous. Tracheid pitting uniseriate, rarely biseriate in early wood; crassulae present, not pronounced. Rays 1–10 cells high, strictly uniseriate; ray cells circular to long-elliptic in cross section. Wood parenchyma absent; transition gradual. Radial diameter of early tracheids, 18–45μ; tangential diameter, 24–35μ; radial diameter of late tracheids, 6–15μ; tangential diameter, 20–35μ. Wall thickness of early tracheids, 1–2½μ; of late tracheids, 2–4μ.

Glyptostrobus

Normal ray tracheids absent; transverse walls of ray cells 1–3½μ thick, primary pit-fields numerous; tangential walls ½–1½μ thick; radial walls 1–3μ thick; from 2–6 usually

simple pits irregularly distributed in two tiers and occasionally three on the tracheid side of the crossfield (Fig. 10), apertures circular to elliptic; indentures regularly present and pronounced in early wood, sporadic in late wood; ray cells occasionally resinous. Tracheid pitting biseriate to multiseriate in early wood; crassulae pronounced. Rays 1–30 cells high, occasionally partly biseriate; ray cells long-elliptic to hexagonal in cross section. Wood parenchyma abundant, scattered, transverse walls occasionally pitted, thickenings usually not conspicuous; transition usually gradual, occasionally abrupt. Radial diameter of early tracheids, 30–60μ; tangential diameter, 20–70μ; radial diameter of late tracheids, 8–20μ; tangential diameter, 20–50μ. Wall thickness of early tracheids, 1–3½μ; of late tracheids, 3–10μ.

Sequoia

Normal ray tracheids usually absent, rarely present and marginal; transverse walls of ray cells 1–4μ thick, with occasional primary pit-fields; tangential walls ½–2μ thick; radial walls ¾–2½μ thick; normally from 2–5 bordered pits in one horizontal series on the tracheid side of the crossfield, apertures small-elliptic, horizontal to diagonal (Fig. 11); indentures absent or rare and inconspicuous; ray cells non-resinous. Tracheid pitting uniseriate to multiseriate in early wood; crassulae pronounced to indistinct. Rays 1–30 cells high, often partly biseriate, occasionally completely biseriate; ray cells hexagonal, occasionally long-elliptic, in cross section. Wood parenchyma abundant, scattered, transverse walls entire; transition usually gradual, occasionally abrupt. Radial diameter of early tracheids, 30–100μ; tangential diameter, 24–60μ; radial diameter of late tracheids, 7–24μ; tangential diameter, 24–60μ. Wall thickness of early tracheids, 1–3μ; of late tracheids, 3–8μ.

Taxodium

Normal ray tracheids absent; transverse walls of ray cells 2–4μ thick, primary pit-fields present, often numerous; tangential walls ¾–2μ thick; radial walls 1–2½μ thick; from 2–6 (generally 3 or 4) bordered pits in one horizontal series on the

tracheid side of the crossfield, apertures small-elliptic, horizontal to diagonal; indentures absent or regularly present and pronounced; ray cells non-resinous. Tracheid pitting biseriate to multiseriate in early wood; crassulae abundant. Rays 1–60 cells high, rarely to often partly biseriate; ray cells circular to long-elliptic, or squared to hexagonal, in cross section. Wood parenchyma abundant, scattered or somewhat banded tangentially, transverse walls thick with numerous coarse pits; transition moderately to extremely abrupt. Radial diameter of early tracheids, 40–90μ; tangential diameter, 35–90μ; radial diameter of late tracheids, 10–30μ; tangential diameter, 40–75μ. Wall thickness of early tracheids, 1½–4½μ; of late tracheids, 3–12μ.

Cryptomeria

Normal ray tracheids absent; transverse walls of ray cells 1½–3μ thick, primary pit-fields numerous; tangential walls ½–1½μ thick; radial walls ¾–2μ thick; from 2–4 pits on the tracheid side of the crossfield in one horizontal series, often simple in early wood, aperture elliptic to circular, diagonal; indentures regularly present and pronounced; ray cells usually non-resinous. Tracheid pitting biseriate, occasionally uniseriate, in early wood; crassulae pronounced to indistinct. Rays 1–24 cells high, occasionally partly biseriate; ray cells long-elliptic to circular or hexagonal in cross section. Wood parenchyma abundant, scattered, transverse walls occasionally pitted, thickenings slight; transition usually abrupt. Radial diameter of early tracheids, 30–60μ; tangential diameter, 30–50μ; radial diameter of late tracheids, 7–15μ; tangential diameter, 30–60μ. Wall thickness of early tracheids, 1½–5μ; of late tracheids, 4–8μ.

Athrotaxis

Normal ray tracheids absent; transverse walls of ray cells 1–2½μ thick, smooth, tangential walls ½–2μ thick; radial walls 1–2μ thick; normally from 2–4 bordered pits in one horizontal series on the tracheid side of the crossfield, apertures small-elliptic, horizontal to diagonal; indentures rare and inconspicuous; ray cells rarely resinous. Tracheid pitting uniseriate to biseriate in early wood; crassulae distinct. Rays 1–14 cells high, occasionally partly biseriate; ray cells long-elliptic, hexagonal, or squared in cross section. Wood parenchyma usually abundant, scattered, transverse walls entire; transition gradual to moderately abrupt. Radial diameter of early tracheids, 30–70μ; tangential diameter, 20–55μ; radial diameter of late tracheids, 7–15μ; tangential diameter, 25–55μ. Wall thickness of early tracheids, 1½–3μ; of late tracheids, 3–6μ.

Taiwania

Normal ray tracheids absent; transverse walls of ray cells 1–3μ thick, primary pit-fields present; tangential walls ½–2μ thick; radial walls 1–2½μ thick; normally 2–4 bordered pits in one horizontal series on the tracheid side of the crossfield, borders circular, apertures lenticular, often slit-like in early wood, diagonal to vertical (Fig. 12); indentures present and pronounced; ray cells usually non-resinous. Tracheid pitting usually biseriate in early wood; crassulae distinct. Rays 1–24 cells high, occasionally partly biseriate; ray cells long-elliptic to hexagonal in cross section. Wood parenchyma moderately abundant, scattered; transverse walls entire; transition gradual to moderately abrupt. Radial diameter of early tracheids, 35–70μ; tangential diameter, 25–50μ; radial diameter of late tracheids, 10–18μ; tangential diameter, 25–50μ. Wall thickness of early tracheids, 2–5μ; of late tracheids, 5–10μ.

Cunninghamia

Normal ray tracheids absent; transverse walls of ray cells 1–3μ thick, primary pit-fields numerous; tangential walls ½–1½μ thick; radial walls 1–3μ thick; normally 2–4 pits in one horizontal series on the tracheid side of the crossfield, often simple in early wood, apertures elliptic and diagonal, occasionally circular; indentures regularly present in early wood, sporadic in late wood; ray cells rarely resinous. Tracheid pitting uniseriate to occasionally multiseriate in early wood; crassulae distinct. Rays 1–24, occasionally 30, cells high, often partly biseriate; ray cells long-elliptic to hexagonal in

cross section. Wood parenchyma abundant, scattered; transition moderately abrupt. Radial diameter of early tracheids, 35–85μ; tangential diameter, 30–60μ; radial diameter of late tracheids, 10–18μ; tangential diameter, 30–60μ. Wall thickness of early tracheids, 1½–4μ; of late tracheids, 4–8μ.

Discussion

Bailey and Faull (1934) demonstrated in an intensive study of the Redwood the wide limits of variation to be encountered in the structure of wood. With this problem in mind it was found that among the diagnostic characters studied, several were particularly inconstant.

The distribution of wood parenchyma is of little taxonomic value; the cells are arranged in no order, occurring in early wood, at the transition, in late wood, and at the end of the growth ring. This condition is commonly referred to as "scattered," in contrast to the somewhat indefinite and usually unreliable "tangential bands" of wood parenchyma.

The transition from early to late wood is another feature subject to the greatest variation, since it is controlled almost completely by climatic conditions. A single slide may show the three principal types of transition: gradual, moderately abrupt, and extremely abrupt.

The usual amount of dimensional variation was encountered in the tracheid measurements of such genera as *Taxodium*, *Sequoia*, *Glyptostrobus*, and *Cunninghamia*. In one slide of *Sequoia* the radial depth of early tracheids was found to vary between 30μ and 100μ. Since these measurements were made of the radial sections, it cannot be contended that the narrower terminal portion of a tracheid had furnished the smaller figure, as might well have been the case had the transverse cut been employed.

The height of rays, as reckoned either in microns or in the number of cells, has been shown to be of small value taxonomically (Essner, 1883). However, definite tendencies can be observed toward the formation of low rays (maxima ranging approximately 8–12 cells) and of extremely high rays (maxima ranging up to 60 cells). These tendencies toward extremes can be assigned a certain diagnostic value; in the

Taxodiaceae they may be associated respectively with *Sciadopitys* and *Taxodium*.

The study of ray cell origin led Bannan (1934) to the discovery of ray tracheids in several genera of Taxodiaceae reported not to possess them by Holden (1913). These were almost exclusively limited to the place of origin of the ray, whether next the pith or in later wood. The occurrence of ray tracheids in *Sequoia* has been previously noted by Gordon (1912) and Belyea (1919). As Fig. 1 clearly shows, these cells cannot be regarded as responses to wound stimuli, such as those reported in *Cunninghamia* by Jeffrey (1908). Nor is their occurrence limited to the earliest formed cells of the ray. They must instead be regarded as normal cells of the ray, forming long after the ray is fully established.

In the matter of crossfield pitting, the only departures from the general rule are found in *Cryptomeria* and *Cunninghamia*. In these genera the early wood pits are somewhat transitional between those of *Taxodium* and those of *Glyptostrobus*, some possessing distinct borders and others clearly simple. However, while the individual pits frequently resemble those of the latter, the crossfields themselves differ in possessing usually a single tier of pits. The crossfields of *Glyptostrobus*, besides consisting of simple pits, are further characterized by the usual occurrence of two tiers on internal as well as marginal ray cells (Fig. 10).

With reference to the transverse walls of wood parenchyma cells, there is slight variation. This takes the form of occasional inconspicuous thickenings in the genus *Cunninghamia*. These do not resemble the regular and coarse simple pits in *Taxodium*, nor the less frequent, though similar, pits found in *Glyptostrobus* and *Cryptomeria*. They are, rather, slightly thickened central portions of a normally thin and entire wall, and their occurrence is rare.

Phylogenetically speaking, the nature of the crossfields is perhaps the most important family character of the Taxodiaceae. All genera but two possess the same general type of crossfield; those of *Glyptostrobus* constitute a slight modification, while the position of *Sciadopitys* is rendered distinctly less definite by this character.

The coarse simple pits on the transverse walls of wood parenchyma cells distinguish *Taxodium* (Figs. 7, 8), in their regularity of occurrence, from the remaining genera. Closely related in this respect are *Glyptostrobus* and *Cryptomeria*, exhibiting the same characteristic pits, but only occasionally and then not as many per wall. *Cunninghamia* is the only other genus in which this feature appears, where it is greatly reduced and rare. The remaining genera, lacking such pits or thickenings altogether, form a singularly homogeneous group: *Sequoia*, *Athrotaxis*, and *Taiwania*. With this characteristic occurring in great paucity, *Cunninghamia* constitutes a link between the two groups.

Sequoia and *Athrotaxis* are further similar in their lack of indentures (Fig. 2), while *Cunninghamia* and *Taiwania* (Fig. 3) possess them with regularity.

The monotypic *Sciadopitys* is distinct from the other members of the family in four major features: the absence of wood parenchyma; a type of crossfield pitting (Fig. 9) matched in *Pherosphaera* and *Phyllocladus* (Slyper, 1933), and *Microcachrys* (Record, 1935), all of podocarp affinities; noticeably smaller tracheids in cross section; and, a corollary of the latter, uniseriate tracheid pitting. The foregoing essentials of the anatomy of this genus have been previously reported (Peirce, 1935), and are suggested as further evidences in support of the proposal of Arnoldi (1901) and Buchholz (1933) to elevate the genus to the rank of a family.

Fitzpatrick (1929) classifies *Cunninghamia* and *Taiwania* with the araucarians largely on the basis of leaf characters. This contention has long existed, but has lost considerable ground among the majority of modern morphologists. It is now generally accepted that *Agathis* and *Araucaria* constitute a distinct group, the Araucariaceae. The latter view is definitely supported by anatomical evidence, since the araucarian tracheid pitting is a distinct type found, among living conifers, only in these two genera. The wood structure of *Cunninghamia* and *Taiwania* strongly confirms their position in the Taxodiaceae.

In a recent communication, Professor R. B. Thomson expressed the opinion that *Athrotaxis laxifolia* is a variety of *A. cupressoides*. Unfortunately, the material of these forms was too limited to allow any positive statement regarding the affinity implied.

Summary

The study of samples of all species commonly recognized in the Taxodiaceae reveals certain relationships which lend themselves readily to the construction of a diagnostic key. *Taxodium*, *Glyptostrobus*, and *Cryptomeria* constitute a closely related group on the basis of coarse simple pits on the transverse walls of wood parenchyma cells; *Sequoia*, *Athrotaxis*, and *Taiwania* combine to form a second group with entire walls. *Cunninghamia* links these distinct groups in possessing slight thickenings in rare instances.

A particularly homogeneous type of crossfield is found throughout the family, with the exception of *Glyptostrobus* and *Sciadopitys*. Those of the former are patently modifications of the general type and afford a reliable distinction between the American and oriental Bald Cypresses. The crossfields of *Sciadopitys* are unique in being matched, not in the Taxodiaceae, but in such podocarp genera as *Pherosphaera*, *Phyllocladus*, and *Microcachrys*.

The retention of *Sciadopitys* in the Taxodiaceae is questioned on the basis of four major anatomical features: absence of wood parenchyma; a distinct type of crossfield pitting; smaller tracheids in cross section; and uniseriate early tracheid pitting.

Variability studies revealed that distribution of wood parenchyma, nature of the transition, radial depth of early tracheids, and ray height are restricted in various degrees as to their utility in the diagnosis of this family.

I acknowledge my gratitude to Professor JOHN T. BUCHHOLZ, University of Illinois, for his many criticisms and suggestions during this investigation. To Professor SAMUEL J. RECORD, Yale University School of Forestry, I am indebted for the majority of wood specimens; other samples were obtained through the kindness of Mr. LLEWELYN WILLIAMS, Field Museum of Natural History, and Professor R. B. THOMSON, University of Toronto.

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Explanation of Figures

Fig. 1. *Sequoia gigantea*. Two ray tracheids in the lower tier of cells. Radial, ×450.

Fig. 2. *Sequoia sempervirens*, showing absence of indentures. Radial, ×375.

Fig. 3. *Taiwania cryptomerioides*. Indentures are prominent. Radial, ×525.

Fig. 4. *Sequoia sempervirens*, illustrating the biseriate condition of a high percentage of the rays of this genus. Tangential, ×110.

Fig. 5. *Taiwania cryptomerioides*. Plasmodesma in face view of tangential wall of ray cell. Tangential, ×550.

Fig. 6. *Cunninghamia Konishii*. Smooth transverse walls of wood parenchyma cells. Tangential, ×450.

Fig. 7. *Taxodium distichum*, with typically coarse pitting on the transverse walls of wood parenchyma cells. Tangential, ×450.

Fig. 8. Same, with pits in face view. Transverse, ×450.

Fig. 9. *Sciadopitys verticillata*. Note the large elliptic apertures of the crossfield pits, inclined diagonally. Radial, ×450.

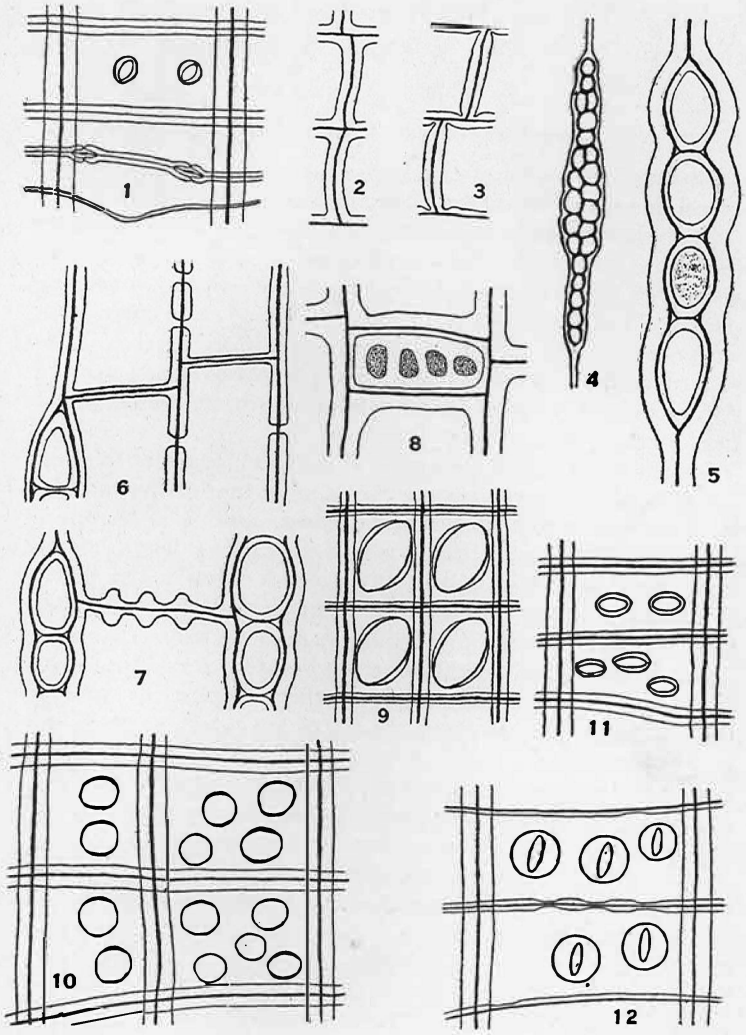
Fig. 10. *Glyptostrobus pensilis*, showing the irregular distribution of simple and slightly bordered pits on the crossfields. Radial, ×450.

Fig. 11. *Sequoia gigantea*, with crossfields typical of the Taxodiaceae. Radial, ×450.

Fig. 12. *Taiwania cryptomerioides*, showing circular pit-borders and nearly vertical slit-like apertures, a slight modification of the foregoing type. Radial, ×550.

SECOND INTERNATIONAL FORESTRY CONGRESS

The first International Forestry Congress was held in Rome in 1926 and the second will convene in Budapest September 10–14, 1936. Preparations for the Congress are in the hands of the Central Committee of Organization appointed by the Ministry of Agriculture, Kossuth Lajos-ter 11, Budapest V, Hungary.



Figs. 1–12. Drawings showing structural details of the rays and wood parenchyma in Taxodiaceae.

RELATION BETWEEN FIBRE AND CAMBIAL INITIAL LENGTH IN DICOTYLEDONOUS WOODS

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During the past two years I have measured many fibres and vessel members in dicotyledonous woods. Dr. Chalk and I (*2, 3*) published some deductions from a study of comparative lengths of vessel members but at that time no consideration was given to fibre length. Later on while we were scrutinizing our fibre measurements and those by Bailey (*1*), in connection with the work for the committee of the International Association of Wood Anatomists considering terms of size, I noticed an unexpected relation between fibre length and vessel member length in woody dicotyledons.

It has already been shown (*1*, *2*) that the length of the vessel members is approximately the same as that of the cambial initials from which they were derived, and it is therefore permissible to assume that it is also the original length of the fibre initials, that is, before any extension has taken place. Comparison of the means of fibre length and vessel member length shows that the mature fibres may be from 1.1 to 9.5 times their original length, but the greater elongations only occur where the cambial initials are short. Where the cambial initials themselves are long the fibres are rarely as much as half as long again.

In order to investigate this point further, the following procedure was adopted: The mean fibre lengths in specimens of 276 genera from 111 different families were grouped according to the length of their cambial initials, as indicated by the vessel member length, and the mean fibre length was obtained for each group. The means of each group are given in columns 1 and 2 of the accompanying table. Column 3 indicates the extension of the fibres, expressed as the ratio of fibre length to cambial initial length. This table shows that in woods with short cambial initials the fibres are approximately 2.5 to 3.5 times their initial length, while in woods with longer cambial initials they are only 1.2 times their initial length.

RELATION BETWEEN FIBRE LENGTH AND CAMBIAL INITIAL LENGTH

(1) Mean cambial initial length (*MCIL*)	(2) Mean fibre length (*MFL*)	(3) Ratio $\frac{MFL}{MCIL}$	(1) Mean cambial initial length (*MCIL*)	(2) Mean fibre length (*MFL*)	(3) Ratio $\frac{MFL}{MCIL}$
150	548	3.65	1350	1871	1.38
250	882	3.52	1450	2410	1.66
350	950	2.72	1550	1970	1.27
450	1038	2.30	1650	2520	1.53
550	1127	2.05	1750	2608	1.49
650	1163	1.78	1850	—	—
750	1300	1.73	1950	2450	1.25
850	1370	1.61	2050	2466	1.20
950	1463	1.54	2150	—	—
1050	1530	1.46	2250	2712	1.20
1150	1828	1.58	2350	—	—
1250	1804	1.44	2450	2979	1.19

Mean fibre length and mean cambial initial length have been plotted in Fig. 1. The relation between them appears to be a straight line, and can be represented by the formula $Y = 0.98X + 550$, where Y represents the fibre length and X the cambial initial length in μ. The majority of the woods measured have cambial initials of between 250 and 1250 μ, and within these limits the points on the graph represent a large number of genera; for some of the higher values, however, only one or two genera were available, and the points are more scattered and consequently show more divergence from the straight line.

This relation is illustrated in a different way in Fig. 2, in which fibre length is plotted against the extension the fibres have undergone, expressed as the ratio of fibre length to the length of the cambial initial. This shows a steady ratio with the longer cambial initials and a sharp rise with the shorter ones.

An adequate explanation of this phenomenon is not possible until we have a much better understanding of all the factors involved in the extension of a cell to as much as 9.5 times its

initial length (*1*). It has been shown (*4*) that woods with short vessel members are as a whole more specialized than those with long ones, and from the above data it appears that a greater proportional extension of the fibres is also a feature of

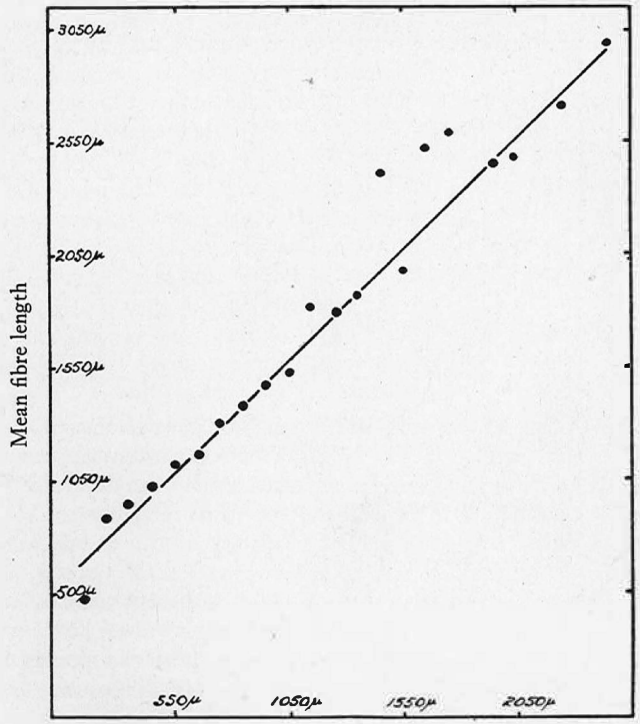

Fig. 1. Relation between mean fibre length and mean cambial initial length.

the more specialized woods. The elongation of the fibres has been ascribed to the pressure exerted by the swelling vessels, but if that is the sole cause it is evident that other factors besides vessel diameter may be involved, such as the number of vessels, the resistance offered by rays and parenchyma, and the relative volumes of vessels and fibres. It is also possible that mechanical efficiency may set a limit to the length of the

fibres. I am at present unable to undertake the far-reaching investigation necessary to answer these questions, but I have thought it worth while to record the existence of the relation between the lengths of fibres and cambial initials, even without offering any explanation.

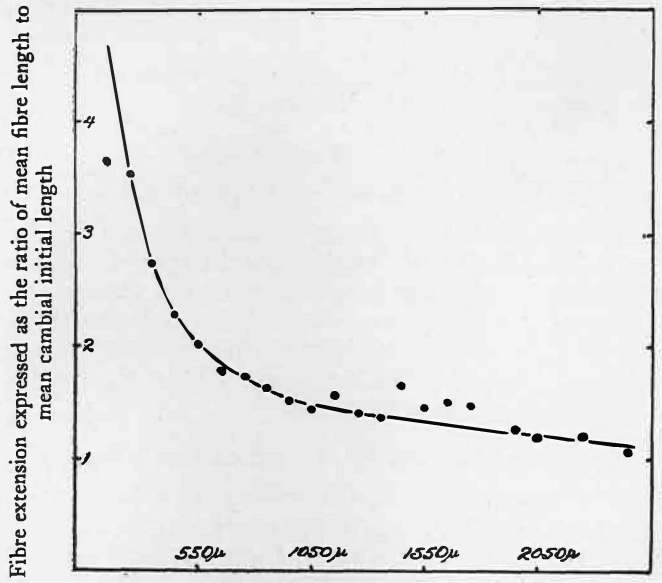

Fig. 2. Relation between fibre extension and cambial initial length.

Summary

Mean fibre length may be 1.1 to 9.5 times the mean length of the cambial initial. Elongation to several times the length of the initial only takes place where the initials are short. The relation between fibre and cambial initial length is shown graphically.

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TYPES OF VESSEL PERFORATIONS IN KOREAN WOODS

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In the identification of dicotyledonous woods, one of the most reliable histological characters is the type of the vessel perforations. This feature has been studied in 285 species of Korean hardwoods and the results for the different families and genera are tabulated below. Five families, namely, Betulaceae, Fagaceae, Saxifragaceae, Euphorbiaceae, and Caprifoliaceae, appear in both lists.

Perforations Exclusively or Predominantly Simple

The following list includes 90 genera of 34 families. The perforations were found to be exclusively simple in all but four families, namely, Betulaceae, Fagaceae, Lauraceae, and Pomaceae. The eight genera indicated by an asterisk exhibit tendencies to the scalariform type of multiple perforations.

Salicaceae
- Chosenia
- Populus
- Salix

Juglandaceae
- Juglans
- Platycarya

Betulaceae
- Ostrya
- Carpinus*

Ulmaceae
- Aphananthe
- Celtis
- Hemiptelea
- Ulmus
- Zelkova

Moraceae
- Broussonetia
- Cudrania
- Morus

Berberidaceae
- Berberis

Fagaceae
- Quercus
- Shiia *
- Castanea

Lauraceae
- Actinodaphne *
- Benzoin *
- Cinnamomum *
- Machilus *
- Malapaenna *

Saxifragaceae
- Deutzia
- Philadelphus

Pittosporaceae
- Pittosporum

Pomaceae
- Amelanchier
- Crataegus *
- Malus
- Micromeles

Pyrus
Pourthiaea
Pseudocydonica
Raphiolepis
Sorbus
SPIRAEACEAE
Sorbaria
DRUPACEAE
Prunus
LEGUMINOSAE
Albizzia
Gleditschia
Maackia
Robinia
Styphnolobium
Cercis
Lespedeza
RUTACEAE
Evodia
Fagara
Phellodendron
Zanthoxylum
Poncirus
Citrus
SIMARUBACEAE
Ailanthus
Picrasma
MELIACEAE
Melia
Toona
EUPHORBIACEAE
Excoecaria
Mallotus
Securinega
ANACARDIACEAE
Rhus
CELASTRACEAE
Euonymus
ACERACEAE
Acer
SAPINDACEAE
Sapindus
RHAMNACEAE
Frangula
Hovenia
Rhamnella
Rhamnus
Sageretia
Zizyphus
TILIACEAE
Grewia
Tilia
FLACOURTIACEAE
Idesia
Myroxylon
ELAEAGNACEAE
Elaeagnus
ARALIACEAE
Acanthopanax
Aralia
Eleutherococcus
Textoria
Kalopanax
EBENACEAE
Diospyros
OLEACEAE
Chionanthus
Forsythia
Fraxinus
Ligustrum
Syringa
VERBENACEAE
Callicarpa
Clerodendron
SCROPHULARIACEAE
Paulownia
BIGNONIACEAE
Catalpa
RUBIACEAE
Adina
CAPRIFOLIACEAE
Sambucus

Perforations Exclusively or Predominantly Multiple

The list below includes 31 genera of 17 families. Some simple perforations in association with the multiple (normally scalariform) types were observed in five genera (indicated by an asterisk) of the four families Fagaceae, Sabiaceae, Ericaceae, and Caprifoliaceae. Reticulate perforation plates are of rare occurrence in *Myrica* (Myricaceae) and *Daphniphyllum* (Euphorbiaceae).

MYRICACEAE
Myrica
BETULACEAE
Alnus
Betula
Corylus
FAGACEAE
Fagus *
MAGNOLIACEAE
Illicium
Magnolia
SAXIFRAGACEAE
Ribes
HAMAMELIDACEAE
Distylium
EUPHORBIACEAE
Daphniphyllum
BUXACEAE
Buxus
AQUIFOLIACEAE
Ilex
STAPHYLEACEAE
Staphylea
Euscaphis

SABIACEAE
Meliosma *
THEACEAE
Camellia
Eurya
Freziera
Stewartia
Taonabo
CORNACEAE
Aucuba
Cornus
Cynoxylon
Macrocarpium
ERICACEAE
Rhododendron
Vaccinium *
SYMPLOCACEAE
Symplocos
STYRACACEAE
Styrax
CAPRIFOLIACEAE
Diervilla *
Lonicera *
Viburnum

The perforation plates of *Illicium* (Magnoliaceae), *Daphniphyllum*, and *Eurya* (Theaceae) were unusually long. For example, a plate in *Eurya japonica* Thunb. measured 560 μ, and it is not unlikely that still longer ones exist.

OCCURRENCE OF RAPHIDES IN WOOD

By ROBERT W. HESS[1]

Needle-like crystals of calcium oxalate, which De Candolle (1827) termed raphides (from the Greek word meaning needle), are of rather wide distribution in the parenchymatous tissues of dicotyledonous plants. The crystals lie parallel to each other, forming sheaf-like bundles, each bundle being imbedded in a mucilaginous substance occupying a large vacuole of the cell. The form of crystal, whether tetragonal or monoclinic, is said to depend upon the degree of concentration of the mother liquor from which it was separated.

The development of inorganic crystals in tissues that soon cease to be functional, such as pith, cortex, and secondary phloem, indicates that they may be formed as a waste product of metabolic processes. Eames and MacDaniels (*Introduction to plant anatomy*, 1925, pp. 15, 17) suggest the possibility that raphides, where they occur in tissues filled with food and in aquatic plants which are otherwise mechanically unprotected, may afford some defense against snails and other small animals. Whether or not they have any protective value in wood, they sometimes occur in such abundance, as in some of the Nyctaginaceae, as to impart a silvery gray color to a

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freshly sawed surface and to be detectable by their acrid taste.

Raphides often occur in the phloem when they are absent from the xylem, and it is not uncommon to find them in the pith also; if they do appear in the wood the bundles are usually fewer than in the phloem. When the dry bark was broken from a specimen of *Bougainvillea glabra* Choisy (Y. 29677), the raphides remaining on the exposed surface of the stem were so numerous as to appear under the lens as laminated silvery scales. The internal phloem of the Nyctaginaceae (*Neea*, *Pisonia*, *Torrubia*, etc.) often contains an abundance of raphides which, owing to their comparatively large size, may be clearly discernible with a lens.

The bundles contain many crystals closely packed together, the ends usually even, but sometimes rounded or ragged. According to De Bary (*Comparative anatomy*, 1884, p. 138), raphides vary both in length and direction in rare instances, such as in the cortex of many species of *Aloe*, *e.g.*, *A. arborescens*, and in the parenchyma of *Mirabilis*. He also refers to the minute raphides which completely fill the numerous crystal sacs of the Cinnamon-bark of Ceylon, so that in transmitted light it appears to have a densely granular content.

The occurrence of raphides in the secondary xylem appears to be confined to the thin-walled mucilage-containing parenchyma cells. According to De Bary (*loc. cit.*, p. 139), the bundles lie at first within a protoplasmic utricle and are enclosed, when mature, by a rather thick layer of homogeneous, transparent mucilage, which in turn is surrounded by a slightly thickened cellulose wall. The mucilage cells may be enlarged or of normal size, and the type appears to be consistent for a given species and often for the genus. *Tetramerista glabra* Miq. (Y. 6316, 8225, 12633, 28909) has raphides enclosed in procumbent ray cells that are considerably enlarged. Some species of *Psychotria*, *Marcgravia*, *Tetracera*, and *Saurauia* have noticeably enlarged mucilage cells enclosing these crystals. The wood parenchyma cells of *Saurauia* spp. are commonly enlarged when mucilaginous and containing raphides, the bundles in *Saurauia rubicunda* (A. Gray) Seem.

(Y. 25714) reaching a maximum length of 610μ (average 298μ). The range in size of the bundles is indicated by comparing those found enclosed in the squarish (not enlarged) ray cells of *Leea Brunonia* C. B. Clarke (Y. 20357), which have a maximum length of 43μ and a minimum of 24.7μ (average 35μ).

Other forms of crystals often occur along with raphides, though not in the same cells. The rays in *Leea Brunonia*, referred to above, also contain many rhombohedral crystals, often in cells adjoining those containing the raphides crystals. Solereder (*Systematic anatomy of the dicotyledons*, p. 1104) gives the chief combinations as raphides and clustered crystals, or raphides and styloids, and adds that, when regarded from a systematic point of view, styloids commonly replace raphides.

Raphides were found only in the wood parenchyma cells in *Saurauia* and *Morinda*, and only in the ray cells of *Straussia*, *Gillespiea*, *Calycosia*, *Calycodendron*, *Marcgravia*, *Greyia*, *Curatella*, *Dillenia*, *Wormia*, *Tetracera*, *Tetramerista*, *Leea*, *Tetrastigma*, and *Vitis;* in some instances, *e.g.*, *Calycodendron*, *Calycosia*, *Gillespiea*, and *Straussia*, they seem to be confined to the upright ray cells. In *Faramea* and *Psychotria* they occur either in the ray cells or in the wood parenchyma cells, or both. They were found in the included phloem or conjunctive tissue of *Phytolacca*, *Neea*, *Pisonia*, *Doliocarpus*, *Bougainvillea*, *Calpidia*, *Colignonia*, *Torrubia*, and *Fevillea*. In some woods they may be in the parenchyma strands associated with the phloem as well as in the included phloem itself. The location of the bundles was not definitely determined in *Cissus sicyoides* L. (Y. 29697, 29698).

The work of Solereder (*loc. cit.*) on crystalline elements refers mainly to the leaves, bark, and pith, and not the woody axis, though the presence of raphides in those parts suggests their possible occurrence in the wood also. According to that authority (p. 1106), "bundles of raphides are found in Dilleniaceae, Ternstroemiaceae (Marcgravieae and Saurauieae excl. *Stachyurus* and *Pelliciera*), Geraniaceae, Rutaceae, Zygophylleae (*Peganum*), Ochnaceae (*Tetramerista*), Ampelidaceae, Melianthaceae, Hydrangeae (Saxifragaceae), Onagrarieae (excl. *Trapa*), Ficoideae, Rubiaceae, Gesneriaceae

(*Napeanthus ripens* J. D. Smith!), Nyctagineae, Phytolaccaceae (Euphytolacceae and *Agdestis*), Urticeae (*Laportea*), Thelygoneae."

Descriptions of the Woods Containing Raphides

Fevillea (Cucurbitaceae)

Woody vines. Large rays divide the stem dichotomously. Ground mass of the wood is composed mostly of large, solitary pores and paratracheal parenchyma. Vessel perforations simple; vessel-parenchyma pitting with a tendency to scalariform.

Material. Raphides apparently confined to rays in the only specimen available, namely, *Fevillea cordifolia* L. (Y. 7098).

Dilleniaceae

Woods reddish to brick-red in color; hard and heavy, or moderately so. Pores mostly solitary, without definite arrangement. Vessels with either exclusively scalariform perforation plates or in part simple and part scalariform. Some of the rays large and conspicuous; heterogeneous. Parenchyma sparingly developed, mostly diffuse. Wood fibers with distinctly bordered pits. Some members, *e.g.*, *Doliocarpus*, are lianas with included phloem in concentric bands. In a study of the woods of 22 species of six genera, raphides were found in eight species of five genera, all belonging to the sections Tetracereae and Dillenieae.

Material. Raphides found only in ray cells in *Curatella americana* L. (Y. 814, 7584); *Dillenia reticulata* King (Desch slide No. 1638); *Tetracera Boivinana* Baill. (Y. 29962); *Wormia* sp. (Y. 10978), *W. biflora* (A. Gray) Seem. (Y. 25674, 25835, 28327), *W. excelsa* Jack. (Y. 30025, 30026, 30027), *W. pulchella* Jack. (Desch slide No. 1662), *W. triquetra* Rottb. (Y. 9807). Raphides found only in included phloem and conjunctive tissue in *Doliocarpus* sp. (Y. 8831).

Greyiaceae

Wood brownish in color. Pores numerous, mostly in irregular groups, nested, or in radial or tangential rows or multiples. Rays nearly all coarse, wide, medium height; cells very large and irregular, not sharply demarcated from the surrounding cells; heterogeneous. Vessel perforations simple; vessel-ray pitting scalariform. Parenchyma abundant, without definite pattern. Wood structure storied, except rays.

Material. Raphides confined to ray cells in *Greyia Sutherlandii* Hk. & Hrv. (Y. 15571) collected with herbarium material in Natal by F. N. Howes, Kew Gardens.

Marcgraviaceae

Sourouba

Pores scattered; mostly solitary, widely variable in size. Vessel perforations scalariform and simple. Intervascular and vessel-ray pits numerous, minute and bordered. Parenchyma sparingly developed, paratracheal. Rays large and coarse. Ray cells not sharply defined on cross section; mostly, or entirely upright or square. Wood fibers have numerous minute slit-like pits; largely septate.

Material. Raphides found in the ray cells of *Marcgravia* sp. (Y. 16689) *M. rectiflora* Tr. & Pl. (Y. 7275, 7451, 10492).

Nyctaginaceae

Woods often yellowish or brown. Included phloem of the island type or sometimes forming more or less definite concentric bands. Vessels small and in radial rows—an island of included phloem often just outside of each row, giving a mushroom design on cross section. Vessel-parenchyma pits very small, bordered. Rays fine, often uniseriate or biseriate; heterogeneous. Wood structure storied in some genera. All of the 37 species of 7 genera studied contained raphides. Often the crystal bundles are very large and easily visible with the lens. In almost all cases the raphides were very numerous.

Material. Raphides were found in the parenchyma associated with included phloem (occasionally also in the ray cells in *Bougainvillea*) in *Bougainvillea* sp. (Y. 28982), *B. glabra* Choisy (Y. 29677), *B. spectabilis* Willd. (Y. 2410, 9898), *Calpidia Nishimuvae* R. & W. (Y. 9897), *Colignonia ovalifolia* Hiemerl (Y. 16909), *Neea amplifolia* Donn. Smith (Y. 10537, 12109), *N. divaricata* Poepp. & Endl. (Y. 19076, 19099), *N. floribunda* Poepp. & Endl. (Y. 18546, 18651), *N. laetevirens* Standl. (Y. 12272), *N. macrophylla* Ekman (Y. 19634), *N. parviflora* Poepp. & Endl. (Y. 18375), *N. Pittieri* Standl. (Y. 10158), *N. psychotrioides* Donn. Smith (Y. 12177, 12205), *N. Spruceana* Heimerl (Y. 17382, 18849), *N. subpubescens* Heimerl (Y. 19071, 19073), *N. urophylla* Standl. (Y. 12178), *Pisonia aculeata* L. (Y. 22535), *P. albida* (Heimerl) Britton (Y. 580), *P. excelsa* Bl. (Y. 31361, 31362), *P. grandis* R. Br. (Y. 24303, 26848, *P. inermis* Jacq., var. *leiocarpa* Forst. Hbd. (Y. 1875), *P. ligustrifolia* Heimerl (Y. 7765), *P. macranthocarpa* Donn. Smith (Y. 10072), *P. subcordata* Sw. (Y. 3076), *P. sylvestris* T. & B. (Y. 31360, 31360A), *P. umbellifera* (Forst.) Seem. (Y. 28054, 29483), *P. zapallo* Gris. (Y. 23526), *Rockia sandwicensis* (Hillebr.) Heim. (Y. 1877), *Torrubia discolor* (Spreng.)

Britt. (Y. 4836, 16724), *T. fragrans* (Dum. Cours.) Standl. (Yale 20516, 20885), *T. longifolia* (Heimerl) Britton (Y. 5225), *T. myrtiflora* Standl. (Y. 18683), *T. noxia* (Netto) Standl. (Y. 22616), *T. obtusata* Jacq. (Y. 16153), *T. Olfersiana* (Link, Kl. & Otto) Standl. (Y. 22503), *T. pacurero* (H.B.K.) Standl. (Y. 23917), *T. Riedeliana* (Fisch.) Standl. (Y. 23954), *T. rufescens* (Gris.) Br. (Yale 19996).

Phytolaccaceae

Woods of two types, normal and anomalous. The latter, the only ones considered here, are typically light and soft, with included phloem in bands simulating growth rings. There are numerous rays of conjunctive tissue between which are large bands of large vessels arranged in radial rows, crowded. The large pores take up the major portion of the space between the radial strips of conjunctive tissue. Vessels with simple perforations. Vessel-parenchyma pits very large and elongated (somewhat gash-like), bordered. Wood fibers with simple pits.

