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# TROPICAL WOODS

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

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

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### THE PÁO MULATO OF BRAZILIAN AMAZONIA

By ADOLPHO DUCKE

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The name Páo Mulato (Mulatto-wood) is applied to five rubiaceous trees of Brazilian Amazonia, which have smooth, shiny, dark-colored, deciduous bark and yellowish or brownish white wood.<sup>1</sup> Practically the use of the name is limited to the common *Calycophyllum Spruceanum* Benth., as the others are too rare to have any commercial value. Two of the latter group belong to *Calycophyllum* and two to the allied genus *Capirona*; they are often called Páo Mulato da Terra Firme because they grow in the upland ("terra firme") forest,

<sup>1</sup> The name refers to the bark and not to the wood as stated by Schumann in Engler-Prantl's *Pflanzenfamilien* 4: 4: 53 (1897).

whereas the common species is nearly restricted to the alluvial lowlands along the rivers. There are also false Páo Mulato trees, such as *Qualea Dinizii* Ducke (fam. Vochysiaceae), of the upland forest of Faro, and the *Terminalia Obidensis* Ducke (fam. Combretaceae), of the inundable banks of the Rio Púrus, the latter generally known as Páo Mulato Branco (White Mulatto-wood) on account of its light-colored stem. The bark of the false kinds is not nearly so smooth and, although shreddy, not so fully deciduous as that of the true species.

In Perú, all the species of *Calycophyllum* and *Capirona* have the vernacular name Capirona.

1. CALYCOPHYLLUM SPRUCEANUM Benth.—The genuine PÁO MULATO. The biggest and most frequent species, very common in Upper Amazonia and along the whole Amazon River, chiefly in inundable lowlands with fertile clay soil; used locally for timber and firewood. When exported (chiefly to Ceará and Rio de Janeiro, where it is employed in furniture), the timber is known to the trade as PÁO MARFIM (Ivory-wood), but that name must not be confused with the Páo Marfim of the drier upland forest of the Lower Amazon, which is *Aгонандра brasiliensis* Miers (fam. Opiliaceae) and is not exported.

2. CALYCOPHYLLUM ACREANUM Ducke, Arch. Inst. Biol. Veg. Rio de Janeiro 2: 1: 70 (1935).—Upland rain forest of Seringal Iracema, Rio Acre, Acre Territory, March 18, 1933, with flowers and mature fruits, A. Ducke, type in the Herb. Jard. Bot. Rio 24414, cotypes in Berlin, Geneva, Kew, Paris, Stockholm, Washington, and Yale, the last with wood sample 209 (Yale 23671). Common name: PÁO MULATO DA TERRA FIRME.

3. *Calycophyllum obovatum* Ducke, comb. nov. = *Warscewiczia obovata* Ducke, Notizbl. Berlin-Dahlem 11: 106: 475 (1932), Arch. Jard. Bot. Rio 6: 91 (1933).—A species in Amazonia vulgari *C. Spruceanum* differt foliis magnis obovatis, inflorescentiis vulgo longioribus et longius pedunculatis, bracteis parvis, harum superioribus alabastra non includentibus, calice saepissime in uno lobulo lamina foliacea alba obovata basi longe cuneata appendiculato, floribus minoribus; a specie

*C. acreanum* Ducke differt calicis appendice foliaceo, ovario sericeo, corolla puberula. Arbor mediocris ligno sordide albido, trunco ut in specibus citatis polito decorticante, floribus albis, capsulis solum novissimis et vetustis visis quam in specie *C. Spruceanum* longioribus.

Non infrequens locis leviter paludosis silvae humilioris catanga<sup>2</sup> dictae in regione Rio Negro superius Brasiliae civitate Amazonas, legit A. Ducke infra Camanáos 20-11-1929 inflorescentiis novissimis, Herb. Jard. Bot. Rio 22837, et circa cataractam Cajú fluminis Curicuriary, 29-2-1936 inflorescentiis adultis, Herb. Jard. Bot. Rio 29034, cum ligno 266 (Yale 32642). Prope Rio Uaupés inferius visum. Nomen vulgare: PÁO MULATO DA CATINGA.

The flowering plant resembles some species of *Warscewiczia* that are provided with a white foliaceous appendage on one of the calyx lobes (e.g., *W. Schwackei* Schum. and *W. elata* Ducke), but the adult flowers and the capsules are those of a true *Calycophyllum*. Furthermore, its whole stem is smooth and glossy, and its bark, which is green when very young, afterwards red ferruginous and finally dark brown, exfoliates in large strips or laminae. This tree may be considered one of the characteristic elements of the flora of the catingas of the Upper Rio Negro, where it is not rare in slightly swampy places.

4. *CAPIRONA DECORTICANS* Spruce.—A magnificent upland forest tree, with dark red flowers and scarlet calyx appendages, collected by me in the State of Pará: Juruty Velho; State of Amazonas: Porto Velho, Rio Madeira; Acre Territory:

<sup>2</sup> The Amazonian catanga, unlike that of northeastern Brazil, which is a forest of small trees losing their caduceous foliage in the dry season, occurs in localities of much rainfall and no well defined dry season, principally in the Upper Rio Negro region and, but less typical, in some parts of the Solimões (Brazilian Upper Amazon) such as Tonantins and São Paulo de Olivença. It is an evergreen forest always composed of a very great number of species, usually uniformly low or medium-sized, but sometimes with scattered tall trees. The catanga soil is sandy, sometimes rocky, and covered with a thin stratum of humus; in swampy places the humus becomes thick and black-brown, the soil is often hollowed, and stems and branches are densely clad with mosses.

Seringal Iracema, with wood sample 208 (Yale 23670). It also occurs in eastern Perú and in Colombia. Common name: PÁO MULATO DA TERRA FIRME.

5. *CAPIRONA HUBERIANA* Ducke, Arch. Jard. Bot. Rio 3: 257 (1922).—Less showy than the preceding, as it lacks the calyx appendage. Upland forest of the middle Trombetas and the neighboring Rio Branco de Obidos; also near Bellavista below the first rapid of the Tapajoz River.—Common name: PÁO MULATO DA TERRA FIRME.

### Key to the Species of *Calycophyllum*

Bracts foliaceous-membranous, including the young floriferous cymulae; ovary silky; petals pubescent; leaves medium-sized or small.

Calyx with a large white foliaceous appendage on one of its lobules; leaves medium-sized. Central America and Cuba. *C. candidissimum* (Vahl) DC.

Calyx without appendage.

Leaves medium-sized (usually 100–150 by 60–80 mm.). Amazonia.

*C. Spruceanum* Benth.

Leaves small (40–60 by 25–35 mm.). Southwestern Matto Grosso, Paraguay, and northern Argentina. . . . . *C. multiflorum* Griseb.

Bracts very small, not including the flower buds; leaves large (200 by 100 mm., or greater), more or less obovate.

Calyx with a large white foliaceous appendage on one of its lobules. Upper Rio Negro basin. . . . . *C. obovatum* Ducke.

Calyx without appendage. Acre Territory. . . . . *C. acreanum* Ducke.

