H. H. Chattaway

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NUMBER 41 March 1, 1935

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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BOTANICAL EXPLORATION OF THE FIJI ISLANDS

By ALBERT C. SMITH

Associate Curator, New York Botanical Garden

As a holder of a Bernice P. Bishop Museum Fellowship in Yale University for 1933–34, I spent nine months collecting botanical specimens in the Fijian Archipelago. More than 2000 herbarium numbers were obtained, in sets of ten or eleven, and through arrangements with Professor Record, 817 wood samples, each accompanied by a herbarium voucher, were added to the collections of the Yale School of Forestry.

The Fiji Islands are of special importance in the study of the botany of the Pacific because of their position in the path of plant migration from southeastern Malaysia into Polynesia. Until the Fijian flora is well known, the relationships of the plants of Polynesian groups farther eastward will remain imperfectly understood. The outstanding contributor to our botanical knowledge was Seemann, whose excellent *Flora*

Vitiensis (1865–1873) is the only comprehensive publication on the plants of Fiji. The late Dr. J. W. Gillespie also spent some months in field work there and subsequently described many new species, but there are still extensive areas botanically unexplored.

Comprising the Fijian Archipelago are more than 200 islands, with a total land surface of 7083 square miles. Viti Levu, largest of the group, has an area of over 4000 square miles or about four-fifths the size of Connecticut, while Vanua Levu covers about 2000 square miles. These two volcanic islands attain an elevation of about 1300 meters and are continental in appearance; in the interiors one becomes unaware of the sea. The southern and eastern slopes of the massive mountain ranges are exposed to the moisture-laden trade winds and receive a well distributed rainfall which may total 200 inches annually, whereas the northern and western slopes are nearly rainless during six months of the year. Accordingly, the wet forest of one side is in sharp contrast with the other's open growth of grass and scrub and the ubiquitous Screw-pines (*Pandanus*).

Suva, the port and capital town of the group, lies by an excellent harbor on the southeastern coast of Viti Levu. I spent the week following my arrival there on October 3, 1933, in preparing for work in the outlying islands where little or no collecting had been done, since Viti Levu has been more thoroughly botanized than the others.

My first field trip was 60 miles southward to Kandavu, a long, fertile, well-populated island culminating at its western end in Mount Mbuke Levu ("great yam hill"), a rounded peak which attains an elevation of 825 meters and supports a dense tropical forest. On the slopes and summit of that mountain, Seemann, 73 years before, found many new species, and I anticipate that some of my specimens will have their usefulness increased by the fact that they come from the type locality. At the time of Seemann's visit, according to his account published in 1862, most of the original forest had been cleared from Kandavu, but, if so, the same species have reclaimed land no longer in use, for at present many of the interior ridges are as densely forested as they were before the

encroachments of a large population. There are some valuable timber trees, the best known being the Ndakua or Fijian Kauri (*Agathis vitiensis*). This species also occurs on Viti Levu, where the stands are large enough to make it of some commercial importance.

I visited Vanua Levu at two different seasons, but limited my work of over three months to the wet tropical forests of the southeastern slopes and summits. Previous collectors had confined their attention to the coast but I ascended nearly all the high mountains, including Mbatini, Ndikeva, the Korotini Range, Mariko, Seatura, and Uluingala, whose summits are reared from 820 to 1030 meters above the sea. All are in the wet zone and belong to the single long range forming the backbone of the narrow island. Since they have much the same general aspect of vegetation and degree of accessibility, I shall describe the ascent of only one of them —Mount Ndikeva, situated a few miles from the coast of Natewa Bay, behind the native village of Korotasere.

The people are kinky-haired Melanesians, darker in color than the Polynesians who inhabit Samoa and Tahiti. They are extremely hospitable and treat a white visitor with considerable respect, especially when his mission is mysterious, even if none too sane—such as collecting leaves. Each group of villages is under the control of a native chief, or Mbuli, who holds a hereditary title, although he is now an employee of the British government. In governing Fiji as a Crown Colony the British have not attempted to change the custom of hereditary chieftainship and have not introduced English even as the official language. Consequently a native interpreter, who can also serve as a head boy, is always necessary. The Mbuli of Korotasere, becoming acquainted with my intention of climbing Mount Ndikeva, appointed a few natives to serve as guides and carriers. In addition to these, several other villagers came along for the excitement, some of them bringing their dogs to hunt wild pigs enroute. In all, eighteen of us started out one morning for the mountain, making an impressive array.

After traversing the narrow coastal plain, we began the ascent of the steep humus-covered slope, guided by an old woodsman who told the boys where to cut a trail. The region is all densely forested and is very rugged, giving the impression of the interior of a tropical continent. The principal families of trees are the Rubiaceae, Apocynaceae, Myrtaceae, and Euphorbiaceae. As always in tropical forests, flowers are inconspicuous, being small, dull in color, and borne high up on the frequently large trees, many of which support dense epiphytic growths of orchids, ferns, and lower crytogams. Lianas form tangles throughout the forest, making progress slow and difficult. Species of *Freycinetia*, a relation of the Screw-pine, grow in dense tangled masses. On the steep slopes, continually wet humus-covered and moss-grown rock surfaces provide a precarious footing. Late in the afternoon our number one guide began looking for a cave he knew about where we could pass the night, but before he could locate it we were all thoroughly drenched by a cold rain. It was quite dark by the time "Ndravundravu," the cave, was discovered and we could make ourselves comparatively dry and comfortable. This cave, one of many on the slopes of Mount Ndikeva, is formed by a huge overhanging cliff which protects a chamber of about 30 by 100 feet. That night we seemed to have moved back many centuries, as we sat around the smoky fire and watched some of the company perform their inevitable dances. Outside our rocky chamber the rain poured down on the dark treetops below.

By morning the rain had ceased, and some of us continued up the mountain, following a narrow ascending buttress to the summit. Vegetation at higher elevations, particularly on such exposed situations as these buttresses, is very different in aspect from that of the forested slopes. The trees and shrubs are lower in stature, and one observes species of *Metrosideros*, *Decaspermum*, *Geissois*, *Calycosia*, and other genera of compact, gnarled habit. Epiphytic vegetation abounds, many species of ferns, mosses, and beautiful orchids covering the woody plants. We collected industriously and towards evening returned heavily laden to the cave. After a second night in our primitive shelter, we returned to Korotasere, collecting enroute, to report a successful trip to the Mbuli and to work on the specimens. At least half of a field botanist's labor

takes place in the village where he has headquarters, as he must press and dry his plants, make detailed notes, and correlate herbarium and wood numbers. The villagers found this work very engrossing and would watch me for hours, giving native names to some of the plants and speculating as to my purpose.

In addition to Vanua Levu and Kandavu, I collected on the somewhat similar volcanic islands of Taveuni, Koro, and Moala. The Lau Islands, at the eastern end of the archipelago, are predominantly limestone in structure and support many plants of different species from those of the volcanic islands. In this group I visited Vanua Mbalavu, Fulanga, and Kambara, islands on which one is closer to the ocean and where the setting is more of the proverbial "South Seas" type.

On July 3, 1934, I regretfully took my permanent departure from Suva, going to Honolulu, where some time was spent sorting my collection at the Bishop Museum. Leaving the first set of herbarium material there, I returned to the New York Botanical Garden, where the specimens will be studied, with the coöperation of specialists in various American and European institutions.

The Fijian flora (seed plants and ferns) is estimated to include upward of 3000 species. The majority of these are doubtless to be found also in adjacent island groups, but a large percentage are endemic to Fiji, though the high mountain plants have been too poorly collected to make an estimate of endemism reliable. It is to be hoped that another field trip can be arranged in the near future, on the coöperative basis which has been so successful in the past, to permit additional collections in Fiji. Seemann's *Flora Vitiensis* is much in need of revision, but that task should be undertaken only when field work has been brought to a reasonable degree of completion.

In conclusion, I should like to express my thanks to the Bishop Museum and Yale University for the fellowship that made this trip possible, to the Yale School of Forestry for a special subvention for the collecting of woods, and to the many inhabitants of Fiji, both European and native, who make a visit to their country both delightful and profitable.

NOTE ON THE GENUS *PARAMACHAERIUM*

By Adolpho Ducke
Jardim Botanico do Rio de Janeiro

Paramachaerium Ducke, Archivos Jard. Bot. IV (1925), p. 86; V (1930), p. 136.—Generi *Pterocarpus* affine, differt calicis basi obtusa, petalis atroviolaceis, legumine ala terminali, oblique triangulari vel falciformi, acuta, brevi vel mediocri, instructo.—Arbores inermes parvae vel usque mediocres trunco vulgo irregulari, cortice succo rubro defluente, ligno molli albido. Species duae hylaeae amazonicae et guianensis silvas riparias a fluminibus periodice inundabiles habitant.

Paramachaerium Schomburgkii (Benth.) Ducke, Arch. J. B. IV (1925), p. 86 = *Machaerium Schomburgkii* Benth. = *Pterocarpus Kuhlmannii* Ducke, Arch. J. B. III (1922), p. 155. Leaflets mostly 5, rarely 3, subopposite; stipules, bracts, and bractlets persistent; flowers in dark brown, tomentous, dense spikes; calyx 8 to 10 mm. long, vexillum 11 to 12 mm.; pod-wing very short, thick, and rigid.—British Guiana (Schomburgk n. 385, floriferous); Brazil, Rio Branco (State of Amazonas): Jarú (Kuhlmann, Herb. Jard. Bot. Rio de Janeiro n. 2980, floriferous); Páo Brasil (Kuhlmann, H.J.B.R. n. 3085, with very young fruits); Caracarahy (Ducke, wood sample n. 217 [Yale n. 27153] and H.J.B.R. n. 23862, with adult fruits).

Rob. Schomburgk by mistake attributed to this species the precious Tigerwood of British Guiana, but, really, the wood of this tree is valueless.

Paramachaerium ormosioides Ducke, comb. nov. = *Pterocarpus ormosioides* Ducke, Arch. J. B. III (1922), p. 154, t. 11 et 12; IV (1925), p. 84; V (1930), t. 13, fig. 33.—Leaflets 5 (3 or 4), alternate; stipules, bracts, and bractlets very deciduous; flowers in lax racemes, nearly glabrous, calyx environ 6 mm. long, vexillum 7 to 8 mm.; pod-wing medium long and rather thin. Brazil: State of Pará, periodically inundated banks of the Rio Tapajoz in the lower cataract region (Ducke, Herb. Amaz. Mus. Pará n. 16780 and 16918); State of Amazonas, Santa Izabel, Rio Negro (Ducke, H.J.B.R. n. 23863).

Synopsis of Genera of the Affinity of *Paramachaerium*

Calyx, especially in the bud, distinctly curved, more or less bilabiate at apex. Petals glabrous.

Calyx base acute or turbinated. Stipules, bracts, and bractlets deciduous.

Stamens monadelphous for not more than one-fourth of their length. Petals of a beautiful bright violaceous blue color. Pod subligneous-coriaceous, trialate (provided at each side with a short longitudinal erect wing and ending in a long transversely striate and venous wing). Tree; leaflets alternate or opposite; heartwood of good quality, brownish yellow, densely striated with brown . . . . *Vataireopsis* Ducke.

Stamens monadelphous for at least two-thirds of their length. Petals yellow. Pod chartaceous, thin but thickened in the middle, or entirely suberous and thick. Trees; leaflets alternate; wood of the Brazilian species whitish, soft, and valueless. . . . . *Pterocarpus* L.

Calyx base obtuse. Petals dark violet. Stamens monadelphous for at least two-thirds of their length. Pod thick, subligneous-coriaceous, reticulated, with a very short or rather elongate terminal wing. Stipules, bracts and bractlets persistent or deciduous. Trees; leaflets alternate or opposite; wood whitish, soft, and valueless. . . . . *Paramachaerium* Ducke.

Calyx not curved. Petals glabrous, or the vexillum sericeous. Trees or lianas. . . . . *Machaerium*, *Centrolobium*, *Platypodium*, *Tipuana*, and *Vatairea*.

Note on the Wood of *Paramachaerium*

Color whitish, with lemon streaks and some kino spots; without figure. Odorless and tasteless. Sp. gr. (thoroughly air-dry) 0.86. Texture fine. Grain irregular. Wood takes a high polish, is fairly tough and strong, probably perishable in contact with the ground.

Pores not visible without lens, solitary or in radial multiples of 2 to several, numerous, well distributed. Parenchyma not visible without lens; terminal and also narrow-aliform, often irregularly confluent. Rays minute; homogeneous; uniseriate and mostly 7–10 cells high. Fibers with numerous, irregularly distributed, slit-like, simple or indistinctly bordered pits. Ripple marks present, very fine, about 115 per inch, fairly regular; all elements storied.

Material: Yale No. 27153; Ducke No. 217.—S. J. R.

FIBRIFORM VESSEL MEMBERS IN THE PASSIFLORACEAE

By Robert H. Woodworth
Biological Laboratories, Harvard University

Among specimens taken for anatomical study from Barro Colorado Island in the Canal Zone are several species of *Passiflora*. A study of the stem anatomy has revealed an interesting type of tracheary element, which is here designated fibriform vessel member. There has been some question as to the propriety of referring to the cells as vessel members inasmuch as they are distinctly of the nature of fibers. The single characteristic that places them in the category of vessel elements is the perforation; otherwise they are quite fiberlike. The cells measure in length from 45 to 60 times their width, and are much longer than the cambial initials. The ends taper to needlelike points (Plate I, 1), and frequently are forked (Pl. I, 5), which indicates increase in length during maturation. The thick walls are similar to those usually seen in fiber-tracheids and, viewed in transverse section, often equal one-half the cell's diameter. The pitting is of the bordered type, the canals flaring to lenticular inner apertures.

Except for the perforations these cells are precisely like the fiber-tracheids all about them. In fact the writer in a preliminary report (*6*) referred to them as perforated fiber-tracheids and indeed, structurally, they are just that. However for purposes of definition this descriptive phrase is unfortunate. Since a tracheid is an imperforate cell with pits to congeneric elements bordered (*4*), it certainly is not appropriate to designate a cell as a perforated imperforate cell. It seems better to recognize the perforation as an opening from one vessel member to another (*4*) and to hold, therefore, that any perforated cell is a vessel element. For these reasons the writer refers to the cells in question as fibriform vessel members.

Passiflora vitifolia H.B.K. is a striking plant, with its large brilliant scarlet flowers and its liana habit of running over the low plants of the forest floor or reaching far up among the crowns of trees. When the single stem is suspended through

30 meters or more before entering the ground its diameter may be no more than two centimeters. The xylem of plants with this habit is usually provided with very large vessels, and, in the specimens available, the largest pores measure 0.5 mm. across, while the majority are between 0.4 and 0.5 mm. in diameter. Figure 14 (Pl. II) shows a member of one of the larger vessels; it has a diameter greater than its length and the simple perforations are at right angles to the vessel axis. Smaller vessels have longer and narrower elements (Pl. II, 15). In the first-formed secondary xylem the pores are much smaller than those of the rest of the wood, some of them being only 30 μ in diameter. Throughout the xylem, even among the first few cells cut off by the cambium, there are also vessel elements of the fibriform type distributed among the fiber-tracheids, from which they differ only in being perforate. In cross sections of the stem the large vessels are seen to compose the major portion of the xylem, and even when the pores are farthest apart no tracheid is more than twelve cells from a vessel. In a stem so well supplied with conducting tissue of a type commonly supposed to be efficient, it seems unlikely that these fiberlike vessel elements contribute significantly to the water movement in the plant.

Among the fibriform vessel members in the xylem of the species being discussed, about four-fifths of those observed were provided with two perforations, the others with only one each (Pl. I, 3; Pl. II, 10). If the element is extremely long with taper-pointed ends, thick walls, and small lumen the perforations are located well down the side, about one-quarter the cell length from the end (Pl. I, 4), and their shape may be circular (with a diameter of 10 μ or less), elliptical, or even linear (12 $\times$ 2 μ) (Pl. II, 9). In wider and shorter cells with thinner walls and larger lumens, the perforations are larger and nearer the ends (Pl. I, 6, 7).

The real nature of these openings is revealed by sections through them. Figure 12 (Pl. II) is a photomicrograph of a cross section showing two pairs of fibriform vessel members with their cavities connected by true perforations. It is obvious that no pit membrane exists. The upper right portion of the photograph shows a part of a large vessel in cross section, thus demonstrating the comparative diameter of ordinary vessels and fibriform vessels. Figure 13 (Pl. II) pictures another transverse section through the perforated portion of two of the fibrous elements (at center); here again, as in every instance the writer has observed, there is no pit membrane. There are several bordered pits in the picture, one of them being located at the bottom of the lower of the two perforated cells, and the pit membranes show as black lines; also the pit canals are very much narrower than the perforations.

The fibriform vessel elements are so long and slender that it is not possible to ascertain their relationship in series by the study of sections. The cells with solitary perforations are probably the end units, and, if their frequency is correctly interpreted, the vertical series of coalesced fibers is not long, though it is possible that some are very short, consisting of as few as two cells, while others are correspondingly longer. In the latter case water might be conducted through some appreciable distance in the stem, but the quantity would only be very small in comparison with that moving through the large vessels. Tyloses are sometimes present in large vessel elements (Pl. II, *15*) and occasionally occlude them, but such occlusions are actually too few to reduce water passage appreciably, and therefore can not be held to initiate the formation of perforations in the fibrous elements. Moreover, these perforated fibers are found along with ordinary vessels among the first cells to mature from the cambium in very young twigs, long before tyloses make their appearance.

Bailey (*2*) has shown that ordinary vessel elements have approximately the same length as the cambial initials, and recently Chalk and Chattaway (*3*) have demonstrated that the total length of a vessel member corresponds closely with that of the cambial cell from which it was derived. Fibriform vessel members, on the contrary, are significantly longer than the fusiform cambial initials. The writer measured the lengths of vertically elongated xylem cells in the stem of *Passiflora vitifolia* and the results are given in Table I. The measurements were made from sections and from macerated tissue, and the mean in each case is the average of about 25 cells.

It is well known that much variation exists in the size of tracheary elements from different individuals of a species and from different parts of the same individual (Kribs, *5*; Bailey and Tupper, *1*). The measurements for Table I, however, were all made on cells from the same piece of stem. Attention is here called to the *relative*, rather than to the *actual*, lengths of cell types. Wood parenchyma strands, septate fiber-tracheids, sieve tube members, and ordinary vessel members are usually supposed to maintain the length of the cambial initial from which each was derived. In the table it is seen that these four types all fall into the same size class. There are two figures, however, that require special mention. The maximum for septate fiber-tracheids applies to the only cell among

TABLE I

LENGTHS OF CELLS IN *PASSIFLORA VITIFOLIA*

	Min.	*Mean*	*Max.*
Wood parenchyma strands	440μ	760μ	858μ
Septate fiber-tracheids	510μ	700μ	1360μ
Sieve tube members	500μ	550μ	803μ
Vessel members	200μ	500μ	825μ
Fibriform vessel members	660μ	1400μ	2000μ
Libriform fibers	1460μ	2000μ	3000μ

hundreds of that category which has been seen to attain such a length, others being close to the mean measurement. Vessel members of the minimum length type (Pl. II, 14) are of common occurrence and are much shorter than any of the other cells arising from fusiform cambial initials. Since they are in direct radial line with much longer tracheary elements obviously derived from the same cambial cell, it seems that the cambial derivative destined to form the very short vessel members must divide transversely once or twice, since otherwise the whole vessel would have to move longitudinally, contracting through its whole length as its individual cells widened; the latter obviously does not happen. The longest vessel members came from first-formed secondary wood, as is normally the case for Dicotyledons (Bailey and Tupper, *1*).

As shown in Table I, the fibriform vessel members and libriform fibers are of quite a different size class from that of the cells maintaining approximately the length of the cambial initial. By examining enough macerated tissue from all parts of the xylem it is possible to construct a perfectly graded series of vessel members from the longest and most fiberlike (almost of the libriform fiber type), through shorter, wider, thinner-walled forms (of the tracheidal type), to the long, narrow vessel members of the first-formed secondary wood, and thence through shorter and wider cells to later-formed vessel members that are shorter than they are wide. It is obvious that there is no sharp dividing line between vessel members of the usual type and those here called fibriform vessel members. Most of the latter appear to be about twice as long as the cambial initials and are therefore unique among known vessel components.

Perforations in the fibrous cells evidently represent large bordered pits that have lost their membranes. The overhanging border, though not readily seen in macerated tissue (Pl. II, 10), is distinct in radial and in transverse sections (Pl. II, 12, 13). Also the aperture is often elliptical, with its long axis parallel to the apertures of the smaller pits in the same wall and lying across the aperture in the adjacent wall. In no instance was there evidence of fusion of bordered pits to form the larger perforation.

In any attempt to account for the presence of such cells as have occasioned this report, there is to be considered not only the factor of utility but also that of heredity. The large vessels are so numerous that it hardly seems likely that the fibriform vessel members contribute significantly to the water requirements of the plant. Furthermore the writer has examined the xylem of other liana types, which would be supposed to have similar need for water, without detecting vessels composed of fiberlike members. Examination of the stems of other species of *Passiflora* has disclosed the fibriform vessel member in all species available. Apparently the urge to form perforations in tracheary elements is strong in this genus. It is noteworthy that the perforations have appeared, not in a series of cells specialized for conduction, but in a series modified for mechanical purposes.

Examination of macerated xylem of the species of *Passiflora*

in the Harvard University collections for anatomical study has disclosed this type of cell in all species represented. These are: *Passiflora menispermifolia* H.B.K., *P. Seemanni* Griseb., *P. biflora* Lam., *P. misera* H.B.K., *P. punctata* H.B.K., *P. auriculata* H.B.K., *P. coriacea* Juss., *P. caerulea* L., *P. maliformis* L., *P. rubra* L., *P. edulis* Sims., *P. gigantifolia* Harms, and *P. quadrangularis* L. Professor Record supplied material of the last two species listed and that of other genera in the Passifloraceae discussed immediately below.

Figure 8 (Pl. I) is from the wood of *P. quadrangularis* L. The cell photographed is unusual in that it has two perforations at each end; since the perforation plates are in different facets of the wall, it is not a case of multiple perforations (*4*). At the other end the cell is tubular, with the perforations in opposite walls of the cell. Apparently two vessels joined with this cell at one end, divorcing again at the other.

Other genera of the Passifloraceae have proved to be interesting. There is a striking similarity between the macerated xylem of *Tacsonia mollisima* H.B.K. and that of species of *Passiflora*. (It should be noted here that although Jussieu considered *Tacsonia* to be a distinct genus, Engler and Prantl place it in the genus *Passiflora*.) The xylem of *Smeathmannia pubescens* Sol. contains an abundance of libriform fibers, but very few fiber-tracheids (just the reverse of the situation in *Passiflora*) and these are longer and thinner-walled, with many more pits, than in corresponding cells of *Passiflora*. The fibriform vessel members seemed about intermediate between those of *Passiflora* and the small vessel elements in such woods as Beech (*Fagus*); one cell was found that had multiple perforations rather than simple. The ordinary vessel elements of *Smeathmannia* are often peculiar. The two perforations may be very close together in the side wall leaving the bulk of the cell as imperforate extensions; in figure 11 (Pl. II), the two perforations shown are directly opposite one another, thus forming a passage across the cell. Occasionally cells were observed with three perforations variously placed. *Androsiphonia adenostegia* Stapf contains a scattering of fiber-tracheids in the xylem, but none were seen to be perforate. The xylem of *Soyauxia grandifolia* Gilg & Stapf contains very few fiber-tracheids, and examination of a large amount of macerated tissue failed to disclose perforated cells similar to those of *Passiflora* and *Tacsonia*. In fact the xylem cells of this and the previous species appeared to be quite unlike those of *Passiflora*.

As a result of correspondence concerning the fiberlike vessel members in the Passifloraceae, Professor Record forwarded to the writer a wood sample that he had just received for determination and had identified as *Evonymus* sp. The specimen proved to contain fibriform vessel members, although most of the thick-walled cells with pointed ends were normal fiber-tracheids. Forty-five species of 35 genera of the Celastraceae were then examined, but the only woods showing any tracheidiform cells with perforations were *Celastrus articulatus* Thunb., *C. scandens* L., *Evonymus atropurpureus* Jacq., and *E. japonicus* L.f. In the case of three of these species the length of the elements could not be determined from the sections and no wood was available for maceration. It was therefore not possible to determine whether the cells in question were truly fiberlike, with long pointed ends, or merely of the nature of small vessels. Macerated wood of *Evonymus atropurpureus* Jacq. showed no fibriform vessel members; small vessels are numerous but they are more like tracheids than fibers. Professor Record writes: "Examining our slides of *Evonymus* and certain other Celastraceae brings to light the same type of cell—that is, they are fiberlike, with rather few and scattered bordered pits, and not readily distinguishable from the adjacent fiber-tracheids except for the presence of perforations." It may be that fibriform vessel members are widely distributed, but previously have been overlooked.

The writer feels that the conclusions of Chalk and Chattaway (*3*) in regard to measuring the length of ordinary vessel members are timely and well drawn. In these fibriform vessel members the total length is apparently much more than that of the cambial initial, but until more is known about such cells it seems better to consider them as a special type than to hold that they must affect the general concept of vessel members.

SUMMARY

1. The secondary xylem of the stem of various species of *Passiflora* (and a few other plants) contains, in addition to the usual type of vessel elements, cells here designated fibriform vessel members, which, except for their perforations, are quite like fiber-tracheids. There are intermediate forms.

2. Fibriform vessel members are about twice as long as the fusiform cambial initials and, therefore, appear unique among vessel elements.

3. Perforations of fibriform vessel members have their origin in single large bordered pits that lose their membranes.

4. There is some evidence that the very short members of the large vessels of *Passiflora vitifolia* H.B.K. come from cells formed by transverse division of cambial cells, rather than from whole cambial initials.

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EXPLANATION OF PLATES I AND II

All figures except 8 and 11 are from *Passiflora vitifolia* H.B.K. Figs. 1–11, 14, 15: Photomicrographs of cells from macerated xylem. F.V.M. = Fibriform vessel member.

No. 1. Fibriform vessel member with two perforations, each about one-third the cell length from the end. ×53.

No. 2. F.V.M. with two perforations. ×53.

No. 3. F.V.M. with only one perforation. ×53.

No. 4. End of very long and thick-walled F.V.M. showing a perforation at one-fourth the cell length from the end. ×125.

No. 5. Forked end of a F.V.M. showing a large perforation. ×138.

No. 6. Small vessel member of tracheidal form. The images within the area of the upper and lower perforations are pits in the rear wall. ×64.

No. 7. Vermiform paravascular vessel member with a single perforation at one end. ×64.

No. 8. End of a tracheidlike vessel member from *Passiflora quadrangularis* L. showing two perforations, each of which opened into a separate cell. The other end of this cell also had two perforations opposite one another and opening into different cells. ×138.

No. 9. End of a very long and thick-walled F.V.M. with a very narrow perforation located at one-fourth the cell length from the end. ×42.

No. 10. F.V.M. with one lenticular perforation. The overhanging borders show distinctly. ×42.

No. 11. Tracheary element from *Smeathmannia pubescens* Sol. The two large perforations are directly opposite one another forming a passage through the cell at right angles to the long axis. ×42

No. 12. Photomicrograph of a cross section of the xylem showing perforations between two pairs of F.V.M.'s. At the right is a part of a large vessel. ×322.

No. 13. Photomicrograph as above showing a perforation between two F.V.M.'s. ×322.

No. 14. One of the wide and short vessel elements. ×75.

No. 15. One of the longer and narrower vessel elements. ×42.

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

Thirteen members were elected during 1934, bringing the total to 77, representing 24 countries, as follows: Algeria (1), Austria (1), Australia (4), Belgium (1), Brazil (3), Canada (4), Ceylon (1), China (1), Federated Malay States (1), France (5), Germany (4), Great Britain (11), India (1), Italy (1), Japan (6), Netherlands (5), New Zealand (1), Philippine Islands (1), Poland (1), South Africa (1), Spain (1), Sweden (1), Switzerland (1), U. S. A. (20).

The Council recently elected, is composed as follows:

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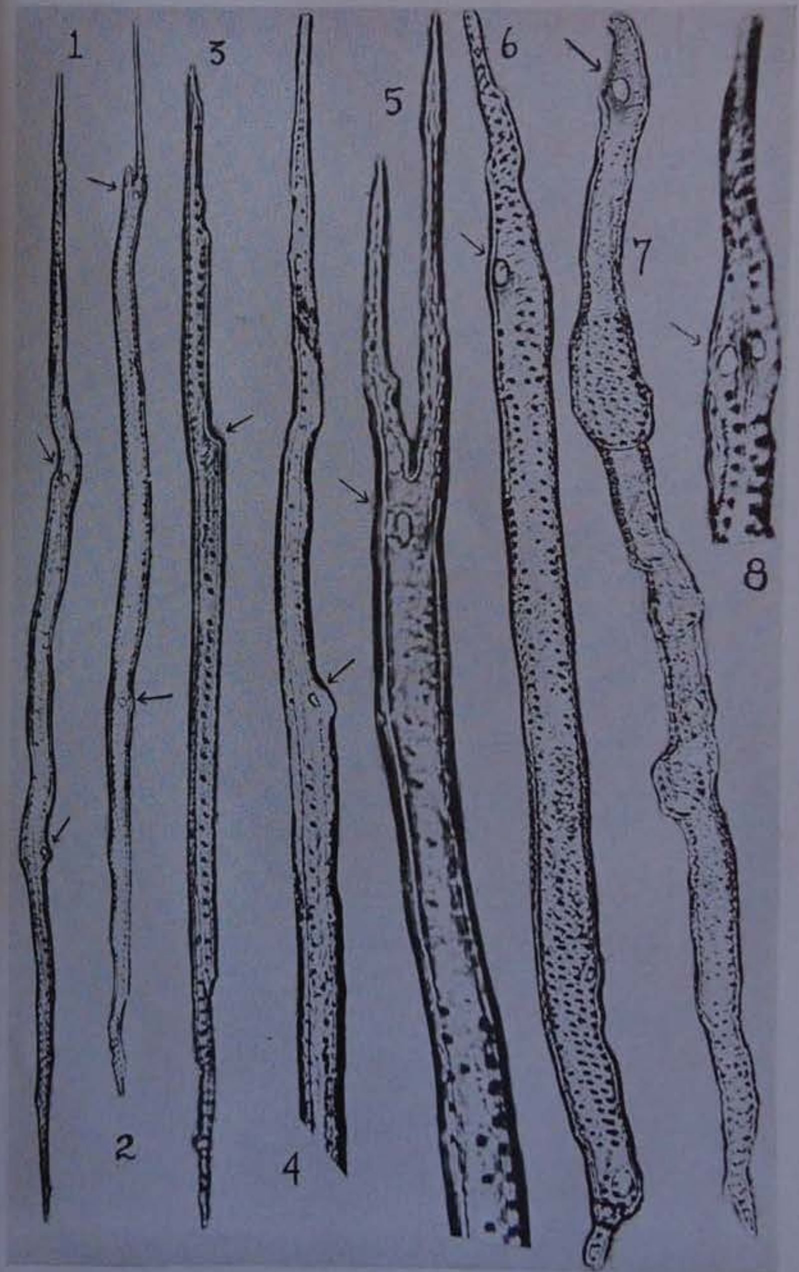

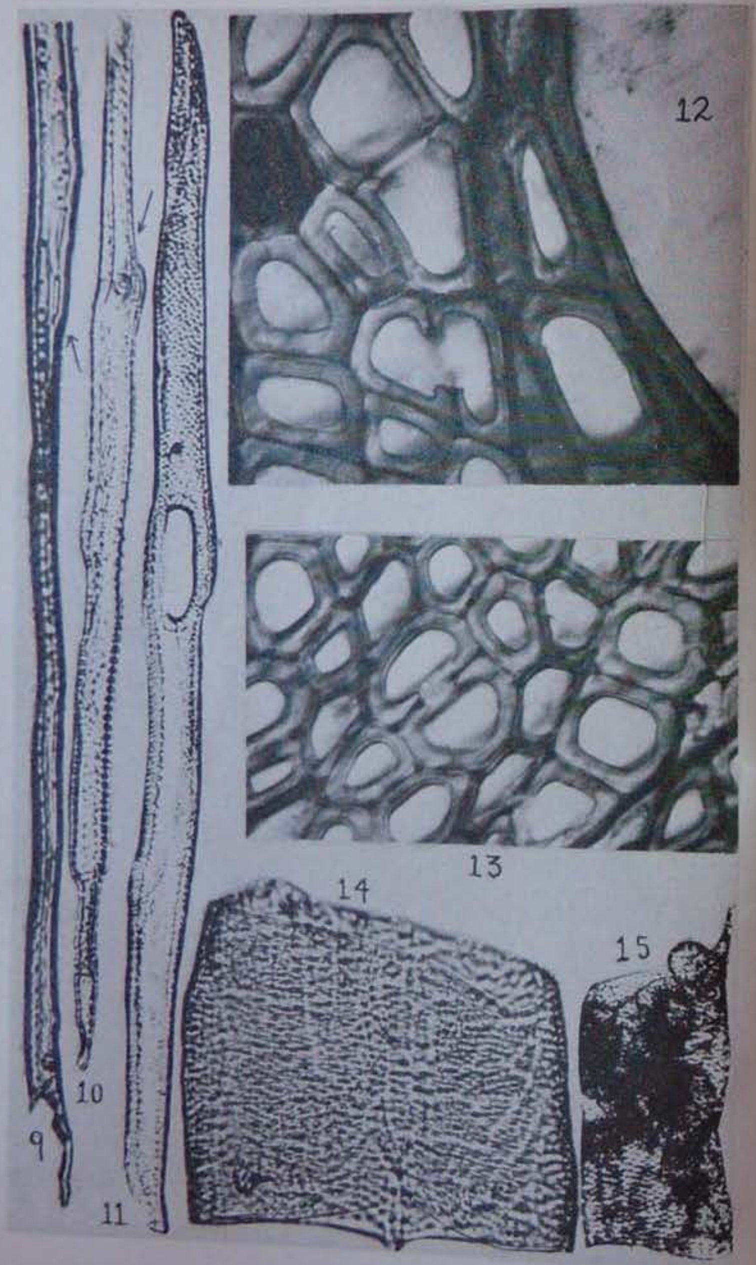

FACTORS AFFECTING DIMENSIONAL VARIATIONS OF VESSEL MEMBERS

By L. Chalk *and* M. M. Chattaway [1]
Imperial Forestry Institute, Oxford

In a recent paper (*4*) the authors discussed the relative merits of different methods of measuring the length of a vessel member. During the course of that investigation certain relationships between the different parts of a member were brought to light, but not being relevant to the points at issue, their consideration was postponed. The original data, amplified where necessary, have now been more fully analysed and the results are discussed below.

In the other paper it was shown that in diffuse-porous woods the total length of a vessel member is normally equivalent to that of the cambial initial from which it is derived. Turning now to the ring-porous woods, we find a somewhat different condition, for in them the large vessel members apparently undergo some kind of readjustment that leaves them distinctly shorter than the vessel members of the late wood. Since no such readjustment was found in equally large vessels in diffuse-porous woods it is thought that this behaviour must be due to some peculiarity in the development of the pore-zone vessels.

The rest of this paper is concerned with diffuse-porous woods only, and is devoted to a discussion of the factors affecting the range of vessel-member length within a single sample, and the relative proportions of tails and perforation plates. The different methods of increasing the number of cells in the cambial layer in storeyed and non-storeyed woods were found to have a definite influence both on the range of length within a sample and on the formation of tails. The method of division itself appears to be closely related to the length of the cambial cells. The range within a sample was found to be a function of the length, and, if a distinction is made between

[1] The authors wish to express their thanks to Mr. S. H. Clarke and Mr. E. D. van Rest, of the Forest Products Research Laboratory, Princes Risborough, for valuable criticism of the statistical treatment.

storeyed and non-storeyed woods, the range can be calculated from the mean length by a simple formula.

The discussion of the length of tails is based on the conception that the length of the overlapping common wall between undifferentiated cells that are to become vessel members is a constant proportion of the total length, this proportion being different in storeyed and non-storeyed woods. Measurement of this overlap was only possible by an indirect method involving the assumption that no readjustment takes place during the expansion of the vessels, and the method is therefore not applicable to ring-porous woods.

The total number of specimens examined was 133, representing 94 genera. All the measurements concerned with length were made on macerated material, 100 measurements of each feature being made from each sample. Vessel diameters were obtained from transverse sections, the tangential diameter only being used (except in the case of the pore-zone vessels), and not less than 50 measurements were made for each mean.

Ring-porous Woods: Total Length of Vessel Members

It has been shown (*4*) that, in diffuse-porous woods, the total length of a vessel member is equivalent to that of the cambiform parenchyma strands in the same sample and therefore closely approximates that of the cambial initial from which it was derived. In certain ring-porous woods, however, it has been found that the large vessel members of the pore zone are appreciably shorter than the vessel members of the late wood.

In Table I the mean lengths of the vessel members in the early wood and the late wood are given in columns (*a*) and (*b*). The differences between them (*a* minus *b*) are shown in column (*c*), a negative sign indicating that the early-wood members are shorter than those of the late wood. The significance of this difference is shown by comparison with the standard error of the difference of the means [2] which is given

[2] Calculated by the formula $E_d=\sqrt{E_a^2+E_b^2}$, where E_d = the standard error of the difference, and E_a and E_b = the standard errors of the means of the individual observations on the early and late wood.

in column (*d*). The difference (*c*) can be regarded as definitely significant if it is more than three times the standard error of the difference (*d*). This condition is fulfilled in all the woods except the last, *Maackia amurensis* Rupr., and since in this instance the difference is considerably more than twice the standard error of the difference of the means, there is a high probability that it too is significant.

TABLE I

Length of Vessel Members in the Early and the Late Wood of Certain Ring-porous Species

Species	Length of vessel members, in μ		Difference of means (a—b)	Standard error of differences of means	Mean diameter of vessels of pore zone, in μ
	Early wood (a)	Late wood (b)	(c)	(d)	(e)
Castanea sativa Mill.	356	582	—226	19.1	280
Quercus robur L.	389	560	—191	11.4	297
Paulownia tomentosa Stend.	173	329	—156	9.4	235
Quercus robur L.	466	592	—126	14.3	310
Ailanthus altissima Swingle.	227	352	—125	9.0	236
Ulmus campestris L.	243	344	—101	7.7	270
Morus alba L.	281	374	— 93	10.3	202
Fraxinus americana L.	278	346	— 68	8.1	289
Gleditsia japonica Miq.	159	218	— 59	15.1	179
Ulmus procera Salisb.	226	276	— 50	6.6	219
Fraxinus excelsior L.	230	271	— 41	6.8	174
Zelkova keaki Maxim.	205	244	— 39	8.3	293
Maackia amurensis Rupr.	154	178	— 24	9.3	175

Attempt was made to compare these measurements with the length of the cambiform parenchyma strands from the same regions. In the late wood the strands and vessel members were found to correspond. In the early wood, however, the tissues were often so distorted by the expansion of the vessels that satisfactory measurements of the parenchyma strands could not be made, though such figures as were obtained suggested very strongly that the strands there were of the same length as those in the late wood. In two diffuse-porous woods, which were measured for comparison, the mean lengths of the vessel members from the inner and outer parts of the growth layer were almost identical.

In contrast to vessel members of diffuse-porous woods and of the late wood of ring-porous woods, the vessel members of the pore zone are probably shorter than the cambial initials from which they are derived, and it is suggested that the tremendous lateral swelling of these vessels is accompanied by some readjustment of the end walls that results in a shortening of the total length. This need not affect the distance between the mid-points of the perforations, and measurements reveal that a given length of vessel includes the same number of members whether they are of the short early-wood type or of the longer late-wood type.

The pore-zone vessels showing this readjustment are of course comparatively wide, but it does not necessarily follow that the readjustment is solely determined by width. Indeed there are some grounds for thinking that it is not; for it will be seen from columns (*c*) and (*e*) in Table I that the greatest differences in length between the early-wood and late-wood vessel members are not always found in the species having the widest vessels. Further, no significant difference could be found between the lengths of the vessel members and the cambiform parenchyma strands in diffuse-porous woods with equally large vessels. It seems probable, therefore, that such shortening and readjustment of the vessel members is specially associated with ring-porousness and that the cause is likely to lie in some peculiarity in the development of the vessels in the pore zone.

Differences between the lengths of cambial initials and vessel members were observed by Bailey (*1*), from which he deduced that the initials tend to be slightly shorter than the vessel members in species with primitive types of vessel, and a little longer than these cells in plants having highly specialised conducting systems. But these differences are very much smaller than those observed by the authors between early and late-wood vessel members, which ranged from 13 to 47 per cent of the length of the late-wood members. Differences of the order of magnitude that Bailey cites were observed by the authors between vessel members and cambiform paren-

chyma strands, but judged by their standard errors these differences were not significant.

Diffuse-porous Woods: Total Length of Vessel Members and Variation Within a Sample

The total length of the vessel member having been shown to be equivalent to that of the cambial initial from which it is derived (except in the pore zone of ring-porous woods), it follows that variations in the length of individual members within a small sample depend on corresponding variations of the cambial initials. The latter are probably determined by the processes of growth and cell division employed by the cambium to keep pace with increase in circumference of the stem.

In the non-storeyed woods, increase in the number of the cambial initials is accomplished by transverse division of the longer cells (*6*), followed by readjustment, and it is logical to infer that the shortest cells would be about half the size of the longest. The relation will not be exact, since division is not entirely limited to the longest cells, and the shortest may in consequence be less than half the length of the longest. This hypothetical relation between the longest and shortest individuals was found to agree closely with the actual ranges of vessel-member length in the 104 specimens of non-storeyed woods examined. In the storeyed woods, on the other hand, cell increase in the cambium is typically through the formation of radial longitudinal walls (*2*); the absence of transverse divisions suggests the probability of a smaller range between the longest and shortest cells, and this is borne out by observations.

These considerations suggest that the extent of variation in vessel-member length within a single sample may be directly related to the lengths of the cambial initials and therefore to the lengths of the vessel members, but that the relation will be different in the storeyed and non-storeyed woods. It is possible that the range may be more closely related to maximum than to mean vessel-member length, but the maximum in any sample depends so largely on chance, unless an enormous number of measurements are taken, that it may be very different in two sets of 100 measurements from the same material. The mean length, being much less dependent on the number of measurements, can be obtained with reasonable accuracy from 100 measurements; hence if any relation exists between length and range it will be more apparent with mean than with maximum length. The range obtained from the extremes measured in 100 samples suffers from a similar defect and it was felt that this could be rectified to some extent by using the mean plus or minus three times the standard deviation as the measure of range. Standard deviations were therefore calculated for 104 non-storeyed and 26 storeyed woods. A representative selection of the ranges obtained in this way is given in Fig. 1; the range for each wood is shown by the horizontal lines, with their mid-points on the line *AB*. The vertical position of each sample on the line *AB* is determined by its mean length, according to the scale on the left.

Key to the Species Represented in Fig. 1

Non-storeyed woods

1. Adinandra dumosa Jack (Theaceae)
2. Warburgia Stuhlmannii Engl. (Canellaceae)
3. Turpinia pomifera DC. (Staphyleaceae)
4. Nyssa sessiflora Hook. (Nyssaceae)
5. Saccoglottis gabonensis Urb. (Humiriaceae)
6. Dillenia meliosmaefolia Hook. f. & Thoms. (Dilleniaceae)
7. Curtisia faginea Ait. (Cornaceae)
8. Schima noronhae Reinw. (Theaceae)
9. Pyrenaria Kunstleri King (Theaceae)
10. Curtisia faginea Ait. (Cornaceae)
11. Symplocos spicata Roxb. (Symplocaceae)
12. Apodytes dimidiata E. Mey. (Icacinaceae)
13. Altingia excelsa Noronha (Hamamelidaceae)
14. Myristica glauca Blume (Myristicaceae)
15. Apodytes dimidiata E. Mey. (Icacinaceae)
16. Ternstroemia japonica Thunb. (Theaceae)
17. Cunonia capensis L. (Cunoniaceae)
18. Corynanthe pachyceras K. Schum. (Rubiaceae)
19. Cassine crocea Presl (Celastraceae)
20. Platylophus trifoliatus D. Don (Cunoniaceae)
21. Magnolia pterocarpa Roxb. (Magnoliaceae)
22. Cornus sanguinea L. (Cornaceae)
23. Talauma spongiocarpa King (Magnoliaceae)
24. Platylophus trifoliatus D. Don (Cunoniaceae)

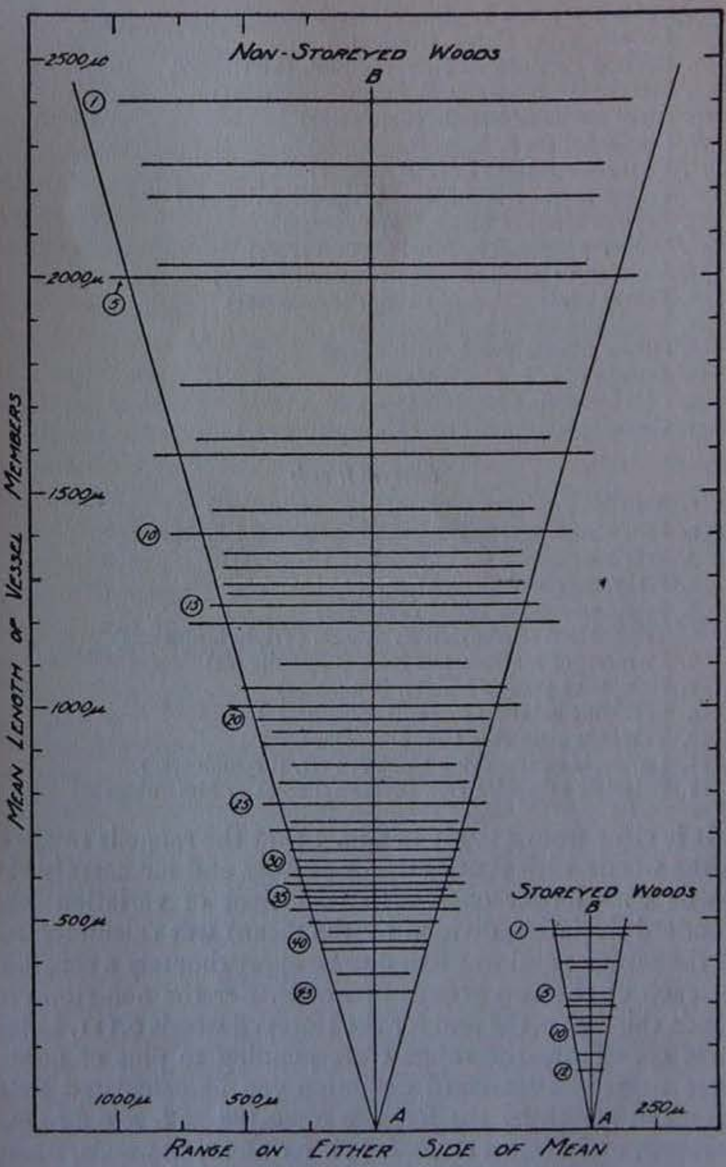

Fig. 1. Relation between range and mean length of vessel members.

25. Cunonia capensis L. (Cunoniaceae)
26. Docynia indica Decne. (Rosaceae)
27. Eugenia Barringtonii Hole, ms. ined. (Myrtaceae)
28. Platylophus trifoliatus D. Don (Cunoniaceae)
29. Alnus glutinosa Gaertn. (Betulaceae)
30. Ocotea bullata E. Mey. (Lauraceae)
31. Platanus orientalis L. (Platanaceae)
32. Pterocelastrus tricuspidatus Walp. (Celastraceae)
33. Arytera littoralis Blume (Sapindaceae)
34. Gonioma kamassi E. Mey. (Apocynaceae)
35. Semecarpus pandurata Kunz (Anacardiaceae)
36. Faurea Macnaughtonii Phillips (Proteaceae)
37. Mimusops elengi L. (Sapotaceae)
38. Ochna arborea Burch. (Ochnaceae)
39. Juglans regia L. (Juglandaceae)
40–42. Olea laurifolia Lam. (Oleaceae)
43. Cocculus laurifolius DC. (Menispermaceae)

Storeyed Woods

1. Aesculus turbinata Blume (Hippocastanaceae)
2. Entandrophragma cylindricum Sprague (Meliaceae)
3. Vepris lanceolata (Lam.) G. Don (Rutaceae)
4. Mansonia altissima A. Chev. (Sterculiaceae)
5. Berria ammonilla Roxb. (Tiliaceae)
6. Triplochiton scleroxylon K. Schum. (Triplochitonaceae)
7. Pterocarpus macrocarpus Kurz (Leguminosae)
8. Holoptelea grandis Mildbr. (Ulmaceae)
9. Erythrina suberosa Roxb. (Leguminosae)
10. Tabebuia glomerata Urb. (Bignoniaceae)
11. Dalbergia melanoxylon Guill. & Perr. (Leguminosae)
12. Balanites aegyptica Del. (Zygophyllaceae or Simarubaceae)

It is clear from a study of Fig. 1 that the range is smallest in the woods with short vessel members and increases in the woods with longer ones. The coefficient of variation (the standard deviation divided by the mean) was calculated for all the samples and was found to be approximately a constant for each of the two groups of woods. For the non-storeyed woods this was 0.188 and for the storeyed woods 0.111. Using these constants, the range corresponding to plus or minus three times the standard deviation can be calculated from the mean length by the formula $R = 0.188 \times L \times 6$ for non-storeyed, and $R = 0.111 \times L \times 6$ for storeyed woods, where R = range and L = mean length. This theoretical range for different lengths is shown on the figure by the oblique lines.

The greater disparity between the theoretical and the actual ranges in the storeyed woods may be partly accounted for by the fact that in many of them the horizontal seriation is not perfect, in the sense that some transverse divisions of the cambial initials probably occur as well as the typical radial ones. This tends to increase the range. For the same reason, the constant calculated for the storeyed woods is to some extent unsatisfactory, as it is influenced by the inclusion or exclusion of woods that are only partially storeyed. For example, *Aesculus turbinata* Blume, which is distinctly storeyed, has an exceptionally wide range for a storeyed wood, as can be seen in Fig. 1. It is noticeable that horizontal seriation is characteristic of woods with very short vessel members, which suggests that the radial division of the cambium only occurs when the cells are below a certain length. No definitely storeyed woods were observed with a mean vessel length greater than 500μ, while below this length there is an increasing tendency towards storeyed arrangement. The mean vessel member length in *Aesculus turbinata* Blume is 480μ, and examination shows that there are areas in the wood which are not storeyed.

Tails and Perforations of Vessel Members

The Overlap. The undifferentiated cell that is to become a vessel member is overlapped at each end by a similar cell that will form part of the same vessel, and it is in these overlapping parts of the walls that the perforations are subsequently formed. The perforation plate at each end may occupy the whole of the overlap, in which case there will be no tail, or it may be smaller than the overlap and the part left over will form the tail.

As a general rule the complementary perforation plates of two members are situated in the central part of the overlap so that any of it not used for the formation of the perforations forms two tails, one belonging to the element above and the other to the element below, as in Fig. 2. The lateral swelling of a vessel member is usually confined to the region between its own perforation plates. In individual elements, as seen in macerated material, the tail belonging to any particular element is visible, but the corresponding tail, formed on the next element, of course disappears when the elements become separated. The tail and the perforation at one end of a single vessel member therefore represent only part of the original overlap.

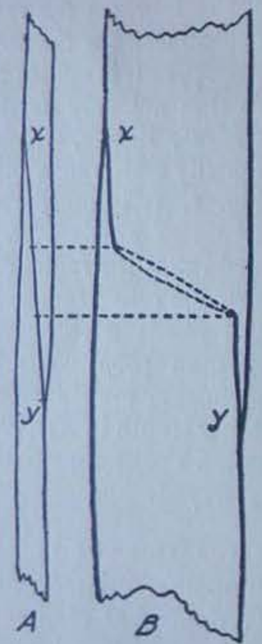

Fig. 2. Diagram illustrating the development of tails; *A*, undifferentiated cells; *B*, fully developed vessel members; *xy* represents the overlap and the dotted lines the portion of the overlap occupied by the perforation plate.

From these considerations it follows that any attempt to understand variation in tail length must be preceded by a study of the factors governing the length of the overlap. It was not possible to measure the actual overlap of undifferentiated cells about to develop into vessel elements, but the following method was used to obtain an approximate measure.

The average tail length in each sample was obtained from 100 vessel members, measured on macerated material, and at the same time the mean axial height of the perforations

was obtained. In diffuse-porous woods the axial or vertical height of the perforation represents an approximation to the length of the original overlap occupied by the perforation. Since the undifferentiated cell is extremely narrow before it enlarges, the overlapping portion is probably so nearly vertical that the difference between the length of the overlap occupied by the perforation and its vertical height should be negligible, as it appears that readjustment only takes place in the pore zone of ring-porous woods. The total length of the overlap was then estimated by adding twice the mean tail length to the vertical height of the perforation, the tail length being doubled to allow for the tail belonging to the next element.

It was evident at once that the calculated overlap bore a close relation to the total length of the element, but there appeared to be some disturbing factor, particularly in woods with very short elements. It has been pointed out that all the storeyed woods occurred at this end of the scale, and it was suspected that the different method of cambial division might be responsible for disturbing the relation with length. The woods were therefore separated into two groups, non-storeyed and storeyed. In each group the mean length of the overlap was expressed as a percentage of the total length in each sample and it was found that the non-storeyed woods, with an average percentage overlap of 27.7 ± 6.7 were significantly different in this respect from the storeyed woods, in which the percentage was 14.7 ± 5.5.

Factors affecting the axial height of the perforation. It was thought likely that the height of the perforation plate in any wood might be influenced by three distinct factors: (*a*) the type of perforation plate, (*b*) the length of the vessel member, and (*c*) the diameter of the vessel. In order to separate the effect of these three factors the measurements were divided into various groups, which are shown in Table II. Firstly, woods with simple perforation plates were separated from woods with scalariform plates. Both of these major classes were then subdivided according to the mean lengths of the vessel members to give three approximately equal groups in each. Since scalariform perforation plates only occur in woods with comparatively long vessel members, these six groups form a continuous series of increasing lengths from *A* to *F*. The mean diameters of these groups show no very marked differences, although the diameters are distinctly

TABLE II

Relation between Dimensions of Vessel Members and Height of Perforation Plates

Type of plate	Length of vessel member, in μ	Diameter of vessel member, in μ	Mean diameter of vessel in μ	Mean height of perf. plates in μ
Simple perforation plates	Group *A* Under 350 (mean 267)	Under 100	63	24
		Over 100	139	37
	Group *B* 350–500 (mean 440)	Under 90	43	36
		Over 90	122	46
	Group *C* Over 500 (mean 616)	Under 100	65	41
		Over 100	161	61
Scalariform perforation plates	Group *D* Under 1000 (mean 803)	Under 60	48	113
		Over 60	82	128
	Group *E* 1000–1500 (mean 1268)	Under 55	47	157
		Over 55	79	182
	Group *F* Over 1500 (mean 2045)	Under 90	75	300
		Over 90	113	436

higher in the simple than in the scalariform classes, so that, if there is any relation between length of vessel member and height of perforation, the mean heights of perforation plate in these groups should form a constantly increasing or de-

creasing series. In each length group the larger diameters were separated from the smaller so as to form two equal sub-groups with approximately equal lengths but widely different diameters. The results of this rearrangement of the data are shown graphically in Fig. 3, in which axial height of the perforation plate is plotted against total length of vessel

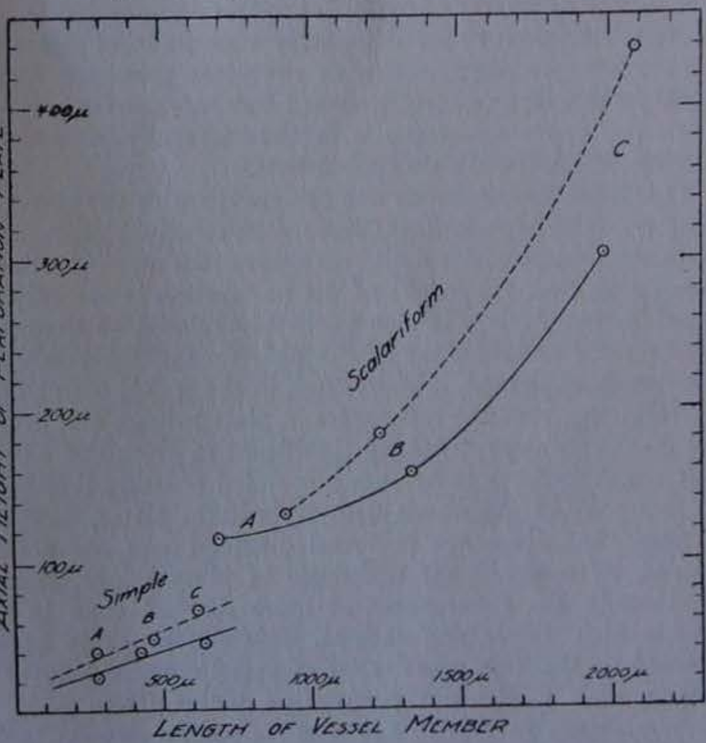

Fig. 3. Effect of diameter and length on the axial height of the perforation plate.

member. The dotted line represents the sub-groups with the greatest diameters and the unbroken line the smaller diameters. It will be seen that plate height increases with member length. The curves for the simple perforation plates, however, are not continuous with those for the scalariform, and this indicates that the change from scalariform to simple involves a decrease in the height of the perforation plate regardless of the total length of the vessel member; for example, at a length of 700μ, the height of the perforation plate will be greater if the plate is scalariform than if it is simple.

In the woods with simple perforations the relation is represented by a straight line, but in those with scalariform plates the line is distinctly curved. A possible explanation is that there are different types of scalariform perforation plates and that the types associated with the more primitive woods, with numerous, fine, closely spaced bars, are relatively longer than the types associated with the more advanced woods having only a few widely spaced bars.

It will be observed that the sub-groups with the larger diameters (the broken lines) have consistently higher plates than the groups with smaller diameters (the unbroken lines), suggesting that the height of the perforation is not only related to length but is also positively related to diameter. Using the standard error of the difference of the means, as previously explained, it was found, in the woods with simple perforations, that the differences in plate heights and in vessel diameters were definitely significant in groups *A* and *C*, but the differences in heights just failed of being significant in group *B*. In the woods with scalariform plates, however, a significant difference in vessel diameter was not accompanied by a significant difference in plate height, though graphically the difference was more marked than in the woods with simple perforations. This can probably be explained by the very great range of vessel member lengths in woods with scalariform perforation plates (from 480μ in *Buxus sempervirens* L. to 2400μ in *Adinandra dumosa* Jack), which makes the effect of member length on plate height difficult to eliminate by grouping. Although efforts to overcome this difficulty by careful selection increased the significance of the difference but did not establish an indisputable relationship, it is a fact that, however the figures are arranged, the groups with the larger vessel diameters always have the higher perforation plates.

Relation between tail and perforation plate. Although it has been shown above that the vertical height of the simple

perforation plate is positively related to vessel diameter, this does not necessarily mean that the percentage of the overlap occupied by the perforation is always higher in a broad vessel than in a narrow one, since member length also affects the proportion. For example, short vessel members overlap less than long ones, hence the same height of perforation plate occupies a greater proportion of the overlap in a short member than in a long one. This may be intensified in woods with very short vessel members by the change to storeyed arrangement, which has the effect of reducing the amount of overlap for any given length.

To distinguish between the effects of diameter and length, partial correlation coefficients were calculated for these factors and the percentage of overlap occupied by the perforation plate.