Material. Six species of three genera were studied, but raphides were found only in the conjunctive tissue of *Phytolacca dodecandra* L'Hér. (Y. 29432).

Rubiaceae

Woods occasionally bright-colored, pink or orange, but mostly dull light-brown or creamy; usually fine-textured; moderately hard to hard. All rays fine, only in part visible to the unaided eye; heterogeneous. Vessels of mature wood typically with simple perforations and without spirals; vessel-parenchyma pits of the same size and shape as the intervascular; all pits are *vestured*. Wood fibers with simple or indistinctly bordered pits. Wood parenchyma sparingly developed or sometimes abundant, as in *Morinda*.

Material. Of 117 species of 50 genera examined, 49 species of 8 genera were found to contain raphides. Only 10 species of *Psychotria* were examined, all of which were found to have raphides. In the following woods they were seen only in the wood parenchyma cells of *Morinda* and *Prismatomeris*, in the rays and sometimes in the wood parenchyma or both in *Psychotria*, in rays only in the others. *Calycodendron Gibbsiae* (S. Moore) A. C. Smith (Y. 27985, 28403), *C. glabrum* (Turrill) A. C. Smith (Y. 25597), *C. magnificum* (Gillespie) A. C. Smith (Y. 27895), *C. Milnei* (A. Gray) A. C. Smith (Y. 28407), *C. pubiflorum* (A. Gray) A. C. Smith (Y. 28398), *C. turbinata* (A. Gray) A. C. Smith (Y. 25678), *Calycosia lageniformis* (Gillespie) A. C. Smith (Y. 25746), *C. petiolata* A. Gray (Y. 25633, 27811), *Faramea amplifolia* Standl. (Y. 17617, 17733), *F. anisocalyx* P. & E. (Y. 17723), *F. bullata* Standl. (Y. 12126), *F. capillipes* Muell. (Y. 17579), *F. cestroides* Standl. (Y. 20915),

F. longifolia Benth. (Y. 23847), *F. maynensis* Spruce (Y. 17784), *F. occidentalis* (L.) A. Rich. (Y. 9725, 9860), *F. quinqueflora* P. & E. (Y. 19256), *F. rectinervia* Standl. (Y. 18074), *F. salicifolia* Presl (Y. 12215), *F.* aff. *scalaris* Standl. (Y. 6758, 6914), *Gillespiea speciosa* A. C. Smith (Y. 27792, 27833), *Morinda bracteata* Roxb. (Y. 2432, 2440), *M. bucidifolia* A. Gray (Y. 28263), *M. citrifolia* L. (Y. 1503, 4812, 20368), *M. Forsteri* Seem. (Y. 26497, 26498), *M. geminata* DC. (Y. 15307), *M. latibracteata* Val. (Y. 26826), *M. lucida* Benth. (Y. 19771), *M. myrtifolia* A. Gray (Y. 27695), *M. panamensis* Seem. (Y. 1519, 7428), *M. tinctoria* Roxb. (Y. 19467), *M. trimera* Hill. (Y. 21205), *Prismatomeris albidiflora* Thw. (Y. 31122, 31123), *Psychotria alba* R. & P. (Yale 19108, 19131), *P. Berteriana* DC. (Y. 1339, 7762), *P. Brackenridgii* A. Gray (Y. 25600, 25697, 25702), *P. Caldwelli* Gillespie (Y. 25826), *P. calycosa* A. Gray (Y. 28424), *P. carnea* (Forst.) A. C. Smith (Y. 25665, 28410), *P. carthaginensis* Jacq. (Y. 12199, 16410), *P. confertiloba* A. C. Smith (Y. 25670, 25734), *P. grandis* Swartz (Y. 10135, 10539), *P. mariana* Bartl. (Y. 20440), *Straussia hawaiiensis* Gray (Y. 1497), *S. kaduana* Gray (Y. 1905), *S. mariniana* Gray (Y. 21228, 26508), *S. oncocarpa* Hbd. (Y. 1504).

Saurauiaceae

Woods pale reddish brown in color, rather light but firm. Pores very small, very numerous, crowded, no special arrangement, open. Parenchyma diffuse, usually inconspicuous. Rays variable in different species from fine to broad and high; decidedly heterogeneous, procumbent cells very small. Vessel perforation plates scalariform, with many fine bars; pits to other vessels variable (in different species), small and round to large, elongated, and scalariformly arranged; pits to ray cells similarly variable. Wood fibers with numerous distinctly bordered pits. Ripple marks absent.

Material. Out of 14 species studied raphides were found in four named and five unnamed species: *Saurauia* spp. (Y. 16044, 16045, 20830, 20845, 29586), *S. pauciserrata* Hemsl. (Y. 10695), *S. purgans* B. L. Burtt (Y. 21164), *S. rubicunda* (A. Gray) Seem. (Y. 25714), *S. villosa* DC. (Y. 10030).

Tetramerista (Theaceae?)

Examination was made of 75 species of 19 genera of Theaceae, but raphides were found only in *Tetramerista*, a genus which from almost every point of view seems out of place in that family.

Wood yellowish brown, coarse textured, hard and heavy. Vessels in short radial rows; pores rather large, visible to the unaided eye. Parenchyma sparingly developed, diffuse or in

short tangential lines. Vessels have simple perforations; all pits minute. Rays very numerous, heterogeneous, 2 or 3 cells wide in the middle and with long uniseriate margins. Wood fibers exceedingly thick walled with very small, simple pits.

Material. Raphides, which occur only in enlarged procumbent ray cells, were found in all of the material of the genera available, namely, *Tetramerista glabra* Miq. (Y. 6316, 8225, 12633, 28909).

Laportea (Urticaceae)

Of the 40 species of 15 genera of Urticaceae examined, raphides were found only in *Laportea*, although other members of the family also contain strips or bands of unlignified parenchymous tissue resembling included phloem.

Pores large and scattered (not in definite radial rows as in Nyctaginaceae). Lignified wood parenchyma paratracheal and metatracheal, rather abundant; unlignified parenchyma (without phloem) in numerous, conspicuous strands. Vessel perforations simple; pits to parenchyma cells very large and irregular. Rays very high, heterogeneous. Ground mass of the wood composed almost entirely of libriform fibers. All elements, except rays, storied.

Material. Raphides found in unlignified parenchyma strips in *Laportea* sp. (Y. 12347), *L. gigas* Wedd. (Y. 5327, 11172), *L. Harveyi* Seem. (Y. 27652), *L. luzonensis* Warb. (Y. 12319), *L. saipanensis* Kanehira (Y. 20432), *L. stimulans* Miq. (Y. 31808, 31809, 31810); in ray cells also in *Laportea vitiensis* Seem. (Y. 27768, 28022, 28294).

Vitaceae

The members of the section Vitoideae are mostly woody vines, and consequently have a specialized structure, of which the numerous large vessels are the most conspicuous feature. The species of *Leea*, composing the section Leeoideae, are upright shrubs and trees, and their woods bear little resemblance to those of the other section and suggest some of the Dilleniaceae.

In the Vitoideae the vessel perforations are simple. Parenchyma is mostly confined to vascular sheaths; in *Cissus*, the ground mass between the sheathed vessels is composed of unlignified parenchyma which is likely to decay and leave the stem a mass of slender tubes. The vessel-parenchyma pit

pairs are large, irregular, half-bordered to simple, sometimes tending to scalariform arrangement. The rays are usually rather large to large. Raphides apparently confined to the rays in *Vitis* and *Tetrastigma*, and to the unlignified parenchyma in *Cissus*.

In *Leea* the pores are solitary or in small groups, uniformly distributed, not very numerous; vessel perforations simple; vessel-ray pit-pairs large, variable in form, with tendency to scalariform arrangement; tyloses abundant. Wood parenchyma sparingly developed. Rays of two sizes, some of them large and conspicuous; heterogeneous, with most of the cells square or upright. Raphides found only in the rays.

Material. Raphides not found in *Psedera;* present in *Cissus sicyoides* L. (Y. 29697, 29698), *Leea* sp. (Y. 28619), *L. angulata* Korth. (Y. 30549, 30550, 30551, 30552, 30553, 30554), *L. Brunoniana* C. B. Clarke (Y. 20357), *L. indica* (Burm. f.) Merrill (Y. 22856, 27769), *L. philippinensis* Merrill (Y. 29944), *L. sambucina* Willd., *L. tetramera* B. L. Burtt (Y. 22850), *Tetrastigma Lauterbachianum* Gilg (Y. 22697), *Vitis tiliaefolia* H. & B. (Y. 16776).

Key to Woods Containing Raphides

1 a. Woods with included phloem or unlignified parenchyma..... 2
1 b. Woods without included phloem..... 6

2 a. Included phloem in bands joined by large rays of conjunctive tissue. Ripple marks absent..... 3
2 b. Included phloem and unlignified parenchyma usually not in bands and not connected by large rays of conjunctive tissue. Ripple marks usually present..... 4

3 a. Wood fibers with large, distinctly bordered pits. *Doliocarpus* (Dilleniaceae).
3 b. Wood fibers with simple pits.....Phytolaccaceae.

4 a. Unlignified parenchyma comprising ground mass of wood. *Cissus* (Vitaceae).
4 b. Included phloem or unlignified parenchyma mostly of insular type. 5

5 a. Pores small, in short radial rows. Vessel-parenchyma pit-pairs small.....Nyctaginaceae.
5 b. Pores large, scattered. Vessel-parenchyma pit-pairs very large. *Laportea* (Urticaceae).

6 a. With broad or rather broad rays..... 7
6 b. Without broad rays..... 13

7 a. Ripple marks present..... 8
7 b. Ripple marks absent..... 9

8 a. Wood abnormal, being composed largely of vessels and rays; a vine.....*Tetrastigma* (Vitaceae).
8 b. Wood normal, with ground mass of wood fibers; a tree....Greyiaceae.

9 a. Woods abnormal, being composed mostly of large vessels and rays; vines..... 10
9 b. Woods normal, with ground mass of wood fibers; trees..... 11

10 a. Rays dividing the stem dichotomously.....*Fevillea* (Cucurbitaceae).
10 b. Rays not dividing the stem dichotomously.....*Vitis* (Vitaceae).

11 a. Wood fibers with conspicuously bordered pits. Parenchyma mostly diffuse.....Dilleniaceae.
11 b. Wood fibers with simple or indistinctly bordered pits..... 12

12 a. Vessel-ray pit-pairs large, irregular, tending to scalariform arrangement. Vessel perforations simple.....*Leea* (Vitaceae).
12 b. Vessel-ray pit-pairs minute, circular, alternate. Perforation plates scalariform in part.....Marcgraviaceae.

13 a. Perforation plates scalariform. Wood fibers with distinctly bordered pits.....Saurauiaceae.
13 b. Perforations simple. Wood fibers with simple or indistinctly bordered pits..... 14

14 a. Raphides confined to procumbent ray cells with convex transverse walls.....*Tetramerista* (Theaceae?).
14 b. Raphides in upright or square cells.....Rubiaceae.

Summary

Raphides are needle-like crystals of calcium oxalate occurring in mucilage cells in parenchymatous tissues of many dicotyledonous plants. They have been found in the woody stems of certain members of the families Cucurbitaceae, Dilleniaceae, Greyiaceae, Marcgraviaceae, Nyctaginaceae, Phytolaccaceae, Rubiaceae, Saurauiaceae, Theaceae, Urticaceae, and Vitaceae. A key is given for the identification of these woods.

DISSOLVING BIOLOGICAL PROVINCIALISM

"It appears significant that only a minority of the scheduled papers read before the systematics section [of the American Association for the Advancement of Science at the St. Louis meeting last Dec.–Jan.] were 'purely' taxonomic in character and interest. Taxonomy is properly an end achieved only through the integration of other fields of biological endeavor.

Highly stimulating, therefore, were the two symposia sponsored jointly by the systematics section of the Botanical Society of America and the Genetics Society of America on 'Contemporary Investigation of Taxonomic Concepts' and 'Species from a Genetic Viewpoint,' with . . . speakers representing the standpoints of anatomy, morphology, taxonomy, geographical distribution, cytology, genetics, and biometry. Such meetings of biologists upon common ground may not soon result in an all-inclusive formula for taxonomic concepts, but the surely resulting spirit of understanding and coöperation should prove to be a most effective agent in the dissolution of biological provincialism."—*Science*, Feb. 7, 1936, p. 129.

CURRENT LITERATURE

Notes on the flora of the Bermudas. By A. B. Rendle. *Journ. Bot. Brit. & For.* (London) 74: 42–50; 1 map; February 1936.

A brief account of the vegetation of Bermuda, as observed by the author during a visit in 1933. There are numerous references to the woody plants, among which are the endemic *Juniperus bermudiana*, *Sabal bermudana*, and *Elaeodendron Laneanum*.

Zur Kenntnis der westindischen Moraceen. II. By G. Rossberg. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 565–587; Dec. 6, 1935.

A detailed account of the *Ficus* species occurring in the West Indies, with a key for their determination, synonymy, and citation of recent collections. New species, from Cuba, are *F. havanensis*, *F. meizonochlamys*, and *F. Ekmanii*. Vernacular names are reported: *F. membranacea* Wright, Jagüey Hembra, Cuba; *F. aurea* Nutt., Figuier, Haiti; *F. jacquinifolia* A. Rich., Figuier-canelle, Haiti; *F. Brittonii* Boldingh, Maho, Bonaire; *F. suffocans* Gris., Jagüey de Lavar, Cuba.

A monograph of the genus *Callicarpa* as it occurs in America and in cultivation. By HAROLD N. MOLDENKE. *Repertorium Specierum Novarum* (Berlin-Dahlem) 39: 288–317; Jan. 31, 1936; 40:38–131; March 31, 1936.

This monograph of *Callicarpa* is the sixth in a series of the author's statistical and taxonomic studies of the Verbenaceae and Avicenniaceae. In the New World the genus is represented by 28 species, 20 of which occur in Cuba; in the Old World by 107 species and 11 varieties. The work includes a discussion of the genus, a key to the American and cultivated species, and a detailed account of each together with complete lists of the many specimens examined.

Catalogo de maderas Cubanas. By J. T. ROIG. Bull. No. 56, Estación Experimental Agronómica, Santiago de las Vegas, Cuba, June 1935. Pp. 77; 6 x 9¼; 1 plate.

The wood collection of the Agricultural Experiment Station at Santiago de las Vegas contains about 750 different samples, representing more than 400 distinct species of Cuban trees. There are 500 trunk sections designed to show the structure to best advantage, and 563 polished boards and 50 articles of turnery to demonstrate the natural attractiveness of color and grain. The collection has been carefully assembled and classified and is interesting and instructive to the public as well as to scientists. The catalog is arranged by families in natural order and contains the number of the specimen, the vernacular and botanical names, the source, the kind of sample, and the reference to the herbarium voucher. This is followed by separate indexes to the scientific and the common names, thus providing a convenient check list. At the end is a catalog of a special collection made and presented by Mr. G. C. Bucher, Santiago de Cuba, who also gave a duplicate set, with herbarium material, to the Yale School of Forestry. The author of this bulletin is Chief of the Section of Economic Botany and is well known for his various publications, especially his 900-page *Diccionario botanico de nombres vulgares Cubanos* (Havana, 1928).

Notes to accompany a vegetation map of northwest Mexico. By DONALD D. BRAND. Bull. 280, Univ. New Mexico (Albuquerque, New Mexico). Pp. 27; 6 x 9; 1 large map; Jan. 15, "1930." (The date of publication is an obvious error, 1936 being probably intended.)

The notes are explanatory of a vegetation map that covers the Mexican states of Sonora, Sinaloa, Chihuahua, and Durango. The vegetation areas recognized and described briefly are the following: Chihuahuan Desert, with (1) Creosote-Yucca Mesquite, (2) Mesquite-grassland, and (3) Succulent desert; Sierra Madre Occidental, of (1) Oak-Agave-Juniper and (2) Pine forest; Sonoran Desert, with the divisions (1) Colorado River Delta, (2) Creosote-Palo Verde-Cacti, (3) Sonoran Mesquite-grasslands, and (4) Subtropical Mimosaceae-Cacti; and Sinaloa tropical. It is to be hoped that the map is of higher quality and greater accuracy than the accompanying explanation, which bears every evidence of being superficial and is lacking in accuracy in a substantial number of instances.—P. C. STANDLEY.

New and noteworthy trees in Texas and Mexico. By C. H. MUELLER. *Bulletin of the Torrey Botanical Club* (Menasha, Wisconsin) 63: 147–155; March 1936.

Among the new trees described from Nuevo Léon, Mexico, are *Ulmus divaricata* Mueller; *Quercus olivicola*, *Q. microlepis*, *Q. monterreyensis*, *Q. cupreata*, *Q. runcinatifolia*, and *Q. tardifolia*, as well as several varieties of *Quercus*, all under the joint authorship of Mueller and Trelease.

Species novae vel minus cognitae ab A. A. Bullock descriptae. Reprint from *Hooker's Icones Plantarum* (London); pls. 3294–3299; 1935.

The reprint contains plates illustrating six Mexican plants, four of which are described as new. One plate illustrates *Hintonia latiflora*, var. *leiantha* Bullock. The new genus *Hintonia* (Rubiaceae) consists of four species of shrubs or small trees of Mexico and Guatemala, referred heretofore to *Coutarea: H. latiflora*, with its var. *leiantha* (vernacular name Copalche) here described as new; *H. Lumaeana; H. Standleyana* (*Cou-*

tarea latiflora Standl., non Sessé & Moc.); and *H. octomera*. *Bouvardia capitata* and *B. cataphyllaris* are described from the State of Mexico.—P. C. STANDLEY.

Investigaciones en las selvas virgenes del sur de la Península de Yucatán. By CARLOS C. HOFFMANN. *Boletín del Instituto de Higiene* (Mexico, D. F.) Segunda Epoca 2: 227–264; 24 figs.; 1 map; January 1936.

The author describes his visits to the chicle-producing region of Campeche and Guatemala, for the purpose of studying diseases of man. He gives considerable information regarding plant and animal life of the region, and a particularly sympathetic account of the people. Of special interest is a somewhat detailed account of the manner in which chicle is gathered. The article is one of the most informative the reviewer has ever read regarding the region covered.—P. C. STANDLEY.

A monograph of the genus *Rehdera*. By HAROLD N. MOLDENKE. *Repertorium Specierum Novarum* (Berlin-Dahlem) 39: 47–55; pl. 196; Nov. 30, 1935.

The new genus *Rehdera* of the Verbenaceae consists of three species of shrubs and trees occurring in Yucatan and Central America. The species are *R. penninervia* Standl. & Mold., Guatemala; *R. mollicella* Standl. & Mold., Guatemala; *R. trinervis* (Blake) Mold., Yucatan to Costa Rica.

Übersicht der Cyrillaceae. By FR. MATTICK. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 668–677; Dec. 6, 1935.

The American family Cyrillaceae consists of the following genera: *Cliftonia* (one species), *Purdiaea* (7), *Cyrilla* (9), and *Cyrillopsis* (1). Material is cited and notes are given for all the species, except those of *Purdiaea* which have been discussed previously by the author.

Forestry in British Honduras. By N. S. STEVENSON. Govt. Printing Office, Belize, 1935. Pp. 21; 8 x 12½; 1 large forest type map in color.

A comprehensive statement prepared by the Conservator

of Forests for the British Empire Forestry Conference in South Africa, 1935.

Supply, consumption and marketing of timber in British Honduras. (A statement prepared for the British Empire Forestry Conference, South Africa, 1935.) By N. S. STEVENSON. Govt. Printing Office, Belize, 1935. Pp. 11; 8 x 12½.

"To summarize briefly, the Colony must continue to rely on Mahogany and Cedar, although perhaps on a more limited scale than heretofore, until the problems of secondary wood exploitation and marketing have been solved."

"Pine appears to be the most promising of these woods. It has the characteristics of Pitch Pine and is of excellent quality, but its exploitation on a larger scale, first to fill local demands and later for export, must await the installation of efficient sawmilling and dressing machinery."

"Banak (*Virola merendonis* Pittier) is in demand in the U.S.A. as a substitute for Cedar in the manufacture of cigar boxes, being imported under the name of 'Bastard Cedar.' The demand far exceeds the present supply owing chiefly to the general preoccupation in the rising Mahogany market and to the difficulties of extraction. A ready market apparently awaits the production of Banak in lumber form. There is also some demand for Balsa wood. The local wood is of a different species and is heavier than the Balsa wood of commerce and there are very considerable difficulties in obtaining ready supplies."

The forests and flora of British Honduras. By PAUL C. STANDLEY and SAMUEL J. RECORD, in coöperation with the CONSERVATOR OF FORESTS and the AGRICULTURAL OFFICER OF THE COLONY. Field Museum Bot. Ser. (Chicago) 12: 1–432; 16 pls., Jan. 27, 1936. Price $2.25 net.

The introduction to *The Forests and Flora of British Honduras* consists of brief accounts of the geography, geology, soils, climate, population, agriculture (by H. P. Smart), and forest produce. Subjects treated in Part I are forest types; forestry; timbers of economic importance, of which the principal ones are Logwood, Mahogany, Cedar, Rosewood, and

Pine; woods suitable for paper pulp; Cohune Palm; chicle gum industry; a list of economic trees and their uses; and a bibliography.

Part II, the systematic portion of the volume, is prefaced by notes upon the relationships of the flora and an explanation of the plan of the list. The systematic enumeration lists the ferns and flowering plants known from the colony, with keys for recognition of the genera and species of trees and shrubs, for each of which there are descriptive notes, citation of vernacular names, and a brief discussion of the properties and uses of the wood. The herbaceous plants are listed merely by name. An appendix contains descriptions of a number of new species in various families.

The number of species listed for British Honduras is 2125. Among the larger families are Leguminosae, with 218 species; Rubiaceae, 111; Compositae, 101; Gramineae, 95; Melastomaceae, 69; Euphorbiaceae, 64; Solanaceae, 47; and Sapotaceae, 22.

Arboles y arbustos notables o poco conocidos del Departamento del Atlántico. By ARMANDO DUGAND G. *Boletín de Agricultura y Ganaderia* (Barranquilla, Colombia) 1: 5: 17–22; December 1935.

The third and concluding part of this series contains descriptions and notes for the following trees of northern Colombia: *Sideroxylon colombianum* (vernacular names Mamón de Leche, Mamón de Tigre), *Bumelia panamensis* (Doncello, Espino de Brujo), *Sterculia apetala* (Camajorú, Camajurú), *Jacquinia aurantiaca* (Barbasco, Barbasco de Púa, Sarnisclo), *Celtis Hottlei*, *Vitex cymosa* (Aceituno), *Bulnesia arborea* (Guayacán, Guayacán Resino, Guayacán de Bola).

Nómina de las maderas que se emplean en Barranquilla para construcción, ebanistería y otras obras. By ARMANDO DUGAND G. *Ciudad de Barranquilla Boletín Municipal de Estadistica* (Anuario de 1935) 4: 24: 40–42; Feb. 28, 1936.

A list of timbers employed in Barranquilla, Colombia, for construction, cabinetwork, and other purposes. Fifty trees are listed by their vernacular names, with also their Latin

names, family, and specific gravity of the wood. A table classifies the woods according to hardness. Another lists them according to local uses.

Mimosaceae and Caesalpiniaceae of Colombia. By N. L. BRITTON and E. P. KILLIP. *Ann. N. Y. Acad. Sci.* (New York) 35: 101–208; 2 plates; April 1, 1936.

This extremely useful account of two groups of the Leguminosae is based principally upon Colombian collections of the New York Botanical Garden and the U.S. National Museum. The preface includes brief mention of most of the botanists who have collected in the country.

Keys are provided for genera and species, and for each species are given synonymy and a list of specimens examined. Some of the large and well-known genera have been subdivided into numerous smaller ones, the treatment being similar to that of Britton and Rose in the North American Flora. The largest group is *Inga*, with 53 species. Many new species are described, and vernacular names are cited for many old species. Among new species for which vernacular names are cited are: *Inga santanderensis*, Guamo; *I. culagana*, Guamo Churimo; *I. pseudospuria*, Rabo de Mono; *Chloroleucon bogotense*, Angarillo; *Poponax canescens*, Chucuncha, Ambuca, Ambuque; *Acaciella Holtonii*, Carbonero; *Senegalia guacamayo*, Guacamayo; *S. Lehmannii*, Guarango; *S. turbacensis*, Zarza Redonda; *Leucaena bolivarensis*, Veranero; *Brownea multijuga*, Clavellín. New genera described are: *Klugiodendron*, related to *Pithecellobium*, with a single species, *K. umbrianum; Arthrosamanea*, based on *Mimosa pistaciaefolia* Willd., *i.e.*, *Samanea pistaciaefolia* Dugand; *Macrosamanea*, based on *Inga discolor* H. & B., referred by recent writers to *Pithecellobium* and *Samanea; Dugandia*, based on *Acacia rostrata* H. & B.; *Pseudovouapa*, based on *Macrolobium stenosiphon* Harms.—P. C. STANDLEY.

Apuntes sobre la geobotánica de Venezuela. By H. PITTIER. Pp. 21. Caracas, 1936.

A brief résumé is given of recent attempts to define life belts as represented in Venezuela, and it is stated that since

these have been based merely upon estimates of elevation and temperature, rather than upon statistical studies of their animal and plant composition, they are mere conventions, open to serious criticism. Brief remarks are made upon the plant associations and formations as influenced by soil, temperature, and rainfall, and a table is provided listing the principal associations represented by the plant life of Venezuela.

Some corrections are found necessary in the author's statements in the *Plantas usuales de Venezuela* regarding the limits of the various plant belts, and it is found preferable to divide the tierra fría of that work into two belts, the tierra fría and tierra gélida. Among the more conspicuous forest trees of the temperate belt or tierra templada are the Yagueros (*Panopsis* and *Roupala*), Caóbanos (*Guarea*), Cedro Montañés, Palo de Vaca (*Brosimum utile*), Tacamahacos (*Protium*), *Podocarpus*, Mují (*Prunus serotina*), Catatú or Quindú Canelo (*Hieronyma Moritziana*), Tara Amarilla (*Oyedaea verbesinoides*), and Tara Blanca (*Montanoa*), and a great variety of palms, among them the Palmera de Cera (*Ceroxylon*).

In the tierra fría between 2800 and 3800 meters woody plants are Curtidores (*Weinmannia*), Quitasol (*Escallonia tortuosa*), Onotillo (*Vallea stipularis*), Chispeadores (*Chaetolepis*), Aliso (*Alnus Mirbelii*), and species of *Monnina* and *Vaccinium*. In the highest limits of the belt are associations of Coloradito (*Polylepis sericea*), mixed with *Senecio arbutifolius*, *Hesperomeles pernettyoides*, *Chaetolepis alpestris*, and other shrubs. In the tierra gélida, or icy region, at 3800 to 5000 meters, the vegetation is chiefly herbaceous, in the uppermost parts principally of rock lichens, but at the lower borders of the belt there are small shrubs of *Pernettya*, *Vaccinium*, and *Hesperomeles*.—P. C. STANDLEY.

Cephaelis potaroensis. By N. Y. SANDWITH. *Hooker's Icones Plantarum* (London) 1–4: pl. 3300; 1935.

Cephaelis potaroensis, a shrub of 5 meters, is described from British Guiana. Notes are published regarding the limits of the genus *Cephaelis*, and the place of the new species within the genus.

Studies in South American Malpighiaceae, Lauraceae, and Hernandiaceae, especially of Surinam. By A. J. G. H. KOSTERMANS. Amsterdam, 1936. Pp. 1–70, 146–356; 6¼ x 9; 1 map.

The publication consists of reprints of the author's accounts of the families indicated in Volume II of Pulle's *Flora of Surinam*, and of an explanatory article that appeared in *Mededeelingen van het Botanisch Museum en Herbarium van de Rijks-Universiteit te Utrecht* No. 25, with some additional matter, particularly a terminal index to vernacular names listed, all of which apply to trees or shrubs.

The publication is of the same high quality that has characterized former parts of the *Flora of Surinam*, and is especially praiseworthy for its careful consideration of recent systematic literature, not only that published in Europe but equally that of American origin, a respect in which it is strikingly unlike some unfortunate recent European monographs. The Malpighiaceae are represented by 13 genera and 42 species; the Lauraceae by 12 genera and 54 species, many of which are important timber trees; the Hernandiaceae by 2 genera and 3 species.

The introductory or explanatory paper contains extensive critical notes regarding some of the species treated. New species are *Persea coriacea*, *Nectandra kaburiensis*, *Aniba Koumaroucapa* (vernacular name Ayououy), *A. Burchelii* (from Brazil), *A. mas*, *A. Gonggrijpii*, *Acrodiclidium Aubletii*, *A. rigidum*, and *Sparattanthelium wonotoboensis*. There are included also chapters entitled "Geobotanical Remarks" and "Useful Plants," the latter including notes regarding the utilization of wood of some of the trees described.—P. C. STANDLEY.

Araliaceae andinae novae. By H. HARMS. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 693–695; Dec. 6, 1935.

New species from Ecuador are *Schefflera Dielsii*, *Oreopanax iotrichus*, and *O. Schimpfii*.

Flora of Peru. Part I. By J. FRANCIS MACBRIDE. Field Museum Bot. Ser. (Chicago) 13: 1–320; 1 map; Jan. 27, 1936.

The first instalment of the *Flora of Peru* includes a preface by B. E. Dahlgren, a brief introduction by the author, a discussion of the plant geography of the Peruvian Andes (with a phytogeographic map) by A. Weberbauer, and a systematic account of the families, those treated being the Cycadaceae to Cyperaceae, inclusive, of the Engler sequence.

The systematic portion includes brief descriptions of the families, genera, and species, with keys for recognition of genera and species and citation of material studied. The families treated consist chiefly of herbaceous plants, but woody plants are found among the Taxaceae, Ephedraceae, Gnetaceae, and Gramineae.

Studies of American plants. VI. By PAUL C. STANDLEY. Field Museum Bot. Ser. (Chicago) 11: 145–276; Feb. 10, 1936.

The paper is devoted principally to descriptions of new species, mostly in the family Rubiaceae, and includes also many transfers of names. Among the new species of woody plants may be mentioned *Coccoloba Williamsii*, Peru, vernacular names Palo Meta-caspi, Tangarana Mashau; *Torrubia Snethlagei*, Maranhão, Brazil; *Rollinia mexicana; Prunus Zinggii*, Mexico; *Porlieria Steinbachii*, Bolivia; *Buxus Conzattii*, Mexico; *Talisia peruviana; Triumfetta leiocarpa*, Mexico, Chayotillo Negro; *Schoenobiblus peruvianus*, Barbasco-caspi; *Alseis peruviana*, Mishu-quiro, Palo Blanco; *Amphidasya ambigua* (*Sabicea ambigua* Standl.), a new genus of Rubiaceae, vernacular name Yerba de Maleficio in Colombia; *A. bullata*, Colombia, Yerba de Maleficio; *Coussarea penetantha*, Colombia, Flor de Muerto; *Faramea fragrans*, Colombia, Clavo; *Hamelia boyacana*, Colombia, Tinto; *Loretoa peruviana*, a new genus of trees of the Rubiaceae, called Metaguais; *Psychotria smaragdina*, Colombia, Esmeralda. New vernacular names are reported for numerous shrubs and trees, principally Mexican.

Phytogeographia do Brasil. By A. J. DE SAMPAIO. Bibliotheca Pedagogica Brasileira, Companhia Editora Nacional, São Paulo, 1934. Pp. 284; 6 x 9½.

There has just come to hand a copy in book form of a course of lectures delivered at the Museu Nacional, under the auspices of the University of Rio de Janeiro. These lectures, published serially in the Correio da Manhã, present a sketch of the plant geography of Brazil.

The general account of the vegetation by regions, "as it is, as it was, and as it ought to be," is also a plea for conservation of flora and fauna by the establishment of sanctuaries or preserves and national parks, together with an adequate program of reforestation. The forest destruction accomplished in four hundred years of agricultural occupation, with intensive, often reckless, exploitation of natural resources, is indicated by some regional statistics, the state of Sergipe furnishing an extreme case with an area of forest formerly of 40 per cent now reduced to 0.1 per cent, Parahyba with a reduction of a former 36 per cent to less than 1 per cent. Bahia, with a reduction of its original 35 per cent of forest area to a present 19 per cent, is possibly more typical of Brazil as a whole.

In the discussion of his main subject, the author follows Engler's floristic-geographical divisions with the minor modifications already suggested by him (see *Tropical Woods* 27: 37). One important and apparently well justified departure is made in treating the region of Maranhão and the north of Piauhy as a separate zone, a subdivision of the extra-Amazonian flora. This zone has hitherto figured simply as an extension of the Hylaea, a transition between that and the generally subxerphilous grassland and caatinga flora to the east of it.

Dr. Sampaio points out that edaphic and hygronomic conditions, relief, drainage, and distribution of rainfall over six months of the year in this "meio-norte" or middle portion of northern Brazil, have produced a situation sufficiently distinct to be considered a special zone, which, adopting the local designation, he calls the zone of the "Cocaes"—vast formations of Babassú (*Orbignya*) in almost pure stands covering a quarter of the area of Maranhão and a part of northern Piauhy where they terminate in close relation to the extensive stands of Carnaúba that form a well known and characteristic feature of the adjoining caatinga or, as he prefers to call it,

Carnaúba zone. To the southwest the zone of the Cocaes, or Babassú zone, reaches across the rivers Tocantins and Araguaya into northern Goyaz and Matto Grosso.

A university extension treatise, Dr. Sampaio's book includes a brief sketch of the history of the botany of Brazil with a list of its principal literature.—B. E. DAHLGREN.

Melastomataceae novae. By A. C. BRADE. *Archivos do Instituto de Biologia Vegetal* (Rio de Janeiro) 2: 13–17; 1 plate; September 1935.

New species of Melastomataceae from Brazil are *Huberia Nettoana*, *Behuria huberioides*, *B. Limae*, and *Benevidesia magdalenensis*.

As especies brasileiras de jatahy, jutahy ou jatobá. By ADOLPHO DUCKE. *Annaes da Academia Brasileira de Sciencias* (Rio de Janeiro) 7: 203–211; 1 pl.; Sept. 30, 1935.

The vernacular names indicated in the title relate to the species of *Hymenaea* (Leguminosae), of which 13 are known from Brazil. Of these, six grow only in the Amazonian Hylaea, three in the northwest and center of Brazil, two in the subtropical south, one extends northeast to the south, and one has a wide range in tropical America. The pulp of the fruit is edible, the bark is employed in tanning, the sap and resin are used in popular medicine, and the usually very hard wood is employed for construction. The Jutahy-cica resin, a kind of copal exported from Amazonia, is obtained almost wholly from *H. Courbaril*. A key is published for separation of the species, which are listed and briefly annotated. *H. altissima* is described as new, from Rio de Janeiro and São Paulo.—P. C. STANDLEY.

New species of the genus *Dimorphandra* Schott section *Pocillum* Tul. By ADOLPHO DUCKE. *Journ. Washington Academy of Science* 25: 193–198; April 15, 1935.

A key is provided for 15 species of the section *Pocillum*, 10 of which occur in the Brazilian states of Pará and Amazonas, and 5 in British Guiana. Five new species are described from Amazonian Brazil.

Aguiaria, novo genero de Bombacaceas, a arvore maior do alto Rio Negro. By ADOLPHO DUCKE. *Annaes da Academia Brasileira de Sciencias* (Rio de Janeiro) 7: 329–331; 1 pl.; Dec. 31, 1935.

Aguiaria excelsa represents a new genus of Bombacaceae, related to *Catostemma*. It is a tree 40 to perhaps 50 meters high, the tallest tree of the region in which it grows, known locally by the name Duraque. The wood is used frequently for construction purposes.

Estudo de um dicotyledoneo fossil do cretaceo. By FERNANDO ROMANO MILANEZ. *Rodriguésia* 1: 2: 83–89; 5 plates; 1935.

From a study of the anatomy of a well-preserved cretaceous fossil wood from the State of Piauhy, Brazil, the author concluded that the specimen was one of the Lecythidaceae and named it *Lecythioxylon brasiliense*, gen. et sp. nov.

Floração da primavera. By L. A. P. [LEONAM DE A. PENNA]. *Rodriguésia* 1: 2: 109–113; 1935.

An alphabetical list of Brazilian plants that flower in spring. Many of them are trees or shrubs, for which vernacular names are indicated.

Neue und kritische Pflanzen aus Südamerika, insbesondere Amarantaceen, sowie eine neue Gattung der Podostemonaceae. By KARL SUESSENGUTH. *Repertorium Specierum Novarum* (Berlin-Dahlem) 39: 1–20; Nov. 30, 1935.

New species of shrubs or trees are *Hirtella formicaria*, Rio Jurua, Brazil; *Humiria Cassiquiari*, Suesseng. & Bergdolt, Venezuela.

Dilleniaceae americanae novae. By H. SLEUMER. *Repertorium Specierum Novarum* 39: 44–47; Nov. 30, 1935.

New species or names are *Doliocarpus amazonicus*, Peru; *D. magnificus*, Brazil and Bolivia; *D. paraensis*, Pará, Brazil; *D. pulcher*, Peru; *D. rufescens*, Bolivia; *Tetracera parviflora* (*Davilla parviflora* Rusby).

A monograph of the genus *Timotocia*. By HAROLD N. MOLDENKE. *Repertorium Specierum Novarum* 39: 129–153; Jan. 31, 1936.

The generic name *Timotocia* (Verbenaceae) is proposed in place of *Casselia* Nees & Mart. The genus consists of 12 species of shrubs or herbs, occurring in central and southern Brazil, Bolivia, Paraguay, and northern Argentina. Three new species are described from Brazil.

Vermischte Diagnosen. III. By H. SLEUMER. *Repertorium Specierum Novarum* 39: 274–282; Jan. 31, 1936.

New species of woody plants are *Davilla emarginata*, Brazil; *Mollinedia pulcherrima*, Peru; *Siparuna pseudospectabilis*, Bolivia; *Ochna Braunii*, *O. praecox*, *O. pseudoprocera*, *O. Schliebenii*, Tanganyika; *Ouratea lutambensis*, Tanganyika; *Cathedra aestuaria*, *C. inaequilatera*, *C. oblonga*, *C. paraensis*, Brazil. The genus *Endusa* Radlk. is reduced to synonymy under *Minquartia*, and there are distinguished two species of the genus, *M. guianensis* of French Guiana, Surinam, and Brazil, and *M. punctata* (Radlk.) Sleumer (*M. macrophylla* Ducke) of Peru and Brazil.

Neue Apocynaceen aus Südamerika. VI. By FR. MARKGRAF. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 553–561; Dec. 6, 1935.

Keys are given for separating the species of *Aspidosperma* of the groups of *A. oblongum* DC. and *A. nobile* M. Arg. New species are *A. salgadense*, Brazil; *A. Kuhlmannii*, Matto Grosso, Brazil, local name Carapanaúba; *A. leucostachys* Kuhlm., Brazil; *A. Woodsonianum*, Surinam and British Guiana; *A. centrale*, Brazil; *A. Sandwithianum*, British Guiana.

Die Palmengattungen *Mauritia* L. f. und *Mauritiella* Burret nov. gen. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 605–611; Dec. 6, 1935.

The genus *Mauritia* (type *M. flexuosa* L.f.) as restricted by the author consists of six species. The new genus *Mauritiella* (type *Mauritia aculeata* H.B.K.) contains 10 South American

species. *M. Duckei* (vernacular name Carana) is described as new from Brazil.

Palmae neogeae. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 612–625; Dec. 6, 1935.

New species are *Oenocarpus grandis*, Rio Madeira, Brazil, vernacular name Baccaba Grande; *Geonoma anomoclada*, Colombia; *G. Dryanderae*, Colombia; *Attalea rhynchocarpa*, Colombia; *Bactris leptochaete*, *B. pulchella*, *B. chlorocarpa*, *B. megistocarpa*, Brazil. Specimens are cited for numerous species previously described. The vernacular name Munbaca is reported for *Bactris pinnatisecta* Burret, from Rio Madeira, Brazil.—P. C. STANDLEY.

Beitrag zur Flora des Itatiaia. By R. PILGER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 689–693; Dec. 6, 1935.

New species of shrubs from Brazil are *Leandra thyrsiflora* Markgraf and *Piptocarpha Bakeriana* Glaziou.

Über die Identifikation der Gattung *Lightia* Schomb. mit der Gattung *Euphronia* Mart. By G. ROSSBERG. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 699–700; Dec. 6, 1935.

Schomburgk described under the name *Lightia* two genera, the first a synonym of *Herrania* Goudot. The second is a synonym of *Euphronia* Mart., a genus of three South American species, referred by Bentham and Hooker first to the Ochnaceae and later to the Rosaceae, but really a member of the family Trigoniaceae.—P. C. STANDLEY.

Neue Arten und Varietäten der Gattungen *Daphnopsis* Mart. et Zucc. und *Funifera* (Leandro ex) C. A. Mey. aus Mittel- und Südamerika. By W. DOMKE. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 722–732; Dec. 6, 1935.

New species are *Daphnopsis Weberbaueri*, Peru; *D. pseudosalix*, Santa Catharina, Brazil; *D. Ulei* Gilg, Rio de Janeiro, Brazil; *D. decidua*, Mexico; *D. longiracemosa* Gilg, Ceará, Brazil; *D. zamorensis*, Ecuador; *D. umbelluligera*, Rio de Janeiro, Brazil; *Funifera grandifolia*, Rio de Janeiro, Brazil.—P. C. STANDLEY.

Studies in Moraceae. II. The genus *Clarisia* Ruiz et Pavon and its synonyms, with a discussion of the generic name. By J. LANJOUW. *Recueil des Travaux Botaniques Néerlandais* 33: 254–276; figs. 1–3; pls. 9–11; March 1936.