### A CORRECTION

In the family description of Betulaceae in *Tropical Woods* 48: 10 appears the statement that *Betula* is characterized by "vessels with spirals." In the ordinary use of the term "spirals," meaning helical ridges on the inner wall, that was obviously a mistake, for which I, as editor, was responsible. What was meant is that the vessels of *Betula* have a spiral structure resulting from the diagonal arrangement of the pits and the frequent coalescence of the apertures, as opposed to the horizontal arrangement in *Alnus*.—S. J. R.

## SYSTEMATIC ANATOMY OF THE WOODS OF THE CUPRESSACEAE

By ALAN S. PEIRCE

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The Cupressaceae, as classified by Pilger (1926), are separable into three sub-families, and 16 genera, as follows: I. THUYOIDEAE: *Actinostrobus* (2 species), *Callitris* (20), *Tetraclinis* (1), *Callitropsis* (1), *Widdringtonia* (5), *Fitzroya* (1), *Diselma* (1), *Thujaopsis* (1), *Thuja* (including *Biota orientalis* L.) (6), *Libocedrus* (9), *Fokienia* (3). II. CUPRESSOIDEAE: *Cupressus* (12), *Chamaecyparis* (6). III. JUNIPEROIDEAE: *Arceuthobium* (1), *Juniperus* (60). Genus of doubtful position: *Macrobiota* (1).

The object of the present paper is to summarize the results of an examination of 84 specimens of the wood of 67 out of a total of 130 species, representing all of the genera except *Arceuthobium* and *Macrobiota*. In most instances both heartwood and sapwood were studied. Every feature of possible diagnostic value was recorded without any attempt at generic distinctions until all of the data had been tabulated. The characters which then appeared to be constant for each genus were employed in the construction of a key. The results are not considered final and are submitted in the hope that they will stimulate further research on a wider range of material.

For descriptions of the principal anatomical features used for diagnostic purposes the reader is referred to the author's paper entitled "Anatomical interrelationships of the Taxodiaceae" which appeared in *Tropical Woods* 46: 1–15, June 1, 1936. The terminology is that approved by the International Association of Wood Anatomists (1933). The material used was mostly from the Yale collections and is cited at the end of each generic description; the numbers refer to the Yale serial index, unless preceded by the initials "FM" (meaning Field Museum of Natural History, Chicago).

### General Anatomical Features of the Cupressaceae

*Tracheids*, in cross section, rectangular (Fig. 7), rounded (Fig. 8), or variable; diameter in early wood seldom greater

than  $35\mu$ ; thickness of wall in late wood usually 2 to  $5\mu$ ; transition from early to late wood gradual to abrupt; pitting typically uniseriate throughout, but occasionally biseriate and rarely multiseriate in early wood; pits to ray cells 2 to 4 per cross-field, with elliptic to circular borders and slit-like to narrowly elliptic, vertical to diagonal (Fig. 3) apertures, except in *Tbujja* (Fig. 4) where they are often simple and almost circular; continuous spiral thickenings absent, but special type of thickening present in some species of *Callitris*.

*Rays* variable in height, the maxima ranging from 10 to 40 cells; typically uniseriate, but occasionally some of the rays are partly to wholly biseriate or rarely multiseriate; outline of cells (tangential section) circular, long-elliptic, wide-elliptic, square, or hexagonal; walls without secondary thickening, hence without true pits; transverse walls with occasional to abundant depressed primary pit-fields; tangential walls uniform or with local thickenings (Fig. 1); indentures present (Fig. 2) or absent (Fig. 1); resinous deposits usually abundant in heartwood; ray tracheids typically present normally though usually sporadic and difficult to find (none observed in *Actinostrobus* and *Libocedrus* in part).

*Resin ducts*, either axial or radial, do not occur normally or develop in response to injury.

#### Key to the Genera

- 1 a. Transverse walls of wood parenchyma cells uniform (Fig. 6) . . . . . 2
- b. Transverse walls of wood parenchyma cells irregularly thickened (Fig. 5) . . . . . 9
- 2 a. Transverse walls of ray cells with occasional primary pit-fields . . . . . 3
- b. Transverse walls of ray cells with abundant primary pit-fields . . . . . 7
- 3 a. Tracheids of early wood squared in cross section (Fig. 7) . . . . . 4
- b. Tracheids all rounded in cross section (Fig. 8) . . . . . 5
- 4 a. Mean height of ray cells  $15-17\mu$ ; late tracheids variable in cross section . . . . . 1. *Actinostrobus*.
- b. Mean height of ray cells  $22-25\mu$ ; late tracheids rectangular in cross section . . . . . 5. *Widdringtonia*.
- 5 a. Mean height of ray cells  $25-28\mu$ ; ray cells wide-elliptic to occasionally circular (tang. sect.) . . . . . 4. *Callitropsis*.
- b. Mean height of ray cells  $15-20\mu$ ; ray cells circular to hexagonal . . . . . 6

- 6 a. Tracheid pitting often biseriate in early wood; bands of secondary thickening across tracheid pit-borders in some species (Figs. 9, 10).  
2. *Callitris*.
- b. Tracheid pitting uniseriate; bands of secondary thickening absent . . . . . 3. *Tetraclinis*.
- 7 a. Indentures rare and inconspicuous . . . . . 11. *Libocedrus*.
- b. Indentures regularly present and pronounced (Figs. 2, 3) . . . . . 8
- 8 a. Tangential walls of ray cells smooth . . . . . 10. *Biota*.
- b. Tangential walls of ray cells with local thickenings (Figs. 1, 3).  
15. *Juniperus*.
- 9 a. Indentures regularly present and pronounced (Figs. 2, 3) . . . . . 10
- b. Indentures absent or rare and inconspicuous (Fig. 1) . . . . . 14
- 10 a. Thickenings on transverse walls of wood parenchyma cells sporadic and delicate . . . . . 10. *Biota*.
- b. Thickenings on transverse walls of wood parenchyma cells abundant and pronounced (Fig. 5) . . . . . 11
- 11 a. Tracheid pits to rays simple or bordered, with large apertures (Fig. 4) . . . . . 9. *Tbujja*.
- b. Tracheid pits to rays with broad borders and slit-like apertures (Fig. 3) . . . . . 12
- 12 a. Mean height of ray cells  $22-27\mu$  . . . . . 8. *Tbujopsis*.
- b. Mean height of ray cells less than  $20\mu$  . . . . . 13
- 13 a. Transverse walls of ray cells of medium thickness; tangential usually smooth, local thickenings occasional . . . . . 13. *Cupressus*.
- b. Transverse walls of ray cells thick, with numerous, distinct primary pit-fields; tangential with abundant local thickenings.  
15. *Juniperus*.
- 14 a. Tangential walls of ray cells with delicate local thickenings (Figs. 1, 3) . . . . . 15
- b. Tangential walls of ray cells smooth (Fig. 2) . . . . . 17
- 15 a. Mean height of ray cells  $18-20\mu$ ; rays seldom over 12 cells high; tracheid pitting uniseriate . . . . . 7. *Diselma*.
- b. Mean height of ray cells  $22-27\mu$ ; rays often up to 20-24 cells; tracheid pitting occasionally biseriate . . . . . 16
- 16 a. Cross-field pits  $6-8\mu$  in diameter; ray cells sparingly resinous.  
6. *Fitzroya*.
- b. Cross-field pits  $4-5\mu$  in diameter; ray cells strongly resinous.  
11. *Libocedrus*.
- 17 a. Mean height of ray cells  $22-27\mu$  . . . . . 11. *Libocedrus*.
- b. Mean height of ray cells less than  $20\mu$  . . . . . 18

- 18 a. Ray cells predominantly hexagonal (tang. sect.); transverse walls of ray cells usually with abundant primary pit-fields. . . . 12. *Fokienia*.  
 b. Ray cells circular to long-elliptic, rarely hexagonal (tang. sect.); transverse walls of ray cells with only occasional primary pit-fields.  
 14. *Cbamacyparis*.