TABLE III

PARTIAL CORRELATION COEFFICIENTS BETWEEN VESSEL DIAMETER, MEMBER LENGTH, AND THE PROPORTION OF THE OVERLAP OCCUPIED BY THE PERFORATION PLATE

Proportion of the overlap occupied by the perforation plate on the basis of—	Scalariform	Simple	
		Non-storeyed	Storeyed
Vessel diameter, eliminating member length............	+0.382	+0.892	+0.530
Member length, eliminating vessel diameter...............	−0.143	−0.530	−0.646
Length and diameter.........	+0.439	+0.565	+0.533

These coefficients indicate a close positive relation between vessel diameter and the proportion of the overlap occupied by a simple perforation plate, and negative relation on a basis of member length. The figures suggest that the same relations exist in woods with scalariform perforation plates, but are either less definite or are disturbed by other factors. The comparatively low coefficient (+0.382) for the proportion of the overlap occupied by the scalariform perforation plate on a basis of vessel diameter is in agreement with the conclusion already reached, namely, that this relation is much less definite for scalariform than for simple perforation plates. Possibly scalariform perforation plates are of different types that vary in height independently of the length of the vessel member. The low coefficient (−0.143) for the proportion of the overlap occupied by the scalariform perforation plate on a basis of member length is probably attributable to the fact that the relation is represented by a curve as seen in Fig. 3.

The coefficients for length and diameter are of interest as they show a slight positive relation in each group, implying that, within a limited range of length, the longest members tend to be broader than the shortest. The maximum widths recorded, however, all occurred in woods with comparatively short vessel members; this, together with the fact that the groups with scalariform perforation plates have lower mean diameters than those with simple perforations, provides some support for the opinion that vessels tend to be smaller in the more primitive woods (*3*, *5*). The correlation coefficient between diameter and length for all the woods measured is, however, only -0.083 ± 0.073, from which it can be concluded that there is no general relation between vessel diameter and member length.

Since tail length is positively related to total length, the longest tails will tend to occur in woods with the longest vessel members, but this may be modified by the type of perforation plate and by the diameter of the vessels. Thus relatively more of the overlap will be taken up (and the length of the tails reduced) if the perforation plates are scalariform and if the vessels are wide. In the non-storeyed woods with simple perforations, the effect of vessel diameter is more marked than that of member length, and wide vessel members are usually associated with shorter tails, in spite of differences in length. Thus the simple correlation coefficient between vessel diameter and the proportion of the overlap occupied by the perforation plate in non-storeyed woods was found to be $+0.850 \pm 0.047$. The effect of length is almost completely masked by this relation.

An attempt has been made to illustrate the above relations

diagrammatically in Fig. 4. The vessel members decrease in length (left to right) from 2000μ in No. 1 (of which less than half the member is shown) to 270μ in No. 9. The length of the overlap, shown by the dotted lines, also decreases from left to right in proportion to the length, the proportion being lower for the storeyed members Nos. 7–9.

Since tail length is determined primarily by the extent of the overlap and is therefore positively related to member length, the longest tails will tend to occur in the longest vessel members. Thus the tail is longer in No. 1 than in No. 2, and in No. 3 than in No. 6. But tail length is also affected by the type of perforation plate and by vessel diameter; for example, the scalariform perforation plate in No. 2 occupies more of the overlap than does the simple perforation of No. 3, so that the tail of No. 2 is the shorter. The effect of diameter in members with simple perforations is illustrated by contrasting pairs of the same length but different diameters. Thus in Nos. 3 and 4, 5 and 6, and 7 and 8, the slight increase in the height of the perforation plate in the larger member is accompanied by a slight decrease in the length of the tail. The effect of vessel diameter on the length of the tail is less marked than that of member length.

In the storeyed woods, Nos. 7–9, the overlap is much smaller in proportion to member length (compare Nos. 6 and 7); hence the perforation plate, though slightly reduced in axial height, occupies a relatively greater proportion of the overlap (compare Nos. 6 and 7 and Nos. 5 and 8). No. 9 illustrates the fact that tails are usually entirely absent from very short vessel members.

The drawings (Fig. 4) illustrate variation in the mean dimensions in any sample; longer or shorter tails will obviously occur in individual members according to the relative positions of the adjoining members. The relative dimensions of the vessel members are based on the curves shown in Fig. 3, and care has been taken not to exaggerate the effect of the different factors involved. The diameters contrasted are only moderately small and large, being 60μ and 140μ, respectively, as compared with a range from 20μ to 266μ in the mean diameters of the samples measured. Similarly the lengths

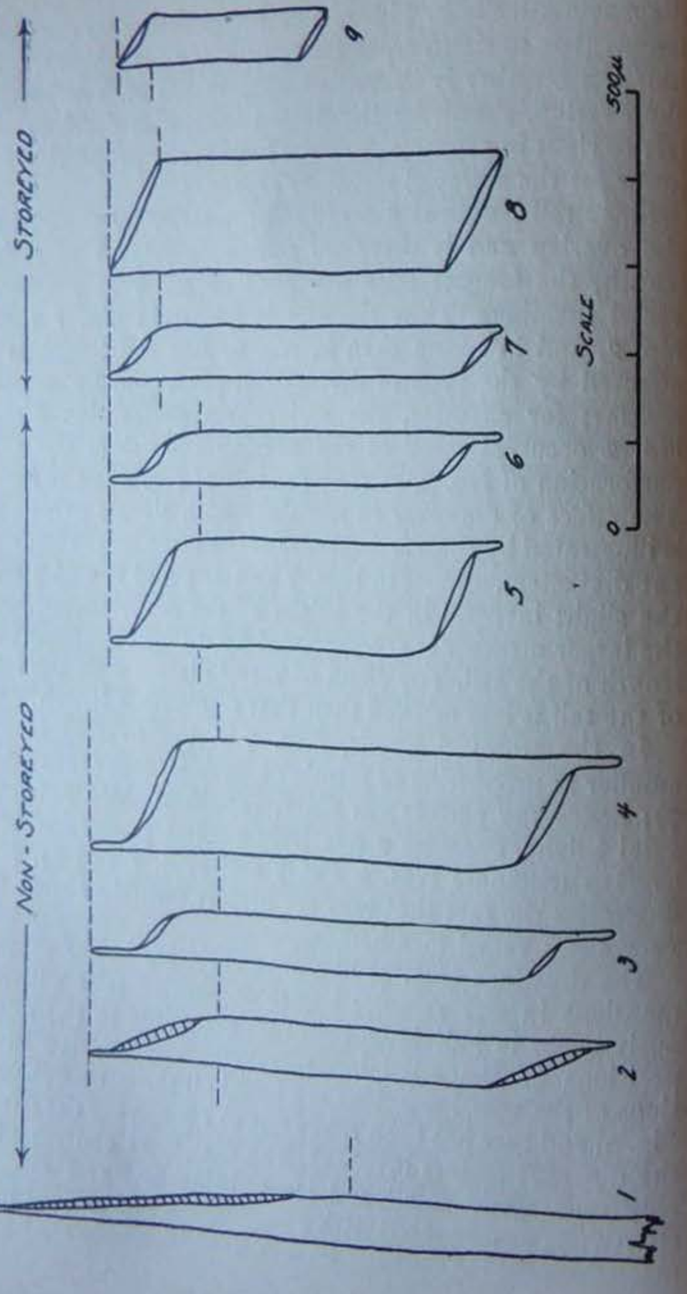

FIG 4. INFLUENCE OF TOTAL LENGTH AND DIAMETER ON TAIL LENGTH OF VESSEL MEMBERS

in the diagram range from 270μ to 2000μ, whereas there was an observed range of 170–2400μ in the mean length measured. These ranges will of course be greater in individual vessel members. The changes from scalariform to simple perforation plates (Nos. 2 and 3) and from non-storeyed to storeyed arrangement (Nos. 6 and 7) are at approximately the appropriate member lengths. Finally attention may be drawn to the fact that the great range in length of scalariformly perforated vessel members has rendered difficult the establishment of any relation between their diameter and the height of their perforation plates.

Conclusions. The interdependence of the various dimensions of a vessel member has a definite bearing on their diagnostic value and substantiates the customary use, in descriptions, of total length, diameter, and type of perforation plate. Since these three dimensions determine the length of the tail and the axial height of the perforation plate, the latter are not likely to be of diagnostic value where the others fail. A possible exception may occur in the case of scalariformly perforated vessel members, since the apparent disturbance of the relationships by different types of scalariform plate suggests that either the character of the scalariform plate itself or the length of the tail might be distinctive.

The close relation between length of the overlap and total length is of interest in connection with the method of measuring mean body length of vessel members on a section (*4*). This measurement depends on the mean distance between the mid-points of the perforation plates and, if we assume that the mid-point of the perforation plate is also the mid-point of the overlap, it is clear that the mean body length should represent a constant proportion of the total length. It might therefore be assumed that mean body length, measured on a section, would be exactly comparable with total length measured on macerated material; but it must be pointed out that the overlap, expressed as a percentage of the total length, is nearly twice as great with non-storeyed as with storeyed arrangement. In other words the mid-point of the overlap and of the perforation plate will be relatively nearer to the end of the member in a storeyed than in a non-storeyed wood. Comparison of Nos. 6 and 7 in Fig. 4 shows clearly that, although the total length is the same, the mean body length is greater in the storeyed than in the non-storeyed woods. In this example it would take rather more than seven members of type 6 to equal in length a vessel composed of six members of type 7.

The demonstrated relation between the mean total member length of a sample and the range in individual members suggests that maximum dimensions are not likely to be of greater significance than the mean in differentiating woods. Clarke and Rendle (7) have already shown that the mean is preferable to the maximum on grounds of relative accuracy.

Summary

1. The large vessel members of the pore zone in ring-porous woods have been found to be consistently shorter than the smaller vessels of the late wood. It is suggested that this is due to readjustment during the great lateral swelling of the vessel members rather than to differences in length in the cambial initials from which they are derived.

2. The extent of variation in vessel-member length within a single sample is directly proportional to the mean length, but the range is smaller in proportion to the length in storeyed than in non-storeyed woods. This is attributed to different methods of division by which the number of cells in the cambium is increased.

3. The tail at the end of a vessel member represents that part of the overlapping ends of the undifferentiated cells that is not ultimately occupied by the perforation plate. The average length of this common wall is proportional to the mean length, but the proportion is different in storeyed and in non-storeyed woods.

4. The mean tail length in any sample was found to be determined by the following factors: (*a*) the actual length of the overlap, which depends primarily on the mean length of the vessel members, but may be modified by storeyed arrangement; and (*b*) the amount of the overlap occupied by the perforation plate, which is determined by the length of the overlap, the type of perforation plate, and the diameter of the vessel. The longest tails usually occur in woods with long vessel members, but the length of the tail may be reduced by scalariform perforation plates, wide vessels, or storeyed arrangement.

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7. Rendle, B. J., and S. H. Clarke: The problem of variation in the structure of wood. *Tropical Woods* 38: 1–8; 1934.

THE YALE WOOD COLLECTIONS

Contributors

On December 31, 1934, the total number of catalogued samples in the Yale wood collections was 28,610, representing 2349 genera of 220 families. The accessions during the year amounted to 4532 and were from the following sources:

Africa: Mr. J. Collardet, Service des Bois Coloniaux, Paris; Syracuse University (originally from Oxford, England) through Mr. H. F. Marco (*East Africa*); Mr. C. Vigne (*Gold Coast*); Minister of the Colonies (*Madagascar*); Comité National des Bois Coloniaux (*Reunion Island*); Mr. Alexander Howard, England (*So. Africa*); Mr. Hans J. Schlieben, through Bot. Museum, Berlin-Dahlem, Germany (*Tanganyika*).

Australia: Mr. C. E. Carter, Canberra; Mr. H. E. Dadswell, East Melbourne; Mr. M. B. Welch, Sydney.

Brazil: Mr. J. Collardet, Service des Bois Coloniaux, Paris, France; Dr. Adolpho Ducke, Manáos; Field Museum of Natural History, Chicago, Ill.

British Honduras: Conservator of Forests, Belize.
Ceylon: Royal Botanic Gardens, Peradeniya (through Dr. I. E. Webber, Riverside, Calif.).
China: Mr. F. A. McClure, Lingnan Natural History Survey and Museum.
Chile: Dr. Carl Skottsberg, Göteborg, Sweden.
Colombia: Mr. A. Dugand G., Barranquilla.
Cuba: Dr. Juan T. Roig, Santiago de las Vegas.
Dominican Republic: Mr. James C. Scarff, San Pedro de Macoris.
Dutch Guiana: Mr. L. Junker, Corantyne.
Ecuador: Dr. A. Rimbach, Riobamba.
Fiji Islands: Dr. A. C. Smith, Asst. Curator, New York Botanical Garden, Yale University-Bishop Museum Fellow, 1933-34.
Hawaii: Bernice P. Bishop Museum, Honolulu; Dr. Harold L. Lyon, Experiment Station, H.S.P.A., Honolulu.
Honduras: Mr. J. B. Edwards (through Arnold Arboretum, Jamaica Plain, Mass.).
India: Forest Economist, Dehra Dun.
Japan: Field Museum of Natural History, Chicago, Ill.; Dr. R. Kanehira, Fukuoka.
Java: Mr. Alexander Howard, London, England; Dr. H. H. Janssonius, Amsterdam, Netherlands.
Micronesia: Dr. R. Kanehira, Fukuoka, Japan.
New Guinea: Mr. J. H. L. Waterhouse, Nodup, Raboul (*New Britain*); New York Botanical Garden (*Papua*).
Philippine Islands: Bureau of Forestry, Manila.
Tasmania; Mr. O. S. R. Overall, Cradle Mountain.
U. S. A.: Arnold Arboretum, Jamaica Plain, Mass.; Mr. S. B. Detwiler, Washington, D. C.; Field Museum of Natural History, Chicago, Ill.; Mr. H. W. Hicock, Prof. H. J. Lutz, Prof. G. E. Nichols, New Haven, Conn.; Dr. I. E. Webber, Riverside, Calif.; Mr. Fred Williamson, Baltimore, Md.
Venezuela: New York Botanical Garden; Dr. H. Pittier, Caracas.
Miscellaneous: Arnold Arboretum (Jamaica Plain, Mass.); Imperial Forestry Institute (Oxford, England); Mr. H. F. Marco (New Haven, Conn.); Kew Gardens (England).

Genera Added January 1-December 31, 1934

Acanthaceae
Graptophyllum
Himantochilus
Pseuderanthemum
Pseudoblepharis
Amarantaceae
Achyranthes
Anonaceae
Hexalobus
Richella
Apocynaceae
Anodendron
Ervatamia
Araliaceae
Cephaloschefflera
Plerandra
Reynoldsia
Bignoniaceae
Martinella
Melloa
Bombacaceae
Huberodendron
Campanulaceae
Apetahia
Brighamia
Clermontia
Cyanea
Delissea
Lobelia
Rollandia
Sclerotheca
Wahlenbergia
Caricaceae
Cylicomorpha
Caryophyllaceae
Schiedea
Celastraceae
Pachystima
Chenopodiaceae
Allenrolfea
Sarcobatus
Chlaenaceae
Leptochlaena
Chloranthaceae
Ascarina
Compositae
Ambrosia
Aster
Bidens
Chrysogonum
Dendroseris
Dicoria
Fitchia
Hesperomannia
Mimela
Remya
Robinsonia
Wilkesia
Convolvulaceae
Breweria
Merremia
Cornaceae
Toricellia
Cunoniaceae
Spiraeopsis
Cycadaceae
Cycas
Dioscoreaceae
Dioscorea
Ericaceae
Paphia
Eupteleaceae
Euptelea
Fumariaceae
Dicentra
Gesneriaceae
Cyrtandra
Gramineae
Schizostachyum
Guttiferae
Lorostemon
Mahurea
Hydrangeaceae
Broussaissia
Lecythidaceae
Foetidia
Leguminosae
Abrus
Aubrevillea
Desmodium
Fishlockia
Flemingia
Kaoue
Paramachaerium
Recordoxylon
Vacheliopsis
Liliaceae
Cordyline
Loganiaceae
Labordia
Loranthaceae
Loranthus
Phrygilanthus
Viscum
Magnoliaceae
Bubbia
Malvaceae
Dicellostyles
Hibiscadelphus
Julostyles
Kokia
Urena
Wissadula
Melastomaceae
Dissotis
Menispermaceae
Cocculus
Menthaceae
Marrubium
Monimiaceae
Matthaea
Trimenia
Moraceae
Mesogyne
Myrsinaceae
Embelia
Geissanthus
Tapeinosperma
Myrtaceae
Acicalyptus
Myrciaria
Nyctaginaceae
Ceodes
Ochnaceae
Testulea

OLEACEAE
Menodora
Steganthus
PALMACEAE
Iriartea (?)
Pinanga (?)
Pritchardia
Pyrenoglyphis
PANDANACEAE
Freycinetia
PHYTOLACCACEAE
Seguieria
PLANTAGINACEAE
Plantago
PODOCARPACEAE
Microcachrys
PRIMULACEAE
Lysimachia
PROTEACEAE
Finschia
RHAMNACEAE
Sageretia
RHIZOPHORACEAE
Haplopetalum
Weihea
ROSACEAE
Chamaebatia
RUBIACEAE
Badusa
Basanacantha
Calycosia
Catesbaea
Kadua
Leptactinia
Mapouria
Notopleura
Pittoniotis
Readea
Strempelia
Stylocoryne
Uragoga
Vangueria
RUTACEAE
Acradenia
Aeglopsis
Chalcas
Clausena
Micromelum
Thamnosma
SAPINDACEAE
Cupaniopsis
Lepidopetalum
SAPOTACEAE
Glycoxylon
Labramia
Nesoluma
SIMARUBACEAE
Aeschrion
Amaroria
Harrisonia
Maunia
SOLANACEAE
Datura
Nothocestrum
STERCULIACEAE
Abroma
Octolobus
STYRACACEAE
Mohrodendron
TILIACEAE
Schoutenia
UMBELLIFERAE
Eryngium
Heteromorpha
URTICACEAE
Cypholophus
Maoutia
VELLOZIACEAE
Barbacenia
VERBENACEAE
Aloysia
Faradaya
Geunsia
Phyla
VIOLACEAE
Viola
VITACEAE
Tetrastigma
ZYGOPHYLLACEAE
Tribulus

Sections for Microscopic Study

During 1934 there were added to the slide collections cross, radial, and tangential sections of 1062 specimens, representing 427 named species, 114 genera, and 29 families, making a total of 2394 named species, 1099 genera, and 162 families. Most of the accessions were received in exchange for wood samples, the principal sources during 1934 being: Professors I. W. Bailey and R. H. Wetmore, Harvard University; Professor W. W. Tupper, University of Michigan; Mr. H. E. Desch, Forest Research Institute, Federated Malay States.

Specimens Distributed

The total number of specimens distributed during 1934 was 1145. With the exception of 130 in general exchange, all were

for use in connection with definite scientific projects. The following report is to supplement those published in *Tropical Woods* 22: 2, 25: 26, 30: 39, 33: 24, and 37: 42.

SYSTEMATIC ANATOMY

Anacardiaceae. To Dr. R. Kanehira, Imperial Forestry Institute, Fukuoka, Japan: 1 sample each of *Lithraea* and *Trichoscypha*. (Total: 143 samples of 38 genera.)

Avicenniaceae. To Dr. Alexis Panshin, U. S. Forest Products Laboratory, Madison, Wisconsin: 25 samples of *Avicennia.*

Cupressaceae. To Mr. Alan S. Peirce, University of Illinois, Urbana: 126 samples of 12 genera.

Euphorbiaceae. To Dr. R. Kanehira: 7 samples of 5 genera. (Total: 348 samples of 107 genera.)

Flacourtiaceae. To Prof. W. W. Tupper, University of Michigan, Ann Arbor: 75 samples of 18 genera. (Total: 157 samples of 39 genera.)

Guttiferae. To Prof. R. H. Wetmore, Harvard University, Cambridge, Massachusetts: 26 samples of 12 genera. (Total: 256 samples of 21 genera.)

Hamamelidaceae. To Mr. Y. Tang, Fan Memorial Institute of Biology, Peiping, China: 22 samples of 6 genera.

Hypericaceae. To Prof. R. H. Wetmore: 7 samples of 3 genera. (Total: 77 samples of 6 genera.)

Nyssaceae. To Mr. Y. Tang: 9 samples of 2 genera.

Polygalaceae. To Prof. W. W. Tupper: 28 samples of 8 genera.

Simarubaceae. To Dr. Irma E. Webber, Rubidoux Laboratory, Riverside, California: 115 samples of 30 genera.

Styracaceae. To Mr. Y. Tang: 21 samples of 4 genera.

Surianaceae. To Dr. Irma E. Webber: 3 samples of *Suriana.*

Taxodiaceae. To Mr. Alan S. Peirce: 27 samples of 8 genera.

Verbenaceae. To Dr. Alexis Panshin: 160 samples of 23 genera.

SPECIAL INVESTIGATIONS

To Prof. I. W. Bailey, Bussey Institution, Forest Hills, Mass.: Alangiaceae, 3 samples of *Alangium;* Clethraceae, 13 samples of 2 genera; Cornaceae, 27 samples of 6 genera, Flacourtiaceae, 165 samples of 39 genera; Humiriaceae, 19 samples of 3 genera; Nyssaceae, 8 samples of 3 genera; Pandanaceae, 14 samples of 2 genera; Staphyleaceae, 10 samples of 3 genera; Styracaceae, 22 samples of 3 genera; Winteraceae, 17 samples of 3 genera.

To Miss M. M. Chattaway, Imperial Forestry Institute, Oxford, England: Tiliaceae, 5 samples of *Grewia.*

To Mr. K. A. Chowdhury, Forest Research Institute, Dehra Dun, India: Dipterocarpaceae, 8 samples of 3 genera.

To Prof. Richard Kräusel, Geolog. Paleontologisches Institute, Frankfurt am Main, Germany: Pinaceae, 9 samples of 2 genera.

To Mr. C. R. Metcalfe, Kew Gardens, England: Olacaceae, 1 sample of *Ximenia;* Santalaceae, 2 samples of *Santalum.*

To Dr. Newell A. Norton, U. S. Forest Products Laboratory, Madison, Wisc.: Leguminosae, 16 samples of 4 genera; Rutaceae, 1 sample of *Fagara.*

To Prof. R. B. Thomson, University of Toronto, Canada: Pinaceae, 1 sample of *Cedrus.*

To Prof. W. W. Tupper, University of Michigan: Euphorbiaceae, 10 samples of *Euphorbia.*

To Prof. R. H. Wetmore, Harvard University, Cambridge, Mass.: Bixaceae, 5 samples of *Bixa;* Cistaceae, 1 sample of *Cistus;* Crossosomataceae, 1 sample of *Crossosoma;* Dilleniaceae, 3 samples of *Wormia;* Saurauiaceae, 6 samples of *Saurauia.*

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

To Prof. Robert H. Woodworth, Harvard University, Cambridge, Mass.: Passifloraceae, 12 samples of 5 genera.

Timbers of Tropical America now out of print

Timbers of Tropical America was published by the Yale University Press in 1924. The printing was from linotype and the forms were destroyed in 1927. The Press sold its last copy of the book in November 1934, so that the work is permanently out of print.

CURRENT LITERATURE

La guana y su aprovechamiento. By HERMANO LEÓN. *Memorias de la Soc. Cubana de Hist. Nat.* (Habana) 8: 63–68; pls. 6; July 7, 1934.

Sterculia cubensis Urban, of the provinces of Camagüey and Oriente, Cuba, called Guana, is a tall tree whose bark, after soaking in water, may be separated into thin tough layers. The bark fiber has been employed extensively for tying tobacco, and is suitable also for the manufacture of hats. The wood is said to be useful for carpenter work. Cutting of the tree is prohibited by law, but since the trees can not be utilized unless they are cut, it is recommended that the law be abrogated.—P. C. STANDLEY.

La guázima. By JESÚS GONZÁLEZ ORTEGA. *Mexico Forestal* 12: 9: 166–168; September 1934.

A detailed account of the botany and technology of *Guazuma ulmifolia* Lam., a small to medium-sized sterculiaceous tree widely distributed in tropical America.

Vegetation of the northwestern coast of Mexico. By FORREST SHREVE. *Bull. Torrey Bot. Club* (Menasha, Wisconsin) 61: 373–380; 3 figs.; October 1934.

The most arid region in North America lies along the lower course of the Colorado River and on both sides of the head of the Gulf of California. In portions of this range *Larrea tridentata* and *Franseria dumosa* form 98 per cent of the vegetation but often cover only 4 to 15 per cent of the ground surface. Going south from central Sonora there is a steady increase in the number of common perennials and in the number of vegetative types represented.

At about Lat. 28° 30′ the vegetation of streamways and alluvial plains begins to be much more dense and many new trees and shrubs occur, the majority of them forms that are dominant in the vegetation farther south. Between Lat. 28° and Lat. 27° there is a rapid change in the character of the vegetation, which becomes denser, taller, and richer in composition, at the same time that a few less xeromorphic species appear. This is the region of transition from desert to the arid type of thorn forest that extends southward from the Mayo River to southern Sinaloa, with little change in physiognomy and ecological characteristics, but with constant additions to its flora.

It is within a relatively short distance that the extended area of desert merges into thorn forest, a type of vegetation also of wide distribution on the Pacific coast of Mexico. The transition coincides closely with the attainment of an annual rainfall of 375 mm. and the disappearance of frost.—P. C. STANDLEY.

New or otherwise noteworthy Apocynaceae of tropical America. IV. By ROBERT E. WOODSON, JR. *Annals Missouri Bot. Gard.* (St. Louis) 21: 613–623; Dec. 12, 1934.

Among the new species described is *Cufodontia arborea*, a large tree of Oaxaca, Mexico, the third species of the genus to become known.

Ökologische Studien über Ameisen und Ameisenpflanzen in Mexiko. By ELISABETH SKWARRA. Königsberg, Germany, 1934. Pp. 153; 41 text figs; 1 map.

The publication is devoted largely to the ants inhabiting orchids and bromeliads, but treats also those associated with trees and shrubs of the genera *Cecropia* and *Acacia*. It includes a brief description of the region of Mirador in the State of Veracruz, Mexico.

Economic products from British Honduras. *Bull. Imperial Institute* (London) 32: 3: 356–375; November 1934.

The subjects treated are secondary timbers (Rosewood and Balsa), crown gum, oleoresin of *Protium* sp., fibers of Cohune Palm and wild plantain, and starch products of cassava and *Zamia furfuracea* L.f.

The resources of British Honduras. *Bull. Imperial Institute* (London) 32: 3: 376–410; November 1934.

A well prepared, concise report subdivided as follows: GENERAL DESCRIPTION: Geographical position; climate and rainfall; health; population; agricultural position; means of transport; forests. ECONOMIC HISTORY: Logwood; Mahogany; other timbers; chicle; cattle industry; agriculture; sponge industry; Cohune nut industry.

Balsa (*Ochroma lagopus* Sw.) i jej wlasności mechaniczne. (With résumé in French.) By JULJAN RAFALSKI. Reprinted from *Roczniki Nauk Rolniczych i Leśnych* 33: 120–136; 1934, and distributed by Institute of Forest Engineering, Univ. of Poznań.

Although the bulk density of dry Balsa wood is only 0.0762, Professor Rafalski finds that the resistance of the timber to endwise compression and to static bending is approximately half as great as for Spruce (*Picea excelsa* Link) of the best quality having a density 4–5 times greater. This fact indicates a need for further investigation of exceptionally light-weight timbers with a view to finding factors other than density that influence the mechanical properties of wood.

Révision du genre *Mollia* Mart. et Zucc. By CHARLES BAEHNI. *Candollea* (Geneva) 5: 402–426; April 1934.

The genus *Mollia*, placed by some authors in the Tiliaceae, is intermediate between the Bixaceae and Cochlospermaceae. The family Bixaceae should be redefined, to contain the present Bixaceae, the Cochlospermaceae, and the genera *Mollia*, *Nettoa*, and *Trichospermum*. *Mollia* consists of 15 South American species. As new there are described from Brazil, *M. lepidota*, var. *casiquiarensis*, *M. cuneata*, *M. intricata*, *M. paraensis*, *M. Sprucei*, and *M. lucens*.—P. C. STANDLEY.

Colheita de material botanico na região amazonica (relatorios de 1929/30 e 1931/33). By ADOLPHO DUCKE. Separata do *Boletim do Ministerio da Agricultura de Janeiro a Marco e Abril a Junho de 1934*; pp. 1–27. Rio de Janeiro, 1934.

A condensed account of the author's itineraries in the State of Amazonas, Brazil, during 1929–30 and 1931–33, where he was engaged in study of the flora. There are brief descriptions of the vegetation at localities where collections were made, with mention of the prominent trees and other plants, for many of which vernacular names are cited.

Einsteinia, um novo e magnifico genero de Rubiaceas de Amazonia brasileira. By ADOLPHO DUCKE. *Annaes da Academia Brasileira de Sciencias* (Rio de Janeiro) 6: 105–107; pls. 1, 2; Sept. 30, 1934.

Einsteinia speciosa (*Kotchubaea speciosa* Ducke, 1932) is the type of a new genus of the Rubiaceae, tribe Gardenieae. It is a small or medium-sized tree, growing about Manáos and elsewhere on the upper Amazon in Brazil.

Additional notes on *Santalum* and *Vaccinium* from the Pacific. By C. SKOTTSBERG. *Medd. Göteborgs Bot. Trädgard* (Göteborg, Sweden) 9: 185–192; 3 figs.; 1934.

Santalum multiflorum and *S. raiatense* recently published by J. W. Moore from Raiatea, Society Islands, are to be referred to the synonymy of *S. insulare* Bert. Notes are published also upon *S. Macgregorii* F. Muell. and *S. papuanum* Summerhayes of Papua. *Vaccinium raiatense* J. W. Moore, described from Raiatea, is a synonym of *V. cereum*.

New or noteworthy trees from Micronesia. VII. By RYÔZÔ KANEHIRA. *Bot. Mag.* (Tokyo) 48: 730–736; 5 figs.; October 1934.

There are reported the following trees, new species unless the author of the species is cited: *Cyathea affinis* (Forst.) Sw.; *C. aramaganensis; Exorrhiza carolinensis* (Becc.) Burret, vernacular name Kiriyau; *E. ponapensis* (Becc.) Burret, Kotop; *Pithecellobium palauense; Drypetes rotensis; Cyathodes mariannensis.*

A record of the results obtained with experimental treated sleepers in the Indian railways between 1911 and 1916. By S. KAMESAM. Forest Bulletin No. 85, Forest Research Institute, Dehra Dun, 1934. Pp. 35; 7¼ x 9¾. Price 10 d.

"In all, according to the records available and the figures given in the present bulletin, 8901 sleepers were laid down by the Indian railways for the trials under review. Of these, 2868 sleepers were treated by the Powell Syndicate, Bombay, and 103 sleepers were treated with creosote under pressure in England, while the rest were treated by the Forest Economist or, under his instructions, by local forest officers. No sleepers were laid down in South India. Except for 711 sleepers (about 8 per cent of the total) impregnated under pressure with green oil and earth oil, or with creosote in England, the experimental sleepers were all treated in open tanks. The sleepers comprised 17 different species of indigenous woods, and were laid in 19 different localities in India and Burma."

"To sum up the situation, creosote is an excellent and well tried preservative for India, but from the results obtained with arsenic in the trials recorded in this Bulletin and in other countries, and taking into special consideration the cost factor, the possibility of arsenic, or preferably arsenic and copper together, taking the place of creosote in India, is a matter which needs very careful consideration."

"Latex canals" of the Apocynaceae. By H. E. DESCH. *Malayan Forester* 3: 4: 219; October 1934.

From an examination of the dried-up material extracted from the radial passages in *Alstonia congensis* Engl. the writer concludes that the openings were originally occupied by unlignified parenchymatous tissue in which small latex canals were imbedded. In position and form the passages suggest leaf traces and some authors have so interpreted them.

Notes on Malayan timbers. II, III. By H. E. DESCH. *Malayan Forester* 3: 3: 138–147; 2 plates; July 1934; 3: 4: 191–202; 1 plate; October 1934.

These two papers are in continuation of a series begun in the April issue of the magazine (see *Tropical Woods* 39: 65). The timbers described in Part II are Sepetir (*Sindora* spp.), Keruing (*Dipterocarpus* spp.), and Kapor (*Dryobalanops aromatica* Gaertn. f. and *D. oblongifolia* Dyer); in Part III, Chengal (*Balanocarpus Heimii* King) and Resak (*Shorea* spp., for the timber but not for the tree in the jungle, which is *Vatica* spp.). Each wood is illustrated by a good picture of the cross section at five times natural size.

Notes on Malayan Dipterocarpaceae. II. By C. F. Symington. *Gardens' Bull., Straits Settlements* (Singapore) 8: 1–40; pls. 1–10; Oct. 10, 1934.

The writer is of the opinion that the genus *Scaphula* Parker (1932) should not be separated from *Anisoptera*. Detailed notes are published regarding various species of *Anisoptera*, *Hopea*, *Balanocarpus*, and *Cotyelobium*. *Vatica dulitensis* is described as new from Sarawak, where it is called Resak Tiong or Resak Bukit; the yellowish wood is a useful timber. *Hopea longiflora* Brandis of Sarawak is transferred to *Balanocarpus*, although the author suggests that "the disruption of the genus *Balanocarpus* is imminent and it will be possible to distribute its members among various groups of *Hopea* and *Shorea*."—P. C. Standley.

Notes on the biology of *Macaranga* spp. By J. A. Baker. *Gardens' Bull., Straits Settlements* (Singapore) 8: 63–67; Oct. 10, 1934.

Of 225 species of *Macaranga*, only 20 are recorded for the Malay Peninsula, where they are outstanding and often dominant second-growth plants, sometimes in nearly pure stands. Their appearance in the succession follows the preliminary phase of *Imperata arundinacea* and *Melastoma polyanthum*, and they may be regarded as Old World counterparts of the neotropical Cecropias. Both genera are characteristic of advanced secondary growth and both are "myrmecophilous." Macarangas are distributed largely through the agency of birds.

In *Macaranga* ants are associated with fistular stems or with food bodies borne on the leaves or stipules, the non-myrmecophilous species having neither of these specializations. Detailed notes are published regarding the ants and other associated insects found upon the plants.—P. C. Standley.

Plantae Hochreutineranae. Etude systématique et biologique des collections faites par l'auteur au cours de son voyage aux Indes Néerlandaises et autour du monde pendant les années 1903 à 1905. Fascicule III. By B. P. G. Hochreutiner. *Candollea* (Geneva) 5: 175–341; April 1934.

An annotated enumeration of plants collected by the author on a journey around the world, the families covered being Apocynaceae to Compositae, inclusive, of the Engler sequence. Vernacular names are cited for numerous species.

Mikrographie des Holzes der auf Java vorkommenden Baumarten. By H. H. Janssonius. Leiden: E. J. Brill. 1934. Pp. 581–835; 5½ x 9; text figs. 323–342.

The latest instalment of this well known work forms the third and concluding part of Volume V, which is devoted to the Monochlamydeae of Bentham and Hooker. The descriptions cover the latter half of the Euphorbiaceae and follow the same general plan as in the earlier parts of this volume. The colossal task of preparing and publishing systematic descriptions of all the woods of Java collected by Koorders and Valeton, to the number of over one thousand species, appears to be approaching completion. Since the inception of the work thirty years ago under the direction of the late Professor Moll, Dr. Janssonius has published detailed descriptions of 885 species. It is understood that the remaining woods have already been described and it is hoped that their publication will not be long delayed.

At this stage it may be appropriate to consider briefly the scientific significance of this unique and painstaking investigation. It is no disparagement to the work of the authors to regard these five volumes as being essentially a preliminary study. Useful as they are in their present condition, their ultimate value will depend on the use that is made of them for compiling in a further volume a summary of their conclusions, which may prove to be without parallel in the literature of plant anatomy. A key to the identification of all the woods of Java is the natural corollary of what has already been published; but of much greater scientific importance would be a study of the systematic significance of anatomical characters based on the largest collection of complete wood descriptions that has ever been attempted. It may be contended that the form of the descriptions is too detailed for ordinary reference purposes. On the other hand it was necessary in a pioneer work of this kind to err on the side of redundency in order to make certain of including all the essential features. It now remains to pick out the essentials.

If Dr. Janssonius is enabled to round off his great work in the manner suggested he will earn the gratitude not only of wood anatomists but of botanists in general.—B. J. RENDLE, *Forest Products Research Laboratory, Princes Risborough.*

A study of the dark colored duramen of ebony. By K. GRIFFIOEN. *Proc. Roy. Acad. Amsterdam* 36: 2: 897–8; 1933.

The analysis of the wood of Gjaja Merah = (*Diospyros* sp.) yielded the following percentages, calculated on a dry basis: moisture 7.75; ash 0.6; cellulose 43.3; lignin (containing the coloring matter) 39.6. The coloring matter was isolated by an initial treatment with sodium hydroxide to obtain a dark brown fluid. Hydrochloric acid produced a gelatinous precipitate, which was washed free of acid, slowly dried in air and with ether. A brown amorphous powder was obtained which had the following characteristics: (1) It was soluble in alkalies and trichloracetic acid, very slightly soluble in ethyl alcohol, and insoluble in water, ether, and acids. (2) Fusion with potassium hydroxide yielded substances with a phenolic nucleus, such as phloroglucinol, pyrocatechol, and protocatechuic acid. (3) By treatment with an alcoholic nitric acid mixture a nitro-compound was obtained, which, in a dry state, was a yellowish brown amorphous powder, soluble in alcohol, acetone, glacial acetic acid, alkalies, and in a 1 per cent solution of sodium fluoride, but was insoluble in ether and benzene. (4) Elementary analysis gave: $C=60.5$ per cent and $H=4.1$ per cent. (5) Acetylbromide dissolves only a very small part of the brown matter.

All of the foregoing properties agree with those of ulmic acids, including those isolated from brown coal and from "Kasseler Braun." It is concluded that a large part of the coloring matter of Ebony wood consists of ulmic acids. From microchemical examination of sections of Ebony wood the author is convinced that the transition of the sapwood into

the heartwood is accompanied by a transformation of lignin into ulmic substances.

The heartwood contains brown ulmic acids within the ray and wood parenchyma cells. In the libriform fibers and the vessels was found a black substance, which is insoluble in alkalies and only partly oxidizable by alcoholic nitric acid, and may be regarded, very probably, as decarboxilized ulmic acids ("huminen"). The sapwood does not contain these black ulmic substances, and the cell walls give very intensive lignin reactions, whereas in the heartwood the reactions for cellulose are positive and those for lignin very feeble. These facts seem to indicate that the lignin in the cell walls of the sapwood is oxidized and deposited within certain cells of the heartwood. A part of this ulmic acid may be afterwards decarboxilized.

The formation of ulmic substances in nature from dead plant material is viewed as the first stage of fossilification. This process apparently takes place under the influence of bacteria. By this process also ulmic substances (at first ulmic acid, which afterwards may be decarboxilized) originate (partly or exclusively) from lignin.

Ulmification and fossilification seem to be analogous, if not identical, processes, and the case described appears unusual since we meet here with ulmification in a probably sterile environment.—CARL G. DEUBER, *Department of Botany, Yale University.*

Contributions a la flore de la Nouvelle-Calédonie. LIV. Plantes recueillies par M. Ch. Bergeret. By A. GUILLAUMIN. *Candollea* (Geneva) 5: 148–152; December 1932.

A report upon a collection of 183 numbers of plants from the Loyalty Islands and Noumea, the majority of them trees and shrubs. Vernacular names are cited for most of the species.

Wood borers in Australia. Part 3. Pin-hole borers. Trade Circ. No. 25, Div. For. Products, Council for Sci. & Ind. Research, Melbourne, 1934. Pp. 11; 6 x 9½; 5 figs.

"This circular is one of the series in which the main types of borers which attack timber in Australia are described. The various pin-hole borer beetles are of importance because of their wide-spread activities and because specifications have in the past frequently excluded timber attacked by them. It is essential to recognize the difference between the attack of these beetles and that of other types such as *Lyctus* and *Anobium*.

"Their activity is restricted to the living or recently fallen tree, and the presence of pin holes in dried timber is not an indication that further attack will follow. The rejection of dried timber because of pin holes is therefore unjustified unless the holes are sufficiently numerous as to cause a decrease in strength in the piece. The removal of this practice would assist the timber industry and do no harm to the timber user, and it is hoped that the circulation of correct information as to the habits of pin-hole borers will help in this respect."

A monograph of the genus *Pavetta* L. By C. E. B. Bremekamp. *Repertorium Spec. Nov.* (Berlin-Dahlem) 37: 1–208; Nov. 10, 1934.

The genus *Pavetta* of the Rubiaceae is distributed through tropical and southern Africa, Asia, tropical Australia, and Melanesia. It is composed chiefly of shrubs, only a few species attaining the size of trees. There are recognized and described briefly 343 species, many of which are new.

Extension et affinités du genre *Humbertiella* Hochr. By B. P. G. Hochreutiner. *Candollea* (Geneva) 5: 1–4; August 1932.

Humbertiella, of the Bombacaceae, as published in 1926 consisted of a single species, native in Madagascar. A second species, *H. Henrici*, now is described from the same island.

Especes et localités nouvelles d'Euphorbiacées d'Afrique et de Madagascar. By J. Léandri. *Bull. Soc. Bot. France* (Paris) 81: 449–454; 1 fig.; 1934.

Sapium Aubrevillei is described as new from Ivory Coast, the vernacular names Cocoti and Losiokos being reported. From Madagascar there are described five new species of *Phyllanthus*.

Paper-making trials with coniferous woods from Southern Rhodesia: *Pinus insignis*, *Pinus patula*, and *Cupressus lusitanica*. *Bull. Imperial Institute* (London) 32: 3: 343–348; November 1934.

"The examination of these three woods has shown that they all furnish very good yields of strong, long-fibered pulp under relatively mild experimental conditions of treatment, and with a low consumption of alkali. The pulps obtained furnished papers possessing excellent strength and generally similar in appearance and character, but (as previously observed at the Imperial Institute in the case of pulps obtained from coniferous woods) the pulps were very resistant to the action of bleaching solutions, so that it was not possible to reduce them easily and satisfactorily to a good pale color. It is probable that by more drastic cooking treatment a whiter product could be obtained, but only at the expense of the yield of pulp.

"In actual practice the yields of pulp would be rather lower than those obtained in the present case under experimental conditions, but it is unlikely that they would differ materially from the yields normally found for coniferous woods, *i.e.*, about 45 to 55 per cent from the oven-dry wood.

"New Zealand *P. insignis* wood has been shown in the United States to give good yields of pulp when treated by the principal pulping methods, but when using the acid sulphite process certain unexplainable difficulties were met with in cooking this and woods of similar species.

"Judging from the character of the pulps obtained in the present investigation there is little doubt that all three woods would prove suitable for the manufacture of strong kraft wrapping papers, by either the soda or the sulphate process. Further, taking into consideration the appearance and color of the *Pinus* woods examined and the fact that the resin contents are low, no difficulty should be experienced in using these woods for making mechanical wood-pulp for newsprint. Owing to its rather dark color and knotty character the *Cupressus* wood would be less suitable for this purpose, and it is likely that a rather strongly colored pulp would result."

Espèces nouvelles de *Drypetes* (Euphorbiacées) de la Côte d'Ivoire. By J. LÉANDRI. *Bull. Soc. Bot. France* (Paris) 81: 458–460; 1934.

From Ivory Coast the following new species of *Drypetes* are described: *D. Aubrevillei*, vernacular names Chleubu and Piatou; *D. Pellegrini*, Kahibéhi; *D. mottikoro*, Mottikoro.

New material of *Monotes Kerstingii* from the Gold Coast. By HELEN BANCROFT. *Kew Bull. Misc. Information* 6: 233–237; 1934.

Contains an account of the occurrence of this tree in the Gold Coast and a detailed description of the wood. The woods of *Monotes* and *Marquesia*, the two genera comprising the tropical African section Monotoideae of the Dipterocarpaceae, are of special interest because they are not known to contain resin ducts, such as characterize the much larger and mostly Indo-Malayan group, Dipterocarpoideae. The present paper is a continuation of Dr. Bancroft's work on the family, with particular reference to its geological history and present and past distributions. (See *Tropical Woods* 36: 68, Dec. 1, 1933.)

Note sur deux plantes nouvelles de Congo Belge. By K. GRAM. *Botanisk Tidsskrift* (Copenhagen) 42: 416–419; figs. 1, 2; 1934.

From Belgian Congo there are described as new and illustrated two trees, *Monopetalanthus Jenseni* and *Aneulophus congoensis*.

The flora of the Libyan Desert. By W. B. K. SHAW and J. HUTCHINSON. *Kew Bull. Misc. Information* 281–289; 1934.

A brief account is given of the vegetation of the Libyan Desert as observed during a trip of more than 6000 miles by automobile during October and November, 1932, in largely unexplored country. The vegetation as a whole is naturally meager, as indicated by the list of plants collected, the trees being confined largely to oases and dry stream beds. The principal trees and shrubs mentioned as occurring in the region are *Maerua crassifolia*, called Sareh; *Tamarix mannifera; Acacia flava, A. spirocarpa*, and *A. tortilis; Salix safsaf; Salvadora persica*, Shau, Arak; *Capparis decidua; Boscia octandra; Balanites aegyptiaca;* and *Leptadenia Spartium*.—P. C. STANDLEY.

Préparation des collections botaniques et forestières dans les pays tropicaux. By D. NORMAND. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 14: 156: 681–687; August 1934.

A description of simple and practical methods of collecting and preparing herbarium and wood specimens in tropical countries.

The evolutionary status of plant families in relation to some chemical properties. By JAMES B. MCNAIR. *American Journal of Botany* 21: 8: 427–452, October 1934.

"The object of this paper is to show that, when the plant families which contain fats, volatile oils, and alkaloids are first separated according to the climate of habitat, some chemical and physical properties of these substances vary in accordance with the degree of evolution of the plant families containing them; and the probability is that, the more highly organized the plant, the more complex are its chemical products."

Terminal and initial parenchyma in wood. By FRANK W. JANE. *Nature* 133: 534; Apr. 7, 1934.

"Mr. K. A. Chowdhury's remarks upon the position of the parenchyma in *Terminalia tomentosa* (*Nature* 133: 215; Feb. 10, 1934) would seem to be applicable to other woods also. A recent examination of the wood of *Cedrela odorata* in this laboratory showed that the larger vessels of the early wood are partly embedded in parenchyma, some of which, judged by its position, was laid down rather earlier than these vessels. It is possible that the latest wood of a season's growth consists chiefly of parenchyma, and that the early wood of the following season is similarly constituted; but the parenchyma is sufficiently homogeneous to render this possibility improbable. Another specimen of *Cedrela*, probably *C. odorata*, showed that the parenchyma separated a region of rather small, fairly thick-walled fibers from another of larger, relatively thin-walled fibers; the comparatively large size and thin walls of the cells of the parenchyma in both these specimens suggest that it was laid down at the beginning of a season's growth, not at the end; it is desirable to confirm this by studies on the living tree.

"Several other meliaceous woods were examined, but with less conclusive results. In *Swietenia Mahagoni*, the parenchyma appears to be terminal and not initial, and in this wood the parenchyma cells are rather small, with relatively thick walls, which would seem to confirm the view that they are laid down at the end of the growing season. In *Khaya grandis* and *Carapa guianensis* it was not possible to decide if the parenchyma was terminal or initial. It is well known that the vessels of the pore ring in Teak (*Tectona grandis*) may be associated with parenchyma, and it would seem to be justifiable to refer to this as initial parenchyma."

Origin and cellular character of xylem rays in Gymnosperms. By M. W. BANNAN. *Botanical Gazette* 96: 2: 260–281; 19 figs.; December 1934.

"The sequence in ray origin and cellular character outward from the pith in living forms, the condition in the different groups of Gymnosperms, and the fossil evidence, all indicate that the primitive ray is parenchymatous and that ray tracheids have arisen at the expense of parenchyma."

Buch der Holznamen. III. Ishan-Mureré vermelho. By HANS MEYER. M. & H. Schaper, Hannover, Germany, 1934. Pp. 233–352; 7 x 10. Price RM. 6.50.

Another installment of a work which is proving of great usefulness to all interested in the scientific equivalents for the common and vernacular names of woods.

H.H.C.

M. M. CHATTAWAY.

Price 35 cents

Yale University School of Forestry

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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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A STUDY OF THE CARYOCARACEAE

By LLEWELYN WILLIAMS [1]

Field Museum of Natural History

The Caryocaraceae are medium-sized to tall, erect trees, rarely shrubs, some of which yield timbers of commercial importance while others furnish sweet, edible nuts which in some countries form an article of export. Although confined to the tropical regions of northern South America and adjacent Central America, they are widely distributed within that territory, especially in the Guianas and the Amazon Valley, growing in the lowlands, subject to periodical inundations, or

1 The writer wishes to thank the Department of Botany of the University of Chicago for providing facilities for histological work; the United States National Museum and Yale University for the use of certain materials for this investigation; and Professor RECORD, of the last-named institution and also Research Associate at Field Museum, for advice and other assistance.

along swampy banks of streams, as well as in the high, flood-free forests up to an altitude of 4000 feet. The geographical range of the family extends from Costa Rica on the north to as far south as the plains of Nandurucay and Ipehu in Paraguay, while the western limits are formed by the montaña of Peru and the upland forests of northern Colombia.

General Description of the Family

The Caryocaraceae consist of only two genera, *Anthodiscus* and *Caryocar*. The morphological characters of the family have been summarized by Pilger (*10*) and Hutchinson (*14*), from whose descriptions most of the following has been taken:

Leaves digitate, trifoliolate, opposite or alternate; stipules 2–4, small and deciduous or none. Flowers perfect, in terminal, ebracteate racemes. Calyx 5–6-lobed, the lobes connate, imbricate. Stamens numerous, subperigynous, connate or in 5–6 series; anthers small, ovoid; filaments long, slender, variously bent in bud, the innermost erect, the outermost sinuously twisted or in-curved lengthwise. Ovary free, superior, 4– or 8–20-celled; ovules solitary in each cell, ascending. Styles 4–8–20, filiform, cleft at tip. Fruit a drupe, with an oil-containing mesocarp and a woody muricate endocarp breaking up into 1-seeded parts; seeds thick, round-reniform or thin, compressed; embryo with a large, fleshy, straight or long and spirally-twisted radicle; endosperm sparse or absent; cotyledons small, hooked-inflexed.

The flowers of *Caryocar* are attractive, pale yellow to red, and frequently of prominent size. Their characteristic feature is the numerous, brightly colored stamens with small anthers, the filaments tortuous and closely packed in the bud, and in some species (*C. glabrum* and *C. Tessmannii*) extending well beyond the petals during inflorescence. In *Anthodiscus* the flowers are greenish to bright yellow with numerous short stamens, the inner ones erect and shorter than the stamens of the outer rows. The small papillae on the filaments of some *Caryocar* species were regarded by Wittmack (*22*) as "distended epidermis cells . . . arranged spirally along the entire length of the filaments of the sterile stamens, whereas in the fertile stamens they are confined to the tip of the filaments." These papillae do not appear to be a constant feature of the family and their function is uncertain. Wittmack suggests that they allow torsion of the staminal filaments which spread radiately at anthesis.

The fruit of *Caryocar* contains four or, through abortion, from one to three, single-seeded nuts. In *C. glabrum* and related species the nuts are entirely smooth when under-ripe, becoming felty on the outside at maturity. The endocarp consists of two layers, the outer soft and rich in oil, the inner one with long, tightly packed, slender processes (club-shaped in *C. nuciferum*), which extend into the lumen of the nut and reach outwardly almost to the periphery of the outer layer.

The bark is variable in color from light yellow or grayish to dark reddish brown; up to 1.6 cm. thick; moderately smooth, slightly blistered or with small scales, in old trees becoming coarse with long scales and deep vertical fissures; inner bark fibrous in some species, especially *C. microcarpum*, and inclined to be bristly in *C. villosum*.

History and Affinities of the Family

The genus *Caryocar* was established in 1771 by Linnaeus (*16*) who, subsequently, placed it in Polyandria, Tetragynia. Prior to this, Clusius (1601) had published a description of *Castanea peruana*, later identified with one of Aublet's species. Aublet (*1*) described four species in 1775, placing them in two genera, *Saouari* and *Pekea*. In 1791, Gaertner (*11*), in consideration of the large radicle of the Pekea seedling, proposed to substitute the name *Rhizobolus* for Aublet's *Pekea*. In 1818, Meyer (*17*) described *Anthodiscus* and placed the genus in the Linnaean class Icosandria, order Polygynia. Six years later De Candolle (*4*) set up the order Rhizoboleae to include six species of *Caryocar*, which he placed between the Hippocastaneae and Sapindaceae. Lindley (*15*) placed the order in his Guttiferal Alliance between the Ternstroemiaceae and Clusiaceae. Wittmack (*23*) also recognized the order Rhizoboleae, placing it between the Ternstroemiaceae and Dichapetaleae of Baillon.

In *Pflanzenfamilien*, Szyszyłowicz (*9*) inserted the Caryocaraceae between the Ochnaceae and Marcgraviaceae, the latter separated from Theaceae (Ternstroemiaceae) by Quiinaceae of Engler and Chlaenaceae of Schumann. Beauvisage (*2*), in his monograph on the Ternstroemiaceae, maintains that the Caryocaraceae, from a strict morphological standpoint, have no important characteristics justifying a distinct family rank, but, from a study of their anatomical features, inclines to the opinion that the family should be placed between the Ternstroemiaceae and the group Chlaenaceae-Dipterocarpaceae.

Descriptions of the Genera and Species

Leaves alternate; raceme long; calyx lobes indistinct; radicle spirally twisted.
Anthodiscus G. F. W. Meyer.
Leaves opposite; raceme short; calyx lobes distinct; radicle straight.
Caryocar Linnaeus.

Anthodiscus

Trees or shrubs; leaflets coriaceous, glabrous, penninerved, entire or crenate. Calyx small, cupulate, 5-dentate, persistent; petals 5; staminal filaments filiform, all fertile, the interior short, erect, the outer long, hooked-inflexed; ovary 8–20-celled. Fruit small, coriaceous, smooth, depressed-globose; seeds small, laterally compressed; the radicle long, slender, vermiform; the cotyledons spirally contorted.

Leaflets 4–6 cm. long, spatulate or elongate-obovate, petiole slender.
  Leaflets equal, sessile or subsessile; raceme short. . . . . 1. *A. montanus.*
  Central leaflet larger than lateral ones, petiolulate; raceme long
  2. *A. peruanus.*
Leaflets 6–12 cm. long.
  Raceme more than 5 cm. long.
    Leaflets broadly obovate, unequal, entire, 5–8 cm. broad; pedicels 7 mm. long. . . . . 3. *A. obovatus.*
    Leaflets oblong-lanceolate, acuminate, serrate-crenate, 3–3.5 cm. broad, short-petiolulate; pedicels 2–3mm. long. . . . . 4. *A. trifoliatus.*
  Raceme up to 5 cm. long.
    Leaflets oblong-obovate, subsessile, serrate-crenulate; pedicels 5 mm. long. . . . . 5. *A. glaucescens.*

1. *Anthodiscus montanus* Gleason. Cheepo (Colombia). Tall tree, 60 to 100 feet in height, with slender flowering branches and round crown. In his description of the species Gleason observes: "Only three species of this poorly known genus have been described. Of these *A. trifoliatus* Meyer and *A. obovatus* Benth. have much larger leaves, petioled leaflets, and elongate racemes. . . . Our plant is much more closely related to *A. peruanus* in which the raceme is elongate . . . and the terminal leaflet much larger than the lateral ones." In dense forest, El Umbo region, state of Boyacá, 130 miles north of Bogotá, Colombia, at altitudes of 3400 to 4000 feet.

2. *Anthodiscus peruanus* Baillon. Tall tree of the non-inundated forest.

Flowers bright golden yellow and fragrant; flowering in November. The wood, according to Ducke (*8*), is clear yellowish brown and hard. Foz do Jutahy, São Paulo de Olivença, upper Brazilian Amazon.

3. *Anthodiscus obovatus* Bentham. Tree (?), collected by Spruce at Pacimoni, and San Carlos, region of Río Negro, upper Brazilian Amazon.

4. *Anthodiscus trifoliatus* G. F. W. Meyer. This species, upon which Meyer established the genus, is described as a tree about 35 feet in height. Region of Río Essequibo, British Guiana, and Department of San Martín, northeastern Peru.

5. *Anthodiscus glaucescens* Macbride. Uncommon shrub, about 6 feet tall, growing along the margin of forest at San Roque, Department of San Martín, Peru (*Williams* 7491, type) at an elevation of 4000 feet.

Caryocar

Small, medium-sized, or tall trees, rarely shrubs; leaves often long-petiolate; leaflets short-petiolulate or almost sessile, subcoriaceous or coriaceous, entire, dentate, serrate, or crenate, glabrous, tomentose or pilose. Calyx persistent, distinctly 5-(rarely 6-) lobed; petals 5, seldom 6. Fruit with glabrous or tomentose pericarp; seeds 1–4, large, subreniform, oily; radicle large, almost filling the entire seed.

Leaflets glabrous above.
  Leaflets acuminate at apex.
    Leaflets entirely glabrous.
      Leaflets 3.5–6 cm. wide.
        Stamens numerous; fruit 5–6 cm. long. . . . . 2. *C. glabrum.*
        Stamens fairly numerous; fruit 2–3.5 cm. long. . 5. *C. microcarpum.*
      Leaflets 7–13 cm. wide.
        Petiole 9–10 cm. long; leaflets 14–17 cm. long. . 10. *C. Tessmannii.*
        Petiole 3.5–5 cm. long; leaflets up to 30 cm. long. . 11. *C. nuciferum.*
    Leaflets barbate beneath at junction of costa and lateral veins.
      Leaflets long acuminate.
        Leaflets entire or crenulate; pedicel 1 cm. long. . . . 3. *C. coccineum.*
        Leaflets distinctly dentate-serrate; pedicel 3 cm. long.
        9. *C. amygdaliferum.*
      Leaflets abruptly acuminate.
        Leaflets serrate-dentate; stipels visible. . . . . 8. *C. barbinerve.*
        Leaflets crenulate; stipels inconspicuous. . . . . 1. *C. gracile.*
    Leaflets pilose beneath along costa and lateral veins; petiole and raceme pubescent. . . . . 4. *C. costaricense.*
  Leaflets obtuse or orbiculate at apex.
    Leaflets obovate-cuneate, remotely dentate or crenate. . 6. *C. coriaceum.*
    Leaflets ovate, distinctly serrate-dentate. . . . . 7. *C. intermedium.*
Leaflets pilose or tomentose above.
  Leaflets acuminate at apex.

Leaflets deeply dentate; calyx, petiole, and pedicel tomentose. 12. *C. dentatum.*

Leaflets crenate or crenate-dentate; petiole pilose...... 14. *C. villosum.*

Leaflets rounded at apex, rugose, densely tomentose.. 13. *C. brasiliense.*

1. *Caryocar gracile* Wittmack. PIQUIÁRANA (Amazon, Brazil). Small or medium-sized to tall, slender tree of the non-inundated forest. Ducke (*7*) distinguishes this tree from *C. glabrum* (Aubl.) Pers. in the smaller dimensions throughout, its inflorescence and shorter staminal filaments. The rose-colored, very fragrant flowers are probably entomophilous, while those of *C. glabrum* have no distinctive odor and are ornithophilous. Cataracts of Cupaty, Colombian territory of the Caquetá, Panuré on the Río Uaupés, estuary of the Río Jutahy, and Río Negro, upper Brazilian Amazon.