A detailed synopsis is given of the genus *Clarisia*, of which *Sahagunia*, *Acanthinophyllum*, and *Soaresia* are synonyms. Eight species are recognized: *C. racemosa* Ruiz & Pavón, Brazil and Peru; *C. colombiana* (Rusby) Lanj., Santa Marta, Colombia; *C. mattogrossensis* Lanj., Brazil; *C. mexicana* (Liebm.) Lanj., Mexico; *C. urophylla* (Donn. Sm.) Lanj., Honduras; *C. biflora* Ruiz & Pavón, Peru; *C. Spruceana* Lanj., Venezuela; *C. strepitans* (Fr. Allem.) Lanj., Brazil, with varieties in the Guianas.—P. C. STANDLEY.

Legislação florestal. Segunda parte: Leis florestaes dos estados. By PAULO FERREIRA DE SOUZA. Pub. by D. N. P. V., Ministerio da Agricultura, Rio de Janeiro, March 1935. Pp. 412; 6¼ x 9.

This publication, which was noticed in the last issue of *Tropical Woods*, is here reviewed at length.

A presidential message to the state assembly of Rio Grande do Sul in 1899 probably summed up fairly the situation then prevailing in respect to forest legislation among the states of Brazil: "Devastation of the forests . . . is a subject much neglected among us at all times. Nor does it appear that in any state of the republic it has attracted the attention of the respective public authorities."

In view of the fact that "cultivation of the soil does not always compensate for the damage resulting from its exhaustion and erosion," the state of Rio Grande do Sul determined (1900) to exercise vigilance over both private and public protective forests, *i.e.*, those enclosing water sources and rivers, as well as those covering the summits and slopes of natural elevations and declivities. As to utilization, it should be guided by "the principle that rational forest exploitation ought to be in proportion to the rate of replacement."

Bahia was one of the first of Brazilian states to legislate for the "protection, conservation and utilization" of its forests. "For the benefit of climate and regularity of the seasons,"

perpetual forest preserves were established there in 1897 in each district where forest areas exist. Regulations of 1905 classify the state forest as (1) protective, defined as in Rio Grande do Sul, but somewhat more amply; (2) forest reserves containing valuable species to be saved from extinction, including forest lands that it may be desired to set aside as public parks, these classes to be preserved in perpetuity; and (3) forest areas which may be reserved in the expectation that they will increase in value and be better utilized at some future time. Felling of trees and the exploitation of forest products without authorization are prohibited and, when permitted, replanting after cutting is required. All cutting on tops of ridges, about springs, brooks and rivers and of windbreaks is forbidden, also the felling of any species in any locality where scarce.

The state of Paraná, with numerous regulations in existence since 1850 for the protection of its maté industry, adopted a code for the conservation of the forests and the regulation of lumbering in 1907. Emphasis is placed on protection against erosion by wind and flood, and replanting is required. Private owners are obliged to give notice of intention to cut lumber, for any but their own use, and to obtain consent. Forest nurseries were established for experimental growing of trees and to supply seed and cutting for reforestation. An annual arbor day was decreed for the state, and provision made for the revision of the code every ten years.

A special forestry service to promote the study of the flora of the state of São Paulo was established in 1911, also for the maintenance of experimental gardens and nurseries for silviculture, the study and drafting of laws and regulations pertaining to forestry with a "view to the reëstablishment of the forests of the state."

Of the block of northeastern states in which the drought problem is a major consideration, Piauhy led in legislative provisions for the safeguarding of its protective forest covering on public and private lands, especially about water sources, brooks, pools, lakes and rivers, summits and upper slopes of mountains and ridges, as a defense against floods and erosion, with planting encouraged by premiums of land and cash. The

state of Sergipe followed with the organization of a forest service and the prohibition of cutting without license, requiring replanting of one half of the area cut and promoting with premiums further replanting. In Pernambuco the forest service dates from 1916 with the establishment of state parks for perpetual preservation.

Of the states in the northeastern drought area, Ceará, except for protecting its Carnaúba stands, apparently enacted legislation to safeguard its remaining forested area only as late as 1928, when an act was passed prohibiting cutting in the immediate vicinity of springs and rivers and on the upper third of all mountains and ridges as well as along public roads.

The laws of Pará include the legislative acts by which the Museu Paraense was founded in 1872 and reorganized in 1892. The first important forestry legislation of this northern Brazilian state dates from the same year as that of Pernambuco (1916). It regulates the cutting of timbers, with replanting enforced on all large projects. It prohibits the destruction of trees yielding economic products, such as oil, resins, rubber, brazil nuts, etc., and the exportation of cuttings or seed except edible ones, such as cacao and brazil nuts. This prohibition has recently been extended to include also the roots of "timbo," which may be exported only in powdered form.

Similar provisions for the protection of trees yielding special forest products, such as rubber, balata, copahyba, etc., were enacted by the state of Amazonas ten years later (1926), the exportation of seeds of Hevea, guaraná, brazil nuts for planting or palm nuts of the species used for smoking rubber being forbidden.

The forestry laws of Maranhão (1927) prohibit the destruction of forests for any purpose at the margins of rivers and water sources.

A forest service was established in the states of Alagoas, Espirito Santo, Santa Catharina, and Minas Geraes in 1928, with the adoption of measures similar to those by that time in force in adjoining states. It is noted that while the account of the legislation of the state of Rio de Janeiro is reserved for the third part of the collection of laws, no legislation is cited for Parahyba, Rio Grande do Norte, Goyaz, and

Matto Grosso, being perhaps superfluous in the first named state as practically devoid of forest, and presumably still lacking in the latter two states, during the period in review.

The important matter of surrounding with elementary safeguards the common practice of clearing ground by burning, receives attention in most of the state codes. Rubber, brazil nuts and minor forest products are objects of special concern in Amazons and Pará, two states threatened neither with immanent extinction of their timber resources, nor with diminution or scarcity of water supply, a matter of importance to almost all the others. Carnaúba is properly a special object of protection in the northeastern states. Wood for fuel is none too abundant in many places. The forests of the eastern humid zone have suffered a considerable reduction. In Paraná, Santa Catharina, and Rio Grande do Sul, the Paraná Pine industry is the principal object of regulation and with maté, which is of interest also to Matto Grosso, has received a large share of legislative attention. In short, while the general objective of conservation is the same throughout, existing differences in respect to extent and character of forested area, nature of forest products, density and other characteristics of the population of the various regions from Amazonas to Rio Grande do Sul, are so marked that they have naturally been reflected in the local legislation of the past fifty years.—B. E. DAHLGREN, *Field Museum of Natural History*.

***Swietenia Krukovii:* a new species of mahogany from Brazil.**

By H. A. GLEASON and A. J. PANSHIN. *American Journal of Botany* 23: 1: 21–25; 3 figs.; January 1936.

"In 1933, Mr. B. A. Krukoff, on his fourth trip to Brazilian Amazonia, collected herbarium material and wood samples of a *Swietenia* on the River Jurupary, in the territory of Acre. This material forms the basis of the present report." The diagnosis of the proposed new species (?) is concerned with the size and shape of the upper two pairs of leaflets from a single specimen (*Krukoff* 5223); and according to the table, only 11 leaflets were measured! There is obviously a need here for statistical analysis. (See *Tropical Woods* 44:29, last par.)

Dr. Panshin contributes an illustrated description of the wood and the collector supplies a lot of interesting field observations, including an account of the exploitation of the timber.

La vegetación de Reconquista (Provincia de Santa Fé). By LORENZO R. PARODI. *Revista Geogr. Americana* (Buenos Aires) 6: 389–407; illustrated; March 1934.

The Department of Reconquista belongs phytogeographically to the Chaco Region, a vast area of forests and of savannas covered with tall grasses. Between the city of Reconquista and its port there are noted the following formations: (1) Espinillar, a xerophilous forest, composed of trees 4–6 meters high, among them *Acacia moniliformis* (Tusca), *A. cavenia* (Espinillo), *Gourliea decorticans* (Chañar), *Prosopis panta* (Algarrobo Amarillo), *P. nandubey* (Ñandubay), *Xylosma venosum* (Espina Colorada), *Celtis tala* (Tala), *Lycium*, and *Grabowskya;* (2) Seibal, an extensive forest of *Erythrina crista-galli* (Seibo); (3) Pajonal, occupied chiefly by grasses; (4) Albardón, the sandy strip of soil near stream banks, occupied by forest and thickets of various species. A special description is given of the vegetation of the islands of the Río Paraná, also of the typical Chaco forests and savannas. Among the trees of these forests are *Gleditschia amorphoides* (Espina Corona), *Enterolobium timbouva* (Timbó), *Allophylus edulis* (Chal-chal), *Ruprechtia viraru* (Viraró), *Schinus dependens* (Incienso), *Eugenia myrcianthes* (Ubajay), *Scutia buxifolia* (Coronillo), *Caesalpinia melanocarpa* (Guasayán), *Astronium Balansae* (Urunday), *Zizyphus mistol* (Mistol), *Terminalia Balansae* (Lapachillo), *Schinopsis Balansae* (Quebracho Colorado). A conspicuous element of the region consists of the extensive palm forests composed of *Copernicia australis* (Caranday), *Butia yatay* (Yatay), and *Arecastrum Romanzoffianum* (Pindó). A special description is given of the vegetation of Malabrigo.—P. C. STANDLEY.

Die Gliederung der asiatischen Tabernaemontanoideen. By FR. MARKGRAF. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 540–552; 7 figs.; Dec. 6, 1935.

A key is provided for separation of the Asiatic genera of Apocynaceae related to *Tabernaemontana*. The following genera are recognized: *Rejoua* Gaud., with 3 species; *Pagiantha* Markgraf, a new genus, with 11 species heretofore referred to *Tabernaemontana; Oistanthera* Markgraf, with a single species, originally described as *Tabernaemontana Telfairiana* Wall.; *Testudipes* Markgraf, a new genus, with a single species, described as *Tabernaemontana recurva* Roxb.; *Ervatamia* (DC.) Stapf, with numerous species; *Eucorymbia* Stapf, with a single species; and *Voacanga* Dup.-Thouars, with 7 species. *Ervatamia obtusiuscula* is described as new from Samoa, Fiji, and Tonga.—P. C. STANDLEY.

Palmae gerontogeae. IV. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 590–602; Dec. 6, 1935.

Unfortunately Beccari's manuscript treating the Old World groups of palms of the Areceae was not published until long after his death. In the meantime many of the palms he treated as new or transferred to other genera already had been studied by other writers, who published the results of their studies, thus invalidating much that appeared to be new in the Beccari treatment as published. The present paper is devoted to corrections of the Beccari paper, indicating various synonyms and making a number of name transfers.—P. C. STANDLEY.

Notes on the systematic position of Bretschneideraceae as shown by its timber anatomy. By Y. TANG. *Bull. Fan Memorial Institute of Biology* (Peiping) 6: 3: 153–157; September 1935.

"The genus *Bretschneidera* was inaugurated by W. B. Hemsley in Hooker's Ic. Pl. t. 2708 in 1901 and placed by him under Sapindaceae. The monotypic species is *B. sinensis*, discovered in Yunnan, later found in Hunan, Kwangtung, Kweichow and Chekiang. In 1919, A. Engler and E. Gilg in *Syllabus der Pflanzenfamilien* transferred it into Hippocastanaceae. In their 9th and 10th editions of 1924, they separated it to form a monotypic family called Bretschneideraceae belonging to the suborder Bretschneiderineae of Rhoeadales

next to the suborder Moringineae owing to the presence of myrosin cells in the bark of twig, pedicels and petals. But J. Hutchinson in his *Families of Flowering Plants. I. Dicotyledons* (1926), transferred it back to Sapindaceae; while Moringaceae is still left in Capparidales."

According to the author's studies: "*Bretschneidera sinensis* is neither closely related to that of Hippocastanaceae and Sapindaceae nor to that of Moringaceae so far as their timber anatomy is concerned. Thus, it is best to treat it as belonging to a separate monotypic family. As its taxonomical structure is not related to Moringaceae at all, but its floral morphology is related to that of Sapindaceae, the writer considers it best to place it in Sapindales, and probably between Aceraceae and Sapindaceae."

Contributions to the flora of Burma. XII. By C. E. C. Fischer. *Kew Bulletin of Miscellaneous Information* 572–576; 1935.

New species of woody plants are *Goniothalamus burmanicus; Scolopia Kermodei*, vernacular names Thabye, Kyettet; *Adhatoda oreophila.*

The composition and origin of a calcareous deposit found in the wood of *Millettia pendula* Benth. By W. G. Campbell. *Empire Forestry Journal* 14: 2: 250–252; 1 plate; December 1935.

The deposit is similar to that more commonly found in Iroko, *Chlorophora excelsa.* (See *Tropical Woods* 29: 33; 36: 69; 37: 58.)

Timber tests: Gerutu-gerutu (*Parashorea lucida* [Miq.] Kurz). By A. V. Thomas. *The Malayan Forester* (Kuala Lumpur) 5: 1: 24–28; January 1936.

"As a result of incorrect identification, the vernacular name Damar Laut (usually applied to species of *Shorea* producing timber of Balau grade) came to be applied erroneously to *Parashorea lucida* [= *P. stellata* Kurz]. Recent enquiry having failed to discover any authentic Malay name for the species, the name Gerutu-gerutu has been coined to meet the deficiency.

"The species ranges from Southern Burma through peninsular Siam to the Malay Peninsula. It has also been recorded in Cochin China and on the east and west coasts of Sumatra. In the Malay Peninsula it appears to be well known only in northern Perak, but it occurs also in Kelantan and Trengganu. In Perak it is locally quite common, usually in valleys in hilly country, below 1,500 ft. One tree to two acres may be found over considerable areas. On account of the freedom with which the tree regenerates it is likely to be of considerable local importance in the future."

"The wood-working characteristics of Gerutu-gerutu vary. On the whole it cannot be sawn as easily as either of the Red Merantis, such as *Shorea leprosula*, or the timber of *Parashorea* spp. received from North Borneo, but offers as much resistance as Kapur (*Dryobalanops aromatica*) or Keruing (*Dipterocarpus* spp.). Although the timber is not generally resinous, the saw teeth may sometimes become blunted rather rapidly; this dulling of sharp-edged tools was also observed during planing and boring. When the knives of the planing machine are very sharp the finished surface of the timber is quite satisfactory, but, in a short time, the grain on the radial surface begins to 'pick up.' Similarly, after several holes have been drilled slight tearing of the grain occurs, particularly along the grain and in pieces from near the pith."

"Gerutu-gerutu could be included in the same grade as Meranti Temak, but the former timber should be more readily salable as it is distinctly easier to work. It should prove suitable for moderately heavy construction under cover, flooring, wall boarding, and possibly panelling. Provided it can be reasonably well protected by preservatives, it could be used for sleepers, bridge decking, etc. In Burma it is utilized chiefly for boat building."

On the origin of the Malaysian mountain flora. Part 2. Altitudinal zones, general considerations and renewed statement of the problem. By C. G. G. J. van Steenis. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 289–417; pls. 2–4; figs. 5–9; December 1935.

"There are 3 factors controlling the static distribution of

mountain plants: dispersal, time, ecological opportunity. For each species these 3 dynamic factors will bear a different importance, but of none of the factors have we reliable knowledge. All remains deductive guesswork. The only known facts indicate that plant genera have apparently been dispersed from definite centers.

"About the age of the species and genera and the period during which there was opportunity for them to disperse from these centers and settle in new localities we are not informed. Particular cases as well as statistics of both altitudinal floras and invasion tracks show that distribution of Malaysian mountain plants is not related to the means of dispersal. The dispersal spectrum as derived from morphology shows always *probable* dispersal by animals, by wind and an often large remnant of species without special means of dispersal. The same phenomena of geographical distribution are represented in groups with totally divergent means of dispersal.

"There is something to be said in favor of dispersal of Malaysian mountain plants over distances up to ca. 50 km. (endozoic, epizoic, hurricanes), but dispersal over long distances, covering more than 1000 or 2000 km., by wind as well as by birds and other animals is quite improbable.

"The existence of races of plants peculiar to local peaks shows that even within smaller distances often no continuous dispersal takes place from one mountain population to another.

"Resuming, we may suggest that the effect of present dispersal can give no clue to an explanation of the present distribution of mountain plants in Malaysia."

Phylogeny of single features, as illustrated by a remarkable new sapotaceous tree from British Malaya (*Madhuca Ridleyi*, n. sp.). By H. J. LAM. *Gardens' Bulletin, Straits Settlements* (Singapore) 9: 98–112; pls. 3–7; Dec. 20, 1935.

Madhuca Ridleyi is a medium-sized tree of Pahang and Upper Perak.

***Didymoecium* genus novum Rubiacearum Morindearum.** By C. E. B. BREMEKAMP. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 425–428; 1 fig.; December 1935.

Didymoecium amoenum, a shrub a meter high, represents a new genus of Rubiaceae of the tribe Morindeae. It is native in Sumatra.

New Malaysian Ericaceae. By J. J. SMITH. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 443–464; December 1935.

Numerous new species and varieties are described in *Rhododendron*, *Gaultheria*, *Diplycosia*, and *Vaccinium*.

Vernacular names of Loranthaceae in the Malay Peninsula and the Netherlands Indies. By B. H. DANSER. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 487–496; December 1935.

Seven and one-half pages are devoted to an alphabetical list of vernacular names reported for Malaysian Loranthaceae.

The vegetation of the Upper-Badak region of Mount Kelut (East Java). By E. W. CLASON. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 509–518; pls. 5, 6; December 1935.

Vegetation in the region described was destroyed by volcanic eruption in 1919, and that now present is of recent growth. It is divided into forest, grass fields, and fern and moss fields. Among the mesophanerophytic trees, with a height of 8–30 meters, are species of *Trema*, *Parasponia*, *Homalanthus*, *Alsophila*, *Ficus*, *Leucosyke*, *Maoutia*, *Viburnum*, *Breynia*, *Psidium*, *Arenga*, *Melochia*, *Wendlandia*, *Maesa*, *Glochidion*, and *Phoebe*. Microphanerophytic trees, 2–8 meters in height, are *Debregasia longifolia* and *Areca pumila*, var. *montana*. Mesophanerophytic shrubs, more than 2 meters in height, include species of *Mussaenda*, *Pandanus*, *Breynia*, *Boehmeria*, *Dodonaea*, *Triumfetta*, *Desmodium*, *Rubus*, *Buddleia*, *Pouzolzia*, and *Melastoma*. Woody lianes are represented by species of *Triumfetta*, *Rubus*, *Lantana*, *Smilax*, *Cissus*, *Gynura*, *Mikania*, *Polygonum*, *Gleichenia*, *Tetrastigma*, *Toddalia*, and *Piper*.—P. C. STANDLEY.

Beiträge zur Kenntnis der Tiliaceae. IV. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 602–605; Dec. 6, 1935.

New species are *Microcos paucicostata*, Borneo; *M. bifida*, British New Guinea; *Grewia Brassii*, British New Guinea.

The effect of chemical solutions on some woods. By M. B. WELCH. *Journ. & Proc. Royal Society New South Wales* (Sydney) 69: 159–166; Jan. 10, 1936.

A study was made to determine the resistance to chemical action of twenty-five, commercially-available, Australian timbers; Port Orford Cedar (*Chamaecyparis Lawsoniana*) was also included in the tests for comparative purposes. The woods were immersed in a number of different acids, alkalis, and inorganic salts. The derived data for the individual species are tabulated on the basis of percentage lateral swelling, as calculated on the original air-dry size of pieces (Table I), and as to comparative stiffness after immersion for varying periods (Table II). The determinations of rigidity are empirical in character, being based on the resistance which the pieces offered to bending in the fingers. The results obtained with the more corrosive acids are also summarized in the body of the text.

In general, the coniferous woods exhibited the greatest resistance to chemical action and compared favorably with Port Orford Cedar in this respect. Of the other woods studied, Teak (*Flindersia australis*), Sassafras (*Doryphora sassafras*), and Sycamore (*Cryptocarya glaucescens*) were most satisfactory; the majority of the hardwoods were definitely inferior. It was found that ammonia, acetic acid, and several of the inorganic acids had but little effect on the stiffness of the various woods, at least at the atmospheric temperatures used in the investigation.—G. A. GARRATT.

Notes on the shrinkage of wood. Part II. By M. B. WELCH. *Journ. & Proc. Royal Society New South Wales* 69: 174–181; Feb. 11, 1936.

This study followed the same general procedure as the earlier investigation of the shrinkage of Australian woods (*Journ. & Proc. Royal Society New South Wales* 65: 235–250; March 16, 1932). Data are presented on the weight per cubic foot and the lateral and volumetric shrinkage of 206 specimens

representing 50 different species of wood; 144 samples of 28 species of *Eucalyptus* are included in the list. Both quarter- and flat-sawed specimens (4 inches wide, 1 inch thick, and 1 inch long) were available for most of the species. It was found that the lateral shrinkage from the green to the air-dry condition (approximately 13 per cent moisture content) was generally from 0.6 to 0.8 of that from the green to the oven-dry condition. The ratio of radial to tangential shrinkage was discovered to be less than 2 to 1 in most specimens.—G. A. GARRATT.

Revision der Gattung *Pernettya* Gaud. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 626–655; Dec. 6, 1935.

The genus *Pernettya* (Ericaceae) consists of 13 species of shrubs, occurring in Tasmania and New Zealand and in the cooler parts of tropical America from Mexico to southernmost South America. A key is provided for segregation of the species, which are treated in great detail as to synonymy and material studied.

Die Gattung *Poupartia* Commerson. By FR. MATTICK. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 678–684; Dec. 6, 1935.

The genus *Poupartia* (Anacardiaceae) consists of 8 species, for which a key is provided, and for which the material studied is cited. The species occur in Mauritius, Réunion, Madagascar, and southeastern Asia, and a single one in Amazonian Brazil.

Commiphorae Trollianae. By FR. MATTICK. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 656–667; Dec. 6, 1935.

Five new species and one new variety of *Commiphora* are described from German East Africa, and there are numerous notes regarding species previously published.

The genera *Erythroxylon* L. and *Nectaropetalum* Engl. By E. P. PHILLIPS. *South African Journal of Science* 32: 305–312; 1 text fig.; November 1935.

"The family Erythroxylaceae is found distributed through-

out the tropics of both hemispheres, though the species are mostly massed in tropical America. In South Africa the family is represented by a few species which have been placed in the genera *Erythroxylon* L. and *Nectaropetalum* Engl. The writer has not been quite satisfied that both these genera should be upheld, and only recently has had an opportunity of examining the available South African material. This examination has confirmed his opinion that the South African plants belong to the same genus, *viz.*, *Erythroxylon* L."

"As far as the writer has been able to gather from literature, five species of *Nectaropetalum* have been described, *viz.*: *N. Carvahoi* Engl., Mozambique, 1903; *N. Kassneri* Engl., British East Africa, 1905; *N. capense* Stapf (= *Peglera capensis* Bolus), South Africa, 1909; *N. zuluense* Corbishley (= *Erythroxylon zuluense* Schönl.), South Africa, 1919; *N. congolensis* S. Moore, Congo, 1920."

"The sinking of the genus *Nectaropetalum* under *Erythroxylon* necessitates a change in nomenclature, and the following changes should be made: *E. Carvahoi* (Engl.) Phillips; *E. Kassneri* (Engl.) Phillips; *E. congolensis* (S. Moore) Phillips."

Material of *Marquesia acuminata* from Northern Rhodesia. By Helen Bancroft. *Kew Bulletin of Miscellaneous Information* 10: 559–568; 2 plates; 1935.

A further interesting contribution to the knowledge of Monotoid timbers, the whole covering specimens of six named and three unidentified species of the two genera *Marquesia* and *Monotes*. The paper contains general information pertaining to *Marquesia acuminata* (Gilg) R. E. Fries (= *Monotes acuminatus* Gilg and probably *Monotes Gilleti* De Wild. also), a detailed description of the wood, and a discussion of the data.

"It appears that while, *as a group*, the Monotoideae are very coherent and may be easily identified by their wood anatomy, no one structural feature or combination of features will serve with certainty to define the various species so far examined.

"In conclusion it may be noted that the evidence so far

provided by wood anatomy strongly upholds Gilg's opinion, drawn from floral and various vegetative characters, that the Monotoideae should be included in the Dipterocarpaceae, rather than in the Tiliaceae."

Dipterocarps in Africa. By H. B. [Helen Bancroft]. *Empire Forestry Journal* (London) 14: 2: 260; December 1935.

"Within the past few months herbarium material has come to hand from areas as far removed as Nigeria, Gabon and the Belgian Congo, which indicates that the *true* Dipterocarps (the sub-family Dipterocarpoideae) are still living in the primitive forests of Africa."

The forest types of vegetation in Tanganyika Territory. By R. J. A. Rea. *Empire Forestry Journal* 14: 2: 202–208; 1 vegetation map; December 1935.

"The extent of closed forest in Tanganyika Territory is very small; the percentage has been estimated as only 1.12 per cent of the total area. The term closed forest here refers only to rain forest and dry evergreen forest, but practically the whole of the Territory is covered with some form of tree growth, and areas of pure grass or herbaceous vegetation are not extensive. The vegetation types are naturally controlled for the most part by climate, but biotic influences are marked by the destruction of forest over wide areas by human agency, and edaphic formations occur as Mangrove forest, salt steppe, and fringing forest."

The vegetation is described under the following types and sub-types: (1) Rain forest—tropical and mountain; (2) dry evergreen forest—Cedar and broad-leaved; (3) Mangrove forest; (4) savannah; (5) short grass steppe; (6) mountain grassland; (7) salt steppe.

Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. X. By J. Mildbraed. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 701–721; Dec. 6, 1935.

Among the new species are the following woody plants of Tanganyika: *Vismianthus punctatus* Mildbr., a new genus of

Connaraceae; *Commiphora acutifoliolata* Mattick; *Triaspis Schliebenii* Alfons Ernst; *Notobuxus obtusifolius* Mildbr.; *Paivaeusa orientalis* Mildbr., local name Mtakoa; *Grewia filipes* Burret, *G. meizophylla* Burret, *Vinticena macromischa* Burret; *Homalium elegantulum* Sleumer; *Scolopia minutiflora* Sleumer.—P. C. STANDLEY.

A sketch of the forest vegetation and flora of tropical Africa. By J. BURTT DAVY. *Empire Forestry Journal* 14: 2: 191–201; 2 plates; December 1935.

The author treats his subject "only on very general lines here, the object being to convey a general impression of the most characteristic features of the rain forest and savannah country of tropical Africa."

The rain forest is of comparably small area, has a precipitation of 50–120 inches, and the trees are tall broad-leaved evergreens. There are two well-marked divisions: (1) The low-level rain forest (mostly below 3000 feet elevation), which may be subdivided into evergreen riparian fringing forest and mixed evergreen and deciduous forest; (2) montane rain forest (mostly at altitudes of 5000–8000 feet) often on steep slopes, facing the ocean, with an abrupt change landward to savannah grassland. "Montane rain forest is found in regions with five to seven rainless months; it is mainly confined to belts or areas where mist and clouds precipitate sufficient moisture to enable epiphytes (orchids, mosses, hepatics, and lichens) to survive through the long dry season; on this account it is often known to local residents as 'mist-belt' forest. . . . Three vegetation zones are recognizable: the broadleaf zone (the lowest), differing entirely in its floristic composition from that of the low-level rain forest; the conifer zone; and the bamboo zone."

The term savannah country is applied to "all vegetation communities in which the trees and shrubs are mainly deciduous (for a short period in the dry season at least), the canopy, even when close, permitting the penetration of sufficient light to allow the growth of a good ground-cover of grass (providing grazing for antelope and domestic animals) and other herbs, and, often, of scattered shrubs; in this it differs essentially

from rain forest and is indicative of drier conditions. . . . The trees are usually small and tortuous, with relatively thick bark; they are often not more than 20 to 40 ft. in height; . . . lianes and epiphytic seed plants are usually scarce, while . . . ferns and ground mosses are almost unknown except near springs or in other exceptionally moist situations."

"A preliminary census of the trees and shrubs of tropical Africa, recently taken at the Imperial Forestry Institute, enumerates 12,458 species, distributed among 950 genera, and 132 families. . . . An analysis of the geographical distribution of genera and families indicates that the pan-tropical and palaeo-tropical genera represent 15 per cent and 20 per cent respectively, or 35 per cent of the whole. The tropical American-African and the Madagascar-tropical African genera are approximately equal in number, together representing about 12 per cent. The north temperate zone element represents 0.8 per cent. The remaining 52 per cent of the genera are endemic to Africa; five of the families to which they belong are also endemic. These figures do not include families and genera endemic to temperate South Africa, or to the Mediterranean zone."

Aufzählung der von Baronin Nolde und O. Hundt in Angola gesammelten Leguminosen. By G. ROSSBERG. *Repertorium Specierum Novarum* (Berlin-Dahlem) 39: 155–168; Jan. 31, 1936.

An annotated list of Leguminosae collected in Angola, many species of trees and shrubs being included, often with citation of vernacular names. *Macrolobium Noldeae*, a large tree, is described as new.

Revision des espèces congolaises du genre *Erythrina* L. By JEAN LOUIS. *Bull. Jardin Bot. Bruxelles* 13: 295–319; figs. 5–8; November 1935.

Of 36 African species of *Erythrina*, 12 have been reported from Congo, but the writer considers that only six are represented, all of which are described, with citation of literature and synonymy, material studied, and vernacular names.

Les Thyméléacées de la flore du Congo Belge. By P. STANER. *Bull. Jardin Bot. Bruxelles* 13: 321–372; figs. 9–22; November 1935.

All the genera and species of Thymelaeaceae represented in Belgian Congo are described, with citation of synonymy and material studied. The genera represented are *Octolepis* (1 species), *Dicranolepis* (6), *Craterosiphon* (2), *Peddiea* (2), *Gnidia* (15), and *Struthiola* (2). New species are *Gnidia Claessensii*, *Struthiola Scaettae*, and *Craterosiphon Quarrei*.

Plantae Letestuanae novae (XXI). By FRANÇOIS PELLEGRIN. *Bull. Société Botanique de France* (Paris) 82: 434–437; 1 fig.; 1935.

Napoleona Le Testui is described as new from Gaboon, and extensive notes are given upon the genus *Paraphyadanthe* Mildbr. of the Flacourtiaceae.

Plantae Letestuanae novae (XXII). By FRANÇOIS PELLEGRIN. *Bull. Société Botanique de France* 82: 466–467; 1935.

New species from Gaboon are *Randia tubaeformis*, *R. Le Testui*, and *Dorothea Le Testui*.

The properties of mansonia (*Mansonia altissima* A. Chev.). Forest Products Research Records No. 7 (Timber Series No. 2). H. M. Stationery Office, London, Feb. 12, 1936. Pp. 4; 6 x 9½; 1 plate. Price 7d. post free.

Mansonia is the only widely used trade name for *Mansonia altissima* A. Chev. (syn. *Achantia altissima* A. Chev.). The native names are Ofun, Aprono, and Puronoo (or Pruno and Apruno). Tree is of medium size, averaging 2–3 feet in diameter, with a clear bole of 60 feet. It occurs from French Ivory Coast through the Gold Coast and Dahomey to Nigeria. The wood is moderately heavy, of medium uniform texture, moderately hard, and has a lustrous surface when finished. The heartwood is similar to Black Walnut (*Juglans nigra* L.) in general appearance and weight, but the strength properties are generally higher and on the basis of Black Walnut equals 100 are:

	When green	*12 per cent moisture*
Ultimate strength, transverse bending	130	115
Stiffness (*i.e.*, resistance to bending)	106	100
Toughness	108	132
Crushing strength parallel to grain	142	108
Hardness (side), indentation test	134	128
Strength in resisting splitting	123	100

Mansonia seasons rapidly and well. Tests indicate a more than average durability. The wood is more easily worked than Black Walnut and a good finish is readily obtainable. It is believed that the wood will prove useful for cabinet making and similar purposes for which Black Walnut is now used. "The Director of Forests, Nigeria, estimates that a sustained annual yield of not less than 170,000 ft. may confidently be expected."—R. W. HESS, *Yale School of Forestry*.

The properties of an African mahogany (*Khaya anthotheca* C. DC). Forest Products Research Records No. 6 (Timber Series No. 1). H. M. Stationery Office, London, Feb. 12, 1936. Price 7 d. post free.

The trade names in use for this species are: Uganda Mahogany, African Mahogany, and Munyama. Other names are: Kwabohori, Akwabohori, Kwaboko, Krala or Acajou Krala, Acajou Blanc de la Côte d'Ivoire, Ira m'Pohé, Acajou à Peau Lisse, and Mangona. The tree is large, yielding long clean logs, up to 5 feet in diameter; it occurs in mixed evergreen and deciduous forests ranging from the Ivory Coast, through the Gold Coast, possibly Nigeria, the French Cameroons and Angola to Uganda; it is in commercial quantities in Uganda, the Cameroons, and the Gold Coast.

The wood closely resembles the general run of African Mahogany in weight, appearance, and working qualities. Seasoning of the timber is quite satisfactory, and with little degrade, although care must be used to secure even drying of thick stock. A moderate durability under damp conditions is indicated. "The strength properties of *Khaya anthotheca* are of very much the same order as those of Central American Mahogany (*Swietenia macrophylla*) and African Mahogany (*Khaya ivorensis*). It may therefore be considered suitable, so

far as strength is concerned, for most of the purposes for which these species are employed." The working qualities are quite good except for a tendency to "pick up" on "ribbon grain" of quarter-sawed stock. Filling is necessary before polishing, owing to the somewhat coarse grain.

The results of laboratory tests and service trials show that *Khaya anthotheca* is suitable for the uses for which other African Mahoganies are applied. For exacting purposes such as cabinet work or decorative work and for veneer, care in seasoning and careful selection is necessary.—R. W. Hess, *Yale School of Forestry*.

Les Iles du Cap Vert: géographie, biogéographie, agriculture; flore de l'Archipel. By Aug. Chevalier. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 15: 170–171: 733–1090; 14 text figs., 16 plates; Oct.–Nov. 1935.

A comprehensive, well illustrated report on the Cape Verde Islands, which have interested the author for many years. It is divided into three main parts: I. Geography, climate, and population. II. Vegetation and agriculture. III. Catalogue of the native and exotic plants.

The taxonomic and climatic distribution of alkaloids. By James B. McNair. *Bulletin of the Torrey Botanical Club* (Menasha, Wisconsin) 62: 219–226; April 1935.

"The object of the present study of alkaloids is to bring out the climatic and taxonomic distribution of alkaloids, the relations between the molecular weights, carbon, hydrogen, and oxygen content of alkaloids and the climatic habitats of the plant families producing them; and the specificity of alkaloids as to species, genera, and families."

Angiosperm phylogeny on a chemical basis. By James B. McNair. *Bulletin of the Torrey Botanical Club* 62: 515–532; December 1935.

Summary

"Some of the chemical products produced by plants are influenced by the climate in which they are formed. Fats (glycerides) produced in the tropics have lower iodine values than fats formed in temperate regions. Alkaloids found in tropical plant families have smaller molecular weights than those of the temperate regions. Volatile (essential) oils have lower specific gravities and higher refractive indices when formed in the tropics than when formed in a temperate climate. In other words it would seem that more complex chemical products are formed in the temperate regions than are formed in the tropics. When these three classes of substances appear in plants of the same climatic zone, *e.g.*, in the tropics, the chemical properties vary with the degree of evolution of the plant according to the Engler and Gilg system. The highest evolved fats have the highest iodine values, the highest evolved alkaloids have the largest molecular weights, and the highest evolved volatile oils have the greatest specific gravities as well as the lowest refractive indices.

"According to evidence obtained from the analyses of alkaloids, glycerides, and volatile oils formed by plants: The Ranunculaceae may have been preceded by the Berberidaceae and Lardizabalaceae. Herbs may have been derived from trees. Monocotyledons may have preceded dicotyledons. Free petal flowers (polypetaly) are more primitive than united petal flowers (gamopetaly). Few carpels (oligocarpy) preceded many carpels (polycarpy). Free carpels (apocarpy) may be more primitive than united carpels (syncarpy or gamocarpy).

"These chemical findings may be used in comparing various systems of plant classification, *e.g.*, the Bessey and the Engler and Gilg systems. The Bessey system considers dicotyledons as more primitive than monocotyledons. Chemical evidence does not support this view, but favors in this regard the Engler and Gilg classification. The other phylogenetic principles as listed in the preceding paragraph are used in both systems, although both consider many carpels more primitive than few carpels.

"In both systems, according to the chemical evidence, the Ranales do not fall in the positions allotted to them. There is, however, better agreement with their position in the Engler and Gilg system. The Ebenales and Gentianales are out of

harmony in the Bessey system. These are closer together (both in Contortae) in the Engler and Gilg system. The Caryophyllales and Gentianales of Bessey are far removed in the Engler and Gilg (being respectively Myrtiflorae and Contortae), and the chemical findings may agree better with that classification than with Bessey's. The Celastrales and Umbellales do not harmonize with the Bessey system. These are in better accord with Engler and Gilg where the orders are considered as Sapindales and Umbelliflorae.

"In the taxonomic revision of various plant groups, the serum diagnostic method of Mez and the electrophoretic method of Moyer may give correct taxonomic sequences, but the use of alkaloids, glycerides and volatile oils gives not only these sequences but also (because they deal in numerical values) gives an idea as to the relative degree in evolution of various groups, *e.g.*, the palms versus the iris, or the palms versus the Rubiales. The methods of Mez and Moyer require fresh material, while the alkaloids, etc., may be obtained from dried herbarium materials."

New materials for paper and board manufacture. *Bulletin of the Imperial Institute* (London) 33: 4: 421–446; (1935) January 1936.

"Results of an investigation of a number of plants which have been examined in the laboratories of the Imperial Institute in recent years with a view to ascertaining their suitability for the manufacture of paper and boards." The timbers included are Gelam, *Melaleuca Leucodendron*, from Malaya and Mangrove, *Rhizophora racemosa*, from Gambia, and on both of them the reports are unfavorable. The bark of Jarrah, *Eucalyptus marginata*, which is available in large quantities at Western Australian sawmills, is capable of furnishing a fairly good yield of coarse-fibred pulp of very satisfactory strength and utilizable in the manufacture of boards.

Timber and attack by *Lyctus* beetle. By F. Y. Henderson. *Annals of Botany* 49: 196: 854–856; October 1935.

"The purpose of this note is to record the fact that, under

easily maintained conditions, living sapwood can rapidly be rendered free from starch and, therefore, if the relationship holds good, immune from attack by *Lyctus*."

Forest bibliography. International Union of Forest Research Organizations. English translation from the German prepared and issued by the Imperial Forestry Institute, Oxford, 1936. Pp. vii+100; 7¼ x 9¾. Price 6 s. net.

The full title to the English edition is "Forest bibliography, with the index numbers 634.9 F. An international decimal classification on the basis of Melvil Dewey's system. Adopted on the recommendation of the International Committee on Forest Bibliography, 1906–1933." The book includes an introduction by Professor Gyula Roth, Sopron, Hungary, President of the Union, and an historical review. The "Guide" (pp. 3–18) covers the following topics: the system; principles and rules; application; maintenance and employment of the literature cards; conversion of previously existing bibliographical systems into the decimal classification. The "Classification Scheme" occupies pp. 19–76, and is followed by geographical and alphabetical indexes.

International Association of Wood Anatomists. *Empire Forestry Journal* 14: 2: 253–254; December 1935.

"The sixth International Botanical Congress, held in Amsterdam, September 1935, afforded an opportunity for the International Association of Wood Anatomists to meet for discussion and the transaction of business. During the four years that have elapsed since its formation, the Association has developed to the extent that there are now over 80 members in 25 countries. The representative character of the membership is in itself a proof of the success which has attended the efforts of the executive to further international coöperation in the field of wood anatomy. The fact that nearly all the principal workers in this subject are now in touch with each other means that good progress has already been made towards achieving the aims and objects of the Association." (Present membership, 98; countries, 27.—S. J. R.)

Yale University School of Forestry

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NOTES ON THE SPECIES OF *HYMENOLOBIUM*: GIANT TREES OF BRAZILIAN AMAZONIA

By ADOLPHO DUCKE

Jardim Botanico do Rio de Janeiro

One of the most important places among the numerous tall trees of the Amazonian forests is occupied by the genus *Hymenolobium* Benth. (Legum. Papil. Dalb.), known chiefly under the vernacular name Angelim.[1] These trees escaped the researches of former botanical travellers, but I now have sufficiently abundant herbarium and wood material of them to attempt their classification. The type specimens of the new species here described are preserved in the Jardim Botanico do Rio de Janeiro; cotypes of them and duplicates of five

[1] In the extra-Amazonian states of Brazil this name generally refers to the genus *Andira;* in various Amazonian localities, also to *Dinizia excelsa* and *Pithecolobium racemosum.*

other species, all accompanied by wood samples, are at the Yale University School of Forestry; herbarium material has been (or will be) distributed to the principal botanical institutions of America and Europe.

The geographical range of this genus extends from the Guianas to Rio de Janeiro, but most of the species grow in the central and oriental parts of the Amazonian hylaea, only two having been found to the south of it. All yield hard and strong timber which is employed industrially at Pará, chiefly in naval construction. The color of the flowers (petals) varies according to the species from a pretty violet to a pale flesh-rose; the pods of two species are of a very beautiful red or violet. Some of the trees are notable for their lofty height, the thickness of their stems, and the great spread of their crown. In all the Amazonian species, with the sole exception of *H. sericeum*, the whole of the trees or the fertile branches of the younger ones are bare during the entire flowering and fruiting period; the old leaves are shed with the advent of the flowers and the new foliage appears only after the fall of the ripe fruits. The floriferous trees, and in *H. petraeum* and *H. pulcherrimum* still more so the fructiferous ones, look like magnificent giant bouquets rising up above the virgin forest. These trees, especially the tallest, flower and fruit at intervals of a few or several years. Flowering lasts no more than a fortnight and the fruits ripen after two months, the period being in the first half of the rainy season (December to March, for the greater part of our region) for all species except *H. petraeum*, whose fertile stage is normally in the middle of the dry season (September). Most of the species grow in the upland rain forests, but *H. petraeum* occurs sometimes also in the drier forests of campos regions, in which case the trees are of lesser size. *H. heterocarpum* grows along the inundable sandy or rocky banks of swift streams in the Rio Negro basin; in the upper part of the range its seeds are eaten, after boiling.