### Descriptions of the Genera

#### 1. ACTINOSTROBUS

Tracheids of early wood squared in cross section, those of late wood variable; pitting strictly uniseriate; cross-field pitting as in family description. Rays 1-24 cells high; occasionally partly biseriate; cells circular to long-elliptic, occasionally squared or hexagonal (tang. sect.); mean height 15-17 $\mu$ ; transverse walls with occasional primary pit-fields, the tangential smooth; indentures absent; resinous contents common; no ray tracheids seen. Wood parenchyma fairly abundant, distribution variable; transverse walls smooth. (*A. acuminatus* Parl., 16595; *A. pyramidalis* Miq., 15478, 15966.)

#### 2. CALLITRIS

Tracheids of early and late wood rounded in cross section; pitting occasionally biseriate in early wood; bands of secondary thickening present across the borders of tracheid pit-pairs in some species (Figs. 9, 10). Rays 1-36 cells high; uniseriate, or occasionally biseriate in part; cells circular to hexagonal, occasionally long-elliptic (tang. sect.); mean height 15-18 $\mu$ ; transverse walls with occasional primary pit-fields, the tangential smooth; indentures absent; resinous contents abundant, especially in heartwood; normal ray tracheids present. Wood parenchyma abundant, distribution variable, mostly scattered; transverse walls smooth and entire. (*C. arenosa* A. Cunn., 19418; *C. calcarata* R. Br., 2641; *C. glauca* R. Br., 9902; *C. intratropica* Benth., 16551; *C. rhomboidea* R. Br., 16364; *C. robusta* R. Br., 16365.)

#### 3. TETRACLINIS

Tracheids all rounded in cross section; pitting strictly uniseriate; bands of secondary thickening lacking; cross-field

pitting as in family description. Rays 1-24 cells high; sometimes partly biseriate; cells circular to hexagonal in cross section; mean height 18-20 $\mu$ ; transverse walls with occasional primary pit-fields; the tangential smooth; indentures absent; cells mostly resinous; ray tracheids present. Wood parenchyma fairly abundant, distribution variable, mostly scattered; transverse walls smooth. (*T. articulata* [Vahl] Masters, 14442.)

#### 4. CALLITROPSIS

Tracheids all rounded in cross section; pitting occasionally biseriate in early wood; cross-field pitting as in family description. Rays 1-24 cells high; sometimes partly biseriate; wide-elliptic to circular (tang. sect.); mean height of ray cells 25-28 $\mu$ ; transverse walls with occasional primary pit-fields; the tangential smooth; indentures absent; cells usually resinous, especially in heartwood; ray tracheids present. Wood parenchyma fairly abundant, distribution variable, mostly scattered; transverse walls smooth and entire. (*C. araucarioides* Compton, 15967.)

#### 5. WIDDRINGTONIA

Tracheids all rectangular in cross section; pitting strictly uniseriate; cross-field pitting as in family description. Rays 1-24 cells high; occasionally biseriate in part; cells circular to hexagonal, occasionally long-elliptic (tang. sect.); mean height of ray cells 22-25 $\mu$ ; transverse walls with occasional primary pit-fields; the tangential smooth; indentures absent; cells usually resinous; ray tracheids present. Wood parenchyma moderately abundant, distribution variable; transverse walls smooth. (*W. juniperoides* [L.] Endl., 14918; *W. Schwartzii* [Marloth] Masters, 23133.)

#### 6. FITZROYA

Tracheids variable in shape in cross section; pitting often biseriate in early wood; cross-field pitting as in family description. Rays 1-12 cells high, occasionally higher; sometimes more than half of them biseriate; cells circular to hexagonal (tang. sect.); mean height 24-26 $\mu$ ; transverse walls with regu-

larly abundant primary pit-fields; the tangential with delicate local thickenings; indentures absent or rare and inconspicuous; cells occasionally resinous; ray tracheids present (Fig. 13). Wood parenchyma moderately abundant, distribution extremely variable; transverse walls with delicate local thickenings. (*F. cupressoides* [Molina] Johnston, 20563, 21065, 23550.)

#### 7. DISELMA

Tracheids all rectangular in cross section; pitting strictly uniseriate; cross-field pitting as in family description, the pits small. Rays 1-12 cells high; occasionally more than half of them biseriate; cells circular (tang. sect.); mean height 18-20 $\mu$ ; transverse walls with regularly abundant primary pit-fields; the tangential with delicate local thickenings; indentures absent; cells non-resinous for the most part; ray tracheids present. Wood parenchyma abundant, distribution variable; transverse walls regularly with delicate local knob-like thickenings. (*D. Archeri* J. D. Hook., 27044.)

#### 8. THUJOPSIS

Tracheids all rectangular in cross section; pitting occasionally biseriate in early wood; cross-field pitting as in family description, the pits small. Rays 1-24 cells high; sometimes more than half of them biseriate; cells circular to long-elliptic (tang. sect.); mean height 22-27 $\mu$ ; transverse walls with abundant primary pit-fields; the tangential usually smooth; indentures regularly present and very pronounced; cells occasionally resinous; ray tracheids present. Wood parenchyma abundant, distribution variable; transverse walls regularly with coarse local thickenings. (*T. dolobrata* [L.f.] Sieb. & Zucc. FM1112, FM268924.)

#### 9. THUJA

Tracheids all rectangular in cross section; pitting sometimes biseriate in early wood; pits of the cross-field elliptic, horizontal to diagonal, often simple or with large apertures (Fig. 4). Rays 1-12 cells high, sometimes higher; occasionally partly biseriate; cells long-elliptic (tang. sect.); mean height

16-19 $\mu$ ; transverse walls with abundant primary pit-fields; the tangential usually smooth, local thickenings rare; indentures regularly present and pronounced; cells usually moderately resinous to non-resinous; ray tracheids present. Wood parenchyma moderately abundant, distribution variable, usually scattered; transverse walls with delicate to somewhat coarse local knob-like thickenings. (*T. koraiensis* Nakai, 9368; *T. occidentalis* L., FM72042; *T. plicata* D. Don, FM1669; *T. Standisbii* [Gord.] Carr., FM93251.)