2. *Caryocar glabrum* (Aubl.) Persoon. PIQUIÁRANA, PIQUIÁRANA DA VARZEA, PIQUIÁRANA DA TERRA FIRME (Amazon, Brazil); COLA, BAT'S SOUARI (British Guiana); ALMENDRO DE BAJO (northeastern Peru). Tall tree, 60 to 120, occasionally up to 150, feet in height, with full, spreading crown. Trunk columnar, usually straight, free of branches up to two-thirds the height and diameter ranging up to 44 inches. Fruit globose-ovate, containing 1 or 2, seldom more, nuts with edible kernel. Found in all parts of state of Pará and probably throughout the Amazon hylaea; lowlands of Peruvian montaña in flood-free forest; San Carlos, Mapiri region, Bolivia, at an altitude of 2800 feet; Colombia; and the regions of the Cuyuni, upper Mazaruni, Demerara, Pomeroon, and Waini Rivers, also at Potaro and Curita in the Guianas.

3. *Caryocar coccineum* Pilger. ALMENDRO (northeastern Peru). Tall tree, from 70 to 100 feet in height; crown spreading; trunk erect, cylindrical, with small buttresses, clear of branches for more than half the height and a diameter of 30 inches. Flowering in September–October; kernel sweet and edible. Lower regions of Santiago, Huallaga, and Itaya Rivers, Peru.

4. *Caryocar costaricense* Donn. Smith. AJO, AJÍ, AJILLO, CABALLO-KUP (Costa Rica). Tall tree characteristic of Diquís Valley, Provincia de Puntarenas, Costa Rica.

5. *Caryocar microcarpum* Ducke (=*C. glabrum*, var. *edule* Wittm.). PIQUIÁRANA DA VARZEA (Amazon, Brazil). Small or medium-sized tree, frequent in flooded land and along banks of streams and lagoons. The species differs from *C. glabrum*, with which it is sometimes confused, in the size of the tree and its habitat. Lower Brazilian Amazon and lowlands of the Peruvian montaña.

6. *Caryocar coriaceum* Wittmack. Slender shrub, reported from the states of Ceará and Bahia, and the region of the Río San Francisco, Brazil.

7. *Caryocar intermedium* Wittmack. Shrub (?), known to occur in the state of Bahia, Brazil.

8. *Caryocar barbinerve* Miquel. Tree 50 to 60 feet tall with deep red stamens. First collected by Sello in the state of Bahia and subsequently by Killip and Smith in the vicinity of Manáos, Brazil.

9. *Caryocar amygdaliferum* Mutis. ALMENDRO (Peru); ACHIOTILLO, MANICHALMOUGRA (Colombia). Tall tree, 60 to 95 feet in height, with a full crown, and straight, cylindrical trunk, from 39 to 52 inches in diameter. Forests of Mariquita, Santa Fé de Bogotá, and Florencia on the Caquetá, Colombia.

10. *Caryocar Tessmannii* Pilger. ALMENDRO (northeastern Peru). Tree 65 feet tall, with trunk clear of branches for about 55 feet, and a diameter of approximately 16 inches. Santiago River, Peru.

11. *Caryocar nuciferum* L. SOUARI, SAOUARI, TATAYOUBA, SUWARROW, BUTTERNUT (Guianas). Tall, erect tree, with columnar trunk, clear of branches up to 80 feet. French Guiana; Demerara, British Guiana; and upper Río Branco, Brazil.

12. *Caryocar dentatum* Gleason. PIQUIÁRANA (Amazon, Brazil). Tree 65 feet in height and 2 feet in diameter. Near Calama, Madeira River region, state of Amazonas, Brazil.

13. *Caryocar brasiliense* Cambessedes. PEQUIÁ-BRAVA (Brazil). Spreading tree 32 feet in height growing in sandy soil, in association with shrubs. Dry plains of Nandurucay and Ipehu, at the foot and on the high plateau of Sierra de Maracayu, Paraguay; northern and western parts of the state of São Paulo, also at Lagoa Santa, state of Minas Geraes, and state of Ceará, Brazil.

14. *Caryocar villosum* (Aubl.) Persoon (*19*). PIQUIÁ, PIQUIÁ-ÉTÉ, PIQUIÁ-ROCHA, PEQUI, PEQUIÁ (Amazon, Brazil). Tall tree, attaining a height of 150 feet, seldom more, and a diameter at the base, quoting P. Le Cointe, up to 16 feet or more. The nuts, in size and appearance, resemble those of *C. glabrum* and are armed with numerous stout processes, shorter and firmer than those of the species mentioned. The kernel has a savory taste, but is rarely eaten. Throughout the lower Brazilian Valley, also in the Guianas and the northern part of the state of Maranhão, Brazil.

Economic Importance of the Trees

The woods of Caryocaraceae in general are hard, tough and durable, fairly easy to work, and darken but slightly upon exposure. On account of their suitable qualities some of the timbers are of commercial importance and find applications in the localities of their growth for civil and naval construction and especially for purposes requiring strength and durability.

The vernacular and trade names for the woods (*3*, *18*, *19*, *20*) in the various countries are: Bokkenoot, Zeephout, Saouary, Saourou, Soeari, Ningre notto (Surinam); Pekea, Pekia, Pequi, Pegui, Pequy, Chavarie, Chawari, Schwari, Saourari, Bois Marie, Bois Mary, Bois de Tatayouba or Tatajuba (French Guiana); Sawarri, Souari, Pekia, Butternut tree (British Guiana); Soeri, Sauarie, Saoearae (Arawak); Schaouarouy, Sawarri, Pekea (Carib); Pekui, Pequiá, Piquiá, Piquiá-été, Piquiárana, Piquiárocha (Amazon, Brazil); Almendron (Peru); Cheepo, Almendron (Colombia).

As early as 1775 Aublet mentioned the use of the wood of *C. glabrum* for making boats, dugout canoes, for bending, sidebeams, planks, and shingles. Referring to the wood of *C. tomentosum* Willd., Hohenkerk (*12*) writes: "From its evident durability and toughness it might be valuable for piling. The wood is little used but the roots make excellent floors and futtocks for shipbuilding and can be had sufficiently large to timber a vessel of large size. Excellent . . . for mill timbers and planks. Logs can be obtained up to 70 feet long by 24 inches square." Stone (*20*) also mentions the use of this wood for flooring, wheels and timber for sugar and water mills. Stone and Freeman (*21*) describe the wood as very tough and cross grained, saws easily, takes nails fairly well, and turns moderately easily but indifferently. Of the same wood from Surinam Pfeiffer (*18*) mentions that it is employed for carriage building, crossties, and staves for barrels.

The wood of *C. butyrosum* Aubl. from British Guiana is described by Stone (*20*) as tough, can be had in logs up to 60 cm. square, is suitable for carpentry but is utilized only to a small extent. The light-colored wood of *C. glabrum* (Aubl.) Pers. is employed in the Brazilian Amazon for making tool handles, also for flooring and frames and in the construction of boats. In northeastern Peru it is used mostly for carpentry and occasionally for making canoes, but these do not last more than three or four years. Huber (*13*) regards *C. villosum* Pers. as one of the most important woods in the lower Amazon region. It is highly esteemed locally for frames, knees, and floor timbers of ships and boats, also for hubs and felloes of wheels, piling, crossties, cooperage, and for miscellaneous civil and naval construction.

"*C. amygdaliferum* Mutis," wrote Cavanilles (*5*), "is one of the tallest and the most noted tree in the forests of Mariquita and Santa Fé de Bogotá, Colombia. Although not as heavy and compact as other woods, its timber is in great demand where broad planks of medium weight and durable quality are desired. In former times the timber was greatly prized for the construction of sheds in the mines of Santa Ana and Laxas." The exceedingly hard, black heartwood of *A. montanus*, according to Lawrance, a recent collector in Colombia, is employed locally for building huts.

Notwithstanding their useful woods, the Caryocaraceae are better known commercially for the edible nuts furnished by some of the species. These attracted the attention of the early botanists who commented upon the economic value of the oil-containing pulp (mesocarp) of the fruit and the sweet, almond-like kernels. "One sees during the months of September and October," wrote Aublet, "dugout canoes laden with this fruit (*C. glabrum*) arriving in Cayenne from Oyopoco. . . . The fruit has a sweet pulp, with the consistency of butter, and a thick kernel, agreeable to taste . . . and is sold in the market places of Cayenne." Lindley (*15*) also described the "saouari or suwarrow nuts sold in shops as the most delicious known and the oil extracted from them is not inferior to that of the olive."

Koster, in 1818, described the Piqui (*Acantacaryx pinguis* Arruda) of Brazil as a medium-sized tree, furnishing a great abundance of fruit about the size of an orange with an oily, nutritious pulp. "It forms a delicacy among the inhabitants of Ceará and Piauhy . . . and in times of drought and famine it has been a great succour to the people." Fonseca mentions that the oil furnished by the fruit of *C. villosum* and *C. brasiliense* is employed for medicinal purposes and for illumination. In northeastern Brazil, especially in the states of Ceará and Piauhy, according to the same authority, the thick oil extracted from the pulp is used as a substitute for butter and the pulp is edible when cooked in water.

Le Cointe computed that one Pekea tree is capable of producing an average of 6000 fruits; 250 fruits are required to furnish one liter of oil from the pulp and 1600 nuts will yield one liter of fat from the kernels. It is estimated that one tree is capable of producing from 20 to 30 liters of oil.

Description of the Woods of the Caryocaraceae

Of the 5 known species of *Anthodiscus* and 14 of *Caryocar*, wood samples were available for study of 7 identified and 1 undetermined species. Most of these, with their respective herbarium vouchers, are in the collections of Field Museum of Natural History. Several wood and herbarium specimens, as well as microscopic slides, were obtained from the Yale University School of Forestry, while herbarium sheets of all the known species of both genera were generously furnished by the United States National Museum.

The number of wood specimens of the various species examined is as follows: Anthodiscus: *A. montanus* (1); Caryocar: *C. coccineum* (1); *C. dentatum* (1); *C. glabrum* (6); *C. gracile* (1); *C. microcarpum* (1); *C. villosum* (3); *C.* sp. (1).

General Properties

The heartwood of *Caryocar* varies from uniform oatmeal to pale yellow, dull grayish-brown, or light brown, sometimes with a pinkish cast; the sapwood, not always sharply defined, is somewhat lighter when fresh, becoming tinged with extensive grayish or bluish-gray areas or dark streaks, at times causing it to appear slightly darker than the heartwood. Dark brown streaks are frequent in *C. dentatum* and in some specimens of *C. glabrum*. The heartwood of *A. montanus*, according to Lawrance, is dark brown or almost black; the sapwood is uniform and of deeper brown than any species of *Caryocar*, deepening to chocolate brown upon exposure. Fresh specimens have a slight acidic odor, but in dry material odor and taste are usually lacking or not distinctive in *Caryocar;* wood of *A. montanus* has no particular taste, but is faintly aromatic.

Woods moderately hard and heavy (*C. coccineum*) to decidedly hard, heavy, and tough (*C. villosum* and *C. glabrum*); sp. gr. (room-dry weight and volume) 0.802–0.906; weight 50–56.6 lbs. per cu. ft. Grain straight (*A. montanus*), roey (*C. glabrum*), or much interwoven (*C. villosum*), inclined in some species, especially *C. glabrum*, to be fibrous. Texture usually medium and uniform in *Caryocar*, occasionally tending to be rather coarse; moderately fine in *Anthodiscus*. Some species susceptible to insect attacks, but most of them durable, easy or moderately easy to work, split readily, sometimes brittle; hold their place and color well, and take a smooth finish with a moderate luster, inclined to become dull upon exposure, and the finished material, particularly that of *C. glabrum* and *C. villosum*, has an oily appearance and a waxy feel.

Gross Anatomy

Woods diffuse-porous. Growth rings indistinct to visible or readily distinguishable, owing to darker areas being free or nearly free of parenchyma, or to certain parenchyma lines being more regular and distinct than others; variation noted in different species and in specimens of the same species.

Parenchyma fairly abundant to abundant. In *Caryocar* distinguishable (with lens) on moistened cross section as numerous, fine or very fine, sometimes scarcely discernible, short, tangential lines extending between the rays and producing a hoary effect with the latter, also in definite, broken or continuous, usually sinuous, concentric lines, occasionally faintly visible to the naked eye; both conditions especially prevalent in *C. glabrum* and *C. villosum*. In *A. montanus*, paratracheal, faintly distinguishable with lens, extending in bands between and often uniting the pores, but the network arrangement, characteristic of *Caryocar*, is lacking. Parenchyma not distinct on longitudinal surfaces in either genus.

Pores barely visible in *A. montanus;* mostly of medium size and visible in *Caryocar*, occasionally rather large, readily distinguishable but not conspicuous, appearing as open pinholes. In most species open, in *C. gracile* and *C. villosum* partly or entirely closed; solitary, or in radially disposed rows of 2–5 cells, at times up to 8, infrequently in tangential or diagonal pairs, occasionally in multiples of up to 6 cells, seldom more; solitary pores oval, ovoid, irregularly round to round in *Caryocar*, mostly elongate-ovoid in *A. montanus*. Distribution of pores or pore groups fairly uniform to uniform, not crowded; both types equally well represented in most species of *Caryocar;* in *A. montanus* pores most frequently in radial rows of 2–3, occasionally 4, and less frequently solitary.

Vessel lines fine or moderately so, distinct and straight, or appearing as prominent deep scratches (*C. villosum*); in *C. glabrum* and *C. villosum* in alternate bands of long and short lines (roey grain); in the sapwood slightly or distinctly deeper in color than background, or in some specimens grayish white, owing to deposits; in the heartwood either inconspicuous and of same color as the ground mass or slightly darker and readily visible. Lustrous tyloses frequent in some specimens of *C. glabrum*, froth-like tyloses common in *C. villosum* and *C. gracile*. Purplish, reddish, dark brown, or almost black deposits characteristic of *C. villosum*, *C. gracile*, and *C. dentatum;* white deposits of frequent occurrence in several species of *Caryocar* and occasionally in *A. montanus*.

Rays fine to very fine, usually invisible on cross section without lens, of lighter color than the ground mass, numerous, closely and uniformly or fairly uniformly spaced (from less than one-third to one pore-width apart), straight or slightly sinuous and at times (in *Caryocar*) curving slightly at point of contact with the pores or pore groups; low and inconspicuous on radial surface and mostly indistinct with lens on the tangential.

Minute Anatomy [2]

Pores few to moderately few, mostly from 1–6, on rare occasions up to 12, pores or pore groups per sq. mm. Variable in size and number in different species and even in specimens of the same species; tangential diameter of larger pores 100–300μ, av. 150μ. In some species the pores are uniform throughout, in others the end pores in the radial rows are larger than those in the intermediate portions, while in a few, such as *C. glabrum*, the rows sometimes diminish gradually towards the extremity; infrequently the median pores are larger than those at the extremities. Isolated pores equal to or narrower than those in groups, but at times in *C. glabrum* and *C. gracile* they are larger than those in radial rows, although the latter are more elongated radially. Thickness of walls 2–6μ, av. 4μ.

Vessel members 440–1240μ long, av. 770μ; tails short or very short to moderately long. Inclination of perforation plates from horizontal to slightly or (as in *A. montanus*) decidedly oblique. In the latter species the vessel members are narrower than in any species of *Caryocar*. Perforations simple, with a tendency to multiple.

[2] Designations applied to size and abundance of the individual wood elements are those proposed by Chattaway (*6*).

Intervascular pit-pairs minute in *A. montanus*, relatively small in *C. microcarpum* to large and distinct in *C. glabrum;* fairly numerous to numerous and crowded; arrangement usually alternate, with tendency in some species to scalariform. Border outline where crowded (*C. villosum*) polygonal (5–6-sided), where not crowded (*C. glabrum*) elongate-oval, round or irregularly round, at times tending to be compressed horizontally or obliquely. Apertures lenticular, narrowly oval or slit-like, horizontal or slightly inclined obliquely, according to the border outline; usually included, infrequently extended and coalescing.

Vessel-ray pit-pairs either large, often crowded, irregularly rounded, polygonal, or elongate to concavo-convex in outline, or else small to moderately small, simple or half-bordered, oval or tangentially elongated, with tendency to scalariform arrangement. Borders complete, visible only at one end, or not discernible. Apertures vary according to the form of the border outline; horizontal, slightly to sharply oblique, or occasionally vertical, at other times small, ovoid to rounded.

Vessel-parenchyma pit-pairs resemble the small vessel-ray pit-pairs; fairly numerous, clustered, oval, with lenticular or oval, included apertures; at times in scalariform arrangement.

Tyloses sparsely to abundantly developed. Very abundant and thick-walled in *C. villosum;* abundant and moderately thick-walled in *C. glabrum*, *C. gracile*, and *C. dentatum;* thin-walled in *C. microcarpum;* usually with fairly distinct, small to medium-sized pits; color pale yellow to light brown. Gum deposits abundant in *C. villosum*, *C. coccineum*, and *C. microcarpum*, but seldom present in *A. montanus*.

Wood fibers (on cross section) constitute one-half to three-quarters the ground mass of the wood; triangular, oblongate or polygonal in outline, and in some species distinctly compressed tangentially, especially at the extremities of the pores or pore groups; in most cases all forms occur uniformly throughout; occasionally in definite radial arrangement, especially between the closely-spaced rays and at the tangential ends of the pores; walls thick (*C. microcarpum*) to extremely thick; lumen minute, almost closed (*C. glabrum*); mucilaginous layers common, especially in the last-named species. Sometimes fibers, slightly larger and thinner-walled than the rest, occur in definite tangential bands 2–5 rows wide, which appear to delimit seasonal growth rings.

Fiber pits usually confined to the radial walls; small, simple to indistinctly bordered; apertures lenticular or slit-like and oblique, or at times rounded; outline indistinct. Pits to ray cells frequently more numerous than other fibers; of same size or larger.

Septate wood fibers common in several species of *Caryocar*, but infrequent in *A. montanus;* appear to be most abundant in the vicinity of the rays. Septa fine; one, two, or occasionally more per fiber. Light to slightly dark brown deposits common. (Non-septate fibers also contain specks of gum, especially abundant in *C. villosum* and *C. coccineum.*)

Isolated fibers (macerated material) very short, 1.0–2.2 mm. in length, av. 1.86 mm.; diam. 5–16μ, av. 8μ; tapering gradually at ends, occasionally terminating abruptly; median portion at times slightly distended; tips often bent, sometimes serrated, infrequently bifurcated.

Paratracheal parenchyma in *Caryocar* in usually incomplete, often compressed, 1–3-seriate sheaths; it is more distinct and abundant in *A. montanus*, being 3–7 cells wide, vasicentric, aliform or confluent. Metatracheal parenchyma in narrow, broken bands, fairly uniform or irregularly spaced. Diffuse parenchyma common, the cells varying from the same size as the fibers to several times larger. In several species the parenchyma cells contain pale yellow, reddish or dark brown gum deposits, concentrated along the end walls or at times filling the entire cells. Rhombohedral or polygonal crystals of calcium oxalate are of common occurrence in most species of *Caryocar*, especially *C. villosum;* not observed in *A. montanus*. Numerous pith flecks were observed in the wood of *A. montanus*.

Rays heterogeneous, very numerous, 12–18 per mm., well distributed and rather uniformly spaced, from 1–9, most frequently from 2–5, fiber rows apart; at times less than the tangential width of solitary pores or pore groups apart; straight or one or both rays curving slightly on contact with the pores or pore groups. Uniseriate and multiseriate rays

(2 or 3, infrequently 4, cells wide) occur in all species, but their relative frequency varies. Entirely uniseriate rays are 2 to 17, seldom as high as 29, cells high; those with paired cells in part range between 9 and 35 cells. Multiseriate rays are 13–49 cells high, in some instances up to 163 cells, while those vertically fused may attain a maximum height of 200 cells; usually with uniseriate margins, 1–10, at times up to 15, cells high. Cells of the uniseriate portions squarish to upright; those of the multiseriate distinctly procumbent. Gum deposits, concentrated along the radial end walls or filling the entire cells, present in several species. Rhombohedral crystals of calcium oxalate occasionally visible in *C. gracile* and *C. glabrum*.

Conclusions

The foregoing descriptions of the general properties and the gross and minute anatomy of the woods under consideration indicate a unified group. In comparing the gross features and the secondary xylem of *Anthodiscus* and *Caryocar*, however, certain differences appear sufficiently well marked to separate the genera. These may be summarized as follows:

Caryocar	*Anthodiscus*
Color generally light.	Color dark.
Texture medium to coarse.	Texture rather fine.
Grain interwoven.	Grain straight.
Growth rings usually distinct.	Growth rings indistinct.
Pores numerous, some rather large.	Pores fewer and smaller.
Parenchyma in fine network with rays.	Parenchyma distinctly paratracheal.
Pith flecks apparently absent.	Pith flecks common.
Inter-vasc. pit-pairs comp. large.	Ditto comparatively small.
Crystals common.	Crystals rare.
Tyloses usually abundant.	Tyloses few or absent.
Gum deposits abundant.	Gum deposits scarce.
Septate fibers common.	Septate fibers few or absent.

Since, as already stated, there were no woods available for some of the species enumerated in this report, one can not be sure that the entire range of variability existing within the two genera has been determined. Nevertheless, particularly in view of the fact that the Caryocaraceae comprise a small endemic group, it is believed that the material is ample to establish the similarities of the woods and to indicate their principal differences. From the evidence thus derived it appears that the organization of the family into two genera, *Anthodiscus* and *Caryocar*, recognized by Wittmack, Szyszyłowicz, Pilger, Hutchinson, and other systematic botanists, is basically sound.

Summary

The Caryocaraceae are medium-sized to tall trees, seldom shrubs, indigenous to the lowland and upland forests of northern South America and adjacent Central America. Two genera are recognized, *Anthodiscus* with five species and *Caryocar* with fourteen. The principal morphological characters distinguishing the genera are the alternate leaves, long raceme, indistinctly lobed calyx, and spirally twisted radicle of *Anthodiscus*, in contrast to the opposite leaves, short raceme, distinctly lobed calyx, and straight, thick radicle of *Caryocar*.

The fruits form an article of trade in some countries as the mesocarp is rich in oil and the nuts are edible. The woods in general are hard and durable and are especially useful for purposes requiring strength and resistance to dampness.

Some of the points of resemblance of the woods are: The uniform distribution of the pores, which are solitary or in short rows or small multiples; the vessel members have simple perforations; the small intervascular pit-pairs are arranged alternately, though with a tendency to scalariform; the wood fibers are thick-walled; and the rays are heterogeneous, fine, closely and evenly spaced.

The available woods of one genus are, however, readily distinguishable from those of the other. The *Caryocar* woods are mostly light in color, of medium to coarse texture, and interwoven, roey or irregular grain, in contrast with the deeper brown, finer texture, and straight grain of *Anthodiscus montanus*. Growth rings are visible in several species of *Caryocar*, indistinct or absent in *A. montanus*. Paratracheal parenchyma is distinct under the microscope in *A. montanus*, indistinct in *Caryocar*. Septate fibers, crystals of calcium oxalate in the parenchyma strands, froth-like, or lustrous tyloses, and deposits of gum are frequent in *Caryocar*, sparse or absent in *A. montanus*.

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NOTES ON THE ITAÚBA TREES: THE AMAZONIAN SPECIES OF THE GENUS *SILVIA* ALLEM.

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During my last botanical trips in Amazonia, I attempted to assemble herbarium and wood samples of the Itaúba trees, for I projected a revision of the species of this well defined and economically important genus. Unfortunately, I did not find in these voyages more than two species in floriferous stage; most of the species of this genus are, however, represented in the herbarium of the Jardim Botanico, and this circumstance allows me to attempt a partial revision of their classification.

The species I have examined can be grouped, on the basis of stamen characters, as follows:

Opercula inserted near the base of the anther cells, which open from the apex to the base.
Filaments perfectly free . . . . 1. *S. itauba.*
Filaments more or less connate, conglutinate, or coherent.
2. *S. decurrens* and 3. *S. anacardioides.*
Opercula inserted near the apex of the anther cells, which open from the base to the apex.
Filaments perfectly free . . . . 7. *S. navalium.*
Filaments more or less connate, conglutinate, or coherent.
4. *S. synandra*, 5. *S. subcordata*, and 6. *S. Duckei.*

I think it is necessary to state expressly that some errors have appeared in the botanical literature regarding the dehiscence of the anther cells. This is the case for Mez's diagnosis of *S. itauba* and for the drawing of *S. anacardioides* in Hooker's *Icones Plantarum*.

1. Silvia itauba (Meissn.) Mez.—*S. polyantha* Mez, a cotype of which I have examined (Ule 6055), does not differ in any character from the present species. *S. Rondonii* Mez

also is nothing but a form of this species, which is disseminated from Guiana through western Pará and eastern Amazonas to northwestern Matto Grosso. I have examined a cotype of *S. Rondonii* (Kuhlmann, Comm. Rondon 1976), which differs from the common *S. itauba* only by its more elongate-obovate leaves and by its less distinctly pubescent inflorescences and flowers. Moreover, the filaments of the stamens of the *S. Rondonii* cotype are only a little less hairy than those of typical *S. itauba* (Spruce 818, determ. Mez). Some specimens collected in the Middle Tapajoz (Herb. Jard. Bot. Rio, 17537) are intermediate between the two.

The androecium of all the *Silvia* species generally is shorter than the perianth at the early phases of anthesis, but afterwards, toward the final stages, it becomes longer. This character, pointed out by Mez, is thus worthless. The opercula of the anther cells are inserted near the cell's base in the abundant material of this species that I have examined (including number 818 of Spruce, determined by Mez); this operculum opens from the apex to the base, just as in *S. anacardioides*. The description of the anther dehiscence of *S. itauba* in Mez's *Monograph* is, therefore, erroneous. The dehiscence of anthers of *S. polyantha* (synonym of *S. itauba*) is, however, correctly described by the same author.

This species furnishes most of the Itaúba wood, the most useful timber of the Lower Amazon, especially for naval construction; its color is a dingy yellow, becoming grayish with time.

2. **Silvia decurrens** Ducke, sp. nov.—A specie proxime affini *S. itauba* differt foliis ramorum fertilium usque ad 250 mm. longis et ad 75 mm. latis elongato-obovatis basi longe cuneatis et sensim in petiolum ad 15 mm. longum decurrenti-attenuatis, inflorescentiis aliquanto strictioribus et robustioribus, floribus crassioribus, staminibus densius pilosis, filamentis in tubum connatis vel arcte cohaerentibus. Arbor magna ligno optimo in vivo laete flavo, floribus viridibus, antherarum valvulis juxta basin locellis affixis, ab apice ad basin dehiscentibus.—Brazil: Habitat in silva non inundabili super ostium fluminis Curicuriary (affluentis Rio Negro superioris, civ. Amazonas), 19–11–1929, leg. A. Ducke (cum

ligno n. 55 [Yale n. 20999]), H. J. B. R. n. 23669. "Itaúba" appellatur.

This new species is remarkable for the form of its leaves. The insertion of the anther opercula is the same as in *S. itauba* and *S. anacardioides*, *i.e.*, at the basal side.

3. Silvia anacardioides (Spruce ex Meissn.) Mez.—I have not seen this plant, which seems to have been collected only once, but I have examined some flowers of the type, obtained through the kindness of Dr. N. Y. Sandwith at Kew. The insertion of the opercula of the anthers corresponds in these flowers to the drawing in Mez's *Monograph* (t. III, fig. 39) and not to that of Hooker's *Icones Plantarum* (t. 1259); these opercula open from the apex to the base of the cell. This species is distinguished from the common *S. itauba* by the form of its leaves and by the stamens, which are more or less connate or closely coherent, with the aspect of a tube; from *S. decurrens* by the very different form of the leaves; from *S. synandra* by the form of the inflorescences and by the different insertion of the anther opercula. Unfortunately, the wood of this species is unknown.

4. Silvia synandra Mez.—This species is known at present only from the drier upland forests around Manáos, where it has been collected in the secondary growth of Pensador by Ule and recently by myself (a small tree, Herb. Jard. Bot. Rio, 25042), and in the virgin forest northeast of Flores (a rather high tree, H. J. B. R. n. 23964, wood sample n. 114 [Yale n. 22574]). The yellow-brown wood has the vernacular name Itaúba. The leaves resemble those of *S. anacardioides*, but the form of the inflorescence is different and the anther cells open from the base to the apex, where they are inserted. The filaments are connate or narrowly coherent, exactly as in *S. anacardioides* and *S. decurrens*.

5. Silvia subcordata Ducke, 1930.—Differs from *S. synandra* only by its more or less cordate leaf base and the longer and more slender inflorescences. The stamens are like those of *S. synandra*, but not like those of *S. itauba* (as I stated in my diagnosis of *S. subcordata* in 1930); they have coherent filaments, and the opercula of the anthers are inserted at the apex of the cell.

6. Silvia Duckei A. Sampaio, 1928 = *Miscantheca Duckei* A. Sampaio, 1917.—A little tree from the lower and dry forests of upland campos regions in the lower Amazon (Jutahy de Almeirim, Montealegre, Santarem) and in the upper Rio Branco and its neighbor Rupununi (British Guiana). The Amazonian vernacular name is Itaúba (Itaúba Amarella or Itaúba Abacate). The yellowish brown wood is good, but less esteemed than that of *S. itauba*. The species is rather variable, but does not resemble that of any other Amazonian species. The filaments of its stamens are connate or coherent; the anthers have the operculum inserted at the basal side of the cell.

7. Silvia navalium Fr. Allem.—The stamens of the sheets I examined correspond perfectly to the description in Mez's *Monograph* (filaments free, opercula of anthers inserted near the apex of the cell, which opens from the base to the apex). This species does not grow in Amazonia, but in the subtropical mountain forests of the State of Rio de Janeiro, where it furnishes the Tapinhoan, a durable but less useful wood.

NOTE ON *GOETHALSIA* (TILIACEAE)

In *Tropical Woods* 40: 18, I stated that the stem structure of *Goethalsia* indicated a close relationship to the Tiliaceae, but not to the Flacourtiaceae. Through the courtesy of United Fruit Company, flowers, fruits, and wood of *G. meiantha* (D. Sm.) Burret were obtained in Chiriquí, Panama. Mr. Alexander Lawrance, Bogotá, Colombia, collected fruiting specimens and wood from the same tree (No. 494) that produced the flowering material used as the basis for Gleason's proposed transfer of the genus. Two eminent botanists, who studied this new material, have written me as follows:

I received the fructiferous samples of *Goethalsia*. This genus, like *Mollia*, *Luebea*, etc., is certainly of greater affinity to the true Tiliaceae than to Flacourtiaceae or *Bixa*, etc.—Adolpho Ducke.

I am now convinced that the genus belongs to the Tiliaceae and not to the Flacourtiaceae.—Alfred Rehder.

For Burret's opinion, see p. 40, *infra*.—S. J. R.

NEW TREES AND SHRUBS FROM PANAMA, COLOMBIA, AND ECUADOR

By Paul C. Standley

Field Museum of Natural History

Panama

Most of the plants collected by Mr. G. Proctor Cooper during a recent botanical exploration of Caribbean shores were determined at the New York Botanical Garden, but the ones described below as new were submitted to the writer by Professor Record, specimens of their woods having been obtained especially for the collections of Yale School of Forestry. There is no doubt that the San Blas coast of Panama, which because of distrust exhibited toward strangers by the inhabitants is still unexplored by botanists, will yield many other new trees of interest when it is possible to make a systematic survey of its forests.

Guatteria lucens, sp. nov.—Arbor usque ad 9-metralis, ramulis gracilibus teretibus fuscis primo sparse adpresso-pilosis cito glabratis, internodiis brevibus; folia mediocria breviter petiolata glabra, petiolo crassiusculo 5–7 mm. longo glabro; lamina anguste oblonga 14–16.5 cm. longa 4–4.5 cm. lata longe anguste acuminata basi subacuta crasse papyracea supra lucida, ad costam vix elevatam interdum breviter pilosula, nervis venulisque prominulis, subtus fere concolor, costa gracili elevata, nervis lateralibus irregularibus brevibus fere rectis remote a margine arcuato-conjunctis, venulis prominulis arcte reticulatis; flores viridescentes axillares solitarii, pedunculo 10–12 mm. longo glabrato; sepala deltoideo-ovata 2.5 mm. longa obtusa patentia extus densiuscule ochraceo-sericea; petala subaequalia 10–13 mm. longa oblonga vel spathulato-oblonga apice rotundata carnosa extus praesertim versus basin ochraceo-sericea intus minute puberula vel fere glabra; stamina numerosa densissime conferta aurantiaca.—Panama: San Blas District, April 1933, *G. Proctor Cooper* 280 (Yale No. 24042; Herb. Field Mus. No. 686347, type).

Couepia panamensis, sp. nov.—Arbor 18–21-metralis, trunco 30–40 cm. diam., ramulis fusco-ferrugineis striatis glabris; folia subcoriacea breviter petiolata mediocria, petiolo crasso 4–6 mm. longo; lamina oblonga vel elliptico-oblonga 9–11 cm. longa 3–4.5 cm. lata abrupte cuspidato-acuminata, acumine angusto attenuato obtuso, basi acuta vel subobtusa, supra in sicco viridis lucida, costa nervisque non elevatis, glabra, subtus fere concolor brunnescens glabra, costa crassiuscula elevata, nervis lateralibus utroque latere circa 7 angulo lato adscendentibus arcuatis tenuibus irregularibus prope marginem arcuato-conjunctis, venulis prominulis arcte reticulatis; inflorescentia terminalis thyrsiformi-paniculata laxiuscule multiflora sessilis 4 cm. longa, ramis sparse minute pilosulis, pedicellis crassiusculis glabris usque ad 8 mm. longis; hypanthium clavato-tubulosum 7–8 mm. longum glabrum basi attenuatum; sepala valde imbricata orbicularia 3 mm. longa ciliolata et prope apicem sparse tomentulosa intus dense sericea reflexa, fauce hypanthii dense villosa; stamina circa 15.—Panama: San Blas District, April 1933, *G. Proctor Cooper* 279 (Yale No. 24041; Herb. Field Mus. No. 686350, type).

"Bark mottled; leaves deep green. Flowers white, the buds pale green." In the two or three other species of *Couepia* known from Central America the leaves are white-tomentose on the lower surface.

Tovomita stenantha, sp. nov.—Arbuscula omnino glabra, ramulis gracilibus teretibus fusco-olivaceis striatis, internodiis brevibus vel elongatis; folia parva petiolata papyracea, petiolo 1–1.5 cm. longo gracili; lamina oblongo-elliptica vel lanceolato-oblonga 6–8.5 cm. longa 2.5–3.8 cm. lata abrupte caudato-acuminata, acumine angusto attenuato 1 cm. longo, basi acuta et paullo decurrens, supra in sicco olivacea, costa nervisque non elevatis, subtus fere concolor, costa gracili elevata, nervis lateralibus utroque latere circa 9 tenerrimis prominulis angulo latiusculo adscendentibus in marginem desinentibus, venulis obscuris laxiuscule reticulatis; inflorescentia terminalis cymosa laxe multiflora sessilis circa 3 cm. longa, ramis gracilibus divaricatis, pedicellis rectis 3–5 mm. longis, bracteis triangulari-ovatis adpressis deciduis acuminatis 1 mm. longis; alabastra oblongo-linearia obtusa 8 mm. longa fere 2 mm. crassa; sepala 2 lineari-oblonga valvata obtusa; petala 4 lineari-oblonga obtusa 6 mm. longa, basi cohaerentia et tubum 2 mm. longum formantia; stamina numerosa petalis breviora, filamentis filiformibus liberis, antheris minutis didymo-globosis.—PANAMA: San Blas District, April 1933. *G. Proctor Cooper* 255 (Yale No. 24034; Herb. Field Mus. No. 686346, type).

Well marked by the small and extremely narrow flowers.

COLOMBIA

Extended collections of woody plants made in the Barranquilla region on the north coast of Colombia by Sr. Armando Dugand G. for the Yale School of Forestry have added a large amount of information to our knowledge of the forest flora of that area, especially because they have been selected with care and annotated with exceptionally useful and significant data. An apparently new tree that he has discovered is described below.

There is published here also a new *Guettarda* from the same region, collected by another local botanist, Reverend Brother Elias. I am glad to have an opportunity to dedicate so well-marked a species to Brother Elias, who has generously presented to Field Museum a large series of interesting plants from the vicinity of Barranquilla.

Zanthoxylum Dugandii, sp. nov.—Arbor 5–6-metralis, trunco 20–30 cm. diam. inermi, ramis crassis pallide brunneis aculeis crassis fusco-ferrugineis 1–1.5 cm. longis armatis, novellis dense viscido-villosulis; folia mediocria vel majuscula petiolata, rhachi 5–17 cm. longa gracili tereti hirtella; foliola circa 11 opposita subsessilia ovata, oblongo-ovata vel oblongo-elliptica 4–9 cm. longa 2–4 cm. lata acuta vel acuminata, basi oblique obtusa vel subrotundata, utroque latere grosse 3–6-crenata, membranacea, supra sparse vel densiuscule hirtella, subtus paullo pallidiora sparse molliter pilosula, inter crenationes glandulis magnis onusta; flores dioici, masculis in paniculas parvas densas multifloras e ramis defoliatis nascentes dispositi 5-meri, ramis viscido-villosis, sepalis parvis oblongis pallidis, filamentis circa 2 mm. longis; paniculae fructiferae terminales 6 cm. longae pedunculatae laxe multiflorae, pedicellis gracilibus usque ad 8 mm. longis; folliculus 1

sessilis obovoideo-globosus 5 mm. longus glaber, seminibus nigris lucidissimis 4 mm. longis laevibus.—COLOMBIA: Canacoima, 100–200 m., in 1934, *Armando Dugand* 676 (Yale No. 28497; Herb. Field Mus. No. 744882, type). Santa Rosa near Barranquilla, in 1932 and 1934, *Dugand* 219 (Yale No. 22508), 414. La Playa, sandy soil, open country, in 1933, *Dugand* 462.

Vernacular name Matijón. "A small tree of 5–6 meters, with smooth, gray or olive-gray bark. The fruits are small and reddish. The tree is more frequent in the type region than anywhere else. The bark, when chewed, is said to deaden sensation in the tongue."

Apparently a well-marked species, noteworthy for the large coarse crenations of the leaflets.

Guettarda Eliadis, sp. nov.—Frutex 3–4-metralis ramosissimus, ramis teretibus fusco-brunneis lenticellis parvis pallidis conspersis, novellis dense hirtellis; stipulae deciduae 6 mm. longae anguste oblongo-triangulares extus dense sericeae; folia petiolata crasse membranacea, petiolo 4–16 mm. longo hirtello; lamina late elliptico-obovata 5–10.5 cm. longa 3–7 cm. lata apice late rotundata vel subtruncata et minute apiculata, rare obtusa, basin versus paullo angustata, basi ipsa rotundata vel obtusa, interdum cordata, supra in sicco viridis, sparsissime minute adpresso-pilosula, ad nervos densius pilosula, subtus pallidior, undique dense flaventi-sericea, costa gracili elevata, nervis lateralibus utroque latere circa 10 angulo semirecto adscendentibus tenerrimis fere rectis, venulis prominulis laxe reticulatis; cymae parvae pauciflorae capituliformes 5–9 mm. longe pedunculatae, floribus sessilibus, bracteis lineari-subulatis 2 mm. longis; drupa subglobosa vel ellipsoidea 5–6 mm. longa apice rotundata 4-locularis dense minute tomentulosa.—COLOMBIA: Megua, August 1933, *Brother Elias* 1072 (Herb. Field Mus. No. 680940, type); July 1934, *Brother Elias* 1252.

Somewhat similar to *G. parviflora* Vahl, which has ordinarily much smaller and acute leaves. Vernacular names Huesito and (?) Aceituno. Described by the collector as a densely branched shrub with short gray trunk, rugose bark, and divaricate branches; fruit finely velvety and red.

ECUADOR

Collections of woody plants made in the highlands of Ecuador by Dr. A. Rimbach for the Yale School of Forestry have been difficult for me to determine, because so little is known regarding the flora of Ecuador. Some of them, probably new but belonging to complicated families in need of critical revision, it has been necessary to leave for the present without specific determinations. A few I have ventured to describe as new, and descriptions of them appear below.

There are added descriptions of three trees obtained in the same country by other collectors, two of them collected forty years ago near the coast by Baron Eggers, whose extensive collections from the region of El Recreo have yielded so many new species. The third species here described was discovered near Guayaquil by the Reverend Luis Mille, whose collection was sent to Professor Record and forwarded to me for determination.

Brosimum latifolium, sp. nov.—Arbor, ramulis griseis glabratis, internodiis brevibus; stipulae 8 mm. longae (et ultra?) anguste triangulares attenuato-acuminatae caducae extus dense pallide sericeae; folia breviter petiolata subcoriacea, petiolo crassiusculo 4–6 mm. longo minutissime puberulo vel glabrato; lamina late elliptica medio latissima 7–12 cm. longa 4–6 cm. lata breviter abrupte acuminata, acumine circa 1 cm. longo triangulari-acuminato acutiusculo, basi rotundata vel obtusissima interdum plus minusve inaequilatera, glabra, supra in sicco griseo-viridis opaca, costa nervisque non vel vix prominulis, subtus fere concolor, costa gracili elevata, nervis lateralibus utroque latere circa 13 angulo recto divergentibus fere rectis prominentibus prope marginem arcuato-conjunctis, venulis prominulis laxe reticulatis; capitula axillaria solitaria 3.5 mm. longa subglobosa 5–6 mm. longe pedunculata dense multiflora, pedunculo gracili minutissime puberulo, bracteis peltatis orbicularibus fere 1 mm. latis minutissime puberulis, stylo breviter exserto; drupa globosa 1 cm. diam.—ECUADOR: El Recreo, March 11, 1897, *H. F. A. Eggers* 15721 (Herb. Field Mus. No. 669955, type).

Vernacular name Tillo. Differing from other South American species in the relatively short and broad leaves, and somewhat suggestive of the West Indian *Brosimum Alicastrum* Swartz, to which, undoubtedly, this tree of Ecuador is related.

Pseudolmedia Eggersii, sp. nov.—Arbor, ramulis gracilibus brunnescentibus tortuosis, novellis sparse sericeis mox glabratis; stipulae caducae lineari-lanceolatae 10–15 mm. longae anguste attenuatae extus dense sericeae intus glabrae; folia brevissime petiolata subcoriacea, petiolo 3–5 mm. longo sericeo vel glabrato; lamina oblonga vel oblongo-elliptica 11–15 cm. longa 4–6.5 cm. lata abrupte caudato-acuminata, acumine angusto attenuato obtuso, basi valde inaequilatera anguste rotundata, utrinque glabra vel in statu juvenili subtus sparse sericea, supra lucida costa elevata, nervis venulisque prominentibus, subtus brunnescens, costa gracili elevata, nervis lateralibus utroque latere circa 15 angulo fere recto divergentibus leviter arcuatis tenuibus prope marginem arcuato-conjunctis, venulis prominulis laxe reticulatis; inflorescentiae axillares solitariae arcte sessiles, bracteis arcte imbricatis brunnescentibus extus sparse minutissime sericeis 2–4 mm. longis exterioribus quam interioribus multo brevioribus late ovatis vel subrotundatis obtusis vel acutiusculis; drupa clavato-oblonga 11–13 mm. longa supra 5 mm. crassa sparse sericea vel glabrata apice apicata, stylo exserto fere 3 mm. longo, ramis circa 2 mm. longis gracilibus.—ECUADOR: El Recreo, May 4, 1897, *H. F. A. Eggers* 15746 (Herb. Field Mus. No. 669970, type). El Recreo, December 16, 1895, *Eggers* without number.

Vernacular name Guión. Described by the collector as a tall erect tree with white wood used for inside construction.

Siparuna Rimbachii, sp. nov.—Dioica. Arbor 8-metralis, ramulis crassis dense pilis stellatis mollibus sordido-fulvis pilosis; folia inter maxima petiolata firme papyracea, petiolo crasso 2–4.5 cm. longo dense stellato-tomentoso; lamina late obovato-elliptica 14–30 cm. longa 10–18 cm. lata apice rotundata breviter vel brevissime acutata, basin versus paullo angustata, basi ipsa plus minusve obliqua et subacuta ad oblique rotundata, in toto margine arcte denticulis obtusis duplici-dentata, supra in sicco obscure viridis primo dense stellato-hirtella serius glabrata, nervis ut venulis profunde impressis, lamina conspicue bullata, subtus pallidior ubique densissime tomento molli sordido stellato obtecta, costa crassa elevata, nervis lateralibus utroque latere circa 18 prominentibus fere rectis versus apicem arcuatis angulo acuto adscendentibus; inflorescentiae axillares solitariae 1–2 cm. longe pedunculatae laxe multiflorae petiolis breviores vel longiores, floribus usque ad 7 mm. longe pedicellatis, ramis dense stellato-tomentosis; receptaculum floris masculi semi-globosum 6 mm. longum extus dense stellato-tomentosum, velo adscendente glabro, ore late aperto; stamina 5, filamentis 2 mm. longe exsertis, filamentis complanatis latis glabris; sepala 5 rotundata 1.5 mm. longa carnosa intus glabra; receptaculum floris feminei obconicum 5 mm. longum basi acutum, sepalis eis floris masculi similibus, velo plano, ore minuto, stylis breviter exsertis; fructus piriformis 4.5 cm. longus intus ruber.—ECUADOR: Eastern cordillera, northern slope of Mt. Tungarahua, 2000 m., bush region, January 1933, *A. Rimbach* 129 (Yale No. 23124; type represented by three sheets in Herb. Field Mus.).

Vernacular name Pera del Monte. "Leaves little aromatic. Fruit pear-shaped, with rose-red pulp." The fruit is well illustrated with one of the handsome colored sketches that the collector furnishes with many of his specimens. Only a very few species of *Siparuna* are known from Ecuador. This one is noteworthy for its large broad leaves and exceptionally large flowers.

Siparuna phaneroneura, sp. nov.—Dioica. Frutex 4-metralis, trunco 2.5 cm. diam., ramulis obtuse tetragonis crassulis dense pilis brevibus stellatis fulvis pilosis, internodiis brevibus; folia mediocria petiolata papyracea, petiolo crasso 1.5–3 cm. longo dense stellato-piloso; lamina late obovato-elliptica supra medium paullo latior 9–12 cm. longa 5–6.5 cm. lata breviter acutata vel subobtusa basin versus paullo angustata, basi ipsa obtusa, anguste rotundata vel interdum acuta, saepe plus minusve inaequilatera, supra in sicco fusco-viridis densissime stellato-tomentosa, costa nervisque subimpressis, lamina paullo bullata, subtus pallidior densissime stellato-tomentosa, costa crassa elevata, nervis lateralibus utroque latere circa 21 elevatis leviter arcuatis, venulis transversis et

parallelis prominulis, margine crebre argute duplici-serrata; inflorescentiae cymosae dense multiflorae pedunculatae petiolis aequilongae vel breviores, floribus dense aggregatis sessilibus vel ad 2 mm. longe pedicellatis, ramis dense stellato-hirtellis; receptaculum floris masculi hemisphericum 2.5 mm. longum basi rotundatum dense stellato-hirtellum echinulatum, velo convexo, ore vix aperto; sepala 5 triangularia acuta patentia 1.5 mm. longa intus glabra; stamina 6 subexserta, filamentis complanatis carnosis.—ECUADOR: Balsapampa, 2500 m., September 14, 1934, *A. Rimbach* 207 (Herb. Field Mus. No. 740306, type).

A relative of *S. echinata* (H.B.K.) A. DC., of Colombia, a plant with much narrower leaves and fewer lateral nerves.

Siparuna fuchsiifolia, sp. nov.—Dioica. Frutex altus fere glaber, ramulis gracilibus teretibus fusco-brunneis, novellis pilis paucis minutis stellatis adpressis conspersis, cito glabratis; folia opposita petiolata rigido-membranacea, petiolo 10–15 mm. longo stellato-pilosulo vel glabrato; lamina anguste elliptico-oblonga medio latissima 8–13 cm. longa 2.5–5 cm. lata subabrupte breviter acuminata, acumine attenuato-acuto, basi acuta aut subobtusa et interdum inaequilatera, supra basin argute minute serrata vel interdum subintegra, marginibus saepe subrevolutis, supra in sicco cinereo-viridis, glabra, costa ut nervis prominulis sed plus minusve interdum profunde impressis, pagina plus minusve bullata, subtus paullo pallidior, sparsissime minute adpresse stellato-puberula vel fere omnino glabra, costa prominente, nervis lateralibus utroque latere circa 12 prominentibus arcuatis; inflorescentiae masculae axillares umbelliformes fasciculatae petiolo paullo longiores pilis paucis minutis adpressis stellatis pallidis conspersae graciliter 1–2 cm. longe pedunculatae circa 3–4-florae, pedicellis ad 4 mm. longis; flores 3–4 mm. latae fere glabrae, receptaculo late turbinato 2 mm. longo basi acuto, sepalis subnullis, velo late convexo, ore vix aperto, stylo breviter exserto.—ECUADOR: Western cordillera, Valley of Pallatanga, 1400 m., in forest, *A. Rimbach* 39 (Yale No. 20732; Herb. Field Mus. No. 688844, type).

Vernacular name Guayusa. The collector's notes are as follows: "A large shrub with greenish flowers. Fruit reddish inside and outside. Leaves and fruit strongly and agreeably aromatic. Infusion of leaves used as a tea, a remedy for pain in the stomach and for sterility in women." The species is noteworthy for the very scant pubescence, the leaves and other parts appearing glabrous to the naked eye; also for the conspicuously impressed nerves of the upper leaf surface. The mature fruit, as illustrated in a drawing by the collector, is subglobose and about 1 cm. in diameter.

Machaerium Millei, sp. nov.—Arbor frondosa ut videtur inermis, ramulis brunnescentibus striatis rimosis, novellis dense pilis adscendentibus brunnescentibus pilosis serius glabratis, internodiis brevibus; folia mediocria petiolata 15–22 cm. longa, rhachi gracili dense pilis mollibus patentibus pilosa; foliola 10–16 alterna 2 mm. longe petiolulata late oblonga vel ovato-oblonga 2.5–6 cm. longa 1–2.5 cm. lata versus apicem obtusum vel rotundatum paullo angustata basi late rotundata, supra in sicco viridia sparse pilis gracillimis brevibus sericea, costa nervisque non elevatis, subtus pallidiora densius sericea, ad costam pilosula, costa gracili elevata, nervis lateralibus arcuatis irregularibus prominulis, venulis vix prominulis laxe reticulatis; flores sessiles vel brevissime pedicellati spicati, spicis ad apicem rami fasciculatis laxe multifloris usque ad 10 cm. longis, rhachi dense breviter brunnescenti-pilosa; legumen stipitatum 4.5–5 cm. longum, parte seminifera 8 mm. latum, versus apicem alae 1.5 cm. latum, apice late rotundatum, glabrum reticulato-venosum, stipite gracillimo 10–15 mm. longo glaberrimo.—ECUADOR: Portovelo, October 1918, *J. N. & George Rose* 23444 (Herb. Field Mus. No. 636066, type). In regione tropica prope Guayaquil, January 1926, *Luis Mille* 825.

Vernacular name Chiche. The plant does not very closely resemble any South American species seen by the writer. The samaras are not quite mature, and it may be that their size is somewhat greater than is indicated in the description.

Daphnopsis loranthifolia, sp. nov.—Arbor, ramulis brunneis pallide lenticellatis, novellis sparse strigosis; folia breviter petiolata coriacea, petiolo crasso 5–8 mm. longo dense sericeo vel glabrato; lamina anguste oblonga vel lanceolato-oblonga 9–13 cm. longa 2.5–4.5 cm. lata acutiuscula vel obtusa, basin versus paullo angustata, basi ipsa obtusa, supra in sicco flaventi-viridis primo dense sericea mox glabrata, nervis venulisque prominulis arcte reticulatis, subtus fere concolor primo dense serius sparse sericea, costa gracili elevata, nervis venulisque obscuris; flores virides umbellati, umbellis axillaribus 1–3.5 cm. longe pedunculatis dense multifloris, pedunculo crassiusculo sparse strigoso, pedicellis 2–3 mm. longis sericeis; perianthii tubus floris masculi 3–4 mm. longus obconicus extus dense sericeus, lobis late ovatis acutis vel breviter acuminatis 2.5 mm. longis; stamina inaequaliter inserta, antheris superiorum breviter exsertis.—ECUADOR: Western cordillera, alt. 2600 m., September 1934, *A. Rimbach* 230 (Yale No. 28644; type in Herb. Field Mus.).

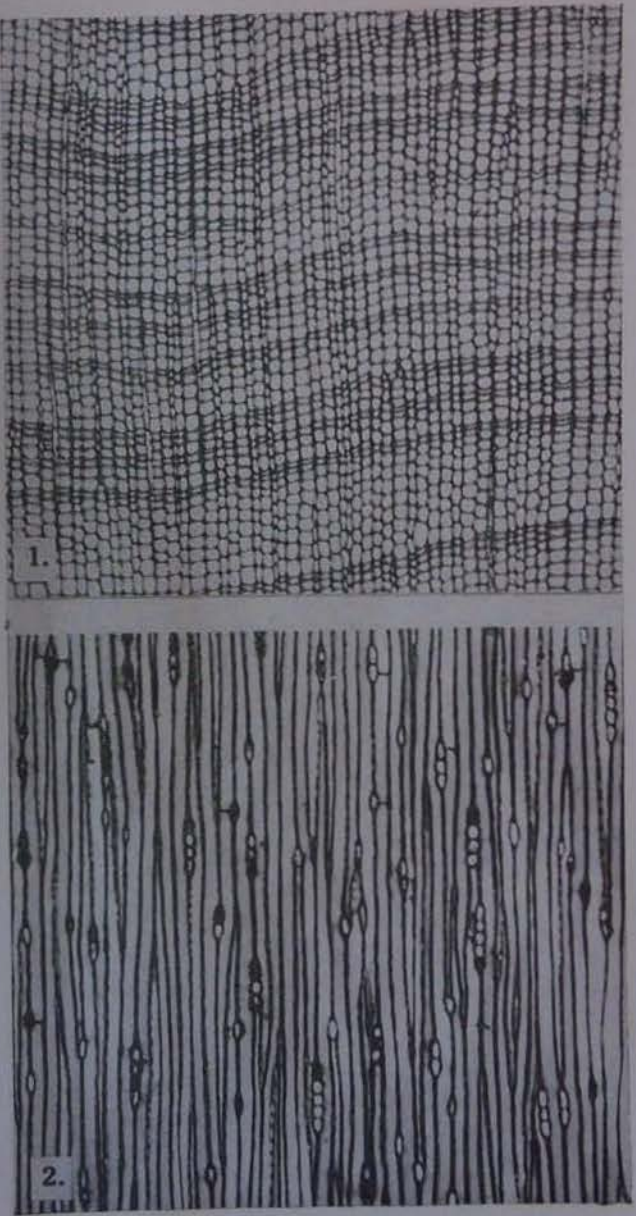
In habit of inflorescence similar to *D. macrophylla* (H.B.K.) Gilg, which, however, has larger flowers and tomentose leaves.

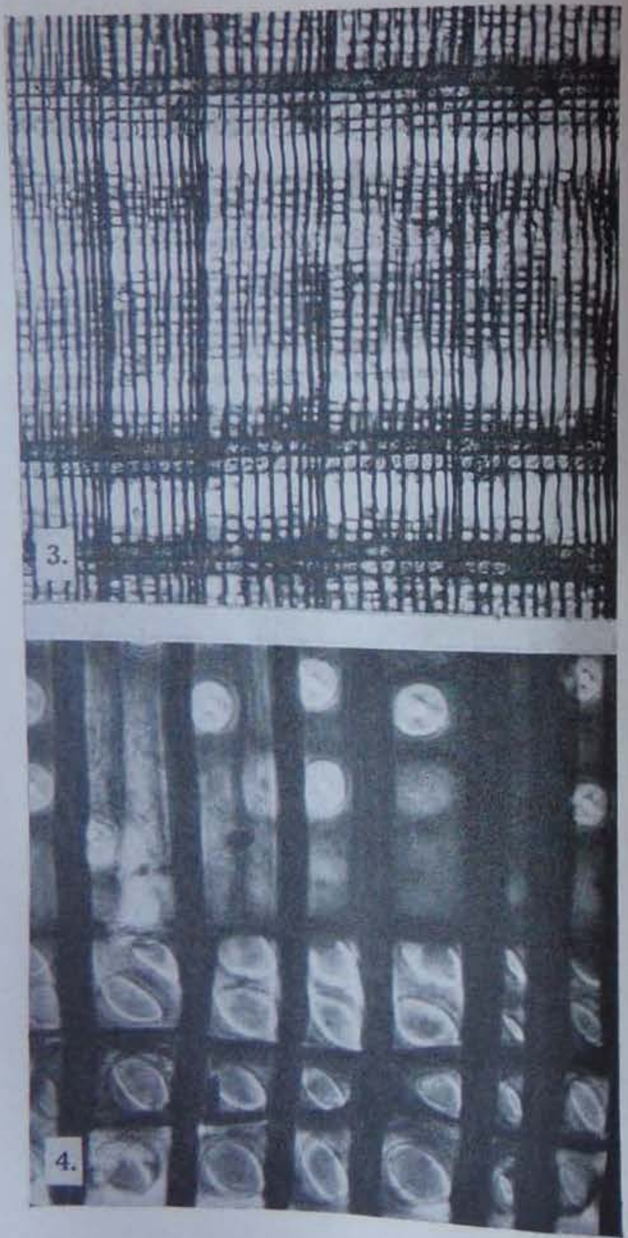
Eschweilera Rimbachii, sp. nov.—Ramuli ut videtur graciles glabri; folia magna brevissime petiolata glabra coriacea, petiolo crassiusculo circa 1 cm. longo; lamina anguste oblonga 27–34 cm. longa 7–9.5 cm. lata abrupte breviter acuminata, acumine 1–2 cm. longo triangulari-acuminato acuto vel subobtuso, basi subrotundata vel subacuta et abrupte breviter decurrens, subintegra, supra in sicco cinereo-viridis lucida, costa nervisque prominentibus sed subimmersis, venulis prominulis arcte reticulatis, costa subtus prominente, nervis lateralibus utroque latere circa 22 angulo lato divergentibus leviter arcuatis prope marginem arcuato-conjunctis; fructus breviter crasse pedunculatus; pyxidium depressum orbiculare 10 cm. altum 20 cm. latum; hypanthium circa 5 cm. altum latissime turbinatum, zona supracalycari 3 cm. alta oblique divergente vel suberecta, operculo convexo conspicue umbonato circa 4 cm. alto; semina circa 8 brunnea 6 cm. longa 5 cm. lata.—ECUADOR: Foot of western cordillera, in moist forest, in 1931, *A. Rimbach* 47 (Yale No. 20740; Herb. Field Mus. Nos. 677029 and 677045, type).

Vernacular name Piñuela. Dr. Rimbach's notes are as follows: "A tree 15 m. high, the trunk 15 cm. thick, with light gray, smooth, slightly warty bark. Without buttresses. Wood whitish, without visible heart. Flowers not seen. Fruit upon the old wood, 10 cm. long, 20 cm. broad, gray-brown, somewhat rough. Pericarp leathery. About 8 seeds, 6 cm. long, 5 cm. broad, with fleshy, yellowish white aril on the inner edge. Wood used for construction." The large and very narrow leaves are distinctive. The fruit (represented by a drawing) somewhat resembles that of *Eschweilera angustifolia* Mart. of Brazil, but has a much more prominent supracalycine zone.