Synoptical Key to the Amazonian Species

Pod elongate-oblong, membranaceous, adapted to dispersion by the wind.

Flowers long-pedicellate, glabrous, in a very lax panicle; calyx 9–13 mm. long, greenish white; petals pale flesh-color; pod very large, whitish green.

One of the stamens much lower connate than the 9 others. Leaflets 3–7, large (60–120 by 30–60 mm.), subcoriaceous; stipels insignificant.
1. *H. complicatum.*

Flowers short-pedicellate; calyx 4–8 mm. long, dark colored; petals rose-violet. Stamens equally or subequally monadelphous.

Leaflets 5–11, large (50–80 by 25–40 mm.), exstipellate, thick and hard, smooth, shining and green above, opaque and pale grayish beneath. Calyx minutely pilose or subglabrous; pod glabrous. . . . . 2. *H. nitidum.*

Leaflets 9–49, smaller (12–60 by 4–25 mm.). Calyx densely sericeous.

Ovary covered with long silky hairs. The foliage persists during the fertile stage. Leaflets 29–37, 10–30 by 7–13 mm., oblong, glabrous above, scarcely pilose or subglabrous beneath; stipels, bracts, and bractlets very small; pod greenish, less pruinose. . . . . 4. *H. sericeum.*

Only the sutures of the ovary hairy. The fertile trees or at least the fertile branches lose their foliage.

Leaflets 9–17 or seldom up to 21, 30–55 by 15–25 mm., glabrous above, scarcely pilose beneath, stipels deciduous and insignificant. Pod blood-red, entirely glabrous. . . . . 3. *H. petraeum.*

Leaflets 13–21, 30–60 by 10–25 mm., often obovate, glabrous or subglabrous above, scarcely pilose beneath; stipels, bracts, and bractlets rather small. Pod bright green, moderately pruinose.
5. *H. modestum.*

Leaflets 17–27, moderately pilose above, rather pubescent beneath, 20–35 by 6–15 mm. Bracts and pod unknown. . . . . 6. *H. elatum.*

Leaflets 21–29, 20–50 by 10–20 mm., a little or rather pubescent above, densely hairy beneath; bracts and bractlets very conspicuous and subpersistent; pod violet, densely pruinose.
8. *H. pulcherrimum.*

Leaflets 27–49, rather hairy, 12–30 by 3–8 mm.; bracts and bractlets soon deciduous; pod greenish with dirty reddish margins, rather densely pruinose. . . . . 7. *H. excelsum.*

Pod adapted for dispersion by water, elliptic, suborbicular or falcato-obovate, spongy coriaceous, green, glabrous. The vegetative parts, the inflorescences, and the indument rather like *H. pulcherrimum*. . . . . 9. *H. heterocarpum.*

1. HYMENOLOBIUM COMPLICATUM Ducke, Arch. Jard. Bot. Rio de Janeiro 3: 158, 1922 = *H. nitidum* Ducke, Arch. Instit. Biolog. Veget. Rio de Janeiro 2: 1: 47, 1935 (non Benth.).—Not rare in upland rain forest with argillaceous soil, in the lower and the upper Rio Negro and tributaries (Manáos, São Gabriel, Rio Curicuriary, Rio Uaupés) and in the middle Tapajoz (cataracts of Mangabal); one of the biggest trees of

these regions, and beautiful when flowering, with the whole crown of pale flesh color. The whitish green pod is the largest hitherto known in the present genus (120–250 by 35–65 mm.). I distributed material from Rio Tapajoz (Herb. Jard. Bot. Rio de Janeiro 11655, and Herb. Amaz. Mus. Pará 16741), Manáos (H. J. B. R. 23839), São Gabriel (H. J. B. R. 23840). Herbarium and wood material from S. Gabriel (61; Yale 21005) and complete herbarium material from Manáos (61a) have been forwarded to Professor Record. The material from Manáos and S. Gabriel was distributed under the erroneous determination *H. nitidum*.

2. HYMENOLOBIUM NITIDUM Benth.—This species, well distinguished by its rather small size and its very hard and thick leaflets, seems to be peculiar to the "catinga" regions of the upper Rio Negro basin where it was discovered by Spruce near the Ipanoré ("Panoré") cataracts of Rio Uaupés. I found it frequent in the low catinga woods along the upper Curicuriary (loco Tumbira, February 1936 legit A. Ducke): floriferous material with young pods (Herb. Jard. Bot. Rio de Janeiro 29005) and wood sample (263; Yale 32639). It is here, in spite of its relatively small size, one of the highest trees, whose poorly ramified crown rises often several meters above the general level of the catinga.

3. HYMENOLOBIUM PETRAEUM Ducke, 1915.—The peculiar grayish bark of the stem and of the old branches, the slight pilosity, and the blood-red pods make it easy to recognize this species, which because of its very hard wood is known in the state of Pará as ANGELIM PEDRA (Stone Angelim). The tree attains enormous dimensions in the upland virgin forest, but it occurs, as smaller individuals, also in the drier forest of certain campos regions (Macapá, Almeirim, Montealegre). I observed it from the vicinity of the Atlantic (Bragança) through the whole state of Pará as far as Manáos. Complete herbarium material has been distributed to the principal botanical institutions, to Yale with a wood sample from Parintins (126; Yale 22586).

4. **Hymenolobium sericeum** Ducke, sp. nov.—Speciei *H. modestum* affine, differt foliis in arbore etiam in ramis fertilibus persistentibus, foliolis 29–37 vulgo 10–30 mm. longis

et 7–13 mm. latis, oblongis, ovario undique dense et longe pallide sericeo-piloso. Arbor magna vel maxima, cortice non soluto, ramulis novellis et inflorescentiis modice canopubescentibus, foliolis supra viridibus nitidulis, subtus albescentibus opacis, panicula inter folia, his multo breviore, petalis roseo-violaceis, staminibus 10 glabris sat alte monadelphis, legumine saepius 80–120 rarius ad 145 mm. longo et 25–30 (38) mm. lato, laete viridi, ad nucleum seminiferum pallido-pruinoso.

Manáos, in relictis silvae primariae terris argillosis altis loco Estrada da Raiz; arbor typica 15–2–1936 plene florifera, legit A. Ducke, Herb. Jard. Bot. Rio de Janeiro 29003, cum ligno 271 (Yale 32647); arbor altera 26–1–1936 cum inflorescentiis novellis, 27–3 fructibus maturis, H. J. B. R. 29004; arbor tertia solum sterilis visa.

Allied to *H. modestum*, but the very big trees preserve their foliage during the whole fertile stage, and the leaflets are smaller and much more numerous. The densely silky ovary distinguishes this species from any other.

5. HYMENOLOBIUM MODESTUM Ducke, 1915.—A tall, but not gigantic, tree growing generally in moist places with sandy soil, in the upland forest. Obidos, Faro, Bella Vista of Tapajoz River, and Manáos. Herbarium material in the principal botanical institutions.

6. HYMENOLOBIUM ELATUM Ducke, 1915.—An insufficiently known species from the upland forest near Belem do Pará. Sterile material was distributed by the Herb. Amaz. Mus. Pará (15652) to Rio de Janeiro, Geneva, and London (British Museum).

7. HYMENOLOBIUM EXCELSUM Ducke, 1915.—The true ANGELIM of the timber trade of Pará, but sometimes called also ANGELIM PEDRA as *H. petraeum;* the tallest species of this genus, with an immense flattened crown and having an elegant aspect due to the symmetrically (mostly quaternary) ramified branchlets and the regularly disposed foliage. The species has been observed from the vicinity of the Atlantic coast (Bragança) through the state of Pará to the eastern part of the state of Amazonas (Parintins); it grows in the upland virgin forest. Complete herbarium material was

distributed to the principal botanical institutions, to Yale with a wood sample (255; Yale 32631, from Parintins).

8. HYMENOLOBIUM PULCHERRIMUM Ducke, 1915.—Easily recognizable by the abundant pilosity of most of its parts, by the well developed stipules, stipels, bracts, and bractlets and principally by the pod, rose violaceous, powdered with a whitish wax-like substance. In the fructiferous more than in the floriferous stage, it is one of the most beautiful trees of Amazonia where it is found in the upland rain forest, chiefly on sandy soil, from Gurupá to the lower Madeira and Manáos. It is frequent in the neighborhood of this city where it is oftener called SAPUPIRA AMARELLA than Angelim. Complete herbarium material has been distributed to the above mentioned institutions and to Yale (Manáos, 45 [with wood sample]; Yale 20726; also 45a and 45b).

9. **Hymenolobium heterocarpum** Ducke, sp. nov.—Speciei *H. pulcherrimum* partibus vegetativis et inflorescentiis simile, floribus autem maioribus, legumine valde diverso. Arbor vulgo mediocris altitudinis rarius usque ad 30 m. alta, trunco non decorticante, coma late patula; ramuli crassi petiolorum cicatricibus crebre notati, parte juniore ut petioli rhachidesque dense fulvotomentosi, stipulis magnis lanceolato-subulatis dense fulvohirtis solum in sterilibus persistentibus, foliis apice congestis. Foliola vulgo 19–31, petiolulis brevibus ut stipellis dense pilosis, usque ad 55 mm. longa et ad 18 mm. lata at saepe multo minora, basi rotundata vel subemarginata, apice obtusa vel retusa et mucronulata, supra parce griseopilosa tardius glabrata, subtus densius canoferrugineo-pilosa, costa subtus et margine utrinque dense fulvopilosis. Paniculae in arbore tota vel in ramis defoliatis, breves latae vel usque ad 250 mm. longae pyramidatae, multiflorae, dense fulvotomentosae, bracteis et praesertim bracteolis persistentibus, his ad 2 mm. longis; calix 7–9 mm. longus dense fulvidotomentosus obtuse dentatus; petala roseo-violacea; stamina 10, glabra, 9 altius connata quam decimum; ovarium glabrum suturis pilosis. Legumen 1- vel 2- rarius 3- rarissime 4-seminatum, stipite tenui calici aequilongo vel parum longiore, usque ad 50 rarius 70 mm. longum et ad 40 mm. latum, compressum, veriabiliter ellipticum suborbiculare vel falcato-obovatum

rarissime falcato-oblongum, laxe reticulatum, glabrum, viride, parte seminifera turgida spongioso-coriacea, margine subcoriaceo vulgo uno latere convexo et multo latiore quam altero; semen maturum elongatum testa brunnea sat tenui.

Habitat ut videtur per totam regionem Rio Negro, in Brasilia, Colombia, et Venezuela, secus ripas saxosas et arenosas rarius inundabiles fluminum et rivorum, praesertim ad cataractas. Floriferum mensibus Novembre et Decembre, fructiferum Februario et Martio legit A. Ducke: specimina typica prope Manáos, florifera et fructifera (Herb. Jard. Bot. Rio de Janeiro 29001) cum ligno 246 (Yale 31973); fructifera ad flumen Curicuriary (H. J. B. R. 29002). Nomen vulgare in Rio Negro parte superiore: CARÁMATE. Semen edule.

This species is generally a middle-sized tree with widely spreading and symmetrically ramified crown of elegant aspect; it is especially beautiful when entirely covered with rose-violet flowers or with its young foliage, which is of a pure bright green so seldom found in any plant. In the cataract regions of certain tributaries of the upper Rio Negro (Curicuriary for example) this tree is very common and may be considered as a characteristic landscape element; its immature seeds are eaten, after boiling.

This is the sole *Hymenolobium* adapted to water-dispersion, having a small-winged, spongy, coriaceous pod which easily floats in the streams. The form and structure of this pod are very different from those of all the other species, and resemble the fruits of certain water-inhabiting Leguminosae of other genera. Most of the analogous cases, however, occur in the group Dalbergieae (to which this plant belongs); *Dalbergia*, *Machaerium*, *Pterocarpus*, and *Vatairea* each contain species with flying pods and species with floating pods.

THE WOODS OF *HYMENOLOBIUM*

By SAMUEL J. RECORD

The following notes are based on a preliminary study of one sample each of seven species of *Hymenolobium* collected by Dr. Adolpho Ducke and enumerated by him in the preceding paper. While the differences observed are enough to separate

the several specimens, more material is necessary to prove their real diagnostic value.

In general, the woods are much alike, although that of *H. nitidum* contains less parenchyma than the others and consequently is noticeably denser and more deeply colored. They have many features in common with *Andira* and *Vataireopsis*, some species of which are also known as Angelim in Brazil. The timber is useful for strong and durable construction, but probably will not attain much commercial importance. It has a small figure of the Partridgewood type, though hardly distinctive enough to create a demand for veneers and turnery.

The sapwood is grayish and ranges in thickness from less than one inch to more than two; transition to heartwood is rather gradual. The heartwood is pale brown when fresh, deepening upon exposure, thus accentuating the differences between the darker fiber layers and the lighter parenchyma bands and stripes. The luster is low, principally because of the abundance of parenchyma. There is no distinctive scent and no bitter taste, such as characterizes the Angelim Amargosa. The texture is coarse and the grain is irregular and interwoven; sharp tools are required to give a smooth finish. Specific gravity of most specimens (air-dry) 0.70–0.80, or 44–50 lbs. per cu. ft. Small patches or streaks having a density greater than 1.00 are sometimes encountered, the excessive weight resulting from deposits of a hard gum or wax that completely fills the vessels and all the cell cavities.

GROSS ANATOMY

Growth rings present or absent; often indicated by more orderly arrangement of elements at successive intervals. *Pores* rather few; mostly solitary, but sometimes in multiples of two to several; well distributed; readily visible, oval, their width commonly slightly greater than normal space between rays; usually open, without tyloses, but occasionally filled with gum. *Vessel lines* conspicuous. *Parenchyma* abundant, composing a fourth to a half of the ground mass; paratracheal, aliform, and confluent, giving rise to elaborate pattern; also in isolated patches and short lines; much variation in different

specimens and also in different parts of the same wood; strands storied, but not distinctly so; cells not in distinct secondary horizontal seriation; reddish, brownish, or purplish gum deposits common in heartwood. *Rays* fine; visible without lens on cross section but usually not on the tangential; low and inconspicuous on radial surface, appearing lighter than the background; sometimes definitely storied, sometimes scarcely at all. *Wood fibers* in dense, rather horn-like layers or patches, in decided contrast to the parenchyma, especially on the cross section and sometimes also on the tangential. *Gum ducts* not observed. *Ripple marks* present; 50–80 per inch, fairly regular in some specimens to very irregular or only local in others; usually more distinct on surface of inner bark than in wood.

Minute anatomy

Vessel members with simple perforations, the plates nearly horizontal; intervascular pitting alternate (visible only in the vessel multiples, which may be absent in a particular section), the pits round, with lenticular, sometimes coalescent apertures; distinctly vestured. *Parenchyma* strands composed of several large cells mostly of unequal length; starch very abundant in sapwood and conspicuous because of the large size of the spherical grains, 3–6 often completely filling a cell; no crystals observed. *Rays* variable from nearly homogeneous to very decidedly heterogenous; sometimes with single, occasionally with several, marginal rows of cells that are larger, squarish to upright, the condition not constant in same specimen; 1–5, mostly 3, cells wide and few to 25, mostly 15–20, cells high; sometimes fairly uniform in size, often variable; storied, distinctly or indistinctly, the latter being the case where the rays are of unequal size, the higher ones occupying parts of two tiers; ray-vessel pit-pairs half-bordered, numerous, crowded, and of the same size and appearance in face view as intervascular; marginal cells filled with large starch grains in sapwood; gum deposits abundant in heartwood; no crystals observed. *Wood fibers* with thick to very thick walls; tapering, without shoulders; pits small, simple, not numerous.

The wood of *H. nitidum* provides several exceptions to the foregoing description. The sample is from a small stem, about 10 cm. in diameter, whereas the others are from large trunks. The core of heartwood, 3.5 cm. through, is brown with darker streaks, turning to deep reddish brown, in decided contrast to the yellowish sapwood; fairly lustrous; its density (air-dry) is about 1.15; weight about 69 lbs. per cu. ft. Parenchyma less abundant than in other species, aliform, the wings rather narrow and from short to long and confluent. The rays are decidedly heterogeneous near the pith, but becoming much less so further out. The wood of *H. heterocarpum* agrees with the general description except that the parenchyma is more definitely banded.

ON THE BRAZILIAN WORDS PÁO AND PAU[1]

By B. E. Dahlgren
Field Museum of Natural History

Páo and *pau* continue to puzzle those who have occasion to note Brazilian names of woody plants. Both forms appear in current botanical literature. The recent Portuguese dictionaries give pau, the older ones, such as Roquette's edition of Fonseca, páo with pau as an alternative, the bilingual dictionaries páo. The definition is: stake, pole, stick, or timber, particularly with reference to kind or variety, and therefore in names of trees and their wood, as in Pau Ferro (iron wood), etc. In the much neglected joint wordlist of Brazilian and Portuguese Academies pau is the form indicated and is no doubt that required by the reform orthography prescribed for official use in Brazil a few years ago but soon afterwards discarded by the framers of the new constitution.

Pau is unquestionably the more practical and simple form since it can be written without the accent required in the word páo. Etymologically it is considered the more correct or reputable as derived, like French nouns, from its Latin progenitor through the accusative, *viz.*, *palum*, by elision of

[1] Written at the request of the editor.

the "l" between the two vowels, while páo appears to be derived by the same process from the ablative, at least equally frequent and important, the form of which in this case persists in the Spanish equivalent *palo*. As a Portuguese word, however, páo appears to be the more ancient. I find it, almost without searching for it, in an extract from the "O Livro de Esopo" of late 12th or early 13th century and, as another random instance, in the Páo da Cobra in Garcia de Orta, "Coloquios dos Simples da India," published in Goa 1563.

Without other evidence at hand, one may conclude that it has been used for at least seven centuries and belongs to the old Portuguese which, like Spanish, was developed not directly from the Latin of classical authors but from the colloquial Latin language as it came to be spoken in the respective parts of the Iberian peninsula, the Portuguese taking definite shape as a modern Romance language in the works of early Lusitanian authors who wrote the vernacular of their day without special reference to Latin etymology. Only some centuries later, with the revival of learning in Europe, was classical scholarship brought to bear in the process of whipping the written language into more literary Latin form; this, only more or less successfully or effectively, and too late, for the schism still exists.

As a result, the coexistence of at least two different derivatives from a Latin word is the rule rather than the exception in Portuguese, with one of such a pair of doubles approaching more closely than the other in form, and usually also in meaning, to its literary Latin ancestor. Thus, from the Latin *causa*, the Portuguese *causa*—cause, case, also *cousa* as well as *coisa*, both equivalent to the English word "thing" or, to use examples especially pertinent to *Tropical Woods*, from *materiam*, *materia*—matter, material, also *madeira*—woody material or lumber, with the variant *madeiro*—a big log or timber; similarly from the Latin *lignum*, *lenha*—firewood, and *lenho*—the ligneous structure or substance of plants.

Rarely, as in coisa and cousa, páo and pau are the two words of such a pair exactly synonymous, their coexistence throughout various centuries furnishing an interesting instance of the ineffectiveness of past attempts at orthographic reform.

CLASSIFICATIONS OF VARIOUS ANATOMICAL FEATURES OF DICOTYLEDONOUS WOODS

By Samuel J. Record

The following lists are assembled in the belief that they will prove useful to all interested in the classification of woods and in the hope that their publication will result in the rectification of mistakes and the addition of much additional information. Some of the tables are new, others have appeared before, though none exactly as presented here; bringing them together should prove convenient for reference purposes. Some of the most important classifications remain to be made; *e.g.*, types of wood parenchyma and the nature of the ray-vessel pitting.

Ring-porous woods. The inclusion of a genus does not mean that every species is ring-porous, for often such is not the case. In fact the wood of a widely distributed species may be ring-porous where the seasonal variations are pronounced and diffuse-porous or intermediate where the climate is more nearly uniform. No distinction is made in the list between woods that show the ring-porous structure distinctly and those that require the use of a hand lens. A key to the group would be useful.

Large rays. A paper on this subject was published by Professor Tupper in *Tropical Woods* 11: 5–9. Last year Mr. H. E. Dadswell and I made a preliminary survey of all of the large-rayed woods in the Yale collections and a report is nearly ready for publication. There probably will be differences of opinion as to the proper interpretation of the term "conspicuously large." ("Aggr."=aggregate rays.)

Ripple marks. I have been studying storied structure for about 25 years, publishing a short paper in *Science* in 1912 and a fairly comprehensive one in *Bulletin of the Torrey Botanical Club* 46: 253–273, July 31, 1919. (See also *Tropical Woods* 9: 13–18; 28: 49–50.) The present list is an extension of that in my book, *Identification of the Timbers of Temperate North America*, pp. 86–87. ("Occ."=occasionally.)

Intercellular canals. I published two annotated lists in the American *Journal of Forestry* 16: 4: 428–441, April 1918; 19: 3: 1–12, March 1921; and one in *Tropical Woods* 4: 17–20,

Dec. 1, 1925. The present table is a revision of one in my book, *T. of T. N. Am.*, pp. 80–81. Radial phloem bridges in the rays of some anomalous woods may appear like large radial ducts, especially when the unlignified tissue has disintegrated.

Included phloem. This is substantially the same as the table given on page 107 of my book, *T. of T. N. A.* The Urticaceae do not really belong in the list, as the strands are not phloem, but unlignified wood parenchyma. They are included because of the close resemblance of the two structures and the difficulty of determining their true nature when the tissue has broken down. Phloem bridges have been observed in the rays in a few instances.

Raphides. For a description of these crystals and a key to the woods in which they have been found, see Hess' paper on the subject in *Tropical Woods* 46: 21–31, June 1, 1936.

Perforations. The two lists are substantially the same as those in my book, *T. of T. N. A.*, pp. 45–46, though there have been a few changes and several additions.

Vestured pits. See *Tropical Woods* 31: 46–48, Sept. 1, 1932 and *Journ. Arnold Arboretum* 14: 259–273. It is not always easy in practice to distinguish deposits or artifacts from outgrowths of the wall, hence the occurrence of vestured pits (formerly known as pits with sieve-like or cribriform membranes) was previously believed to be more extensive than indicated in the list.

Scalariform pitting. In general, this refers to the intervascular pitting, usually seen to best advantage in tangential sections. Frequently, however, the pitting between vessels and adjoining ray cells and wood parenchyma is also scalariform. In some instances, as in the Fagaceae, only the small vessels have scalariform pitting, whereas in others, such as the Monimiaceae and some of the Rhizophoraceae, the large vessels show it very strikingly. ("Occ."=occasionally.)

Spirals in vessels. Reference is to thickenings on the inside of the secondary wall and not to striations. Spirals may characterize all of the vessels of a wood or only a few of them (especially the smallest); may be coarse and distinct or very fine and indistinct; may be visible on the whole wall or only where in contact with certain elements or in the tails of the

members. At best, spirals are only a specific feature and are much more likely to be developed in woods of the temperate zones than in those of the tropics.

Spirals in fiber-tracheids. See *Tropical Woods* 3: 12–16, September 1925. Such spirals constitute only a specific character, being absent even from some species of *Ilex*, a genus in which usually they are especially well developed. Most of the plants listed grow in the north temperate zone.

Conspicuous bordered pits in fibers. This is not a list of all woods containing fiber-tracheids, but only of the families in which some or all of the woods are characterized by fibers having bordered pits that are conspicuous because of their large size, abundance, or both. The choice has been rather arbitrary in a few instances.

In preparing these lists I have examined thousands of specimens and slides in the Yale collections and have also made free use of many published works, beginning with Solereder's *Systematic Anatomy of the Dicotyledons*. Much assistance in one way or another was received from the following members of the International Association of Wood Anatomists: I. W. Bailey, F. B. H. Brown, L. Chalk, M. M. Chattaway, H. E. Dadswell, H. E. Desch, M. Fujioka, G. A. Garratt, E. S. Harrar, H. H. Janssonius, R. Kanehira, H. B. Marco, R. P. McLaughlin, L. Piccioli, B. J. Rendle, W. W. Tupper, I. E. Webber, R. H. Wetmore, L. Williams, and N. Yamabayashi.

Ring-porous Woods

(Those marked with asterisk are only partially ring-porous)

Acanthaceae
- Aniscanthus

Alangiaceae
- Alangium

Anacardiaceae
- Cotinus
- Pistacia
- Rhus

Anonaceae
- Asimina

Apocynaceae
- Allamanda

Aquifoliaceae
- Nemopanthes

Araliaceae
- Acanthopanax
- Aralia
- Gilibertia
- Hedera
- Heptapleurum
- Kalopanax
- Polyscias
- Pseudopanax

Aristolochiaceae
- Aristolochia

Asclepiadaceae
- Periploca

Berberidaceae
- Berberis

Betulaceae
- Carpinus *

Bignoniaceae
- Bignonia
- Catalpa
- Chilopsis

BORAGINACEAE
- Auxemma
- Cordia
- Ehretia

CALYCANTHACEAE
- Calycanthus

CAPRIFOLIACEAE
- Lonicera
- Symphoricarpus

CELASTRACEAE
- Canotia
- Celastrus
- Euonymus

COMBRETACEAE
- Combretum

COMPOSITAE
- Proustia

CORIARIACEAE
- Coriaria

CORNACEAE
- Cornus *
- Garrya *

CUNONIACEAE
- Platylophus *

EBENACEAE
- Diospyros

ELAEAGNACEAE
- Elaeagnus
- Hippophae
- Shepherdia

ERICACEAE
- Andromeda
- Arbutus
- Arctostaphylos
- Rhododendron

ERYTHROXYLACEAE
- Erythroxylon

EUPHORBIACEAE
- Elaeococca
- Mallotus

FAGACEAE
- Castanea
- Castanopsis
- Pasania
- Quercus

FOQUIERIACEAE
- Foquieria

GROSSULARIACEAE
- Ribes

HYDRANGEACEAE
- Philadelphus

JUGLANDACEAE
- Carya (Hicoria)
- Juglans *
- Platycarya
- Pterocarya

LAURACEAE
- Sassafras

LEGUMINOSAE
- Acacia ?
- Albizzia ?
- Amorpha ?
- Cercis
- Cladrastis
- Eysenhardtia
- Genista
- Gleditschia
- Gymnocladus
- Indigofera
- Laburnum
- Maackia
- Parkinsonia
- Prosopis *
- Pterocarpus *
- Robinia
- Sophora
- Ulex *
- Wistaria

LEITNERIACEAE
- Leitneria *

LOGANIACEAE
- Buddleia

LORANTHACEAE
- Loranthus

LYTHRACEAE
- Lagerstroemia

MALVACEAE
- Thurberia

MELIACEAE
- Cedrela
- Melia
- Toona

MENTHACEAE
- Lavandula
- Rosmarinus
- Salvia

MORACEAE
- Broussonetia
- Cudrania
- Maclura (Toxylon)
- Morus

MYRICACEAE
- Myrica

OLEACEAE
- Chionanthus
- Fontanesia
- Forsythia
- Fraxinus
- Jasminum
- Ligustrum
- Phillyrea
- Syringa

PASSIFLORACEAE
- Passiflora

RHAMNACEAE
- Ceanothus
- Hovenia
- Rhamnella *
- Rhamnus
- Zizyphus *

ROSACEAE
- Crataegus *
- Cydonia *
- Exochorda
- Mespilus *
- Prunus *
- Rosa

RUBIACEAE
- Nauclea ?
- Pinckneya

RUTACEAE
- Evodia
- Orixa
- Phellodendron
- Ptelea

SANTALACEAE
- Osyris

SAPINDACEAE
- Koelreuteria

SAPOTACEAE
- Bumelia

SCROPHULARIACEAE
- Paulownia

SIMARUBACEAE
- Ailanthus
- Picrasma(?)

STERCULIACEAE
- Firmiana
- Fremontia
- Reevesia
- Sterculia

STYRACACEAE
- Styrax

TAMARICACEAE
- Myricaria

THEACEAE
- Camellia *

TILIACEAE
- Erinocarpus
- Grewia *
- Vallea *

ULMACEAE
- Celtis
- Planera
- Ulmus
- Zelkowa

VERBENACEAE
- Clerodendron
- Citharexylum *
- Lippia
- Peronema
- Tectona
- Vitex *

VITACEAE
- Vitis

FAMILIES CONTAINING WOODS WITH CONSPICUOUSLY LARGE RAYS

Actinidiaceae
Akaniaceae
Amygdalaceae
Anonaceae
Aquifoliaceae
Araliaceae
Aristolochiaceae
Berberidaceae
Betulaceae (aggr.)
Bombacaceae
Cactaceae
Campanulaceae
Casuarinaceae
Chloranthaceae
Cornaceae
Corylaceae (aggr.)
Cucurbitaceae
Dichapetalaceae
Dilleniaceae
Elaeagnaceae
Epacridaceae
Escalloniaceae
Euphorbiaceae
Fagaceae
Flacourtiaceae(?)
Gesneriaceae
Greyiaceae
Guttiferae
Icacinaceae
Lecythidaceae
Leguminosae
Loganiaceae
Malvaceae
Marcgraviaceae
Menispermaceae
Monimiaceae
Myrsinaceae
Neumanniaceae
Papaveraceae
Piperaceae
Platanaceae
Proteaceae
Ranunculaceae
Rhizophoraceae
Rosaceae
Sabiaceae
Simarubaceae
Sterculiaceae
Symplocaceae
Tamaricaceae
Theophrastaceae
Trochodendraceae
Vacciniaceae
Verbenaceae
Violaceae
Vitaceae
Winteraceae

OCCURRENCE OF "RIPPLE MARKS" OR STORIED STRUCTURE

(Asterisk means that not all elements are storied)

AMARANTACEAE
- Charpentiera *

BERBERIDACEAE
- Berberis *

BIGNONIACEAE
- Crescentia
- Enallagma
- Paratecoma
- Tabebuia (Tecoma)

BIXACEAE
- Bixa

BOMBACACEAE
- Aguiaria *
- Bombacopsis *
- Bombax *
- Camptostemon
- Catostemma *
- Cavanillesia *
- Ceiba *
- Chorisia *
- Cumingia

Gossampinus *
Hampea *
Montezuma *
Pachira *
COCHLOSPERMACEAE
Cochlospermum
COMPOSITAE
Artemisia *
Baccharis *
Bigelovia *
Brachylaena
Hymenoclea *
DIPTEROCARPACEAE
Balanocarpus (occ.)
Dryobalanops ?
Shorea (occ.)
EBENACEAE
Diospyros (few spp.)
ELAEOCARPACEAE
Muntingia *
GESNERIACEAE
Cyrtandra *
HIPPOCASTANACEAE
Aesculus
LAURACEAE
Cryptocarya (2 spp.)
LEGUMINOSAE
Aeschynomene *
Amphimas
Andira
Apoplanesia
Apuleia
Arthrocarpum
Ateleia *
Baikaea
Baphia
Bauhinia
Belairia
Bergeronia
Bocoa
Bowdichia
Brya
Butea
Caesalpinia
Canavalia
Castanospermum
Cedrelinga
Centrolobium
Cercis
Cytisus *
Dalbergia
Dalea
Daniella
Daviesia
Derris
Dialium
Dicorynia
Diphysa *
Dipteryx
Distemonanthus
Drepanocarpus
Ecastophyllum
Erythrina *
Etaballia
Eysenhardtia
Fordia *
Genista
Geoffroya
Gliricidia
Gourliea
Haematoxylon
Harpalyce
Herminiera *
Holocalyx
Hymenolobium
Ichthyomethia
Indigofera
Inocarpus
Koompassia
Laburnum *
Lecointea
Lennea *
Lonchocarpus
Machaerium
Martiusia
Melanoxylon
Mezoneurum *
Millettia
Muellera
Myrocarpus
Myrospermum
Myroxylon
Olneya *
Ormocarpum *
Ormosia
Ougeinia
Pahudia
Paramachaerium
Parasolea *
Parkia
Pericopsis
Phylloxylon
Pictetia
Pithecolobium (occ.)
Plathymenia
Platycyamus
Platymiscium
Platypodium
Poeppigia
Poincianella
Pongamia
Pseudocopaiva
Pterocarpus
Pterodon
Pterogyne
Rhynchocarpa
Schotia *
Sophora *
Stahlia
Storckiella
Swartzia
Sweetia
Tamarindus
Tipuana
Torresia
Vatairea
Wallaceodendron
Zollernia
Zuccagnia
MALVACEAE
Abutilon *
Bastardiopsis *
Bombycidendron
Cephalohibiscus
Gossypium *
Hibiscus
Thespesia
MELIACEAE
Carapa (occ.)
Cedrela (occ.)
Chickrassia (occ.)
Entandrophragma (occ.)
Khaya (occ.)

Pseudocedrela
Swietenia
Xylocarpus
MELIANTHACEAE
Bersama *
MORACEAE
Ficus (few spp.)
MORINGACEAE
Moringa (occ.)
MYOPORACEAE
Eremophylla
Myoporum (occ.)
MYRSINACEAE
Aegiceras *
NYCTAGINACEAE
Pisonia *
PIPERACEAE
Piper * (occ.)
RUTACEAE
Chloroxylon
Esenbeckia (occ.)
SIMARUBACEAE
Balanites *
Picraena *
Picrasma
Simaruba
STERCULIACEAE
Cistanthera
Eriolaena *
Firmiana *
Guazuma *
Heritiera *
Kleinhovia
Melochia
Pterocymbium *
Pterospermum *
Scaphium
Sterculia *
Tarrietia *
SURIANACEAE
Suriana
TAMARICACEAE
Myricaria *
Tamarix *
THYMELAEACEAE
Daphnopsis
Lasiosiphon *
Schoenobiblos *
TILIACEAE
Apeiba *
Belotia *
Berrya
Carpodiptera *
Columbia *
Diplodiscus
Goethalsia *
Grewia *
Heliocarpus *
Luehea
Mollia *
Pentace
Pityranthe
Schoutenia *
Tilia *
TRIPLOCHITONACEAE
Mansonia
Triplochiton *
ULMACEAE
Holoptelea
Phyllostylon
URTICACEAE
Laportea *
Touchardia *
Urera *
ZYGOPHYLLACEAE
Bulnesia
Guaiacum
Larrea
Porlieria

OCCURRENCE OF INTERCELLULAR CANALS

Vertical—Normal

CORNACEAE
Mastixia
DIPTEROCARPACEAE
(All exc. Monotoideae)
LEGUMINOSAE
Copaifera
Daniella
Detarium
Eperua
Kingiodendron
Prioria
Oxystigma
Sindora
SIMARUBACEAE
Simaruba

Vertical—Gummosis Type

AMYGDALACEAE
Amygdalus
Prunus
Pygeum
BOMBACACEAE
Bombacopsis
Bombax
Catostemma
Cavanillesia
Ceiba
Durio
BORAGINACEAE
Cordia
COMBRETACEAE
Terminalia
ELAEAGNACEAE
Elaeagnus
ELAEOCARPACEAE
Elaeocarpus
Sloanea
HAMAMELIDACEAE
Altingia
Liquidambar
LECYTHIDACEAE
Eschweilera
Lecythis
LEGUMINOSAE
Andira
Berlinia
Hardwickia
Herminiera
Hymenaea

Macrolobium
Peltogyne (?)

MALVACEAE
Hibiscus
Thespesia

MELIACEAE
Carapa
Cedrela
Dysoxylon
Entandrophragma
Khaya
Lovoa
Melia
Sandoricum
Swietenia

MORINGACEAE
Moringa

MYRTACEAE
Angophora
Eucalyptus
Rhodamnia

PROTEACEAE
Banksia
Cardwellia
Grevillea

RUTACEAE
Balfourodendron
Citrus
Esenbeckia
Euxylophora
Flindersia
Xanthoxylum

SAPINDACEAE
Dilodendron

SIMARUBACEAE
Ailanthus
Balanites

STERCULIACEAE
Brachychiton
Heritiera
Sterculia
Tarrietia
Theobroma

VOCHYSIACEAE
Qualea
Vochysia

Radial—Small

AMYGDALACEAE
Pygeum (?)

ANACARDIACEAE
Astronium
Buchanania
Campnosperma
~~Dracontomelum~~
Euroschinus
Gluta
Koordersiodendron
Melanorrhoea
Odina
Parishia
Pistacia
Pleiogynium
Poupartia
Rhodosphaera
Rhus
Schinopsis
Schinus
Sclerocarya
Spondias
Swintonia
Tapirira

ARALIACEAE
Acanthopanax
Arthrophyllum
Cheirodendron
Cussonia
Didymopanax
Dyzygotheca
Gilibertia
Heptapleurum
Myodocarpus
Nothopanax
Oreopanax
Schefflera
Sciadodendron

BURSERACEAE
Boswellia
Bursera
Canarium
Dacryodes
~~Elaphrium~~
Garuga
Protium
Santiria

CRYPTERONIACEAE
Crypteronia

EUPHORBIACEAE
Euphorbia
Homalanthus

GUTTIFERAE
Mammea
Ochrocarpus
Rheedia

HAMAMELIDACEAE
Altingia

JULIANIACEAE
Amphipterygium

MYRTACEAE
Eugenia
Leptospermum

Radial—Large

APOCYNACEAE
Alstonia
Ambelania
Aspidosperma
Cerbera
Cerberiopsis
Couma
Dyera
Lacmellia
Lanugia
Lepiniopsis
Macoubea
Malouetia
Neocouma
Nerium
Parahancornia
Plumeria
Pterochrosia
Rauwolfia
Rejoua
Stemmadenia
Tabernaemontana
Thevetia
Zschokkea

EUPHORBIACEAE
Alchornea
Conceveibastrum
Croton
Euphorbia

Gavarretia
Mabea
Pera
Sapium
Senefeldera

LOGANIACEAE
Anthocleista
Bonyunia ?