#### 10. BIOTA

Tracheids all rectangular in cross section; pitting occasionally biseriate in early wood; cross-field pitting as in family description. Rays 1-24 cells high; sometimes partly biseriate; cells circular to wide-elliptic, occasionally hexagonal (tang. sect.); mean height 13-15 $\mu$ ; transverse walls with regularly abundant primary pit-fields; the tangential smooth; indentures regularly present and pronounced; cells usually resinous; ray tracheids present. Wood parenchyma moderately abundant, distribution variable, usually scattered; transverse walls usually smooth, sometimes with few delicate local thickenings. (*B. orientalis* [L.] Endl., 6553.)

#### 11. LIBOCEDRUS

Tracheids all rectangular in cross section; pitting sometimes biseriate in early wood; cross-field pitting as in family description, the pits small. Rays 1-24 cells high; occasionally more than half of them biseriate; cells circular, sometimes long-elliptic or hexagonal (tang. sect.); mean height 22-27 $\mu$ ; transverse walls regularly with primary pit-fields; the tangential smooth or with extremely delicate and inconspicuous thickenings; indentures absent or sporadic; cells usually resinous; ray tracheids present (Fig. 12) or absent. Wood parenchyma abundant, distribution variable; transverse walls usually smooth, but with delicate or somewhat coarse knob-like thickenings in some species. (*L. Bidwillii* Hook., 5157; *L. chilensis* [Don] Endl., 1764, 3761; *L. decurrens* Torrey, FM613277; *L. macrolepis* [Kurz] Benth., FM270111; *L. papuana* F. Muell., 27233; *L. uvifera* [Don] Pilger, 3768.)

## 12. FOKIENIA

Tracheids rectangular in cross section; pitting strongly biseriolate, especially in early wood; cross-field pitting as in family description. Rays 1-24 cells high; sometimes partly biseriolate; cells predominantly hexagonal (tang. sect.); mean height 17-18 $\mu$ ; transverse walls occasionally to regularly with primary pit-fields; the tangential smooth; indentures absent or sporadic and inconspicuous; cells resinous to non-resinous; ray tracheids present or absent. Wood parenchyma abundant, distribution occasionally banded tangentially, usually scattered; transverse walls commonly with delicate local knob-like thickenings. (*F. Hodginsii* [Dunn] Henry & Thomas, 12921; *F. Maclurei* Merrill, 23080.)

## 13. CUPRESSUS

Tracheids variable in shape in cross section; pitting uniseriate, occasionally biseriolate in early wood; cross-field pitting as in family description. Rays variable in height, up to 36 cells; occasionally partly biseriolate; cells predominantly circular (tang. sect.); mean height 15-20 $\mu$ ; transverse walls with regularly abundant primary pit-fields; the tangential usually smooth, occasionally with local thickenings in a few species; indentures regularly present to sporadic, but always pronounced; cells strongly resinous; ray tracheids present (Fig. 14). Wood parenchyma abundant, distribution variable, usually scattered; transverse walls with usually delicate, occasionally somewhat coarse, knob-like thickenings. (*C. arizonica* Greene, 14784; *C. funebris* Endl., 21756; *C. Goveniana* Gordon, FM01702; *C. lusitanica*, var. *Benthami* Carr., 7489; *C. Macnabiana* Murray, FM01703; *C. macrocarpa* Gordon, FM01701; *C. sempervirens* L., FM272164; *C. torulosa* D. Don, FM614364.)

## 14. CHAMAECYPARIS

Tracheids rectangular in cross section; pitting uniseriate to biseriolate in early wood, rarely multiseriolate; cross-field pitting as in family description. Rays 1-24, infrequently 1-12, cells high; rarely partly biseriolate; cells circular to hexagonal, occasionally long-elliptic (tang. sect.); mean height 15-19 $\mu$ ;

transverse walls sometimes with primary pit-fields; the tangential smooth; indentures absent or rare and inconspicuous; cells usually non-resinous, occasionally slightly resinous; ray tracheids present, sometimes numerous (Fig. 16). Wood parenchyma abundant, often banded tangentially, occasionally scattered; transverse walls with sporadic to regular local knob-like thickenings. (*C. formosensis* Matsumura, 24065; *C. Lawsoniana* [Andr.] Parl., FM31; *C. nootkatensis* [Lamb.] Spach, 11289; *C. obtusa* Sieb. & Zucc., FM270108; *C. pisifera* Sieb. & Zucc., FM93249; *C. thyoides* L. B.S.P., FM612762, FM01700.)

## 15. JUNIPERUS

Tracheids of variable form in cross section; pitting uniseriate, or in early wood sometimes biseriolate or even multiseriolate in a few species; cross-field pitting as in family description. Rays variable in height; strictly uniseriate to partly biseriolate at times; cells circular to long-elliptic, occasionally hexagonal (tang. sect.); mean height 14-17 $\mu$ ; transverse walls thick, many primary pit-fields; the tangential with knob-like local thickenings; indentures regularly present and pronounced; cells usually resinous, especially in heartwood; ray tracheids present (Figs. 11, 15). Wood parenchyma sparse to abundant, scattered or banded tangentially; transverse walls typically with knob-like local thickenings, but smooth and entire in *J. Oxycedrus* and *J. rigida*. (*J. Asbei* Buchholz, 26629; *J. barbadensis* L., FM74285; *J. californica* Carr., 11296; *J. chinensis* L., 23038; *J. communis* L., 16488, 28580; *J. communis*, var. *montana* Aiton, 23174; *J. excelsa* Bieb., 22908; *J. gracilior* Pilger, 4145; *J. lucayana* Britton, 16748; *J. monosperma* Sarg., 11299; *J. occidentalis* Hook., 11300, FM01705; *J. Oxycedrus* L., 14443; *J. pachyphloea* Torrey, 11304, FM01704; *J. phoenicea* L., 14444; *J. polycarpus* C. Koch, 9760; *J. procera* Hochst., 16522; *J. rigida* Sieb. & Zucc., 10237; *J. sabina* L., 23165; *J. scopulorum* Sarg., 11306; *J. semiglobosa* Regel, 22940; *J. squamata*, var. *fargesia* Rehder & Wilson, 23057; *J. thurifera* L., 14445; *J. turkestanica* Komarov, 22941; *J. utabensis* Lemmon, 11307; *J. virginiana* L., 11308, FM72520; *J. Wallichiana* Hook.f. & Thoms., 3830.)



### Discussion

Normal ray tracheids were found, though not always without considerable search, in all of the 67 species examined except in *Actinostrobus* (both species), *Libocedrus Bidwillii*, *L. macrolepis*, *L. papuana*, and *Fokienia Hodginsii*, although Holden (1913), after a detailed study, reports them lacking in *Diselma*, *Fitzroya*, *Biota*, *Libocedrus chilensis*, *Cupressus torulosa*, *Chamaecyparis obtusa*, *Juniperus macrocarpa*, and *J. utabensis*. Holden further reported only traumatic tracheids in the rays of *Chamaecyparis pisifera*, *C. thyoides*, *Cupressus Goveniana*, *C. lusitanica*, var. *Benthami*, *C. Macnabiana*, *C. macrocarpa*, and *Libocedrus decurrens*, whereas the present writer observed ray tracheids in all of these species occurring in connection with such regular histography (Figs. 12, 14), as to preclude traumatic origin. Tang (1933) reports the absence of tracheids in the rays of five species of Chinese Cupressaceae, but the present writer's material of those species contains them. Kanehira (1926) observed no ray tracheids in nine members of the family, in all but one of which they were found during this investigation.