Athenaea glabra, sp. nov.—Frutex 4-metralis praeter flores omnino glaber, ramulis crassiusculis, internodiis brevibus vel elongatis; folia petiolata inaequalia crasse papyracea, petiolo crassiusculo 5–12 mm. longo; lamina lanceolato-oblonga vel anguste elliptico-oblonga 4.5–12.5 cm. longa 1.5–4.5 cm. lata longiacuminata, acumine angusto attenuato, basi acuta vel acuminata, integra, in sicco brunnescens, subtus paullo pallidior, costa pallida prominente, nervis lateralibus utroque latere circa 7 valde adscendentibus arcuatis; flores axillares fasciculati, pedicellis recurvis filiformibus 4–7 mm. longis; calyx campanulatus 4 mm. longus basi rotundatus, dentibus triangulari-oblongis obtusis 1 mm. longis erectis; corolla viridescens intus rubro picta 12 mm. longa extus glabra, lobis 5 oblongo-triangularibus 6 mm. longis; antherae 2 mm. longae oblongae rimis longitudinalibus dehiscentes; fructus globosus 8 mm. diam. aurantiacus.—Ecuador: Western cordillera above Balsapampa, 2600 m., December 14, 1934, *A. Rimbach* 239 (Yale No. 28653; Herb. Field Mus. No. 753597, type).—Colombia: Western Andes of Popayán, 2800–3100 m., *Lehmann* 8510.

Psychotria Rimbachii, sp. nov.—Arbuscula, ramulis crassis sparse minute puberulis vel fere glabris; stipulae caducae brunnescentes suborbiculares 1 cm. longae extus minute puberulae apice rotundatae; folia inter maxima brevissime petiolata papyracea, petiolo crasso 10–14 mm. longo sparse minute puberulo; lamina obovato-oblonga 25–29 cm. longa 10–12.5 cm. lata apice acuta vel rotundata et breviter abrupte acutata, basin versus sensim angustata, basi ipsa acuta, supra in sicco cinerea glabra, costa prominula, nervis vix prominulis pallidis, venulis obsoletis, subtus fere concolor, minutissime puberula vel nervis costaque exceptis glabrata, undique





minute pallido-puncticulata, costa gracili elevata, nervis lateralibus utroque latere circa 23 prominentibus angulo lato adscendentibus leviter arcuatis, venulis inconspicuis laxe reticulatis; inflorescentia terminalis pedunculata 8 cm. longa 4.5 cm. longe pedunculata, basi radiatim ramosa, flores sessilibus in capitula subglobosa dense multiflora 1–1.5 cm. diam. dispositis, capitulis paucis ramos terminantibus, ramis basalibus usque ad 3 cm. longis minutissime puberulis vel glabratis, bracteis caducis; hypanthium glabratum 2 mm. longum basi rotundatum, calyce 2 mm. longo glabro obsolete obtuse remote denticulato vel subintegro; corolla alba extus minutissime puberula 6–7 mm. longa (et ultra?), tubo crasso fauce villoso, lobis 5 oblongis acutiusculis tubo brevioribus; antherae subexsertae.—Ecuador: Western cordillera, valley of Río Chimbo, 800 m., October 1932, *A. Rimbach* 112 (Yale No. 22814; Herb. Field Mus. No. 666798, type).

"A small tree in shade of forest. Bark rather smooth, brown. Leaves stiff." A species of the subgenus *Mapouria*, distinguished by the large and handsome leaves, and the openly branched inflorescence, composed of about 7 large heads of flowers.

EXPLANATION OF PLATES I AND II

Photomicrographs of the secondary xylem of an old stem of *Microcachrys tetragona* (Hook.) Hook. f. (Yale No. 27045), to accompany article on next page.

No. 1. Cross section, showing parts of 13 growth rings. × 105.

No. 2. Tangential section, showing low, uniseriate rays, with resin plates opposite some of them. × 105.

No. 3. Radial section through 5 growth layers, showing 3 rays and the type of pitting in the tracheids. × 105.

No. 4. Detail of No. 3, greatly enlarged, showing types of pitting between tracheids and between tracheids and ray cells. × 840.

THE WOOD OF *MICROCACHRYS TETRAGONA*

By Samuel J. Record

Microcachrys tetragona (Hook.) Hook. f. (fam. Podocarpaceae) is a prostrate shrub endemic to Tasmania. Specimens of the foliage and stem (Yale No. 27045) were recently received from Miss Doris Overall (Darwin Nurseries, Sulphur Creek), who collected them at an elevation of about 5000 feet on Cradle Mountain. The piece of the stem is 2.5–4 cm. in diameter, eccentric, contorted, and beset with clusters of small twigs as in "witch's broom"; bark thin, the outer part purplish brown and flaky, the inner finely laminated white and light brown. Heartwood pale brown, rather waxy, with mildly resinous scent; sapwood nearly white, not sharply demarcated; texture very fine, uniform. Growth rings visible under lens on smooth section, very narrow (5–10 per mm.), each limited by a fine, dark line of late wood. Resin ducts absent; wound parenchyma sometimes present. Rays minute; not visible without lens on cross and tangential sections, low and scarcely distinct on the radial.

Minute Anatomy

Growth rings 3–15 cells wide, mostly less than 10; transition from early to late wood gradual, the latter frequently consisting of a single row of flattened tracheids (Pl. I, 1). Wood parenchyma normally absent. Radial walls of the tracheids with numerous bordered pits in single file (Pl. II, 3), rarely in pairs; the border outline circular, nearly as wide as the lumen and varying in size with it; apertures lenticular, inclined, and included; crassulae distinct in stained sections; trabeculae observed. Pits in tangential walls limited to latewood tracheids; distribution irregular; border outlines often only about half the width of the lumen; apertures slit-like, inclined, sometimes slightly extended. All pit membranes uniformly thickened, without tori. Resin plates common in tracheids, opposite the rays (Pl. I, 2). Rays wholly parenchymatous; uniseriate (Pl. I, 2); mostly 1–5 cells high, max. 15, the cells in single rows frequently of very irregular form (rad. sect.); walls thin; horizontal and end walls apparently unpitted; blind pits absent. Where ray cells are in contact with

the tracheids (Pl. II, 4), the pits in the latter are large, more or less distinctly bordered, the apertures widely dilated and of various shapes in early wood ("Eiporen"), narrowing to lenticular or slit-like in late wood; number of pits per cross field usually 1 or 2, but in the taller cells frequently 3 and sometimes 4 or 5 in a vertical row; pit membranes commonly bulging into lumina of tracheids.

CURRENT LITERATURE

Early imports of mahogany for furniture. By R. W. Symonds. *The Connoisseur* (London) October 1934, pp. 213–220; December 1934, pp. 375–381; illustrated.

"During the seventeenth century, Oak and Walnut were the principal woods employed in England for furniture making, but the eighteenth century saw the introduction and general use of Mahogany, which possesses qualities far more desirable than either Oak or Walnut. . . . The discovery of Mahogany as a new wood must have been an event of the utmost importance to the craft of furniture making. . . . It is generally considered that 1720–21 was the period when Mahogany furniture began to be made in England, but very little contemporary evidence has been brought to light to verify this approximate date. The earliest mention of Mahogany in the newspapers of that time, that I have been able to find, occurs in an advertisement of the cargoes of two prize ships, published in the *London Gazette* under the date of February 22nd to 25th, 1702. . . . The first reference to Mahogany in the statistics of imports which were filed at the Public Record Office is under the date of Christmas 1699–Christmas 1700. . . .

"It would appear from the contemporary information, cited from the statistics of imports, Sheraton's *Cabinet Dictionary*, and the *History of Jamaica*, that the first Mahogany to be imported into England in the early eighteenth century was Jamaican and, afterwards, Cuban. In the third quarter of the same century, Honduras Mahogany was imported.

The reason for the cessation of any particular variety of Mahogany was because the trees near the coast having been felled, the traders sought another supply which was cheaper, owing to its being more easily procurable. It was not so much a question of seeking wood of fine quality, otherwise exporters would have gone to the trouble and expense of transporting the better quality timber from the interior."

"The oft-quoted story of Dr. Gibbons (1649–1728) and his candle box cannot, I consider, be relied upon as evidence concerning the first use of Mahogany, as there is no indication of the date when the incident occurred."

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

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

The distribution of tabular roots in *Ceiba* (Bombacaceae). By A. E. NAVEZ. *Proceedings National Academy of Sciences* 16: 339–344; 1930.

Tabular roots or "buttresses" are especially noticeable in regions where the superficial layers of soil are relatively thick and present little resistance for anchorage; also where the top layers of humus soil are very thin and are supported directly by a rocky basement. Both of these conditions exist in Cuba where a correlation was found between the frequency of tabular roots and the dominant (trade) winds, which blow from NE and ENE. In 94 per cent of the cases examined the root with the largest mass and largest insertion-radius was found on the side corresponding to the direction of the strongest wind. These roots are viewed as traction-resistant and not compression-resistant structures, *i.e.*, they act as resistance cables and not as buttresses against a wall.—CARL G. DEUBER, *Department of Botany, Yale University.*

Neue *Xolisma*-Arten von Hispaniola. By H. SLEUMER. *Repertorium Specierum Novarum* (Berlin-Dahlem) 36: 270–273; Dec. 31, 1934.

From Haiti and the Dominican Republic there are published seven new species of shrubs and small trees of the genus *Xolisma* (Ericaceae).

Trees of Trinidad and Tobago. By R. C. MARSHALL. Govt. Printing Office, Port-of-Spain, 1934. Pp. 101; 5¼ x 8½; 20 plates (line drawings); price 3 s.

"The information contained in this small volume is practically all abstracted from a larger work—as yet unfinished—on the silviculture of Trinidad and Tobago trees, at which the writer has been working for the past ten years. With a few negligible exceptions all descriptions of native trees have been written up from notes taken, and from fresh material collected, in the forest. In writing descriptions emphasis has been laid on characteristics of bark, leaf and fruit, and the flowers have been relegated to a relatively minor position."

"The present work deals with over 250 native trees and it is believed that it comprises the bulk of the trees commonly met with in the forest. In writing it an effort has been made to use simple language and to avoid scientific terms which may be puzzling to the layman."

"When these notes were commenced the main object was to produce an easily available volume by which the identity of forest trees could be checked and, as a corollary, to endeavor to standardize local names. . . . In order to make the work more comprehensive it was later decided to add brief descriptions of the more prominent of the exotic trees which have been planted for ornamental or shade purposes in Port-of-Spain and elsewhere."

Flora of Trinidad and Tobago. Myrtales (pars). By R. O. WILLIAMS. Vol. 1, part 6, pp. 333–410. Port-of-Spain, Trinidad. 1934.

The present instalment of the flora treats the families Myrtaceae, Lecythidaceae, and Melastomaceae, represented by 11, 2, and 22 genera respectively. New species described are *Myrcia granulata*, *Eugenia perplexans*, *Miconia savannarum*, *Clidemia microthyrsa*, and *C. macropetala*.

Estudio botanico de algunos arboles Mexicanos: Ebano, *Caesalpinia sclerocarpa* Standley. By JESÚS GONZÁLEZ ORTEGA. *México Forestal* (Mexico, D.F.) 12: 12: 216–217; December 1934.

Ebano is a small to medium-sized tree of slow growth in southwestern Mexico. In mature trees the sapwood is thin and white, the heartwood dark brown to blackish and noted for its resistance to decay and marine borers. The timber is obtainable in pieces up to 16 feet long and a foot square, and is used for piling, wharf construction, posts, railway crossties, and for fuel and charcoal. The paper includes a complete botanical description of the tree.

Candelón, *Rhizophora mangle* L. By JESÚS GONZÁLEZ ORTEGA. *Boletín de Pro-Cultura Regional* (Mazatlán, Mexico) 1: 41: 14–16; December 1934.

An account of the botanical characters and technical properties of the Red Mangrove, variously known in different parts

of Mexico as Candelón, Mangle, M. Colorado, M. Dulce, M. Tinto, and Tab-che or Tap-che. The bark is a source of tannin, dyestuff, and medicine. The timber, which is obtained in pieces up to 16 feet long and 10 inches in diameter, is used for durable construction both on land and in water.

Preliminary sketch of the phytogeography of the Yucatan Peninsula. By CYRUS LONGWORTH LUNDELL. Contributions to American Archeology, No. 12; preprint from Pub. No. 436, Carnegie Institution of Washington, pp. 253–355 (including appendix, *The grasses of the Yucatan Peninsula*, by Jason R. Swallen, pp. 323–355), October 1934. Pp. 253–321; 9 x 12; 1 text fig. (map).

"In this preliminary study the primary and secondary stages and the climax types of the vegetation of the Yucatan Peninsula are described and classified, using as a basis the physiographic, climatic, and anthropogenic factors of the environment. The major phytogeographical divisions and formations are defined. Annotated lists are given of species collected or noted in all the associations which were studied."

The survey is based chiefly on data gathered by Professor Lundell during four seasons, 1928–1933. The work of the first two seasons was done during his residence in British Honduras in connection with experimental work on the chicle-producing tree, *Achras zapota*, under the direction of the Tropical Plant Research Foundation. "The 1933 expedition was undertaken as a part of the biological survey of the Maya country begun in 1930 under the joint auspices of the Carnegie Institution of Washington and the University of Michigan (Bartlett, 1932). The present article covers in detail only the ecology of certain sections of the peninsula. Others will deal specifically with the Department of Petén, Guatemala, and northern British Honduras."

A collection of plants from the Galapagos Islands. By ERLING CHRISTOPHERSEN. *Nyt Magazin for Naturvidenskaberne* 70: 67–96; 1 plate; Jan. 15, 1932.

An annotated list of 156 species collected on Chatham, Charles, Indefatigable, and James Islands by Miss Borghild

Rorud. Two new species, *Acacia Rorudiana* and *Periloba galapagensis*, are described.

Plants of the Astor expedition, 1930 (Galapagos and Cocos Islands). By HENRY K. SVENSON. *American Journal of Botany* 22: 2: 208–268; 9 pls., February 1935.

An annotated list, by families, of plants collected on the Galapagos Islands, with a brief account of the general features of the vegetation. Cocos Island, 300 miles west of Costa Rica, with hills rising to 1500 feet, has a known flora of 100 species, about 10 of them endemic. From Cocos Island the present paper lists 4 mosses and 31 flowering plants.

***Goethalsia* Pitt. doch eine Tiliacee, keine Flacourtiacee.** By M. BURRET. *Repertorium Specierum Novarum* (Berlin-Dahlem) 36: 195; Nov. 5, 1934.

Gleason believes that this genus belongs to the Flacourtiaceae, and considers it necessary to publish an emendation of the generic description. The author previously has stated his belief, in accordance with that of Pittier, that *Goethalsia* belongs to the Tiliaceae and is closely related to *Colona*. Re-examination of type material convinces him this belief was well founded, and also that Pittier's original description of the genus is much more accurate than the emendation published by Gleason, who misinterpreted the structure of the flower.—P. C. STANDLEY.

Essai de fabrication de papier avec le bois dit palétuvier blanc de Guyane. By L. VIDAL. *Revue International du Bois* (Paris) 1: 6/7: 25–29; June/July 1934.

White Mangrove, believed to be *Avicennia nitida*, is a common tree in the tidal marshes of French Guiana. The wood can be pulped successfully by the soda process, but because of the shortness of the fiber it is unsuited for use alone and should be mixed with conifer pulp. The billets are subject to discoloration by a fungus and the stain adds to the difficulty of bleaching. The pulp is not considered a promising source of viscose, since, aside from other considerations, the content of alphacellulose is too low, being only 69 per cent.

Studies in Boraginaceae. X. The Boraginaceae of northeastern South America. By IVAN M. JOHNSTON. *Journal of the Arnold Arboretum* (Jamaica Plain, Mass.) 16: 1: 1–64; January 1935.

The paper treats the Boraginaceae known from the Guianas and the adjoining portions of Brazil, north and east of the Amazon and the Rio Negro. Keys and descriptions are provided for the genera and species, with citations of the collections examined. The genera represented are *Cordia* (24 species), *Lepidocordia* (1), *Tournefortia* (7), and *Heliotropium* (6). New species are *Cordia fallax* (British Guiana); *C. laevifrons* (Dutch and French Guiana; vernacular name Tiki Topichi), *C. fulva* (Dutch and French Guiana), *C. Sagotii* (Dutch and French Guiana, with numerous vernacular names), *C. hirta* (Dutch and French Guiana, Venezuela), *C. naiadophila* (Venezuela and Brazil). Vernacular names are given for many of the species.—P. C. STANDLEY.

Nova Sapotacea productora de balata, da Amazonia brasileira. By ADOLPHO DUCKE. *Annaes da Academia Brasileira de Sciencias* (Rio de Janeiro) 6: 207–210; 1 plate; Dec. 31, 1934.

Lucuma gutta is described and figured from the middle Rio Purús, State of Amazonas, where it is called Abiu-rana-gutta. The tree produces a balata of superior quality, although little known in the markets, probably because of an insufficient number of the trees.

Especies maderables aptas para la confección de envases para frutas. By CESAR CORNELL. *Boletín Mensual del Ministerio de Agricultura de la Nación* (Buenos Aires) 35: 1–3: 13–66; 38 figs.; Oct.–Dec. 1933.

This paper discusses the various problems concerned with the fruit packing-box industry in Argentina, describes the native and exotic timbers now used or suitable for the purpose, and makes suggestions for the establishment and care of plantations of rapid-growing, soft-wooded trees. The native species considered belong to the genera *Araucaria*, *Salix*, *Enterolobium*, *Pithecolobium*, *Sapium*, *Tessaria*, *Chorisia*, *Pentapanax*, *Alnus*, *Croton*, *Ocotea*, *Cedrela*, *Cecropia*, *Pisonia*, *Ruprechtia*, and *Luehea*.

Micrografia de maderas. By Lucas A. Tortorelli. *Maderil* (Buenos Aires) 7: 74: 7–9; 7 figs.; August 1934.

A short account of the work of the Sección Técnica de Bosques (Dirección de Tierras, Ministerio de Agricultura) in the field of wood anatomy, illustrated with photomicrographs of Quebracho Colorado (*Schinopsis balansae* Engl.), Cedro de Missiones (*Cedrela fissilis* Vell.), Cedro de Salta (*C. Lilloi* C. DC.), Roble Pellin (*Nothofagus obliqua* Mirb.), and Rauli (*N. procera* Poepp.).

Las plantas indígenas no alimenticias cultivadas en la Argentina. By Lorenzo R. Parodi. *Revista Argentina de Agronomia* (Buenos Aires) 1: 165–212; phytogeographic map; 1934.

In this paper upon the native inedible plants in cultivation in Argentina there are listed by families about 200 species, with notes regarding their origin, extent of cultivation, and local names. Of particular interest are the map and the brief tabulation of the phytogeographic regions of the country. Many of the species listed are trees and shrubs, some of the more important trees being species of *Araucaria*, *Schinus*, *Ilex*, *Salix*, *Juglans*, *Phytolacca*, *Acacia*, *Enterolobium*, *Gleditsia*, *Parkinsonia*, *Piptadenia*, *Cedrela*, *Chorisia*, *Jacaranda*, and *Tecoma*. The plantations of Yerba Mate (*Ilex paraguariensis*) are estimated to cover 44,966 hectares, and the annual consumption of the leaves in Argentina is estimated at 90 to 100 million kilograms. The paper includes two pages of bibliography of works consulted.—P. C. Standley.

Timber studies of Chinese trees. V. Preliminary studies of the weight of some Chinese woods. By Y. Tang. *Bull. Fan Memorial Institute of Biology* (Peiping) 5: 4: 149–199; Nov. 8, 1934.

Presents in tabular form the specific gravities and weights per cubic foot of 437 specimens of Chinese woods representing 341 species of 192 genera.

Handeliodendron, a new genus of Sapindaceae. By Alfred Rehder. *Journal of the Arnold Arboretum* (Jamaica Plain, Mass.) 16: 1: 65–67; 1 plate; 1 text fig.; January 1935.

Handeliodendron Bodinieri (Lévl.) Rehder is a new name for *Sideroxylon Bodinieri* Léveillé, a large tree of Kweichou, China. It is said to be common at an altitude of about 500 m. at Pingchow, Mapo, and has dark gray bark, lenticellate branchlets, and reddish, black-seeded fruit. The wood, but not the bark or other parts of the plant, contains saponin, according to Dr. H. Handel-Mazetti, in whose honor the genus is named.

Ecological investigation on the qualities of the timber of "hinoki," *Chamaecyparis obtusa* Sieb. et Zucc. (In Japanese, with résumé in English.) By Toichi Miyoshi. *Bull. Forest Exp. Sta. Imperial Household* (Tokyo-Fu, Japan) 2: 3: 1–146; plates I-XXIV, with 92 photomicrographs; 1934.

A splendidly illustrated report on the influence of environment upon the anatomy of the wood of *Chamaecyparis obtusa*. A second report will be concerned with variations in the chemical and physical properties of the timber.

New or noteworthy trees from Micronesia. VIII. By Ryôzô Kanehira. *Botanical Magazine* (Tokyo) 48: 919–927; figs. 6–11; December 1934.

New species are *Capparis carolinensis*; *Merrilliodendron rotense*, a new genus of Icacinaceae, from Rota, Marianne Islands; *Rinorea carolinensis*, *Timonius villosissimus*, *Uncaria korrensis*, *Psychotria Gaudichaudii*, *Amaracarpus marianensis*.

New or noteworthy trees from Micronesia. IX. By Ryôzô Kanehira. *Botanical Magazine* (Tokyo) 49: 60–68; 7 figs.; February 1935.

New species described and illustrated are *Pandanus divergens* (Aira Palau Islands), *P. cylindricus* (Ponape; vernacular name Silaue), *P. dilatatus* (Ponae, called Kienpel), *P. erythrophloeus* (Paulau Islands). *P. carolinianus* and *P. guamensis* of Martelli also are illustrated.

Tannin content of Philippine barks and woods. By Luz Baens, F. M. Yenko, Augustus P. West, and H. M. Curran. *Philippine Journal of Science* (Manila) 55: 2: 177–190; 1 pl.; October 1934.

A report on determinations of the tannin content of many barks and woods of native trees. "Some of the barks were high in tannin and appeared to be of commercial value. Most of the woods, however, gave negative tests for tannin, although a few contained a very small amount." Tests were also made on nuts and unripe fruits, and on bark of the Australian Black Wattle (*Acacia decurrens*) cultivated in Mindanao from seeds obtained from the Forest Research Institute, Buitenzorg, Java. "The Black Wattle bark gave the highest tannin content of all the barks analyzed. Bark from trees four years old contained about 45 per cent of tannin. Excellent extract can be made from this bark. . . . The development of Philippine plantations of Black Wattle trees would seem to offer promising prospects."

Investigations on the effect of external stimulus on diametric growth of stems. By A. Guha-Thakurta and B. K. Dutt. *Transact. Bose Res. Inst. Calcutta* 8: 85–114; 15 figs.; 1934.

At the youngest internodes of *Cajanus indicus* light retards growth, at the thicker shoots of *Antirrhinum* it produces at first an acceleration, later a retardation. Evidently the plants are affected disproportionately, since an electric excitement of equal intensity in the inner and the outer parts always shows growth retardation. [But older, slowly growing organs exhibit an acceleration, and the reviewer wonders if the transferring lever of the apparatus is capable of quantitatively measuring the phenomenon of growth. Sad to say the existing literature is, moreover, not considered.]—Hans H. Pfeiffer, *Bremen.*

Variations in the medullary bundles of *Achyranthes aspera* L. and the original home of the species. By A. C. Joshi. *New Phytologist* 33: 53–57; 2 figs.; 1934.

Within the bundle ring boundary there are not always two free collateral bundles as in *Achyranthes crispa*, *A. argentea*, and *A. bidentata*. In *A. aspera* from Lahore the inner bundles are free a little distance above and below the node, while between the nodes they unite into a central bicollateral bundle. Plants from Bombay have only 20 per cent of the internodes with bicollateral bundles, those from Calcutta always have free bundles in the internodes, and specimens from Benares show an irregular distribution between the two types. If the free bundles are considered as the primitive state and the bicollaterals as the descended type, then the original arrangement occurs in the tropics and the youngest form in plants from the most northern place Lahore, while between the two regions are intermediate forms.—Hans H. Pfeiffer.

Miscellanea systematica et phytogeographica. III. By Paul Cretzoiu. *Repertorium Specierum Novarum* (Berlin-Dahlem) 36: 265–269; Dec. 31, 1934.

The first part of the paper enumerates the Malayan Burseraceae in the herbarium of the University of Vienna, the specimens being cited by locality and collector. Two new varietal names are published in *Canarium*.

Notes on Malayan timbers. IV. By H. E. Desch. *Malayan Forester* (Kuala Lumpur) 4: 1: 23–29; 1 plate; January 1935.

The fourth in an important series begun in April 1934. The timbers described and illustrated are Nemesu (*Shorea pauciflora* King) and Damar Laut Merah (*S. Kunstleri* King).

"Locally Nemesu as a timber is usually not differentiated from those timbers locally known as Meranti in the F. M. S. or as Seraya in Singapore. . . . It works well, takes a smooth finish, and is attractive when polished. It should be suitable for inexpensive furniture, high class joinery work and flooring, shop fittings, and other similar purposes.

"Nemesu is equivalent to and could be substituted for the best grades of Red Lauan which often masquerade under the name of Philippine Mahogany. Though neither Nemesu nor Red Lauan can be regarded as a true substitute for Mahogany, they are suitable for certain of the purposes to which that timber is put, but they differ in being somewhat harder, coarser in texture, and less rich in color or figure, and do not possess the striking low ratio between tangential and radial shrinkage of Mahogany. It is this character that has been so important a contributory factor in establishing Mahogany as the finest cabinet wood in the world."

"The timber of Damar Laut Merah, because of its restricted occurrence, is only of local importance. It belongs to a grade very considerably superior to the best forms of Meranti, including Meranti Bakau, and in certain properties approaches Chengal and the different forms of Balau. . . . It is . . . a suitable timber for heavy construction work. . . . Its weight and hardness are against it for decorative work, such as furniture and panelling, though true quarter-sawn material has an attractive figure."

Timber tests: Nemesu (*Shorea pauciflora* King) and damar laut merah (*Shorea Kunstleri* King). By A. V. Thomas. *Malayan Forester* (Kuala Lumpur) 4: 1: 30–38; January 1935.

Report on tests on small clear specimens in a green condition made at the Timber Research Laboratories, Sentul, F. M. S. The two timbers are those described by Mr. Desch in the preceding paper.

Beiträge zur Kenntnis der Tiliaceen. III. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 160–167; Dec. 31, 1934.

New species are *Colona isodiametrica*, Celebes, vernacular name Samoeking; four new species of *Microcos* from Borneo and New Guinea; *Corchorus pachyphyllus*, Western Australia. The genus *Nettoa* of Baillon is found to be a synonym of *Corchorus*.

Eine neue, interessante *Gonostylus*-Art aus W. Borneo. By W. Domke. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 233–234; Dec. 31, 1934.

Gonostylus sympetala, a tree of 27 m., with basal trunk circumference of 5.5 m., is known in western Borneo by the names Kaju laka, Garu laka, and Kajoe Bictaroh (?).

Notes on some of the Ebenaceae and Verbenaceae of the Solomon Islands collected on the Arnold Arboretum expedition, 1930–1932. By R. C. Bakhuizen van den Brink. *Journal of the Arnold Arboretum* (Jamaica Plain, Mass.) 16: 1: 68–75; pls. 120–122; January 1935.

An annotated list, including descriptions of three new varieties, one new species (*Gmelina salomonensis* Bakh.), and one new combination, *Teysmanniodendron Ahernianum* (Merr.) Bakh. (= *Vitex Aherniana* Merrill).

Check List of the Common Names

Aibul	*Diospyros ferrea*, var. *salomonensis* Bakh.	Ebenaceae
A-la-loi-alugi	*Clerodendron inerme* (L.) Gaert.	Verbenaceae
Ambus-gor-le-le	*Clerodendron confusum* Hallier f.	Verbenaceae
Arka-koo	*Clerodendron Buchanani* (Roxb.) Walp.	Verbenaceae
Arru-arru	*Premna integrifolia* L.	Verbenaceae
Bau	*Callicarpa pedunculata* R. Br.	Verbenaceae
Bu-bula	*Avicennia marina*, var. *resinifera* (Forst.) Bakh.	Verbenaceae
E-ya-papor	*Clerodendron confusum* Hallier f.	Verbenaceae
Father	*Vitex cofassus* Reinw.	Verbenaceae
Fuho	*Clerodendron confusum* Hallier f.	Verbenaceae
Gaitutunu	*Diospyros ellipticifolia* (Stokes) Bakh.	Ebenaceae
Garlu	*Premna integrifolia* L.	Verbenaceae
Gegila	*Diospyros maritima* Bl.	Ebenaceae
Gno-gno-finete	*Diospyros ferrea*, var. *salomonensis* Bakh.	Ebenecaae
Hada	*Vitex cofassus* Reinw.	Verbenaceae
Kaka-fair	*Clerodendron confusum* Hallier f.	Verbenaceae
Kimberi or Kim-berri	*Callicarpa pentandra*, var. *paloensis* (Elm.) Bakh., forma *furfuracea* Bakh.	Verbenaceae
Koko	*Gmelina salomonensis* Bakh.	Verbenaceae
Koru-kopu	*Clerodendron confusum* Hallier f.	Verbenaceae
Moi-kewie	*Vitex cofassus* Reinw.	Verbenaceae
Naosokoño	*Faradaya amicorum*, var. *salomonensis* Bakh.	Verbenaceae
Pumb-arg-aru	*Clerodendron inerme* (L.) Gaert.	Verbenaceae
Qua-eu	*Premna integrifolia* L.	Verbenaceae
Quoi-esa	*Callicarpa pentandra*, var. *paloensis* (Elm.) Bakh., forma *furfuracea* Bakh.	Verbenaceae

Seupa	*Teysmanniodendron Ahernianum* (Merr.) Bakh.	Verbenaceae
Sor-ku-ku	*Callicarpa pentandra* Roxb.	Verbenaceae
Vada; Varha; Vasa; Vatha	*Vitex cofassus* Reinw.	Verbenaceae
Wara	*Vitex cofassus* Reinw.	Verbenaceae

The properties and uses of miro (*Podocarpus ferrugineus*). By ALEX. R. ENTRICAN. Leaflet No. 20, N. Z. State Forest Service, Wellington, March 15, 1934. Pp. 7; 6 x 9.

"As the commonest associate of New Zealand Rimu, Miro (*Podocarpus ferrugineus*) is milled in every important timber-producing district in the Dominion and often sold as Rimu (*Dacrydium cupressinum*), although not popularly accepted as the equal of this wood on account of its more difficult working and nailing properties. In strength, Miro ranks third only to Kauri (*Agathis australis*) and Tanekaha (*Phyllocladus trichomanoides*), both high-priced special-use woods, and is much superior to all other indigenous softwoods, including Rimu, Matai (*Podocarpus spicatus*), Totara (*Podocarpus totara*), White Pine (*Podocarpus dacrydioides*), Silver Pine (*Dacrydium Colensoi*), and Kawaka (*Libocedrus* spp.). It is particularly suitable for both light and heavy interior structural work, but it is also useful for flooring, weatherboarding, and other finishing timbers."

The properties and uses of matai (*Podocarpus spicatus*). By ALEX. R. ENTRICAN. Leaflet No. 21, N. Z. State Forest Service, Wellington, June 23, 1934. Pp. 9; 6 x 9.

Matai has a wide botanical distribution from North Auckland to Southland, but attains its optimum development in the central districts of the North Island at elevations of 1800–2000 feet above sea level, where the usual range in height of mature trees is 80–130 feet, with merchantable boles of 22–46 inches (d.b.h.) and a length of 24–72 feet. Although the tree is relatively medium-sized, it is sometimes 150 feet tall and 8 feet in diameter. The estimated timber supply is over two billion board feet, of which about 90 per cent is located in the central North Island forests, where it comprises about one-fifth of the total stand of 15–20 thousand feet per acre. The normal annual demand for all purposes is estimated at 16 million feet, although the maximum cut for one year was about 24 million. Logging involves no special difficulties, except that care must be taken in felling to prevent splitting and shattering the timber, which is exceptionally free from defects. Green lumber weighs about 68 lbs. per cu. ft., seasoning to about 38 lbs. at 12 per cent moisture. The wood is easy to work, finishes smoothly, takes paint and varnish without trouble, but is likely to split in nailing; though less durable than some other species in contact with the ground, it gives excellent service for weatherboarding and similar uses. Most of the lumber is consumed in general construction, being suitable for practically every part of a building from floor to roof, though usually restricted to window sills, interior and exterior flooring, and weatherboarding. "It is the preëminent flooring timber of the Dominion, its hardness and exceptionally even-wearing qualities ranking it as one of the finest softwood floorings in the world."

The properties and uses of totara (*Podocarpus totara* and *P. Hallii*). By ALEX. R. ENTRICAN. Service Leaflet No. 22, N. Z. State Forest, Wellington, June 23, 1934. Pp. 9; 6 x 9.

"Totara is a medium-density softwood easily seasoned and worked, and of exceptional utility. It ranks amongst the most durable woods of the world, possessing excellent lasting qualities not only in contact with the ground, but also in its resistance to marine borers. Although milled and marketed in practically every timber-producing region in New Zealand, over 90 per cent of the total production originates in the central North Island forests, which contain extensive supplies of virgin timber estimated at over 2,500,000,000 ft. b.m. These trees grow to a large size, exceeding 100 ft. in height and 5 ft. in diameter. Totara timber is obtained from the two species, *Podocarpus totara* and *Podocarpus Hallii*. The two woods are similar in appearance and used for the same general purposes, although differing slightly in density and in character of grain. In most districts the supplies of *P. Hallii* are of negligible importance and purely of local significance and, generally speaking, the two woods are not distinguished commercially."

Nuovo contributo alla flora della Somalia Italiana. By EMILIO CHIOVENDA. *Atti della Società dei Naturalisti e Matematici di Modena* (Modena, Italy) 66: 3–21; Dec. 24, 1934.

A list of plants, with appropriate notes and descriptions, collected in Italian Somaliland by Dr. Ezio Suckert in 1933. Special mention is made of *Balanites Suckerti*, the first species of the section Roxburghianae (family Zygophyllaceae) recorded from the territory, and of *Cordia Suckerti*, which shows a marked affinity with types of this genus from regions far removed. In northern Somaliland there was found a species of the American genus *Selinocarpus*. "Its occurrence in Oriental Africa is not easily explained, . . . but it probably furnishes an instance of migration across western Africa where several American types are known to be frequent." Other new species of trees and shrubs described are *Commiphora Suckertiana*, *Conopharyngia humilis*, and *Jatropha parvifolia*. Indexes for the scientific and vernacular names are included.

CHECK LIST OF THE COMMON NAMES

Abdi cajan	*Pentodon pentander* (Schum. & Thonn.) Vatke	Rubiaceae
Ad ade	*Heliotropium cinarescens* Steud.	Boraginaceae
Ada bil	*Maerua somalensis* Pax	Capparidaceae
Aded	*Acacia Asak* (Forsk.) Willd.	Leguminosae
Adei	*Salvadora persica* L.	Salvadoraceae
Agin	*Heliotropium ovalifolium* Forsk., var. *angustifolium* Chiov.	Boraginaceae
Agin	*Sphaeranthus stenostachys* Chiov.	Compositae
Aginde	*Heliotropium ovalifolium* Forsk.	Boraginaceae
Agno Cafaret	*Oldenlandia corymbosa* L.	Rubiaceae
Allan	*Lawsonia inermis* L.	Lythraceae
Ananie	*Tragia tripartita* Schweinf.	Euphorbiaceae
Armò	*Cissus phyllomicron* Chiov.	Vitaceae
Arundi	*Solanum Sennii* Chiov.	Solanaceae
Balambal	*Abutilon pannosum* (Forst.) Schlectend.	Malvaceae
Bamio	*Blepharispermum lanceolatum* Chiov.	Compositae
Baror grue	*Commiphora Erlangeriana* Engl.	Burseraceae
Boro	*Aristolochia bracteata* Retz.	Aristolochiaceae
Boro doret	*Aerva persica* (Burm. f.) Merrill	Amarantaceae
Bule	*Dasysphaera Robecchii* Lopriore	Amarantaceae
Caar	*Tribulus terrestris* L.	Zygophyllaceae
Cabcann	*Thespesia Danis* Oliv.	Malvaceae

Cengi	*Fimbristylis dichotoma* (L.) Vahl	Cyperaceae
Chesseriod	*Oxystelma bornouensis* R. Br.	Asclepiadaceae
Coatto	*Juncellus pygmaeus* (Rottb.) Clarke	Cyperaceae
Corallita	*Antigonon leptopus* Hook. f. & Arn.	Polygonaceae
Deg deran	*Ipomoea marmorata* Britt.	Convolvulaceae
Degheian	*Boscia coriacea* Pax	Capparidaceae
Donche	*Cassia longiracemosa* Vatke	Leguminosae
Dugal erigiren	*Courbonia virgata* (Fenzl) Brongn.	Capparidaceae
Ellan	*Lawsonia inermis* L.	Lythraceae
Fid fide	*Gongrothamnus Hildebrandtii* (Vatke) Oliv. & Hiern	Compositae
Fifiole	*Clitoria Ternatea* L., var. *flore albo* Ainslie	Leguminosae
Flor de San Diego	*Antigonon leptopus* Hook. f. & Arn.	Polygonaceae
Gaangoi	*Momordica trifoliolata* Hook. f.	Cucurbitaceae
Galancal	*Courbonia tubulosa* Gilg	Capparidaceae
Gando	*Tribulus terrestris* L.	Zygophyllaceae
Garabdar	*Corchorus hirsutus* L.	Tiliaceae
Gare damere	*Cucumis pustulatus* (Naud.) Hook. f.	Cucurbitaceae
Ghet ano	*Euphorbia indica* Lam.	Euphorbiaceae
Ghet biod	*Psoralea corylifolia* L.	Leguminosae
Hoop	*Grewia penicillata* Chiov.	Tiliaceae
Kullun	*Balanites Suckertii* Chiov.	Zygophyllaceae
Lammalosci	*Maerua socotrana* (Schweinf.) Gilg	Capparidaceae
Lubeto	*Ficus capreifolia* Delile	Moraceae
Luctole	*Commiphora Suckertiana* Chiov.	Burseraceae
Mane	*Hyperanthera longituba* (Engl.) Chiov.	Moringaceae
Marmarò	*Acridocarpus ferrugineus* Engl.	Malpighiaceae
Mehdei	*Cassia abbreviata* Oliv.	Leguminosae
Merdis	*Anisotes involucratus* Fiori	Acanthaceae
Nuche	*Sphaeranthus indicus* L.	Compositae
Oddo	*Cordia Suckertii* Chiov.	Boraginaceae
Ombrocoi	*Cleome strigosa* (Bojer) Oliv.	Capparidaceae
Ontor	*Cordyla africana* Lour.	Leguminosae
Orbomò	*Asystasia ansellioides* Clarke	Acanthaceae
Osinadei	*Aerva lanata* (L.) Juss.	Amarantaceae
Rosa di monte	*Antigonon leptopus* Hook. f. & Arn.	Polygonaceae
Sai ure	*Lasiocorys argyrophylla* Vatke	Labiatae
San Miguelito	*Antigonon leptopus* Hook. f. & Arn.	Polygonaceae
Sar sare	*Momordica trifoliolata* Hook. f.	Cucurbitaceae
Sciate	*Gisekia pharnaceoides* L.	Aizoaceae
Selelmah	*Sesamothamnus Rivae* Engl.	Pedaliaceae
Sinei malovei	*Centema Stefaninii* Chiov. and *Digera alternifolia* (L.) Aschers.	Amarantaceae
Uarmei	*Cyperus exaltatus* Retz.	Cyperaceae

Ueghei	*Cassia adenensis* Benth.	Leguminosae
Ur ure	*Basilicum polystachyum* (L.) Moench	Labiatae
Us cabe	*Jatropha parvifolia* Chiov.	Euphorbiaceae

—L. Williams, *Field Museum of Natural History.*

Une relique de la sapinière Méditerranéenne: le Mont Babor. Monographie de l'*Abies numidica* Lann. By A. Barbey. Paris, Librairie Agricole, 1934. Pp. xx+82; 6½ x 10; 33 half-tone plates.

An authoritative description of a small area of country about Mt. Babor in Algeria, with special reference to the little known Silver Fir, *Abies numidica* Lann. The forest is considered a unique relic of ancient times when vast forests of similar composition covered Syria and other Mediterranean countries, and a plea is made for its preservation. The author believes that Firs were originally numerous in association with Cedars and that the two timbers were often used indiscriminately by builders as Cedar of Lebanon. One long chapter of the book is devoted to the forest entomology of the locality. The preface (pp. vii–xx) is by Professor Ph. Guinier. The book is well written and the typography and numerous illustrations are excellent.

Sur trois arbres de la forêt gabonaise. By A. Walker. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 14: 154: 421–426; June 1934.

Contains notes communicated to Prof. Aug. Chevalier by Abbé A. Walker, a missionary to Gaboon, on the vernacular names, uses, etc., of three trees producing scented resins. The vernacular names listed are as follows:

Olumi Rouge (*Copaifera* sp., probably *C. Salikounda* Heckel, according to D. Normand): Andèm, Didémbó or D. di Dang'ó, Indémba, Léndémba or L. le Béi, Motómbi, Mutómbé, Mutómbi, Murèi, Mutèli, Ntèna, Olumi or O. wa Tenatena, and Otómbi.

Olumi Noir (*Detarium* sp.): Dindémbó di Vindo, Gélómbi, Gilómbi, Gilombo, Ilombi, Léndémba lé Yindi, Murègi, Murèi-gifufu, Nsiré (?), and Olumi wa Vyóvyó.

Arbre à Briquet (*Grewia coriacea* Mast.): Lékong'o, Mondji or Mwondji, Ngwagiri, Okong, Okongea, and Okongi.

Eine zweite Probefläche aus dem Regenwald von Fernando Poo aufgenommen von H. Burchardt. By J. Mildbraed. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 183–186; Dec. 31, 1934.

Examination of the vegetation of a hectare of rain forest three to four km. from the coast of Fernando Po shows that there are present 259 trees of all sizes, 51 with a diameter of 60 cm. or more and 83 with a diameter of 30–59 cm. They represent 26 species, the majority of the tall trees being *Chrysophyllum africanum*, *Pycnanthus kombo*, and *Coelocaryon Preussii*. There are present also 12 species of shrubs, three of vines, and three of herbs.—P. C. Standley.

Au sujet de l'appellation commerciale des bois du Cameroun. *Revue Internationale du Bois* (Paris) 1: 11: 60–63; November 1934.

The first part of this article is a contribution by the Inspection des Eaux et Forêts, Territoires du Cameroun, to clarify the confusion and imprecision of commercial names applied to meliaceous woods which form the principal forest products of the territory. "Generally speaking, the races or tribes west of the Fang (a group of Bantu negroes) know little about the forests and their resources. Only the older people are still able to distinguish the species." Since the first exploitation of the forests in 1922 or 1923 the necessary menial labor has been supplied by the Etons, Boulous, and Yaoundés, subtribes of the Fang group, and it is now customary to recognize the Yaoundé designations of the trees.

The most common species of *Entandrophragma* in the French Cameroons are *E. cylindricum*, *E. utile*, *E. Candollei*, and *E. Leplaei*. The first three are known, in the Yaoundé dialect, as Assié. If a more precise designation is required the following distinction is made: *E. cylindricum*, Assié; *E. utile*, Assang-Assié; and *E. Candollei*, Atom-Assié. Originally the timbers were sold in the trade under the general name Assié, but later the designation Sapéli was proposed and adopted for *E. cylindricum*, and the trade names Assié-foncé or Assié-foncé Sapéli reserved for *E. Candollei*. Édoussié or Édissié

(*E. Leplaei*), of little commercial importance, is sold as Mangona Foncé.

The same confusion exists among the vernacular names for *Khaya* species. Locally, the appellation Magona or Mangona, probably a corruption of Mahogany, is given without distinction to all species of this genus. Among the Yaoundés, however, *K. Klainei* is known as Ngollo or Ngollon and is sold under the name Red Mahogany or Acajou Rouge; and *K. anthotheca* as Mangona or (in the trade) White Mahogany.

Finally, the Olonvogo of commerce (*Fagara* sp.) is sometimes sold under the name Fraké Dur, whereas the true Fraké is a species of *Terminalia;* and *Daniella thurifera* is occasionally exported under the name Bombaba, which is *Dialium macranthum.*

In the second part of the article J. Meniaud, Chef du Service des Bois à l'Institut Nationale d'Agronomie Coloniale, contributes brief observations on the nomenclature of Cameroon woods.

Logs of Assié (*E. utile*) are sometimes sold under the name Sapéli, the trade designation for *E. cylindricum.* The two species are very similar in several respects, but Sapéli, when freshly cut, has an odor resembling Cedar—a distinguishing feature not possessed by other Mahoganies or false Mahoganies.

Logs of Kossipo (*E. Candollei*) are found occasionally in mixture with Assié (Sipo of the Ivory Coast), but the timber is denser, darker, less attractive, and not suitable for all the purposes of Assié.

A French Cameroon wood sold under the name Édissié has not been determined botanically, but it resembles Bossé and Mugtibanaye of the Ivory Coast, and has nothing in common with the so-called Édoussié, and probably is not one of the Meliaceae. To avoid confusion with Édoussié or Édissié, the author suggests that the woods of *Afzelia africana* or *Afzelia* sp. should be called Doussié or N'Doussié, names already adopted by the trade. The two Khayas of the Cameroons, which are identical with the Grand Bassam and Krala of the Ivory Coast, should be known as N'Gollon (*K. ivorensis*) and Mangona (*K. anthotheca*) in preference to Acajou Rouge or

Red Mahogany and Acajou Blanc or White Mahogany, respectively.—L. WILLIAMS, *Field Museum of Natural History.*

Silvicultural notes on *Mansonia altissima.* By W. D. MACGREGOR. *Empire Forestry Journal* (London) 13: 2: 235–238; 2 plates; December 1934.

Mansonia altissima A. Chev., known in Gold Coast as Pruno or Apruno and in Nigeria as Ofun, is a tall, well formed, sterculiaceous tree whose timber resembles Black Walnut, has excellent working and seasoning qualities, and is finding a ready market in England.

During the past three years the writer, the Silviculturalist of the Nigerian Forest Service, has been studying the silvics of the species. "The most important feature of the tree is that in its first year it is a shade demander and thereafter a light demander. . . . The 1933 regeneration coupe has met with most satisfying success and the writer feels justified in stating that the methods of securing and establishing natural regeneration of Ofun are now known and can be applied on a practical scale. . . . In the nursery there is little difficulty in securing germination and healthy seedlings. For success fresh seed must be used and the beds should be moderately shaded and well watered. Germination is effected in two to three weeks and a viability of 80 per cent or more should be obtained."

Silviculture of the mixed deciduous forests of Nigeria, with special reference to the south-western provinces. By W. D. MACGREGOR. Oxford Forestry Memoirs, No. 18. Mr. Milford, Oxford University Press, Oct. 18, 1934. Pp. 108; 7½ x 10¾; plates 48, text figs. 22; price 15 s. net.

"The mixed deciduous forest type occupies an important part in the forest flora of Nigeria. Ecologically it comes between the true deciduous and the true evergreen forest types. Botanically it contains high forest trees of both types, but differs from the deciduous in containing evergreen under canopies and from the evergreen in containing top canopies of deciduous trees. Judged by the presence of high forest trees, the mixed deciduous type is nearer to the deciduous type than to the evergreen type. It is a climatic formation in which deciduous trees attain their optimum development. In its most humid form the mixed deciduous merges imperceptibly into the evergreen or rain forest type. It requires a rainfall ranging from 50 to 70 inches per annum.

"A detailed study would recognize numerous sub-types according to the presence of plant indicators and the frequency distribution and girth range of type trees. With the evergreen forests to the south and the deciduous forests to the north, the mixed deciduous forests form an almost continuous belt of varying width running parallel to the coast. Although they contain a wealth of important timber trees of large dimensions, they have not been exploited to the same extent as the rain forests. This is due in large measure to their geographical position, which places them outside the zone of streams and rivers suitable for floating timber. There can be no doubt, however, that the introduction of other means of extraction will, in time, open up these great resources of timber wealth."

"The regeneration of these forests is a problem of considerable importance. It is obvious that over areas of thousands of square miles the system of clear felling and replanting is both impracticable and silviculturally undesirable. To preserve the ecological balance, regeneration must employ natural or natural *cum* artificial methods. Forest reservation and the introduction of a minimum girth felling limit have safeguarded the stability of the forest wealth, for, in the absence of shifting cultivation or actively eroding lands, there is no forest retrogression. As yet natural regeneration methods for these forests have been applied on an experimental scale only, but sufficient data have now been obtained to justify the application of these methods on a larger scale."

The subject matter of this attractively printed and illustrated memoir includes statistical investigations of the rate of growth of Nigerian trees in plantations and natural forests; experimental silviculture—seed collection and treatment, nursery wood, planting, artificial and natural regeneration; silvical characters of indigenous and exotic species; and descriptions of seedlings. In an appendix (pp. 105–108) is a report on Olokemeji soils by H. C. Doyne and W. A. Watson, agricultural chemists.

L'exploitation forestière à la Côte occidentale africaine. By FRANÇOIS CERMAK. *Zeitschrift für Weltforstwirtschaft* (Neudamm & Berlin) 1: 4/5: 234–264; 10 figs.; Jan./Feb. 1934.

The paper is in two parts. The first is concerned with the development of the timber industry in the French colonies in West Africa and discusses certain retarding factors such as the exacting requirements of European importers, the mixed nature of the forest, an unfavorable climate, lack of labor, and government forest regulations. In the second the author makes suggestions, based on his personal experience, for reducing the cost of operations from the felling of the trees to the loading of the logs for shipment.

Aperçu sur la systématique des bois. By D. NORMAND. *Revue Internationale du Bois* (Paris) 11: 15–25; November 1934.

This article may be regarded as a historical review of the technical studies of wood anatomy, a science which the French pertinently call "xylologie." Although investigations along this line can be traced back to M. Malpighi (1671), N. Grew (1675), or to A. de Leeuwenhoek (1695), the origin of scientific researches bearing upon the anatomy of plants is truly linked with the perfection of optical instruments at the beginning of the 19th century, and the study of wood, as it is now understood, originated in the present century. But throughout the generations, irrespective of geographical or political boundaries, the basic principles of these studies are fundamentally the same. Through their valuable contributions, the establishment of this comparatively young science is attributable to such eminent botanists as Th. Hartig, Herbert Stone, H. H. Janssonius, J. W. Moll, Hans Solereder and others.

The first part of the article is devoted primarily to the investigations on dicotyledonous woods by French anatomists from the beginning of the 19th century up to the present day. As early as 1810 Mirbel came to the conclusion that the comparative structure of plants furnished sufficient evidence for the separation of the natural groups. His researches influenced Regnault, in 1860, to undertake studies on the structural affinity of the stems of plants of the group Cyclospermeae.

On the basis of similar investigations, Jean Chalon, in 1867–8, published two memoires designed to serve for the determination of families, genera, and species. A few years later A. Mathieu published his *Flore forestière* (3rd ed.) in which were included the botanical characters of the principal indigenous species of France with macroscopic descriptions of the woods, their properties and densities. In 1907 Perrot and Gérard completed their *Recherches sur les bois de différentes espèces de Légumineuses africaines*, treating with the properties, macroscopic and microscopic structure of the wood, distribution and abundance of the species, and the potential value of the timber for industrial purposes. This method, involving both the scientific and commercial phases, was regarded at the time as an innovation in the study and presentation of descriptions of woods and established a precedent for subsequent French investigators of tropical woods.

In the latter part of the article there is a concise discussion of researches undertaken in recent years by wood anatomists in England and the United States and the methods pursued by them in interpreting the structure of wood. These investigations of wood anatomy are not confined to mere descriptions of structural characters, but their usefulness extends to other branches of botany. The data compiled assist the taxonomist in determining herbarium material or, in doubtful instances, they may reveal some affinity among plants of the same family, while the problem of phylogeny is also brought within the scope of the xylologist. The final category is the systematic study of the anatomy of woods of a natural order or family, along which line, under the guidance of Professor Record, treatises have already appeared on the Meliaceae, Magnoliales, Myristicaceae, and Monimiaceae. Furthermore, the information gained from these systematic studies and a more thorough appreciation of the properties of woods are of infinite value in their rational application industrially.

Combining the French, Dutch, English, and American systems the author presents in table form the most important elements to be considered in drawing up a qualitative and quantitative description of dicotyledonous woods based on: (*a*) medullary rays; (*b*) wood parenchyma; (*c*) vessels; (*d*) fibers; (*e*) accessory elements, such as secretory tissues, growth rings, false rays, etc.; and (*f*) grain.—LLEWELYN WILLIAMS, *Field Museum of Natural History*.

The properties of wood. (In Russian.) By S. I. VANIN ET AL. Forest Technical Academy, Leningrad, 1934. Pp. 548; 5¾ x 8½; text figs. 224.

This comprehensive, copiously illustrated treatise is divided into 12 chapters, with subjects and authors as follows: I, Anatomical structure of wood and bark (pp. 10–52), by Professor Vanin; II, The most important native and exotic timbers (pp. 53–98), by Professor Vanin, N. K. Malaha, and V. P. Maltchevsky; III–VI, Chemical, physical, and mechanical properties of wood, and methods of timber-testing (pp. 99–313), by Professor Vanin; VII, Defects (pp. 314–388), by Professor Vanin and A. I. Kuznetzoff; VIII–IX, Durability, wood preservation, and fireproofing (pp. 389–442), by Professor Vanin; X, Uses of native and some exotic woods (pp. 443–481), by Professor Vanin; XI, Lumber grading (pp. 482–509), by A. I. Kuznetzoff; XII, Plastic mass from wood (pp. 510–514), by Professor Vanin. The work includes an extensive bibliography (pp. 515–544) arranged by subjects.

Structure anatomique et valeur technique du bois. By PAUL JACCARD. Zurich, July 1934. Pp. 20; 8¼ x 11¾; figs. 34.

A popular account of the structural peculiarities of wood, copiously illustrated with drawings and photographs.

Salient lines of structural specialization in the wood rays of Dicotyledons. By DAVID A. KRIBS. *Botanical Gazette* (Chicago) 96: 3: 547–557; 1 pl.; March 1935.

The line of evolutionary development of rays is from the heterogeneous to the homogeneous types. The most primitive are "the multiseriates with their greatly elongate uniseriate wings, together with the high uniseriates composed of greatly elongate cells. As specialization continues, the multiseriates become more fusiform in outline [tangential section], the wings become shorter, and the cells of the uniseriates become shorter. . . . The next step in the evolutionary sequence involves a change from the heterogeneous to the homogeneous condition in which the cells of the uniseriates are identical with those of the multiseriates; in addition, the uniseriates are becoming shorter and less numerous and the multiseriates are mostly fusiform and homogeneous. . . . Finally, the most highly specialized condition is represented by the homogeneous type . . . in which the uniseriates are usually scarce or absent, the multiseriates being fusiform and homogeneous."

The organization of the cell wall of the conifer tracheid. By R. D. Preston. *Phil. Trans. Royal Society of London* (Ser. B) 224: 511: 131–174; pls. 17, 18; Dec. 12, 1934.

"An attempt to elucidate certain problems connected with the growth of a softwood tree, using methods similar to those of crystal physics." The organization of the cellulose wall is considered with reference to the processes of growth and development. The investigation led to the working hypothesis "that both cambial initials and apical meristem cells have wall structures closely resembling those of adult wood elements."

The range of the paper is indicated by the subject headings: Radial growth in the conifer; The cellulose wall and its bearing on cell growth; The nature of the molecular spiral on the tracheid wall; The origin of the spiral structure of tracheid walls. Under the last are discussions of "pressure wood" and "tension wood," spiral grain, and the occurrence of right-spiralled and left-spiralled tracheids in the same tree.

The toxic principle of the poison ivy. By G. Albert Hill, Vincent Mattacotti, and W. D. Graham. Reprinted from *Journal of the American Chemical Society* 56: 2736–2738; December 1934.

In the light of researches of Pfaff (1897), Acree and Syme (1906), McNair (1916), and Majima (1907–1922), the work of isolating and identifying the toxic principle of the Poison Ivy, *Rhus Toxicodendron*, was brought to a successful conclusion in the Hall Laboratory of Chemistry, Wesleyan University (Middletown, Conn.). At first the leaves, some fresh, others

dried and pulverized, were used for extraction, but owing to waxy impurities and technical difficulties, the bark was later turned to as a source, although that gathered in the winter was found to be nearly devoid of toxic material. By means of boiling point, molecular weight determinations, and by the preparation of a number of derivative compounds, the yellow oil isolated from the bark during the growing season established the identity of the poison with *urushiol*. Urushiol has been found to be the poisonous principle of Japan lac obtainable from *Rhus vernicifera*. Personal experiments of the authors verified Japanese findings that the hydroxyl groups in urushiol are the chief cause of its well-known violently vesicant action.—Carl G. Deuber, *Department of Botany, Yale University*.

Botanische Untersuchungen im Tropenwalde in ihrer Bedeutung für die Forstwirtschaft. By J. Mildbraed. *Zeitschrift für Weltforstwirtschaft* (Neudamm & Berlin) 1: 8/9: 518–528; 3 figs.; May/June, 1934.

The author points out some of the difficulties that confront the European forester when first he attempts to manage a tropical forest, and offers advice on how to avoid mistakes. One of the principal problems arises from the multiplicity of species in the virgin forest, and the object of management is to convert that unprofitable type into stands of a few commercially and silviculturally desired species.

Sur l'origine des ébènes commerciaux de l'antiquité du XVII^e–XVIII^e siècle et de l'époque contemporaine. By Aug. Chevalier. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 14: 948–965; November 1934.

The author introduces his subject with some historical notes relating to the periods with which he deals and points out the difficulty of establishing the origin of the precious woods used from the earliest times or the most remote periods of civilization in the Old World and the identification of the wooden articles found amongst the relics of the Ancient Egyptians, Greeks, Romans, or the peoples of the extreme East. For more than a thousand years in Europe and the near

East only the indigenous woods were used for making furniture and in building construction—especially Oak, Walnut, and sometimes Olive in the Mediterranean region. The Cherry and Pear were then used largely in the manufacture of furniture—beds, tables, seats, etc. For the decoration of churches or for lasting and durable work, Oak and Chestnut were used. He attributes the use of exotic woods to the Renaissance period, and from the beginning of the extensive voyages round the world these foreign woods began to make their appearance for the manufacture of furniture, a small number of species being available at first. The only precious woods known up to the 15th Century were Cade or Palissandre de Barbarie (*Callitris articulata*)[1], the Benus (Ebène), the Brésil (*Caesalpinia*),[2] and the Cyprès [Cypress (*Cupressus sempervirens*)].

The rare woods provided by the forests of Asia and America, the tropical Islands in the Atlantic, the Indian and the Pacific Oceans, were used in preference to the indigenous woods. Of these Ebony was regarded as being amongst the most valuable and the most delicate to work and to this circumstance he attributes the origin of the name "Ebénistes" for the workers in the then new trade of cabinet or furniture making; but the botanical origin of the woods used in "Ebénisterie" was for a long time unknown and it is only in comparatively recent years that the specific sources of the principal Ebonies of commerce have been decided. As evidence of the use of Ebony in remote ages reference is made to the finding of many small objects made of the wood in the Tombs and he quotes from Herodotus (490–480 B.C.) who, in recording the gifts of the Ethiopians sent to the Persian Kings, mentions

[1] *Callitris articulata* (Vahl) Murbeck = *Thuja articulata* Vahl = *Tetraclinis articulata* (Vahl) Masters; it is also known as Thuya Wood. The name Cade is now applied to *Juniperus Oxycedrus* L. of the Mediterranean region—a scented wood yielding Oil of Cade.