SOLANACEAE
Cestrum
Duckeodendron
Solanum

THYMELAEACEAE
Daphne
Daphnopsis
Lasiosiphon
Peddiea

OCCURRENCE OF INCLUDED PHLOEM

Band Type

AMARANTACEAE
All (?) genera

AVICENNIACEAE
Avicennia

BUXACEAE
Simmondsia

CAPPARIDACEAE
Cadaba
Forchhammeria
Maerua
Niebuhria
Roydsia

CHENOPODIACEAE
Atriplex
Chenopodium
Eurotia
Grayia
Haloxylon
Suaeda

CONVOLVULACEAE
Porana

DILLENIACEAE
Doliocarpus

LEGUMINOSAE
Dalbergia
Machaerium
Pueraria
Spatholobus
Wistaria

MENISPERMACEAE
Abuta
Anomospermum
Chondrodendron
Cocculus
Disciphania
Hyperbaena
Pachygone
Pericampylus
Tiliacora

PHYTOLACCACEAE
Agdestis
Barbeuia
Ercilla
Gallesia
Phytolacca
Rhabdodendron
Seguieria

PLUMBAGINACEAE
Acantholimon
Aegialitis
Limoniastrum

POLYGALACEAE
Bredemeyera
Comesperma
Moutabea
Securidaca

Island Type

APOCYNACEAE
Lyonsia

COMBRETACEAE
Calycopteris
Combretum
Guiera

HIPPOCRATEACEAE
Salacia

HYPERICACEAE
Endodesmia

ICACINACEAE
Chlamydocarya
Sarcostigma

LOGANIACEAE
Antonia
Bonyunia
Logania
Norrisia
Strychnos

MELASTOMACEAE
Kibessia
Lijndenia
Memecylon
Mouriria
Olisbea
Pternandra

NYCTAGINACEAE
Bougainvillea
Calpidia
Colignonia
Neea
Pisonia
Torrubia

ONAGRACEAE
Epilobium
Oenothera

SALVADORACEAE
Dobera
Platymitium
Salvadora

THYMELAEACEAE
Aquilaria
Brachythalamus
Gyrinops
Gyrinopsis
Linostoma
Lophostoma
Synaptolepis

(URTICACEAE)
(Gyrotaenia)
(Laportea)
(Myriocarpa)
(Urera)

VOCHYSIACEAE
Erisma
Erismadelphus

OCCURRENCE OF RAPHIDES

(According to R. W. HESS, *Tropical Woods* 46: 22–31)

DILLENIACEAE
- Curatella
- Doliocarpus
- Tetracera
- Wormia

GREYIACEAE
- Greyia

MARCGRAVIACEAE
- Marcgravia

NYCTAGINACEAE
- Bougainvillea
- Calpidia
- Colignonia
- Neea
- Pisonia
- Rockia
- Torrubia

PHYTOLACCACEAE
- Phytolacca

RUBIACEAE
- Calycodendron
- Calycosia
- Faramea
- Gillespiea
- Morinda
- Prismatomeris
- Psychotria
- Straussia

SAURAUIACEAE
- Saurauia

THEACEAE (?)
- Tetramerista

URTICACEAE
- Laportea

VITACEAE
- Cissus
- Leea
- Tetrastigma
- Vitis

FAMILIES CHARACTERIZED BY SIMPLE PERFORATIONS IN THE VESSELS

(Asterisk indicates tendency to multiple perforations)

- Acanthaceae
- Aceraceae
- Achatocarpaceae
- Actinidiaceae *
- Akaniaceae
- Alangiaceae
- Amarantaceae
- Amygdalaceae
- Anacardiaceae *
- Anonaceae
- Apocynaceae
- Araliaceae *
- Aristolochiaceae
- Asclepiadaceae
- Avicenniaceae
- Berberidaceae
- Bignoniaceae
- Bixaceae *
- Bombacaceae
- Boraginaceae
- Bretschneideraceae
- Brunelliaceae *
- Burseraceae
- Cactaceae
- Calycanthaceae
- Campanulaceae
- Capparidaceae
- Caricaceae
- Caryocaraceae *
- Caryophyllaceae
- Casuarinaceae *
- Celastraceae *
- Chenopodiaceae
- Chlaenaceae
- Cistaceae
- Cneoraceae
- Cochlospermaceae
- Combretaceae
- Commelinaceae
- Compositae
- Connaraceae
- Convolvulaceae
- Coriariaceae
- Crassulaceae
- Cruciferae
- Crypteroniaceae
- Cucurbitaceae
- Datiscaceae
- Dichapetalaceae *
- Dipterocarpaceae
- Ebenaceae
- Elaeagnaceae
- Elaeocarpaceae *
- Erythroxylaceae *
- Euphorbiaceae *
- Fagaceae *
- Flacourtiaceae *
- Fouquieriaceae *
- Geraniaceae
- Gesneriaceae
- Gonystylaceae
- Goodeniaceae
- Greyiaceae
- Guttiferae
- Hernandiaceae *
- Hippocastanaceae
- Hippocrateaceae *
- Hydrophyllaceae
- Hypericaceae
- Juglandaceae *
- Julianiaceae
- Koeberliniaceae
- Krameriaceae
- Lardizabalaceae *
- Lauraceae *
- Lecythidaceae
- Leguminosae
- Leitneriaceae

- Linaceae
- Loganiaceae *
- Loranthaceae
- Lythraceae
- Malpighiaceae
- Malvaceae
- Marcgraviaceae *
- Melastomaceae
- Meliaceae
- Melianthaceae
- Menispermaceae
- Menthaceae
- Moraceae
- Moringaceae
- Myoporaceae
- Myrsinaceae *
- Myrtaceae
- Nyctaginaceae *
- Ochnaceae *
- Olacaceae *
- Oleaceae *
- Oliniaceae
- Onagraceae *
- Opiliaceae
- Oxalidaceae
- Pandaceae *
- Papaveraceae
- Passifloraceae *
- Phytolaccaceae
- Piperaceae *
- Pittosporaceae
- Plantaginaceae
- Platanaceae *
- Plumbaginaceae
- Polygalaceae
- Polygonaceae
- Portulacaceae
- Primulaceae
- Proteaceae
- Punicaceae
- Quiinaceae
- Ranunculaceae
- Rhamnaceae
- Rhizophoraceae *
- Rosaceae *
- Rubiaceae *
- Rutaceae *
- Salicaceae
- Salvadoraceae
- Santalaceae
- Sapindaceae
- Sapotaceae *
- Sarcospermaceae
- Scrophulariaceae
- Simarubaceae
- Solanaceae
- Sonneratiaceae
- Sterculiaceae
- Surianaceae
- Tamaricaceae
- Theophrastaceae
- Thymelaeaceae
- Tiliaceae
- Tremandraceae
- Trigoniaceae
- Triplochitonaceae
- Turneraceae *
- Ulmaceae *
- Umbelliferae *
- Urticaceae
- Valerianaceae *
- Verbenaceae *
- Vitaceae *
- Vochysiaceae
- Zygophyllaceae

FAMILIES CHARACTERIZED BY SCALARIFORM PERFORATION PLATES IN THE VESSELS

(Asterisk indicates tendency to simple perforations)

- Actinidiaceae *
- Aextoxicaceae
- Aquifoliaceae
- Betulaceae
- Brunelliaceae *
- Buxaceae *
- Canellaceae
- Caprifoliaceae *
- Celastraceae *
- Cercidiphyllaceae
- Chloranthaceae
- Clethraceae *
- Columelliaceae
- Cornaceae *
- Corylaceae *
- Crossosomataceae *
- Cunoniaceae *
- Cyrillaceae
- Daphniphyllaceae
- Dilleniaceae *
- Epacridaceae *
- Ericaceae *
- Escalloniaceae
- Eucommiaceae *
- Eucryphiaceae
- Eupomatiaceae
- Eupteleaceae
- Garryaceae
- Gomortegaceae
- Grossulariaceae
- Hamamelidaceae
- Himantandraceae *
- Humiriaceae
- Hydrangeaceae
- Icacinaceae *
- Lacistemaceae
- Magnoliaceae *
- Monimiaceae *
- Myricaceae *
- Myristicaceae *
- Myrothamnaceae
- Neumanniaceae
- Nyssaceae
- Ocktoknemataceae
- Platanaceae *
- Rhizophoraceae *
- Rhoipteleaceae
- Sabiaceae
- Saurauiaceae *
- Schizandraceae
- Scytopetalaceae

Stachyuraceae
Staphyleaceae *
Styracaceae
Symplocaceae
Theaceae *
Vacciniaceae *
Violaceae *

Occurrence of Vestured Pits

(According to I. W. Bailey, *Journ. Arnold Arboretum* 14: 259–273; 1933)

Apocynaceae
Asclepiadaceae
Capparidaceae
Combretaceae
Cruciferae
Crypteroniaceae
Dipterocarpaceae
Euphorbiaceae
(Bridelieae)
Leguminosae (exc.
Bauhinieae)
Loganiaceae
Lythraceae
Malpighiaceae
Melastomaceae
Myrtaceae
Ochnaceae
(Exalbuminosae)
Oleaceae
Oliniaceae
Onagraceae
Polygonaceae
Punicaceae
Rubiaceae
Sonneratiaceae
Thymelaeaceae
Vochysiaceae

Families Containing Woods with Scalariform Vascular Pitting

Aextoxicaceae
Apocynaceae (occ.)
Aquifoliaceae
Araliaceae
Brunelliaceae
Chloranthaceae
Cornaceae
Cunoniaceae
Eucryphiaceae
Euphorbiaceae (occ.)
Eupteleaceae
Fagaceae (occ.)
Flacourtiaceae (occ.)
Greyiaceae
Grossulariaceae
Hamamelidaceae
Magnoliaceae
Monimiaceae
Myristicaceae
Nyssaceae
Rhizophoraceae
Schizandraceae
Symplocaceae
Umbelliferae
Vacciniaceae
Violaceae
Vitaceae

Occurrence of Spiral Thickenings in Vessels

ACERACEAE
Acer
(Negundo)
ACTINIDIACEAE
Actinidia
AMYGDALACEAE
Prunus
Pygeum
ANACARDIACEAE
Cotinus
Rhus
Pistacia
ANONACEAE
Asimina
APOCYNACEAE
Carissa
Tabernaemontana
Vinca
AQUIFOLIACEAE
Ilex
ARALIACEAE
Aralia
Astrotricha
Hedera
Heptapleurum
Nothopanax
Oreopanax
ARISTOLOCHIACEAE
Aristolochia
BERBERIDACEAE
Berberis
Mahonia
BIGNONIACEAE
Catalpa
Chilopsis
Doxantha
BORAGINACEAE
Ehretia
Lithospermum
BRETSCHNEIDERACEAE
Bretschneidera

BUXACEAE
Simmondsia
CALYCANTHACEAE
Calycanthus
CAPPARIDACEAE
Cleome
CAPRIFOLIACEAE
Abelia
Leycesteria
Lonicera
Sambucus
Symphoricarpus
Viburnum
CASUARINACEAE
Casuarina
CELASTRACEAE
Canotia
Celastrus
Euonymus
Lophopetalum
Maytenus
Plenckia
CERCIDIPHYLLACEAE
Cercidiphyllum
CHENOPODIACEAE
Atriplex
Camphorosma
Eurotia
Halocnemon
Halostachys
Haloxylon
Kochia
Noaea
Rhagodia
Suaeda
COMPOSITAE
Flotovia
Proustia
Vernonia
CONNARACEAE
Ellipanthus
CORNACEAE
Aucuba
Cornus
Toricellia
CORYLACEAE
Carpinus
Corylus
Distegocarpus
Ostrya
ELAEAGNACEAE
Elaeagnus
Hippophae
Shepherdia
ELAEOCARPACEAE
Elaeocarpus
EPACRIDACEAE
Acrotriche
Epacris
Lysinema
ERICACEAE
Andromeda
Arbutus
Arctostaphylos
Calluna
Gaylussacia
Kalmia
Menziesia
Oxydendrum
Rhododendron
ESCALLONIACEAE
Escallonia
EUCOMMIACEAE
Eucommia
EUPHORBIACEAE
Alchornea
Aporosa
Cleidion
Glochidion
Mallotus
Trewia
EUPTELEACEAE
Euptelea
FLACOURTIACEAE
Abatia
Azara
Hisingera
Poliothyrsis
GARRYACEAE
Garrya
HAMAMELIDACEAE
Corylopsis
Hamamelis
Liquidambar
Rhodoleia
HIMANTANDRACEAE
Himantandra
HIPPOCASTANACEAE
Aesculus
HYDRANGEACEAE
Deutzia
Hydrangea
Philadelphus
JUGLANDACEAE
Platycarya
KOEBERLINIACEAE
Koeberlinia
LARDIZABALACEAE
Hollboellia
LEGUMINOSAE
Amphithalea
Anagyris
Argyrolobium
Cercis
Coelidium
Cytisus
Erinacea
Gleditschia
Gymnocladus
Laburnum
Lathriogyne
Lebeckia
Liparia
Lotononis
Maackia
Petteria
Platylobium
Priestleya
Robinia
Wistaria
LEITNERIACEAE
Leitneria
LINACEAE
Roucheria
LOGANIACEAE
Buddleia
Chilianthus
Gomphostigma
Logania
Nuxia
Nicodemia
MAGNOLIACEAE
Aromadendron

Magnolia
Michelia
Talauma

MALVACEAE
Abutilon
Hoheria
Malvastrum
Plagianthus
Sida
Sphaeralcea
Wissadula

MELIACEAE
Melia

MELIANTHACEAE
Melianthus

MENTHACEAE
Prasium
Prostanthera
Rosmarinus
Salvia
Sideritis
Teucrium
Thymus
Westringia

MONIMIACEAE
Peumus

MORACEAE
Broussonetia
Chlorophora
Maclura (Toxylon)
Morus
Streblus

MYOPORACEAE
Myoporum

MYRSINACEAE
Maesa

OLEACEAE
Chionanthus
Fontanesia
Forsythia
Jasminum
Ligustrum
Olea
Osmanthus
Phillyrea
Syringa

PAPAVERACEAE
Dedromecon

PHYTOLACCACEAE
Anisomeria

PITTOSPORACEAE
Pittosporum

POLYGONACEAE
Eriogonum
Calligonum
Chorizanthe
Coccoloba
Muehlenbeckia
Ruprechtia
Triplaris

PROTEACEAE
Dryandra
Grevillea
Helicia
Persoonia

RANUNCULACEAE
Clematis
Naravelia

RHAMNACEAE
Adolia
Ceanothus
Colletia
Rhamnus
Zizyphus

ROSACEAE
Amelanchier
Aronia
Cercocarpus
Chaenomeles
Cotoneaster
Cydonia
Eriobotrya
Exochorda
Hesperomeles
Kageneckia
Mespilus
Micromeles
Osteomeles
Peraphyllum
Photinia
Pyrus
Raphiolepis
Rosa
Sorbus

RUBIACEAE
Vangueria

RUTACEAE
Phellodendron

SAPINDACEAE
Koelreuteria
Sapindus

SAURAUIACEAE
Saurauia

SCHIZANDRACEAE
Kadsura
Schizandra

SCROPHULARIACEAE
Aptosimum
Castilleia
Freylinia
Gerardia
Leucophyllum
Lyperia
Monttea
Paulownia
Veronica

SIMARUBACEAE
Ailanthus

SOLANACEAE
Acnistus
Anthocercis
Cestrum
Grabowskia
Lycium
Solanum

STACHYURACEAE
Stachyurus

STAPHYLEACEAE
Staphylea

STERCULIACEAE
Fremontia
Heritiera
Hibiscus
Reevesia
Sterculia

SYMPLOCACEAE
Symplocos

THEACEAE
Adinandra
Camellia
Schima
Ternstroemia

THYMELAEACEAE
Daphne

Dirca
Ovidia
Phaleria

TILIACEAE
Echinocarpus
Tilia

TREMANDRACEAE
Platytheca

TURNERACEAE
Turnera

ULMACEAE
Aphananthe
Celtis
Planera
Ulmus
Zelkowa

URTICACEAE
Leucosyke

VACCINIACEAE
Gaylussacia
Pentapterygium
Thibaudia
Vaccinium

VERBENACEAE
Caryopteris
Geunsia

OCCURRENCE OF SPIRAL THICKENINGS IN FIBER-TRACHEIDS

(See *Tropical Woods* 3: 12–16)

AQUIFOLIACEAE
Ilex

BORAGINACEAE
Ehretia
Lithospermum

CAPRIFOLIACEAE
Abelia
Leycesteria
Lonicera
Symphoricarpus
Viburnum

CELASTRACEAE
Euonymus

CORNACEAE
Aucuba
Cornus

ELAEAGNACEAE
Elaeagnus

EPACRIDACEAE
Epacris

ERICACEAE
Arbutus
Arctostaphylos

GARRYACEAE
Garrya

HAMAMELIDACEAE
Hamamelis

HYDRANGEACEAE
Deutzia
Philadelphus

KOEBERLINIACEAE
Koeberlinia

NYSSACEAE
Nyssa

OLEACEAE
Fontanesia
Forsythia
Jasminum
Syringa

PROTEACEAE
Knightia

ROSACEAE
Chaenomeles
Crataegus
Cydonia
Mespilus
Rosa
Stephanandra

STACHYURACEAE
Stachyurus

SYMPLOCACEAE
Symplocos

TREMANDRACEAE
Tetratheca

FAMILIES CHARACTERIZED BY WOOD FIBERS WITH CONSPICUOUS BORDERED PITS

Actinidiaceae
Aextoxicaceae
Amygdalaceae
Apocynaceae
Aquifoliaceae
Aristolochiaceae
Canellaceae
Casuarinaceae
Celastraceae
Cercidiphyllaceae
Clethraceae
Columelliaceae
Cornaceae
Crossostomataceae
Cunoniaceae
Dilleniaceae
Elaeagnaceae
Epacridaceae
Ericaceae
Escalloniaceae
Eucommiaceae
Eucryphiaceae
Euphorbiaceae (few)
Hamamelidaceae
Hippocrateaceae
Humiriaceae
Icacinaceae

Koeberliniaceae
Linaceae
Magnoliaceae
Monimiaceae (few)
Neumanniaceae
Nyssaceae
Ochnaceae
Olacaceae
Opiliaceae
Passifloraceae
Platanaceae
Quiinaceae
Rhizophoraceae
Rosaceae
Saurauiaceae
Schizandraceae
Stachyuraceae
Staphyleaceae
Theaceae
Trigoniaceae
Turneraceae
Vacciniaceae
Winteraceae

CURRENT LITERATURE

The woods of sclerophyllous and desert shrubs of California. By IRMA E. WEBBER. *American Journal of Botany* 23: 3: 181–188; 1 plate; March 1936.

"Woods of both sclerophyllous and desert shrubs are characterized by narrow, often diffuse-porous growth rings with relatively little late wood, and are usually very well provided with vessels and parenchyma. Their vessel members are commonly short and of small diameter, while their rays are usually small and numerous.

"Woods of sclerophyllous shrubs, when compared with those of desert shrubs, show a tendency to have slightly wider growth rings; slightly more numerous vessels of somewhat smaller diameter; vessel members of slightly greater average length which commonly have spiral thickenings on the lateral walls, and frequently have scalariform perforation plates; a less marked development of mechanical elements; and somewhat more numerous rays of smaller size.

"Differences between woods of the sclerophyllous shrub group and those of the desert shrub group are not of such an order as to be highly indicative of differences in conduction or storage in the two ecological types of shrubs."

Contributions to the flora of tropical America. XXV. Species novae mexicanae Hintonianae. *Kew Bulletin of Miscellaneous Information* 1–16; 1936.

Among new species described from Mexico, chiefly from the State of Mexico, are the following woody plants: *Piscidia grandifolia*, var. *glabrescens* Sandwith, vernacular name Cahuirriaca Prieta; *Lonchocarpus Hintoni* Sandwith, Palo de Aro, Cajurica, Aricuahue, Zopilacuague; *Cassia Hintoni* Sandwith; *C. trichocraspedon* Sandwith; *Mimosa egregia* Sandwith, Espino Chacapo; *Styrax Hintoni* Bullock; *Adenocalymma Hintoni* Sandwith, Bejuco Blanco.

Enumeration of the Malpighiaceae of the Yucatan Peninsula. By C. V. MORTON. *Carnegie Inst. Wash. Publ.* 461: 125–140; April 24, 1936.

A brief account, with keys to genera and species and citation of specimens, of the Malpighiaceae of Yucatan, Campeche, British Honduras, and the Department of Petén, Guatemala. *Tetrapteris arcana* (British Honduras and Salvador) and *Malpighia Lundellii* (British Honduras) are new species, and several new combinations are published.

A revision of the Mexican and Central American species of *Smilax*. By E. P. KILLIP and C. V. MORTON. *Carnegie Inst. Wash. Publ.* 461: 255–296; pls. 1–11; July 10, 1936.

For Mexico and Central America there are recognized 25 species of *Smilax*, eight others being listed as more or less uncertain in status. Eight species are described as new.

Studies in the Apocynaceae. IV. The American genera of Echitoideae. By ROBERT E. WOODSON, JR. *Annals Missouri Bot. Garden* (St. Louis) 23: 169–438; pls. 1–7; April 1936.

This paper concludes the author's account of the group Echitoideae of the family Apocynaceae. The genera treated are *Neobracea* (4 species); *Galactophora* (5); *Salpinctes* (2); *Peltastes* (6); *Stipecoma* (1); *Angadenia* (2); *Urechites* (2); *Rhabdadenia* (3); *Elytropus* (1); *Cycladenia* (1); *Echites* (6); *Temnadenia* (4); *Fernaldia* (2); *Asketanthera* (4); *Macropharynx* (1); *Thenardia* (4); *Prestonia* (60); *Rhodocalyx* (1); *Laubertia* (4); *Tintinnabularia*, a new genus with one Guatemalan species. The paper includes an index to all the exsiccatae cited in the series of papers. Numerous new species are described in various genera.

Entwurf zu einem natürlichen System der Cupuliferen und der Gattung *Quercus* L. By O. SCHWARZ. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 1–22; 2 text figs.; March 15, 1936.

A new classification is proposed for the Cupuliferae, and a key is provided showing the relationship between the genera recognized: *Fagus*, *Nothofagus*, *Castanea*, *Castanopsis*, *Pasania*, *Cyclobalanus*, *Lithocarpus*, *Cyclobalanopsis*; *Erythrobalanus* (Oerst.) Schwarz, a new genus with about 175 species in North and Middle America; *Macrobalanus* (Oerst.) Schwarz, a new genus, with 10 species in Middle America; *Quercus*. A classification is proposed also for the genus *Quercus* (containing about 320 species), with special reference to the species of the western Old World.

A monograph of the genus *Cornutia*. By HAROLD N. MOLDENKE. *Repertorium Specierum Novarum* (Berlin-Dahlem) 40: 153–205; June 30, 1936.

The American genus *Cornutia* (Verbenaceae) is treated in detail by the author, who states: "Fully 250 persons have published on, collected specimens of, or in other ways contributed to our knowledge of the genus. The present monographer recognizes as valid 12 species and 11 varieties, one species remains of doubtful status, and 35 names have been relegated to synonymy. A total of 789 herbarium specimens, including the type collections of 21 species and varieties, and 114 mounted photographs have been examined. No fossil representatives of the genus are as yet known." New species are *C. australis* (Minas Geraes, Brazil), *C. lilacina* (Guatemala, Salvador, Honduras), *C. jamaicensis*, *C. thyrsoidea* (Jamaica).—P. C. STANDLEY.

Plantas útiles de Colombia. Tomo I. Generalidades, Criptógamas, Gimnospermas y Monocotiledóneas. By ENRIQUE PÉREZ ARBELÁEZ. Bogotá, 1936. Pp. 172; 116 figs.

This account of the useful plants of Colombia includes seven pages of bibliography of the flora of Colombia and chapters upon the utilization of the plants, classification of the economic plants, cryptogams, gymnosperms, and monocotyledons. The chapter treating classification of economic

plants is a complete list of such plants as known from Colombia, with vernacular names and a word or two as to their uses. A very large number of vernacular names are reported for trees and shrubs used for various purposes, and the list will be highly valuable for reference purposes.

Since the present part of the work treats chiefly monocotyledons, few woody plants are mentioned, but there are brief accounts of the species of *Podocarpus* and a considerable number of palms. Especially admirable are the numerous line drawings used as illustrations. All or most of them are original, and the majority of them are remarkably well done.—P. C. STANDLEY.

Arboles y arbustos notables o poco conocidos del Departamento del Atlantico. II serie, primera parte. By ARMANDO DUGAND G. *Boletín de Agricultura y Ganaderia* (Barranquilla Colombia) 2: 6: 27–40; 2 text figs.; April 1936.

The first part of this new series contains descriptions and notes for the following trees of northern Colombia: *Anona purpurea* (vernacular names Guanabano Pun, Matimba, Gallina Gorda), *Aspidosperma ellipticum* (Amargo), *Tabernaemontana psychotrifolia* (Huevos de Verraco, Cojón de Toro, Cojón de Fraile), *Rauwolfia heterophylla* (Cruceto), *Sciadodendron excelsum* (Madura Platano), *Tabebuia chrysea* (Roble, Roble Amarillo), *T. coralibe* (Alumbre, Coralibe, Arco, Coralibe de Arco, Polvillo), *T. Billbergii* (Coralibe, Lumbre, Alumbre), *Arrabidaea Sanctae-Marthae* (Bejuco Real, Pintabollo), *Cavanillesia platanifolia* (Macondo), *Cordia alliodora* (Canalete de Humo), *C. gerascanthoides* (Canalete Prieto), *Bursera Simaruba* (Almacigo, Carate, Caratero, Resbala Mono, Indio Desnudo, Indio en Cuero), and *Stuebelia nemorosa* (Calabazuelo).

British Guiana. Report on the Forestry Department for the year 1935. By B. R. WOOD. Georgetown, 1936. Pp. 12; 8½ x 13½.

The following items are taken from the chapter on utilization: Determa (*Ocotea rubra*) was again the chief timber converted and sold. Crabwood (*Carapa guianensis*) ranked second in volume sold, but was exceeded by Greenheart in

quantity produced; the latter was all sawn for special purposes.

Simarupa (*Simaruba amara*) splits rather badly when being sawn, though this defect can be obviated to a certain extent by water-seasoning the logs and by sawing only 8 in. widths and under. The lumber can be air-seasoned in two months; it is rather responsive to atmospheric changes.

Hububalli (*Loxopterygium Sagotii*) has proved to be a first-class furniture wood and the supply is greater than formerly supposed. A trial shipment has been sent to London.

"Morabukea [*Mora Gonggrijpii*] sawn in 1934 was found to have dried out to a moisture content of approximately 20 per cent, and selected material was sent to the Colonial Forest Resources Development Department to be tested out as to its suitability for strip and block flooring. During this experiment a number of boards showed rather fine ribbon grain and extra logs were sawn to determine how often this occurred. It was thought that Morabukea might be utilized for heavy office furniture, counters, etc. It was found, however, that ribbon grain is not a common characteristic of Morabukea.

"A small amount of Kabukalli [*Goupia glabra*] was sawn to investigate its possibilities as a furniture wood. The figure and varying color found in this wood is rather beautiful and if, as is hoped, the offensive smell can be eliminated by water seasoning it might prove worth exploiting as the tree occurs fairly plentifully throughout the Colony. Further experimental sawing and seasoning experiments with this timber are now in progress.

"The growing scarcity of Determa made it imperative that some other wood should be tried out for general purposes. Hill Itèballi [*Vochysia* sp.] has been sawn and seasoned but up to the time of writing no trials have been made as this material has only recently reached air dry condition. From a superficial examination, however, Itèballi would appear to have all the characteristics of a general utility wood."

Monographie du genre *Cestrum* L. By PIERRE FRANCEY. *Candollea* (Geneva) 6: 46–398; 1935; 7: 1–132; 3 pls.; 1936.

The genus *Cestrum* (Solanaceae), consists of 257 species of shrubs and small trees of the American tropics. The present

elaborate monograph, with keys, full descriptions, and citation of literature and specimens, has every appearance of being an exceptionally capable piece of work. It is especially welcome because hitherto the genus has been in a chaotic state systematically. The study is based upon examination of material in many of the larger herbaria of America and Europe, and includes descriptions of many new species. One of the appendices consists of a page of vernacular names applied to the various species.—P. C. STANDLEY.

Über die Gattung *Themistoclesia* Kl. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 108–111; March 15, 1936.

A key is provided for segregation of the species of *Themistoclesia* (Ericaceae), of which 12 are recognized. *T. Pittieri* is described as new from Colombia and Peru, and to the genus are transferred, with new combinations, *Vaccinium anfractum* A. C. Smith, *Anthopterus mucronatus* Benth., and *Vaccinium Pennellii* A. C. Smith.

Die Arten der Gattung *Vaccinium* L. in Zentral- und Südamerika. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 111–140; March 15, 1936.

A key is provided for the subgroups of the whole genus *Vaccinium*, and another for separation of the species of Central and South America. In this region there are recognized 29 species, for which there are indicated synonymy and distribution, with citation of specimens examined. *V. amicorum* is described as new from Peru.

Las especies argentinas y uruguayas del género *Trixis*. By ANGEL L. CABRERA. *Revista Museo de La Plata* (Buenos Aires) 1: 31–86; pls. 5–6; figs. 1–17; 1936.

In Argentina and Uruguay the author recognizes 14 species of *Trixis* (Compositae), a genus of herbs and shrubs. Two new species are described, one of which, *T. Ragonesei*, from Jujuy, Argentina, is a scandent shrub.

Flora of Peru. Part II. By J. FRANCIS MACBRIDE. Field Museum Bot. Ser. (Chicago) 13: 2: 1–254; June 10, 1936.

This instalment of the *Flora of Peru* is devoted to an account of the Piperaceae or Pepper Family, by William Trelease. The family is represented by 309 species of *Peperomia*, 2 of *Pothomorphe*, 409 of *Piper*, and one of *Pleiostachyopiper*, a new genus credited to Killip, Smith, and Trelease, and based upon *Piper nudilimbum* C. DC. The majority of the species are described as new.

Problemas fitogeográficos relativos a la región magallánica. By A. DONAT. *Revista Argentina de Agronomía* (Buenos Aires) 2: 6: 86–95; 2 figs.; August 1935.

Phytogeographically Tierra del Fuego belongs wholly to western Patagonia, and two regions may be distinguished, the northern or Valdivian and the southern or Magellanic. The latter has a smaller number of species, as is to be expected since it lies farther from the equator. It is characterized also by certain species that do not extend to the Valdivian region, the most important being a tree, *Nothofagus betuloides*. The paper terminates with more than a page of bibliography of the area discussed.

Bericht über die pflanzengeographischen Ergebnisse der Inlandeisexpedition der Argentinischen Geographischen Gesellschaft "Gaea" 1933. By A. DONAT. *Bericht. Deutsch. Bot. Gesell.* (Berlin) 54: 27–46; 2 figs.; Feb. 27, 1936.

An account of observations upon the plant geography of the inland ice region of southern Patagonia. There are included notes upon the distribution of *Nothofagus* species in the area.

Studies of South American plants. V. Additional notes on Thibaudieae. By ALBERT C. SMITH. *Bulletin of the Torrey Botanical Club* (Menasha, Wisconsin) 63: 307–316; illustrated; June 1936.

New genera of Ericaceae are *Demosthenesia*, with 7 species, transferred from *Ceratostema; Plutarchia* with 6 species, transferred from *Ceratostema;* and *Polyclita*, with one species

(*Thibaudia turbinata* Hoer.). The paper includes also notes upon species of other genera.

A study of the Nolanaceae. By IVAN M. JOHNSTON. *Proceedings American Academy of Science* 71: 1–87; April 30, 1936.

The family Nolanaceae, composed chiefly of herbs but including a few low shrubs, is confined to the coastal regions of northern Chile and southern Peru. Two genera are recognized, *Nolana* with 57 species, and *Alona* with 6.

Excursión botánica al cerro más alto del Uruguay. By W. G. HERTER and F. ROSA MATO. *Revista Sudamericana de Botánica* (Montevideo) 3: 1–7; 3 text figs.; April 1936.

The highest mountain of Uruguay is the Cerro de las Animas in the Department of Maldonado, with an elevation of 500 meters. The vegetation consists in large part of spiny shrubs and small trees, the tallest tree being *Rapanea laetevirens*, about 10 meters in height. Woody Compositae are numerous and abundant. The palm *Arecastrum Romanzoffianum* attains here almost the southern limit of its range. Among the woody plants mentioned are *Eupatorium pinnatifidum* (vernacular name Chirca), *Dodonaea viscosa* (Chirca de Monte), *Colletia cruciata* (Espina de la Cruz), *Discaria longispina* (Quina del Campo), *Scutia buxifolia* (Coronilla), *Celtis tala* (Tala), *Schinus dependens* (Molle), *Acanthosyris spinescens* (Quebrachillo), *Iodina rhombifolia* (Sombra de Toro), *Berberis laurina* (Espina Amarilla), *Maytenus ilicifolia* (Cangorosa), *Lithraea brasiliensis* (Arbol Malo, Aruera), *Allophylus edulis* (Chalchal), *Daphnopsis racemosa* (Envira), *Blepharocalyx Tweediei* (Arrayán), *Eugenia glaucescens* (Murta), *Myrrhinium rubriflorum* (Piojo de Chancho). The *Rapanea* mentioned is called Canelón; the *Arecastrum* Palma Chirivá.—P. C. STANDLEY.

Glossario dos termos usados em anatomia de madeiras. By FERNANDO ROMANO MILANEZ and ARTHUR DE MIRANDA BASTOS. *Rodriguésia* (Rio de Janeiro, Brazil) 1: 4: 25–42; March–June 1936.

A Portuguese version of the "Glossary of terms used in describing woods" prepared by the committee on nomen-

clature of the International Association of Wood Anatomists and published in English in *Tropical Woods* 36: 1–12, Dec. 1, 1933. The use of the "glossario" is simplified by the addition of an index.

South American plants used as fish poisons. By E. P. KILLIP and A. C. SMITH. 27 mimeographed pages. Washington, D. C., Feb. 8, 1935.

A list, by families, of 140 South American plants known or reported in use as fish "poisons." For most of the species are cited vernacular names and range. Most important are *Lonchocarpus* species, some of which contain the principle rotenone, important in the manufacture of certain insecticides. Among other trees used as fish poisons are *Andira* spp., *Apurimacia incarum*, *Bowdichia virgilioides*, *Derris* spp., *Muellera moniliformis*, *Piscidia carthaginensis*, *Cusparia trifoliata*, *Tapura* spp., *Euphorbia cotinifolia*, *Hippomane Mancinella*, *Hura crepitans*, numerous Sapindaceae, *Caryocar* spp., *Gustavia* spp., *Jacquinia* spp., *Thevetia* spp., and *Clibadium* spp.—P. C. STANDLEY.

Plantes nouvelles ou peu connues de la région amazonienne (IX Sêrie). By A. DUCKE. *Archivos do Instituto de Biologia Vegetal* (Rio de Janeiro) 2: 157–172; pls. 1, 2; December 1935.

New ligneous plants described from Amazonia are *Ampelozizyphus amazonicus*, a new genus of Rhamnaceae; *Sloanea pseudo-dentata*, *S. obidensis*, *S. Kuhlmannii*, *S. excelsa*, *S. macrantha*, *S. polyantha*, *S. grandis*, *S. erismoides*, *S. verrucosa*, *S. longipes*, *S. porphyrocarpa*, *S. bracteosa*; *Lacunaria grandifolia* (vernacular name Moela de Mutum), *L. pulchrinervis*; *Mouriria micradenia*; *Basanacantha altiscandens*. There is included a key to the known species of *Lacunaria*.—P. C. STANDLEY.

Revision of the genus *Hevea* Aubl., mainly the Brazilian species. By ADOLPHO DUCKE. *Archivos do Instituto de Biologia Vegetal* 2: 217–246; pls. 1–3; December 1935.

This paper, in English, consists of a detailed account of the economically important genus *Hevea*, based in large part upon

the author's extensive field experience with the trees. Their classification is difficult because of individual variations of the trees and also because of their tendency to hybridize. A chapter is devoted to the geographic distribution of the genus, and vernacular names are reported for the 12 species recognized. A very detailed key is provided for recognition of the species, each of which is discussed in some detail. Four probable hybrids are described. The paper is doubtless the most comprehensive and authoritative one treating this group of rubber-yielding trees.—P. C. STANDLEY.

O angelim araroba: *Vataireopsis araroba* (Aguiar) Ducke, nov. comb. By ADOLPHO DUCKE. *Annaes da Academia Brasileira de Sciencias* (Rio de Janeiro) 8: 1: 25–27; 1 plate; March 1936.

The Brazilian tree known as Angelim Araroba or Angelim Amarello, the source of the medicinal powder of Araroba, was named *Andira araroba* by Aguiar in 1878. According to Dr. Ducke it is a second species of *Vataireopsis*, a genus established by him in 1933 for a medium-sized Amazonian tree, *V. speciosa*. Angelim Araroba occurs in the high forest along streams in southern Bahia and Espirito Santo.

Notes on the Myristicaceae of Amazonian Brazil, with descriptions of new species. I, II. By ADOLPHO DUCKE. *Journ. Washington Academy of Science* 26: 213–222, 253–264; May 15 and June 15, 1936.

"During my botanical trips in Amazonia I assembled a good number of plants of that interesting but not sufficiently studied family, Myristicaceae, which must be considered one of the most important elements of the hylaea flora, principally in the western half of this immense plain." There are notes on four species of *Compsoneura*, one of *Osteophloeum*, and 17 of *Iryanthera*, eight of which are new. Regarding *Iryanthera*, he says:

"The species of this very natural genus are more difficult to classify than those of *Virola*, being nearly as numerous but

much more uniform in their characters. Indument is always scarce, the leaves and the adult fruits being glabrous; the structure of the androecium is less variable than in *Virola*. Probably the fruits furnish the best characters to establish a natural arrangement of the species, but unfortunately most of these are only known in the male form. This genus is apparently restricted to the Amazonian hylaea (including the Guianas and the northwestern part of the State of Maranhão), where it is represented by a rather considerable number of species, though much less abundant in individuals than is *Virola;* it is one of the most characteristic elements of the hylaea flora. All the species grow in upland virgin forest, where they prefer the neighborhood of small streamlets. All are known by the vernacular name Ucuhúba-rana (false Ucuhúba), those which furnish wood of good quality also as Punán."

The names of the new species are: *Iryanthera dialyandra*, *I. polyneura*, *I. longifolia*, *I. lancifolia*, *I. coriacea*, *I. elliptica*, *I. grandis*, *I. obovata*, *Virola divergens*, *V. albidiflora*, *V. minutiflora*, *V. crebrinervia*, *V. multicostata*, *V. multinervia*, *V. decorticans* (also in Peru), and *V. parvifolia*. Notes are given regarding the occurrence and characters of numerous older species. There is provided a key to the species of *Virola* occurring in Amazonian Brazil, based upon characters of the fruit and androecium.

Zur Kenntnis der Phanerogamenflora des Sandgebietes im Süden von Rio Grande do Sul. By GUST. O. A: N MALME. *Svenska Bot. Tidskrift* (Stockholm) 30: 1–29; 1936.

The coast of the State of Rio Grande do Sul, Brazil, is low and monotonous, and almost without harbors. It consists of extensive dunes of loose sand, alternating with swamps and areas of grassland. The vegetation upon the dunes is sparse, and composed of relatively few species. The only trees are small ones, representatives of species which in other regions often attain a large size. Among them are *Jodina rhombifolia*, *Pisonia nitida*, *Xanthoxylon hiemale*, *Erythroxylon argentinum*, *Schinus dependens*, *Maytenus boaria*, *Allophylus edulis*,

Cupania vernalis, *Casearia silvestris*, *Myrrhinium rubriflorum* (and two other Myrtaceae), *Bumelia obtusifolia*, *Chrysophyllum maytenoides*, and *Rapanea parvifolia*. Species of shrubs are more numerous.

The paper consists primarily of a systematic list of the plants collected by the author in the region.—P. C. STANDLEY.

***Burretiodendron*, a new genus of Tiliaceae.** By ALFRED REHDER. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 17: 1: 47–49; 1 plate; January 1936.

Burretiodendron Esquirolii (Lévl.) Rehder (=*Pentace Esquirolii* Léveillé=*Eriolaena Esquirolii* Léveillé) is a small to medium-sized tree of southeastern Yunnan and Kweichou, China.

"This new genus does not seem to be closely related to any of the genera of the Tiliaceae or Sterculiaceae, but is best perhaps placed in the Tiliaceae near *Luehea;* from the Sterculiaceae it differs in the dry winged fruit dividing septicidally into one-seeded carpels broadly winged all around, and in the androecium which in the latter family has the episepalous stamens sterile or lacking, while in *Burretiodendron* they are all fertile. With *Luehea* it agrees in the lack of an androgynophore and in pentadelphous stamens, but differs markedly in the unisexual flowers, in the slender-clawed petals without glandular spot at the base and in the fruit separating into 5 one-seeded carpels. In the presence of a nectary at the base of the sepals, *Burretiodendron* differs from all Tiliaceae. In the fruit separating into one-seeded winged carpels, it resembles *Colona*, but is easily distinguished by the unisexual flowers in axillary short cymes, the lack of an androgynophore, the clawed petals without nectary and the pentadelphous stamens. *Eriolaena*, in which Léveillé placed the flowering specimen, differs among other characters chiefly in its ligneous loculicidally dehiscent capsule with many winged seeds. *Pentace*, to which he referred the fruiting specimen, is easily distinguished by the rather small bisexual flowers in large terminal panicles and the much smaller indehiscent one-seeded fruit."

Formosan trees. By Ryôzô Kanehira. Pub. by Dept. of Forestry, Formosa, 1936; Yokendo, Ltd., 70 Morikawacho, Hongo-ku, Tokyo, distributor. Pp. 574; 7½ x 10¼; 50 plates, 664 text figs. Price 14.50 yen, postpaid.

"The first edition of *Formosan Trees* was published in 1917 by the Formosan Government. It was prepared to serve as a reference book for those engaged in Formosan forestry. At that time the late Dr. B. Hayata was actively studying the Formosan flora and the first five volumes of his monumental work, *Icones Plantarum Formosanarum*, had then been published. The reference material on which the book was based was inadequate, and naturally those species described in the last five volumes of Hayata's work could not be included. It was admittedly a makeshift work, prepared and issued on the basis of the information then available, because it was felt that a compilation of existing data was needed by field men in forestry.

"In the year the book was published, the late E. H. Wilson of the Arnold Arboretum came to Formosa to study its forest flora. He collected a large number of plant specimens and I had the opportunity of travelling with him during his stay in the island. He, a widely travelled botanist, indicated to us the richness of the Formosan flora, with its magnificent forest trees, some of them several thousand years old and unrivalled in the world. This contact increased my interest in the study of Formosan trees. Having found the first edition of my *Formosan Trees* inadequate and incomplete for the very interesting and unique forest types characteristic of the island, and encouraged and advised by Mr. Wilson, I decided to revise this work. In connection with this task, I planned to collect a comprehensive series of specimens of the ligneous plants for study and at the same time to identify and properly arrange the large amount of accumulated material that had remained unstudied for several years in the Government Herbarium at Taihoku. My colleague Mr. S. Sasaki coöperated in this work, prosecuting extensive botanical explorations in various parts of the island. My own collections were largely confined to ligneous plants. In 1926, a new herbarium building was erected and equipped at the Taihoku Botanical Garden

which greatly facilitated our work. Critical species were studied by comparing the more recently collected specimens with Hayata's types in the Tokyo Imperial University Herbarium. At the same time duplicates were sent to various institutions in foreign countries for direct comparison with the types there preserved. In connection with this work I am especially indebted to the late E. H. Wilson of the Arnold Arboretum and to Dr. E. D. Merrill of the New York Botanical Garden. Sasaki's work continued until 1928 when his 'Catalogue of the Government Herbarium' was published, on which to a considerable degree, the present work is based as to nomenclature and admitted species.

"I have attempted to compile for the benefit of the student of Formosan trees, pertinent data appertaining to the admitted species, including the accepted scientific names, adjusted synonymy, local names, occurrence, habitat, distribution, and brief diagnoses. Most of the species are illustrated."—*From author's preface.*

Plantae boninenses novae vel criticae. V. By Takasi Tuyama. *Botanical Magazine* (Tokyo) 50: 129–134; figs. 24–26; March 1936.

Included is a formal description of the new genus (previously published as a nomen nudum) *Dendrocacalia* Nakai, with a single species, *D. crepidifolia*. The plant is a tree of 1.5–4 meters, native in Bonin, and related to *Cacalia* and *Senecio*. Its local names are Wadan-no-ki and Nigana-no-ki.

Tropical planting and gardening. (4th ed.) By H. F. Macmillan. Macmillan & Co., Ltd., St. Martin's Street, London, 1935. Pp. 560; 6 x 9.

The author is to be congratulated on the production of a fourth edition of this standard work, which is on a much broader scale than the others and should meet with the approval of a wider circle of readers connected with agriculture and horticulture in tropical and warm countries. It covers the cultivation of plants for ornament, utility, or commercial

purposes in tropical and subtropical regions in general, and there is a chapter devoted to arid or subdesert places.