The occurrence in *Chamaecyparis nootkatensis* of low rays composed entirely of tracheids (Fig. 16) has been noted by Penhallow (1907), Record (1934), and Brown and Panshin (1934). Similar structures exist, although they are not nearly so common, in the present writer's material of *Cupressus arizonica*, *C. lusitanica*, var. *Benthami* (Fig. 14), and *Fitzroya cupressoides* (Fig. 13).

A recent study of the origin of ray cells by Bannan (1934) is of interest here because he found ray tracheids in all the genera of the Cupressaceae he studied, namely *Callitris*, *Chamaecyparis*, *Cupressus*, *Juniperus*, *Libocedrus*, *Thuja*, and *Widdringtonia*. Since, however, he did not list the species, a close comparison with this work is not possible. Furthermore, the present investigation was largely confined to old wood, whereas Bannan's interest was primarily with new rays and the younger parts of old rays in specimens of all ages, as well as with the oldest regions next the pith. The combined results indicate that the distribution of ray tracheids is too general to have much significance.

Indentures in ray cells were described in a previous paper (Peirce, 1936) and used to advantage with the Taxodiaceae. Slyper (1933) employed the feature sparingly in a key to coniferous woods, but his separation of *Thuja* and *Biota* on that basis is not substantiated, since indentures are regularly present and pronounced in the material studied for this report.

Fujioka (1913) called attention to the fact that in *Juniperus* the transverse walls of the ray cells are appreciably thicker than in the other genera and contain many depressed primary pit-fields. His expression "Juniperus-pitting," which has been used by many subsequent investigators, was shown by Bailey and Faull (1934) to be inappropriate because the ray cells of the Cupressaceae have only modified primary walls and hence are without pits in the usual meaning of the term.

Within this family, as in the Taxodiaceae, both the type of transition from early to late wood and the distribution of wood parenchyma are too variable to be of any positive diagnostic worth. Pitting in the radial walls of the tracheids ranges from typically uniseriate to occasionally biseriate and rarely multiseriate, the latter condition being found in a single specimen of *Chamaecyparis*.

The reduction or disappearance of the border from the pits where the tracheids are in contact with ray cells makes *Thuja* unique in its type of cross-field pitting (Fig. 4), but the genus is easily identified as cupressaceous by the remaining family characteristics.

The cell-height of rays is usually an inconstant feature. Tang (1933) reports 11 cells as the maximum he observed in *Biota*, whereas the present writer found rays up to 21 cells high in the material of that monotypic genus. Wide fluctuations in ray height were long ago noted by Essner (1883) and more recently by Shimakura (1936), and it must be concluded that only extremely low or high rays can be assigned any diagnostic value.

The transverse walls of the wood parenchyma cells afford the major distinctions within the Cupressaceae. Possessing smooth walls are four species of *Libocedrus*, two of *Juniperus*, and all of *Actinostrobus*, *Callitris*, *Tetraclinis*, *Callitropsis*, and *Widdringtonia*. The last five genera constitute a particularly

homogeneous group, since each is also characterized by only occasional primary pit-fields on the transverse walls of ray cells. With the exception of *Chamaecyparis*, the remaining ten genera, including *Libocedrus* and *Juniperus*, are well supplied with these primary pit-fields, and all ten are characterized by knob-like local thickenings on the transverse walls of the wood parenchyma. The latter character varies intergenerically as to abundance, but with not the degree of constancy desired for reliable generic distinction. It will be noted that the main lines of distinction revealed by this anatomical study do not conform closely with the classification proposed by Pilger (1926).

In the first group of five genera, further distinctions may be made on the basis of the form of the tracheids in cross section and the average height of the ray cells, as may be noted in the key.

The primary division of the second group of ten rests on the presence or absence of indentures. The depressions may be easily observed in the ray cells of *Biota*, *Thuja*, *Tbujopsis*, *Cupressus*, and *Juniperus*, but they are either lacking altogether or very inconspicuous in *Diselma*, *Fitzroya*, *Libocedrus*, *Fokienia*, and *Chamaecyparis*. Among the other features of the ray cells which are useful in separating genera are mean height, relative abundance of primary pit-fields on the transverse walls, and the occurrence of local thickenings on the tangential walls.

The cross-field pitting of *Biota* shows no departure from the family type, whereas the four species of *Thuja* examined display consistently the modification already noted (Fig. 4). Moreover, the tangential walls of the ray cells of *Thuja* possess occasional local thickenings, while those of *Biota* are smooth. These features serve effectually to distinguish the two, at least anatomically as independent genera.

Florin (1930) has proposed that *Libocedrus uvifera* (Don) Pilger be made the type of a new genus which he named *Pilgerodendron*. Examination of the wood has failed to disclose any features that would warrant giving generic status to that species and not to some of the others, for *Libocedrus* as a whole is comparatively heterogenous.

### Summary

From a study of 84 wood samples of 67 species representing 15 genera of the family Cupressaceae a diagnostic key has been prepared, together with descriptions of the genera.

Ray tracheids were found in all but six of the species. The general distribution of these cells minimizes the significance that formerly was imputed to them in classifying the members of the family.

The Cupressaceae is separable into two groups on a basis of the sculpture of the transverse walls of the wood parenchyma cells. A group of five genera (*Actinostrobus*, *Callitris*, *Tetralclinis*, *Callitropsis*, and *Widdringtonia*) lacks the thickenings so characteristic of the others. Within the latter group the occurrence of indentures in the transverse walls of the ray cells constitutes a character of relatively high generic importance. The division of the family on an anatomical basis does not conform closely with Pilger's classification.

*Biota*, often designated as a subgenus or section of *Thuja*, is considered, on anatomical grounds, worthy of generic rank. The outstanding distinction is that the pits in the tracheid walls where in contact with the rays have wide borders and narrow apertures in *Biota*, whereas they are simple or narrowly bordered, with large apertures, in *Thuja*.

Usual variability is encountered in this family as to the type of transition from early to late wood, distribution of wood parenchyma, and most measurement data. However, the height of ray cells has proved in most instances a useful criterion.

Appreciative acknowledgment is made to Professor JOHN T. BUCHHOLZ, University of Illinois, for his helpful guidance of the investigation; to Professor SAMUEL J. RECORD, Yale University School of Forestry, who supplied most of the specimens and edited the manuscript; and to Mr. LLEWELYN WILLIAMS, Field Museum of Natural History, and Dr. ELLWOOD S. HARRAR, Duke University, Durham, North Carolina, for additional material.