[2] *C. Sappan* L., now called Sappan Wood, was known originally as Brazil Wood (of the East)—under which name it was an important article of commerce in the Middle Ages. Brazil was discovered May 3, 1500, and the country was given this name because of the red dyewood of another species of *Caesalpinia* (*C. echinata* Lam.) found growing there.

virgin gold, logs of Ebony, Ethiopian boys, and elephant tusks; from Theophrastus (350 B.C.) who knew two species of Ebony, one from Ethiopia and one from India; from Vergil (*Georgics*, book II, line 116, published at Naples in 30 B.C.), according to whom black Ebony was produced exclusively in India; and from the writings of Pliny (published 77 A.D.) when one Ebony wood was known in Rome.

The author then proceeds to set out information on those species of the Ebonies of commercial value, the botanical origin of which has been established, mainly in the course of the 19th century. They are mostly species of *Diospyros* and *Maba* (Ebenaceae) and a few species sometimes sold under the name of Ebony, including *Dalbergia Melanoxylon* Guill. & Perr. of Africa, *Brya Ebenus* of the Antilles, and *Melanoxylon Brauna* Schott of Brazil (all Papilionaceae).

They are dealt with under the following heads: (1) Macassar Ebony—*Diospyros Macassar* A. Chev. (*D. utilis* Koord.) of the Celebes Islands. (2) The Ebony of Senegal, Upper Egypt, Abyssinia, and Eastern Africa—*Dalbergia Melanoxylon* Guill. & Perr. (3) Ebonies of Western Africa—*Diospyros evila* Pierre of Gaboon; *D. crassiflora* Hiern (*D. incarnata* Gürke) of Gaboon, Cameroons, and S. Nigeria (Yoruba, Old Calabar, etc.); *D. Dendo* Welw. of Angola and Cameroons. (4) Ebonies of Madagascar—chiefly *D. Perrieri* Jumelle and *D. Caucheana* sp. nov. (5) Mauritius and Reunion—*D. tesselaria* Poir. and other species. (6) East India—*D. Ebenum* Koenig, of the forests of the Deccan and Carnatic India and in Ceylon, and *D. Melanoxylon* Roxb. of S. India and Ceylon. (7) Ebony of Indo-China—*D. vera* (Lour.) A. Chev. (*Maba Ebenoxylum* G. Don). (8) The False Ebonies of tropical America, in which the author includes the leguminous trees, *Melanoxylon Brauna* Schott of Brazil (known as Brauna in São Paulo) and *Brya Ebenus* DC. (Cocus, Granadillo, or West Indian Ebony) of Jamaica, Cuba, and Dominican Republic.

It may be of interest to add *Diospyros mespiliformis* Hochst., a West African Ebony found from Senegal to N. Nigeria, extending to East Africa, and known in the trade as Lagos, Old Calabar, Gaboon, and Zanzibar Ebony; also it is of special interest to note that the specific name of *Macassar* has been given to the Macassar Ebony, so well known in the trade, but hitherto only referred to botanically as *Diospyros* sp., and that a new species is described—*Diospyros Caucheana* A. Chev., belonging to Madagascar and named in honor of Normand Cauche, a traveller who first brought this tree into notice.

A separate section is devoted to *Dalbergia Melanoxylon* Guill. & Perr., an Ebony or Blackwood tree that has probably the widest distribution of any of those mentioned in tropical Africa, where it is known variously as Ebony Wood, Senegal, Unyoro, Senaar, and Sierra Leone Ebony, Congo-Holz, etc., and in the trade usually as African or Mozambique Ebony and African Blackwood. According to Gamble (*Indian Timbers*, p. 247) this species is cultivated in India, where it is known as China Blackwood. There seems to be little or no doubt that this wood is the same as that mentioned by Herodotus as paid in tribute to the Persian Kings and thus one of, and probably the earliest, Ebony in use, since the Ethiopia of ancient authors was principally applied to the country we now know as Abyssinia, Nubia, and Upper Egypt.

The term Black Ebony appears to be usually applied to the commercial wood imported from Gaboon, Calabar, East India, Ceylon, Madagascar, Macassar, and Mauritius; that from Gaboon being regarded, in the London market, as the darkest, that from Madagascar as the densest, and the Macassar Ebony as furnishing the largest pieces.

The name Ebony as applied to various woods seems to be almost as indefinite as that of Mahogany and the author is to be congratulated on affording so much useful and reliable subject matter, although he describes it as a modest contribution to our knowledge of their history.

In conclusion he refers to the rarity or possible extinction by over exploitation of certain species furnishing Ebony wood and recommends the conservation and cultivation on a forest scale for the protection of the industry.—J. H. HOLLAND.

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A STUDY OF THE LECYTHIDACEAE[1]

By GEORGE A. DIEHL

The Lecythidaceae are small to exceptionally large trees widely distributed in tropical regions of both hemispheres, though most abundant and of greatest stature in the Amazon forest. Their timbers are of minor commercial importance at present, their best known products being the Brazil nuts, of *Bertholletia excelsa*, and the Sapucaia, cream, or paradise nuts, of *Lecythis paraensis*. Owing to the cup-like form of the opercu-late fruits of some of the trees, the group is often known as the Monkey-pot Family.

Systematic botanists are not agreed as to (1) the relationship of the Lecythidaceae to the Myrtaceae, (2) the internal organization of the Lecythidaceae, and (3) the natural affini-

[1] Abstract of a dissertation presented for the degree of Doctor of Philosophy in Yale University. The work was done under the supervision of Professor RECORD.

ties of the genera *Asteranthos* and *Napoleona*. The present investigation approaches these taxonomic problems through the comparative anatomy of the secondary xylem.

General Plant Description

The Lecythidaceae have simple, alternate, non-glandular leaves, without stipules. Flowers rather large and showy, actinomorphic or zygomorphic, hermaphrodite; calyx 4–6-lobed, lobes valvate or slightly imbricate; petals 4–6, free or united into a campanulate tube and then with many ribs; stamens numerous, in several series, sometimes the outer ones modified into staminodes and resembling a corona; filaments mostly united and often arranged to one side of the flower; anthers basifixed and rarely adnate, opening at the side by a slit; staminal disk sometimes lobed; ovary inferior or semi-inferior, 2 or more celled; ovules 1–many on axile placentas, sometimes towards the apex of the cells; style mostly simple. Fruit woody, fibrous, or fleshy, indehiscent or operculate at the apex; seeds without endosperm; embryo divided or entire. (Hutchinson, *12*.)

Lignier, on a basis of the cortical bundles, separated the family into three tribes: (1) Lecythideae, with normal orientation, *i.e.*, with the phloem on the outside, toward the epidermis; (2) Barringtonieae, inverted, *i.e.*, with the phloem toward the axis; and (3) Napoleoneae (*Asteranthos* and *Napoleona*), normal as to the cortical bundles, but without posterior and anterior, dorsal and ventral, bundles, or arcs of bundles, in the petioles.

Anatomical features of the secondary xylem of the Lecythidaceae indicate a close relationship between the genera which constitute this distinctive group.

Economic Importance of the Lecythidaceae

While many of the timbers are suitable for construction purposes and carpentry, they are practically unknown to commerce. *Cariniana pyriformis*, improperly known as Colombian Mahogany, once had a limited trade in France and New York (*27*). Special attention has been directed to the Manbarklak

(*Eschweilera* sp.) of Surinam, because of its comparative immunity to attack by shipworms and other marine borers, its resistance being attributed to the presence of silica particles in the parenchyma cells. Many species supply good material for local use in the construction of houses, boats, carts, native furniture, boxes, and the like.

Brazil nuts and, to a less extent, Sapucaia nuts are regular articles of export from Brazil to the United States and Europe (*24*). They contain an almost colorless and odorless oil, used for cooking and soap-making and, in general, as a substitute for olive oil. Miers (*20*) and Pierrot (*24*) state that the finely laminated inner bark of the trunks as well as the outer husks of the fruits of these two species furnish a kind of oakum for caulking ships.

Distribution

The genera represented in the Western Hemisphere are *Allantoma*, *Asteranthos*, *Bertholletia*, *Cariniana*, *Couratari*, *Couroupita*, *Eschweilera*, *Grias*, *Gustavia*, and *Lecythis*. Of these, the first three are confined to South America, *Bertholletia* being indigenous to Brazil. All of the remaining genera of this group are distributed over northern South America, Central America, and the Antilles.

The genera of the Eastern Hemisphere are *Barringtonia*, *Careya*, *Chydenanthus*, *Foetidia*, *Napoleona*, *Petersia*, and *Planchonia*. *Napoleona* and *Petersia* are the only African representatives and are found in Gold Coast, Ivory Coast, and Liberia; *Petersia* is the most widely distributed of all the genera, extending as far east as the Philippine Islands. *Foetidia* is confined to Madagascar and the islands in the vicinity. The remaining genera are spread throughout Malaysia and Oceania as far east as the Society Islands, while *Planchonia* and *Careya* inhabit the Andaman Islands, eastern India, and Burma.

Taxonomic History of the Lecythidaceae

Of the seventeen genera now commonly recognized, Lineaus described *Lecythis* in 1758 and *Grias* in 1759, later (1762) placing them in the division Polyandria, Monogynia.

During the subsequent 26 years the following genera were described, *Couratari* Aubl. and *Couroupita* Aubl. (1775), *Barringtonia* Forst. (1776), *Gustavia* L. (1785), and *Foetidia* Commers. (1786). Definite family affinities were first indicated when Jussieu (1789) placed these genera, excepting *Foetidia* and *Grias* [2], in his second section of the Myrtales.

Napoleona was discovered by Polisôt de Beauvais in 1787, but his drawings and description of the genus were not published until 1805. *Asteranthos* was figured and described by Desfontaines in 1820. In 1822 Robert Brown wrote: "*Napoleona* and *Asteranthos* are without doubt nearly related; and, even independent of the structure of fruit yet to be ascertained, possess sufficient characters to separate them from every known family. In adopting the generic name proposed by M. Desvaux for *Napoleona* this order may be called Belviseae." For the next thirty years the natural position of the Belviseae was in doubt.

After an examination of *Bertholletia*, *Couratari*, *Couroupita*, *Gustavia*, and *Lecythis*, in French Guiana, Poiteau (1825) decided that they, together with *Barringtonia*, had sufficient individual characteristics to warrant forming a new family, the Lecythidaceae. De Candolle, however, did not accept Poiteau's treatment and, in 1828, arranged the Myrtaceae into five tribes, as follows:

MYRTACEAE: I. Chamaelaucieae DC.; II. Leptospermeae DC.; III. Myrteae DC.; IV. Barringtonieae DC. (*Barringtonia* Forst., *Stravadium* Juss. and *Gustavia* L.); V. Lecythideae Rich. & Poit. (*Lecythis* L., *Eschweilera* Mart., *Bertholletia* Humb. & Bonpl., *Couroupita* Aubl., and *Couratari* Aubl.). Myrtaceae dubiae: *Foetidia* Commers., *Careya* Roxb., and *Grias* L.

The De Candolle classification was followed by Dumortier (1829), Bartling (1830), and Meisner (1836–43). Endlicher (1836–40) likewise accepted the general principles of the De Candolle classification, but designated the divisions sub-

[2] Jussieu applied the generic names *Butonica* Rumph. and *Pirigara* Aubl. to *Barringtonia* Forst. and *Gustavia* L., respectively. He included *Foetidia* in Section I of the Myrtaceae and assigned *Grias* to the Guttiferae.

families rather than tribes. In the preparation of an enumeration of the plants at the Museum of Natural History in Paris, Brongniart (1850) accepted and used the classification set forth by Poiteau. Lindley (1830), disagreeing with De Candolle and others who combined the Barringtonieae and Lecythideae with the Myrtaceae, included the former group in the Myrtle family with the notation, "probably not belonging to the order," and placed the other in the proximity of the Ternstroemiaceae. Lindley (1853) gave the two groups family ranking, placing the Lecythidaceae in his Myrtales, next to the Myrtaceae, "from which they differ in their great almond-like seeds and alternate, often serrated leaves, without pellucid dots," and the Barringtoniaceae in the Grossales as "they are assuredly quite distinct [from the Myrtaceae], differing in the presence of a large quantity of albumen, and in having alternate leaves, without transparent dots, but often serrated." He further stated that while the Lecythidaceae and Barringtoniaceae agree in many respects, the former have stipules and "their singular hooded plate of sterile or additional stamens is most remarkable." He considered the Belvisiaceae (*Napoleona* and *Asteranthos*) as belonging to "the great Myrtal alliance" with striking affinities to *Barringtonia* and *Careya*.

Berg (1854) and Martius (1857–59) both followed the De Candolle classification closely; Bentham and Hooker (1862–67) accepted it with modification, combining the tribes Barringtonieae and Lecythideae into one, Lecythideae, which they in turn divided into three subtribes, as follows:

MYRTACEAE: I. Chamaelaucieae; II. Leptospermeae; III. Myrteae; IV. Lecythideae: (1) Barringtonieae (*Barringtonia* Forst., *Petersia* Welw., *Careya* Roxb., *Planchonia* Blume, *Gustavia* L., and *Grias* L.); (2) Eulecythideae (*Couratari* Aubl., *Couroupita* Aubl., *Lecythopsis* Schranck, *Lecythis* L., and *Bertholletia* Humb. & Bonpl.); (3) Napoleoneae (*Napoleona* Beauv. and *Asteranthos* Desf.). Genus anomalum: *Foetidia* Commers.

After studying a living plant of *Napoleona*, in blossom at Kew, and comparing it with dried specimens collected by Beauvais, Jussieu, Hendelot, Vogel, and others, Masters

(1869) decided that the closest relationship is with *Asteranthos*, thus supporting the view of Bentham and Hooker. In his rather imposing monograph of the family Miers (1873) accepted Lindley's arrangement and recognized the families Lecythidaceae and Barringtoniaceae. Because of the diversity of structure in the Lecythidaceae and the Myrtaceae he concluded that "under such conditions it appears to me injudicious to agglomerate into a single natural order groups so utterly distinct." Subsequently he published the results of a study of the genera *Asteranthos* and *Napoleona* and declared that the latter must be considered as "the monotypic representation of a distinct family, the Belvidiaceae, definitely excluding *Asteranthos*." He compared *Asteranthos* with *Rhododendron* and found nothing to separate that genus from others of the Rhododendreae (a tribe of the Ericaceae, as arranged by Lindley), "except a more rotate corolla, with more numerous and shorter lobes." Baillon (1875) followed Bentham and Hooker's modification of the De Candolle system but changed the name of the fourth tribe to Barringtonieae. Sagot (1884) adopted the De Candolle classification for his catalogue of the vascular plants of French Guiana, and expressed the opinion that Miers had accepted too many species. Constantin and Dufour (1885) combined the Barringtoniaceae, Lecythidaceae, and Belvisiaceae of Lindley into a single family, the Lecythidaceae, without subdivisions. They found that anatomically the Lecythidaceae form a homogeneous group because of the presence of cortical bundles and the absence of secretory processes and internal phloem. Lignier (1887), on the basis of the orientation of the cortical bundles, divided the Lecythidaceae into three tribes: Barringtonieae, Lecythideae, and Napoleoneae (*Asteranthos* and *Napoleona*). Niedenzu (1892) likewise considered the Lecythidaceae as a distinct family and, by using a combination of taxonomic characters and the anatomical features presented by Lignier, separated it into four subfamilies as follows: I. Foetidioideae (*Foetidia* Commers.); II. Planchonioideae (*Planchonia* Blume, *Petersia* Welw., *Careya* Roxb., *Barringtonia* Forst., and *Chydenanthus* Miers); III. Napoleonoideae (*Asteranthos* Desf. and *Napoleona* Beauv.); IV. Lecythidoideae (*Japarandiba* Adans. [=*Gustavia* L.], *Grias* L., *Couroupita* Aubl., *Lecythis* L., *Eschweilera* Mart., *Bertholletia* Humb. & Bonpl., *Cariniana* Casaretto, *Cercophora* Miers, *Couratari* Aubl. [=*Lecythopsis* Berg], and *Allantoma* Miers).

It is interesting to note that outstanding workers in the present century, such as Brandis (1911), Warming (1911), Wettstein (1911), Rendle (1925), Hutchinson (1926), and Johnson (1931), have returned to the simple classification inaugurated by Poiteau, considering all of the genera as members of an undivided family, the Lecythidaceae, distinct from the Myrtaceae. Solereder (1908) follows the Lignier arrangement, which is based on a study of the vegetative anatomy and supports, to some degree, the Poiteau classification. Finally, Knuth (1934) accepts the view of Lindley and states that the New World genera should be considered as a separate family, the Lecythidaceae, distinct from the Old World genera, which he assigns to the Barringtoniaceae; he also refutes the idea of a relationship between *Asteranthos* and *Rhododendron*, as suggested by Miers.

It will be noted from the above discussion that the changes in the classification of the Lecythidaceae have been concerned primarily with internal arrangement rather than with position relative to other families. As early as 1789 the known genera were assigned to the order Myrtales by Jussieu, and that general relationship has been recognized in practically all subsequent botanical literature. Some of the more recent investigators follow Poiteau and make no subdivision of the family; others divide it into a number of tribes; and still a third group accept the classification as presented by Lindley and consider the genera as organized into two separate families, the Barringtoniaceae and the Lecythidaceae.

The genera *Napoleona* and *Asteranthos* have had a diversified treatment in the various classifications. By some authorities they have been regarded merely as individual genera in the families Myrtaceae or Lecythidaceae; others have grouped them together to form a definite tribe having various affinities; while three investigators, namely, Lindley (1853), Miers (1873), and Knuth (1934), have considered one or both of these genera as constituting a separate family.

Description of the Woods of the Lecythidaceae

Material

The material used in the investigation consists of 112 specimens of mature secondary xylem representing 17 genera and 56 species of the Lecythidaceae. These woods are contained in the collections of the Yale School of Forestry. On the whole the genera are well represented, the material being distributed as follows:

Allantoma Miers—1 specimen.
Asteranthos Desf.—1 specimen.
Barringtonia Forst.—10 specimens of 5 species.
Bertholletia Humb. & Bonpl.—3 specimens of 1 species.
Cariniana Casar.—20 specimens of 5 species.
Careya Roxb.—1 specimen.
Chydenanthus Miers—1 specimen.
Couratari Aubl.—2 specimens of 2 species.
Couroupita Aubl.—5 specimens of 3 species.
Eschweilera Mart.—22 specimens of 11 species.
Foetidia Commers.—1 specimen.
Grias L.—5 specimens of 2 species.
Gustavia L.—9 specimens of 6 species.
Lecythis Loefl.—17 specimens of 8 species.
Napoleona Beauv.—3 specimens of 2 species.
Petersia Welw.—6 specimens of 3 species.
Planchonia Blume—5 specimens of 3 species.

Macroscopic Features

General Properties. Contrast between heartwood and sapwood not pronounced; distinct in a few specimens of *Asteranthos*, *Barringtonia*, *Lecythis*, and *Planchonia*. Sapwood usually light grayish or drab to light brown; heartwood essentially brown, with numerous variations in hue, ranging from yellow and olive (*Napoleona* and *Eschweilera*) through pink and red (*Bertholletia* and *Planchonia*) to decidedly chocolate and even purplish (*Cariniana* and *Foetidia*). Woods mostly without distinct scent; sometimes with a fetid and nauseous odor in fresh material, persisting in *Foetidia* and *Gustavia*. Woods variable from light and soft to very hard and heavy, sp. gr. 0.39–1.2 (based on thoroughly room-dry weight and volume); weight, 24–72.5 lbs. per cu. ft.; densest specimens are of *Eschweilera* and *Lecythis*, as well as *Asteranthos lineata* and *Foetidia mauritiana*. Grain mostly straight, except in *Foetidia*, *Petersia*, and *Planchonia*. Texture fine to very coarse. Some timbers easy to work, others difficult to saw because of silica content.

Growth rings distinct, indistinct, or absent; occasionally indicated by differences in the spacing of the parenchyma and the relative abundance of the pores. At times wide bands of wood parenchyma appear to terminate seasonal growths.

Wood parenchyma abundant, mostly in definite metatracheal bands or lines; paratracheal or poorly metatracheal in *Petersia;* bands conspicuous in *Bertholletia*, *Eschweilera*, and *Lecythis*, ranging from 2–10 per mm. (measured radially); indistinct to unaided eye in remaining genera, ranging up to 23 per mm. Pith flecks infrequent.

Pores mostly moderately numerous[3] (up to 20 solitary pores and pore multiples per sq. mm.); very numerous (over 40 per sq. mm.) in *Gustavia*; chiefly in radial multiples of 2 or 3, sometimes in irregular clusters or solitary; small and indistinct to unaided eye (cf. *Fagus*) in *Asteranthos*, *Careya*, *Foetidia*, *Gustavia*, and *Napoleona*, in remaining genera rather large and distinct (as in early wood of *Quercus alba*).

Rays, on cross section, widely variable in visibility from almost indiscernible with the lens to broad and conspicuous; of about the same width as the intervening fiber masses (wider rays about 5 pore-widths apart) in *Barringtonia*, *Grias*, *Gustavia*, and *Napoleona;* in remaining genera about as wide as, or wider than, the individual parenchyma bands and spaced from ¼–3 pore-widths apart and often bent in contact with larger pores. On radial section, conspicuous to quite inconspicuous; usually of same color or darker than the background, but at times lighter and producing silver grain. On tangential section, mostly low and narrow (rather high in 4 genera named above); fairly distinct to indiscernible, depending on color contrast with the background; usually darker than ground mass.

Vertical gum ducts, gummosis type, present in tangential

[3] The numerical values used in the descriptions are those proposed by Chattaway (7).

rows in some specimens, suggesting "gum veins" in *Eucalyptus*.

Minute Anatomy

Vessels with mostly short to long members; overlapping tips rare in *Planchonia andamanica* and *P. timorensis*, but elsewhere common, not exceeding 0.3 mm. in length. Perforation plates exclusively simple, horizontal to slightly inclined.

Pits to other vessels medium sized, numerous (exceedingly small and numerous in *Gustavia* and *Foetidia mauritiana*), alternate or locally opposite; border outlines circular or oval to decidedly polygonal, depending upon degree of crowding, or sometimes, as in *Planchonia andamanica* and some specimens of *Napoleona*, elongated horizontally to about twice the ordinary width; apertures lenticular to slit-like or rarely circular or oval, usually included, but in some specimens of *Cariniana legalis* and *Couratari* sp. extending beyond the borders and coalescing. Pits to rays of two sizes, often together: (*a*) large and usually elongated, horizontally or more frequently obliquely inclined, commonly with distinct tendency to scalariform arrangement, variable from partially bordered (radial ends only) to completely so; (*b*) small, resembling intervascular, rarely crowded, alternate or occasionally opposite, the apertures included and roughly conforming to shape of border. Pits to wood parenchyma of same types as to rays, the large ones frequently in scalariform arrangement, the small ones in two or more vertical rows and alternate or irregular to locally opposite.

Tyloses variable in abundance, mostly thin-walled; sclerotic in some specimens of *Asteranthos*, *Eschweilera*, and *Lecythis*. Yellowish to reddish brown deposits rather infrequent, but occasionally filling entire vessels in *Foetidia mauritiana*.

Wood fibers comprise half or less of the cross section; usually in radial lines; mostly angular in section, occasionally oval to circular; walls somewhat variable in thickness throughout specimens. Gelatinous fibers common in *Grias*, *Gustavia*, *Barringtonia*, and *Petersia*. Radially flattened fibers in contact with metatracheal parenchyma at times demarcate the relatively indistinct and poorly defined growth rings.

Pits small, simple or indistinctly bordered; apertures slit-like, vertical or more frequently oblique. Septate fibers observed in *Planchonia andamanica* (Yale No. 7820). Isolated fibers (macerated material) fairly regular in outline, tapering gradually from the middle to the rather sharp and often serrated ends.

Wood parenchyma characteristically metatracheal (paratracheal or weakly metatracheal in *Petersia*), and of two general types: (*a*) uniseriate lines, continuous or infrequently broken, the cells oval to rather angular in section, somewhat resembling the fibers, occasionally radially flattened; (*b*) bands 2–6, sometimes up to 15, cells wide, often uniform in a specimen, the cells squarish to irregular in section. Disjunctive condition common in individual specimens. Yellowish to reddish brown deposits fairly common.

Crystalliferous wood parenchyma strands, for convenience designated crystal strands, are of common occurrence in the New World genera and *Foetidia mauritiana* and serve as a basis for separating them from the rest of the Lecythidaceae. In most of the genera (*Allantoma*, *Asteranthos*, *Bertholletia*, *Cariniana*, *Couratari*, *Eschweilera*, *Foetidia*, and *Lecythis*) the crystal strands are very distinctive in appearance. As seen on tangential section the individual cells are generally less than one-fifth as high as the ordinary wood parenchyma cells and are disposed in more or less extensive series. For the most part they are definitely uniseriate in arrangement throughout the strand, but a localized biseriate condition is occasionally noted; no increase in the width of the crystal strand occurs where two cells are formed by a vertical cross wall. No pits or other markings are visible on the walls. Each cell in the strand contains a solitary crystal encased in an integument and variously attached to the cell wall by extensions of secondary thickenings.

In *Foetidia mauritiana* the crystal strands are diffuse; in the rest of the genera they are usually closely associated with the metatracheal wood parenchyma, normally occurring on the margins of the lines or bands, directly in contact with the wood fibers on one side only. Within the cells there is a concentration of secondary thickening, in which the crystals are imbedded, toward the side adjacent to the fibers; a large cavity usually occurs on the opposite side.

In *Grias, Gustavia, Asteranthos,* and *Couroupita* the individual parenchyma cells have been subdivided into vertical series of 2–8 (mostly 4) smaller cells, each of which contains a solitary crystal. These crystal-bearing cells may occasionally make up complete wood parenchyma strands, as in *Couroupita darienensis;* much more frequently, however, they are confined to a portion of a strand, being either terminal (making up one or both ends) or more centrally located. Small simple pits may frequently be distinguished in the somewhat irregularly thickened walls of these crystalliferous cells.

Rays contacting one or both sides of the pores or pore groups, except in the small-pored woods such as *Grias, Gustavia,* and *Napoleona.* In most species 2–7 cells wide and few to 60 cells high; in *Grias, Gustavia,* and *Napoleona,* up to 15 cells wide and few to more than 100 cells high. Uniseriate rays and margins fairly common. Vertically fused rays not observed in *Bertholletia, Couroupita, Couratari, Foetidia, Grias, Gustavia,* and *Napoleona;* in the remaining genera they are variable in occurrence and are mostly biseriate and triseriate. Marginal cells rather square to definitely elongated vertically; localized groups of procumbent cells fairly frequent within the central portions of the rays. In *Allantoma lineata* the rays are distinctly homogeneous.

Dark yellow to reddish brown deposits abundant, frequently entirely filling the cell cavities. Crystals common in the Old World genera and occasional in *Cariniana, Couroupita,* and *Gustavia.*

Comparison with the Myrtaceae

One of the chief points of difference between the various classifications is concerned with the degree of affinity of the Lecythidaceae and the Myrtaceae. A survey of representative wood specimens of the latter family was made in order to determine whether any definite anatomical differences could be detected.

The secondary xylem of the Myrtaceae is marked by the predominance of solitary pores, although small groups of 2–5 pores are occasionally present. Intervascular pitting alternate and usually crowded. Pit-pairs between vessels and parenchyma alternate or transitional from alternate to scalariform and mostly half-bordered. Growth rings frequently entirely lacking; when present, distinct or indistinct, being

delimited by bands of somewhat denser fibers more or less definitely flattened radially. Fiber-tracheids predominate. Wood parenchyma extremely variable in amount, paratracheal and diffuse, metatracheal lacking; crystals sometimes present. Rays typically heterogeneous, except in *Eucalyptus;* mostly uniseriate, occasionally 2–4, rarely 6, cells wide. Vessel-parenchyma pitting simple, rather large, oval to squarish in outline. Vertical gum ducts sometimes developed as result of injury.

From the foregoing discussion of the secondary xylem it will be noted that the Myrtaceae differ from the Lecythidaceae principally in having mostly solitary pores, fibers with distinctly bordered pits, and wood parenchyma that is paratracheal or diffuse instead of distinctly metatracheal.

Conclusions

A study of 112 specimens of the woods of the Lecythidaceae, representing 17 genera and 56 species, indicates that they form a fairly homogeneous group. No unusual or striking feature characterizes them as a whole, unless it is the occurrence of concentric lines or bands of metatracheal parenchyma. Other points of similarity are the exclusively simple perforations of the vessel members, the simple to indistinctly bordered pits of the wood fibers, and the character of the intervascular and the vessel-parenchyma pitting. Excepting the occurrence of crystal strands, differences within the family, *i.e.*, between genera and groups of genera, are few and, being of degree rather than of kind, are at present of dubious diagnostic value.

The Lecythidaceae may be separated into two sections on the basis of the presence or absence of crystal strands. These structures are a unique and distinctive character and show a striking correlation with the geographical distribution, being absent in the Old World genera, except *Foetidia,* and constantly present in those of the New World.

The anatomical structure of the Lecythidaceae lends support to their segregation from the Myrtaceae.

On the basis of the anatomical structure, *Asteranthos* and *Napoleona* are properly included with the Lecythidaceae.

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STUEBELIA NEMOROSA (JACQ.) DUGAND, COMB. NOV.

By Armando Dugand G.
Barranquilla, Colombia

Among the botanical specimens sent by the writer as vouchers for the authenticity of wood samples collected in Atlántico, Colombia, for the Yale School of Forestry, was one determined by Paul C. Standley, Field Museum of Natural History, Chicago, as *Stuebelia nitida* Pax. Material of the same kind of tree, kept at the herbarium of Colegio Biffi, Barranquilla, has been determined at the Smithsonian Institution as *Capparis nemorosa* Jacq. This apparent confusion in identifications moved the writer to refer to Jacquin's and Pax's descriptions and, as he presumed, both agree quite well with the material collected. It would seem therefore that Pax overlooked Jacquin's priority with regard to the specific name when he created the genus *Stuebelia* in 1888. It happens that both species are identical and their synonymy is as follows:

Stuebelia nemorosa (Jacquin) Dugand, comb. nov. *Capparis nemorosa* Jacq. in Select. Stirp. Amer. Hist., 164, 1763; *Stuebelia nitida* Pax, Beiträge zur Kenntnis der Capparidaceae, p. 39, Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie, Leipzig, 1888.

Stuebelia nemorosa is known to the natives of northern Colombia as Calabazuelo or Calabasuero. It is a small tree, 4–5 m. tall, the trunk 20–30 cm. in diam., irregularly shaped, the bark gray and rough; the crown is depressed and the foliage evergreen. The leaves are coriaceous, ovate, slightly cordate at the base and acute or acuminate at the apex, 8–16 cm. long and 5–8 cm. broad, the adult ones shiny on the upper face and opaque-pubescent beneath, the young ones densely covered on both faces with a whitish pubescence which is easily rubbed off.

The flowers are large, showy, and white, with the calyx large, irregularly bilobate, and covered with a dense creamy white pubescence of stellate hairs. The fruits are baccate, large, shining green, ovoid-oblong in shape, 9–12 cm. long and 6–7 cm. in diameter.

The tree is fairly common in dry situations where the soil is clayey and is found generally associated with other Capparidaceae, which form a large percentage of the arborescent flora of the xerophilous forests of Atlántico.

THE GENUS *CORNUS* IN SOUTH AMERICA

By Paul C. Standley

Field Museum of Natural History

The genus *Cornus* was first reported from South America in 1929 (*Tropical Woods* 19: 4–5) by Macbride, who described two new species, *C. peruviana* and *C. boliviana*. Both were based upon rather fragmentary material, in fruit only, and since fruiting specimens of this genus sometimes simulate closely similar material of the genus *Viburnum*, there was a little doubt, although very little, as to the proper reference of the material to *Cornus*.

In 1930 (*Tropical Woods* 24: 29) the same author published another paper, in which he transferred the Peruvian species, calling it *Viburnum peruvianum*, but remarking that it "has the pubescence described by Solereder and Sertorius as entirely characteristic of *Cornus* . . . The fruits in their immature condition are, externally at least, as uncharacteristic of *Viburnum* as is the pubescence." This being the case, the necessity of a transfer is hardly justified by a preceding explanation: "Recent study of these plants at Berlin-Dahlem in conjunction with material in that herbarium . . . convinces me that *Cornus peruviana* is identical with an apparently unpublished species of *Viburnum* obtained in flower by Ruiz and Pavón; and that *C. boliviana* also is not a *Cornus*, although its identity is uncertain."

The present writer has for some time felt certain that the material concerned belonged properly to the genus *Cornus*, and has had in mind the preparation of a note to that effect for publication, but fortunately such publication has been delayed. There has just been received for study, through Professor Record, a specimen collected on the Pastaza River, Ecuador, at 2000 meters in February 1935, *Dr. A. Rimbach* 271. This specimen is in flower, and while there can be confusion between *Viburnum* and *Cornus* with fruiting specimens, there can be no uncertainty when flowering material is examined, since flowers of the two genera are not very similar.

The Ecuador specimen is a *Cornus*, and I can see no differences between it and the type of *C. peruviana*. Moreover, I find no differences of any kind between the types of *C. peruviana* and *C. boliviana*. The genus *Cornus*, then, may be recorded now for three countries of the Andes, and the synonymy of the single species represented is indicated below. It does seem remarkable that a plant of such wide distribution should not have been reported long ago, and one may hazard the belief that it will be found among the undetermined material in European herbaria obtained by some of the early collectors who worked in the southern and central Andes.

Cornus peruviana Macbride, Trop. Woods 19: 5. 1929. *C. boliviana* Macbride, loc. cit. *Viburnum peruvianum* Macbride, Trop. Woods 24: 29. 1930. Known from Peru (Cani, Dept. Huánuco), Bolivia (locality unknown), and Ecuador (Pastaza River). Some of the leaves are alternate, as in *C. alternifolia* of the United States. *C. peruviana* is different in most of its characters from *C. excelsa* H.B.K., the species that extends farthest southward in North America.

A NEW *SOROCEA* FROM BRAZIL

By Paul C. Standley
Field Museum of Natural History

The tree here described, apparently an unusually distinct new species, was discovered in a series of plants obtained at Fordlandia on the Tapajoz River in Brazil. The extensive collections of trees made there under the direction of Mr. Roy Carr have previously supplied data for several papers that have appeared in *Tropical Woods*, and specimens of most of the woods that were associated with the herbarium specimens have been deposited by Field Museum in the study series of the Yale School of Forestry.

Sorocea stenophylla, sp. nov.

Arbor 5-metralis, trunco 15 cm. diam., ramulis teretibus gracilibus, novellis sparsissime hirtellis cito glabratis, internodiis brevibus; folia breviter petiolata subcoriacea glabra, petiolo crassiusculo 6–10 mm. longo; lamina oblongo-linearis circa 17 cm. longa et 1.5–2.5 cm. tantum lata anguste longissime attenuata apice spinoso-mucronata, basi breviter cuneato-acuta, remote inaequaliter grosse vel adpresse serrata, dentibus spinis brevibus gracilibus rigidis terminatis, supra in sicco cinereo-viridis, costa gracillima prominente, nervis prominulis, lucida, subtus fere concolor, costa elevata, nervis lateralibus numerosis angulo exacte recto divergentibus sub marginem arcuato-conjunctis, venulis prominentibus laxiuscule reticulatis; inflorescentiae femineae axillares spicatae dense multiflorae usque ad 2 cm. longae; fructus subglobosus 6 mm. longus minutissime puberulus vel glabratus, styli ramis breviter exsertis.—Brazil: Bôa Vista, Tapajoz region, State of Pará, September 17, 1933 (?) *Capucho* 447 (Herb. Field Mus. No. 663700, type).

Vernacular name Araçary. No other species of the genus has such narrow leaves as this. The basal teeth of the leaves are sometimes much larger than the others, so that the base of the blade is almost hastately lobed.

NEW FOREST TREES OF THE BRAZILIAN AMAZON

By Adolpho Ducke
Jardim Botanico do Rio de Janeiro

The species described or mentioned below represent a second series [1] of new or noteworthy trees I have collected in the Brazilian State of Amazonas, in coöperation with the Yale University School of Forestry. The type specimens are preserved in the Jardim Botanico do Rio de Janeiro; cotypes have been distributed to the botanical institutions at Berlin-Dahlem, Geneva, Kew, Paris, Stockholm, Utrecht, and Washington. The herbarium specimens sent to Yale were accompanied by samples of the heartwood, sapwood, and bark from the trunk of the type trees in the new species.

Leguminosae

Torresia acreana Ducke, sp. nov.—A specie *T. cearensis* F. Allem. differt statura elata, foliis vulgo 17–25-foliolatis, foliolis lanceolato-ovatis apice acutis, inflorescentiis longioribus et laxioribus, harum rachidibus et calicis tubo subglabris. Arbor ultra 30 m. alta cortice ferrugineo saepe in laminas tenues soluto, ligno brunnescente odorato bono, foliolis usque ad 6 cm. longis ad 3 cm. latis, floribus albis in arbore defoliata. Fructus (non visus) eo speciei *T. cearensis* similis dicitur. Arboris partes omnes cumarinam fortissime redolent. —Nomina vulgaria: Cumarú de cheiro, Imburana de cheiro.

Seringal Iracema, Rio Acre (Territorio Acre), sat frequens in silva primaria non inundabili, leg. A. Ducke 18–3–1933 foliis adultis et inflorescentiis novissimis (cum ligno n. 205 [Yale 23667]), florifera omnino defoliata V-1933. Specimina in Herb. Jard. Bot. Rio n. 23769.

This, the second species of the genus *Torresia*, is a big forest tree highly esteemed for its excellent timber and for its seeds, which are the source of a popular perfume. I found it near the recently established town of Rio Branco, but it does not

[1] Vide *Tropical Woods* 31: 10, September 1932.

reach the mouth of the Rio Acre. *Torresia cearensis* Allem. grows in drier regions from the interior of Northeast Brazil to the northern part of Minas Geraes. The vernacular names are the same for both species.

LINACEAE

Vantanea macrocarpa Ducke, sp. nov.—Arbor magna cortice fusco sublaevi saepe in laminas sat magnas soluto, partibus vegetativis omnibus glabris. Folii petiolo 6–14 mm. longo valido supra profunde canaliculato, lamina vulgo 100–200 mm. longa et 50–100 mm. lata ovato- vel oblongo-elliptica, basi fortiter complicata rotundata vel obtusa medio breviter in petiolum acutata, apice vulgo breviter et obtuse acuminata, apice ipso vulgo retusiusculo, margine integro, coriacea, supra magis quam subtus nitida, costis subtus magis quam supra prominulis, costa primaria subtus basi crassa, supra saepe subimmersa, venulis supra nullis subtus laxe reticulatis subtilibus vel subobsoletis. Inflorescentiae terminales et in axillis superioribus, in corymbam saepe ad 2 dm. altam amplamque compositae, parce fusco-puberulae, pedunculis bis vel ter trichotomis, bracteis et bracteolis in speciminibus nostris deficientibus, pedicellis 2–5 mm. longis. Flores albi, in alabastro subcylindrici obtusiusculi; calix anthesi circa 2 mm. longus ac latus, minime puberulus, vix ad ⅓ ab apice quinquelobatus, lobis obtusis latis glandula impressa obsoleta; petala 10–12 mm. longa 1–1½ mm. lata, glabra; stamina inaequilonga basi plus minus concrescentia, glabra filamentorum marginibus minute papillosis, antheris parvis a connectivo longe superatis; discus intrastaminalis ovarii ⅔ aequans, glaber, distinctissime laciniatus; pistillum glabrum. Drupa 50–100 mm. longa 35–45 mm. lata, ovato- vel sub-oblongo-ellipsoidea, pericarpio tenui sicco non eduli, endocarpio osseo 5-loculari (loculis saepe uno vel duobus rarius tribus abortivis).

Habitat in silva primaria non inundabili circa cataractas fluminis Tarumá prope Manáos (civitate Amazonas), 25-4-1932 florifera, leg. A. Ducke (cum ligno n. 98 [Yale 21357]), Herb. Jard. Bot. Rio n. 20427. Nomen vulgare: UCHY-RANA (cum aliis).

This new species differs from the other two Amazonian

species with small white flowers (*V. cupularis* Huber and *V. paraensis* Ducke) in its larger leaves, its much larger drupes, its long laciniated disk, and its glabrous ovary. It approaches, in these characters, *V. guianensis* Aubl., but that has much larger flowers of a beautiful crimson. The drupes are generally larger and particularly longer than in *V. guianensis*. The structure is approximately the same in both species.

Roucheria punctata Ducke, comb. nov. *Hebepetalum punctatum* Ducke, Bull. Muséum Paris II: 4: 735 (1932) and Archivos Jard. Bot. Rio de Janeiro 6: 38 (1933).—The genus *Roucheria* is very different from *Hebepetalum* as classified by Winkler in Engler & Prantl's *Natürliche Pflanzenfamilien* (2d ed.) 19a: 105–110; the trees of the two genera are very dissimilar. The present species is not very rare in the neighborhood of Manáos where recently I collected herbarium material with mature flowers (Herb. Jard. Bot. Rio n. 23821) and wood (n. 119 [Yale 22579]).

Hebepetalum parviflorum Ducke, ibidem, must take the name **Roucheria parviflora** Ducke, comb. nov.

OCHTHOCOSMUS BARRAE Hallier f.—Our Manáos specimens (Herb. Jard. Bot. Rio n. 19100 and n. 23421, wood n. 5 [Yale 20686]), distributed under the name *O. roraimae*, evidently belong to this species.

RUTACEAE

Hortia superba Ducke, sp. nov.—Speciei *H. excelsa* Ducke affinior, differt foliis rigide coriaceis supra bullato-venulosis subtus ad nervos longius erecto-pilosis, paniculae ramificationibus ultimis pedicellisque multo gracilioribus, floribus minoribus, calice anthesi solum 1–2 mm. alto. Arbor 15–20 m. alta, foliis usque ad 80 cm. longis ad 15 cm. latis forma ut in specie citata, floribus ut in specie *H. longifolia*. Flores pulchre rosei, inodori.

Manáos, loco Estrada do Aleixo, in silva humida non inundabili, 8-3-1932 florif., leg. A. Ducke (cum ligno n. 82 [Yale 21341]), Herb. Jard. Bot. Rio n. 23767.

Another new species of *Hortia*, one of the largest and most beautiful of this remarkable genus, which now contains five species for the Hylaea and two for tropical South and Central Brazil.

OCHNACEAE

Wallacea multiflora Ducke, sp. nov.—Speciei *W. insignis* Spruce ex Benth. partibus vegetativis omnino similis, foliis autem durius coriaceis margine remote denticulatis et ad denticulos ciliatis; inflorescentiis, floribus et fructibus valde diversa. Panicula racemiformis stricta 12–22 cm. longa, pedunculo nudo valido parti floriferae dense multiflorae plus minus aequilongo; flores (praesertim inferiores) vulgo e nodo vel ramulo brevi 3–5 subfasciculati, pedicellis sat robustis 8–15 mm. longis, quam speciei alterae (*W. insignis*) minores, sepalis solum 8–10 mm. longis ovato-oblongis, petalis pulchre roseis 12–16 mm. longis, staminodiis nullis, staminibus vix 5 mm. longioribus, ovario minus distincte stipitato. Capsula ut speciei *W. insignis* at brevior, ellipsoidea vel subglobosa, basi obtusa, apice obtusa vel rotundata breviter apiculata. Arbor parva ligno rufo.

Habitat in silva riparia super cataractam Cajú fluminis Curicuriary (affluentis Rio Negro superioris, in civitate Amazonas), 20–10–1932 leg. A. Ducke (cum ligno n. 161 Yale [22621]), Herb. Jard. Bot. Rio n. 23740.

This second species of a remarkable genus differs from the other especially in the lack of staminodia. Both should be included in the same genus, however, because of their resemblance in all other important characters. The new species grows on the banks of the Curicuriary, tributary of the upper Rio Negro, beyond the second cataract. *Wallacea insignis*, discovered by Richard Spruce at the Rio Uaupés near the village of Panuré (now Ipanoré), has also been collected at the headwaters of the Rio Tarumá, near Manáos and on the banks of the Rio Aruan confluent of the Arapiuns, a left tributary of the lower Tapajoz.

GUTTIFERAE

Mahurea tomentosa Ducke, sp. nov.—Arbor sat elata, latice resinoso flavo, ligno rufescente. Ramuli glabri nigrescentes. Stipulae squamiformes minimae. Folia petiolo 15–25 mm. longo, glabro, lamina vulgo 100–200 mm. longa et 40–90 mm. lata, elliptico-obovata vel obovato-oblonga, basi acuta et in petiolum attenuata, apice saepissime obtusa, rarius

subacuta, tenuiter et elastice coriacea vel subcoriacea parum nitidula, supra glabra, subtus tomento microscopico subcanescente, utrinque sat dissite tenuiter penninervia et subtiliter reticulata, vulgo abundanter pellucido-punctata et striolata. Panicula 100–200 mm. alta sat ample pyramidata vel angustior racemiformis, substricta vel flexuosa, laxa, tomentella; pedicelli anthesi 10–20 mm. longi, cum sepalis et petalis extus cano-tomentosi; sepala coriacea rotundata, maiora anthesi circa 10 mm. longa; petala ad 15 mm. longa tenuia rosea. Stamina sepalis aequilonga glabra, antheris lineari-oblongis. Pistillum glabrum. Fructus ignotus.

São Jeronymo (infra Tabatinga, Rio Solimões, civ. Amazonas), silva non inundabili loco paludoso, 27–10–1931 leg. A. Ducke (cum ligno n. 33 [Yale 20714]), Herb. Jard. Bot. Rio n. 23779. Arborem vidi unicam.

This is the southernmost species of the genus. It was discovered north of the Rio Solimões or Upper Amazon, a short distance from the Peruvian limits, so the geographical range of this genus extends from the left bank of Solimões through the southeastern point of Colombia and the upper Brazilian and Venezuelan Rio Negro and Orinoco to the three Guianas. It seems to have some affinities with *M. exstipulata* of Roraima and Pacaraima mountains, but its leaves are much broader, obtuse at summit, and more coriaceous. *M. Duckei* Huber, of the Caquetá, has much stiffer leaves, with rounded or emarginate base, and shorter inflorescences and pedicels.

CURRENT LITERATURE

American palmettoes. By L. H. BAILEY. *Gentes Herbarum* (Ithaca, N. Y.) 3: 6: 275–339; figs. 145–190; December 1934.

"In botanical nomenclature the Palmettoes are Sabals. . . . Sabals are citizens of the western hemisphere. About 80 binomials have been applied, but many of them are only listed names and without significance in nomenclature. We are able at present to distinguish about a score of species, but the number is undoubtedly considerably greater than this. . . . The Sabals were first known in botanical writings as *Cham-*

aerops, *Corypha*, *Rhapis*, before those generic names were restricted to palms of the eastern hemisphere; and they were not clearly distinguished from the American genera *Thrinax* and *Trithrinax*. The genus *Sabal* has been twice divided. One of the segregations, *Serenoa* by J. D. Hooker, is universally accepted; the other, *Inodes* by O. F. Cook, has been less convincing because materials in herbaria have been insufficient to show the characters, and on the other hand the recent accumulation of evidence appears to prove the separation to be untenable."

"Palmettoes are highly variable subjects. . . . Not only in stature and general habit, but in cut and color of foliage, hang of leaves, abundance or scarceness of bloom, size of inflorescenses and of the flowers themselves, are the differences apparent within the same species. Variation in size and shape of fruits, however, appears to lie within rather narrow limits, although this subject also requires further study. In this paper, descriptions of the various Palmettoes are not attempted, but diagnoses are drawn for the purpose of distinguishing the species."

Die Palmengattung *Desmoncus* Mart. By M. Burret. *Repertorium Specierum Novarum* (Berlin-Dahlem) 36: 197–221; Nov. 5, 1934.

The palm genus *Desmoncus* is divided into two sections, represented by 41 species in tropical America. The following new species are described: *D. Huebneri*, northern Brazil, vernacular name Jacitara; *D. Schippii* and *D. leiorhachis*, British Honduras; *D. leptochaete*, Costa Rica, Matamba; *D. campylacanthus*, Rio de Janeiro, Brazil, Jacitara; *D. longisectus*, Alagoas, Brazil; *D. dasyacanthus*, Venezuela; *D. brevisectus*, Pará, Brazil; *D. latisectus*, Bolivia.—P. C. Standley.

Palmae neogeae. VII. By M. Burret. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 151–159; 3 figs.; Dec. 31, 1934.

Species of American palms treated are: *Chelyocarpus Ulei* Dammer; *Tessmanniophoenix chuco* (Mart.) Burret; *Brahea psilocalyx* Burret, reduced to synonymy under *Acoelorhaphe Wrightii* Wendl.; *Geonoma multisecta*, nov. comb., based on *Taenianthera multisecta* Burret; *Attalea Tessmannii* Burret; *Scheelea Dryanderae* Burret; *Hexopetion mexicanum* (Liebm.) Burret, a new genus of Mexico and Central America; *Bactris longipes* Poepp., known at Manáos, Brazil, as Ubim rana; *B. bella* Burret, a new species from Manáos; *Pyrenoglyphis Ottostapfeana* (Barb. Rodr.) Burret, nov. comb.—P. C. Standley.

Chromosome numbers in the Hamamelidaceae and their phylogenetic significance. By Edgar Anderson and Karl Sax. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 16: 2: 210–215; 3 figs.; April 1935.

"The cytological studies present a number of facts of taxonomic significance. (1) The Hamamelidoideae are a coherent group with a common base number. (2) The count on *Liquidambar* suggests that the Liquidambaroideae may possibly be derived from a different stock than the Hamamelidoideae, since they apparently have a different base chromosome number. If this difference in base number should be found to persist in the other genus of that subfamily it would indicate that the divergence between the two subfamilies occurred before the differentiation of the family as a whole. . . . (3) Polyploid series have been found in *Fothergilla* and *Corylopsis* and are not to be unexpected in other genera of the family when these are investigated more extensively. . . . On the whole, the cytological evidence favors Hutchinson's interpretation of the phylogenetic position of the Hamamelidaceae."

Some new and neglected species and varieties of the Verbenaceae. By Harold N. Moldenke. *Repertorium Specierum Novarum* (Berlin-Dahlem) 37: 209–239; Dec. 31, 1934.

There are described as new 47 species and varieties in the genera *Aegiphila*, *Amasonia*, *Bouchea*, *Citharexylum*, and *Stachytarpheta*.

A study of *Idria columnaris* and *Fouquieria splendens*. By R. R. HUMPHREY. *American Journal of Botany* 22: 2: 184–206; 1 pl.; February 1935.

Idria and *Fouquieria* are the only genera of Fouquieriaceae, a family confined to southwestern North America. A detailed account is given of the anatomy of the two species as a basis for future ecological and physiological studies.

Studies in the Apocynaceae. IV. The American genera of Echitoideae. By ROBERT E. WOODSON, JR. *Annals Missouri Bot. Gard.* 22: 153–306; May 25, 1935.

The genera monographed are *Forsteronia* (48 species), *Secondatia* (6), *Trachelospermum* (1), *Malouetia* (20), and *Odontadenia* (26). Most of the plants of these groups are herbaceous or suffrutescent vines, but the species of *Malouetia* are shrubs or small trees. Among the species treated may be mentioned *Forsteronia floribunda*, called Milk Withe and Rubber Withe in Jamaica; *Malouetia Tamaquarina*, Oonseballi and Jaramiloerang (Surinam), Molongo de Colher (Brazil).

Ericaceae americanae novae vel minus cognitae. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 119–140; Dec. 31, 1934.

New species from tropical America are published in the genera *Cavendishia*, *Ceratostema*, *Gaultheria*, *Gaylussacia*, *Leucothoe*, *Orthaea*, *Siphonandra*, *Sphyrospermum*, *Themistoclesia*, *Thibaudia*, and *Vaccinium*. Two new genera are proposed, *Diogenesia* from Peru and *Empedoclesia* from Guatemala.

Taxonomic notes on American phanerogams. II. By LYMAN B. SMITH. *Phytologia* (New York) 1: 138–139; fig. 14; January 1935.

Lozania bipinnata is described as new from Colombia. A key is given for recognition of the five species of the genus, and two new names are published—*L. pedicellata* (*Lacistema pedicellatum* Standl.) and *L. Pittieri* (*Lacistema Pittieri* Blake).

Observaciones geobotánicas en Colombia. By JOSÉ CUATRECASAS. No. 27, Trabajos Mus. Nacional de Cienc. Nat. (Ser. Bot.), Madrid, Dec. 31, 1934. Pp. 144; pls. 32, figs. 5.

A detailed and highly technical account of the plant ecology of limited regions of the lowlands and especially of the highlands of Colombia, visited by the author in 1932. There are extensive descriptions of the woody vegetation of several typical areas. The excellent plates are perhaps the finest ever published to illustrate the vegetation of the Andean region. —P. C. STANDLEY.

Arboles y arbustos notables o poco conocidos del Departamento del Atlántico. By ARMANDO DUGAND G. *Boletín de Agricultura y Ganadería* (Barranquilla, Colombia) 1: 2: 21–32; 3 pls.; April 1935.

There are described, with notes and citation of vernacular names, in some cases with illustrations, *Bravaisia integerrima*, *Aspidosperma Dugandii*, *Tabebuia Dugandii*, *Bombacopsis Fendleri*, *Pereskia colombiana*, *Gustavia superba*, *Acacia costaricensis*, *Crudia obliqua*, *Machaerium capote*, *Platypodium Maxonianum*, *Piscidia carthaginensis*, and *Geoffroya striata*.

In announcing the regular appearance of a botanical section in future issues of the *Boletín* the editor says: "Con el artículo inicia su valiosa colaboración en el Boletín de Agricultura y Ganadería del Atlántico el Señor Don Armando Dugand, investigador apasionado y profundo de la flora del litoral, cuyos trabajos científicos han merecido acogida respetuosa por parte de las revistas botánicas de vuelo internacional, entre otros por la famosa publicación *Tropical Woods*, de los Estados Unidos, y cuyo nombre ha servido de patrón para plantas de nuestro suelo, por él sabiamente clasificadas y descubiertas."

Studies of South American plants. IV. By A. C. SMITH. *Phytologia* (New York) 1: 126–132; January 1935.

New species are described in the following genera: *Siparuna* (Colombia), *Trigonia* (Colombia), *Ceratostema* (Ecuador, Colombia), and *Macleania* (Ecuador).

The genus *Espeletia:* A study in phylogenetic taxonomy. By ALBERT C. SMITH and MINNA F. KOCH. *Brittonia* (Lankester, Pa.) 1: 479–530; pls 1, 2; figs. 1–5; May 1935.

The genus *Espeletia* (Compositae) consists of 30 species, growing mainly in the paramos from Colombia and Venezuela to Ecuador. They are chiefly large herbs of peculiar aspect, but sometimes shrubs or small trees. *E. neriifolia* is called Incienso, Frailejón de Arbolito, and Oreja de Burro in Venezuela.

Eine neue Art der Gattung *Aveledoa* Pittier. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 148–150; Dec. 31, 1934.

The genus *Aveledoa* was based upon a single species of northern Venezuela. *A. Tessmanniana*, a tree of 25 m., is described as new from eastern Peru. The genus has been referred previously to the Opiliaceae, but study of new material shows that it is more properly referable to the Icacinaceae.

Contributions to the flora of tropical America. XXII. The genus *Swartzia* in British Guiana. By N. Y. SANDWITH. *Kew Bulletin of Miscellaneous Information* 353–368; 1934.

Eighteen species of *Swartzia* are listed for British Guiana, and a key provided for their recognition. Vernacular names are indicated for most of the species. Besides several new varieties, the following new species are described: *S. Jenmani*, vernacular name Parakusan; *S. roraimae; S. oblanceolata*, Siribidani.

Contributions to the flora of tropical America. XXIII. Notable additions to the flora of British Guiana. By N. Y. SANDWITH. *Kew Bulletin of Miscellaneous Information* 117–132; 1935.

Among the trees and shrubs listed are: *Chrysochlamys Weberbaueri* Engl., vernacular name Tapirero; *Ternstroemia dentata* (Aubl.) Sw., Omirir; *Galipea Davisii*, sp. nov.; *Fagara apiculata*, sp. nov., Sada; *Minquartia guianensis* Aubl., Crucaballi; *Talisia furfuracea*, sp. nov., Black Moraballi; *Matayba oligandra*, sp. nov., Kuleshiri; *Dinizia excelsa* Ducke, Parakwa; *Licania grisea* Kleinh., Iron Mary, Unikiakia; *Hirtella Davisii*, sp. nov.; *Eschweilera holcogyne*, sp. nov., Howdan; *E. praeclara*, sp. nov., Howdan; *Couratari fagifolia* (Miq.) Eyma, Wadara; *C. pulchra* Sandw., Wadara; *Mouriri Sideroxylon* Sagot, Mamuriballi; *Lucuma sericea* Krause, Bakupar; *Ocotea tomentella*, sp. nov., Baradan.

Additions to Pulle's Flora of Surinam. I. Plants collected by J. Lanjouw in 1933. By J. LANJOUW. *Med. Bot. Mus. Univ. Utrecht* 32: 19: 215–261; pl. 2; figs. 1–4; April 1935.

A list of plants collected in Surinam by the author. Among the woody plants mentioned are: *Coccoloba mollis*, vernacular name Mierenhoedoe; *Triplaris surinamensis*, Miera Hoedoe; *Ruprechtia marowynensis* Eyma, sp. nov.; *Jatropha gossypiifolia*, Roode Schijtnoten; *Zizyphus Jujuba*, Olijf; *Siparuna surinamensis*, sp. nov., Jara Kopie; *Iryanthera Hostmanni*, Srè Bèbè; *Hibiscus Rosa-sinensis*, Matrozenroos; *Thespesia populnea*, Boschkatoen; *Bombax aquaticum*, Mo Mo; *B. flaviflorum*, Para Katoen, Sienzon; *Apeiba glabra*, Boesi Soersakka; *Clusia parvicapsula*, Mangro; *Symphonia globulifera*, Matatji; *Gustavia augusta*, Man Tapoeripa; *Eschweilera subglandulosa*, Barklak; *Ambelania Sagotii*, Bat Batti; *Thevetia peruviana*, Tawai; *Tabernaemontana grandiflora*, Skijtnotto; *Genipa americana*, Oeman Tapoeripa, Taparoepa; *Duroia aquatica*, Marmeldoosje.

The paper includes a synopsis of the genus *Apeiba* by H. Uittien. Six species are recognized: *A. tibourbou*, Mexico to Brazil; *A. tibourbou*, var. *Krukoffii* Uitt., Brazil (where called Pente de Macaco) and Jamaica; *A. Schomburgkii*, Surinam to Colombia; *A. echinata*, Guianas and Brazil; *A. membranacea*, Costa Rica to Brazil; *A. intermedia; A. glabra*, Guianas and Brazil.—P. C. STANDLEY.

***Dolichopterys*, a new genus of the Malpighiaceae.** By A. KOSTERMANS. *Med. Bot. Mus. Univ. Utrecht* 32: 21: 279–281; fig. 1; April 1935.

Dolichopterys, with a single species, *D. surinamensis*, a woody vine, is described from Surinam. It is related to *Lophopterys* Juss.