Mr. Macmillan has been fortunately situated in Ceylon, where his many years' experience permit him to write with authority on the subject. The Royal Botanic Gardens, Peradeniya (of which he was Superintendent), were founded in 1822, or more than a century ago, and with practically every climate under the sun available in the island for the successful cultivation of an almost endless variety of plants or, as he himself states, "where are found a variety of climatic conditions and a wealth of vegetation, indigenous or exotic, cultivated or wild, not commonly met with elsewhere in the tropics," it is no exaggeration to say the work is a mine of information, acceptable to the professional planter or gardener and as a text book for first enquirers.

In Section I, after describing four climatic zones, hot and moist, hot and dry, intermediate, and cool, ranging from sea level to an altitude of over 8000 feet, the opening chapters deal with the practical side of planting and gardening: climate, soils, plant life, manures (inorganic and green), tillage, irrigation, propagation, planting, pruning, laying out a garden, the making of lawns, and hedges.

In Section II there are listed beautiful flowering and foliage trees, suitable for low or medium elevations, including the "Queen of flowering trees" (*Amherstia nobilis*), of which a colored plate is given as the frontispiece, believed to be the finest flowering tree in the world—native of Burma and introduced to Ceylon in 1860; the Cannon-ball tree (*Couroupita guianensis*), native of tropical South America, introduced to Ceylon in 1881 and flowering and fruiting regularly since 1898; the Queen Flower or Pride of India (*Lagerstroemia flos-reginae*), a large and important deciduous tree of India, Assam, Burma, Ceylon; the Flame Tree or Flamboyante (*Poinciana regia*), native of Madagascar, introduced to Ceylon before 1841, an ornamental tree cultivated throughout the tropics; Mora (*Mora excelsa*), a timber tree of British Guiana, introduced to Ceylon in 1881 where the large one-seeded pods are produced in November and December; and Mahogany (*Swietenia mahagoni*), a well known timber tree of

tropical America, introduced to Ceylon about 1840, where it is found to be a useful shade and ornamental foliage tree, seeding freely during June and July. In the same section particulars are given of trees for fuel, packing-chest woods, important timbers and cabinet woods of the tropics, and trees reasonably immune from termites.

Section III includes fruit culture of all the tropical and subtropical fruits that are usually imported and that may be seen in Covent Garden market according to season, as well as the many excellent fruits that may be grown for local use; vegetables and food crops, spices, condiments, and culinary herbs.

Section IV is devoted to beverages, such as tea, coffee, cocoa (or cacao), yerba mate (or Paraguay tea); toddy (or spirit), which is distilled from the sap of the inflorescence of the Nipah Palm (*Nipa fruticans*), thriving in low-lying places subject to tidal influence in the eastern tropics; the Palmyra Palm (*Borassus flabellifer*) of India (where the spirit, distilled from the sap, as under Nipah, is called Arrack), Ceylon, tropical Africa, etc.; other palms or plants from which beverages (infused, fermented, or distilled) may be obtained; various edible products, including rice, sago (*Metroxylon sagu*) (extracted from the pith of the trunk) of Sumatra, Java, Borneo, and Malay Peninsula; sugar cane, etc.; drugs, medicinal plants, poisonous plants, oils (fixed and essential), rubber, gums and resins, fibers, sericulture, dyes and tans, and fodder plants.

Section V deals with perfume plants, bee plants, pests (insect and fungous), and weeds; preserves, weight of seeds, etc.; and finally a useful glossary and an excellent index.—J. H. Holland.

Contributions to the flora of Siam. Additamentum XL. *Kew Bulletin of Miscellaneous Information* 34–47; 1936.

Among the new species of woody plants described from Siam are *Kadsura ananosma* Kerr; 8 species and varieties of *Vaccinium* by Fletcher; *Xolisma foliosa* Fletcher; 4 species and varieties of *Maesa* by Fletcher; *Rapanea subpedicellata* Fletcher; and 6 species and varieties of *Embelia* by Fletcher.

The anatomy of some lauraceous scent-yielding woods known as "medang." By B. ALWYN JAY. *Kew Bulletin of Miscellaneous Information* 1: 66–72; 5 plates, 1 text fig.; 1936.

This paper, the third in a series on scented woods (see *Tropical Woods* 34: 47 and 44: 61), is concerned with the following species of the Federated Malay States: *Cinnamomum parthenoxylon* Meissn., *C. inunctum* Meissn., *C. iners* Reinwdt., *Alseodaphne penduliflora* Gamble, *Dehaasia Curtisii* Gamble, *D. cuneata* Blume, *Litsea castanea* Hook. f., *L. myristicaefolia* Wall., *L. megacarpa* Gamble, *L. tomentosa* Blume, and *Nothaphoebe panduriformis* Gamble.

"It is of interest to note that no characters could be found whereby the wood of *C. parthenoxylon* could be distinguished from that of *C. inunctum*. Moreover the morphological differences between these species are small. According to Ridley the leaves of *C. parthenoxylon* are glaucous, whereas those of *C. inunctum* are not. Gamble makes the distinction that the axils of the leaf-nerves of *C. parthenoxylon* bear pitted glands, while those of *C. inunctum* have none. Mr. C. E. C. Fischer says that, in his opinion, these dissimilarities are hardly sufficient to differentiate these species with certainty, so that it is possible that they are identical. For these reasons *C. parthenoxylon* and *C. inunctum* have been described together. Moreover, since all the species dealt with resemble one another very strongly, the only complete description that has been drawn up is the one for these two species. Brief descriptions, including only those features which appear to be of diagnostic value, are given of the other species, thereby avoiding repetition. The number of species examined during the course of this investigation is so small that no attempt has been made to find characters whereby the different genera may be distinguished from one another."

Mikrographie des Holzes der auf Java vorkommenden Baumarten. VI. By H. H. JANSSONIUS. Leiden: E. J. Brill, 1934–36. Pp. 1–611; 5½ x 9; text figs. 343–365.

With the appearance of the second part of Volume VI, the great task of preparing and publishing detailed descriptions of

the Koorders and Valeton collection of Javanese woods is concluded, after 32 years. The whole work is concerned with about 2400 specimens, representing 991 species and varieties of 366 genera and 74 families. It was begun under the direction of the late Professor J. W. Moll, who wrote the introduction, classified the elements of woods, and defined the terms to be used in the descriptions. All the rest represents the uninterrupted research by Dr. Janssonius, for a time at the Botanical Institute of the University of Groningen and later in the Commercial Museum of the Colonial Institute, Amsterdam. Late in 1935, all of the specimens large enough were cut in two, one half retained at the Museum, the other deposited in the collections of the Yale School of Forestry (Y. Nos. 30025–31896).

The families included in Vol. VI are: Urticaceae, Juglandeae, Myricaceae, Casuarineae, Cupuliferae, and Coniferae. There are two long lists of references (pp. 495–564), one by authors, the other by families. The bibliography is followed by a table of contents for the six volumes, an index to the current one, and a "Nachwort" by the author. An index to the whole work is promised.

Contributions to the flora of Borneo and other Malay islands. V. New and noteworthy species from Sarawak collected by the Oxford University Expedition, 1932. *Kew Bulletin of Miscellaneous Information* 17–21; 1936.

New trees from Sarawak are: *Palaquium Richardsii* Griff. & Lam., vernacular name Niatoh; *Lithocarpus sarawakensis* Warb., Impinit Batu, Berangan Batu; *L. sericobalanos* Warb., Impinit, Alun; *Castanopsis lentiginosa* Warb.

On the systematic position of the genus *Dolianthus* C. H. Wright. By C. E. B. BREMEKAMP. *Kew Bulletin of Miscellaneous Information* 103–105; 1936.

The genus *Dolianthus*, referred by its author to Loganiaceae, is found upon further study to belong to the Rubiaceae, tribe Psychotrieae.

Eine neue Myrtaceen-Gattung von Celebes. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 101–106; fig. 5; March 15, 1936.

The new genus *Kjellbergiodendron* of the Myrtaceae consists of two species of small trees of Celebes.

Trees and shrubs of Kenya Colony. Govt. Printer, Nairobi, February 1936. Pp. xi+201; 6 x 9¾; price 5 shillings.

PREFACE

"The present publication is a revision and amplification of *A Descriptive Catalogue of Some of the Common Trees and Woody Plants of Kenya Colony*, by Mr. E. Battiscombe, late Conservator of Forests, published in 1926 (now out of print). The title of the book has been abbreviated, but the arrangement remains the same. The families follow the system proposed by Hutchinson in his book *The Families of Flowering Plants*.

"The material which made possible the original publication and the present enlargement has been collected mainly by members of the Forest Department, and is included in the Department's herbarium in Nairobi. Specimens have been identified at the Royal Botanic Gardens, Kew, and the Imperial Forestry Institute at Oxford, to the staff of both of which a great debt of gratitude is due. The description of the new species and the revisions of the old are mainly the work of Mr. I. R. Dale, Assistant Conservator of Forests.

"The list is still far from complete, particularly as regards the dry bush country and the savanna areas between the Highlands and the Coast and the Northern Frontier District. It has also not been possible as yet to attempt to record the complete distribution of the various species. It has, however, been felt desirable, owing to the great increase in our knowledge of the local flora in recent years, to republish the Catalogue, although under present economic conditions it has not been possible to do so in the same style as the original edition or to include illustrations.

"Native names have been recorded wherever possible, as these are the simplest means by which the layman can identify

a species in the Catalogue. It should be noted, however, that such names are often unreliable, and that often many variations of the name are found in the same tribe. It is frequently doubtful how a name should be spelled, and this renders the vernacular index a rather uncertain aid. The index has been divided into groups of more or less allied tribes, and it is hoped that this will facilitate its use and reduce the field of search in many cases. An introductory note has been included, describing the main forest types in Kenya, as it is thought that this may enable the user of the Catalogue better to appreciate the nature of the Colony's woody flora.

"It is hoped that the present work will lead to increased knowledge of our flora and produce criticisms and suggestions for improvements which will render possible a much fuller and more detailed publication in the future."—H. M. GARDNER, *Conservator of Forests*.

La forêt equatoriale africaine: son passé, son présent, son avenir. By LOUIS LAVAUDEN. Pub. by Assn. Colonies-Sciences & Com. Nat. des Bois Coloniaux, Paris, 1935. Pp. 22; 6¼ x 9½. Price 4 francs.

An important discussion of tropical forests and the problems involved in their utilization and management. A mimeographed translation into English has been distributed by the Imperial Forestry Institute, Oxford, England.

Flora of West Tropical Africa. By J. HUTCHINSON and J. M. DALZIEL. Vol. II, part 2, pp. 293–651; figs. 278–381: map. London, February 1936. Price 8s. 6d.

The present and final part of the Flora of West Tropical Africa treats the Monocotyledones, an index for the two volumes accompanying the part. Naturally, very few woody plants are included, but some may be found in such genera as *Dracaena* (here placed in Agaveaceae), *Pandanus* (represented by one species), *Smilax*, and a few bamboos. The palms are represented by eleven genera and 25 species. The map is a colored vegetation map of the region covered by the flora, the vegetation belts represented on it being thorn scrub

savanna, tree savanna, equatorial forest, montane vegetation, and mangrove vegetation.

The completion of this flora is one of the most important recent achievements in systematic botany, providing, as it does, a condensed account of the vegetation of a large area of Africa. Because the region covered produces some of the most important tropical woods, the work will be of great practical value to all who are interested in forestry. Besides the unusually detailed keys to genera and species, the usefulness of the flora is greatly enhanced by its large number of excellent illustrations.—P. C. STANDLEY.

Les forêts de la Casamance. By GRANDCLÉMENT. *Actes & Comptes Rendus de l'Association Colonies-Sciences* (Paris) 12: 131: 97–100; May 1936.

The forests of the Casamance region, Senegal, are accessible enough for foreign trade, but the trees are mostly of rather short stature and their timber is not at present in much demand. The principal species are: Mahogany or Caïlcédrat (*Khaya senegalensis*), Linké (*Afzelia africana*), Ven (*Pterocarpus* sp.), Santan (*Daniella Oliviera*), Santanforo (*D. thurifera*), Tomboiro Noir (*Chlorophora regia*), and Tomboiro Blanc (*Antiaris africana*).

Rubiacées nouvelles d'Afrique Occidentale. By A. AUBRÉVILLE and F. PELLEGRIN. *Bull. Société Botanique de France* (Paris) 83: 35–41; figs. 1, 2; May 18, 1936.

New woody Rubiaceae described from West Africa are: *Mitragyna ciliata*, vernacular names Bahia, Soso, Souso, N'tobo, N'toro; *Cuviera bolo*, Bolo; *Canthium tekbe*, Tekbe; *C. manense; Tricalysia Vignei.*

Types of pitting in conifers. By ALAN S. PEIRCE. *Trans. Illinois State Acad. Sci.* 28: 2: 101–104; 1 plate; December 1935.

"Illustrated descriptions are given of various moderately constant types of conifer pitting. Among these are four conditions occurring on radial walls of tracheids, three occurring on transverse walls of wood parenchyma, five on crossfields,

and two on the tangential walls of ray cells. The descriptions are accompanied by the general distribution and potential diagnostic value of the types. Care should be taken to use these characters only in combination with others, because of great variations in wood anatomy."

Mikroskopische Holzstruktur und Holzbestimmung. By P. JACCARD. Reprinted from *Schweizerischen Zeitschrift für Forstwesen* (Bern) 2, 3; 1936. Pp. 32; plates 2, text figs. 23.

A well illustrated and instructive treatise on wood anatomy, the importance of study in that field, the problems involved, a summary of progress along various lines, and suggestions for students.

Buch der Holznamen. IV-1, Murza–Sage. IV-2, Saget–Zypresse. By HANS MEYER. M. & H. Schaper, Hannover, Germany, 1935–36. Pp. 353–464, 465–564; 7 x 10. Price, 1 and 2, RM. 10.50; either separately, RM. 6.

The second installment of Part IV brings to a conclusion an exceedingly useful publication, the Book of Wood Names, upon which the author was engaged at the time of his death, May 20, 1935. The last part of the manuscript was edited by Professor Brunner and Dr. Maeckel, of the Institut für angewandte Botanik, Hamburg, and the proofs were read by Mr. Otto Meyer, the author's brother. In a foreword, Professor Bredemann, Director of the Institut, says:

"Criticisms have repeatedly contained an expressed desire for an enlargement of the work, but the late author's idea was to provide, at first, a suitable basis upon which the work could be built up, and Dr. Hans Meyer, himself, in his preface to the book calls it an appropriate primary basis for further work *in which all those who are interested are kindly asked to participate*, and this wish, on behalf of the late author, is again repeated here. The Institute, from which his 'Book of Wood Names' proceeds, intends continuing the work, and contemplates issuing a supplement in two or three years time, which will contain those wood names not already included in this book, or which have come into use since its publication."

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Yale University School of Forestry

TROPICAL WOODS

NUMBER 48 DECEMBER 1, 1936

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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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IDENTIFICATION OF WOODS WITH CONSPICUOUS RAYS

By H. E. DADSWELL *and* S. J. RECORD

The identification of an unknown wood is a process of segregation and elimination. The correct determination of a specimen requires consideration of every possibility residing in more than 3000 genera of over 230 families. This involves a comprehensive systematic study of all the woods of the world, a task well begun but still very far from completion. Enough progress has been made, however, to permit the classification of most of the families and genera with respect to certain outstanding structural features. Such groups serve as units for more intensive analysis and are preliminary to the preparation of a much needed general key to woods.

Fourteen different classifications were published in the September issue of *Tropical Woods*. One of them lists the

names of 57 families containing woods with conspicuously large rays. The present paper deals with that group as exemplified in the collections of the Yale School of Forestry. An artificial key has been constructed, but owing to the wide range of variation encountered in some of the generally recognized taxonomic divisions it has not always been possible to discover characters that would hold for entire families. Following the key are concise descriptions of 50 families or germane parts of them, all prepared on the same general plan so as to make them readily comparable.

Except for one abnormal gymnosperm, the families considered are dicotyledons of 34 orders, according to Hutchinson's classification, as follows:

MAGNOLIALES
- Winteraceae
- Trochodendraceae

ANONALES
- Anonaceae

LAURALES
- Monimiaceae
- Lauraceae

RANALES
- Ranunculaceae

BERBERIDALES
- Berberidaceae
- Menispermaceae

ARISTOLOCHIALES
- Aristolochiaceae

PIPERALES
- Piperaceae
- Chloranthaceae

RHOEADALES
- Papaveraceae

VIOLALES
- Violaceae

PROTEALES
- Proteaceae

DILLENIALES
- Dilleniaceae

CORIARIALES
- Coriariaceae

BIXALES
- Neumanniaceae

TAMARICALES
- Tamaricaceae

CACTALES
- Cactaceae

THEALES
- Marcgraviaceae
- Actinidiaceae

MYRTALES
- Lecythidaceae
- Rhizophoraceae

GUTTIFERALES
- Guttiferae

TILIALES
- Sterculiaceae
- Bombacaceae

MALVALES
- Malvaceae

EUPHORBIALES
- Euphorbiaceae

CUNONIALES
- Greyiaceae

ROSALES
- Rosaceae
- Leguminosae

HAMAMELIDALES
- Platanaceae

FAGALES
- Betulaceae
- Corylaceae
- Fagaceae

CASUARINALES
- Casuarinaceae

CELASTRALES
- Aquifoliaceae
- Icacinaceae

RHAMNALES
- Vitaceae

RUTALES
- Simarubaceae

SAPINDALES
- Akaniaceae
- Sabiaceae

UMBELLIFLORAE
- Cornaceae
- Araliaceae

ERICALES
- Vacciniaceae
- Epacridaceae

MYRSINALES
- Myrsinaceae
- Theophrastaceae

CAMPANALES
- Campanulaceae

An earlier study of the large-rayed woods in the Yale collections was made by Professor Walter W. Tupper in 1927,

and a summary of the results was published in *Tropical Woods* 11: 5–9. He observed conspicuous rays in representatives of only 24 families, but at that time the total number of specimens available for study at Yale was about 11,000, representing less than 1200 genera and 150 families, whereas there are now 33,000 specimens of nearly 2600 genera and 227 families.

In different woods and sometimes in the same sample one may find almost every possible gradation in ray size. The decision as to what constitutes a size class is always arbitrary and, in the absence of any recognized standard, is merely an expression of personal opinion. The authors of this report have included every available wood in which the rays appear to be the most prominent feature on cross section. This criterion is obviously inexact, but it was found more readily usable and practical than any scale of actual sizes. Only border-line cases are left in doubt, and such would exist no matter what classification was adopted. In this category are certain Cucurbitaceae, Dichapetalaceae, Elaeagnaceae, Escalloniaceae, Gesneriaceae, Gnetaceae, Loganiaceae (*Strychnos*), Phytolaccaceae, Symplocaceae, and Tiliaceae.

Key to Woods with Conspicuous Rays

1 a. Vessels absent 2
b. Vessels present 3

2 a. Early-wood tracheids with scalariform pitting ..... Trochodendraceae.
b. Tracheids with round bordered pits ..... Winteraceae.

3 a. Woods with anomalous structure (included phloem) 4
b. Woods with normal structure 5

4 a. Raphides in conjunctive tissue ..... *Doliocarpus* (Dilleniaceae).
b. Raphides absent ..... Menispermaceae.

5 a. Aggregates of narrow rays present; solid broad rays absent 6
b. Narrow rays not aggregated; solid broad rays present 9

6 a. Perforations all multiple (scalariform) ..... Betulaceae (in part).
b. Perforations exclusively or predominantly simple 7

7 a. Vessels with spirals ..... Corylaceae.
b. Vessels without spirals 8

8 a. Wood fibers with simple pits ..... Lauraceae (in part).
b. Wood fibers with bordered pits ..... Fagaceae (in part).

9 a. Perforation plates with several circular openings.....Ephedraceae.
b. Perforation plates not foraminate..... 10

10 a. Wood fibers with conspicuous bordered pits..... 11
b. Wood fibers with simple or inconspicuous bordered pits..... 25

11 a. Vines, with very porous, coarse-textured wood..... 12
b. Erect plants of normal structure..... 14

12 a. Rays all large.....Aristolochiaceae.
b. Rays of two distinct sizes..... 13

13 a. Vessel pits minute.....Actinidiaceae.
b. Vessel pits large.....*Sabia* (Sabiaceae).

14 a. Wood parenchyma distinct with lens..... 15
b. Wood parenchyma not distinct with lens..... 17

15 a. Perforations predominantly multiple.....Icacinaceae.
b. Perforations predominantly simple..... 16

16 a. Woods reddish.....Casuarinaceae.
b. Woods yellowish or white.....Rhizophoraceae (in part).

17 a. Ring-porous.....*Rosa* (Rosaceae).
b. Diffuse-porous..... 18

18 a. Large rays very high (suggesting *Quercus*)..... 19
b. Large rays rather low (suggesting *Platanus* or *Fagus*)..... 21

19 a. Pores few, rather large.....Dilleniaceae.
b. Pores numerous, small to minute..... 20

20 a. Large rays few, widely spaced.....*Dracophyllum* (Epacridaceae).
b. Large rays very numerous.....Neumanniaceae.

21 a. Woods white; rays not in contrast with background...Aquifoliaceae.
b. Woods brown or red; rays in contrast with background..... 22

22 a. Perforations simple; vessels with and fibers without spirals.
Prunus (Rosaceae).
b. Perforations multiple, at least in part..... 23

23 a. Rays fairly homogeneous; vessels and fibers without spirals.
Platanaceae.
b. Rays decidedly heterogeneous..... 24

24 a. Ray cells often as large as the pores; vessels and fibers with spirals.
Aucuba (Cornaceae).
b. Ray cells much smaller than pores; vessels and fibers with or without spirals.....Epacridaceae, Vacciniaceae.

25 a. Vessel pits vestured.....Leguminosae.
b. Vessel pits not vestured..... 26

26 a. Rays with aggregates of resin cells.....Myrsinaceae.
b. Rays without aggregates of resin cells..... 27

27 a. Bundles of raphides present..... 28
b. Bundles of raphides absent..... 31

28 a. Ripple marks present; all elements storied; trees.....Greyiaceae.
b. Ripple marks absent; mostly woody vines..... 29

29 a. Ray-vessel pitting very fine; vines.....Marcgraviaceae.
b. Ray-vessel pitting coarse..... 30

30 a. Vines; wood very coarse-textured.....Vitoideae (Vitaceae).
b. Trees; wood rather fine-textured.....*Leea* (Vitaceae).

31 a. Pores and parenchyma forming tangential festoons..... 32
b. Pores and parenchyma not forming festoons..... 33

32 a. Ripple marks present; large rays with sheath cells.
Hoberia (Malvaceae).
b. Ripple marks and sheath cells absent.....Proteaceae.

33 a. Perforations exclusively or predominantly multiple..... 34
b. Perforations exclusively or predominantly simple..... 39

34 a. Scalariform plate as long as vessel member.....Chloranthaceae.
b. Scalariform plate less than half as long as vessel member..... 35

35 a. Parenchyma in very numerous, irregular lines.
Euphorbiaceae (in part).
b. Parenchyma usually sparingly paratracheal or diffuse..... 36

36 a. Radial canals present; pores medium-sized.....Araliaceae (in part).
b. Radial canals absent; pores very small..... 37

37 a. Wood hard, fine-textured; all shrubs and small trees.....Violaceae.
b. Wood of medium density and texture; often large trees..... 38

38 a. Ray-vessel pitting scalariform.....Monimiaceae.
b. Ray-vessel pitting fine, alternate.....*Meliosma* (Sabiaceae).

39 a. With distinctly metatracheal parenchyma..... 40
b. Without distinctly metatracheal parenchyma..... 47

40 a. Vascular tracheids common about large vessels...Fagaceae (in part).
b. Vascular tracheids absent or rare..... 41

41 a. Parenchyma and rays in distinct "spider-web" pattern...Anonaceae.
b. Parenchyma in fine, irregular network..... 42

42 a. Ray-vessel pitting fine..... 45
b. Ray-vessel pitting coarse (at least in part)..... 43

43 a. Pores very irregularly distributed.....*Balanites* (Simarubaceae ?).
b. Pores fairly uniformly distributed..... 44

44 a. Ripple marks, sheath and tile cells often present. Malvaceae, Sterculiaceae.
b. Ripple marks, sheath and tile cells absent. . Matisieae (Bombacaceae).

45 a. Ripple marks, sheath and tile cells often present. . . . . Bombacaceae.
b. Ripple marks, sheath and tile cells absent. 46

46 a. Crystalliferous parenchyma strands common. . . . . Lecythidaceae.
b. Crystalliferous strands absent or rare. . . . . Euphorbiaceae.

47 a. Vessels with spirals. 48
b. Vessels without spirals. 51

48 a. With ripple marks. 49
b. Without ripple marks. 50

49 a. Rays nearly homogeneous. . . . . *Berberis* (Berberidaceae).
b. Rays distinctly heterogeneous. . . . . *Clematis* (Ranunculaceae).

50 a. Rays nearly homogeneous. . . . . *Peumus* (Monimiaceae).
b. Rays distinctly heterogeneous. . . . . Araliaceae (in part).

51 a. Ray-vessel pitting coarse. 52
b. Ray-vessel pitting fine. 57

52 a. Rays of two sizes. 53
b. Rays nearly all large. 54

53 a. Vascular pitting distinctly scalariform. . . . . Guttiferae (in part).
b. Vascular pitting mostly not scalariform. . . . . Araliaceae (in part).

54 a. Radial channels present. 55
b. Radial channels absent. 56

55 a. Radial channels numerous; parenchyma sometimes abundantly paratracheal. . . . . Cactaceae.
b. Radial channels few; parenchyma sparingly paratracheal. *Bocconia* (Papaveraceae).

56 a. Most of the ray cells upright; wood fibers typically septate. Akaniaceae.
b. Most of the ray cells not upright; wood fibers typically non-septate. Campanulaceae.

57 a. Rays exceptionally high (node to node); oil cells sometimes present. Piperaceae.
b. Rays not very high; oil cells absent. 58

58 a. Rays fairly homogeneous; ripple marks absent. . . . . Theophrastaceae.
b. Rays distinctly heterogeneous; ripple marks present. 59

59 a. Vascular tracheids present, often abundant. . *Tamarix* (Tamaricaceae).
b. Vascular tracheids absent. . . . . Coriariaceae.

Descriptions of Fifty Families with Broad-rayed Woods

Actinidiaceae

Actinidia, with over 20 species of climbing shrubs, has its center of distribution in China. The coarse-textured, brown wood suggests *Vitis*. Growth rings distinct. Some of the pores very large, locally zonate; others rather small, scattered, mostly solitary. Large vessels with simple perforations, small ones with scalariform plates having several to many bars; spirals present; pits minute. Rays of two distinct sizes, uniseriate, with nearly all cells upright or square, and multiseriate (*Platanus* type), with body cells procumbent and uniform; pits to vessels minute. Wood parenchyma diffuse and in irregular, inconspicuous tangential lines; cells thick-walled, abundantly pitted. Wood fibers with numerous conspicuous bordered pits on radial and tangential walls; borders round, apertures slit-like and inclined.

Akaniaceae

The only genus, *Akania*, is a small Australian tree known as Turnipwood because of the turnip-like odor of the bark. Wood brownish, with silky luster; density medium. Pores very small, not distinct without lens, fairly numerous, solitary or in small groups. Vessels without spirals; perforations simple, with slight tendency to multiple; intervascular pitting alternate to opposite, the pits small. Rays mostly large (Plate II, 2), a few small; heterogeneous, the cells large, irregular, and thin-walled; some sheath cells present; ray-vessel pits pairs mostly large, elongated, simple to half-bordered. Wood parenchyma sparingly paratracheal; pits to vessels usually large and elongated, tending to scalariform arrangement. Wood fibers thick-walled, septate; pits numerous, very small, simple to indistinctly bordered.

Anonaceae

A large family, mostly shrubs and slender trees, widely distributed in tropical and sub-tropical regions. Woods greatly

variable in density. Color yellowish or brownish to greenish or almost black. Diffuse-porous (exc. *Asimina*), the pores solitary or less often in multiples. Vessels without spirals (exc. *Asimina*); perforations simple; pits minute. Rays fine to coarse, generally 4 to 14 cells wide; genera with largest rays are *Anaxagorea, Bocagea, Cyathocalyx, Desmopsis, Goniothalamus, Griffianthus, Guatteria, Mezzettia, Mitrephora, Polyalthia, Stelechocarpus, Stenanthera, Trivalvaria, Unonopsis;* homogeneous to distinctly heterogeneous; ray-vessel pitting often unilaterally compound; large oil cells present in some species. Wood parenchyma characteristically in numerous, regularly spaced lines or narrow bands, interrupted by rays so as to give a ladder-like or spider-web appearance; oil cells sometimes present. Wood fibers non-septate; pits very small, bordered.

Aquifoliaceae

The principal genus, *Ilex*, is widely distributed in both temperate and tropical regions. The wood is noted for its uniform texture and its chalky or bluish white color. Pores very small, in radial rows (Plate III, 2). Vessels with many-barred perforation plates; spirals frequently present; intervascular pitting opposite or scalariform. Rays of two sizes; decidedly heterogeneous; ray-vessel pit-pairs small, half-bordered. Wood parenchyma sparingly developed in short, inconspicuous lines or diffuse. Wood fibers thick-walled, often with spiral thickenings; pits with distinct borders and narrow apertures.

In *Byronia, Nemopanthes*, and *Phelline* the rays are somewhat less conspicuous, and there are no spirals in the vessels and fibers. *Nemopanthes* is ring-porous, although all the pores are of about the same size.

Araliaceae

A large, mostly tropical family of trees, shrubs, and herbaceous plants. Woods light-colored, mostly rather soft, not extensively used. Several genera ring-porous; others diffuse-porous, the pores usually small to medium-sized, solitary or in small groups, without pattern. Vessels with simple, less

commonly with multiple, perforations; spirals present in some genera; intervascular pitting coarse, with tendency to scalariform. Rays of two sizes, the larger ones medium-sized to very distinct (*e.g., Aralidium* and *Pseudopanax*); heterogeneous, at least in part; pits to vessels variable in size and shape, often very large and sometimes in scalariform arrangement; intercellular canals present in some species. Wood parenchyma sparingly paratracheal. Wood fibers septate; pits simple, numerous, lenticular, distinct; starch grains common in sapwood.

Aristolochiaceae

Aristolochia is a large, very widely distributed genus of herbs, woody vines, and a few small trees; often grown for decorative purposes. Wood white or yellow, coarse-textured, frequently ring-porous. Some of the pores very large, others much smaller. Vessels with simple perforations; spirals sometimes present in smallest vessels; intervascular pitting coarse, tending to scalariform. Rays all wide, height often equal to length of internodes, usually not in contact with the vessels; fairly homogeneous, cells thin-walled; crystals common. Wood parenchyma sparingly paratracheal and sometimes in irregular, uniseriate, tangential lines. Wood fibers with numerous conspicuous bordered pits.

Berberidaceae

A family of several genera of herbs and shrubs, mostly of the north temperate zone. In *Berberis* the wood is hard, the interior of old trees brown, thick sapwood bright yellow. Pores small to minute, the larger ones zonate (ring-porous), the others in an irregular pattern composed of wavy and zig-zag lines or bands (Plate III, 3). Vessels with simple perforations; spirals present; elements storied; pits small, alternately arranged. Rays nearly all large, *Platanus* type; not storied; fairly homogeneous; pits to vessels small, circular. Wood parenchyma sparse or absent. Wood fibers small, thick-walled, with minute simple pits. Ripple marks distinct. The other genera are diffuse-porous and lack storied structure.

Betulaceae

This family, in the restricted sense, consists of two well-known north temperate genera, *Alnus* and *Betula*. Woods moderately hard, fine-textured, uniform, diffuse-porous. Pores small to minute, thin-walled, rather few to many, commonly in multiples, without pattern. Vessels with many-barred scalariform perforation plates; pits very small. Rays narrow and low, sometimes aggregated; homogeneous or nearly so; pits to vessels very small. Wood parenchyma sparingly developed, mostly diffuse. Wood fibers with small bordered pits.

The principal differences between the two genera are as follows: *Alnus:* Vessels without spirals; pitting mostly opposite. Aggregate rays common; other rays mostly uniseriate. Parenchyma diffuse. *Betula:* Vessels with spirals; pitting alternate, the pits minute. Aggregate rays uncommon; ordinary rays 1 to 5 cells wide. Parenchyma may be terminal and metatracheal as well as diffuse.

Bombacaceae

The Bombacaceae are small to exceptionally large tropical trees mostly with soft to exceedingly soft, coarse-textured woods, usually light-colored, but sometimes brown or red. Pores usually large, often paired, scattered. Vessels with simple perforations; without spirals; pitting coarse. Rays in part distinct to conspicuous; heterogeneous, the cells commonly large, thin-walled, irregular; small rays may be storied; pits to vessels generally large, simple to bordered. Parenchyma typically in closely-spaced, uniseriate lines forming an irregular network. Wood fibers thin-walled, with simple pits; commonly septate. Ripple marks common, all elements being storied except the large rays. Vertical traumatic gum ducts have been observed in several genera.

The family is not clearly differentiated from Sterculiaceae and Malvaceae, and there are various exceptions to the foregoing description. For example, some woods, such as *Matisia* and *Quararibea* are comparatively dense, without ripple marks and sheath and tile cells, and the vessel pits are minute. In *Catostemma* the fibers are very thick-walled, non-septate, and

in bands alternating with equally wide or wider parenchyma layers. The rays of some genera, *e.g.*, *Cullenia* and *Durio*, contain tile cells.

Cactaceae

The Cactaceae are succulent and spiny shrubs and trees characteristic of desert regions. The wood is yellow or brown and varies from light and soft to hard and heavy; in some genera it is in ribs or forming a skeletonized framework. Vessels with simple perforations; spirals absent; pits large, irregular, often elongated. Rays coarse, often conspicuous; heterogeneous, the cells generally large and irregular; not storied; pits to vessels gash-like, tending to scalariform arrangement. Parenchyma sparse to abundant, paratracheal and diffuse, but without definite pattern. Wood fibers with simple pits. Radial channels usually give a characteristic pitted appearance to the tangential surface of the wood.

Campanulaceae

Most of the Campanulaceae are herbs, but some are shrubs or small trees. Using *Clermontia* and *Wahlenbergia* as types, the woods are light-colored, moderately hard and heavy, rather fine-textured. Growth rings absent. Pores small to very small, not very numerous, usually in pairs, short radial rows, or small clusters, without definite pattern. Vessels with simple perforations; without spirals; pits rather large, sometimes elongated. Rays nearly all coarse, composing about a third of the cross section; not storied; heterogeneous, the cells large, irregular, mostly upright; in cross sections under the microscope the rays of *Clermontia* are not always clearly demarcated from the fibers; pits to vessels large, irregular. Wood parenchyma absent or indistinct. Wood fibers with thin walls and numerous simple or indistinctly bordered pits; rarely septate.

Casuarinaceae

The members of the only genus, *Casuarina*, are trees and shrubs distributed from India to Australia. The woods are typically reddish or brown, hard and heavy, fine-textured. Pores rather small to minute, not very numerous, usually

solitary with tendency to diagonal arrangement. Vessels with simple or less commonly multiple perforations; spirals sometimes present; pitting alternate. Rays (in nearly all species) of two sizes, the largest very conspicuous, *Quercus* type; heterogeneous; pits to vessels small. Parenchyma in numerous, fine, closely spaced metatracheal bands (Plate I, 3) distinct with lens. Wood fibers with thick walls and distinct bordered pits.

Chloranthaceae

A small family of herbs, shrubs, and small trees growing in the tropics and south temperate zone. Wood brownish, of medium density, rather fine-textured. Pores small to minute; solitary, in pairs or short lines, well distributed. Vessels with fine-barred scalariform perforation plates virtually as long as the members; without spirals; intervascular pitting frequently scalariform. Rays almost all large, composing a third or more of the cross section, high and conspicuous on radial surface; heterogeneous, the cells large, thin-walled, mostly upright or square; pits to vessels large, often elongated and in scalariform arrangement. Parenchyma sparingly paratracheal and diffuse or in broken metatracheal lines. Wood fibers with simple or indistinctly bordered pits; sometimes septate.

Coriariaceae

The only genus, *Coriaria*, is represented in the warm temperate regions of both hemispheres. The plants are shrubs and small trees. Pores small to minute; in ring-porous species there is a rather wide zone of larger pores in early wood and numerous narrow bands of very small pores and paratracheal-confluent parenchyma in late wood; in diffuse-porous woods they are nearly of a size, irregularly distributed, solitary or in radial or tangential groups. Vessels with simple perforations; without spirals; pitting fine, alternate. Rays all coarse, some of them conspicuously so; not storied; heterogeneous, many of the cells upright or square; pits to vessels small. Wood parenchyma paratracheal, sometimes abundant and confluent. Wood fibers with minute simple pits. Ripple marks usually present, fine, rather irregular.

Cornaceae

The only member of this family with conspicuous rays is *Aucuba*, a small genus of shrubs in eastern Asia. The wood is hard and very fine-textured. Pores small to minute, not crowded, occurring singly or in small multiples. Vessels with scalariform perforation plates having numerous narrow bars; spirals distinct; pitting often scalariform. Rays of two sizes, the larger ones of the *Platanus* type; heterogeneous, most of the cells upright or square and many of them as large as the pores; pits to vessels small, round or elongated radially. Parenchyma sparingly diffuse. Wood fibers thick-walled, arranged in definite radial rows; spirals present; pits distinctly bordered.

Corylaceae

A small family of shrubs and small trees of the north temperate zone. Wood light-colored, hard, fine-textured. Pores small to minute, becoming smaller toward the ring margin; numerous, usually in short radial lines, without definite pattern. Vessels mostly with simple perforations, but with tendency to few-barred scalariform plates; spirals present; pitting alternate to scalariform. Aggregated rays present in *Carpinus* (Plate III, 5) and *Corylus;* ordinary rays very fine; homogeneous to more or less heterogeneous; pits to vessels very small to rather large. Parenchyma very sparingly developed, mostly in irregular metatracheal lines. Wood fibers with bordered pits.

Dilleniaceae

The several genera of this family are tropical or sub-tropical trees, shrubs, and lianas. Wood reddish, hard and heavy to moderately so, strong and durable. Pores small to large (in vines), mostly medium-sized; typically solitary (exc. for tangential pairs where elements overlap), rather few, scattered, without pattern. Perforation plates predominantly scalariform with many bars, although simple and scalariform types occur together; spirals absent; pitting coarse, with tendency to scalariform. Rays of two sizes, the large ones of the *Quercus*

type; heterogeneous, the cells mostly square; pits to vessels large, often elongated; bundles of raphides common. Wood parenchyma in irregular uniseriate lines or diffuse; inconspicuous. Wood fibers thick-walled, with conspicuous bordered pits. *Doliocarpus* is a liana, with included phloem in concentric bands; raphides occur in the phloem and conjunctive tissue.

Epacridaceae

This is an Australian family of shrubs and small trees closely related to the Ericaceae. Wood brown, dense, very fine-textured. Pores minute, scarcely visible with lens, numerous, diffuse, without pattern. Vessels mostly with multiple, with tendency to simple, perforations; scalariform plates with many closely spaced bars; spirals present or absent; pitting fine, sometimes scalariform. Rays usually of two sizes, the larger of the *Fagus* type except in *Dracophyllum*, which has rather few, widely spaced, broad and high rays of the *Quercus* type; heterogeneous; the cells mostly small, thick-walled, many square or upright; pits to vessels very small, often elongated. Parenchyma diffuse and sometimes in numerous irregular metatracheal lines; not distinct with lens. Wood fibers thick-walled; bordered pits distinct; spirals present or absent.

Ephedraceae

The only genus, *Ephedra*, with about 35 species of low shrubs, is widely distributed in warm, dry regions of both hemispheres. The wood has gymnospermous tracheids and angiospermous vessels and rays. Growth rings present, coniferous type. Pores small, numerous, mostly solitary, well distributed, though sometimes more numerous in early wood. Vessels with foraminate perforation plates; without spirals; intervascular pitting of coniferous type. Rays minute to mostly large and conspicuous, the latter usually having a distinct herring-bone appearance on cross section; heterogeneous; cells variable in size and shape throughout; abundantly pitted; pits to vessels and tracheids small, rather few, the pit-pairs half-bordered; ray tracheids absent. Wood parenchyma

very sparingly developed, diffuse. Tracheids, coniferous type, compose ground mass of wood; flattened in late wood; bordered pits numerous and distinct in both radial and tangential walls; crassulae present in radial walls.

In *Gnetum gnemon* L. (fam. Gnetaceae), another gymnospermous wood with vessels and fairly large rays, the vessel perforations are mostly simple, sometimes foraminate; the tracheids have very small, irregularly distributed bordered pits, without crassulae; and wood parenchyma is more abundant.

Euphorbiaceae

A very large, widely distributed, highly diversified family of trees, shrubs, and herbs. Most of the woods have small to medium-sized rays, but in *Aporosa*, *Baccaurea*, *Phyllanthus*, *Protomegabaria*, *Uapaca*, and perhaps a few others they are fairly large and conspicuous. The anatomy of the five genera may be summarized as follows: Pores small, fairly numerous, well distributed, solitary, in multiples, or short radial rows. Vessels with simple perforations, except in *Aporosa* and *Protomegabaria*, which have scalariform, many-barred plates; sometimes with indistinct spirals; pitting coarse, alternate or opposite. Rays of two sizes, the larger ones not very high, *Platanus* type; heterogeneous, many of the cells upright or square; pitting coarse, tending to scalariform. Wood parenchyma sparingly diffuse in *Phyllanthus;* better developed in *Uapaca*, where it is paratracheal and diffuse; abundant in the others, occurring as numerous, closely spaced, irregular lines. Wood fibers with thick to exceedingly thick walls, the latter with gelatinous inner layer; sometimes septate; pits small, not very numerous, simple or bordered.