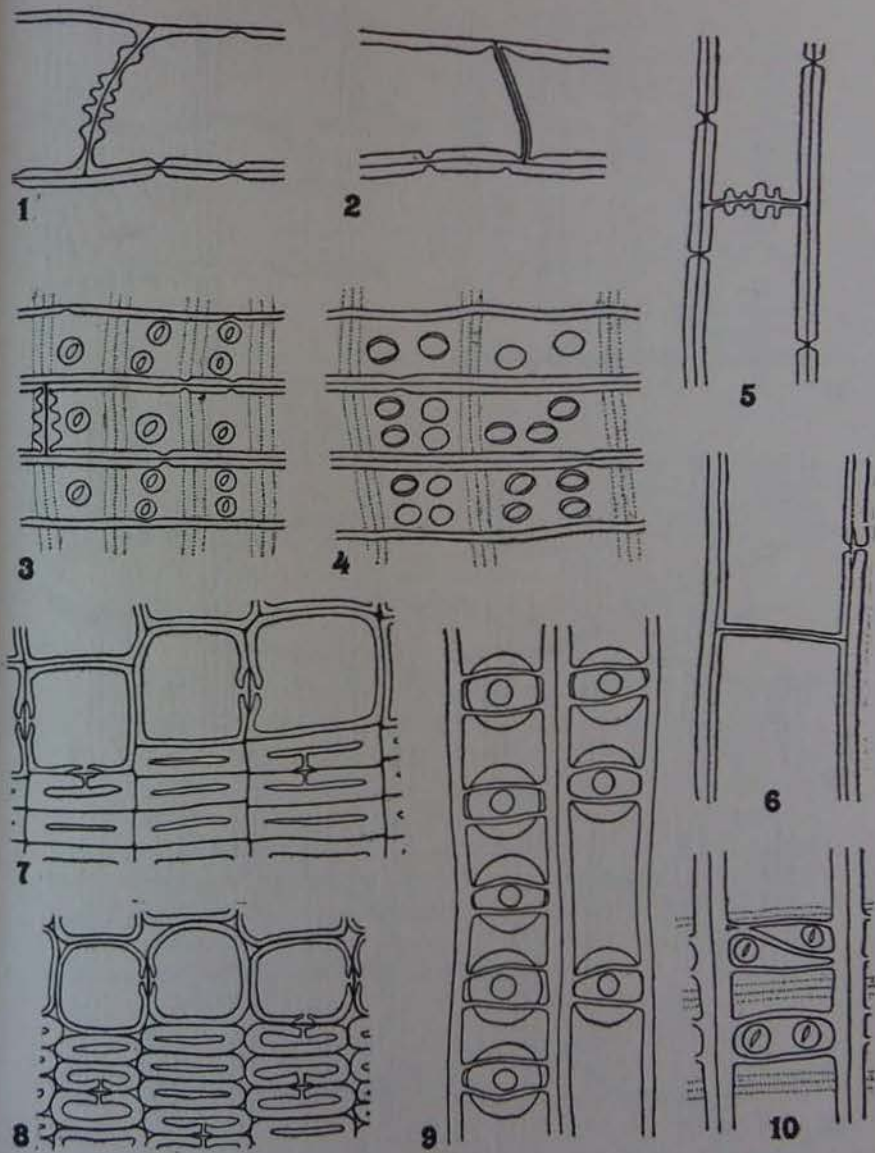
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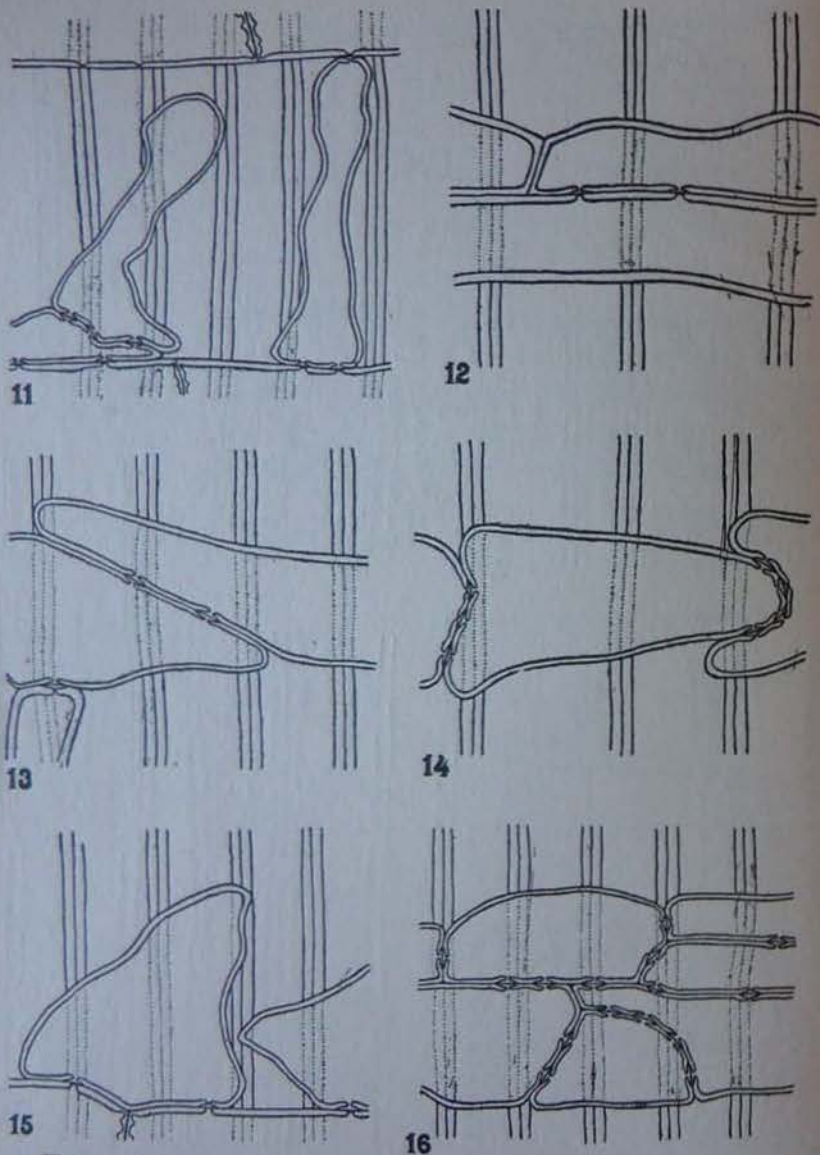
## Explanation of Figures

All figures approximately 500 X.

- Fig. 1. *Fitzroya cupressoides*. Radial section, showing knob-like local thickenings on the tangential walls of ray cells. Notice the lack of indentures.
- Fig. 2. *Cupressus Macnabiana*. Radial section, with indentures portrayed prominently. Contrast with Fig. 1.



Figs. 1-10. Anatomical details of certain woods of the Cupressaceae.



Figs. 11-16. Types of ray tracheids in the Cupressaceae. Details of vertical tracheids omitted.

Fig. 3. *Juniperus Asbei*. Radial section, illustrating cross-field pitting typical of the family in general.

Fig. 4. *Tbija Standisbii*. Radial section, showing cross-field pitting typical of *Tbija*.