Les bois de la Guyane française. Le manil et le parcouril. By M. Demougeot. *Revue Internationale du Bois* (Paris) 1: 11: 54–59; November 1934.

Manil and Parcouril, in the author's opinion, rank next to Angélique (*Dicorynia paraensis*) in their excellent qualities and the wide range of purposes for which they can be used. Botanists generally classify them as two distinct species (*Symphonia globulifera* L. and *Platonia insignis* Mart., resp.), but from a comparative study of their wood structure they are almost identical, the main difference being in the color. Their relationship is so well marked that it is almost impossible to distinguish standing trees, and the natives of French Guiana often confuse their respective vernacular names.

Both kinds grow scatteringly throughout French Guiana, especially in marshy regions, and compose about 5 per cent of the total timber stand of the colony. The trunks are straight, cylindrical and taper gradually towards the summit, free of branches for 20 to 25 meters, and have an average diameter of 50 to 55 cms., at times up to 1 m. 30 cm. Bark white, exfoliating, fibrous, useful for cordage, and yields a black, viscous resin which is used for caulking boats.

The wood of Manil is light colored, the thin sapwood white to yellow, the heartwood grayish, clear of defects, and rather heavy. The wood of Parcouril is darker than that of Manil, and gradually turns black upon exposure to air. Both are durable, resistant to insect attacks, resilient, hold their place well and are affected but slightly by atmospheric changes, in which respect they resemble Angélique, rather fine grained, easy to work, and take a lustrous finish suggestive of Oak on the flat grain and of Birch when quarter-sawed.

White laminations (parenchyma) are common in both woods. The elements appear to be more distinct and regular in Parcouril than in Manil. The differences between the two woods are further reflected in their physical properties. That of Parcouril is firmer and denser than Manil. The growth rings, indicated by variation in depth of color, are of variable width. These are composed of two layers, one porous and corresponding to springwood, and the other darker and more

compact, equivalent to the summerwood of species in temperate zones.

Both the gray and yellow woods have been employed over a long period of time for numerous purposes, especially for making rum (aguardiente) barrels. The principal use at the present time is for cases and crates for shipping bananas. They are also excellent for carpentry, construction, and cabinet work, for which purpose the yellow variety is preferred on account of its more attractive color. Hitherto the inaccessibility of these potentially valuable timbers has hampered their exploitation; consequently they are found only in small quantities in the foreign markets.—L. Williams, *Field Museum of Natural History*.

Certain Melastomaceae of Surinam. By H. A. Gleason. *Med. Bot. Mus. Univ. Utrecht* 32: 18: 203–214; April 1935.

New plants described are *Ernestia Pullei; Brachypremna petiolata*, a new genus, probably related to *Ernestia; Adelobotrys monticola, Macrocentrum fruticosum, Topobea cuspidata, Henriettella caudata, Leandra montana, Clidemia biformis, Miconia surinamensis*, and *M. diaphanea*.

Neue andine Melastomataceen. By Fr. Markgraf. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 177–182; Dec. 31, 1934.

New species from the Andes of South America are published in the genera *Leandra* and *Miconia*.

Estudios sobre la flora del Departamento del Cuzco. III Supplemento. By F. L. Herrera. *Revista Universitaria* (Cuzco, Peru) 23: 111–147; March 1934.

A systematic list of plants collected in the Department of Cuzco, Peru. Among the woody plants listed are the following: *Berberis boliviana*, vernacular name Chchecche; *B. carinata*, var. *echinata*, Ccjeshua-chchecche; *B. rariflora*, Chchecche; *Bocconia frutescens*, Yanali; *Weinmannia bifida*, Huichullu; *Piptadenia colubrina*, Huillca; *Cedrela Herrerae*, Cedro; *Acalypha macrostachya*, Pespita; *Rhus juglandifolia*, Incati; *Maytenus verticillata*, Duraznillo; *Muntingia Calabura*, Ccoillor-ppanchu; *Bixa Orellana*, Achiote, Achihuiti; *Carica* *platanifolia*, Monte-papaya; *Eugenia oreophila*, Unca; *Oreopanax incisus*, Maqui-maqui; *Thibaudia boliviensis*, Monte-capuli; *Datura sanguinea*, Puca-campanchu; *Nicotiana tomentosa*, Ckamato.—P. C. STANDLEY.

New or renamed spermatophytes, mostly Peruvian. II. By J. FRANCIS MACBRIDE. *Candollea* (Geneva) 6: 1–19; December 1934.

Among the new plants described are species of *Berberis*, *Turnera*, *Doliocarpus*, *Tetracera*, *Davilla*, *Weigeltia*, and *Conomorpha*, and there are new names in *Pithecollobium*, *Tipuana*, *Paullinia*, *Ardisia*, and *Diospyros*.

Studies in the Boraginaceae. XI. By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 16: 145–205; April 1935.

The paper includes a monograph of the Old World species of *Tournefortia*, 12 being recognized. The genus *Messerschmidia* L. is re-established, composed of 3 species distributed in both hemispheres. There are numerous notes upon plants of other genera, mostly herbaceous, with descriptions of new species, and the following new species of *Cordia* are described: *C. Weddellii*, Bolivia; *C. setigera* and *C. Braceliniae*, Brazil; *C. Klugii* and *C. ripicola*, Peru.—P. C. STANDLEY.

Colheita de material botánico na região amazonica (Relatorio 1931–1933). By ADOLPHO DUCKE. *Boletim do Ministério da Agricultura*, Rio de Janeiro, 1934, pp. 33–47.

The author furnishes an interesting account of his collecting in the state of Amazonas during the years 1931–33, with brief characterizations of various localities visited by him. With Manáos as headquarters and point of departure, he collected chiefly on the Rio Negro, Rio Branco, Rios Purús and Acre. The subject matter of the following extract (translated) will be of interest:

"Excursion by the road which leads from the city Rio Branco in the direction of upper Purús and across the colony 'Nova Empress' to the roads that penetrate into the virgin forest, opened for the extraction of Aguano. The environs of the city are fairly well occupied by small farmers from the northeastern states [of Brazil]. There are even places that suggest the pleasant aspects of the fields of Ceará. The virgin forest is similar to that of the Seringal [rubber plantation] Iracema, with the same soil, in large part full of holes, and, as far as I could determine, as to trees, the same flora. The forest here contains, however, a valuable tree which I did not find at Iracema, the true Aguano [Mahogany], *Swietenia Tessmannii* Harms, of the family Meliaceae. At present this is the most highly prized of Amazonian woods and is exported from Iquitos on a large scale. The Aguano (Peruvian name, accepted in Brazil in spite of the existence of its Portuguese equivalent, Mógano) belongs to a botanical genus comprising five species. Its geographical area includes the Antilles with the Bahamas, the extreme south of Florida and the American continent from the tropical part of Mexico to Venezuela and the western republics, south to Rio Ucaiali in Peru, the territory of Acre and the Rio Madeira of Bolivia and Matto Grosso. The exploitation of Mahogany in Brazil is very recent and for the present restricted almost entirely to the upper Purús, from whence the wood is floated down the river in 'balsas' [rafts] into the composition of which there enter, for greater buoyancy, also trunks of Cedar. The Mahogany is certainly the tallest and the thickest of the trees of the region. I judge that they may reach 60 meters in height, but the excessively thick trunks are frequently rotted and hollow in the center. In spite of my search I failed to find a young plant and it was not a simple matter to shoot down a branch of one of the giant trees."—B. E. DAHLGREN, *Field Museum of Natural History*.

Botanical miscellany. By H. A. GLEASON. *Phytologia* 1: 133–137; January 1935.

Besides descriptions of new species of Melastomaceae, notes are given on the recent discovery in Acre Territory, Brazil, of *Torresia cearensis* Allem., of the Leguminosae, whose fruits are described in detail. Its vernacular name is Cumaru de Cheiro. *Alseis latifolia*, a tree of 8 meters, is described from Maranhão, Brazil.

Some necessary nomenclatural changes (with one new species). By H. A. GLEASON. *Phytologia* 1: 141–144; January 1935.

Martiodendron is proposed as a new name for the genus of Leguminosae commonly known as *Martiusia*, a preoccupied name, and *M. macrocarpon* is described as new from the Rio Embira, Brazil. The new name *Apoleya* is proposed as a substitute for the homonym *Apuleja* of the same family.

Florula riograndensis. Bearbeitung der von Alfred Bornmueller in den Jahren 1903 bis 1907 in Rio Grande do Sul gesammelten Pflanzen. By JOSEPH BORNMUELLER. *Revista Sudamericana de Botánica* (Montevideo) 1: 129–148; October 1934.

A list of plants collected in Rio Grande do Sul, Brazil, by the author, the families enumerated being the Filices to Euphorbiaceae, inclusive, of the Engler sequence.

Studies in Moraceae. I. The genera *Trymatococcus* Poepp. et Endl. and *Craterogyne* Lanj. By J. LANJOUW. *Med. Bot. Mus. Univ. Utrecht* 32: 20: 262–278; figs. 1–6; April 1935.

A key is provided for distinguishing the four known species of *Trymatococcus*, which occur in the Guianas and Amazonia. They are described, with full synonymy and citation of material examined, and the inflorescences of each species are illustrated. *T. oligandrus* Lanj. (*Lanessania oligandra* Benoist) is known in Surinam as Letterhout, and by the Arowak name of Beloekoro. *Craterogyne* is a new genus, composed of four African trees referred heretofore to *Trymatococcus*. Vernacular names are reported for *C. africana*, Ngona (Spanish Guinea); Mkingano (Kenya).

The author states that, in the Engler classification, *Craterogyne* now occupies the place of *Trymatococcus* in the Moroideae-Dorsteniae, while the latter genus replaces *Lanessania* in the Artocarpoideae-Brosimae. An examination of the wood samples of two Amazon species of *Trymatococcus* in the Yale collections indicates a very close affinity to *Brosimum*, particularly in the narrow aliform parenchyma and the latex tubes in the rays. The wood of a single specimen of *Craterogyne kameruniana* (Engl.) Lanj. (Yale 23279, Vigne 2550) is very distinct, showing numerous concentric metatracheal bands and no latex tubes.

Algumas observações sobre borracha de Hipocrateáceas. By JOÃO GERALDO KUHLMANN. *Boletim do Ministério da Agricultura*, Rio de Janeiro, 1934, pp. 29–31.

A brief article concerning the Hippocrateaceae, especially *Hippocratea ovata* Lam., as a source of rubber. A sample of rubber obtained from that species is described as being less elastic than that of *Hevea*, but vastly superior in resistance to attrition; it is non-resinous and in many respects comparable to balata. The plant is a shrubby vine, abundant among the scrubby vegetation of the littoral of Rio de Janeiro and other eastern states of Brazil. It is said to be easily propagated. The rubber may be obtained without the destruction of the plant usual in balata extraction. A preliminary test by a crude method gave 14 per cent of gum from the bark.

The occurrence of rubber in the Hippocrateaceae has long been known, having been verified in a score of species of *Salacia* and *Hippocratea*, but this fact has hitherto been of only academic interest. Dr. Kuhlmann's observations appear sufficiently encouraging to warrant him in recommending further investigation of the possibilities of the Cipo Preto as a practical source of rubber.—B. E. DAHLGREN, *Field Museum of Natural History*.

Las bosques y la economia forestal Argentina. By FRANCO ENRIQUE DEVOTO. Pub. by Div. de Bosques, Min. de Agr., Buenos Aires, 1934. Pp. 16; 7½ x 11; illustrated.

The rich tropical rain forest, with representatives of about 50 families and 200 species of trees, extends for some distance southward from the northeastern boundary of the country; the reputed wealth of this forest is more floristic than forestal. Brief mention is made of the different forest regions and their principal commercial trees. Decrease in temperature and increase in altitude cause marked reduction in the number of species.

A second part of the report deals with forest economics, and states that out of a total estimated forest area (tabulated by provinces or territories) of 1,068,200 square kilometers, more than 30 per cent has been destroyed by fire during the past 30 years. It is indicated that the waste of the forest will cause a future shortage of timber, and planting is recommended as a remedial measure.

As rapidly as its resources permit, the Section of Forest Technology is extending its study of the timbers occurring in sufficient quantity to be of economic importance. The author, who is Chief of the Section, recommends the extension of its work, and gives an account of a study trip to European and Asiatic countries and to California.—F. W. FOXWORTHY.

Reviving the sandalwood industry. By C. S. JUDD. *Paradise of the Pacific* (Honolulu) 47: 4: 19–20; 5 photos; April 1935.

"On a small hill 750 feet above the sea in the middle of the Waahila ridge above St. Louis Heights in Honolulu, there is a grove of young trees which will produce in a few decades a wood considered the most valuable in the world. This grove consists of over 1500 Sandalwood trees raised from seed obtained from Mysore, India, and planted out by laborers of the Board of Agriculture and Forestry in November 1932 and January 1933 as an experiment to determine whether or not it is feasible to re-establish an industry which 125 years ago gave the infant kingdom of Hawaii its start in the commercial world.

"The experiment, so far, gives every promise of success and may lead to further plantings which are destined to bring considerable revenue to the Territory a few decades hence. These trees, now scarcely over two years old, are flourishing and some of them are already over seven feet in height. From the same lot of seed a Sandalwood tree planted on the Punahou School campus on May 12, 1932, is now 14 feet high and 4 inches in diameter. When it was two years old it began to produce fertile seeds and thousands of seedlings have been started from this one tree. It is situated on the makai side of Rice Hall near a Kou tree and some Wauke bushes. Other Sandalwood trees planted by the B. P. Bishop Estate at Maunalua have done equally well."

"Sandalwood seed planted in the nursery will germinate readily and grow to a height of about six inches but unless a host is provided before the end of the first year the young seedlings will perish. It is therefore the practice, when the Sandalwood seedling is transplanted into an individual container, to plant at the same time a few Ironwood seeds. The latter soon sprout and grow into seedlings upon the roots of which the Sandalwood roots will soon attach themselves and obtain nourishment. Both host and Sandalwood transplant are carried into the field together and planted and it is extremely important that the root systems be not disturbed."

Contributions to our knowledge of the Kwantung flora. II. By E. D. MERRILL and W. Y. CHUN. *Sunyatsenia* (Hongkong) 2: 3–22; ill.; September 1934.

Numerous species are reported as new for Kwantung, and among the woody plants described as new are species of *Alphonsea*, *Polyalthia*, *Capparis*, *Ormosia*, *Dalbergia*, *Sauropus*, *Evonymus*, *Turpinia*, *Ventilago*, *Reevesia*, *Tutcheria*, *Memecylon*, *Erycibe*, and *Lasianthus*.

Additions to the flora of Kwantung and south-eastern China. II. By WOON-YOUNG CHUN. *Sunyatsenia* 2: 49–87; ill.; September 1934.

In the paper 83 species and varieties are discussed, of which 37 species and 8 varieties are added to the Kwantung records. Genera new to the province are *Hartia*, *Hopea*, *Mappia*, *Pyrularia*, *Rhamnella*, and *Lysionotus*. A few species are recorded for the first time from China; and nine new species and a new variety are described in *Eurya*, *Hartia*, *Ilex*, *Rhododendron*, and *Maesa*.

Study of diameter growth of eight species in the Makiling National Park. By JUSTINO SEGUERRA. *Makiling Echo* (Manila) 13: 4: 213–238; October 1934.

"The objects of this paper are: (1) to find the approximate number of years trees in natural stand require to grow from one diameter class to the next higher class, (2) to ascertain the ages of individual trees of given sizes in the natural forest,

(3) to determine the growth per cent by diameter classes, and (4) to observe inherent and environmental factors which may influence growth."

Notes on some poisonous plants found in the Makiling National Park and its vicinity. By MAMERTO D. SULIT. *Makiling Echo* 14: 1: 14–29, January 1935.

"This paper deals with the poisonous plants causing irritation, swelling, and minute ulcers of the skin. The species herein treated are fully discussed, giving special emphasis to those plants producing stinging hairs and stinging crystals under the families Palmae, Araceae, and Urticaceae. Likewise, plants producing poisonous saps, as some of the species under the families Moraceae and Anacardiaceae, are described in detail."

New or noteworthy trees from Micronesia. X, XI. By RYÔZÔ KANEHIRA. *Botanical Magazine* (Tokyo) 49: 103–114, 185–195; figs. 8–24; March, April 1935.

The papers are devoted to descriptions and illustrations of new and old species of *Pandanus* and *Freycinetia*. Among the new species are *Pandanus Hosinoi* (called Nane Kejak, on Ponape); *P. korrensis* (Syu, on Palau); *P. kusaiensis* (Kosbia, on Kusai Island); *P. laticanaliculatus* (Jonmoua, on Jaluit Emedi); *P. laticanaliculatus*, var. *edulis* (Erwan, on Jaluit Emedi); *P. Utiyamai* (Lajaperik, on Ponape); *P. trukensis* (Meuoa, on Kusai; Mojel, on Jaluit); *P. tectorius*, var. *fatyanion* (Fatyanion, on Truk); *P. tectorius*, var. *ongor* (Ongor, on Palau Korror); *P. tectorius*, var. *acutus* (Ongor, on Palau).—P. C. STANDLEY.

Les chênes dans la production forestière indochinoise. By AIMÉE CAMUS. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 15: 161; 20–25, January 1935.

The Oaks of Indo-China are of two genera, *Quercus* and *Lithocarpus* (*Pasania*), the species of the latter being much the more numerous. The woods vary widely in density and strength and are of general use for carpentry, construction of

all kinds, furniture, cooperage, and fuel. Other Fagaceae in Indo-China are *Castanea*, *Castanopsis*, and *Fagus sinensis* Oliv.

CHECK LIST OF THE COMMON NAMES

Bu go	*Quercus Helferiana* DC.
Ca hin	*Lithocarpus fissa* Champ.
Cay de	*Lithocarpus echidnocarpa* Hickel & Camus
Cay gie den	*Lithocarpus fissa* Champ.
Cay so	*Lithocarpus microbalanus* Camus and *L. tubulosa* H. & C.
Cay sôi	*Lithocarpus fenestrata* Roxb.
Cay sôi càu	*Lithocarpus cerebrina* H. & C. and *Quercus Fleuryi* H. & C.
Cha; Cha dú	*Lithocarpus leiostachya* Camus
Chibu go	*Quercus Helferiana* DC.
Dom pra màt	*Lithocarpus Harmandii* H. & C.
Gie	*Lithocarpus* spp. and *Quercus* spp.
Gie cau	*Lithocarpus cerebrina* H. & C., *L. fenestrata* Roxb., *L. Finetii* H. & C., and *Quercus chapensis* H. & C.
Gie châng cay	*Lithocarpus cornea* Loureiro
Gie den	*Lithocarpus Bonnetii* H. & C.
Gie sôi	*Lithocarpus Bonnetii* H. & C. and *L. tubulosa* H. & C.
Gous	*Lithocarpus blaoensis* Camus
Kobodine	*Quercus Helferiana* DC.
Ko nay	*Lithocarpus cerifera* H. & C.
Mai khek; Mai kho; Mai ko khe	*Quercus serrata* Thunb.
May ko sa	*Quercus Griffithii* Hook.f.
Sôi	*Quercus Chevalieri* H. & C.
Sôi phang	*Lithocarpus cerebrina* H. & C.
Tao	*Quercus lanata* Smith
Xèu biên	*Quercus Fleuryi* H. & C.

Fluorescence of wood under ultra-violet light. By S. KRISHNA and K. A. CHOWDHURY. *Indian Forester* (Calcutta) 61: 4: 221–228; 1 pl. in colors; April 1935.

"The results obtained so far [on 100 specimens of Indian timbers] indicate that ultra-violet light excites fluorescence in wood in a striking manner. But at the present stage of our knowledge it is not possible to give proper interpretation of the phenomenon. There are a variety of factors which influence fluorescence in wood. Some are involved in the wood itself and the others in the light source. It has yet to be determined how far the fluorescence exhibited by wood is characteristic of the species and how far it is dependent on the age, season of collection, and the locality of growth. Moreover, different parts of the tree often show different fluorescence, for instance, the sapwood and the heartwood. . . . Work that has so far been done in this line goes to show that, with a more systematic and thorough investigation, it might be possible to solve a variety of problems connected with wood structure, such as the identification of the wood of several Dipterocarps which are indistinguishable under the microscope."

Results of experiments on the kiln-drying of wood with ozonized air. By S. N. KAPUR. *Indian Forest Records* (Economy series) 20: 13: 1–20; 5 figs.; 1934.

"The information available in literature on the so-called ageing of wood with ozone is very meagre and indefinite, and relates only to some micro-chemical and chemical reactions of the woods tested, while next to nothing is known about the effect of the process on important physical properties such as shrinkage, swelling, moisture equilibrium, and hygroscopicity, which are far more important than the mere presence or absence of some chemical constituents such as starch, sugars, and tannins. If a piece of wood naturally aged by prolonged air-seasoning is in any way superior to a piece of freshly kiln-dried wood, its superiority should lie in its greater stability to weather changes, and if it has a low starch content, another piece of wood with a low starch content cannot be accepted as equally aged, unless the latter is also tested for its reaction towards changes in atmospheric humidity, and found to be equally stable.

"It was, therefore, decided to test matched specimens of certain timbers, by drying one set in an atmosphere containing ozone, and another, under exactly the same conditions of drying, but without ozone, and in this manner to determine: the rate of drying of both sets; the development or otherwise of case-hardening stresses and other seasoning defects; the

tangential and radial shrinkage from green to oven-dry conditions; the shrinkage and swelling of the final dried wood after exposure to various relative humidities; the moisture equilibrium of the woods at different relative humidities; and the rate of absorption of moisture with a given change in the atmospheric humidity."

CONCLUSIONS

"Woods containing oils and oleo-resins, which are difficult to kiln-dry, are in no way benefited by the addition of ozone to the circulating air in a kiln. The addition of ozone to the air in a kiln does not speed up the rate of drying of either resinous or non-resinous woods. Timbers dried in an atmosphere of ozone, *i.e.*, 'artificially aged,' do not show any more stability towards changes of atmospheric humidity than those dried in a kiln without the addition of ozone. The total shrinkage and the equilibrium moisture content attained by a timber at any given humidity are the same for specimens dried with or without ozone. The rate of shrinkage and the rate of change in the moisture content of timber when transferred from one humidity to another are the same for woods dried with or without ozone. Woods liable to collapse during kiln-drying, *e.g.*, Needlewood (*Schima Wallichii*), behave equally badly during ozone-drying."

Testing of Indian timbers for veneer and plywood: Results of tests up to 1933. By W. NAGLE. *Indian Forest Records* (Economy series) 20: 14: 1–56; 3 pls.; Dec. 6, 1934.

The first part (pp. 1–18) of this instructive report describes the methods employed in constructing plywood, the machinery used for the purpose, and the different forms of finished plywood used for commercial work. The second part (19–46) consists of notes "based on the experience gained with Indian timbers in the experimental veneer and plywood mill of the Forest Research Institute at Dehra Dun, and it is hoped that they will be of some assistance to those now manufacturing and those contemplating the manufacture of veneers and plywood in India." It deals with 48 species of 37 genera and 26 different families. On pp. 47–54 are tables giving the results of mechanical tests on plywood and 3-ply tea boxes.

The botanical identity of jelutong. By C. F. Symington. *Malayan Forester* (Kuala Lumpur) 4: 2: 82–85; 1 pl.; April 1935.

"Although the Jelutong tree is too well known in the Malay Peninsula to need further introduction, there has always been some doubt concerning its botanical identity. Briefly, the description of early Peninsular collections under two distinct botanical names has led to determined efforts to find a practical interpretation for a non-existent specific difference. After study of the herbarium material at Kew, Singapore, and Kepong, and after considerable field observation, I am forced to conclude that we have but one species, namely *Dyera costulata* Hook. f."

Studies in the Ericales. II. A new genus of Vaccinioideae from Borneo. By H. K. Airy-Shaw. *Kew Bulletin of Miscellaneous Information* 150–156; 1935.

Cymothoe cyclophylla, a small epiphytic shrub, is described as a new genus. A key is given for its separation from allied genera of the tribe Thibaudieae.

Species of *Terminalia* from the Solomon Islands. By A. W. Exell. *Journ. Botany* (London) 73: 131–134; May 1935.

The following species are listed for the Solomon Islands: *T. Catappa* L., vernacular name Aliti; *T. complanata* Schum. & Hollr., Clenige, Gaurrasu, the trunk used for making canoes; *T. megalocarpa*, sp. nov., Kariruru; *T. solomonensis*, sp. nov., Ngar, used in making canoes, being very free in splitting to make planks, called also Tauma and Tramu; *T. Kajewskii*, sp. nov., Oieguy, Koilicka; *T. Brassii*, sp. nov., a tree up to 50 m. high.

Loranthaceae collected in the Solomon Islands by L. J. Brass and S. F. Kajewski, on the Arnold Arboretum Expedition, 1930-1932. By B. H. Danser. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 16: 206–209; pl. 129; April 1935.

New species are *Dactyliophora salomonia*, vernacular name

Bitorchi; *Sogerianthe versicolor*, Oong, Buraronu. The local name of Ti-nuissi is reported for *Dendrophthoe falcata*.

Flowering plants of Samoa. By Erling Christophersen. Bull. No. 128, Bernice P. Bishop Museum, Honolulu, February 1935. Pp. 221; 7 x 10; 32 figs.

A report upon a collection of plants made by the author in Samoa in 1929 and 1931–32, and upon other plants in the Bishop Museum not previously studied. Many species of trees and shrubs are listed, often with vernacular names, and new species and varieties are published in numerous groups.

Matériaux pour la flore de la Nouvelle-Calédonie. XXXVIII. Bignoniacées. By A. Guillaumin. *Bull. Société Botanique de France* (Paris) 82: 47–48; May 1, 1935.

There are few Bignoniaceae in New Caledonia. *Dolichandrone* and *Pandorea* are represented by one species each; *Deplanchea* by four, all endemic, for whose separation a key is provided.

Un nouvelle Didiéréacée. By Henri Humbert and Pierre Choux. *Bull. Société Botanique de France* 82: 55–62; pls. 2–5; May 1, 1935.

The family Didieraceae consists of xerophytic plants of Madagascar, representing four genera and eight species, three of the genera being monotypic. *Alluaudiopsis fiherenensis*, published as a new genus, is a large shrub, whose anatomy is described in detail.

Essai de révision des espèces africaines du genre *Annona* L. By W. Robyns and J. Ghesquière. *Bull. Soc. Royale de Bot. de Belgique* (Brussels) 67: 7–50; 4 pls.; 9 figs.; 1934.

There are found in Africa 10 species of *Annona*, representing two sections of the genus. A key is provided for distinguishing the species, for each of which there is a complete description with citation of synonymy, distribution, and vernacular names, and numerous notes. *A. Friesii* is a new species from Northern Rhodesia.

Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. VII. By J. MILDBRAED. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 187–201; Dec. 31, 1934.

New species of woody plants from Tanganyika are *Chloristylis ulugurensis; Vepris Mildbraediana* G. M. Schulze; *Grewia Schliebenii* Burret, *G. megistocarpa* Burret; *Dombeya heterotricha*, local name Msivoi; *Chrysophyllum kilimandscharicum* G. M. Schulze, local name Gapigo; *Mimusops Schliebenii* Mildbr. & Schulze; *Olea Schliebenii* Knobl., Chundi; *O. kilimandscharica* Knobl., Msadolo.

Observations on the genus *Commiphora* and its distribution in Tanganyika Territory. By B. D. BURTT. *Kew Bulletin of Miscellaneous Information* 101–117; pls. 1–5; 1935.

The genus *Commiphora* is chiefly African, being found throughout that continent, only 11 species occurring elsewhere. In Tanganyika Territory 37 species are known; for separation of the more common ones a key is provided. *C. Zimmermannii* Engl., the Mbungwa of the natives, yields a light straight-grained timber which takes a dark polish, but it is not exploited. Poles of all species take root readily when placed in the ground, and are invaluable for making live fences for cattle kraals. Stools, spoons, and milk bowls are carved from the wood of *C. ugogensis*. Five new species are described.—P. C. STANDLEY.

Some fossil dicotyledonous woods from Mount Elgon, East Africa. I. By HELEN BANCROFT. *American Journal of Botany* 22: 2: 164–183; 1 pl.; February 1935.

"Certain petrified plant-fragments, collected by Dr. O. H. Ödman from Mount Elgon in equatorial Africa, are reviewed. The age of the fragments and the conditions under which fossilization took place are indeterminate.

"Specimens E 1, 10, and 12 are portions of woody stems, the structure of which indicates unmistakably their dipterocarpaceous affinities. The name *Dipterocarpoxylon africanum* is therefore proposed for these specimens, which are especially interesting in showing the true dipterocarp type to have had, formerly, a much wider distribution than at the present day."

The taxonomic history and geographical distribution of the Monotoideae. By HELEN BANCROFT. *American Journal of Botany* 22: 505–519; fig. 1; May 1935.

The Monotoideae comprise two genera, *Monotes* and *Marquesia*, of the Dipterocarpaceae, being shrubs or small trees distributed over a large part of tropical Africa. In *Monotes* 28 specific names have been published; in *Marquesia* there are three species. The paper presents a history of the groups, with notes upon their anatomy. Various aspects of the morphology and systematic anatomy of the group are now under consideration at the Imperial Forestry Institute, Oxford, England.

Die Flora des Namalandes. VI. By PAUL RANGE. *Repertorium Specierum Novarum* (Berlin-Dahlem) 36: 241–264; Dec. 31, 1934.

A systematic list of plants occurring in Namaland, Africa, with citation of localities, the families covered being Leguminosae (in part) to Umbelliferae.

Note sur le genre *Pseudagrostistachys* Pax et K. Hoffm. (Euphorbiacées). By J. LEBRUN. *Bull. Soc. Royale de Bot. de Belgique* (Brussels) 67: 97–100; 1934.

The genus *Pseudagrostistachys* consists of three species, *P. ugandensis* in Uganda; *P. africana* in Fernando Po and San Thomé; and *P. Humbertii*, a tree of 20 m., here described as new from Belgian Congo.

Révision des Araliacées du Congo Belge. By J. LEBRUN. *Bull. Jardin Bot. Bruxelles* 13: 11–22; October 1934.

The Araliaceae are represented in Belgian Congo by the genera *Polyscias* (1 sp.), *Cussonia* (8 spp.), and *Schefflera*

(7 spp.). For each species there is citation of synonymy, range, and vernacular names; there is also a key for recognition of the species of each genus. New species are *Cussonia sessilis* and *Schefflera sycidiifolia*.

Révision des espèces congolaises du genre *Strophanthus* P. DC. By P. STANER and D. MICHOTTE. *Bull. Jardin Bot. Bruxelles* 13: 23–56; October 1934.

In the Congo there are 16 species of *Strophanthus*, for whose recognition there is provided a key. Each species is described in detail, with synonymy, distribution, vernacular names, and miscellaneous notes. One new species, *S. Bequaertii*, is described.

Les Guttifères de la flore du Congo Belge. By P. STANER. *Bull. Jard. Bot. Bruxelles* 13: 61–164; December 1934.

Keys are provided for distinguishing the genera and species of Guttiferae known from Belgian Congo, all of which are described with synonymy, citation of specimens and vernacular names, and numerous notes. The genera represented are *Hypericum* (7 species), *Haronga* (1), *Psorospermum* (3), *Vismia* (3), *Mammea* (1), *Lebrunia*, a new genus with one species, *Allanblackia* (3), *Garcinia* (9), *Symphonia* (1), *Pentadesma* (2). New species are described in *Hypericum*, *Allanblackia*, and *Pentadesma*. There is published, besides the synoptical keys, one based upon vegetative characters, and the paper concludes with an index to the numerous vernacular names.—P. C. STANDLEY.

Mr. John Gossweiler's Portuguese West African plants. Dicotyledones: Polypetalae. Addendum. By A. W. EXELL. *Journ. Botany* (London) 73: Suppl. 1–12; March 1935.

The families treated are Ranunculaceae, Anonaceae, Menispermaceae, Cruciferae, Capparidaceae, and Violaceae, numerous species being listed with localities and other data, and new ones described in the genera *Uvaria*, *Xylopia*, *Tiliacora*, *Penianthus*, *Dioscoreophyllum*, *Boscia*, and *Rinorea*. *Dialytheca Gossweileri* is a new genus of Menispermaceae.

The new generic name *Neostenanthera* is proposed for the homonym *Stenanthera* Engl. & Diels, Anonaceae. *Polyalthia Mortehanii* De Wild. is known in Portuguese Congo as Muamba.—P. C. STANDLEY.

***Uapaca* (Euphorbiacées) nouveaux d'Afrique Occidentale Française.** By A. AUBRÉVILLE and J. LÉANDRI. *Bull. Société Botanique de France* (Paris) 82: 49–55; figs. 1, 2; May 1, 1935.

The genus *Uapaca*, confined to Africa and Madagascar, comprises 20 to 30 species, which often are closely related. Two keys are provided for recognizing the six species known from French West Africa. New species are *U. paludosa*, vernacular name Dambrohia; *U. somon*, called Somon; *U. esculenta*, Borikio, Nanby, Rikio Noir, Kébi, Admellebié, Alohoua.

***Trichoscypha* (Anacardiacées) nouveaux de la Côte d'Ivoire.** By A. AUBRÉVILLE and FR. PELLEGRIN. *Bull. Société Botanique de France* 81: 647–649; 1934.

New species are *Trichoscypha Chevalieri*, *T. cavalliensis*, *T. Beguei* (vernacular name Daokro), *T. oba* (Oba Oba, Bim, Manoskpoel Aatjhe, Gogomango), *T. yapoensis* (Daokro). A key is given for segregation of the 6 species known from Ivory Coast.

De quelques Sapotacées de la Côte d'Ivoire. By [ANDRÉ] AUBRÉVILLE and F. PELLEGRIN. *Bull. Société Botanique de France* 81: 792–800; 2 figs.; March 16, 1935.

Sapotaceae described from Ivory Coast include the new genera *Breviea* with one species (based on *Chrysophyllum sericeum* A. Chev.; vernacular name Apobeaou); *Endotricha taiensis*; *Aningeria*, with 3 species, *A. altissima* having the local name of Grogoli; and *Gluema ivorensis*, vernacular name Adiépinégoa. New species are *Chrysophyllum Beguei* and *Vincentella camerounensis* Pierre. There are also new combinations in *Sersalisia* and *Vincentella*.—P. C. STANDLEY.

Étude anatomique des rameaux chez les essences forestières d'Algérie avec quelques observations sur les modifications amenées par l'âge. By J. DE SAINT-LAURENT. *Bull. de la Station de Récherches Forestières du Nord de l'Afrique* (Alger) 2: 2: 61–201; text figs. 30–106; pls. xvi–xxxvii; Dec. 31, 1934.

A highly valuable work covering the wood, bark, and pith of small stems of 88 trees and shrubs, representing 60 genera of 36 families, and a comparison of the size of elements and other anatomical details of the juvenile growth with those of old wood and bark. There is the discussion of the various factors involved, a descriptive illustrated key to the young stems, synoptical tables for comparison of the elements, and 88 photomicrographs (×50).

Bestimmungstabelle für rezente und fossile Coniferenhölzer nach mikroskopischen Merkmalen. By E. J. SLYPER. *Recueil des Travaux Botaniques Néerlandais* 30: 482–513; 19 figs.; 1933.

Along with some recent papers on wood anatomy the author gives here a detailed determining key, which is of importance for the diagnosis of woods of fossil conifers, and even if it miscarries, the information it contains, *e.g.*, about traumatic resin canals, resin parenchyma, etc., is highly useful in the study of both living and fossil woods. (See *Tropical Woods* 39: 72.)—HANS H. PFEIFFER, *Bremen*.

An apply for coöperation in plant taxonomical research. By C. G. G. J. VAN STEENIS. *Bull. Jardin Botanique de Buitenzorg* 3: 13: 281–283; December 1934.

It is much to be regretted that many modern world monographs of plants are compiled principally or wholly upon material in the larger herbaria of Europe and America, which often contain, besides the older collections, only scattered duplicates from the extensive recent collections of herbaria in other countries. It is urgently recommended that monographers study all available material, such as that in the herbaria of Peradenyia, Calcutta, Singapore, Buitenzorg, Sarawak, Manila, Rangoon, Brisbane, and Melbourne.

Karanja: Pongamia glabra Vent.; Papilionac.; Beng.
Karanjalam: Holoptelea integrifolia Planch.; Ulmac.; C.-O.-Ind.
Karanji: Holoptelea integrifolia Planch.; Ulmac.; C.-O.Ind.
" : Pongamia glabra Vent.; Papilionac.; C.-O.-Ind.
Karantáng: Buchanania sp.; Anacardiac.; Phil. (Palawan)
Karánung: Diospyros nitida Merr.; Ebenac.; Phil. (Mindoro)
Karāpa: Carapa spp.; Meliac.; Sur.
Karapu: Canarium strictum Roxb.; Burserac.; sw. O.-Ind. (Madras)
Karar: Bauhinia purpurea L.; Caesalpiniac.; nw. O.-Ind. (Punjab)
Karaseri: Oxandra lanceolata Baill.; Anonac.; br. Gu.
Karasuzansho: Zanthoxylum ailanthoides S. et Z.; Rutac.; Jap.
Karatákat: Parinarium sp.; Rosac.; Phil. (Ilocos, Cagayan)

M. M. CHATTAWAY.

M.M.C.

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TROPICAL WOODS

NUMBER 44 DECEMBER 1, 1935

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TROPICAL WOODS

NUMBER 44 December 1, 1935

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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SYSTEMATIC ANATOMY OF THE WOODS OF THE RHIZOPHORACEAE [1]

By HERBERT F. MARCO

The Rhizophoraceae, as the family is now constituted, comprise 16 genera and about 100 species of trees and shrubs, which are distributed throughout the tropical regions of the world. The family is of limited economic importance and is best known on account of the peculiar adaptation characters of the littoral species, or Mangroves, especially the formation of prop roots (*Rhizophora* spp.) and the germination of the seed while the fruit is still attached to the tree. In 1814, Robert Brown, in his study of the Australian flora, found that a relationship existed between *Rhizophora* L., *Bruguiera* Lam.,

[1] Abstract of a dissertation presented for the degree of Doctor of Philosophy in Yale University. The work was done under the supervision of Professor RECORD.

and *Carallia* Roxb. and proposed that they be combined to form a natural order Rhizophoreae. Subsequently other genera were added, but most of these grew inland and did not possess the special adaptation characteristics, and largely because of that fact the internal organization of the family has been subjected to much revision. In 1865, Bentham and Hooker grouped the genera then known into three tribes, the first embracing only the Mangrove genera, the other two the inland species; this classification has since become widely adopted. Schimper (1893) rejected Bentham and Hooker's proposals on the grounds that adaptation characters are insufficient to designate a natural group and, further, that the divisions presented did not show the true affinities of the genera. As a result of this disagreement, Schimper suggested an entirely different classification, based on the natural relationship of the various genera. In 1922, Ridley, apparently ignoring Schimper's work, raised the tribes proposed by Bentham and Hooker to independent orders (families).

The wood anatomists who studied some of the representatives of this family followed Bentham and Hooker's classification and found that the Mangrove species (Rhizophoreae) were structurally very distinct from the inland species (Legnotideae). Solereder (1908) showed how these two groups differed in the anatomy of their secondary xylem. Janssonius (1918), as a result of his study of *Rhizophora*, *Bruguiera*, *Carallia*, and *Gynotroches*, remarked that the differences between these two divisions were as great as those normally found between two families and, further, that such marked contrasts almost never occurred between groups within the same family.

The lack of agreement among taxonomists concerning the internal organization of the Rhizophoraceae and the recognized structural differences between the Rhizophoreae and Legnotideae have prompted the present investigation. The object of this study has been to determine to what extent a critical survey of the anatomy of the secondary xylem of the 16 genera and 41 species represented in the Yale wood collections would aid in the reorganization of this family.

Geographical Distribution

The Rhizophoraceae are entirely tropical and extend around the world, from Florida in the north to tropical Australia in the south. Indigenous to the Americas are three genera, *Cassipourea*, *Rhizophora*, and *Sterigmapetalum*, the last named being reported only from the Brazilian Amazon region, while the others are found in the West Indies, Bahamas, Galapagos Islands, Lower California, Central America, and along the northern and eastern coasts of South America to the limits of the tropics. *Rhizophora Mangle* L. is the single representative of the family in the United States and is confined to the southern coast of Florida and its Keys. The remaining genera are native to the Old World: India, Ceylon, Malayan Peninsula and Archipelago, Penang, Malacca, East Indies, Indo-China, Borneo, Formosa, Philippines, Polynesia, tropical Australia, Madagascar, and equatorial Africa. The genus *Macarisia* is confined to Madagascar.

The Rhizophoreae, or true Mangroves, namely, *Rhizophora*, *Bruguiera*, *Ceriops*, and *Kandelia*, reach their highest development in the Malayan Peninsula and are the characteristic species of muddy tidal swamps and estuaries. Their peculiar mode of propagation necessitates a soil that will readily receive the young seedlings, consequently they do not thrive along rocky shores. The remaining genera, which constitute the bulk of the family, are found exclusively on upland sites, a fact contrary to the general impression that the family is essentially maritime.

Rhizophora and *Anisophyllea* have very wide distributions. The latter is restricted to the eastern hemisphere, but *Rhizophora* girdles the world.

Economic Importance

With the exception of the littoral, or Mangrove, species, the Rhizophoraceae have almost no economic importance. The land building and binding properties of the Mangroves are undoubtedly of primary importance. The stilt-like roots and numerous pneumatophores form areas of quiet water which encourage the deposition of silt carried down by the rivers. As the silt deepens the plants move seaward, and gradually a new terrain forms upon which more valuable species of other families develop.

The bark of the Mangrove species (*Rhizophora*, *Bruguiera*, *Ceriops*, and *Kandelia*) contains from 20 to 45 per cent of tannin and is one of the important sources of this product. The grade of tannin is considered inferior to that obtained from Oak, Quebracho, Mimosa, Sumac, etc., since it imparts a red color to the leather and is only satisfactorily used in combination with the better tannins. The leaves and bark of the same genera yield the formerly well known red and brown cutch dyes, but these products have been largely supplanted by cheap aniline dyes. The logs, after they have been stripped of their bark, are usually left to decay.

The woods of the tidal genera, being hard, heavy, and fine-textured, make excellent firewood and charcoal and are greatly exploited in regions where other fuels are scarce. In addition to fuel, Schneider (1916) gives the following uses in the Philippines: salt water and foundation piling, mine timbers, house posts, furniture and cabinet work, flooring, fresh water foundation piling, musical instruments, and native implements. From experiments conducted by Vidal and Aribert (1928) it was found that some species of *Rhizophora*, *Bruguiera*, and *Ceriops* yield a fair grade of manila and kraft pulp.

The timbers of some of the inland genera (*Carallia*, *Anisophyllea*, *Combretocarpus*, *Anopyxis*, and *Gynotroches*) are easily worked and exhibit a handsome silvery grain when quartered, thus making them suitable for furniture, cabinet, and panel work. They are utilized locally for construction, as planks and posts, flooring, and native implements. The wood of *Cassipourea* is very durable, strong, and flexible and is employed in native implements, canoe paddles, house poles, and picket enclosures.

Poga oleosa supplies a soft, golden brown, medium-textured, straight-grained wood, which Unwin (1920) recommends as a substitute for light Cedar or Mahogany. The nuts of this species have a soft, white, and very oily kernel, which is reputed to have an even better flavor than the Brazil nut.

Taxonomy and Wood Anatomy by Natural Groups

On the basis of their macroscopic and microscopic features the woods of the Rhizophoraceae may be divided into three groups which, to facilitate discussion, are designated the Rhizophoreae, the Gynotrocheae, and the Macarisieae. The Gynotrocheae, as it is treated in this study, has a subordinate group, the Anisophylleae, which agrees in composition, rank, and name with a similar group proposed by Bentham and Hooker.

The genera investigated are grouped as follows: 1. RHIZOPHOREAE: *Rhizophora* L., *Bruguiera* Lam., *Ceriops* Arn., and *Kandelia* Wight & Arn.; 2. GYNOTROCHEAE: *Gynotroches* Bl., *Crossostyles* Forst., *Carallia* Roxb., *Anisophyllea* R. Br., and *Combretocarpus* Hook. f.; 3. MACARISIEAE: *Macarisia* Thouars., *Cassipourea* Aubl. (including *Dactylopetalum* Benth. and *Weihea* Spreng.), *Blepharistemma* Wall., *Sterigmapetalum* Kuhlm., and *Anopyxis* Engl.; 4. UNCLASSIFIED: *Poga* Pierre and *Pellacalyx* Korth.

The terminology used in describing the woods of the Rhizophoraceae is that proposed by the Committee on Nomenclature of the International Association of Wood Anatomists (1933). The size classes of the wood elements are in agreement with those suggested by Chattaway (1932).

1. RHIZOPHOREAE

Rhizophora, *Bruguiera*, *Ceriops*, and *Kandelia*, which constitute the Rhizophoreae, were designated by early botanists as the Mangroves. Together with certain members of other families (*e.g.*, *Avicennia* and *Aegiceras*), they form associations now commonly known as Mangrove swamps. The four genera show remarkable adaptations to their environment. All have viviparous reproduction, *Rhizophora* has prop or stilt and aerial roots, and *Bruguiera* and *Ceriops* have pneumatophores.

The Rhizophoreae are evergreen trees with opposite, simple, coriaceous, entire leaves. Twigs swollen at the nodes and with prominent petiolar scars. Flowers hermaphroditic, regular, borne in rather large axillary cymes; calyx tube obscure, adnate to the ovary, and having 4-14 valvate lobes; petals shorter than and of same number as the calyx lobes and alternating with them; stamens borne in pairs, 8 to many; ovary inferior; style simple; ovules pendulous from the apex of the cell. Fruit 1-celled, usually 1-seeded, indehiscent; the embryo germinating while it is still attached to the tree (vivipary).

Woods ranging in color from light tan or yellowish brown tinged with red to dull red brown; medium to very hard and heavy (sp. gr. 0.62 to 1.16); straight-grained; very fine-textured; difficult to cut, but work well, taking a smooth hard finish and a high polish. Odor and taste absent or not distinctive. Pores numerous, small, often appearing to the unaided eye as light fine dots, evenly distributed and either solitary or in groups. Vessel lines fine but readily visible, especially in the darker woods. Tyloses scanty to abundant in some woods, absent in others. Parenchyma usually scanty, closely associated with the pores and difficult to discern even with the aid of a lens. Rays fine, near limit of vision on cross and tangential sections, but distinct on the radial, producing low to very high ray flecks which have a purplish cast. Growth rings are generally absent; when present usually demarcated by denser, relatively poreless zones.

Pores moderately to very numerous, small to large, solitary or in multiples (2–14), or in clusters (3–10); walls thick, at points of contact with other pores very thick. Parenchyma scanty (except in *Kandelia*), vasicentric, mostly uniseriate; cells thick-walled, flattened; vasicentric and also in metatracheal bands, 2–4 cells wide, in *Kandelia*. Vessel members long, with exclusively scalariform, heavy-barred, steeply inclined perforation plates; overlapping ends long, truncate or tapering, scalariformly pitted; intervascular pitting exclusively scalariform, the pits long and crowded vertically; tyloses sporadic or abundant, thin-walled; dark brown or reddish brown infiltrations often present. Rays heterogeneous; the uniseriate rare or very few, the multiseriate numerous, moderately broad (up to 10 cells wide), low to moderately high (frequently over 10 mm. and 100 cells high); cells fine, thick-walled; crystals common; pits to contiguous ray cells very small, or in some species both large and small; ray-vessel pit-pairs variable in shape, nearly round to linear, unilaterally and bilaterally compound pitting often predomi-

nant. Libriform fibers long, very thick-walled, often gelatinous, hexagonal or angular on cross section; pits very small, inconspicuous, round, simple; lumina often completely filled with gums. Globular, granular, or amorphous gummy deposits in part or all of the elements.

As a group, the Rhizophoreae show a remarkably unified wood structure and are characterized by: (1) heavy-barred, exclusively scalariform perforation plates (Plate VI, 24); (2) characteristic scalariform intervascular pitting (Plate III, 13); (3) scanty vasicentric parenchyma (Plate I, 1); (4) numerous moderately broad, low to moderately high, fine-celled, multiseriate rays, and very few uniseriate rays (Plate III, 13, 15); (5) libriform fibers with inconspicuous pits; (6) common occurrence of unilaterally and bilaterally compound pitting between rays and vessels. These features bind the Rhizophoreae closely together structurally and segregate them from the other groups under consideration.

Unilaterally and bilaterally compound pitting is common between rays and vessels, but rare between wood parenchyma and vessels. In *Ceriops* the outlines of the ray pits involved in the unilaterally compound pitting are shield-shaped and afford a reliable means of identification (Plate VI, 28); in *Rhizophora* and *Bruguiera* this type of pitting is variable.

In *Rhizophora mucronata* no uniseriate rays were found in tangential sections representing a tangential area of 450 sq. mm. of two samples from widely separated regions. For the four genera and their species only 124 uniseriate rays were present in an area of approximately 25,000 sq. mm.; their height was generally over 0.2 mm. (5 cells) high, maximum 0.4 mm. (12 cells).

The multiseriate rays of the four genera under consideration fall into two more or less distinct size classes. In *Rhizophora* and *Bruguiera* they are moderately broad, 2–10, generally 4–6, cells wide, and low to moderately high (commonly over 3 mm.). In contrast, the rays of *Ceriops* and *Kandelia* are fine to moderately fine, 3 or 4, rarely more than 5, cells wide and low to rather low (seldom exceeding 3 mm. in height).

The characteristic scalariform intervascular pitting (Plate III, 13) of the Rhizophoreae is an outstanding example of this type. The pits are very crowded from tip to tip and extend completely across the member wall. The presence of gum adds distinctness to the narrow apertures.

2. GYNOTROCHEAE

Gynotroches, *Crossostyles*, *Carallia*, *Anisophyllea*, and *Combretocarpus*, which form the Gynotrocheae, are all inland genera and do not possess any of the adaptation characteristics of the Mangroves. *Carallia* has been reported to produce aerial roots from the lateral branches and this feature is cited to show a relationship to the Rhizophoreae. The members of this group are nowhere abundant and, unlike the Mangroves, are not gregarious. This fact, together with the economic unimportance of the plants, may account for the lack of general botanical information other than the brief taxonomic descriptions given in floras.

The Gynotrocheae are evergreen trees or shrubs with simple, entire, or serrate leaves which are alternate in *Anisophyllea* and *Combretocarpus* but opposite in the other genera. Flowers regular, in axillary cymes or fascicles; calyx tube 4–8-lobed, inserted below the margin of an entire or weakly lobed disk; petals 4–8, entire or valvate, often lacerated or fringed, inserted below the disk; the stamens 8–16, in pairs inserted on and at the base of the petals; ovary superior or occasionally slightly inferior, 1–6-celled; style 1, simple, filiform or columnar, the stigma 3—many-lobed (except in *Anisophyllea* and *Combretocarpus* which have 3 styles, with simple stigmas). Ovules 2–6 per cell, pendulous from the apex or near the middle. Fruit berry-like, fleshy or somewhat dry; 1—many-seeded.

Woods grayish white to golden brown, at times with darker streaks; medium to hard and heavy (sp. gr. 0.63–0.98); coarse-textured; straight-grained; cut well and take a smooth finish and a high polish. Odor and taste absent or not distinctive. Growth rings absent or poorly defined. Parenchyma distinct or indistinct to the unaided eye, but clearly visible with a lens as weak to well-defined confluent paratracheal or metatracheal lines or bands; in *Anisophyllea* and *Combretocarpus* and occasionally in *Carallia* producing with the rays a pronounced spiderweb or ladder-like effect. Pores variable from small (readily visible with lens) to large (distinct to the unaided eye); mostly solitary or to a lesser extent arranged in multiples or clusters; evenly distributed. Vessel lines coarse,

appearing as white, dark, or lustrous scratches. Tyloses present or absent; white deposits and gums often completely occluding the vessels. Rays broad to extremely broad, conspicuous on all sections; high to very high, producing on radial surface a pronounced ray fleck, lighter than the background; cells coarse (readily visible with a lens).

Pores few to moderately numerous, small to moderately large (large in *Anisophyllea* and *Combretocarpus*), mostly solitary, round, ovate or angular; also in multiples (2–6) or in clusters (3–7); walls thin. Parenchyma very abundant; in weakly confluent paratracheal and metatracheal lines or bands in *Gynotroches* and *Crossostyles*, in well developed bands in *Carallia*, in pronounced symmetrical broad bands in *Anisophyllea* and *Combretocarpus*. Vessel members long (except in *Anisophyllea* and *Combretocarpus*, where they are short to very short), with oblong or round, simple perforations (except in *Gynotroches* where some vessel members in the first formed secondary xylem have scalariformly perforated plates with very thin, delicate, few to numerous bars); plates steeply inclined to horizontal; overlapping ends present or absent. Intervascular pits (except in *Gynotroches*) small to moderately large, crowded, alternate, sometimes tending to become opposite and elongated in various directions; apertures horizontal, included or extended (*Anisophyllea* and *Combretocarpus*); artifacts common, often giving a vestured appearance, especially in *Carallia;* pits in *Gynotroches* crowded vertically and extending completely across the member wall. Tyloses present or absent, thick- or thin-walled. Rays heterogeneous; many uniseriate; others broad to extremely broad (up to 40 cells and 1.2 mm. wide), rather low to very high (frequently over 100 cells and 15 mm. high), the cells thin-walled and coarse; pits to contiguous ray cells abundant, small; ray-vessel pit-pairs variable in shape, round to linear, with unilaterally compound pitting often present, abundant in *Gynotroches* and *Combretocarpus*. Fiber-tracheids long, very thick-walled, often gelatinous; pits very small to large, apertures vertical, included or slightly extended. Crystalliferous fibers often present in *Carallia* and *Combretocarpus*. Cell contents: chalky infiltrations often completely occluding the vessels; globular, granular, or amorphous gum deposits frequently present in all elements; crystals few to abundant, chiefly in the rays.

Although the wood structure of the Gynotrocheae is not as unified as in the Rhizophoreae, the genera included nevertheless form a homogeneous group. The characteristic features are: (1) large simple perforations; (2) crowded, alternate (except in *Gynotroches*) intervascular pitting (Plate III, 16; IV, 20); (3) abundant confluent paratracheal and metatracheal parenchyma; (4) broad to extremely broad, high, coarse-celled multiseriate rays (Plate III, 14, 16) and abundant uniseriate rays; (5) fiber-tracheids with distinct pits; (6) unilaterally compound pitting between the ray and wood parenchyma and the vessels (except in *Anisophyllea*). The first five features are in contrast with those enumerated for the Rhizophoreae and, consequently, the two groups are readily distinguishable.

The intervascular pitting of *Gynotroches* (Plate III, 14) is of the type of the Rhizophoreae, but the simple perforations, the extremely broad, high rays, the fiber-tracheids, the parenchyma patterns, and other features require that the genus be included in the Gynotrocheae. Another feature of *Gynotroches* that is not shared with the remainder of the group is the sporadic occurrence of scalariformly perforated plates in the smaller vessels, generally in the first-formed secondary wood. In the specimens studied, all vessel members in the outer portion of the mature secondary xylem had simple perforations.

The wood parenchyma falls into two categories. In *Gynotroches* and *Crossostyles* it is in closely spaced irregular lines or narrow bands (Plate I, 5) whereas in the other three genera it is in well developed bands, which are widely and irregularly spaced in *Carallia*, but closely and symmetrically spaced in *Anisophyllea* and *Combretocarpus* (Plate I, 6).

The definite arrangement of the parenchyma, the large size of the pores, the shortness of the vessel members, and the coalescent apertures of the vessel member pits distinguish *Anisophyllea* and *Combretocarpus* from the other members of the Gynotrocheae. They are considered in this study as

forming the tribe Anisophylleae of Bentham and Hooker, who segregated the genera on the basis of their 3 styles, alternate leaves, and exalbuminous seeds.

3. Macarisieae

The Macarisieae comprise the genera *Macarisia*, *Cassipourea*, *Blepharistemma*, *Sterigmapetalum*, and *Anopyxis*, the last two forming a special section. Like the Gynotrocheae, they have none of the adaptation features characteristic of the Rhizophoreae. They are mostly small trees or shrubs occurring in isolated localities and are without economic importance. The best known are *Anopyxis* and certain species of *Cassipourea*, which are large forest trees yielding handsome, tough, strong, serviceable woods, though as yet used only locally.

The Macarisieae are evergreen trees or shrubs with opposite, simple, crenate or dentate leaves. Flowers monoecious or dioecious, solitary or in axillary cymes; calyx tube short, 4–7-lobed, obscure or companulate and adnate to the base of the ovary; petals 3–6, inserted upon the disk, lacerated, dentate, or fringed; stamens 8–30, inserted on the margin of the disk; staminodes numerous in *Anopyxis* and *Sterigmapetalum;* ovary free, 5- or 6-celled; style filiform; stigma weakly lobed; ovules 2 per cell, pendulous from the apex. Fruit dry or fleshy, septicidally dehiscent; generally 2 seeds per chamber; seeds winged.

Woods uniformly grayish white to light reddish brown; medium to hard and heavy (sp. gr. 0.67 to 0.98); generally straight-grained; very fine-textured; difficult to cut, but work well, taking a smooth hard finish and a good polish. Odor and taste absent or not distinctive. Growth rings absent or sometimes indicated by denser bands. Pores very numerous, very small to moderate-sized, indistinct to fairly visible, mostly solitary and well distributed, occasionally in multiples of 2 or 3; tyloses and reddish gums sporadic, but often occluding the pores. Vessel lines very fine. Parenchyma abundant, but indistinct to the unaided eye; in weak, irregular, confluent paratracheal and metatracheal lines, or occasionally in narrow, irregular bands. Rays very fine, faintly visible or indistinct on cross section, numerous to very numerous; ray fleck low to very low on radial section.

Vessels thin-walled, except in *Sterigmapetalum* and *Anopy-*

xis; sclerotic tyloses present in some specimens of *Cassipourea elliptica;* members long, generally with pitted tails; both simple and multiple perforations present, the plates of the latter with numerous, delicate, often reticulate bars; intervascular pit-pairs very small, their arrangment alternate or opposite, crowded or scattered, and in some genera tending to scalariform. Rays heterogeneous, numerous to very numerous, very fine to fine (1–4, generally 2 or 3, cells wide), low to very low; cells fine, thin-walled except in *Sterigmapetalum;* crystals sometimes present; pits to contiguous ray cells very small and abundant; ray-vessel pit-pairs irregular in size and outline, but commonly linear and in scalariform arrangement. Fiber-tracheids long, thick-walled, often gelatinous; pits distinctly bordered.

The outstanding characteristics of the Macarisieae are: (1) numerous small pores; (2) both simple and multiple perforations; (3) small intervascular pits in alternate, opposite, or scalariform arrangement; (4) abundant confluent paratracheal and metatracheal parenchyma (except in *Sterigmapetalum* and *Anopyxis*) (Plate I, 4); (5) exclusively fine rays (Plate IV, 17); (6) wood fibers with distinct bordered pits.

In *Anopyxis* and *Sterigmapetalum* the pores are larger, thicker-walled, and less numerous than in the other genera of the Macarisieae. In *Sterigmapetalum* the parenchyma is arranged in short tangential lines in contact with the pores only on one side (Plate II, 9); in *Anopyxis* it is conspicuously aliform (Plate II, 10). Cross sections of the woods of the two genera resemble the Rhizophoreae, especially *Ceriops* and *Kandelia*, but the sum total of the anatomical features places them in the Macarisieae. Their segregation into a dependent section is aided by the fact that both have dioecious flowers and numerous staminodes, whereas these features are not found in the remaining genera of the Macarisieae.