Fagaceae

A family of six genera and many species of trees, well known for their valuable timber. Wood brownish, mostly hard and strong, fine-textured to coarse. Pores all very small in *Fagus* and *Nothofagus*, some large to very large in other genera; *Castanea* and certain species of *Castanopsis*, *Pasania*, and *Quercus* (Plate I, 5) with ring or band of large pores in early wood, and small to minute pores more or less radially arranged

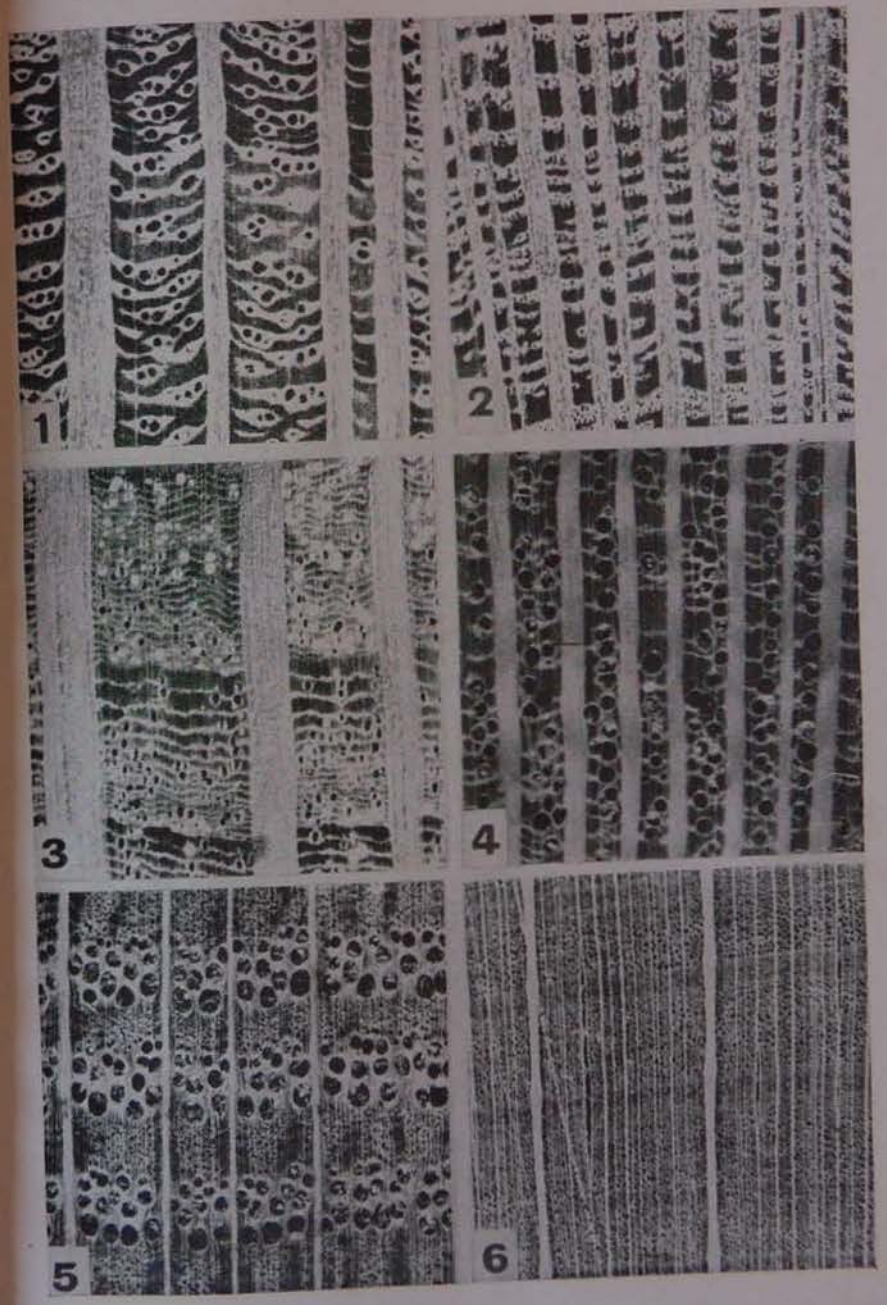
in late wood. Larger vessels with simple perforations, smallest ones often with scalariform plates, usually with few bars; spirals absent; intervascular pitting alternate, with tendency to scalariform in small vessels. Vascular tracheids common about large vessels. Rays more or less heterogeneous; pits to vessels rather large, often elongated; size of rays as follows: in *Castanea* and *Nothofagus*, all very fine; in *Castanopsis* and *Pasania*, sometimes all very fine, sometimes aggregated, sometimes with large solid rays or large ray complexes; in *Fagus*, two-sized (Plate I, 6), the larger distinct, but of the *Platanus* rather than *Quercus* type; in *Quercus*, rarely all very fine, usually of two distinct sizes, the large ones solid or interrupted by fiber layers. Wood parenchyma mostly in uniseriate lines, distinct to indistinct; also diffuse and sometimes paratracheal. Wood fibers mostly thick-walled; pits small, simple or indistinctly bordered in *Nothofagus*, bordered in the other genera.

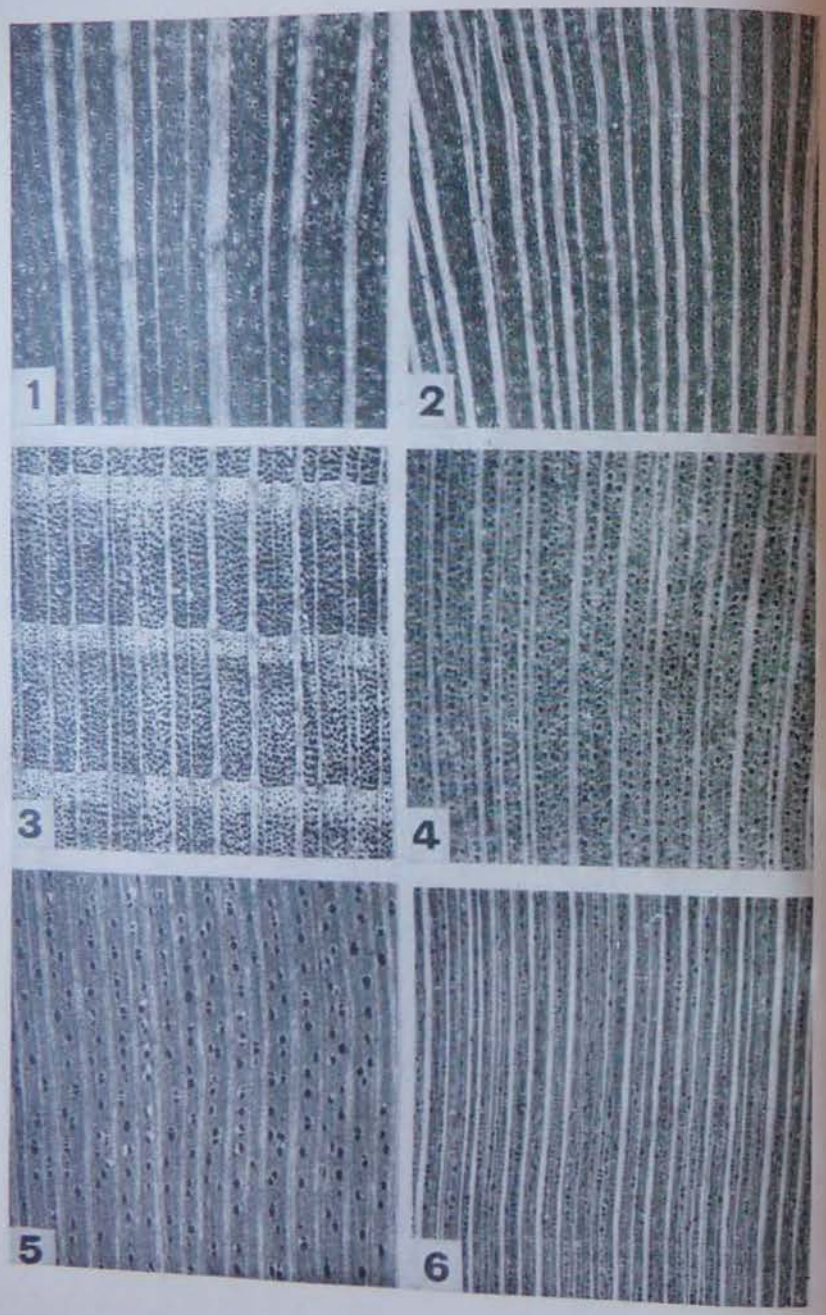
Greyiaceae

Greyia, the only genus, includes two or three closely related species of small South African trees. Wood brownish, of medium density, fine-textured. Pores small, of irregular form; numerous, mostly in clusters or multiples. Vessels with simple perforations; without spirals; pitting opposite to scalariform. Rays nearly all coarse; heterogeneous, the cells large and irregular, not sharply demarcated from adjacent elements; some of the cells contain bundles of raphides; pits to vessels mostly elongated. Wood parenchyma paratracheal and diffuse, not conspicuous. Wood fibers rather thin-walled, with small, simple pits. Ripple marks present, distinct under lens; all elements storied, except the rays. (Description based on a single specimen of *Greyia Sutherlandii* Hook. & Harv., Yale 15571.)

Guttiferae

A large, widely distributed tropical family of trees and shrubs, mostly with yellowish or reddish, hard and heavy woods. Three closely related tropical American genera, *Chrysochlamys*, *Tovomita*, and *Tovomitopsis*, have large rays, very conspicuous on radial surface. Their anatomy is as follows: Pores small, numerous, solitary, or in multiples, small

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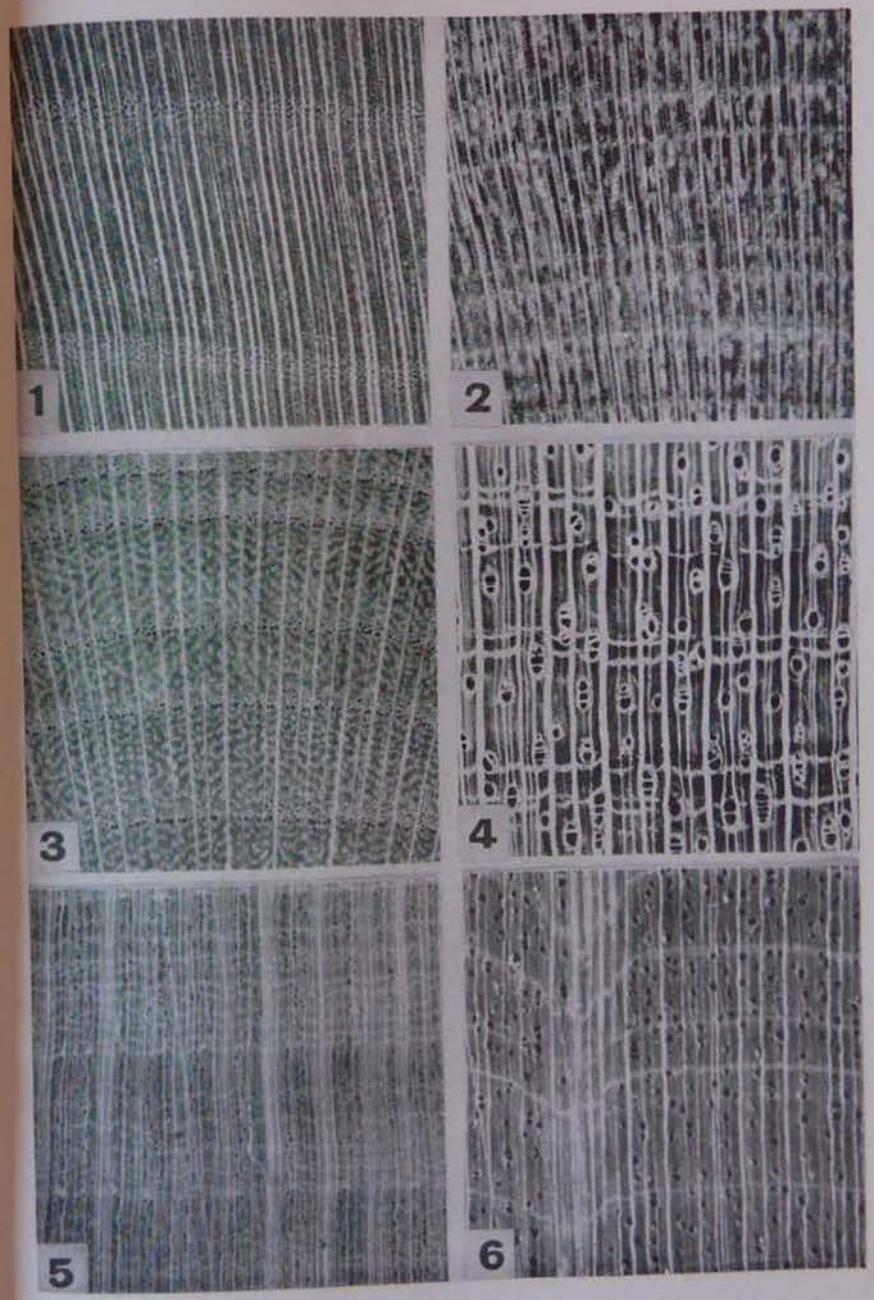
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clusters, or short radial rows, without definite pattern. Vessels with simple perforations; without spirals; pitting scalariform. Rays of two sizes, the larger of the *Platanus* type; heterogeneous, most of the cells square or upright, the marginal ones palisade; pits to vessels large, often elongated and parallel. Wood parenchyma diffuse, sparingly paratracheal, occasionally aliform. Wood fibers thick-walled, with small simple or indistinctly bordered pits; sometimes septate.

Icacinaceae

A large tropical family of trees, shrubs, and woody vines with dense, medium-textured, yellow or brownish woods. Pores generally small, numerous, well distributed without definite pattern (Plate II, 4), usually solitary but occasionally grouped (in more or less tangential arrangement in *Stemonurus*). Vessels mostly with multiple perforations having many, sometimes anastomosing bars, but with tendency to simple perforations which predominate in certain genera; spirals absent; pitting coarse, alternate to opposite. Rays of two sizes, the larger ranging from medium-sized, *Fagus* or *Platanus* types, in some genera to very coarse, *Quercus* type, in others; heterogeneous, many of the cells upright or square; pits to vessels large, often elongated, with tendency to scalariform arrangement. Wood parenchyma abundantly developed, typically in fine network of irregular metatracheal lines and diffuse; occasionally (*e.g.*, in *Desmostachys* and *Stemonurus*) metatracheal and confluent. Wood fibers generally very thick-walled, with conspicuous bordered pits.

Lauraceae

A large, mainly tropical or sub-tropical family of trees and shrubs, many of which are of commercial importance. Wood variously colored; often highly lustrous, sometimes spicily scented; rather light and soft to exceedingly hard and heavy; texture medium. Pores medium-sized to very small, diffuse (except in *Sassafras*), solitary or in small multiples, without definite pattern. Vessels usually with simple perforations; scalariform plates with few bars sometimes present; spirals absent; pitting coarse, mostly alternate. Rays generally very

fine, occasionally up to 8 cells wide; aggregated in *Cryptocarya corrugata* C. T. White & Francis (Plate III, 6) and *C. glaucescens* R. Br.; homogeneous to heterogeneous, usually weakly heterogeneous; large oil cells present in some species; pits to vessels typically very large and irregular. Wood parenchyma paratracheal and diffuse, sometimes metatracheal; fairly abundant but not conspicuous; large oil cells sometimes present. Wood fibers with simple pits; sometimes septate.

Lecythidaceae

A family of 17 genera of small to gigantic tropical trees. Wood yellow, brown, or red; light and soft to hard and heavy; texture very coarse to medium; sometimes (*e.g.*, *Foetidia* and *Gustavia*) malodorous. Pores diffuse, small and very numerous (*e.g.*, in *Gustavia*) to rather few and large (*e.g.*, in *Cariniana*); chiefly in small radial multiples, without definite pattern. Vessels with exclusively simple perforations; without spirals; pits to other vessels sometimes minute (*e.g.*, in *Gustavia* and *Foetidia mauritiana*), more often rather large, alternate or locally opposite. Rays rather fine in most genera, coarse and conspicuous in *Grias*, *Gustavia*, *Napoleona*, and less so in *Barringtonia;* occasionally homogeneous, but generally heterogeneous, many of the cells square or upright; pits to vessels of two sizes, small and large, often occurring together. Wood parenchyma abundantly developed, typically metatracheal, either in numerous, irregular lines or in concentric bands; crystalliferous strands characterize all neotropical genera and *Foetidia mauritiana*. Wood fibers with thin to very thick walls; pits small, simple to indistinctly bordered. Vertical traumatic gum ducts observed in *Eschweilera* and *Lecythis*.

Leguminosae

The woods of this great family are characterized by fine to minute rays. Out of 265 genera examined, coarse rays were found only in *Erythrina*, certain species of *Entada* (a liana), and *Monopteryx*. Since only in the last are they high and conspicuous, the following description is limited to wood of *Monopteryx uaucu* Ducke, a large Amazonian tree. Wood brown to

reddish brown, lustrous; odorless and tasteless; very hard and heavy; medium-textured. Pores rather large to very small, not very numerous, well distributed, without definite pattern, mostly solitary, but sometimes in very long radial multiples. Vessels with simple perforations; without spirals; pits small, alternate, vestured. Rays of two sizes, the largest broad and high, rather widely spaced, having a herring-bone appearance on cross section due to bending inward of the wood fibers; tangential section shows large rays composed of parenchyma and irregular masses of wood fibers; ray parenchyma cells virtually all procumbent; ray-vessel pitting similar in appearance to intervascular. Wood parenchyma abundantly developed about pores, aliform and confluent. Wood fibers very thick-walled, with minute simple pits. Ripple marks absent.

Malvaceae

A large, widely distributed family of herbs, shrubs, and small trees of great economic importance, but not for timber. Wood widely variable in color, light to moderately heavy, mostly fine-textured. Pores small to minute, diffuse, solitary or in small multiples, sometimes clustered, without definite pattern. Vessels with exclusive simple perforations; spirals present in several genera; pitting fine, alternate to opposite, occasionally scalariform in part. Rays very fine in most genera, broad to very broad in others (*e.g.*, *Cienfuegosia*, *Hoberia*, *Lagunaria*, *Lavatera*, *Malvastrum*, *Plagianthus*, and *Spaeralcea*); heterogeneous, cells mostly upright or square; sheath cells sometimes present; ray-vessel pit-pairs half-bordered, of same size as the intervascular or unilaterally compound. Vascular tracheids present in *Malvastrum*, *Plagianthus*, and *Wissadula*. Wood parenchyma scanty to abundant, paratracheal in all genera, metatracheal in many, diffuse or terminal in a few. Wood fibers with thin to thick walls; pits small, usually simple, sometimes bordered. Vertical traumatic gum ducts occasionally present in a few genera. Ripple marks present or absent.

Hoberia and *Plagianthus* are exceptional in having a tangential arrangement of pores and parenchyma suggesting Proteaceae.

Marcgraviaceae

A small tropical American family of climbing shrubs. In *Marcgravia rectiflora* the pores are small to rather large, few to fairly numerous, scattered, mostly solitary. Vessel perforations simple; spirals absent; pitting alternate. Rays mostly large, some very wide and high; heterogeneous, the cells mostly large, upright or square; bundles of raphides present; pits to vessels very small. Wood parenchyma very limited, paratracheal and diffuse. Wood fibers mostly septate; pits numerous, small, simple or indistinctly bordered.

Menispermaceae

A large tropical family of twining plants and a few erect shrubs and small trees. Wood hard, of anomalous structure, the included phloem and conjunctive tissue forming concentric bands apparently terminating seasonal growths. Pores rather small to minute; few in some genera, very numerous in others, with a more or less pronounced tendency to tangential arrangement. Vessels with simple perforations; without spirals; pitting fine, alternate. Rays nearly all broad, composing a third to a half of the cross section; wider near the bands of conjunctive tissue; heterogeneous, many of the cells square; ray-vessel pit-pairs small, half-bordered. Wood parenchyma diffuse or in fine, irregular, metatracheal lines. Phloem in islands filling space between rays at margin of conjunctive parenchyma; layer of sclerotic cells sometimes present in conjunctive tissue and across rays. Wood fibers with numerous, small, indistinctly bordered pits.

Monimiaceae

The Monimiaceae are mostly shrubs or trees, principally of the tropical and sub-tropical regions of the southern hemisphere. Woods typically light olive-brown, but ranging to blackish-brown; a few species aromatic; rather light to heavy, mostly medium-textured, straight-grained. In the Monimioideae the pores are very small, diffuse, rather few to very numerous, solitary or in multiples of 2 to 4, sometimes 5 or 6. Vessels with many-barred scalariform perforation plates;

spirals absent; intervascular pitting scalariform to opposite. Rays nearly all conspicuous (Plate II, 6); distinctly heterogeneous, most of the cells squarish; oil cells absent; ray-vessel pitting typically scalariform. Wood parenchyma diffuse and weakly paratracheal. Wood fibers with simple or small bordered pits; usually septate.

Peumus is exceptional in that the vessels have exclusively simple perforations, fine spirals, and alternate pitting; rays nearly homogeneous; wood fibers with simple pits.

Myrsinaceae

A large family of shrubs and small trees widely distributed in tropical and sub-tropical regions, but of no commercial importance as a source of timber. Woods pale to dark brown or reddish, attractively figured on radial surface; mostly of medium density and texture. Pores small to minute, diffuse, numerous, solitary or more often in multiples (Plate II, 1), radial lines, or clustered, sometimes with tendency to diagonal or tangential arrangement; rarely in contact with rays, except in *Maesa*. Vessels usually with exclusively simple perforations; scalariform plates with slender bars common in *Maesa;* spirals absent, except in *Maesa;* pitting very fine, usually alternate. Rays nearly all coarse (except in *Maesa* where they are distinctly 2-sized), the largest high and conspicuous; complexes of resinous cells, with walls of adjacent cells indistinct or broken down so as to produce cyst-like structures common in many genera, distinct under lens on all sections and appearing like intercellular canals on the tangential; heterogeneous, most of the cells coarse, square or upright; limits of rays not always clearly demarcated on cross section; pitting fine, alternate to opposite. Wood parenchyma sparingly metatracheal and diffuse. Wood fibers with numerous small simple pits; often septate. Ripple marks present in *Aegiceras*, which has comparatively small rays.

Neumanniaceae

The single African genus, *Neumannia* (*Aphloia*), is usually included with the Flacourtiaceae, although the wood is unique in that family. Wood pale brown, of medium density, rather

Marcgraviaceae

A small tropical American family of climbing shrubs. In *Marcgravia rectiflora* the pores are small to rather large, few to fairly numerous, scattered, mostly solitary. Vessel perforations simple; spirals absent; pitting alternate. Rays mostly large, some very wide and high; heterogeneous, the cells mostly large, upright or square; bundles of raphides present; pits to vessels very small. Wood parenchyma very limited, paratracheal and diffuse. Wood fibers mostly septate; pits numerous, small, simple or indistinctly bordered.

Menispermaceae

A large tropical family of twining plants and a few erect shrubs and small trees. Wood hard, of anomalous structure, the included phloem and conjunctive tissue forming concentric bands apparently terminating seasonal growths. Pores rather small to minute; few in some genera, very numerous in others, with a more or less pronounced tendency to tangential arrangement. Vessels with simple perforations; without spirals; pitting fine, alternate. Rays nearly all broad, composing a third to a half of the cross section; wider near the bands of conjunctive tissue; heterogeneous, many of the cells square; ray-vessel pit-pairs small, half-bordered. Wood parenchyma diffuse or in fine, irregular, metatracheal lines. Phloem in islands filling space between rays at margin of conjunctive parenchyma; layer of sclerotic cells sometimes present in conjunctive tissue and across rays. Wood fibers with numerous, small, indistinctly bordered pits.

Monimiaceae

The Monimiaceae are mostly shrubs or trees, principally of the tropical and sub-tropical regions of the southern hemisphere. Woods typically light olive-brown, but ranging to blackish-brown; a few species aromatic; rather light to heavy, mostly medium-textured, straight-grained. In the Monimioideae the pores are very small, diffuse, rather few to very numerous, solitary or in multiples of 2 to 4, sometimes 5 or 6. Vessels with many-barred scalariform perforation plates;

spirals absent; intervascular pitting scalariform to opposite. Rays nearly all conspicuous (Plate II, 6); distinctly heterogeneous, most of the cells squarish; oil cells absent; ray-vessel pitting typically scalariform. Wood parenchyma diffuse and weakly paratracheal. Wood fibers with simple or small bordered pits; usually septate.

Peumus is exceptional in that the vessels have exclusively simple perforations, fine spirals, and alternate pitting; rays nearly homogeneous; wood fibers with simple pits.

Myrsinaceae

A large family of shrubs and small trees widely distributed in tropical and sub-tropical regions, but of no commercial importance as a source of timber. Woods pale to dark brown or reddish, attractively figured on radial surface; mostly of medium density and texture. Pores small to minute, diffuse, numerous, solitary or more often in multiples (Plate II, 1), radial lines, or clustered, sometimes with tendency to diagonal or tangential arrangement; rarely in contact with rays, except in *Maesa*. Vessels usually with exclusively simple perforations; scalariform plates with slender bars common in *Maesa;* spirals absent, except in *Maesa;* pitting very fine, usually alternate. Rays nearly all coarse (except in *Maesa* where they are distinctly 2-sized), the largest high and conspicuous; complexes of resinous cells, with walls of adjacent cells indistinct or broken down so as to produce cyst-like structures common in many genera, distinct under lens on all sections and appearing like intercellular canals on the tangential; heterogeneous, most of the cells coarse, square or upright; limits of rays not always clearly demarcated on cross section; pitting fine, alternate to opposite. Wood parenchyma sparingly metatracheal and diffuse. Wood fibers with numerous small simple pits; often septate. Ripple marks present in *Aegiceras*, which has comparatively small rays.

Neumanniaceae

The single African genus, *Neumannia* (*Aphloia*), is usually included with the Flacourtiaceae, although the wood is unique in that family. Wood pale brown, of medium density, rather

Marcgraviaceae

A small tropical American family of climbing shrubs. In *Marcgravia rectiflora* the pores are small to rather large, few to fairly numerous, scattered, mostly solitary. Vessel perforations simple; spirals absent; pitting alternate. Rays mostly large, some very wide and high; heterogeneous, the cells mostly large, upright or square; bundles of raphides present; pits to vessels very small. Wood parenchyma very limited, paratracheal and diffuse. Wood fibers mostly septate; pits numerous, small, simple or indistinctly bordered.

Menispermaceae

A large tropical family of twining plants and a few erect shrubs and small trees. Wood hard, of anomalous structure, the included phloem and conjunctive tissue forming concentric bands apparently terminating seasonal growths. Pores rather small to minute; few in some genera, very numerous in others, with a more or less pronounced tendency to tangential arrangement. Vessels with simple perforations; without spirals; pitting fine, alternate. Rays nearly all broad, composing a third to a half of the cross section; wider near the bands of conjunctive tissue; heterogeneous, many of the cells square; ray-vessel pit-pairs small, half-bordered. Wood parenchyma diffuse or in fine, irregular, metatracheal lines. Phloem in islands filling space between rays at margin of conjunctive parenchyma; layer of sclerotic cells sometimes present in conjunctive tissue and across rays. Wood fibers with numerous, small, indistinctly bordered pits.

Monimiaceae

The Monimiaceae are mostly shrubs or trees, principally of the tropical and sub-tropical regions of the southern hemisphere. Woods typically light olive-brown, but ranging to blackish-brown; a few species aromatic; rather light to heavy, mostly medium-textured, straight-grained. In the Monimioideae the pores are very small, diffuse, rather few to very numerous, solitary or in multiples of 2 to 4, sometimes 5 or 6. Vessels with many-barred scalariform perforation plates; spirals absent; intervascular pitting scalariform to opposite. Rays nearly all conspicuous (Plate II, 6); distinctly heterogeneous, most of the cells squarish; oil cells absent; ray-vessel pitting typically scalariform. Wood parenchyma diffuse and weakly paratracheal. Wood fibers with simple or small bordered pits; usually septate.

Peumus is exceptional in that the vessels have exclusively simple perforations, fine spirals, and alternate pitting; rays nearly homogeneous; wood fibers with simple pits.

Myrsinaceae

A large family of shrubs and small trees widely distributed in tropical and sub-tropical regions, but of no commercial importance as a source of timber. Woods pale to dark brown or reddish, attractively figured on radial surface; mostly of medium density and texture. Pores small to minute, diffuse, numerous, solitary or more often in multiples (Plate II, 1), radial lines, or clustered, sometimes with tendency to diagonal or tangential arrangement; rarely in contact with rays, except in *Maesa*. Vessels usually with exclusively simple perforations; scalariform plates with slender bars common in *Maesa;* spirals absent, except in *Maesa;* pitting very fine, usually alternate. Rays nearly all coarse (except in *Maesa* where they are distinctly 2-sized), the largest high and conspicuous; complexes of resinous cells, with walls of adjacent cells indistinct or broken down so as to produce cyst-like structures common in many genera, distinct under lens on all sections and appearing like intercellular canals on the tangential; heterogeneous, most of the cells coarse, square or upright; limits of rays not always clearly demarcated on cross section; pitting fine, alternate to opposite. Wood parenchyma sparingly metatracheal and diffuse. Wood fibers with numerous small simple pits; often septate. Ripple marks present in *Aegiceras*, which has comparatively small rays.

Neumanniaceae

The single African genus, *Neumannia* (*Apbloia*), is usually included with the Flacourtiaceae, although the wood is unique in that family. Wood pale brown, of medium density, rather

fine-textured. Pores very small, numerous, well distributed without pattern, mostly solitary. Vessels with scalariform perforation plates, the bars slender and numerous; without spirals; pitting mostly opposite. Rays of two sizes, the larger ones composing a third to a half of the cross section and highly conspicuous on radial surface; heterogeneous, many of the cells (especially of the uniseriate rays) upright or square; pitting fine, opposite. Wood parenchyma abundantly diffuse and sparingly paratracheal; not distinct with lens. Wood fibers with thick walls and very numerous, irregularly distributed, distinct, bordered pits.

Papaveraceae

A family of herbs, rarely shrubs (*Dendromecon* and *Romneya*) and small trees (*Bocconia*). The following description is based on *Bocconia frutescens* L., a small tropical American tree. Stem with large, orange-colored pith and deeply fissured bark. Wood yellow or pinkish; of medium density, rather coarse-textured. Pores small, rarely visible without lens, diffuse, not very numerous, solitary or in small multiples. Vessels with exclusively simple perforations; without spirals; pitting coarse, alternate. Rays all coarse, making up about a third of the cross section, but not very high; heterogeneous, the cells mostly square or upright; pits to vessels large, often radially elongated. Wood parenchyma sparingly paratracheal. Wood fibers with numerous, very small, irregularly disposed, simple pits. A few, large, open, radial canals observed.

Piperaceae

A family of several genera and many species of herbs and shrubs, erect or scandent, mainly tropical. The following description applies to certain species of *Piper*. Pores few to fairly numerous, small to minute, solitary or in small multiples; rarely in contact with the rays. Vessels predominately with simple perforations, but with some tendency to multiple; without spirals; pitting very fine, alternate. Rays variable in width, but all wide to very wide, and exceptionally high, extending the full length of the internodes; heterogeneous, most of the cells square or upright; large oil cells sometimes present;

pits to vessels uncommon, very small. Wood parenchyma sparingly paratracheal; pits to vessels small, often much elongated and in scalariform arrangement. Wood fibers with numerous, simple to indistinctly bordered pits; storied in some species.

Platanaceae

The only genus, *Platanus*, consists of several species of large trees growing in temperate regions of the northern hemisphere. Wood light brown to pinkish, highly figured on radial surface; rather hard; medium-textured. Pores small, very numerous, crowded together without pattern (Plate II, 3). Vessels in part with simple, more often with multiple perforations, the plates of the latter with thin, few to many bars; spirals absent; pitting alternate, opposite or scalariform. Rays mostly broad but low, some uniseriate; fairly homogeneous; pits to vessels oval, often elongated and parallel. Wood parenchyma sparingly developed, mostly in short metatracheal lines and diffuse. Wood fibers with distinct bordered pits.

Proteaceae

A large family of trees and shrubs, mostly of South Africa and Australia, a few tropical American. Woods light brown to dark red, rather soft to very hard; texture medium to coarse. Pores variable in size from few and large to small and numerous, arranged typically (with parenchyma) in tangential festoons between the rays (Plate I, 1, 2). Vessels with simple perforations; spirals sometimes present; pitting very fine, alternate. Rays of two sizes, the uniseriate low and heterogeneous, the larger high, conspicuous, and rather homogeneous. Wood parenchyma abundantly developed about pores and confluent. Wood fibers with small bordered pits. Vertical traumatic gum ducts occur in some genera.

Franklandia, *Persoonia*, and *Symplyonema* are said to have only narrow rays, but the subject needs further investigation. In *Embothrium* the pores are less distinctly grouped tangentially and the paratracheal parenchyma is less confluent.

Ranunculaceae

The only genus of this large family that will be considered is

Clematis, with many species of woody vines. Pores very numerous, the larger ones in wide zones, the smaller ones interspersed and in groups, often tangentially arranged, in late wood, giving the cross section a lace-like appearance. Vessels with simple perforations; fine spirals present; pits crowded, alternate. Rays all coarse, sometimes very broad; not storied; heterogeneous, many of the cells upright or square, pits to vessels small. Parenchyma sparingly paratracheal. Wood fibers with minute simple pits. Ripple marks present, fine, indistinct, fairly regular.

Rhizophoraceae

The broad-rayed members of this tropical family are *Anisophyllea*, *Carallia*, *Combretocarpus*, *Crossostyles*, *Gynotroches*, *Pellacalyx*, and *Poga*. The last two will be considered separately; the woods of the others, the Gynotrocheae, are white to yellowish brown, mostly hard and heavy, coarse-textured, odorless. Pores small to rather large and distinct, few to fairly numerous, solitary or less often in small multiples or clusters, evenly distributed. Vessels with predominantly simple perforations; without spirals; pitting fine to coarse, alternate to opposite. Rays of two sizes, the larger broad, mostly high, conspicuous; heterogeneous, the cells coarse and irregular; ray-vessel pit-pairs variable, round to linear; unilateral compound pitting common. Wood parenchyma abundant, ranging from weakly confluent paratracheal and metatracheal lines (Plate I, 4) to symmetrical broad bands. Wood fibers with thick, frequently gelatinous, walls; pits bordered, distinct.

Poga, a West African tree, has soft, lustrous, brownish, fine-textured wood, with very large scattered pores; coarsely pitted vessels; highly conspicuous rays; narrow, confluently paratracheal bands of parenchyma; and thin-walled wood fibers.

In *Pellacalyx*, of Malaya, the wood is whitish, rather soft, coarse-textured, with rather few large pores tangentially arranged in parenchyma bands between the rays, suggesting Proteaceae; vascular pitting very coarse, opposite to scalariform; wood fibers with thick walls and large bordered pits.

The Rhizophoreae have narrow rays, but some of them are rather high and conspicuous on radial surface. Pores are small to minute; vessels with exclusively scalariform, coarse-barred perforation plates, and scalariform intervascular pitting; rays heterogeneous; wood parenchyma sparingly developed, except in *Kandelia;* wood fibers thick-walled, with very small, simple pits.

Rosaceae (including Amygdalaceae)

Nearly all members of this large, very widely distributed family of trees, shrubs, and herbs, are characterized by narrow rays. In *Prunus*, *Rosa*, and a few other genera, however, they are fairly conspicuous. The wood of *Prunus* is brownish or reddish, hard, fine-textured. Pores very small, numerous; diminishing in size and number in outer part of growth ring and tending to radial arrangement. Vessels with exclusively simple perforations; spirals present; intervascular pitting fine, alternate. Rays fine to fairly wide (Plate III, 1); low but conspicuous on radial surface; somewhat heterogeneous; pits to vessels small, numerous. Parenchyma very sparingly paratracheal and diffuse. Wood fibers with distinct bordered pits, without spirals. Vertical traumatic gum ducts sometimes present.

In *Rosa* the wood is usually ring-porous, though none of the pores are very large; only the small vessels have spirals; perforations simple and multiple, the plates of the latter type with few bars or reticulate; rays heterogeneous; wood fibers often with spirals; otherwise similar to preceding.

Sabiaceae

A small tropical and sub-tropical family of small trees and shrubs, of no commercial importance. The species of *Sabia* are east Asian climbing shrubs. Pores large in part, diffuse, mostly solitary, not crowded. Vessels with simple perforations; without spirals; pitting very coarse and irregular. Rays of two sizes, the uniseriate decidedly heterogeneous, the other very large, fairly homogeneous; pits to vessels large, gash-like. Wood parenchyma sparingly paratracheal. Wood fibers with very numerous, conspicuous bordered pits. (Material: Sec-

tions of *Sabia paniculata* Edgew. from Imp. For. Inst. Oxford, No. 1481.)

The many species of *Meliosma* are mostly small trees of tropical and sub-tropical America and eastern Asia. Wood brown; of medium density and texture. Pores small to minute, fairly numerous, solitary or in short radial chains. Vessels with several-barred scalariform or reticulate perforation plates; without spirals; pitting fine, alternate. Rays mostly moderately large; heterogeneous, the cells mostly square or upright; pits to vessels numerous, small. Wood parenchyma sparingly paratracheal. Wood fibers with minute, simple or indistinctly bordered pits.

Simarubaceae (?)

The only genus with broad-rayed wood is *Balanites*, which some authorities include in a special section of the Zygophyllaceae, though it might better be made the type of a separate family. The plants are thorny shrubs or small trees of Africa and India. Wood yellow, very hard and heavy, fine-textured. Pores small to minute, very irregularly distributed, in small groups and radial and diagonal chains, sometimes with tendency to tangential arrangement. Vessels with simple perforations; without spirals; pitting very fine, alternate. Rays nearly all large; fairly to decidedly broad, but not very high; fairly homogeneous; not storied. Pits to vessels small. Wood parenchyma paratracheal and in very numerous, fine, metatracheal lines producing a network, barely visible with lens. Vertical traumatic gum ducts sometimes present. Wood fibers thick-walled, with small indistinctly bordered pits. Ripple marks present, fine, fairly regular.

Sterculiaceae

A large, widely distributed tropical and sub-tropical family of trees, shrubs, and a few herbs; of little commercial importance as a source of timber. The woods exhibit a wide range of variation, but are mostly rather soft and of medium to coarse texture. Pores generally rather large, but frequently medium-sized to very small; typically numerous, well-distributed, solitary or more often in radial multiples of few to several pores

each (Plate III, 4); a few species ring-porous. Vessels with exclusively simple perforations; spirals present in some species; pitting very fine, alternate. Rays widely variable in size, often in same genus; fine, medium, or broad and conspicuous, not very high; heterogeneous; tile cells and sheath cells common; pits to vessels very small. Wood parenchyma sparingly developed to abundant; diffuse, metatracheal (fine irregular lines to broad bands), or paratracheal (small amount to distinct patches), or various combinations. Traumatic vertical gum ducts sometimes present. Wood fibers with minute, rather few, indistinctly bordered pits. Ripple marks characterize several genera; the larger rays occupy few to several stories.

Tamaricaceae

A family of four genera of half-shrubs, shrubs, and shrub-like trees. The several species of *Myricaria* are low shrubs native to Europe and Asia; wood ring-porous; pores in early wood small and numerous, those in late wood very small to minute, not very numerous, solitary or more often in small multiples or groups; otherwise as below.

The principal genus, *Tamarix*, is native to the Mediterranean region, but has been widely planted for decorative purposes. Wood of pinkish color fading gradually into the yellow sapwood; moderately hard; of medium to coarse texture. Pores rather small to minute, often diminishing in size but not definitely zonate; solitary, in small multiples, or in groups. Vessels with simple perforations; without spirals; pitting very fine, alternate. Very small vascular tracheids, often with vessels of about the same size, sometimes abundant in late wood. Rays multiseriate, medium-sized to very coarse; not storied; heterogeneous; many of the cells square or upright; pits to vessels small. Parenchyma sparingly paratracheal. Wood fibers small, not radially arranged; pits minute, simple. Ripple marks present, very fine, irregular, rather indistinct.

Theophrastaceae

A small family of tropical American shrubs and small trees

of no commercial importance; often included as a special section in the Myrsinaceae. Wood yellowish to bright yellow (specimens of *Clavija* with purplish blue stain), hard, fine-textured. Pores minute, often scarcely distinct under lens, numerous to fairly so, solitary, or in small multiples or clusters, sometimes with tangential arrangement giving locally ring-porous appearance. Vessels with simple perforations; without spirals; pitting very fine, alternate. Rays all broad and conspicuous, though not exceptionally high; fairly homogeneous; pits to vessels minute. Parenchyma very sparingly paratracheal. Wood fibers short, thick-walled, with numerous small, simple or indistinctly bordered pits.

Trochodendraceae

This family, in its strictest sense, consists of one genus and species, *Trochodendron aralioides*, a rather small tree of eastern Asia. Wood pale brown, moderately dense, fine-textured; growth rings distinct, with early and late wood suggesting a conifer. Vessels absent. Rays of two sizes, the larger resembling those of *Fagus;* heterogeneous; walls often thick and uneven; pits to wood tracheids oval. Wood parenchyma in numerous irregular tangential lines in late wood. Ground mass composed of long tracheids; pitting distinctly scalariform in radial walls of early wood cells.