Fig. 5. *Juniperus virginiana*. Tangential section, showing the primary pit-fields in the transverse walls of wood parenchyma cells; the pit-fields are circular in face view.

Fig. 6. *Actinostrobus pyramidalis*. Tangential section, showing smooth and entire transverse walls of wood parenchyma cells.

Fig. 7. *Cbamaecyparis formosensis*. Cross section, showing rectangular outline of tracheids.

Fig. 8. *Cupressus arizonica*. Cross section, showing rounded outline of tracheids.

Fig. 9. *Callitris glauca*. Radial section, showing peculiar bands of secondary thickenings traversing the borders of pit-pairs.

Fig. 10. *Callitris calcarata*. Radial section, showing the nature of the cross-fields resulting from the presence of the bands shown in Fig. 9.

Figs. 11-16. Ray tracheids in radial view. Details of vertical tracheids omitted. 11. *Juniperus utabensis*. 12. *Libocedrus decurrens*. 13. *Fitzroya cupressoides*. 14. *Cupressus lusitanica*, var. *Benthami*. 15. *Juniperus cbinensis*. 16. *Cbamaecyparis nootkatensis*.

#### PERMANENT PREPARATIONS OF MACERATED WOOD FIBRES

The following method of preparing permanent stained preparations of macerated wood fibres has been developed in the Wood Structure Section of the Forest Products Research Laboratory of Great Britain. Small chips of wood are treated with Schultze's macerating mixture (nitric acid and potassium chlorate) in the usual way until they are sufficiently soft for the fibres to be teased apart. The chips are then washed in several changes of water to remove all trace of acid, then thoroughly dehydrated in several changes of alcohol. Staining is effected by transferring the chips to a one per cent solution of light green in 75 parts of clove oil and 25 parts of absolute alcohol. The application of gentle heat facilitates the penetration of the stain. After about ten minutes the material is removed from the staining reagent and any excess of the stain is drained off with filter paper. A chip is then placed on a glass slide with a few drops of thin Canada balsam in xylol, when the fibres can be teased apart with needles in the usual

manner. Finally, the cover glass is placed in position and when the balsam has partially hardened the preparation can be pressed and cleaned. Remarkably clear macerations may be prepared by this method in a very short time.—G. L. FRANKLIN.

## THE YALE WOOD COLLECTIONS

### Accessions

At the end of the calendar year 1936 the total number of catalogued wood samples in the Yale wood collections amounted to 33,730, representing 10,651 named species of 2592 genera of 227 families. There were 1911 accessions during the year. The largest contributions were from Australia (700) and the Federated Malay States. The sources of all the wood samples received are as follows:

AFRICA: R. S. Bacon Veneer Co., Chicago (*Madagascar*); Miss M. M. Chattaway, Imperial Forestry Institute, Oxford (*Port Elizabeth, South Africa*); Prof. A. Chevalier, Paris (*West Africa*); Greene Trading Co., Inc., New York (*East Africa*); Mahogany Association, Inc., Chicago (*Gold Coast*); Mauritius Forest Department, Curepipe (*Mauritius*); Mr. C. H. Pearson, New York (*Mombasa*); Dr. E. P. Phillips, Dept. Agr. and Forestry, Pretoria (*N. E. Transvaal, Zululand*).

ARGENTINA: Dr. L. Chalk, Imperial Forestry Institute, Oxford.

AUSTRALIA: Mr. H. E. Dadswell, Council for Sci. and Ind. Research, South Melbourne.

BRAZIL: Mr. Arthur de Miranda Bastos, Serviço Florestal do Brasil, and Dr. Adolpho Ducke, Jardim Botânico, Rio de Janeiro.

BRITISH GUIANA: Conservator of Forests, Mazaruni Station.

BRITISH HONDURAS: Conservator of Forests, Belize.

CHINA: Mr. Y. Tang, Fan Memorial Institute, Peiping; Mr. Ching Wan, Honan University, Kaifeng.

COLOMBIA: Mr. A. Dugand G., Barranquilla.

COSTA RICA: Rev. Ralph E. Danforth, West Boylston, Massachusetts.

DOMINICAN REPUBLIC: Mr. J. G. Scarff, San Pedro de Macoris.

DUTCH GUIANA: Mr. R. H. G. McArthur, Paramaribo.

ECUADOR: Dr. A. Rimbach, Riobamba.

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

HAWAII: Bernice P. Bishop Museum, Honolulu.

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

JAPAN: Dr. R. Kanehira, Kyushu Imperial University, Fukuoka; Prof. N. Yamabayashi, Agr. and For. College, Suigen, Chosen; Prof. Fumihiko Sekiya, Miye College of Agr. and For., Tsu-shi, Miye-ken; Prof. Kametaro Ohara, Nagoya Commercial College; Prof. M. Fujioka, Tokyo Imperial University; Prof. Gazen Kano, Taihoku Imperial University, Formosa; Mr. Rudolph Block, London, England.

MEXICO: Prof. Helia Bravo H., Univ. Nat. de México, México, D. F.

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

NEW ZEALAND: Mr. C. E. Foweraker, Christchurch.

PANAMA: Canal Zone Experiment Gardens, Balboa Heights.

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

PHILIPPINE ISLANDS: Bureau of Forestry, Manila.

TURKESTAN: Prof. J. Rafalski, University of Poznań, Poland.

U. S. A.: Dr. A. H. Graves, Brooklyn Botanic Garden; Dr. John K. Small, N. Y. Botanical Garden; Mr. R. W. Hess, Dr. H. F. Marco, and Mr. W. L. Mitchell, New Haven, Conn.; Mr. Wm. F. Koch, Haverhill, New Hampshire; Mr. George N. Lamb, Chicago, Ill.; Mr. H. L. Lewis, Carlsbad, New Mexico; Mr. S. R. MacDonald, Wallingford, Conn.; Penrod, Jurden & Clark Company, St. Louis, Mo.

U. S. S. R.: Mr. A. Yatsenko-Khmelevsky, Tiflis.

VENEZUELA: Dr. H. Pittier, Caracas.