In some of the genera of this group the simple perforations are three to four times longer than they are wide, the sides of the openings are conspicuously parallel, and the ends are symmetrically rounded (Plate VI, 25). The scalariform perforation plates often tend to have this oblong shape, but generally are longer. In both types, however, the perforation rims are wide and distinct.

In some specimens of *Cassipourea elliptica* concentric zones were found in which the pores are completely occluded by sclerotic tyloses or by amorphic deposits of red or yellow gum (Plate IV, 17). The lumina of the tyloses are frequently filled with large crystals (up to 65 μ in length) or plugged with gum.

4. Unclassified

Poga and *Pellacalyx* are two distinct genera that have been included with the Rhizophoraceae, although they appear decidedly out of place in the family.

Poga.—The single species, *Poga oleosa* Pierre, is a medium-sized to large evergreen West African tree, which is much better known locally as a source of edible nuts than for its timber. According to Unwin (p. 368), it is one of the few trees in Nigeria that is preserved when a fresh clearing is made for a farm.

Leaves entire, alternate. Flowers very small, dioecious, in dense axillary spikes; calyx 4-parted, triangular, lobed; petals 4, inserted on the disk, indistinctly lobed, glandularly fringed; stamens 8, short, flat, and attached to the disk; anthers 2-valved; ovary superior, 4-chambered, with 1 ovule to each chamber; style egg-shaped, pointed. Fruit a 4-chambered nut, often with 1 or 2 of the chambers sterile; exocarp fleshy and very thick; endodermis lignified; seeds rather long, with hard, crusty, cinnamon-brown shell; exalbuminous; embryo not divided, rich in oils around periphery.

Wood uniformly lustrous golden brown; soft, readily dented with thumb nail; light (sp. gr. 0.51 to 0.56); with straight or somewhat twisted grain; fine-textured; works easily and takes a smooth finish and high polish. Odor and taste absent or not distinctive. Growth rings absent. Pores very large, open, appearing as pin holes, scattered, mostly solitary, sometimes in multiples of 2–4. Vessel lines conspicuous, appearing as deep, coarse scratches. Parenchyma fairly abundant, visible with lens as narrow confluent paratracheal bands. Rays very broad, high, readily visible on all sections, producing a handsome figure on radial surface.

Wood parenchyma bands 2–4 cells wide; cells thin-walled, very large and flattened radially, especially when in contact with the pores. Vessel members long, thin-walled; tyloses absent; perforations simple, the plates nearly horizontal; intervascular pit-pairs very large (27 μ), round, alternate, numerous; apertures oblique, slit-like, extended, frequently coalescent. Rays coarse-celled, heterogeneous, the multiseriate very broad (up to 20 cells and 0.3 mm. in width), rather low to moderately high, the cells thin-walled, often with gummy contents; pits to contiguous ray cells very numerous, small; ray-vessel pitting unilaterally compound, one simple ray pit (often 50 to 60 μ long) subtending several vessel pits. Fiber-tracheids thin-walled; pits apparently restricted to radial walls, fairly large, the apertures vertical and extended.

The outstanding characteristics of the wood of *Poga* are: (1) the lustrous golden brown color; (2) extremely large pores (Plate II, 11); (3) widely spaced, narrow bands of confluent paratracheal parenchyma; (4) few, very broad, rather low to moderately high rays; (5) thin-walled fiber-tracheids; (6) large, round or oval intervascular pit-pairs; (7) unilaterally compound vessel-parenchyma pitting (Plate V, 21).

Pellacalyx.—The two known species, *P. axillaris* Korth. and *P. Saccardianus* Scort., are small to medium-sized, slender, evergreen trees occurring in the Malay Peninsula and islands. The timber is of no commercial importance, but is used to a limited extent locally for construction purposes. The woods of both species are much alike.

Leaves opposite, serrate-petioled. Flowers monoecious, axillary, solitary or in dichotomously branched loose clusters or cymes; calyx tube 4–6-lobed, urn-shaped and drawn out into a long tube above the ovary; petals 4–6, very small, inserted on margin of disk, or absent; stamens 8–12, very short, inserted on crenulate disk; filaments awl-shaped; anthers small; ovary inferior, 5–10-chambered; style awl-shaped; stigma bowl-shaped, 5–10-lobed; ovules pendulous in clusters or bundles, many to each chamber. Fruit berry-like, fleshy, 5–10-celled, many-seeded; seeds arranged in uniseriate rows; albumen copious; testa wrinkled and thick.

Wood uniformly grayish white throughout; rather soft and light (sp. gr. 0.62); straight-grained; coarse-textured; easy to work. Odorless and tasteless. Growth rings absent. Pores few, large, open, solitary or in clusters of 3 or 4 and arranged in short tangential rows. Vessel lines very coarse, giving splintery appearance to wood, especially to tangential surface. Parenchyma disposed in rather broad, confluent, paratracheal bands, completely embedding the pores. Rays very broad, high, conspicuous on all sections, especially the radial.

Wood parenchyma bands 6–12 cells wide; cells thin-walled. Vessels thin-walled; tyloses absent; members very long, terminating abruptly; perforations usually simple, round or oval; very large, delicately reticulate perforation plates sporadic; plates obliquely inclined or nearly horizontal; intervascular pit-pairs very large (av. 24–30 μ), crowded, rectangular, opposite; apertures large, lenticular, included, very conspicuous. Rays heterogeneous; cells thin-walled; multiseriate rays very broad (up to 21 cells and 0.5 mm. in width), moderately high to high; pits to contiguous ray cells very numerous, large and conspicuous; ray-vessel pitting predominantly scalariform, the pit-pairs very large, almost simple. Fiber-tracheid pits extremely large and conspicuous (commonly 30 μ high); apertures vertical, extended, very broad and lenticular in *P. axillaris*, slit-like in *P. Saccardianus;* walls thick.

A summary of the characteristic features of the woods of *Pellacalyx* includes: (1) arrangement of the pores in tangential rows (Plate II, 12); (2) large, simple perforations (Plate V, 23); (3) large, conspicuous, opposite intervascular pit-pairs (Plate V, 22); (4) very broad, high rays; (5) very large bordered pits in the fiber-tracheids.

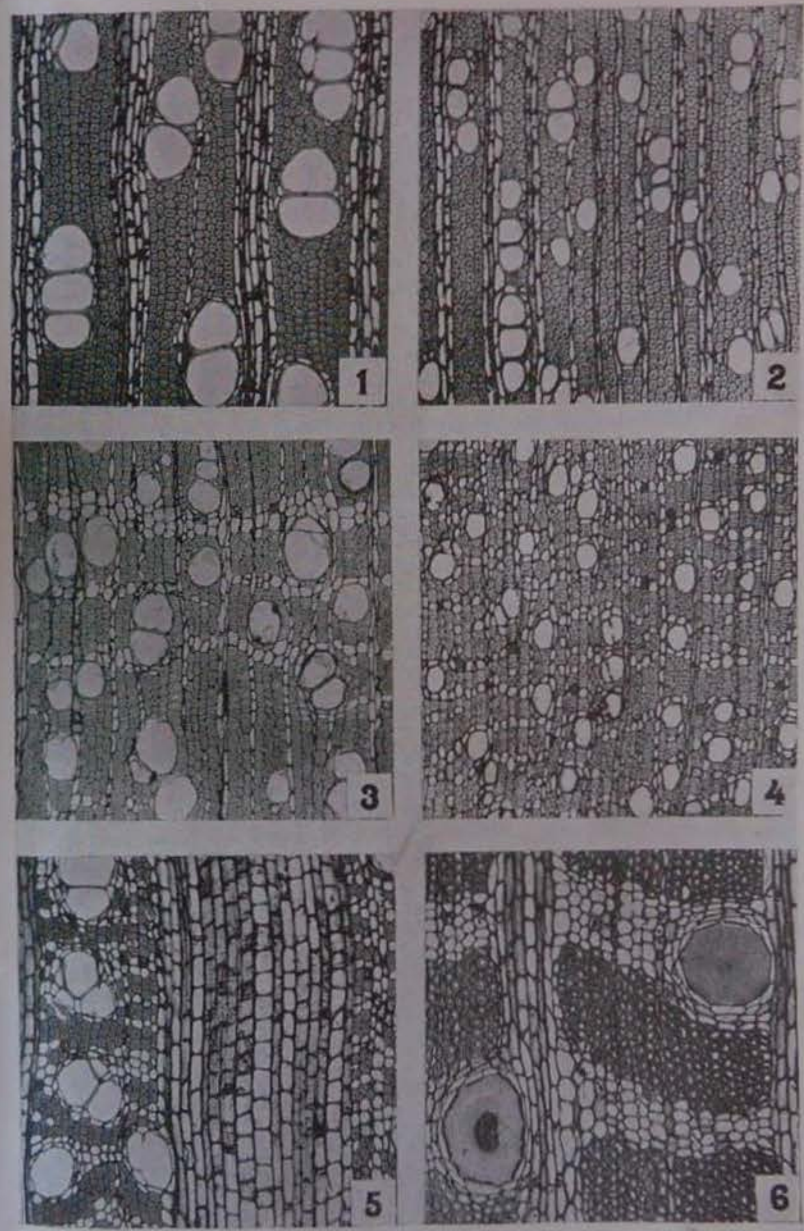
Comparison of the Taxonomic and Anatomical Divisions

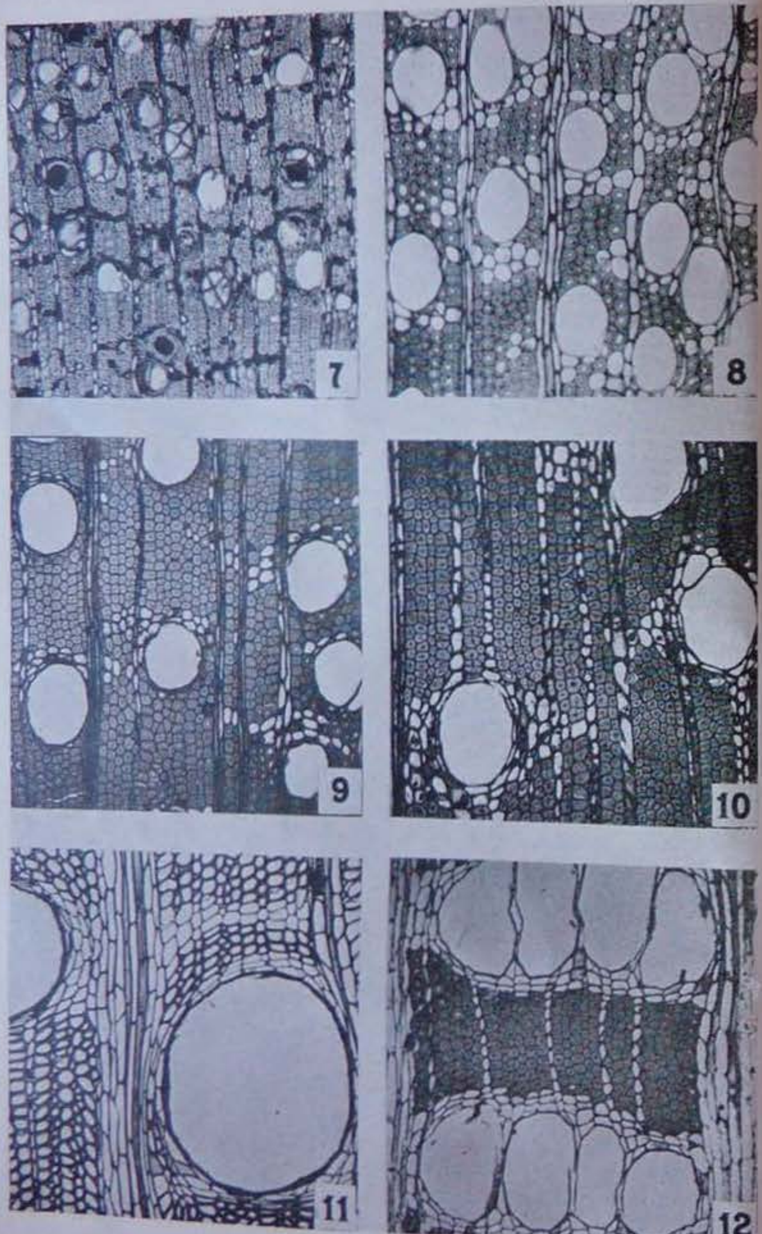
The composition and internal division of the Rhizophoraceae have been a subject of controversy among taxonomists ever since the family was first proposed by Robert Brown in 1814. As previously stated, there are three proposed systems for the classification of the genera of the Rhizophoraceae: (1) that of Bentham and Hooker who separated the tidal, or Mangrove, species from the inland species on the basis of their adaptation characters; (2) that of Ridley, who considered the Bentham and Hooker subdivisions sufficiently distinctive to be designated as families; and (3) that of Schimper who contended that the placing of *Rhizophora*, *Bruguiera*, *Ceriops*, and *Kandelia* in a separate, independent group is erroneous, since this arrangement is based upon the response of the plants to environmental conditions alone and does not show the true affinities of the genera within the family. Further he states that *Rhizophora* and *Bruguiera* are more closely related to certain upland genera than they are to each other. Consequently, in the Schimper system, the Mangrove genera are not treated as a whole, but are segregated in different tribes, each of which includes some of the inland genera.

The wood anatomy of the available representatives of this family does not fully conform with any of the three classifications just mentioned. On a basis of their wood structure, the tidal genera, which constitute the anatomical division Rhizophoreae in this study, unquestionably form a well-defined, homogeneous, natural aggregation readily separable from other members of this or any other family. Since the flowers, fruits, and leaves are also distinctive, it appears that these four genera might well be set up as an independent family, as proposed by Ridley.

The division Legnotideae (the inland genera), as proposed by Bentham and Hooker, represents a very heterogeneous and unnatural classification. Schimper found that certain of these genera, namely *Weihea*, *Cassipourea*, *Blepharistemma*, *Dactylopetalum*, and *Macarisia*, exhibit a relationship so well defined that he placed them in a separate tribe, the Macarisieae (to which *Anopyxis* and *Sterigmapetalum* were later assigned). Schimper placed the remaining genera of Bentham and Hooker's Legnotideae, namely *Carallia*, *Crossostyles*, *Gynotroches*, and *Pellacalyx*, in the same tribe with the Mangrove genera. This relationship, however, as pointed out above, is more than doubtful. Ridley, on the other hand considered *Carallia*, *Gynotroches*, and *Pellacalyx* sufficiently allied and distinctive to form an independent family. He did not deal with the other genera of Bentham and Hooker's Legnotideae, since his study was confined to the Malayan flora. Anatomically the woods of Bentham and Hooker's Legnotideae form two distinct groups, designated in this study as the Macarisieae and the Gynotrocheae. The grouping of the genera in the Macarisieae is the same as that proposed by Schimper; the Gynotrocheae agree in part with Ridley's Legnotideae. Each of these divisions is as well defined and as natural an aggregation as the Rhizophoreae.

Bentham and Hooker proposed a tribe, Anisophylleae, to include the genera *Anisophyllea* and *Combretocarpus*. Schim-

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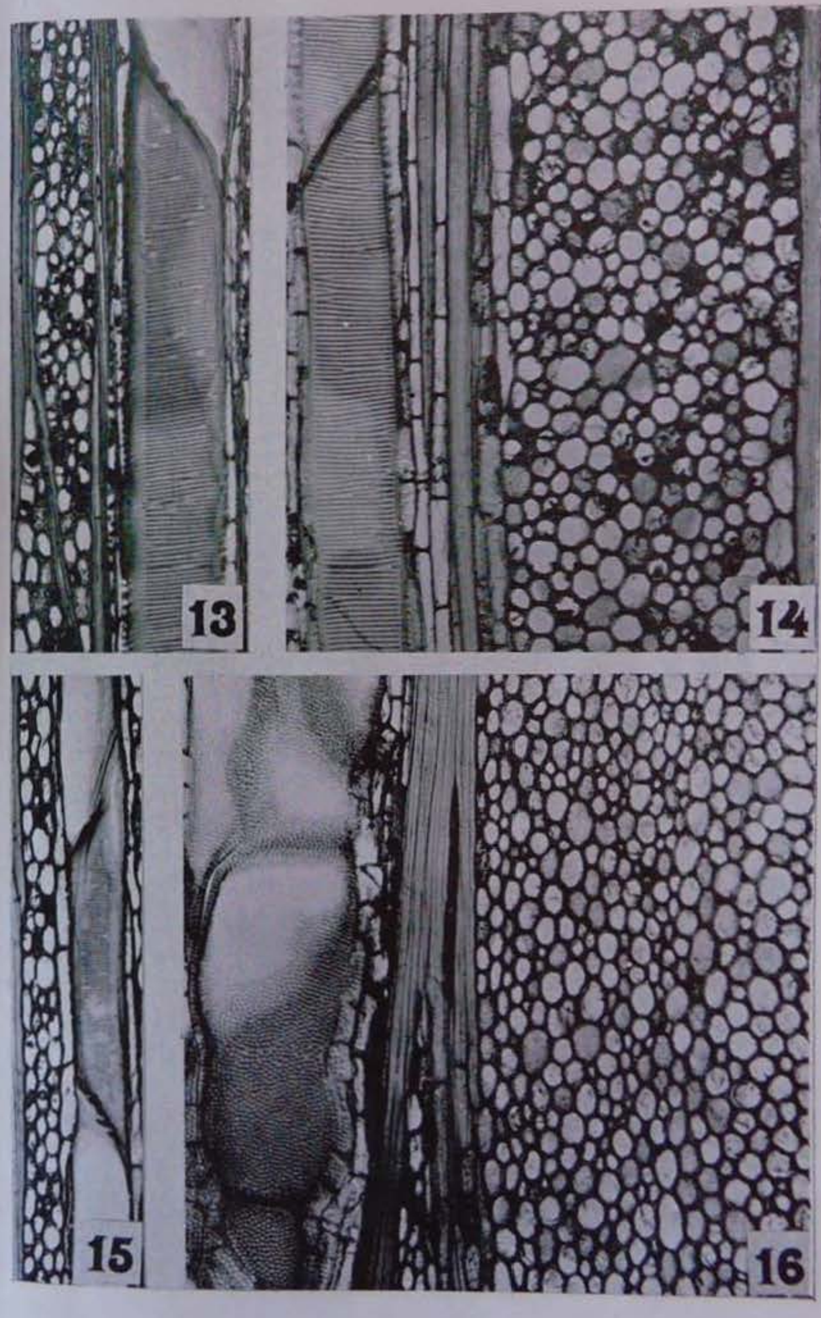
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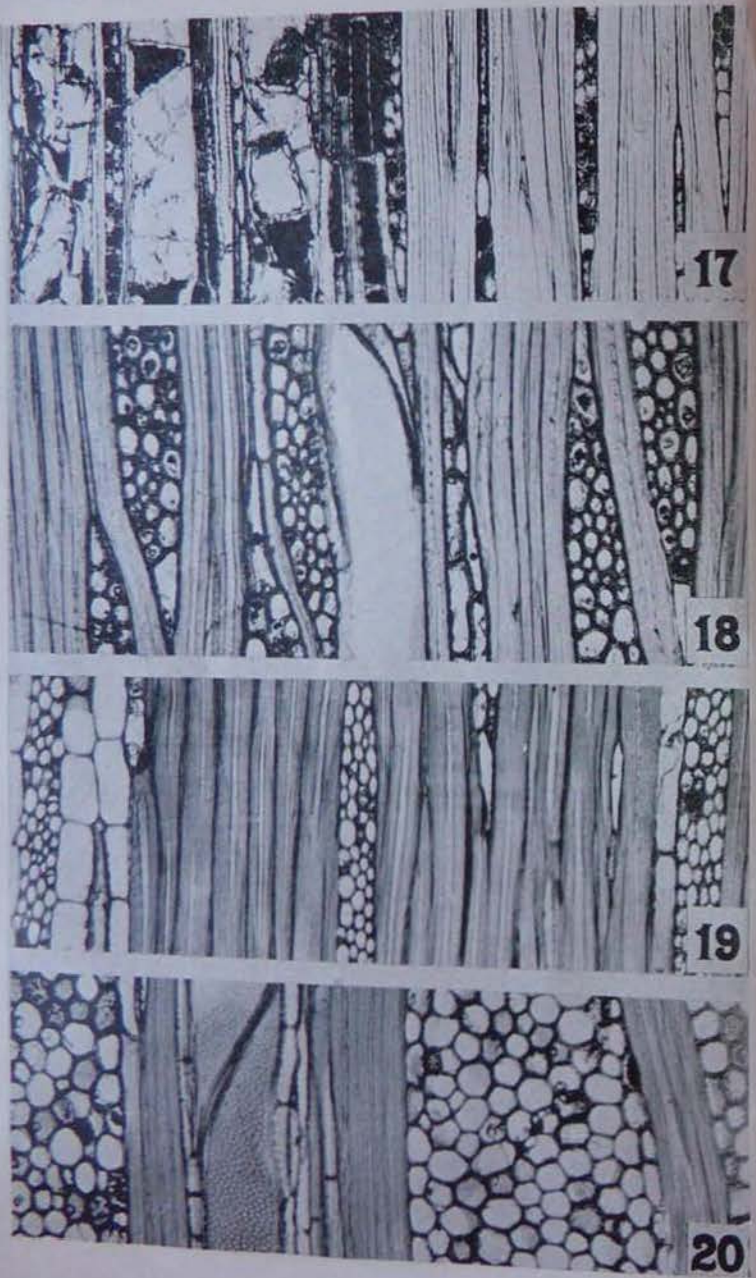
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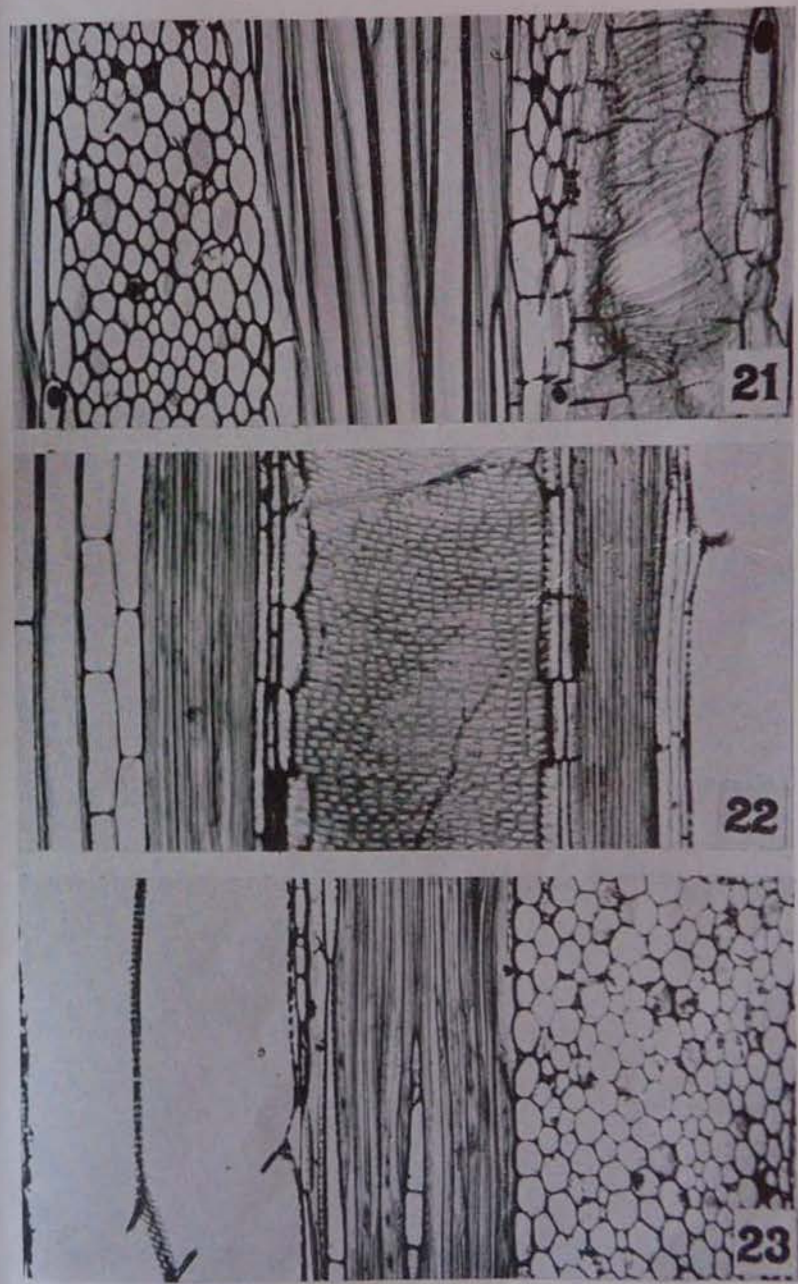
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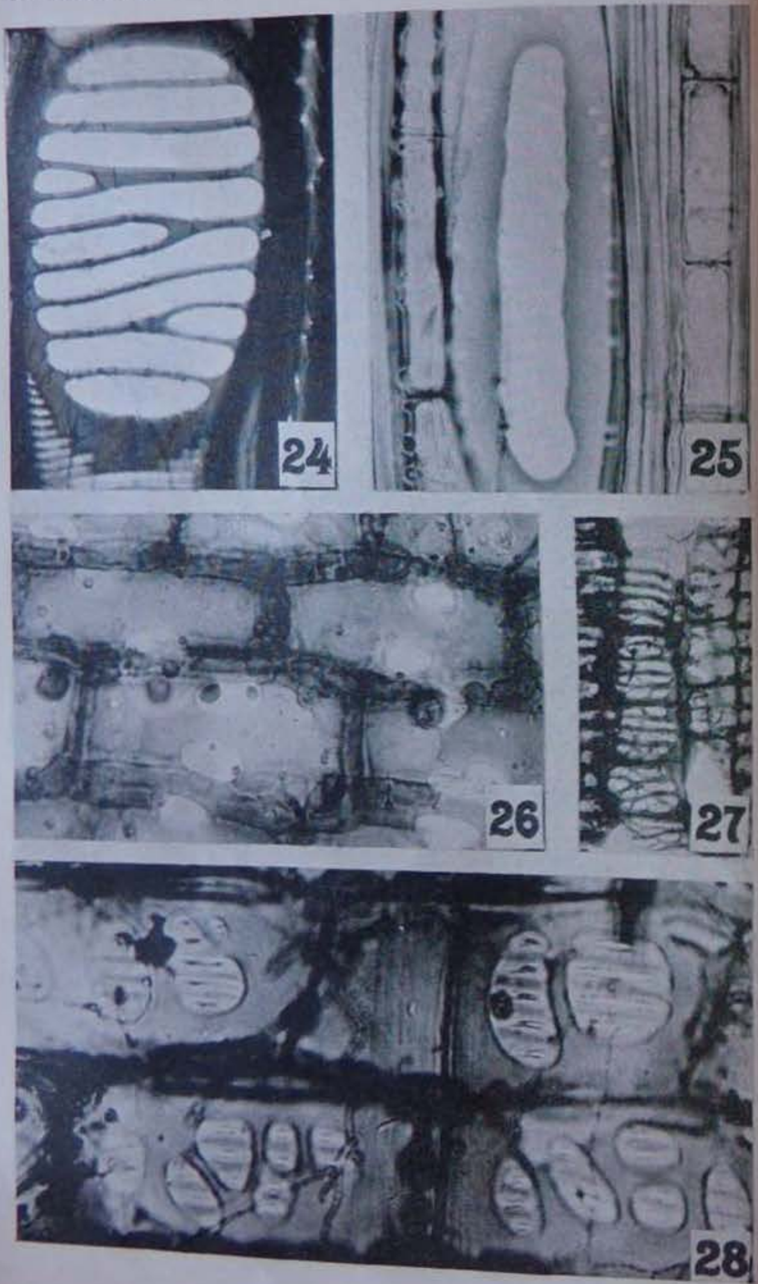

per accepted this subdivision but designated it as a subfamily (to which *Poga* was later assigned). Ridley treats the genus *Anisophyllea* as constituting a monotypic family (*Poga* and *Combretocarpus* not being native to Malaya). The wood structure of *Anisophyllea* and *Combretocarpus* indicates that they are closely related to the Gynotrocheae, though sufficiently distinct to permit their segregation as a section.

It is of interest to note that, with the exception of *Pellacalyx*, all the genera accepted as members of the Rhizophoraceae by Bentham and Hooker and by Schimper fit harmoniously into one of the above groups. It is the later additions, namely *Sterigmapetalum*, *Anopyxis*, and *Poga*, whose position in the groups is questionable. *Sterigmapetalum* has many of the features of the Macarisieae, but its highly characteristic parenchyma pattern calls for a separate section. Sprague (1909) found *Anopyxis* Engl. to be synonymous with *Pynaertia*, which De Wildeman described as a new genus of the Meliaceae. Systematic botanists now agree that this genus does not belong in the Meliaceae and that it shows some affinity to *Macarisia*. The position of *Anopyxis* in the Rhizophoraceae is still questionable and this is reflected in the wood structure. In some of its features it appears related to *Sterigmapetalum* and, provisionally at least, the two genera may be placed in the same section of the Macarisieae. No places have been found for *Pellacalyx* and *Poga*, although the wood of the latter superficially resembles that of *Embothrium* (Proteaceae).

Key for the Determination of the Woods of the Rhizophoraceae

1 a. Pores very large (up to 540 μ, av. 350–450 μ); mostly round and solitary, or few, rather large (up to 270 μ, av. 200–230 μ), and arranged in short tangential rows. 2

b. Pores less than 300 μ in diameter and not arranged in tangential rows 3

2 a. Intervascular pit-pairs very large and conspicuous, crowded and opposite. Pores arranged in tangential rows, generally in contact with one another. Rays very broad to exceedingly broad, moderately high to high. Fiber pits very large and conspicuous. . . . *Pellacalyx*.

b. Intervascular pit-pairs large, not very crowded, alternate. Pores mostly solitary. Rays very broad, rather low to moderately high. Fiber pits not conspicuous . . . . *Poga*.

3 a. Intervascular pitting exclusively scalariform. Perforation plates scalariform, with heavy bars. Wood fibers with simple pits. Uniseriate rays rare or not abundant 4
b. Intervascular pitting alternate. Perforations simple or both simple and multiple. Wood fibers with bordered pits. Uniseriate rays abundant 7

4 a. Both large and small pit-pairs between rays cells 5
b. Only small pit-pairs between ray cells 6

5 a. Unilaterally compound vessel-ray pits shield-shaped or oblong. Rays rarely more than 3.5 mm. high and 3–4 cells wide. Wood parenchyma scanty, vasicentric, uniseriate, occasionally in short confluent paratracheal lines, 1–3 cells wide or, when growth rings are present, terminal 2–4 cells wide . . . . *Ceriops*.
b. Unilaterally compound vessel-ray pits without distinctive shape. Rays up to 10+ mm. high and 4–6 cells wide. Wood parenchyma entirely vasicentric, scanty, 1–2 cells wide . . . . *Bruguiera*.

6 a. Wood parenchyma entirely vasicentric, 1–2 cells wide. Rays up to 10+ mm. high and 2–9 cells wide . . . . *Rhizophora*.
b. Wood parenchyma vasicentric, 1–3 cells wide, and metatracheal confluent, 2–4 cells wide. Rays rarely more than 3.5 mm. high and 5 cells wide . . . . *Kandelia*.

7 a. Woods with very broad, coarse-celled, high to very high rays. Perforations simple (occasionally multiple in the smaller vessels of *Gynotroches*) 8
b. Wood with fine to very fine rays, 3–4 cells wide. Perforations simple or multiple 12

8 a. Pores rarely more than 150 µ in diameter, moderately numerous (av. 11–15 per sq. mm.). Wood parenchyma vasicentric and in irregular metatracheal lines 9
b. Pores up to 275 µ in diameter, rarely more, few (av. 2–5 per sq. mm.). Wood parenchyma vasicentric and in well defined paratracheal confluent and metatracheal bands 10

9 a. Intervascular pitting exclusively scalariform . . . . *Gynotroches*.
b. Intervascular pitting alternate . . . . *Crossostyles*.

10 a. Pores mostly in multiples or clusters. Wood parenchyma in irregular bands. Vessel members long; pit apertures not coalescent . . *Carallia*.
b. Pores mostly solitary. Wood parenchyma in pronounced symmetrical bands. Vessel members very short to short 11

11 a. Unilaterally compound pitting between vessels and ray and wood parenchyma very common. Intervascular pit apertures included. . . . . *Combretocarpus*.
b. Unilaterally compound pitting between vessels and ray and wood parenchyma rare. Intervascular pit apertures coalescent . . *Anisophyllea*.

12 a. Wood parenchyma aliform, or in very short tangential lines, generally in contact with the pores on one side only. Pores 2–10 per sq. mm. 13
b. Wood parenchyma vasicentric and in metatracheal lines. Pores 20–150 per sq. mm. 14

13 a. Wood parenchyma aliform. Pores 2–4 per sq. mm. . . . . *Anopyxis*.
b. Wood parenchyma in short tangential lines, generally in contact with pores on one side only. Pores 8–12 per sq. mm. . . . *Sterigmapetalum*.

14 a. Rays biseriate, rarely triseriate . . . . *Blepharistemma*.
b. Rays mostly triseriate, sometimes 4-seriate 15

15 a. Both simple and multiple perforations common; simple perforations generally oblong. Pores less than 80 µ in diameter . . . *Cassipourea*.
b. Perforations predominantly simple and round. Pores average 140 µ in diameter . . . . *Macarisia*.

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Explanation of Plates

PLATES I, II. Cross sections of the woods of 12 genera showing the relative size and arrangement of the pores and parenchyma, the width of the rays, and other details. × 55.

No. 1. *Bruguiera conjugata* (L.) Merr. No. 2. *Ceriops tagal* C. B. Rob. No. 3. *Kandelia Rheedii* Wight & Arn. No. 4. *Blepharistemma corymbosum* Benth. No. 5. *Gynotroches axillaris* Blume. No. 6. *Combretocarpus Motleyi* Hook. f. No. 7. *Cassipourea elliptica* Poir. No. 8. *Macarisia pyramidata* Thou. No. 9. *Sterigmapetalum obovatum* Kuhlm. No. 10. *Anopyxis ealaensis* Sprague. No. 11. *Poga oleosa* Pierre. No. 12. *Pellacalyx axillaris* Korth.

PLATE III. Tangential sections of the woods of four genera showing the types of intervascular pitting and the relative thickness of the larger rays. × 110.

No. 13. *Bruguiera conjugata* (L.) Merr. No. 14. *Gynotroches axillaris* Blume. No. 15. *Ceriops tagal* C. B. Rob. No. 16. *Anisophyllea laurina* R. Br.

PLATE IV. Tangential sections of the woods of four species of three genera showing relative size of rays and other structural details. × 110.

No. 17. *Cassipourea elliptica* Poir. No. 18. *Anopyxis ealaensis* Sprague. No. 19. *Anopyxis occidentalis* A. Chev. No. 20. *Carallia integerrima* DC.

PLATE V. Longitudinal sections of the woods of *Poga* and *Pellacalyx*. × 110.

No. 21. Tangential section of *Poga oleosa* Pierre showing part of a broad ray at the left, thin-walled wood fibers in the middle, and unilaterally compound vessel-parenchyma pitting at the right. No. 22. Radial section of *Pellacalyx axillaris* Korth. showing thin-walled parenchyma, thick-walled fiber-tracheids, and part of a vessel member with large opposite pits. No. 23. Tangential section of the same showing simple perforations of vessel members, thick-walled fiber-tracheids, and part of a large ray.

PLATE VI. Types of vessel perforation and ray-vessel pitting.

No. 24. Scalariform perforation plate in *Kandelia Rheedii* Wight & Arn. × 400. No. 25. Elongated simple perforation in *Cassipourea Afzelii* Alston. × 400. No. 26. Characteristic pitting of contiguous ray cells in *Bruguiera conjugata* (L.) Merr. × 890. No. 27. Ray-vessel pitting in *Anopyxis ealaensis* Sprague. × 110. No. 28. Unilaterally compound ray-vessel pitting in *Ceriops tagal* C. B. Rob. × 890.

NOTE ON THE WOOD OF *CEPHALOHIBISCUS*

By SAMUEL J. RECORD

In a lot of wood and herbarium specimens collected for the Yale School of Forestry by Mr. J. H. L. Waterhouse on Bougainville Island in December 1932, is one of *Cephalobibiscus Peekelii*, a new genus and species (fam. Malvaceae) recently described by Ullrich (Notizbl. bot. Gart. und Mus. Berlin-Dahlem 114: 12: 494–500) from material obtained in northwestern Melanesia. The native names are Tararu or Taruru and Pureu (Bougainville); Palamoroa (New Britain). According to the collector the tree attains a height of 40–50 feet; its bark is used locally for settling troughs in sago-making. The seed wool is similar to kapok. The wood is used to a limited extent in native houses.

Sapwood white, not sharply demarcated; heartwood with pinkish tinge or faint pinkish streaks; lustrous. Light and soft, but tough; sp. gr. (air-dry) 0.29; weight 18 lbs. per cu. ft.; texture rather coarse; grain roey; wood saws woolly and the fibers tend to pull out in planing; not resistant to decay.

Growth rings indistinct. Pores mostly visible, open, rather few, scattered without pattern, solitary or less frequently in small radial multiples. Vessel lines distinct. Parenchyma in very numerous, short, irregular, tangential lines, not visible without lens. Rays all storied, of fairly uniform size, visible on all sections, being somewhat darker than ground mass. Ripple marks distinct, regular, all elements storied, about 60 per inch (24 per cm.).

Vessel members with blunt ends and large, simple perforations; pits to other vessels rather small, alternate, crowded, the narrow apertures often coalescent. Parenchyma in short, uniseriate, metatracheal lines; also diffuse and sparingly paratracheal; cells thin-walled. Rays 2 or 3 cells wide and 8–12, rarely up to 15, cells high; heterogeneous, with interior cells procumbent, the single marginal rows usually square or upright; cells all thin-walled; tile and sheath cells absent; ray-vessel pitting similar in surface view to intervascular or unilaterally compound. Fibers definitely storied; thin-walled; pits minute, numerous but irregularly distributed in radial walls, simple or indistinctly bordered, the apertures slit-like

ON THE OCCURRENCE OF *LACMELLEA* AND A NEW SPECIES OF *ZSCHOKKEA* IN CENTRAL AMERICA

By ROBERT E. WOODSON, JR.

Missouri Botanical Garden, Washington University, St. Louis

Nearly every family of flowering plants includes one or more rather enigmatic genera usually based upon a single poorly known species of rather uncertain distribution and relatively rare occurrence. The original description itself, occasionally all that is known to the botanical world in general, may be painfully inadequate and unaccompanied by illustrations. The case of the genus *Lacmellea* Karst. therefore is not extreme as the author provided an excellent plate in folio size (Karst. Fl. Columb. 2: pl. 152. 1862) to illustrate the single species in both the general habit and the structural details of flower and fruit.

Lacmellea edulis has remained poorly understood largely because of its evident rarity. Originally reported from the Colombian Andes, I had been unable to find actual specimens referable to the species in any of the larger American herbaria. It was of great interest therefore when the species was reported from the Panama Canal Zone by Standley (Contrib. Arnold Arb. 5: 127. 1933). Upon examination of two of the three specimens cited by Standley (*Wilson* 98; *Woodworth & Vestal* 639) it was obvious that the plants reported from Barro Colorado Island do not represent *Lacmellea edulis* Karst, but a new species of *Zschokkea*.

Zschokkea panamensis Woodson, spec. nov.—Arborea ut dicitur 10–12 m. altitudine attingens; ramulis teretibus graciliusculis glabris post maturitatem inconspicue lenticellatis; foliis oppositis petiolatis oblongo-ellipticis 6–10 cm. longis 2–3 cm. latis apice sat abrupte acuminatis basi obtuse cuneatis firmiter membranaceis subcoriaceisve omnino glaberrimis petiolo canaliculato 0.7–0.9 cm. longo; inflorescentiis cymosis opposito-lateralibus breviter stipitatis foliis multo brevioribus floras albidas 3–9 gerentibus; pedicellis 0.4–0.6 cm. longis glabris; bracteis ovato-subreniformibus scariaceis minimis; calycis laciniis ovato-subreniformibus late obtusis

rotundatisve 0.1–0.15 cm. longis margine ciliolatis caeterumque glabriusculis; corollae salverformis tubo proprio 1.8–2.0 cm. longo ca. 0.15 cm. basi diametro metiente extus glabro faucibus 0.4–0.5 cm. longis tubo paululo latioribus lobis oblique oblongo-ellipticis obtusis 0.7–0.8 cm. longis extus minute papillatis patulis; antheris 0.5 cm. longis angustatis; ovario ovoideo-fusiforme cum stylo 0.75–0.8 cm. longo minutissime papillato; stigmate anguste oblongoideo simplice ca. 0.25 cm. longo minutissime denseque papillato breviter (ca. 0.05 cm.) apiculato; fructibus ignotis.

Trees, said to attain 10–12 m. in height; branches terete, relatively slender, glabrous, inconspicuously lenticellate when fully mature; leaves opposite, oblong-elliptic, 6–10 cm. long, 2–3 cm. broad, apex rather abruptly acuminate, base obtusely cuneate, firmly membranaceous to subcoriaceous, glabrous throughout; petioles canaliculate, 0.7–0.9 cm. long; inflorescence cymose, opposite-lateral, shortly pedunculate, much shorter than the subtending leaves, bearing 3–9 white flowers; pedicels 0.4–0.6 cm. long, glabrous; bracts ovate-subreniform, scarious, minute; calyx-lobes ovate-subreniform, broadly obtuse to rounded, 0.1–0.15 cm. long, the margins ciliolate, otherwise glabrous; corolla salverform, the proper-tube 1.8–2.0 cm. long, about 0.15 cm. in diameter at the base, glabrous without, the throat 0.4–0.5 cm. long, somewhat broader than the proper-tube, the lobes obliquely oblong-elliptic, obtuse, 0.7–0.8 cm. long, minutely papillate without, patulous; anthers 0.5 cm. long, very narrow; ovary ovoid-fusiform, very minutely papillate (with the style) 0.75–0.8 cm. long; stigma narrowly oblongoid, simple, about 0.25 cm. long, very minutely and densely papillate, shortly (about 0.05 cm.) apiculate; fruit unknown.—PANAMA: Canal Zone: Barro Colorado Island, February 1932, *R. H. Woodworth & P. A. Vestal* 639 (Herb. Missouri Bot. Garden, Type); Cocle: above Penonomé, March 5–19, 1908, *R. S. Williams* 587 (Herb. N. Y. Bot. Garden).

The specimen collected by Williams is not designated as a cotype because the foliage is somewhat more nearly coriaceous than that of the type and may ultimately be proved distinct. *Z. panamensis* is the first record of the South American genus

Zschokkea from north of Colombia. It differs from *Z. floribunda* of Brazil chiefly in its narrower foliage and proportionally longer corolla-lobes.

There can be no doubt that the plants cited above belong to *Zschokkea* because of the high insertion of the stamens, the characteristic stigma, and the bilocular, syncarpous ovary. However some disappointment was felt in the fact that the identity of *Lacmellea* was still uncertain.

This disappointment was dispelled only recently when I received a very poorly preserved herbarium specimen from an undesignated locality in British Honduras collected together with copious flowers and floral buds preserved in alcohol for anatomical study by Mr. William A. Schipp. This plant was recognized almost at once as exactly corresponding to the original illustration of *Lacmellea edulis* Karst., the corollas of which are much smaller than those of *Zschokkea* with the anthers inserted near the base of the short tube. The single specimen is incorporated within the herbarium of the Missouri Botanical Garden.

With the occurrence of *Lacmellea* in British Honduras firmly established by Schipp's unnumbered collection, another specimen by the same collector was found by chance among a series of undetermined sheets. This collection is in fruit, which also coincides with the details illustrated by Karsten, and bears the data: "Small tree overhanging riverbank, also found inland at high altitudes. Fruit yellow, which has the odor of Mango; wood light yellow and brittle; rare. Rio Grande River, 50 ft. altitude. Trunk 30 ft., 9 inches diameter. November 4, 1933. *W. A. Schipp 1234*." Duplicates are presumably to be found in several American herbaria.

Commercial use might supposedly be made of the latex which is said to be palatable and sweet. As a matter of fact, the generic name was compounded by Karsten with reference to the local Colombian name Leche y Miel (milk and honey).

The Yale collections contain a wood specimen (Y. 14902; N.S. 120) of *L. edulis* (Palo de Vaca) collected by Neil Stevenson along the Rio Blanco, British Honduras, April 2, 1929. Provisional determination of sterile herb. mat. by Standley recently confirmed by Woodson.—S.J.R.

A NEW *STERCULIA* FROM PANAMA

By Paul C. Standley

Field Museum of Natural History

Among the numerous specimens of trees collected in Panama in 1927 by G. Proctor Cooper and George M. Slater for the Yale School of Forestry in cooperation with United Fruit Company (see *Tropical Woods* 16: 1–35), was one (in sterile condition) that I named *Sloanea megaphylla* Pittier after comparison with the type of that species in the U. S. National Herbarium. The resemblance of the leaves is so striking that there was little reason for questioning the accuracy of the determination.

Recently, however, Professor Record has informed me that the wood of the Cooper & Slater tree has the structure of *Sterculia* rather than of *Sloanea*. He has also sent me flowers and fruit, which were inadvertently omitted from the first lot, and while it is now clear that the material represents a *Sterculia*, I know of no species to which it can be referred. I am accordingly describing it as new and naming it in Professor Record's honor.

Sterculia Recordiana, sp. nov.—Arbor excelsa ad 23 m. alta, trunco fere 1 m. diam., ramulis crassis dense pilosis atque flavido-tomentulosis apice dense foliatis, internodiis brevissimis; folia mediocria petiolata subcoriacea, petiolo 1.5–7 cm. longo dense tomentuloso et sparse piloso; lamina ovalis, ovali-oblonga vel obovato-elliptica 13–27 cm. longa 6.5–16 cm. lata apice rotundata et breviter apiculato-acuminata, basi breviter aperte cordata vel interdum truncata, conspicue bullata, supra in sicco brunnescens glabra nervis nervulisque impressis sublucida, subtus praesertim in statu juvenili glaucescens parce stellato-pilosula, ad nervos costamque tomentulosa, basi 5-nervia, nervis lateralibus utroque latere circa 10 prominentibus, nervulis valde prominentibus reticulatis, marginibus integris vel undulatis; inflorescentiae ut videtur axillares, subsimplices vel sparse paniculato-ramosae ad 15 cm. longae vel ultra, rhachi gracili sparse pilosa et dense brunneo-tomentulosa, cymis laxe paucifloris, pedicellis gracilibus usque ad 1 cm. longis; sepala circa 9 mm. longa [illegible] lanceolato-oblonga acuminata extus tomentulosa et sparse hirsuta intus prope basin villosa; carpella (unum solum visum) fructus magna subglobosa obliqua circa 7 cm. longa et aequilata sublateraliter apicata glabrata.—PANAMA: Changuinola Valley, May 1927, *G. Proctor Cooper & George M. Slater* 104 (Yale No. 10285; Herb. Field Mus., type). Cricamola Valley, February 17, 1928, *Cooper* 536 (Yale No. 12156). Bocas del Toro region, August 2, 1923, *A. J. Cox* 12823 (Yale No. 6751).

Vernacular name Panamá, according to Cox, this being the name applied commonly to *Sterculia apetala* (Jacq.) Karst. In leaf form the tree somewhat suggests some of the South American species of the genus, but the pubescence of the leaves is essentially different from that of any South American species seen by the writer. The leaves are quite unlike those of any other species known from Central America.

SOME PROBLEMS FOR THE WOOD ANATOMIST[1]

By SAMUEL J. RECORD

Five years ago at Cambridge, on the occasion of the Fifth International Botanical Congress, a small group of scientists laid the foundation for the International Association of Wood Anatomists, which was formally constituted at Paris a year later. This Association, now in convention here, has a present enrollment of 87 members of 25 different countries. Its object is to advance the knowledge of wood anatomy in all its aspects. Its activities are: (*a*) to interchange ideas and information through correspondence and meetings; (*b*) to facilitate the collection and exchange of material; (*c*) to work toward standard terminology and descriptions; (*d*) to stimulate the publication of scientific articles and abstracts; (*e*) to encourage and assist the study and teaching of wood anatomy.

The first specific problems undertaken in the name of the Association are concerned with terminology. If members are to work together advantageously they must be able to understand each other. It is not a question of using a common tongue, but of agreeing upon ideas or concepts and standardizing the expressions of them in different languages. We now realize that some long accepted ideas regarding wood structure are definitely wrong and that many others are in need of modification. With new discoveries being made, new insights being obtained, new concepts being formed, it must be understood that all proposed standards are tentative and subject to changes in the light of new facts and experience. But merely because perfection can not be attained at once is no reason for delaying attempts to reach a basis for mutual understanding. And once terms and definitions have been adopted by a responsible and representative body they should either be employed as recommended or their use avoided. Only in this way can confusion be reduced or prevented.

[1] Abstract of a paper read at a meeting of the Section of Morphology and Anatomy, Sixth International Botanical Congress, Amsterdam, September 3, 1935.

The response to the first efforts of the Association to standardize its terminology has been so encouraging that committees are now at work on technique, with particular reference to measurements, so that results obtained by different investigators will be comparable. The discussion is far-reaching and important questions arise at every step. What measurements are worth while? How shall they be made? How can representative samples be obtained? What are the variables involved and how can their significance, or lack of it, be estimated?

It would be very helpful if we had complete lists of all the woods in which certain structural features are found. As examples of the things I have in mind I may mention storied structure, included phloem, intercellular canals, latex and tanniniferous tubes, different types of perforations and pits, and arrangement of rays and of wood parenchyma. Comparative study of such lists would reveal natural groupings and indicate their systematic worth. With such data it would also be simple to make artificial keys for the determination of unknown specimens. Every wood anatomist feels the need for such assistance and should be willing to cooperate in securing the necessary information.

The diagnostic value of various poorly known features should be investigated. Among these may be mentioned crystals and starch, both in ray and wood parenchyma cells and in wood fibers; fibriform vessel elements, spiral thickenings in vessels and fibers, and sclerotic tyloses. The various deposits in wood provide a great field for chemical exploration. I believe that it would be well worth while to prepare a standard series of chemical tests which could be easily applied to all specimens studied. The optical properties also require much further investigation. Indeed, in whatever direction we look, we see unlimited opportunities for research. We have scarcely begun to realize the possibilities latent in so common and familiar a substance as wood.

I believe that most anatomists prefer to leave matters of taxonomy to systematic botanists. The work would be greatly simplified if the persons who name and classify plants could be depended on to do it exactly right. Unfortunately such is not always true and the anatomist is forced to question the determination of his specimens. If the naming is correct, then he must either adjust his own concepts or inquire into the basis for the original classification. He may conclude that a species has been referred to the wrong genus, or a genus to the wrong family, or that there is something unnatural about the arrangement. His task then is not only to call attention to apparent error, but also to indicate how it can be corrected. Here is opportunity for closer cooperation between anatomists, taxonomists, and all others who are interested in the relationships of plants. The ordinary systematic botanist is too often content to go his way alone, ignoring or not realizing the help that is his for the asking. We must seek out those who are willing to work with us and maintain their interest and respect by the excellence of our suggestions. This means that we must proceed cautiously and avoid extravagant claims.

One method of procedure in this field is to study all of the woods of a family or other presumably related group. The first difficulty encountered is that of securing adequate material. With this in mind we are assembling at Yale a general wood collection of the greatest possible variety. In it there are now over 30,000 specimens, representing about 9500 named species of 2400 genera and 220 families. We are emphasizing genera because the comparative study of species and smaller divisions usually requires too great a quantity of specially selected material. In some instances, of course, species may be as distinct as genera, hence the unit for a particular project should be flexible and not made smaller than the available material will justify. A general reconnaissance of the Yale specimens would reveal natural groupings, expose many artificial classifications, indicate the trends of evolutionary development, and prepare the way for more intensive investigations to follow. We solicit further assistance toward generic completion of a collection of woods that is open to competent research workers everywhere.

Much of the early work on comparative anatomy was done on twigs from herbarium specimens, whereas at present it is mostly with older wood from the main stem. Both types of material should be studied together for they supplement one another. Comparatively little attention is being given to roots, although they hold much of scientific interest, especially to students of evolution. It will repay every student of wood to extend his interests to the anatomy of pith and bark, for their structures are likely to be as significant as those of the xylem. In fact, wood anatomy should not be considered as standing alone, but in connection with the other branches of botanical science as wood itself is integrated with the other tissues of a tree.

When it comes to the differentiation of closely related species it is well for the wood anatomist to realize that his idea of what constitutes a species may be entirely different from that of the taxonomist. Published diagnoses are often nothing more than descriptions of a dried fragment which may not be typical of the plant as a whole. The distinguishing characteristics are frequently of the class that the anatomist has found to be too variable for use without statistical analysis. Botanists continue to propose new species on the basis of size of leaves and fruits, length of petioles, angle of leaf bases, relative abundance of pubescence, and other minor features with only the haziest idea of their systematic worth and with no regard for the behavior of plants in nature. Giving the rank of true species to mere tendencies or variations in response to edaphic or ecological conditions instead of designating them varieties, forms, or mere states, helps no one and seriously interferes with the work of the xylologist, as well as the forester, ecologist, and all concerned with living plants. It is our duty to call these reckless botanists to account and to make it clear that taxonomy is not a game but a serious effort to find a natural classification for plants. We can do this by setting and maintaining high standards for our own work and insisting that the taxonomists do likewise.

In conclusion, I wish to emphasize that the science of wood anatomy is in a formative state. Properly developed it will profoundly affect the orderly classification of plants, will revise paleobotany, and make clearer the lines of descent. In the practical field, it will make for better understanding of the problems attending the utilization of timber and help in the development and conservation of our forest resources.

FIBER-TRACHEIDS, LIBRIFORM WOOD FIBERS, AND SYSTEMATICS IN WOOD ANATOMY[1]

By E. Reinders

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When the Recording Secretary of our Section invited me to present my objections to the "Glossary of terms used in describing woods" proposed by the Committee on Nomenclature of the International Association of Wood Anatomists,[2] I decided to confine my remarks to the definitions of the terms *fiber-tracheid* and *libriform wood fiber.*

The application of those terms has been troublesome to plant anatomists from the time of Sanio; in fact Sanio himself, at the beginning of his work, was sometimes in doubt as to their correct usage. Janssonius likewise experienced the same difficulty at first and in the initial work on the woods of Java

[1] Paper read at a meeting of the Section of Morphology and Anatomy, Sixth International Botanical Congress, Amsterdam, September 3, 1935.

[2] See *Tropical Woods* 36: 1–12; December 1, 1933.

he and his leader, Moll, designated the most characteristic fiber-tracheids in existence, those of Dilleniaceae, libriform wood fibers. This mistake, which in the light of greater experience was subsequently recognized and corrected, was attributable perhaps to Moll's characterization of tracheal elements as rather thin-walled.

Moll and Janssonius' *Mikrographie des Holzes der auf Java vorkommenden Baumarten* has influenced the study of anatomy, especially wood anatomy; indeed one might consider the present laudable efforts toward standard terminology and descriptions a logical extension of the principles of that monumental work, namely, the application of Linnaean rules to micrography. Many terms, formerly often neglected or even rejected, have come into fairly general use in the sense of Sanio's conceptions. There are still some exceptions, however, and the aforesaid Committee has recently introduced some changes in terminology which probably will spread throughout the world of English-written literature.

Of the two types of fibers under discussion, the Glossary calls fiber-tracheids those with bordered pits, libriform those with simple pits. This basis for distinguishing the two forms is not new, as it was thoroughly tested (but rejected as unfit) by Sanio himself. Nevertheless many others since have made the same proposal. Inasmuch, however, as Sanio in 1863 and Janssonius in 1931 have expressed the seasoned opinion that the line of demarcation between fiber-tracheid and libriform wood fiber should be drawn elsewhere, it seems appropriate to assemble their arguments, which are somewhat scattered in the works of both authorities.

In a purely morphological sense, Sanio's definitions of the two elements fall short in practical application. They have accordingly been extended by Janssonius and may be stated as follows:

Fiber-tracheid.—Moderately elongated; commonly with thick and apparently somewhat swollen walls, rarely with mucilaginous layers; hardly ever septate; never containing starch; rather often annularly or spirally thickened; having rather large bordered pits with lenticular to slit-like apertures. The pits are comparatively numerous in the tangential walls, in many instances outnumbering those in the radial. When such fibers constitute the ground tissue, the pits toward the vessels ordinarily have borders of much the same size as those of pits in the walls of contact of two vessels. (Correlatives present in the latter case will be mentioned later.)

Libriform wood fiber.—Much elongated; mostly with relatively thick walls, without swollen appearance and rather often with mucilaginous layers; hardly ever annularly or spirally thickened; sometimes septate by very thin, commonly unpitted partition walls formed after secondary thickening of the fiber walls, the septate and non-septate types often occurring together; often containing starch (in sapwood) or crystals; having simple pits or pits with narrow borders and slit-like apertures (or rarely both kinds). In the tangential walls, pits are commonly much less numerous than in the radial and may be entirely lacking; in the parts of the wall adjacent to vessels they are absent or few. The bordered pits leading to parenchyma cells are often more numerous and their borders somewhat larger than those to fibers of the same kind.

The foregoing definitions are rather ponderous, though it is only for the border-line cases that the full information is needed. The desire for handier designations is readily understandable, but more is involved than mere convenience of expression. The problem has two aspects—one a matter of simple morphology, the other of taxonomy.

Morphologically the Sanio-Janssonius characterizations fit into the system of wood terminology as closely as the actual forms in nature will permit. In that classification only real tracheids with their mechanical function emphasized are called fiber-tracheids. The proposed standard definition, on the other hand, places in the category of tracheids legions of fibers with few pits or none at all towards vessels, and containing starch or crystals, septate even, thus being intermediate to parenchyma rather than to tracheal elements. In many instances different names must be applied to two fibers showing no difference at all except that one of them has bordered pits. The fibers of *Garcinia dioica* and *G. laterifolia*, for example, become tracheids by definition, whereas those of *G. balica*, *G. dulcis*, and *G. celebica*, however similar to those of the first two species, will remain libriform. Does this not violate the whole system of wood terminology?

One of the shortcomings of the Sanio concepts is that they are not decisive in intermediate cases, although the really dubious forms are not frequent, according to Janssonius' and my own experience. But then, will the proposed alternatives serve any better in this respect? Thinking of the cases just mentioned, I fear they will not. Moreover, there are several species in various families where, in the same sample, one may find fibers with simple and bordered pits, but in all other respects quite identical and this occurs in septate types as well as in non-septate; for example, in *Heritiera litoralis*, *Alsodeia cymulosa*, *Duabanga moluccana*, *Sonneratia acida* and *S. nitida*, *Casearia grewiaefolia*, *Homalium* spp., *Chrysophyllum Roxburghii*, and *Sideroxylon nitidum*. Here one might have recourse to the following consideration: In the fibers of many of the woods named the pit borders are small or even very small and so might be looked upon as rudimentary and the pits considered simple. Immediately, however, arises the question where to draw the line, for in some of those woods the borders of the fiber pits attain the same width as those in the vessels.