Vacciniaceae

A widely distributed family of shrubs closely related to the Epacridaceae and Ericaceae. Woods brown, hard, fine-textured. Pores small to minute, well distributed, numerous, solitary to crowded together. Vessels typically with scalariform perforation plates having few to many bars; sometimes with spirals; intervascular pitting often scalariform. Rays in *Vaccinium* of two distinct sizes, the larger fairly conspicuous, all decidedly heterogeneous, with pits to vessels small, oval to elongated; in *Agapetes* they are mostly all coarse, moderately heterogeneous, with ray-vessel pitting coarse and scalariform. Wood parenchyma very sparingly developed or absent. Wood fibers with numerous conspicuous bordered pits.

Violaceae

A widely distributed family of 16 genera and 800 species of herbs, half-shrubs, shrubs, and a few small trees. Woods mostly yellow, hard, fine-textured. Pores small to minute, variable in abundance and arrangement, often in radial rows, sometimes clustered; *Hymenanthera* more or less ring-porous, the larger pores in a single row. Vessels with many-barred scalariform plates in most genera; perforations simple in *Hybanthus*, *Hymenanthera*, and *Melicytus;* spirals present in *Hymenanthera;* intervascular pitting variable from very fine and alternate to opposite or scalariform. Rays of two sizes, the larger often conspicuous; heterogeneous, many of the cells square or upright; ray-vessel pitting variable from very fine and alternate to coarse and scalariform. Wood parenchyma sparingly paratracheal or diffuse. Wood fibers usually thick-walled, frequently septate; pits small, numerous, indistinctly bordered.

Vitaceae (Ampelidaceae)

A widely distributed family, typically woody vines, except *Leea*. In the Vitoideae, the woods are mostly brown, rather hard, very coarse-textured. Pores very large to small, the largest sometimes zonate (*Vitis*); numerous, usually in small multiples or groups. Vessels with simple perforations, though with some tendency to multiple; without spirals; pitting coarse, tending to scalariform. Rays typically large or moderately so; heterogeneous; the cells coarse; bundles of raphides sometimes present; pits to vessels rather large. Wood parenchyma paratracheal. Wood fibers with simple pits; frequently septate. Tracheids with scalariform pitting and sometimes with spirals reported by Solereder.

The several species of *Leea* are upright shrubs or trees of tropical Asia and, to less extent, of Africa and Australia. Wood reddish, hard, rather fine-textured. Pores rather small, not very numerous, well distributed, solitary or in small multiples (Plate II, 5). Vessels with simple perforations; without spirals; intervascular pitting often scalariform. Rays usually of two distinct sizes, the larger high and conspicuous; heterogeneous, many of the cells square or upright; bundles of

raphides common; ray-vessel pitting coarse, often scalariform. Wood parenchyma very sparingly paratracheal. Wood fibers often septate; pits small, inconspicuous, simple or indistinctly bordered.

Winteraceae

Of the three genera usually assigned to this family, *Illicium* has wood of normal structure and fine rays, whereas *Drimys* and *Zygogynum* are without vessels and have distinct rays. The anatomy of the last two is as follows: Transition in growth rings gradual. Rays of two sizes, the larger suggesting *Fagus;* heterogeneous; pits to wood tracheids round. Wood parenchyma sparingly diffuse; also terminal in *Zygogynum*. Ground mass of wood composed of very long tracheids having two or more rows of pits with circular borders and oblique, lenticular apertures.

Explanation of Plates

From photographs of cross sections by H. E. Dadswell. × 8.

Plate I

No. 1. *Cardwellia sublimis* (Proteaceae).
No. 2. *Banksia integrifolia* (Proteaceae).
No. 3. *Casuarina Fraserana* (Casuarinaceae).
No. 4. *Carallia* sp. (Rhizophoraceae).
No. 5. *Quercus* sp. (Fagaceae).
No. 6. *Fagus* sp. (Fagaceae).

Plate II

No. 1. *Rapanea variabilis* (Myrsinaceae).
No. 2. *Akania Hillii* (Akaniaceae).
No. 3. *Platanus* sp. (Platanaceae).
No. 4. *Chariessa Moorei* (Icacinaceae).
No. 5. *Leea angulata* (Vitaceae).
No. 6. *Hedycarya angustifolia* (Monimiaceae).

Plate III

No. 1. *Prunus* sp. (Rosaceae).
No. 2. *Ilex* sp. (Aquifoliaceae).
No. 3. *Berberis* sp. (Berberidaceae).
No. 4. *Tarrietia argyrodendron peralata* (Sterculiaceae).
No. 5. *Carpinus* sp. (Corylaceae).
No. 6. *Cryptocarya corrugata* (Lauraceae).

CURRENT LITERATURE

Index of American palms. By B. E. Dahlgren. **Fossil palms.** By A. C. Noé. Field Museum Bot. Ser. (Chicago) 14: 1–456; April 30, 1936.

This bibliographic index of American palms represents an immense amount of labor, bringing into one volume an index of the systematic literature of the group, something that had not been attempted previously. There are listed 2800 names, of which 1170 represent accepted or presumably valid species at the end of the year 1935.

The main portion of the volume consists of a list of American genera and species of palms, with references to the principal descriptions, and citation of distribution, illustrations, and vernacular names. This is followed by a bibliography of the systematic literature and a list of pre-Linnaean names and literature. There is also an index to the vernacular names known, with a bibliography of their sources. Of special interest is a geographic list of species, enumerating the palms known from each American country. The terminal portion of the volume consists of a list of American fossil palms, with a bibliography of their literature.

The following new names are published in the volume: *Acoelorraphe Schippii* (Burret) Dahlgren (formerly *Paurotis*); *Syagrus amadelpha* (Barb. Rodr.) Frambach (*Cocos*); *S. arenicola* (Barb. Rodr.) Frambach (*Cocos*); *S. edulis* (Barb. Rodr.) Frambach (*Cocos*); *S. purusana* (Huber) Frambach (*Cocos*); and *S. Wildemaniana* (Barb. Rodr.) Frambach (*Cocos*).—P. C. Standley.

Studies in the oaks of the mountains of northeastern Mexico. By Cornelius H. Mueller. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 17: 160–179; July 1936.

From northeastern Mexico there are published numerous varieties and forms of previously described species of *Quercus*, several new hybrids, and the following new species: *Q. verde*, *Q. pinnativenulosa*, *Q. flocculenta*, *Q. galeanensis*, *Q. gracilramis*, and *Q. tenuiloba*. Notes are included regarding the distribution of many species earlier published.

Revision des genres *Neoleretia, Mappia,* et *Humirianthera.* By Ch. Baehni. *Candollea* (Geneva) 7: 167–184; pl. 4; 1936.

The genus *Mappia* consists of six species, ranging from the West Indies and Mexico to Peru and Brazil. The new genus *Neoleretia* Baehni consists of four species previously referred to *Mappia*, occurring in China, Siam, Philippines, and East Indies. *Humirianthera* Huber includes two species, *H. rupestris* Ducke and *H. ampla* (Miers) Baehni (*Leretia ampla* Miers), both of Brazil.

Notes on Guiana Sapotaceae. By P. J. Eyma. *Med. Bot. Mus. Univ. Utrecht* 27: 156–210; figs. 1–3; March 1936.

The author discusses in some detail the generic classification of the American Sapotaceae and comes to the conclusion that the best characters are found in the seeds. It is admitted that a division of the family by which flowering specimens can not be placed readily in genera has practical defects, but the flower characters are found to be too variable to possess final value in segregating genera.

To *Pouteria* there are reduced the genera *Lucuma*, *Labatia*, *Oxythece*, *Barylucuma*, *Glyxcoxylon*, and *Pradosia*, each of which is discussed at length. New species of *Pouteria* are *P. grandis*, British Guiana (vernacular name Bakupar) and Surinam; *P. trigonosperma*, Surinam, with numerous local names; *P. melanopoda*, Surinam, with several local names; *P. hispida*, Surinam (Toewonoele); *P. filipes*, Surinam (Moraballi Firobero, Tometome Kjiu Kwatere); *P. scytalophora*, Surinam (Konoko Balli, Remoe Epe), French Guiana, Brazil; *P. Gongrijpii*, Surinam, with several native names; *P. ptychandra*, Surinam; *P. surinamensis*, Surinam (Kienboto); and *P. Pullei*, Surinam. There are included notes upon various old species, often with citation of vernacular names.

Achrouteria pomifera is a new genus, occurring in British Guiana, Surinam, and Brazil; known in British Guiana as Limonaballi and Haimara-kushi, in Surinam as Batabaly. *Ecclinusa guianensis* is a new species of Surinam and French and British Guiana, for which several local names are reported. Notes are published regarding *Manilkara* and several other genera of the family.—P. C. Standley.

Plantas indigenas e exoticas provenientes da Amazonia, cultivadas no Jardim Botanico do Rio de Janeiro. By P. Campos Porto. *Rodriguésia* (Rio de Janeiro) 2: 5: 93–157; 11 plates; 1936.

This annotated list of Amazonian plants growing in the Botanical Garden of Rio de Janeiro contains a great wealth of information in concise form. For each species it gives the scientific and common names and family; source; range of distribution; and interesting miscellaneous data.

Estructura secundaria das raizes de *Rhipsalis.* By Fernando Romano Milanez. *Rodriguésia* 2: 5: 165–175; 9 plates, 1 text fig.; 1936.

A well illustrated account of the anomalous structure of the root of several species of *Rhipsalis* (Cactaceae).

Ericaceae americanae novae vel minus cognitae. III. By Hermann Sleumer. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 206–214; July 15, 1936.

New species of American Ericaceae are *Gaultheria Ulei*, Brazil; *Leucothoe Bradei*, Minas Geraes, Brazil; *Pellegrinia Weberbaueri*, Peru. There are numerous name transfers and notes regarding species previously published. A synopsis is given of the sub-groups of the genus *Leucothoe.*

***Arecastrum.* The queen palms.** By L. H. Bailey. *Gentes Herbarum* (Ithaca, N.Y.) 4: 2–14: 7 figs.; September 1936.

The palm genus *Arecastrum* consists of a single species, *A. Romanzoffianum* (*Cocos Romanzoffiana* Cham.), ranging from southern Brazil to Uruguay, Paraguay, and northern Argentina. Three varieties are recognized. The paper contains several excellent illustrations showing habit and details of the plants.

The Butias. By L. H. Bailey. *Gentes Herbarum* (Ithaca, N.Y.) 4: 15–50; figs. 8–27; September 1936.

The palm genus *Butia*, whose species formerly were referred to *Cocos*, is distributed from central Brazil to northern

Argentina. A key is given for separation of five species frequent in cultivation, all of which are described and discussed, and briefer descriptions are included of eight other species not known to be in cultivation. Several varieties, one of them new, are described under *B. capitata*.

Flora of Peru. Part VI. By J. Francis Macbride. Field Museum Bot. Ser. (Chicago) 13: 1–261; Sept. 18, 1936.

This part, the fourth one published, of the *Flora of Peru* consists of an account of the family Rubiaceae by Paul C. Standley. There are recognized 86 genera, the largest being *Psychotria*. While most plants of the family are shrubs, there are some trees of economic importance, especially in the genera *Cinchona* and *Calycophyllum*. The genus *Stachyococcus*, with a single species, originally named *Retiniphyllum adinanthum* Standl., is described as new, and a number of new species are described in various genera.

Reconocimiento de maderas del pais. Conferencia pronunciada por el ingeniero agrónomo D. Lucas A. Tortorelli, en la Sociedad Cientifica Argentina. *Maderil* (Buenos Aires) 8: 95: 5–11; 18 figs.; May 1936.

This paper, with its numerous photomicrographs of Argentine woods, was presented by Mr. Tortorelli, Téchnico de la Dirección de Tierras del Ministerio de Agricultura, at a formal meeting convened under the auspices of the Centro de Ingenieros Agrónomos on May 28, 1936, and represents the beginning of a comprehensive study of Argentine timbers. A reprint of the address, together with another illustrated paper by the same author, entitled "Los rayos infrarrojos y su aplicación en la microfotografía de tejidos de maderas," has been issued by the Centro de Ingenieros Agrónomos, Sarmiento 559, Buenos Aires.

El estudio de la estructura de las maderas. By Arthur de Miranda Bastos. *Maderil* 8: 96: 5–16; 18 figs.; June 1936.

A well illustrated exposition in Spanish of the "Glossary of terms used in describing woods" prepared by a Committee on

Nomenclature of the International Association of Wood Anatomists. The author, a Brazilian, was one of the founders of the Association and, with his colleague, Professor Milanez, recently published a Portuguese version of the Glossary in *Rodriguésia* 1: 4: 25–42.

Las especies argentinas y uruguayas del género *Caesalpinia*. By Arturo Burkart. *Revista Argentina de Agronomía* (Buenos Aires) 3: 67–112; August 1936.

For Argentina and Uruguay there are recognized 14 species of *Caesalpinia*, of which the following are new: *C. cromantha*, provinces of Salta and Catamarca, Argentina; *C. argentina*, Province of Jujuy, Argentina, and southern Bolivia. Vernacular names are reported for many of the species listed. Of greatest importance economically is *C. melanocarpa* Gris., a tree sometimes 15 meters high, whose dense, hard wood is employed for railway ties, posts, carts, tool handles, furniture, firewood, and other purposes. Its heartwood is dark purple, with a specific gravity of about 1.2. The wood of the roots is said to be almost black and to be used as a substitute for ebony.—P. C. Standley.

Contribución al conocimiento de los bosques de la República Argentina. Estudio forestal del caldén. By Vsevolod Koutche and Jorge N. F. Carmelich. *Boletin Mensual del Ministerio de Agricultura de la Nación* (Buenos Aires) 37: 109–128; 16 plates; 1 map; December 1935.

Caldén (*Prosopis algarrobilla* Gris.) is a deciduous tree of wide distribution in Argentina, but of optimum development in La Pampa, San Luis, and Cordoba where the climate is temperate, the humidity low, and the soil sandy and permeable. It has a wide crown and a short thick or divided trunk and either grows gregariously in open stands or in association with Algarrobo (*Prosopis alba* Gris.), Chañar (*Gourliea decorticans* Gill.), and Sombra de Toro (*Jodina rhombifolia* H. & A.). Of shrubs, the more common species are Piquillín (*Condalia microphylla*), Molle (*Moya ferox*), Jarilla (*Larrea divaricata*), Atamisco (*Atamisquea emarginata*), and Alpataco (*Prosopis alpataco*).

"The timber has a thin, yellowish sapwood and a dark orange heart. It is used locally for fence posts and fuel. The short, twisted nature of the bole and the liability to heart rot render the timber unsuitable for lumber or for export. However, the authors maintain that, with proper management and weeding out of old trees, the forests can be developed to produce exportable material for staves, parquetry, and paving blocks.—LLEWELYN WILLIAMS, *Field Museum of Natural History.*

Informe sobre los bosques del Parque Nacional del Iguazú. By FRANCO E. DEVOTO and MÁXIMO ROTHKUGEL. *Boletin Mensual del Ministerio de la Nación* 37: 129–226; 50 plates; 1 map; December 1935.

The authors were commissioned by the Ministry of Agriculture to survey and appraise the forests and forest products of a tract of 75,000 hectares adjacent to the Iguazú Falls, which was established as a national park in 1909. In this paper they describe the method evolved to determine the abundance, utilization, and economic value of the species growing in the region, and they also discuss soil and climate, plant formations and associations, problems of propagating different species, and the feasibility of colonization.

The terrain is undulating and there are numerous streams. Although rains are frequent and at times torrential, the climate is more favorable than in some other parts of the Republic, such as the Chaco. The soil may be classified into four types: chocolate-colored heavy clay on the hills; reddish yellow clay on the slopes; white sand along the banks of the streams; and a black soil, rich in humus, covering the forest floor. Yerba Mate (*Ilex paraguayensis* St. Hil.), dominates the vegetation in certain areas, especially near the sources of the Ibicuy and Santo Domingo. Its most common associates are Bravo (*Prunus subcoriacea*), Sota Caballo (*Luehea divaricata*), Guaicá (*Ocotea puberula*), Tacuara (*Guadua* sp.), Curupicai (*Sapium haematospermum*), Guarana (*Dracaena* sp.), Canelón (*Rapanea laetivirens*), Guayaibí Blanco (*Patagonula americana*), Caa-berá (*Rapanea* sp.), Manduvirá (*Geoffroea superba*), Tarumá (*Vitex montevidensis*), and Canela de Viado

(*Helietta cuspidata*). Abandoned clearings are first occupied by such plants as Fumo Bravo (*Baccharis* sp.) and Camba-acá or Capoeirero (*Trema micrantha*), but are later supplanted by Loro Blanco (*Bastardiopsis densiflora*) and eventually by Lapacho, Cedro, Palo Rosa, and Ibirá Puitá, and other species typical of the high forest.

There are graphs indicating the frequency and diameter of the more important timber trees; charts showing the number of trees in the different units; lists of trees and shrubs in the various formations; and an alphabetical list of families, species, and vernacular names of trees, shrubs, palms, and lianes found in the territory of Misiones.—LLEWELYN WILLIAMS, *Field Museum of Natural History.*

Quelques Fagacées nouvelles de l'Inde et de l'Indo-Chine. By AIMÉE CAMUS. *Bull. Société Botanique de France* (Paris) 83: 343–345; 1936.

New species of trees from India and Indo-China are *Quercus baniensis*, *Q. Ramsbottomii*, *Lithocarpus Parkinsonii*, *L. Cottonii*, *L. dolichostachys*, and *L. pycnostachys*.

Fagacées asiatiques nouvelles. By AIMÉE CAMUS. *Notulae Syst.* (Paris) 5: 72–75; November 1935.

New trees from southeastern Asia are *Castanopsis goniacantha* (Tonkin), *C. longipes* (Annam), *Lithocarpus cambodiensis* (Cambodge), *L. pleiocarpa* (Tonkin), and *L. Petelotii* (Tonkin).

Palmae gerontogeae. V. By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 185–200; July 15, 1936.

New species of palms are: *Pinanga pachycarpa*, Sumatra; *P. viridis* and *P. discolor*, Kwang-Tung, China; *P. macroclada*, Yunnan, China; *Areca leptopetala*, Celebes. The new genus *Pseudopinanga* is described, with 14 species, some of which have been referred previously to *Pinanga*. New species of *Pseudopinanga* are *P. pilosa* and *P. aristata*, British North Borneo; *P. paucisecta*, North Borneo; *P. macrorhachis*, *P. Kjellbergii*, *P. anomodonta*, and *P. multosecta*, Celebes.

A silicified dicotyledonous wood. *Dryoxylon mohgaoense* sp. nov. from the Deccan Intertrappean beds of India. By K. P. Rode. *Journ. Indian Bot. Soc.* (Madras) 15: 2: 131–138; 2 plates, 1 text fig.; 1936.

"Except for the absence of vestured pits, all other characters are obtained in an almost identical manner in the Japanese specimen [described by Stopes and Fujii as *Jugloxylon Hamaonum* from the Upper Cretaceous], and for this reason the present specimen was originally named *Parajugloxylon*."

Timber tests: Mengkulang (*Tarrietia simplicifolia* Mast.). *The Malayan Forester* (Kuala Lumpur) 6: 3: 127–131; July 1936.

"The genus *Tarrietia* is represented in Southern Burma, Siam, Indo-China, the Malay Peninsula, the Netherlands Indies, the Philippine Islands and Australia. In Malaya four species are known, all of which are recognized by the vernacular name Mengkulang, though other names are sometimes used. The commonest species in Malaya is *Tarrietia simplicifolia*, which is widely distributed throughout the Peninsula and favors forest of good quality in flat or gently undulating areas of low elevation. The trees are of scattered occurrence, the estimated average density being about one per five acres."

"It is obvious from the data for the mechanical properties that Mengkulang would make a very useful moderately heavy constructional timber, but unfortunately its natural durability is poor. It could undoubtedly be protected by suitable preservative treatment, but it is not found in sufficient quantity to be a serious rival to the usual constructional timbers of the country. It is not dissimilar in appearance to the Merantis, particularly Nemesu, with which it is sometimes mixed, but it is somewhat heavier and distinctly stronger and harder than this timber and its strength properties are considerably higher than those of the softer red Merantis, such as Meranti Tembaga. As it polishes very well it would be a good timber for furniture, cabinet work, shop fittings, etc., but care is necessary to prevent warping. Its toughness and shock-resisting ability make it suitable for carriage work, the ribs of boats, and similar purposes where frequent shocks have to be sustained. It would appear to be a promising timber for steam-bending and its possibilities for sliced veneers are reported to be favorable.

"In the Philippine Islands, timber of the same genus is used for flooring, doors, interior finish, furniture and cabinet work, boat ribs and planking and it is suggested that it would make excellent slack cooperage stock, while in Australia the timber of *Tarrietia* spp. is said to be used *inter alia* for short tool-handles, fishing-rods, and electrical cabinet work. It is stated to be an insulating timber of unusual merit and to be therefore eminently suitable for the making of switchboard and electrical wood appurtenances."

Commercial timbers of the Malay Peninsula. I. The genus *Shorea*. By H. E. Desch (with **Botanical notes** by C. F. Symington). *Malayan Forest Records* No. 12, September 1936. Pp. 73; 7¼ x 10; 9 plates, 5 text figs. Price 2s. 6d. post free.

"This publication is the offspring of a series of articles entitled 'Notes on Malayan Timbers,' which appeared in *The Malayan Forester* between April 1934 and January 1935. It was originally intended to continue such notes until all the commercial timber species of the Peninsula had been described and then to reissue them in the form of a *Forest Record*. After the fourth had appeared it was considered that the articles were taking up too much space in a periodical intended to be of general interest and they were discontinued in favor of the immediate preparation of a *Forest Record*.

"The instructions issued at this time envisaged a continuation of the treatment adopted in the Notes and this was attempted, but found impracticable. Further investigation disclosed that the then-accepted groups, in the case of timbers of the genus *Shorea* particularly, were arbitrary and unworkable. For example, having described the timber of Nemesu (*S. pauciflora*), it was found that the description fitted timbers of the Meranti Tembaga (*S. leprosula*) type in most essential respects, while the timbers of species allotted, at that time, to the Meranti Bakau group were not really dissimilar. It was apparent that the attempt to set up divisions in a group

of timbers so similar to one another was impracticable, while the assumption that differences did exist was responsible for some of the prevailing misconceptions and might well lead to further inaccuracies. In the circumstances there was no alternative but to abandon existing conceptions of timber groups and to work from first principles. The method followed has been to classify the timbers of a genus on their anatomical structure, general appearance, and physical properties, irrespective of existing conceptions of classification. The first genus to be so treated was *Shorea*—undoubtedly the most important source of timber in the Peninsula."

"The genus *Shorea* provides by far the highest proportion of the timber commercially exploited in the Peninsula, different species fulfilling, more or less satisfactorily, the widely varying requirements of the timber-consuming industries of the country. The genus is represented in the Peninsula by 54 known species, 47 of which are dealt with in this publication. All the species considered here are trees attaining commercial timber size, although, by reason of their scarcity, or the inaccessibility of the localities where they occur, the timber of certain species is not of commercial importance.

"For commercial purposes the timber of the different species may be regarded as belonging to two main classes: (1) hard to very hard, heavy to very heavy, moderately durable to very durable timbers of fine to only moderately coarse texture and (2) soft to moderately hard, light to moderately heavy, non-durable timbers of moderately to rather coarse texture. The former class may be divided into two groups: a more or less natural group—Balau, and an arbitrary one—Damar Laut Merah. The latter class may also be divided into two natural groups—White Meranti and Red Meranti—while these groups may be further subdivided each into two subgroups. It is of interest to note that while based primarily on gross timber characters, the main groups do, except in one case, follow the natural botanical classification of species closely."

This well arranged and splendidly illustrated publication contains a general description of the timber of the genus, with a key to the groups and sub-groups which are then described in detail, with a minimum of overlapping. There are numerous

tables and three short appendixes. There are 22 photomicrographs of cross sections, at a uniform magnification of 35 diameters; in addition there are seven photographs showing the appearance of the ends of specimens under a 5× hand lens.

Seraya, meranti and lauan. By B. J. RENDLE and S. H. CLARKE. *Forest Products Research Records* No. 12 (Timber Series No. 4). H. M. Stationery Office, London, Oct. 8, 1936. Pp. 10; 6 x 9½; 1 plate. Price 6d. net.

"The botanical family Dipterocarpaceae is one of the most important groups of timbers in the East, constituting in some countries more than one-half of the standing timber. . . . The timbers of the family cover a wide range in color, density, texture and strength; some are among the strongest and most durable in the tropics, but the majority are relatively soft and light and in the producing countries are important as general utility woods, corresponding more or less to the softwoods in Europe and North America. . . . It is evident from enquiries received at the Laboratory that some confusion exists in the wood-using industries regarding the various timbers of the family, and this publication has been prepared to clarify the situation in so far as the soft timbers are concerned, by providing a key to trade and vernacular names, and by indicating the chief points of resemblance and difference between the principal commercial varieties. . . . The bulk of the timber in the class under discussion is produced by species of *Shorea*, but a few species of *Pentacme*, *Parashorea* and to a less extent *Balanocarpus* are also included."

"Within the family Dipterocarpaceae there are probably more than 70 species yielding timber of the soft *Shorea* class, but some of these have not yet been named botanically. The similarity in appearance and properties of the various species often makes specific distinction of the timbers impracticable, and accordingly some of the more closely related species are grouped together for commercial purposes. It is not necessary here to refer to all the named botanical species that furnish timber for export, and only the more important ones will be mentioned.

"As commercial supplies are distinguished primarily according to their geographical origin, it will be convenient to outline the usual subdivision of the class under the countries concerned. Roughly speaking, the name Lauan in the Philippine Islands corresponds to Meranti in British Malaya and Sarawak and Seraya in North Borneo. The name Cedar has also been used for the Bornean timbers, but this is being superseded by the more precise term Seraya."

Die von S. F. Kajewski auf den Salomons-Inseln gesammelten Oleaceen. By H. Sleumer. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 258–259; July 15, 1936.

Linociera Kajewskii is described as new from Bougainville, and notes are given regarding older species of *Jasminum* and *Linociera*.

Plantae Letestuanae novae (XXIII). By François Pellegrin. *Bull. Société Botanique de France* (Paris) 83: 316–317; 1936.

New species are *Gardenia Le Testui*, *Rutidea striatulata*, and *Chasalia tchibangensis*, all of the family Rubiaceae.

Neue Palmen aus Neuguinea. III. Zugleich Palmen von den Salomo-Inseln. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 65–101; fig. 4; March 15, 1936.

New palms described from New Guinea and the Solomon Islands include species or varieties of *Orania*, *Areca*, *Calyptrocalyx*, *Heterospathe*, *Gulubia*, and *Ptychosperma*. There are published also the following new genera: *Paragulubia macrospadix*, Solomon Islands, local name Kuritu; *Rehderophoenix pachyclada*, Solomon Islands, local name Magimagi; *Strongylocaryum macranthum* (local name Puepue), *S. Brassii*, and *S. latius*, Solomon Islands.

Die Palmengattung *Gronophyllum* Scheff. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 200–205; July 15, 1936.

In the palm genus *Gronophyllum* the author recognizes 6 species, from Ceram, Celebes, and Dutch New Guinea. New species from Celebes are *G. Sarasinorum* and *G. Kjellbergii*. *G. densiflorum* Ridl., of Dutch New Guinea, is transferred to the genus *Leptophoenix*.

Beiträge zur Kenntnis der Tiliaceae. V. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 252–255; July 15, 1936.

New species of Tiliaceae are: *Brownlowia Clemensiae*, Sarawak; *Grewia Kjellbergii*, Celebes; and *Trichospermum Kjellbergii*, Celebes.

Contributions à la flore de la Nouvelle Calédonie. LXV. Plantes recueillies par I. Franc de 1905 a 1930 (XI^e^ supplément). By A. Guillaumin. *Notulae Syst.* 5: 13–16; November 1935.

New woody plants from New Caledonia are *Hibbertia catargyrea*, *Xylosma capillipes*, and *Lucuma Lecomtei*.

Contributions à la flore de la Nouvelle-Calédonie. LXVI. Plantes de collecteurs divers. By A. Guillaumin. *Notulae Syst.* (Paris) 5: 131–134; February 1936.

Ligneous plants described as new are *Pittosporum artense* and *Zanthoxylum Schlechteri*.

Matériaux pour la flore de la Nouvelle Calédonie. XL. Revision des Légumineuses. By A. Guillaumin. *Bull. Société Botanique de France* (Paris) 83: 294–315; 1936.

In number of species the Leguminosae rank seventh among the families existing in New Caledonia. They are represented by 55 genera. A key is given for separation of the genera, and others for separating species of many of the groups. New species are *Cynometra neo-caledonica*, *Caesalpinia ouenensis* and *C. rubiginosa*, *Mezoneuron deverdiana*, and *Albizzia glandulosa* and *A. Guillainii*.

Un *Savia* nouveau de Madagascar. By Paul Danguy. *Notulae Syst.* (Paris) 5: 1–2; November 1935.

Savia maroando is described as new from Madagascar. Its local name is Maroando.

Les *Smilax* et les *Dracaena* de Madagascar. By H. PERRIER DE LA BÂTHIE. *Notulae Syst.* (Paris) 5: 82–105; February 1936.

Smilax is represented in Madagascar by one species, *S. Kraussiana* Meissn. In *Dracaena* the author recognizes four species, one of which, *D. reflexa* Lam., is divided into 14 varieties, many of which are described as new.

Beiträge zur Kenntnis der Flora von Süd-Rhodesia. IV. By TYCHO NORLINDH and H. WEIMARCK. *Bot. Notiser* (Lund, Sweden) 1–50; figs. 1–13; 1936.

Among new ligneous plants described from Southern Rhodesia are various species and varieties of *Loranthus* and *Viscum;* 2 species of *Clematopsis;* and 4 species of *Grewia.*

Celastraceae novae vel melius cognoscendae. II. By TH. LOESENER. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 215–226; July 15, 1936.

New species of Celastraceae are *Celastrus madagascariensis,* Madagascar; *Maytenus scytodophylla,* Bahia, Brazil; *M. rapakir,* New Mecklenburg, vernacular name Rapakir; *M. Schumanniana,* Brazil; *Lophopetalum Winkleri,* Southeast Borneo; *Solenospermum macranthum,* Dutch New Guinea; and *S. Ledermannii,* Dutch New Guinea. There are also numerous transfers of name, and a few notes regarding species earlier published.

Neue afrikanische *Jasminum*-Arten. By E. KNOBLAUCH. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 256–257; July 15, 1936.

New species are *Jasminum biflorum,* German East Africa, and *J. kombense,* Madagascar. *Noldeanthus angolensis* Knobl. is renamed *Jasminum Noldeanum* Knobl.

Neue und selten Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. XI. By J. MILDBRAED. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 260–303; July 15, 1936.

Among new plants described from Tanganyika are: *Uvaria divaricata* Diels, vernacular name Muta; *U. decidua* Diels; *Lettowianthus stellatus* Diels, a new genus of Anonaceae, vernacular name Mtototo; *Cleistochlamys Kirkii* Oliv., Nkoljongo (Zanzibar), Mgandu, Koliongo; *Ophrypetalum odoratum,* a new genus of Anonaceae; *Popowia Buchananii,* var. *trichantha* Diels, Pempantavala; *Xylopia collina,* Mutuka, Pempantavala; *Maerua Schliebenii* Ch. Gilg, Singogolomandjanga; and *Omphalea Mansfeldiana* Mildbr., Moto. Numerous other species of herbaceous and woody plants are described in various families.

Contributions à l'étude des espèces du genre *Uapaca* Baill. (Euphorbiacées). By É. DE WILDEMAN. From *Mémoires* published by Institut Royal Colonial Belge (sec. des Sciences naturelles et médicales), Vol. IV; Brussels, 1936. Pp. 192; 6½ x 10; 5 plates, 44 text figs.

The members of the genus *Uapaca* are for various reasons difficult to classify specifically. They are dioecious plants and herbarium specimens of many of them are incomplete and unsatisfactory for taxonomic work. There are also evidences of crossing and hybridizing which restrict the choice of characters stable enough for reliable classification. The author discusses the many problems involved, reviews the work of others in the same field, and gives the results of his own studies. The African trees and shrubs are described in detail and there are keys to the species, references to the literature, a list of vernacular names, and much information of interest to botanists and foresters.

A list of true and false mahoganies. By R. MELVILLE. *Kew Bulletin of Miscellaneous Information* 3: 193–210; 1936.

A brief résumé is given of the history of Mahogany, which was used in ship repairing and building as early as 1521. The timber reached England by 1724, and by 1750 Chippendale was using it for furniture. By 1880 the demand for the wood in England had outstripped the supply and efforts were being made to introduce it into cultivation in various parts of the British Empire. Some of the plantations, especially those of

Swietenia macrophylla in India, were successful. In addition, considerable quantities of *Khaya* and *Entandrophragma* were imported from West Africa.

The author lists five species of "true Mahoganies," namely, *Swietenia mahagoni*, Spanish Mahogany of the West Indies; *S. macrophylla*, Honduras Mahogany of Central America; *S. Candollei* Pittier, Venezuelan Mahogany; *S. humilis*, Mexican Mahogany; and *S. Krukovii*, Brazil. He has evidently overlooked the Peruvian Mahogany, *S. Tessmannii*, which has certainly as good claim to specific rank as the recently described Brazilian species.

Of "false Mahoganies," that is, trees other than Swietenias to which the name Mahogany has been applied at some time or other, almost 200 species are listed. While the majority are Meliaceae, others belong to such diverse groups as Dilleniaceae, Flacourtiaceae, Vochysiaceae, Guttiferae, Dipterocarpaceae, Sterculiaceae, Burseraceae, Leguminosae, Rosaceae, Myrtaceae, Lecythidaceae, Sapotaceae, Juglandaceae, and numerous other families. The paper includes an index of common names and a brief bibliography.—P. C. STANDLEY.

La forêt. Supplement to the July 1936 issue of *Revue des Agriculteurs de France*, 8 Rue d'Athènes, Paris 9. Pp. 100; 9 x 12; 103 illustrations; July 1936.

The *Revue* is a monthly magazine sponsored by the Société des Agriculteurs de France, 8 rue d'Athènes, Paris 9. This sumptuous supplement is designed to encourage a greater appreciation of the aesthetic and economic value of trees and forests. Among the many contributors to its pages are Professor PH. GUINIER, Directeur de l'École Nationale des Eaux et Forêts de Nancy; M. CHARLES COLOMB, Inspecteur Général des Eaux et Forêts de France; M. J.-M. FORTUNET, Directeur de l'École Supérieure du Bois de Paris; and M. JOSEPH DE PESQUIDOUS, de l'Académie Française. Of particular interest to wood technologists are the articles on the uses of wood for furniture, cabinet work, architecture, paper, artificial textiles, charcoal, distillates, and gas. The typography is excellent and the many artistic and interesting illustrations are beautifully reproduced. (The attention of members of the

I.A.W.A. is directed to page 56 where Professor COLLARDET is shown directing a laboratory exercise in the École Supérieure du Bois!)

The study of the soil in the field. By G. R. CLARKE. Published under the auspices of the Imperial Forestry Institute, University of Oxford. Clarendon Press, Oxford, 1936. Pp. 142; 4¾ x 6¾. Price 5s. (in New York $1.75).

"There are many people . . . who are not and never can be soil specialists, but to whom some knowledge of the soil is essential, and to whom some instruction as to what to look for and to describe and record is of very great importance."

In this handy little book, consideration is appropriately given to the more important environmental factors which influence soil character. Over one-third of the text is devoted to description of soil profile characteristics. The more important features are treated in detail sufficient to supply the reader with a working knowledge. Methods of soil surveying and mapping are reviewed and the principles of a number of classification systems described. This concise and well balanced treatise should prove useful to field workers generally.

The constitution and properties of lapachol, lomatiol, and other hydroxynaphthoquinone derivatives. By SAMUEL C. HOOKER ET AL. Memorial volume to Samuel C. Hooker (1865–1935) edited by LOUIS F. FIESER, Harvard University. Mack Printing Co., Easton, Pa., 1936. Pp. 135; 8 x 10½; 1 photo.

"Investigations on lapachol and related substances were initiated by Dr. Hooker in 1889 at a time when he occupied the position of chief chemist with the Franklin Sugar Refining Co. In such time as was not devoted to this technological duties, and with the experimental collaboration of various voluntary assistants who proffered their services in return for the valuable training which the association provided, he pursued the work actively until 1896 and published a series of eleven principal papers in this first period of the investigations. In that year the increasing importance of his position in the sugar industry made it necessary to discontinue the researches

in organic chemistry, but Dr. Hooker retained a keen interest in the field of investigation which his early work had largely uncovered and vastly enriched, and he was ever mindful of the statements which he had included in the last two papers, published in 1896. 'The results of my experiments will form the subject of a future paper,' he had said, and 'I shall hope to return to the consideration of this subject in the future.' After an interim of nearly twenty years, during which time his activities were quite remote from chemical research, Dr. Hooker retired from business and, among other occupations of his years of leisure, turned again to his lapachol studies. He worked in part alone and at times with a trained assistant to perform analyses and to repeat on a large scale and to extend experiments which he had fully explored in numerous tests carried out with very small quantities of material under microscopic control.

" . . . The eleven papers published in 1936 constitute a logical and natural continuation of the papers which appeared in the years 1889 to 1896, and the publications as a whole comprise a remarkably complete and unified exposition of a brilliant chapter in organic chemistry. The publication of a memorial volume including Dr. Hooker's collected works on the subject of lapachol chemistry is an appropriate tribute to a great man, and the project was authorized and supported by members of Dr. Hooker's family. . . ."—*From editor's preface.*

Vertical resin ducts in the secondary wood of the Abietineae. By M. W. Bannan. *New Phytologist* (Cambridge, Eng.) 35: 1: 11–46; 1 plate, 23 text figs.; Feb. 27, 1936.

"In the various genera of the Abietineae the vertical resin ducts in the secondary wood arise by schizogeny and the surrounding cells by segmentation of fusiform elements. The type of cell associated with the ducts differs over the tree, but for each genus there are characteristic limits of variation. The amount of resin produced is correlated with these differences. In the subtribe Abieteae the ducts are generally cyst-like and confined to tangential series at wounds. In the Pineae the ducts are longer, and often scattered in distribution, becoming further dispersed at a distance from the centers

of injury. The evidence obtained from the study of field material and from experimental sources indicates that the more general occurrence of ducts in the Pineae as compared with the Abieteae is correlated with this lengthening and scattering of the ducts produced subsequently to injury, rather than to a normal occurrence independent of wounding as has been commonly supposed. The different genera may be arranged in a series in which there is an enlargement and dispersion of the response to injury. From the comparison of similar experimental wounds it has been determined that in the individual species the resin tissue resulting from injury increases from the seedling to the adult stage, and from the inner to the outer wood in both seedling and adult. Such conditions in the living forms, together with the available fossil evidence, are indicative of a phylogenetic enlarging of the response to injury among the Abietineae."—*Author's summary.*

The distribution of the lengths of fibres and vessel members and the definition of terms of size. By L. Chalk. Mimeograph; 13 pp.; 4 figs. Imperial Forestry Institute, Oxford, 1936. Price 1s.

"When describing a wood it is useful to indicate in words whether certain cells are short or long, wide or narrow, in addition to giving the dimensions in figures. Such terms of size must be defined if they are to be used consistently and if they are to be intelligible to anyone besides the observer. In the past the tendency has been for each wood anatomist to make his own definitions, with the result that the same element may be described as small by one author and medium-sized by another. In order to end this unsatisfactory state of affairs the International Association of Wood Anatomists set up a committee in 1934, under the chairmanship of the author, to investigate the possibility of preparing standardized definitions of terms of size.

"In the early stages of the work of the committee it became clear that it would be necessary to accumulate data on a representative collection of species if the recommendations of the committee were to be more than a record of personal preferences. The investigation described in this paper was

accordingly undertaken in order to provide a sound basis for discussion, and it was decided in the first place to confine attention to two features, fibre length and vessel member length.

"The first objective was the range to be covered by the classes and the second the number of classes into which this range could be most suitably divided. Various proposals had been made on the latter point suggesting from three to ten classes. The committee, in an interim report made to a meeting of the International Association of Wood Anatomists in Amsterdam in 1935, recommended the use of three classes—short, medium-sized, and long—on the ground that smaller classes would fail to cover the normal range of variation within a species.

"The investigation has shown that no definite limits can be fixed for the extremes of the ranges and the problem resolved itself into deciding on a suitable width for the middle class and determining how it should be centred. It should be wide enough to prevent the likelihood of different samples of a single species spreading into all three classes, but at the same time it should not be so wide that it would include nearly all woods. The first part of the paper is concerned with the analysis of the distribution curves, and the second with the application of these data to the particular problem of the middle class."

"The distribution curves of mean fibre length and mean vessel member length are given for over 300 species. Both curves are positively skewed and agree closely with smooth curves calculated on the basis of the method of Kapteyn. Alternative methods of dividing the range into classes for descriptive terms, and the method of centring a medium-sized class, are discussed. Using three classes—short, medium-sized, and long—the limits suggested for the middle classes are 900 to 1600μ for fibre length, and 350 to 800μ for vessel member length."

"It may, however, sometimes be desirable to qualify these terms to distinguish, for example, between the moderately long and the very long. . . . The limits of these sub-classes for fibre length and vessel member length are given" in the accompanying table.

SUB-CLASSES FOR LENGTH OF WOOD FIBRES AND VESSEL MEMBERS

Class	Sub-class	Fibres	Vessel members
Short	Extremely short	Less than 512μ	Less than 177μ
	Very short	512–682μ	177–240μ
	Moderately short	682–912μ	240–342μ
Medium-sized		912–1622μ	342–799μ
Long	Moderately long	1622–2167μ	799–1131μ
	Very long	2167–2891μ	1131–1866μ
	Extremely long	Over 2891μ	Over 1866μ

GENERAL INDEX

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