One of the arguments in favor of the Sanio characterization is the following correlation: According to Von Höhnel, Record, and Janssonius, storied wood exhibits a set of features peculiar to the storied arrangement itself and also, in large measure, to such non-stratified wood species as belong to families in which horizontal seriation occurs. In this complex the parenchyma fibers and strands are short, with few or no partition walls and with cuneate, often densely pitted, ends; the libriform wood fibers are all of equal length, each with a wide middle part and thin, bayonet-like, scarcely pitted endings. The cambium fibers, middle parts of libriform fibers, vessel members, parenchyma fibers or strands, and the rays, when joining in the storied arrangement, are all rather short and of almost equal length. On transverse section, the libriform fibers appear in alternate radial rows of wide middle parts and very narrow endings.

Now Janssonius found that storied arrangement always occurred in one species or another of every Javanese family having libriform fibers as a ground tissue, with the exception of the Bignoniaceae. All other, non-storied species or samples belonging to the same families showed one or more features of the correlative set of characteristics mentioned above. The four Javanese Bignoniaceae (representing three genera) do not have storied woods, although the ground tissue consists of libriform fibers and several of the correlative features are present; but some bignoniaceous woods of tropical America, for example *Tecoma leucoxylon* of Surinam, have beautifully storied wood with most of the associated characteristics. And of all Javanese woods described, the ground tissue of which consists of Sanio's fiber-tracheids, none was found to be storied, nor did any of them show the said correlatives. Woods of these latter families as a rule have scalariform perforation plates and two types of medullary rays, one of which is uniseriate with upright cells only, the other mostly heterogeneous. The families of this kind are scattered through the whole system, though somewhat more densely in the Calyciflorae of Bentham and Hooker; they are often considered to be primitive.

This connection of Sanio's fiber-tracheids with so diverging a set of other characters, together with taxonomic or even phylogenetic relations, indicate that the Sanio concepts under discussion are really natural. But they do so only if the author, when deciding between the two terms, was not more or less unconsciously influenced by the taxonomic relation itself. There is one place in the *Mikrographie des Holzes* (4: 31, note on *Anthocephalus*) that might raise some doubt in this respect. Lots of other cases (and, on my part, comparison with many of the woods under consideration) show clearly, however, that there is no reason for any mistrust of that kind. Moreover, decision in such extremely rare intermediate cases is of no consequence in the matter of the relations as mentioned above.

There is still another point worthy of comment. According to an explanation at the end of the Glossary, the Committee on Nomenclature considers libriform fibers to be tracheary elements whose mechanical functions have become emphasized. This opinion is communicated under No. 71 dealing with the term "fiber-tracheid"; so it suggests the reason for the definitions of both elements. From the expression "has become emphasized" and the neglect of the obvious relation to parenchyma, together with existing tendencies in literature, one may infer that the opinion is based on phylogenetic considerations. If so, the soundness of such grounds is open to question.

Phylogenetic deductions up to the present can hardly be more than morphological comparisons, with a very seductive hypothetical explanation in the background. Comparative morphology furnishes the facts, and even an intelligent seriation of the facts, to which phylogenetic speculations give a certain color, sometimes a stimulus, as a working hypothesis. The use of such speculations as a starting point for morphological terminology is logically open to criticism. It is also dangerous in practice, since every change in phylogenetic construction (alien to morphology) tends to make morphological terms obsolete. Phylogeny is not far enough advanced to justify its use in upsetting well-founded morphological distinctions. The procedure should be in the opposite direction, for a good assembly of unbiased morphological data will provide the most reliable foundation for phylogeny. That taxonomic and phylogenetic results will then come of themselves is clearly shown, not only by the remarkable correlations cited above, but also by the only new argument I can add to those of Sanio and Janssonius to conclude this paper.

In summarizing by families the principal anatomical features of the woods described in *Mikrographie des Holzes der auf Java vorkommenden Baumarten*, just for testing some theses on the present subject, I was struck by the fact that there is a correlation between fiber-tracheids (taken in the sense of Sanio) and all other taxonomic family characteristics (including perhaps the famous systematic intuition!). For it never happens that such fiber-tracheids constitute the ground tissue in single species and rarely in single genera of natural and homogeneous families. On the contrary, they nearly always characterize a whole family or such sections of it as have already been set apart by taxonomists.

Following are examples from the study of Javanese woods, using the classification of Bentham and Hooker: Fiber-tracheids compose the ground tissue in Dilleniaceae, Ternstroemiaceae, Saxifragaceae, Hamamelidaceae, and Styraceae. Of the Rosaceae, the Chrysobalaneae and Pomeae have fiber-tracheids, while both Amygdaleae described have libriform fibers. *Marlea*, of the Cornaceae, has libriform fibers, but *Mastixia* and *Nyssa*, now commonly excluded from that family, have fiber-tracheids. Among the Rhizophoreae, *Rhizophora* and *Bruguiera* have libriform fibers, whereas *Carallia* and *Gynotroches*, which are set apart by Durand, Miquel, and Hutchinson, have fiber-tracheids. In the Olacineae, *Strombosia* and *Anacolosa* have libriform fibers, while fiber-tracheids characterize *Stemonurus*, *Gomphandra*, *Apodytes*, and *Platea*, which are inserted in the Icacinaceae by Engler. Of the Euphorbiaceae studied, only *Daphniphyllum* has fiber-tracheids, and this genus has already been transferred to the Hamamelidaceae. The correlation is not so striking in the Celastrineae, but *Evonymus*, *Microtropis*, *Lophopetalum*, and *Elaeodendron* have fiber-tracheids, and *Caryospermum* and *Siphonodon* have libriform fibers; but Lösener (in Engler and Prantl's *Pflanzenfamilien* 3: 5: 220–222) segregates *Perrottetia* (including *Caryospermum*) into a section of its own and designates *Siphonodon* as an anomalous genus in the Celastraceae. Correlations are less clear in the Apocynaceae, Rubiaceae, and Myrtaceae, but even in these families one does not find single species with fiber-tracheids in genera with libriform fibers, or *vice versa*.

The argument from the correlation premise owes its validity to the fact that the author of *Mikrographie des Holzes* was not materially influenced by taxonomic considerations in deciding between fiber-tracheids and libriform fibers. Had he made the mere presence or absence of a pit border the sole criterion for distinguishing the two types of fibers the result would have been quite different and fiber-tracheids would appear scattered irregularly through very natural families and even through several good genera.

CURRENT LITERATURE

An extension of the known range of the Mexican bald cypress. By IRA L. WIGGINS. *Torreya* (Menasha, Wisc.) 35: 65–67; June 1935.

Taxodium mucronatum was found by the author in the state of Sonora, Mexico, in Lat. 27° 40′ N., in a desert region at an altitude of about 800 meters.

Notes botaniques sur l'archipel des Bermudes. By HENRI PRAT. *Bull. Soc. Bot. de France* (Paris) 82: 162–168; 2 figs.; 1935.

Because of its mild climate and isolation, Bermuda constitutes an exceptionally interesting field for biological studies. The terrestrial vegetation, with its high percentage of endemic species, is similar to that of the warm-temperate regions of North America, likewise that of the marshes and coasts,

but the marine flora is clearly tropical. The large number of calcareous algae and the corals help to prevent erosion, and with the aid of the land flora have preserved the islands upon their volcanic foundation. Mention is made of some of the trees and shrubs of the flora.—P. C. STANDLEY.

Revision der Gattung *Befaria* Mutis. By R. MANSFELD and H. SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 235–276; 1935.

The genus *Befaria* (Ericaceae) is represented by 25 species, ranging from Mexico and the Gulf Coast of the United States southward through the South American Andes. All the species are described, with citation of synonymy and collections examined. New species from Peru are *B. peruviana*, *B. Weberbaueriana*, local name Pulunrosa, *B. sandiensis*, Chini-chini; from Colombia, *B. Dryanderae*, Angujo.—P. C. STANDLEY.

Various Palmae Corypheae of Central America and Mexico. By HARLEY HARRIS BARTLETT. *Carnegie Inst. Wash. Publ.* 461: 27–41; pls. 1–12; July 10, 1935.

The genus *Brahea* as here limited consists of three species, *B. Conzattii*, a new species from Oaxaca, *B. Berlandieri*, a new species of Nuevo León, and *B. dulcis* (H.B.K.) Mart. To *Acoelorrhaphe* there are transferred *Brahea pimo* Becc. and *B. salvadorensis* Wendl. *A. Cookii* is described as new from Guatemala. *A. pinetorum*, a new species of British Honduras and Campeche, is known in the former region as Hairy Tom Palmetto, Papta, and Prementa. *Sabal mayarum* is a new species of Cuba, British Honduras, and Yucatan, vernacular names being Botan (British Honduras) and Huano (Yucatan). Notes are given regarding *S. mexicana* Mart., for which names noted are Huano de Sombrero and Bonxaan (Guatemala), Palma de Sombrero (Salvador).

The generic name *Acanthorrhiza* is reduced to synonymy under *Cryosophila*, the Mexican and Central American species being *C. nana* (H.B.K.) Blume; *C. Warscewiczii* (Wendl.) Bartl.; *C. Cookii* Bartl., Costa Rica; *C. albida* Bartl., Panama (called Palma de Escoba) and Costa Rica; *C. argentea* Bartl., British Honduras (called Give-and-take), Guatemala (Escoba, Akuum, the latter name Maya), and Campeche (Palma de Escoba).—P. C. STANDLEY.

Ericaceae americanae novae vel minus cognitae. II. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 277–294; 1935.

The generic names *Ceratostema* Juss. and *Englerodoxa* are found to be synonyms, and five species are recognized under *Ceratostema*. The generic name *Pellegrinia* is proposed for the plants heretofore referred to *Ceratostema*, 20 species being included in it. A key is provided for 12 species of *Gaultheria* known from Mexico and Guatemala. New species described are *Anthopterus Ericae*, Ecuador; *Gaultheria subrotunda*, Nicaragua. There are also extensive notes regarding species previously published in various genera.—P. C. STANDLEY.

New Apocynaceae and Asclepiadaceae. By ROBERT E. WOODSON, JR. *American Journal of Botany* 22: 684–692; 1 pl.; July 1935.

New species of trees and shrubs are *Aspidosperma cruenta*, Guatemala; *A. Lundelliana*, Campeche, Mexico; *Thevetia Steerei*, Yucatan.

New species of plants from Guatemala. By C. V. MORTON. *Phytologia* (New York) 1: 145–150; September 1935.

New species of woody plants are *Chusquea lanceolata* Hitchc., *Dalea dispar* Morton, *Buddleia Skutchii* Morton, and *Solenophora Pirana* Morton.

***Couma guatemalensis* as a possible future source of chicle.** By J. S. KARLING. *American Journal of Botany* 22: 580–593; pl. 1; June 1935.

Preliminary tapping experiments were conducted with *Couma guatemalensis* Standl. (*Tropical Woods* 7: 8) in the lower Motagua Valley of Guatemala during 1930–31. Daily and alternate ibidem tapping with a gouge over a period of 33 days yielded an average of approximately 4.5 grams of bone-dry gum per tree, but the individual yields were highly

variable. As a result of the experiments it is uncertain whether or not the tree is well adapted to profitable plantation culture, but it must be borne in mind that all the data relate only to a wild, heterogeneous population. While the species grows rapidly in comparison with *Achras Zapota*, its rate of recovery and response to tapping or wounding are not particularly encouraging.—P. C. STANDLEY.

***Scheelea Lundellii*, a new "corozo" palm from the Department of Petén, Guatemala.** By HARLEY HARRIS BARTLETT. *Carnegie Inst. Wash. Publ.* 461: 43–47; pls. 1–5; July 10, 1935.

Scheelea Lundellii is described as new, a palm attaining a height of 20 meters. Its local names are Corozo and Kantutz (Maya).

A method of procedure for field work in tropical American phytogeography based upon a botanical reconnaissance in parts of British Honduras and the Petén forest of Guatemala. By HARLEY HARRIS BARTLETT. *Carnegie Inst. Wash. Publ.* 461: 1–25; pls. 1–14; July 10, 1935.

The modern point of view in botanical survey has hardly been applied in the tropics. There are no ecological or phytogeographical publications for any restricted tropical area which give such definite information as is available for temperate regions. Some observers have practically denied that rich tropical floras can be divided into definable plant associations, but the judgment of the most experienced observers is that this is incorrect.

A detailed method is proposed for beginning studies upon tropical vegetation, with the suggestion that there be adopted at first the practical classification of the region used by local residents, who often have an elaborate vocabulary describing local types of vegetation. Using such terms as are employed in Petén and British Honduras, brief descriptions are given of the plant formations of the region, with a list of characteristic species found in each. The paper includes a large number of vernacular names of plants, many of which, probably, have not been recorded previously.

This paper is recommended highly for use of any one wishing to obtain a general idea of the vegetation of the Yucatan Peninsula, or to engage in botanical field work in Central America or southern Mexico.—P. C. STANDLEY.

Contributions to the flora of tropical America. XXIV. Review of the species of *Byrsonima* occurring in British Guiana. By N. Y. SANDWITH. *Kew Bull. Misc. Information* 5: 311–316; 1935.

A key is provided for 12 species of *Byrsonima* occurring in British Guiana, and *B. eugeniifolia* is described as new. Niedenzu's genus *Alcoceratothrix* is reduced to synonymy under *Byrsonima*.

The culture of the balsa tree in Ecuador. By SAMUEL GREENHOUSE. *Journal of Forestry* (Washington) 33: 10: 870–876; October 1935.

"In 1927 the Balsa Wood Company of New York bought a tract of land on the Rio Grande, part of the Guayas River system, in Ecuador, Los Rios Province, Parish of Vinces, Township of Quevedo. Here, under the guidance of Sr. Frederico von Buchwald, a man with long and varied experience in tropical agriculture, the culture of pure stands of Balsa on a sustained yield basis was begun. It was to this plantation, known as Hacienda Lata, that the writer came in 1932 to apply his knowledge of forestry to the work, and it was here that he obtained whatever original information is found in this article. All the work done and experiments made were with *Ochroma grandiflora*. . . . Several factors tended to shape the silvicultural method used at Hda. Lata. The more important are:

"Seeds, having proper moisture and temperature conditions, must be acted on by direct sunlight in order to germinate. This makes removal of all previous cover necessary. The density of natural reproduction makes unnecessary any artificial seeding or planting, but necessitates some means to prevent overcrowding. Until they are 6 months old and about 1½ inches in diameter, the plants are very little more than pith and cortex. They are very easily broken or injured,

and even a slight injury often causes death. Even after the trees are fully mature, a slight hurt will cause the wood to develop a hard and fibrous texture, and thereby lose its commercial value. The tree is then called 'macho' ('burrillo' in Central America) as against 'hembra' ('Balsa real' in Central America), the soft textured tree. This makes it compulsory that the plantation be handled as little as possible, for the careless workman is the chief cause of injury.

"Until it is seven years old, the water needs of the Balsa tree are supplied by a shallow root system. About that time, due to increasing competition, it will develop a tap root. This causes the wood in the center of the tree, near the base, to become saturated. Decomposition takes place, and the wood in that area assumes a red color, and gradually becomes doty. With time this supersaturated area spreads laterally and in height, decreasing the value of the log. The tree must therefore be harvested before this development occurs.

"The bole above the first branch will not produce merchantable logs. Lumber with knots has no value. More emphasis must therefore be placed on growth in height than in diameter."

"After attempting a variety of methods of cultivating Balsa trees, the most practical, from a standpoint of cost and results obtained, is as follows: Work of clearing the jungle to be started as early in the dry season as possible, but not before the rains have definitely ceased. All Balsa trees to be left standing for seed production. An occasional timber tree to be left standing for use as spar tree at time of logging. Intensive burning of slash all through the dry season, to destroy all leaves and twigs. It is impossible to destroy larger branches. After seedlings are from 3 to 6 months old, weeds are to be removed, but only where necessary. Blank spaces to be planted through broadcast seeding (once only). After weeding once, the stand should not be handled until maturity."

A monograph of the genus *Recordia*. By HAROLD N. MOLDENKE. *Phytologia* (New York) 1: 171–174; September 1935.

The genus *Recordia* (Verbenaceae) and its single species, *R. boliviana*, known only from Bolivia, are described in detail.

Florula riograndensis. Bearbeitung der von Alfred Bornmueller in den Jahren 1903 bis 1907 in Rio Grande do Sul gesammelten Pflanzen. By JOSEPH BORNMUELLER. *Revista Sudamericana de Botánica* (Montevideo) 2: 33–48; June 1935.

The concluding part of a report upon a collection of 800 numbers of plants, obtained in a little known region of the State of Rio Grande do Sul, Brazil. The families treated are the Gesneriaceae to Compositae.

Contribución al conocimiento de la flora del Río Negro (Uruguay). By W. G. HERTER. *Revista Sudamericana de Botánica* 2: 57–63; June 1935.

Exploration of an area of about 11,000 hectares on the upper Río Negro in the Department of Cerro Largo, Uruguay, near the Brazilian border, resulted in a list of 32 forest trees, 16 shrubs, and 12 lianas. Fourteen of the trees and one of the lianas were armed with spines. One palm, *Arecastrum Romanzoffianum*, is relatively common in the region. Among the woody plants are *Acacia Farnesiana* (vernacular name Espinillo), *Parkinsonia aculeata* (Cina-cina), *Erythrina crista-galli* (Ceibo), *Cassia corymbosa* (Rama negra), *Sesbania punicea* (Acacia mansa), *Psittacanthus cuneifolius* (Flor de pajarito), *Discaria longispina* (Quina del campo), *Scutia buxifolia* (Coronillo), *Xylosma Salzmannii* (Espina corona), *Maytenus ilicifolia* (Cangorosa), *Guettarda uruguayensis* (Vellodiño), *Sebastiania Klotzschiana* and *S. Schottiana* (Blanquillo), *Schinus dependens* (Molle del monte), *Celtis tala* (Tala), *Acacia bonariensis* (Uña de gato), *Smilax brasiliensis* (Zarzaparrilla colorada), *Blepharocalyx lanceolatus* (Arrayán), *Eugenia pitanga* (Ñangapiré), *Sapium montevidense* (Curupí), *Sebastiania brasiliensis* (Palo de leche), *Lithraea melleoides* (Aruera, Arbol malo), *Eugenia opaca* (Guayabo), *Ocotea acutifolia* (Laurel), *Allophylus edulis* (Chalchal), *Cupania vernalis* (Cambuatá), *Rapanea laetevirens* (Canelón), *Ruprechtia polystachya* (Viraró), *Pouteria neriifolia* (Mataojo), *Quillaya brasiliensis* (Quillay, Palo de jabón), *Daphnopsis racemosa* (Envira), *Phyllanthus Sellowianus* (Sarandí blanco),

Cephalanthus glabratus (Sarandí colorado), *Vitis palmata* (Parra de zorro), *Myrtus cuspidata* (Arazá), *Heimia salicifolia* (Quiebra arado), *Eupatorium pinnatifidum* (Chirca). The paper includes notes regarding the plant societies of the region.—P. C. STANDLEY.

Botánicos especialistas relacionados con la flora sudamericana. *Revista Sudamericana de Botánica* 2: 64–70; June 1935.

Two lists, an alphabetical one of botanists specializing in study of certain groups of South American plants, and a systematic list of plant families, with indication of the specialists interested in each.

Addimenta cognitionis Lecythidacearum. II. By R. KNUTH. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 113–117; June 30, 1935.

New Lecythidaceae are *Chytroma Tessmannii*, Peru; *Sapucaya Schwackei*, Minas Geraes, Brazil; *Chytroma Miersii*, Amazonas and Pará, Brazil; *Eschweilera alba*, Amazonas and Pará; *E. bogotensis*, Colombia; *E. brancoensis*, Amazonas; *E. manaosensis*, Amazonas; *Chytroma rhododendrifolia*, Amazonas.

Neue Apocynaceen aus Südamerika. V. By FR. MARKGRAF. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 295–301; 1935.

New species are *Ambelania zschokkeiformis* and *A. Duckei*, Brazil; *Tabernaemontana palustris*, Brazil; *Aspidosperma eteanum*, *A. igapoanum*, and *A. auriculatum*, Brazil; *A. rauwolfioides*, Bolivia and Peru.

Le "pajurá" et le "parinary" d'Amazonie. By A. DUCKE. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 15: 179–182; figs. 10, 11; March 1935.

Parinarium montanum (Aubl. in part) Huber (*P. pajura* R. Ben., *Moquilea rufa* B. Rodr. in part) is known in Amazonia by the names Pajurá and Paranary. Its fruits are edible. *P. Rodolphi* Huber (*P. montanum* Aubl. in part, *P. montanum* R. Ben.), called Parinary and Paranary, has fruits which are scarcely edible. *Couepia bracteosa* Benth. (*Moquilea rufa* B. Rodr. in part), called Pajurá, has edible fruit. The last has been confused with the Oity Coró of Pernambuco, *Couepia rufa* Ducke (*Pleragine rufa* Arruda Camara, *Moquilea rufa* B. Rodr. in part). The Oity Grande of Bahia has been determined as *Licania Salzmanni* (Hook.f.) Fritsch. The name Pajurá is given sometimes also to a tree of the Sapotaceae, *Lucuma speciosa* Ducke; that of Pajurá-rana to *Licania parinarioides* Huber.—P. C. STANDLEY.

Umbauba. By E. TEIXEIRA DA FONSECA. *Revista da Flora Medicinal* (Rio de Janeiro) 1: 289–296; 1935.

Various species of *Cecropia* in Brazil are known as Umbauba or Imbauba. Their soft woods are used to some extent for paper pulp, while the resin and leaves, particularly of *C. peltata*, have medicinal value.

Nova especie de Quiinaceas. By ADOLPHO DUCKE. *Boletim Mus. Nacional* (Rio de Janeiro) 10: 103–104; 1 pl.; 1934.

Lacunaria Sampaioi is a new tree of the Quiinaceae, from the Rio Cuminá, State of Pará, Brazil.

Nomes vulgares de plantas da Amazonia. By A. J. DE SAMPAIO. Separata do *Boletim Mus. Nacional* Vol. X, 1934. Pp. 69; 7¼ x 10¾.

A useful check-list of the common names of Amazonian plants, with annotations by Dr. Adolpho Ducke.

Notas sobre a galha lenhosa da goiabeira. By FERNANDO ROMANO MILANEZ. *Rodriguésia*[1] (Rio de Janeiro) 1: 1: 3–7; figs. 8; 1935.

Results of a study of woody galls on the Goiabeira (*Psidium Guayava* L.), which are attributed to the disturbing action of a fungus localized in the cambium. The anatomical differ-

[1] *Rodriguésia* is a new journal, this being the first number, issued by the Instituto de Biologia Vegetal, the Jardim Botanico do Rio de Janeiro, and the Estação Biologica do Itatiaya, Brazil. It is distributed from the Jardim Botanico, the editorial committee consisting of P. Campos Porto, Fernando R. da Silveira, and Leonam de A. Penna.

ences between diseased and normal wood are made clear by comparative descriptions illustrated with photomicrographs and drawings.

Relatorios das comissões desempenhadas pelo chefe da secção de botanica, Adolpho Ducke, na região amazonica durante os annos de 1919 a 1928. By ADOLPHO DUCKE. *Rodriguésia* 1: 17–71; 1935.

The veteran collector and celebrated monographer of the Amazonian flora gives in this paper, in the form of official reports, a somewhat detailed account of his various collecting expeditions to the states of Pará and Amazonas and to Peru. These notes contain a vast amount of interesting information regarding the vegetation of the localities visited, hundreds of species with their vernacular names being mentioned. The information is of a nature that it is impossible to summarize, but the paper will be invaluable to all who are interested in the Amazonian flora.—P. C. STANDLEY.

***Ficus retusa* L., var. *nitida* Thunb. e não *Ficus benjamina* L.** By C. P. & A. C. B. *Rodriguésia* 1: 77–78; figs. 1, 2; 1935.

A tree usually known in Brazil by the name *Ficus benjamina* is planted commonly in gardens, parks, and streets about Rio de Janeiro, and probably in other cities. It is found that the proper name for the tree is *F. retusa* L., var. *nitida* Thunb.

Floração de inverno. By L. A. P. *Rodriguésia* 1: 81–83; 1935.

A list of certain plants flowering in the Botanic Garden of Rio de Janeiro from June 22 to September 22. Because of vernacular names cited, there are mentioned here the following species: *Andira fraxinifolia* Benth., Angelim Doce; *Bauhinia variegata* L., Unha de Vacca; *Bombax insigne* Schum., Mamorana-grande; *Brownea ariza* Benth., Sol da Bolivia; *Dombeya mollis* Hook., Aurora; *Erythrina crista-galli* L., Corticeira; *E. glauca* Willd., Bucaré, Assacu-rana; *Petraea volubilis* Jacq., Flor de Viuva; *Randia Ruiziana* DC., Estrella do Norte; *Sterculia foetida* L., Chichá; *Stifftia chrysantha* Mikan, Rabo de Cotia.

Studies in Theaceae. I. *Eurya* subgen. *Ternstroemiopsis*. By CLARENCE E. KOBUSKI. *Journ. Arnold Arboretum* 16: 347–352; pl. 153; July 1935.

The group treated is confined to the Hawaiian Islands, and consists of two species of small trees. *E. Degeneri* is described as new.

New or noteworthy trees from Micronesia. XII, XIII. By RYÔZÔ KANEHIRA. *Botanical Magazine* (Tokyo) 49: 271–279; figs. 25–28; photos 3; and 352–358; figs. 29–31; 1935.

Among the trees listed, new species (unless the name is followed by the name of the author) are the following: *Palaoea falcata*, a new genus of Sapindaceae; *Tristellateia australasica* A. Rich., Japanese name Kôsyun-kadura; *Ventilago Nisidai*; *Amaracarpus kusaiensis*; *Trukia megacarpa* (*Timonius megacarpus* Kanehira), a new genus of Rubiaceae; *Pterocarpus carolinensis*, local names Aras and Arau, the wood much esteemed for building purposes; *Pipturus micronesicus*; *Leea pallidifolia*; *Psychotria diospyrifolia* and *P. leptothyrsoides*; *Pandanus cylindricus*, var. *sinnau*, local name Sinnau; *P. Cominsii* Hemsl., Niffa.

New or noteworthy trees from Micronesia. XIV, XV. By RYÔZÔ KANEHIRA. *Botanical Magazine* 49: 425–431, 525–532; figs. 32–42; 1935.

New species of *Pandanus* are described as follows: *P. brachypodus*, Enchabi Island (local name Punmusi); *P. rhombocarpus*, Enchabi (Papparawa); *P. macrocephalus*, Mokiel Island (Intekul); *P. rotundatus*, Ponape (Magojokjok); *P. enchabiensis*, Enchabi (Maok); *P. duriocarpoides*, Yap; *P. eyesyes*, Kusai Island (Eyesyes); *P. insularis*, Kusai (Meu Kosa); *P. lakatwa*, Jaluit (Lakatwa); *P. obliquus*, Jaluit (Lajokorer); *P. tomilensis*, Yap.

On some Indian and Burmese Dillenias. By C. E. PARKINSON. *Indian Forester* (Calcutta) 61: 7: 447–453; pls. 28–29; July 1935.

"While studying herbarium material of the Indian and

Burmese Dillenias the writer has become aware of certain misconceptions regarding the identity of some of the species which it is endeavored to explain and clear up here. The species involved are the large yellow-flowered ones belonging to Section C in Brandis's paper on the Indian Dillenias in the *Indian Forester*, Vol. XXVI (1900), pp. 429–431. That Brandis was not satisfied with this section, is evident from his remarks in this paper and in Indian Trees. Hitherto *Dillenia ornata* Wall has been reduced under *D. aurea* Smith and *D. pulcherrima* Kurz maintained, but, as the writer proposes to show, the two former are distinct and it is the last mentioned species that should be reduced."

The author describes a new species, *D. andamanica*, and includes a key for it and two allied species.

A monograph of the genus *Tectona* as it occurs in America and in cultivation. By HAROLD N. MOLDENKE. *Phytologia* (New York) 1: 154–164; September 1935.

The single species of Teak listed, *Tectona grandis* L.f., is described in detail, with synonymy, uses, habits, and an account of the wood. Numerous vernacular names are cited, and a list is given of the cultivated and naturalized specimens examined.

Plantation experiments at Kepong. By J. G. WATSON. *Malayan Forester* (Kuala Lumpur) 4: 3: 110–119; July 1935.

"The object of this article . . . is merely to give an account of the reactions of some of the species [of over 40 genera] that have been planted at Kepong where, by and large, conditions are far from favorable at the best and peculiarly bad at the worst."

"We now know that the bamboo pot is not only unnecessary but that it hampers development and that, given a fair share of luck with the weather, the majority of species can be set out as naked-rooted nursery transplants with reasonable prospect of success. We know that line plantings in high forest are useless unless the over-crop is removed before the plants have become suppressed and that, for this reason, plantings in 'belukar' are more likely to succeed in spite of the inferiority of the soil. We know that it is excessive transpiration due to drying winds that is chiefly responsible for failures in the open, and that even in the driest spells there is sufficient moisture in the soil to keep established plants alive. We are satisfied that plantings in areas infested with 'bertam' [*Eugeissona triste* Griff.] are useless unless that palm is rigorously cut back (exposure being the lesser of the two evils) and that the rich appearance of the soil beneath this plant is not necessarily favorable to tree growth. We have made considerable progress in the reconditioning of denuded soils by means of planting unfastidious species. And finally, we have learned a lot with regard to the nursery treatment and early development of the species that have passed through our hands, and study of which is only possible under what may be termed laboratory conditions."

Cedrela in the Malay Peninsula. By C. F. Symington. *Malayan Forester* 4: 3: 119–126; June 1935.

"Although *Cedrela* has for many years been of commercial importance in the neighboring territories of Burma, Sumatra, Java, and the Philippines, information concerning its presence in the wild state in the Malay Peninsula has, until the last few years, been limited to the bare record of its occurrence, based on the evidence of two herbarium collections both made in 1886. . . .

". . . A questionnaire sent to Forest Officers in December 1933, and recent observations by the Research Branch have resulted in the acquisition of much fresh information concerning the identity, distribution, and abundance of *Cedrela* in the Peninsula.

"It is now established that two species of *Cedrela* are native in the Peninsula. The writer considers all specimens collected prior to 1932 to belong to *C. Sureni* (Bl.) Burkill and is of opinion that there is no reason for supposing that Curtis' Penang specimen (*C. Toona*, var. *pilistaminea* of De Candolle and Burkill) was other than a wild tree. The other species, which was first collected in 1932, is *Cedrela serrata* Royle. This species is considered by Dutch botanists to be synonymous with *Cedrela sinensis* L. A. Juss., an earlier described species from the hills of Southern China. The genus *Toona* being upheld by Dutch botanists, our species are known in the Dutch East Indies as *Toona Sureni* (Bl.) Merr. and *Toona sinensis* (L. A. Juss.) Roem."

There are botanical descriptions of the two species and a discussion of their culture and economic possibilities.

Tests on timbers from the state of North Borneo. By A. V. Thomas. *Malayan Forester* 4: 3: 131–135; June 1935.

Contains the results of mechanical tests on small, clear, unseasoned specimens of Urat Mata (*Parashorea* sp.) and Belian (*Eusideroxylon Zwageri*).

Tembusu. By J. G. Watson. *Malayan Forester* 4: 3: 136–137; June 1935.

Tembusu (*Fagraea fragrans* Roxb.) "is not recommended as subject for planting with the idea of its ultimate exploitation for timber, for it does not form a large tree and it would hardly be possible to obtain heartwood in commercial sizes. Neither would it be advisable to grow it as a firewood crop, for its wood has no particular merit as a fuel, and plenty of other trees will grow a good deal faster. Its chief claim to attention is its extreme good nature and its consequent suitability for use in the rehabilitation of denuded soils."

Timber uses. By B. S. Mee and D. S. P. Noakes. *Malayan Forester* 4: 3: 138–141; June 1935.

An interesting account of "some of the more specialized uses" of Malayan timbers.

Palmae malesicae. II. _Nenga Wendlandiana_ Scheff. or _Nenga pumila_ (Mart.) Wendl. ? By C. X. Furtado. *Gardens' Bulletin, Straits Settlements* (Singapore) 8: 159–163; Jan. 26, 1935.

There has been doubt as to which of the two names mentioned should be regarded as a synonym. The subject is discussed in detail, and the conclusion reached that the preferable name is *Nenga pumila*. This being true, *Areca pumila* Blume is antedated by *A. pumila* Mart., and should be known as *Areca latiloba* Ridley.

The Batak lands of north Sumatra, from the standpoint of recent American botanical collections. By HARLEY HARRIS BARTLETT. *Univ. Philip. Nat. App. Sci. Bull.* (Manila) 4: 3: 211–323; 2 maps; June 1935.

The object of this paper is "to correlate existing geographic knowledge with the results of recent botanical activity. For those who need more information, this paper will facilitate access to more thoroughgoing geographical literature, but it will be sufficient in itself for most botanical purposes."

The Cornaceae, sensu stricto, of the Netherlands Indies. By B. H. DANSER. *Blumea* (Leiden) 1: 46–74; Aug. 25, 1934.

The Cornaceae are represented in the Netherlands Indies by *Mastixia* with nine species and *Mastixiodendron* with one. These are described, and keys provided for their recognition. The paper includes a long list of vernacular names of the trees.

The genus *Alangium* in the Netherlands Indies. By S. BLOEMBERGEN. *Blumea* 1: 241–294; 5 figs.; April 30, 1935.

Alangium is represented in Netherlands Indies by 16 species, all of which are described, with extensive notes regarding synonymy, material examined, and other matters. There are two keys, one based upon flowering specimens, the other upon fruiting specimens. Four new species are described. The paper includes an index of almost two pages of vernacular names of the trees.

The Malaysian genus *Rigiolepis* Hooker f. By J. J. SMITH. *Blumea* 1: 323–342; April 30, 1935; illustrated.

The genus *Rigiolepis* of the Ericaceae consists of 16 species of shrubs, confined to Java, Sumatra, and Borneo. Six species are described as new.

The genus *Nyssa* in the Netherlands Indies. By J. WASSCHER. *Blumea* 1: 343–350; April 30, 1935; illustrated.

The genus is represented by a single species, *Nyssa javanica* (Blume) Wang., a tall tree, sometimes 40 meters high, for which numerous vernacular names are reported.

The Compositae of the Malay Archipelago. I. Vernonieae and Eupatorieae. By JOSÉPHINE TH. KOSTER. *Blumea* 1: 351–536; May 25, 1935; illustrated.

A detailed account, with extensive notes, of several genera of Malayan Compositae. Some of the species treated are trees or shrubs, for many of which vernacular names are cited.

Flacourtiaceae novae. By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 12: 140–143; Dec. 31, 1934.

New species are *Homalium tatambense*, Solomon Islands; *Scolopia Gossweileri*, Angola.

Melanesia plants. I. By B. L. BURTT. *Kew Bull. Misc. Information* 5: 298–306; 1935.

New woody plants from Solomon Islands are: *Dillenia ingens* (vernacular names Kauhana, Hebere), wood splitting easily and said to harden with age; *Melicope grandifolia* (Hongoponipo); *Fagara megistophylla* (Kiha); *Canarium salomonense* (Kuhurima); *Vavaea bougainvillensis* (Mono); *Leea tetramera* (Kuuko, Kuuku, Ku'u Ku'u, Tavuruvu, Bau); *Pentaspadon minutiflora* (Siinari, Vitawa).

Beitrage zur Flora von Papuasien. XXI. By C. LAUTERBACH. *Bot. Jahrbücher* (Leipzig) 67: 143–236; 1935.

The paper enumerates three families of Papuasian plants, Myristicaceae by Markgraf, Moraceae by Diels, and Plantaginaceae by Pilger. Keys are provided for recognition of genera and species, all of which are treated in detail.

The Myristicaceae are represented by *Gymnacranthera* (one species), *Horsfieldia* (17), and *Myristica* (23). Five new species of *Horsfieldia* are described and three of *Myristica*.

The Moraceae are represented by *Fatoua* (1), *Pseudomorus* (1), *Malaisia* (1), *Streblus* (3), *Calpidochlamys* (a new genus of trees, with 2 species), *Cudrania* (1), *Antiaropsis* (1), *Parartocarpus* (2), *Artocarpus* (4), *Ficus* (138). Many new species are described.

Materials towards a study of the flora of the island of New Guinea. By H. J. LAM. *Blumea* (Leiden) 1: 115–159; 3 figs.; Aug. 25, 1934.

A brief account of the principal plant associations of New Guinea, illustrated by a map; also tabular information regarding representation of families and genera, endemism of genera and species, endemic and subendemic genera, groups with strong differentiation, and geographic relations. Generic endemism is indicated as 11.6 per cent, specific endemism as 84.7 per cent. Appendices list the more important collectors in the island and the principal botanical literature.—P. C. STANDLEY.

Plant collecting in Fiji. By A. C. SMITH. *Journ. N. Y. Botanical Garden* (Lancaster, Pa.) 35: 261–280; 7 figs.; December 1934.

The author spent nine months in 1933–34 in the various islands of Fiji, collecting herbarium material and wood specimens, 817 of the latter being obtained. A general account is given of the aspect of the vegetation upon several of the islands, the plants being mentioned by both their Latin and vernacular names.

Macroscopical and anatomical characters of the wood of *Eucalyptus globulus* Labill. and *E. rostrata* Schl. By CORNELIA A. GOUWENTAK. Reprinted from *Mededeelingen van de Landbouwhoogeschool* (Wageningen) 39: 3; 1935. Pp. 17; 6¾ x 9¾; 3 text figs.

Detailed descriptions of the wood of two 6-year-old trees from a forest plantation in Andalusia, Spain. The principal features of the two species are summarized in parallel columns for comparison.

The starch content of some Australian hardwoods in relation to their susceptibility to attack by the powder post borer, *Lyctus brunneus* Stephens. By J. E. CUMMINS and H. B. WILSON. Reprint No. 25 from *Journ. Council for Sci. & Ind. Research*, May 1935, pp. 101–110; pls. 2–4.

There is not only a lower limit to vessel size but also to starch content below which a timber ceases to be susceptible to attack by *Lyctus* beetles.

The selection, preservation, distribution, and identification of Australian pole timbers. By J. E. CUMMINS and H. E. DADSWELL. Pamphlet No. 55, Council for Sci. & Ind. Research, Melbourne, 1935. Pp. 79; 6 x 9½; figs. 20, pls. 7.

A carefully prepared, well illustrated report covering the following subjects: Results of a recent survey of the present practices of Australian pole-users; statistics of the number, size classes, average cost, renewals, and annual extensions of poles throughout the Commonwealth; discussion of the factors affecting the service life of poles and methods of preservation; descriptions of the different timbers and keys for identification. The plates are from photographs of cross sections of the most important pole woods as they appear under a hand lens.

The identification of the principal commercial Australian timbers other than eucalypts. By H. E. DADSWELL and AUDREY M. ECKERSLEY. Bull. No. 90, Council for Sci. & Ind. Research; Tech. Paper No. 16, Div. of Forest Products, Melbourne, 1935. Pp. 103; 6 x 9½; 56 figs.

"This Bulletin completes the first survey of the commercial timbers of genera other than *Eucalyptus*. . . . The work discussed constitutes the first step in a planned study of Australian timbers, *viz.*, the establishment of useful keys, for the main commercial species, which will prove workable while a more careful detailed study is made."

The major part of the bulletin is devoted to descriptive notes on the various timber species, which are grouped according to families following the classification of Engler and

Prantl, except that the Coniferae are considered last. The 97 species covered are representative of 71 genera and 31 families. The vernacular names of each timber are given, together with a statement of the distribution of the species in Australia and brief descriptions of the general (physical) properties and anatomical features of the wood. While the emphasis has been placed upon the macroscopic structural features, as revealed by a 10 × hand lens (supplemented, when necessary, by a telescopic type of lens having a magnification of 40 ×), the important characteristics of the minute anatomy are also included in many cases. Information is also given relative to the commercial importance of most of the woods, many of which "are being increasingly exploited and used for cabinet work, joinery, veneers, plywood, panelling, flooring, and specialty purposes such as sporting goods and turnery."

To assist in classifying the timbers under consideration according to structural characteristics, the species are listed under the various distinctive anatomical features in a separate section. Following this is the key for the identification of the woods. This key is based as far as possible on macroscopic characteristics, the microscopic features being used only in a few cases where separation of the woods is otherwise difficult. While the bulletin is concerned with woods other than those belonging to the genus *Eucalyptus*, the points at which the Eucalypts may cause confusion are indicated in the key.

At the close of the bulletin is a series of 56 photographs, selected to illustrate the details of structure of the important timbers as revealed by a hand lens. In most cases these were taken under a magnification of 10 ×, although a higher magnification (35 ×) was used in a few instances. All but four of the photographs are cross-sectional views of the woods.—G. A. GARRATT.

Espèces nouvelles de *Savia* (Euphorbiacées-Phyllanthoidées) de Madagascar. By J. LÉANDRI. *Bull. Société Botanique de France* 81: 587–589; 1934.

New species described from Madagascar are *Savia andringitrana*, *S. bemarensis*, and *S. Decaryi*.

Sur la présence à Madagascar du genre *Glochidion* (Euphorbiacées). By J. LÉANDRI. *Bull. Société Botanique de France* 81: 606–607; illustrated; 1934.

Glochidion Perrieri, a new species, is the first *Glochidion* to be reported from Madagascar. The genus is represented in Asia, Oceania, and America, but not in Africa.

A key to the more important indigenous and exotic timbers grown or marketed in South Africa. By J. H. VAN WYK. *Annals Univ. Stellenbosch* 13 (sec. A): 2: 1–29; July 1935. Price 2 s.

"In South Africa little information is available for the proper identification of our commercial timbers and this contribution attempts to show in a non-technical, yet scientific manner the structural differences of our more common timbers and how to identify them. It aims at supplying Forest Officers and others with sufficient information to enable them to identify some of the more common indigenous timbers, as well as the chief imported timbers sold in the South African market and the principal exotics grown in the Union. Only macroscopic features have been made use of in drawing up the key, features that are either visible to the naked eye or by means of a hand lens of ten magnifications. The macroscopic features considered are those of the air-dried heartwood of the different species."

Die Flora des Namalandes. VII. By PAUL RANGE. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 122–130; June 30, 1935.

A systematic list of plants collected in Namaland, Africa, the families covered being Plumbaginaceae to Hydrophyllaceae, inclusive.

New trees and shrubs from tropical Africa. IV. By A. C. HOYLE and H. DUNKLEY. *Kew Bull. Misc. Information* 5: 255–265; 1935.

New species of woody plants are: *Dasylepis Burtt-Davyi* Edlin, Nyasaland; *Grewia velutinissima* Dunkley, Northern

Rhodesia, vernacular names MuNzo (Chitoka) and MuUndu (Chikapandi); *Hibiscus Burtt-Davyi* Dunkley, Nyasaland; *Drypetes Vignei* Hoyle, Gold Coast, Opahah or Opaha; *Gelonium occidentale* Hoyle, Gold Coast; *Grossera Vignei* Hoyle, Gold Coast; *Dalbergia glandulosa* Dunkley, Northern Rhodesia, Mukonkoto (Chitoka) and Muwunda (Sikololo); *Pterocarpus Martinii* Dunkley, Northern Rhodesia, MuLianzovu (Chitoka); *Ekebergia velutina* Dunkley, Nyasaland, Mututumuku (Yao), Musefu (Chinsenga), Mutumuko; *Diospyros Vaughaniae* Dunkley, Zanzibar and Kenya Colony; *Strychnos bicirrifera* Dunkley, Kenya Colony, Mbugu-bafe (Swa.); *Belonophora coriacea* Hoyle, Nigeria, Igabakue Izigha; *Sabicea rosea* Hoyle, Gold Coast.

Tropical African plants. XIII. *Kew Bull. Misc. Information* 5: 271–285; 1935.

New names for woody plants are: *Triplochiton zambesiacus* Milne-Redhead, Southern and Northern Rhodesia, vernacular names Muzonzo (S. Rhodesia), Mukunzu or Mukonza (N. Rhodesia); *Loranthus tetraparitus* Bruce, Tanganyika Territory; *Clausenopsis Hildebrandtii* (Engl.) Milne-Redhead, *Clausena Hildebrandtii* Engl.; *Disperma eremophilum* Milne-Redhead, Kenya Colony; *Rhinacanthus pulcher* Milne-Redhead, Kenya Colony.

Notes on the genus *Royena* Linn. By B. L. Burtt. *Kew Bull. Misc. Information* 5: 286–292; 1935.

A key is given to five tropical African species related to *Royena macrocalyx* Gürke. The species are: *R. macrocalyx* Gürke, Kenya Colony (vernacular names Mkuroponya, Mkongo, Mdaa), Tanganyika Territory (Mdala Mweupe, Mgoyo, Mdala), Nyasaland, Portuguese East Africa; *R. heterotricha* (Welw.) Burtt, Belgian Congo, Angola; *R. zombensis* Burtt, new species, Nyasaland (Mchekecheta, Mgulakula, Nkukukulu, Ndima), the timber used for poles; *R. amnicola* Burtt, new species, Tanganyika Territory (Nyakititu); *R. Fischeri* (Gürke) Gürke, Tanganyika Territory (Mlamata, Nyakititu, Msindilo, Msubata, Benjero, Mbanjiru).

Check-lists of the forest trees and shrubs of the British Empire. No. 1. Uganda Protectorate. Compiled by J. Burtt Davy and Florence Bolton with the collaboration of N. V. Brasnett, W. J. Eggeling, and C. M. Harris. Imperial Forestry Institute, Oxford, July 1935. Pp. 132.

An enumeration of the woody plants of Uganda Protectorate, listing 107 families, 452 genera, and 1146 named species and varieties, not including a substantial number of exotic species. For each species are listed the collections examined, with notes concerning size and habit of plant and vernacular names, when known. The introduction includes a very brief chapter upon the floristic composition of the forests, and a list of 18 more important timber trees, concerning the nature and uses of whose wood brief notes are supplied.

Notes from the British Museum Herbarium. *Journ. Bot. Brit. & For.* (London) 73: 262–263; September 1935.

A new species described is *Acacia Eggelingii* Baker f., of Uganda, a tree of 20 to 50 feet. The sapwood is white, the heartwood dark brown, resembling that of *Albizzia coriaria;* reported by the natives to be a good timber, hard and durable.

Eine neue Oleaceengattung in Angola: *Noldeanthus* gen. nov. By E. Knoblauch. *Repertorium Specierum Novarum* (Berlin-Dahlem) 38: 74; June 30, 1935.

Noldeanthus angolensis, a new genus of Oleaceae, is a woody vine native in Angola at an elevation of 1200 meters.

Sur le *Maesopsis* de l'Ouest Africain et le bois de nkanguele. By D. Normand. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 15: 164: 252–263; 1 plate; April 1935.

Taxonomists are inclined to believe that *Maesopsis Eminii* Engl. and *M. berchemioides* (Pierre) Engl. (= *Karlea berchemioides* Pierre) are two names for the same tree in the eastern and western parts of its range, but from the standpoint of the forester they appear to represent distinct forms of unequal value for timber production. Unlike the other woods of the family (Rhamnaceae), that of *Maesopsis* is light, soft, easy to work, and considered suitable for many of the same purposes as *Cedrela*. Included in the report is a discussion of the value of measurements in anatomical descriptions.

The wood anatomy of representative members of the Monotoideae. By Helen Bancroft. *American Journal of Botany* 22: 8: 717–739; figs. 2; pls. 3; October 1935.

"The wood anatomy of *Monotes africanus* (Welw.) A. DC. and of *Marquesia macroura* Gilg is described in detail, and that of other members of the Monotoideae briefly considered, with a view to obtaining data as to the systematic position of the group, which different authors have allied with the Dipterocarpaceae and the Tiliaceae.

"So far as available material will allow a general statement to be made, the timbers of the Monotoideae possess a uniform structural plan, with small, usually isolated, vessels, extremely fine rays, a rather dense ground mass of fibers, and comparatively little of either meta- or paratracheal parenchyma. This structural plan is, in certain respects, unlike that of the families with which the Monotoideae is considered to be most closely allied. It approaches most nearly to that of the subfamily Dipterocarpoideae, though differing from it in the absence of secretory canals, in the possession of almost entirely uniseriate rays, and in the presence of a much smaller amount of wood parenchyma. It differs markedly from the structural plan of the Tiliaceae, where there is a general tendency to the arrangement of rather small vessels in radial groups, to the production of tangential lines of parenchyma, and to the possession of rays of two sizes.

"The indications from wood anatomy concerning the systematic position of the Monotoideae are, therefore, that the group is less closely allied to the Tiliaceae than to the Dipterocarpoideae; and that it should remain as a subfamily of the Dipterocarpaceae, or that it may, perhaps, be raised to the status of a separate family, when the evidence of other characters has been reviewed and discussed."

A critical revision of certain taxonomic groups of the Malvales. By H. L. Edlin. *New Phytologist* 34: 1: 1–20, Feb. 21, 1935; 34: 2: 122–143, May 15, 1935.

In the first part of this paper Mr. Edlin discusses the former classifications of the Malvales, and makes certain suggestions for a new arrangement of the families. He proposes a subdivision of the existing family Sterculiaceae into Buettneriaceae and Sterculiaceae, the latter containing only the genera previously assigned to the subfamily Sterculieae. There is much to recommend this rearrangement, for this subfamily alone of the whole Malvales has flowers that are both apetalous and unisexual, or at least unisexual in function. The author writes: "The occurrence of *either* apetaly or unisexuality is by no means unusual in the Malvales, and appears to have little systematic significance; but the *association* of these characters is only found within the Sterculieae." These conclusions are supported both by the general anatomy and by the structure of the wood. The rest of Part I is occupied with a consideration of various tribes and of atypical genera.

In Part II the author gives brief descriptions of the families in the Malvales, with a list of the genera included in each, a key to the families, and a discussion of the phylogeny of the Malvales. His general conclusions and suggestions are as follows:

"Examination of herbarium specimens, together with a consideration of the systematic anatomy and wood structure, shows that the existing classification within the group Malvales is unsatisfactory. A review of former classifications shows that diversity of opinion exists among the authorities.

"After consideration of many atypical genera, it is found that all the Malvales may be referred to definable families, and that a practicable key may be drawn up for these. On this basis, the probable phylogeny of the Malvales has been worked out. The two families Scytopetalaceae and Tiliaceae appear to be the oldest and most primitive of the Malvales. The three families Sterculiaceae, Buettneriaceae, and Bombacaceae, appear to have evolved from the Tiliaceae upon mutually independent lines. The Malvaceae proper are a small advanced group derived from the Bombacaceae.

"In particular it is suggested that the family Gonystylaceae, with the single genus *Gonystylus*, should be merged in the family Scytopetalaceae. That the Elaeocarpaceae should become a tribe of the family Tiliaceae. That the family Chlaenaceae should be entirely excluded from the Malvales. That the tribe Sterculieae should stand apart as a distinct family, Sterculiaceae; and the name Buettneriaceae should be applied to the remainder of the family at present called 'Sterculiaceae.' That the tribe Hibisceae, together with certain atypical genera of the Malvaceae, as formerly delimited by Bentham and Hooker, should be transferred from that family to the Bombacaceae. That the genus *Kydia* should form a distinct tribe, Kydieae, in the family Bombacaceae. The tribe Fremontieae, with the two monotypic genera *Fremontia* and *Cheirostemon*, should be placed in the family Bombacaceae.

"Other conclusions and proposed alterations are: *Prockia*, *Hasseltia*, and *Plagiopteron*, remain in the Tiliaceae, but *Ropalocarpus* has been excluded. The division of *Grewia* into two genera, *Grewia* L. and *Microcos* Burret, as proposed by Burret, appears to be sound, but there are insufficient grounds for his isolation of a third genus, *Vincentia* Boj. The family Sterculiaceae falls naturally into two tribes: The Tarrietieae include the three genera *Tarrietia*, *Heritiera*, and *Argyrodendron;* the other genera are referred to the Sterculieae. The Australian species of *Tarrietia* are placed in the distinct genus *Argyrodendron* F. v. M.; the name *Argyrodendron trifoliatum* F. v. M. is revived for the species also called *Tarrietia argyrodendron* Benth.; the name *Argyrodendron actinophyllum* (Moore) Edlin, nov. comb., is proposed for the species hitherto called *Tarrietia actinophylla* Moore.

"*Cistanthera* is placed with *Triplochiton* and *Mansonia* in the tribe Mansonieae of the Buettneriaceae. *Humbertiella* Hochr. is transferred from the Malvaceae to the tribe Dombeyeae of the Buettneriaceae. The genera *Howittia* and *Hampea* are referred to the tribe Hibisceae (Bombacaceae). *Bernoullia* Oliv. is placed in the tribe Adansonieae (Bombacaceae). *Nettoa* Baill. and *Hua* Pierre ex de Wild. are excluded from the order Malvales."

The paper concludes with an index to genera occurring in the Malvales, showing the family and subfamily proposed for each genus.—M. M. Chattaway.

The structure of some sandalwoods and their substitutes and of some other little known scented woods. By C. R. Metcalfe. *Kew Bull. Misc. Information* 4: 165–195: 4 plates with 4 photomicrographs each; 1935.

"This account may be regarded as a continuation of a previous paper [see *Tropical Woods* 34: 47] on the structure of some scented woods from the East. Some additional information has been obtained concerning the structure of the wood of *Cinnamosma fragrans*, which was described in the last paper, as well as of the closely related genus *Warburgia*, and the description of the former given in the previous article needs to be slightly modified in order that the woods of the two genera may be distinguished.

"The Sandal- and other woods here described are dealt with primarily according to their country of origin. At the present time the chief sources of true Sandalwoods, by which are meant oil- and scent-yielding woods belonging to the Santalaceae, are India and Australia, whilst some are obtained from Polynesia and New Caledonia. Of these, it is generally agreed that East Indian Sandalwood, which is the product of *Santalum album*, is the most superior both in the quality of the wood and yield of oil. Australian Sandalwood is largely the product of *Eucarya spicata* Sprague & Summerhayes, although other members of the Santalaceae have also been used. In India the quite distinct woods *Erythroxylum monogynum* Roxb. and *Ximenia americana* Willd. are sometimes used as substitutes, and *Eremophila Mitchelli* Benth. (Myoporaceae) is the source of a bastard Sandalwood in Australia. Descriptions of these have therefore been included.

"The so-called West Indian or Venezuelan Sandalwood of commerce, the oil of which is said to be very inferior to that of *Santalum album*, is believed to be the product of *Amyris balsamifera* L. (Rutaceae), the wood structure of which is here described. The botanical source of the Sandalwoods of East Africa and Madagascar is somewhat obscure, but it seems evident from the information and specimens collected together during the present investigation that, although there is evidence that the wood of some member or members of the Santalaceae may be employed, a proportion is provided by the quite unrelated genus *Brachylaena* of the family Compositae. In addition scented woods are obtained from *Cinnamosma fragrans* Bail. and *Warburgia* spp. (Canellaceae).

"Although they are not commonly known as Sandalwoods, brief accounts of the scented woods of *Convolvulus scoparius* (Canary Rosewood) from Teneriffe, and *Urandra* sp. (Darudaru or Dedaru) from Singapore have been included."

"The similarity in the wood structure of *Ximenia* and *Santalum* is of taxonomic interest. *Ximenia*, of the family Olacaceae, was placed by Bentham and Hooker, together with the Ilicineae, in the Olacales, which were regarded as being widely separated from the Santalaceae. Engler and Gilg on the other hand classify the Olacaceae together with the Loranthaceae and Santalaceae in the same order, the Santalales. Hutchinson differs from Engler and Gilg in placing the Olacaceae and Santalaceae in the separate orders Olacales and Santalales, respectively, but he regards many of the Santalales as reduced parasitic forms of the closely related Olacales. The similarity of the wood structure of *Ximenia americana* and *Santalum album* supports the classification of Engler and Hutchinson rather than that of Bentham and Hooker.

"Comparison of the wood of *Ximenia americana* with that of *Santalum album* shows that the former can be distinguished most easily by the following characters of the medullary rays: (1) The rays are shorter. (2) The broader rays are more markedly heterogeneous, and the upright cells are fairly frequent in the middle of the rays as well as at the margins. (3) The frequent occurrence of uniseriate rays composed only of upright cells. (4) The vessel-ray pits are frequently much larger and less numerous."

The woods of *Warburgia* and *Cinnamosma fragrans* can be distinguished as follows: In *Warburgia* the pores are more frequently in tangential or oblique pairs, while the fibers are less frequently in radial rows, are less rectangular in section and have a wider lumen. Paratracheal parenchyma partly or wholly surrounds most vessels in *Cinnamosma*, but is relatively scarce in the other. The rays are partly or wholly biseriate, rarely partly triseriate, in *Warburgia*, but almost exclusively uniseriate, with a few partly biseriate, in *Cinnamosma*.

The visible structure of the secondary wall and its significance in physical and chemical investigations of tracheary cells and fibers. By I. W. Bailey and Thomas Kerr. *Journ. Arnold Arboretum* 16: 3: 273–300; plates 140–149; July 1935.

"An extensive survey of a wide range of gymnosperms and angiosperms has shown that the structural pattern of the secondary wall is clearly visible in the large fiber-tracheids and libriform fibers of various dicotyledons. By using untreated sections of such cells as controls, it is possible to observe the exact effects of specific chemical and mechanical treatments upon normal structures, and thus to extend the scope of investigation to cover a wide range of less favorable material.

"The cellulosic matrix of the swollen secondary wall of cotton, as of normal tracheids, fiber-tracheids, and libriform fibers, is an extremely heterogeneous but firmly coherent structure, the finer details of which grade down to the limits of microscopic visibility. There is no reliable evidence to indicate that the matrix is composed of discrete entities of visible size—*e.g.*, elementary fibrils, dermatosomes, ellipsoidal bodies, etc.—that are bound together by non-cellulosic material. On the contrary, our data demonstrate that such putative entities actually are heterogeneous fragments that are shredded or disrupted from an originally continuous and coherent matrix. If there are discontinuities in the structural pattern of the cellulose in normal tracheary cells, they are confined to the submicroscopic field, *e.g.*, to the realm of micelles or molecular chains. The visible structural pattern of the cellulosic matrix varies greatly in form and texture, not only in different plants, but also in homologous cells of the same plant, and even in different parts of the same cell.

"There are at least two optically different elongated complexes of cellulose which may be segregated into radio-helical, radio-longitudinal, or concentric-longitudinal lamellae, or into various radio-concentric patterns. The orientation of the elongated complexes of the structural pattern fluctuates more or less in successively formed parts of the secondary wall. In the case of normal tracheids, fiber-tracheids, and libriform fibers, there are three layers due to varying orientations: narrow inner and outer layers, in which the orientation is more nearly at right angles to the longitudinal axis of the cell, and a central layer of varying width, in which the orientation is parallel to this axis or does not deviate excessively from it. 'Lignin' and other non-cellulosic constituents may be deposited in the elongated, intercommunicating interstices of the cellulosic matrix, thus resulting in two continuous, interpenetrating systems. In heavily lignified forms, either system may be dissolved without seriously modifying the structural pattern of the remaining system. The purified cellulose and the 'lignin' residue reveal positive and negative images of the original structural pattern.

"Deviations from the typical 3-layered type of secondary wall are of not infrequent occurrence. Thus, many thick-walled libriform fibers and fiber-tracheids have no clearly differentiated inner layer; whereas others have more than three layers of varying 'fibrillar' orientation. Conspicuous discontinuities in the structural pattern of the cellulose commonly occur in the multiple-layered walls of so-called gelatinous fibers, in certain types of best fibers, and in sclereids. They are due to narrow layers of truly isotropic material which contain little, if any, cellulose. There are five different types of visible concentricities which occur in varying combinations, and may be associated at times with radio-helical or radio-longitudinal lamellae. Therefore, it is misleading and fruitless to attempt to homologize all types of fibers in a single structural model."