## Genera Added January 1-December 31, 1936

ACANTHACEAE	COMBRETACEAE	Tetranthera
Barleria	Ramatouella	LEGUMINOSAE
Eranthemum	COMPOSITAE	Arthrosamanea
Isoglossa (slide)	Anaphalis	Bergeronia
AMARANTACEAE	Cosmos	Brasilettia
Pfaffia	Ericentrodea	Chamaefistula
ANACARDIACEAE	Faujasia	Lespedeza
Blepharocarya	Polymnia	Libidibia
Drimycarpus (slide)	Proustia	Mildbraediendendron
Nothopegia	CONVOLVULACEAE	Muelleria
ANONACEAE	Maripa	Rhynchosia
Alphonseopsis	CRASSULACEAE	Rothia
Brieya	Bryophyllum	Schefferodendron
Dennettia	EUPHORBIACEAE	Senegalia
Fissistigma	Alchorneopsis	Styphnolobium
Griffithia	Aporosella	Vachellia
Unona	Blachia	Zuccagnia
APOCYNACEAE	Conceveibastrum	LOGANIACEAE
Carruthersia	Dactylostemon	Bonyunia
Diplorrhynchus (slide)	Emblia	LORANTHACEAE
Ichnocarpus	Gavarretia	Gaiadendron
Neocouma	Lebedieropsis	MALPIGHIACEAE
Pagiantha	Scortechinia	Glandonia
Vallaris (slide)	Senefeldera	Lophanthera
Vallesia	Sumbavia	Ptilochaeta
ARALIACEAE	FLACOURTIACEAE	MELASTOMACEAE
Brassaia	Bennettia	Astronidium
Gamblea	GUTTIFERAE	Loreya
ARISTOLOCHIACEAE	Marila	Rhynchanthera
Pararistolochia (slide)	Poeciloneuron	MONIMIACEAE
BIGNONIACEAE	HAMAMELIDACEAE	Xymalos
Mayodendron	Disanthus	MORACEAE
BORAGINACEAE	Eustigma	Naucleopsis
Saccellium	Fothergilla	MYRTACEAE
BURSERACEAE	Parrotia	Ananomis
Balsamodendron	Rhodoleia	Myrrhinum
Boswellia	Sinowilsonia	Nelitris
CAPPARIDACEAE	ICACINACEAE	Pareugenia
Atamisquea	Merrilliodendron	NEUMANNIACEAE
Boscia	Phlebocalymna	Neumannia
Cadaba (slide)	JULIANIACEAE	NYCTAGINACEAE
Niebuhrria (slide)	Amphipterygium	Reichenbachia
CELASTRACEAE	LAURACEAE	OLACACEAE
Plenckia	Hypodaphnis	Worcesterianthus

OLEACEAE	Einsteinia	Monttea
Nyctanthus	Kotchubaea	Wightia
ONAGRACEAE	Morelia	SOLANACEAE
Oenothera	Oxyanthus	Brunfelsia
PALMACEAE	Pelagodendron	Grabowskya
Calamus	Retiniphyllum	Sessea
Licuala	Trukia	STERCULIACEAE
Paurotis	RUTACEAE	Argyrodendron
Ptychosperma	Adiscanthus	Buettneria
Serenoa	Balsamocitrus	Pterygota
POLYGALACEAE	Nycticalanthus	STYRACACEAE
Moutabea	SANTALACEAE	Huodendron
PROTEACEAE	Choretum	Lissocarpa
Hicksbeachea	Scleropyrum	THYMELAEACEAE
RHAMNACEAE	SAPINDACEAE	Ovidia
Ampelozizyphus	Athyana	TRIGONIACEAE
Cormonema	Diplokeleba	Trigoniastrum
ROSACEAE	Hemigyrosa	ULMACEAE
Docynia	Lecaniodiscus	Hemiptelea
Kageneckia	Sarcopteryx	VERBENACEAE
Pseudocydonia	SAPOTACEAE	Holmskioldia
RUBIACEAE	Niemeyera	VIOLACEAE
Cosmibuena	SCROPHULARIACEAE	Alsodeia
	Antirrhinum	

## Sections for Microscopic Study

During 1936 there were added to the slide collections cross, radial, and tangential sections of 1009 specimens representing 599 named species, 326 genera, and 92 families, making a total (after allowing for duplications) of 6244 specimens of 3140 named species, 1342 genera, and 175 families. Some of these were prepared in the Yale laboratories; others were obtained by purchase or in exchange, the principal sources during 1936 being: Mr. H. E. Desch, Forest Research Institute, Federated Malay States; Prof. R. H. Wetmore, Harvard University; Dr. L. Chalk, Imperial Forestry Institute, Oxford.

## Specimens Distributed

There were distributed during the year 840 wood specimens, mostly for use in connection with specific scientific projects now under way or in preparation. (See *Tropical Woods* 45: 27.)

## SYSTEMATIC ANATOMY

**Anacardiaceae.** To Dr. R. Kanehira, Imperial Forestry Institute, Fukuoka, Japan: 1 sample each of *Blepharocarya*, *Camptosperma*, *Cotinus*, *Melanochyla*, *Notbopegia*, and *Spondias*; 5 samples of 4 spp. *Holigarna*. To Mr. W. N. Watkins, U. S. National Museum, Washington, D. C., 2 samples, 2 spp. *Schinopsis*.

**Apocynaceae.** To Prof. Fernando Romano Milanez, Serviço Florestal do Brasil, Rio de Janeiro, 3 samples, 3 spp. *Aspidosperma*.

**Aquifoliaceae.** To Mr. L. Williams, Field Museum, Chicago, 3 samples, 2 spp. *Byronia*; 65 samples, 36 spp. *Ilex*; 1 sample, 1 sp. *Nemopantbes*; 2 samples *Sphenostemon*.

**Erythroxylaceae.** To Mr. Harry R. Muegel, University of Cincinnati, Ohio, 2 samples, 2 spp. *Erythroxylon*.

**Euphorbiaceae.** To Dr. R. Kanehira, 1 sample each of *Euphorbia*, *Garcia*, *Gavarettia*, *Hymenocardia*, *Maprounea*, and *Phyllanthus*; 2 samples, 1 sp. each of *Homalanthus*, *Mallotus*, *Ostodes*; 3 samples, 2 spp. each of *Excoecaria*, *Macaranga*; 17 samples, 10 spp. *Glochidion*.

**Humiriaceae.** To Mr. Harry R. Muegel, 1 sample each of *Saccoglottis* and *Vantanea*.

**Linaceae.** To Mr. Harry R. Muegel, 1 sample each of *Ociboccosmus* and *Roucheria*.

**Loganiaceae.** To Prof. R. A. Cockrell, University of Michigan, Ann Arbor, 1 sample *Strychnos*.

**Lythraceae.** To Prof. Juljan Rafalski, University of Poznań, Poland, 1 sample *Physocalymma*.

**Podocarpaceae.** To Prof. Charles E. Foweraker, Canterbury University College, Christchurch, 1 sample *Dacrydium falciforme*; 2 samples *Phyllocladus hypophyllus*; 4 samples, 3 spp. *Podocarpus*.

**Trochodendraceae.** To Dr. K. M. Gupta, Bewar, Rajputana, India, 10 samples (stem and root) of *Trochodendron aralioides*.

**Vitaceae.** To Mr. H. E. Dadswell, Council for Sci. and Ind. Research, South Melbourne, Australia, 3 samples *Leea angulata*.

## SPECIAL PROJECTS AND EXCHANGES

To Mr. H. E. Dadswell, 378 samples, 59 families, 224 genera, 210 species of Mr. J. H. L. Waterhouse's New Guinea woods, in exchange.

To Dr. L. Chalk, Imperial Forestry Institute, Oxford, 192 samples: Betulaceae (1), Corylaceae (1), Dichapetalaceae (1), Fagaceae (3), Gonystylaceae (1), Hydrangeaceae (1), Leguminosae (1), Loganiaceae (1), Malpighiaceae (2), Melastomaceae (1), Moraceae (1), Onagraceae (6), Papaveraceae (5), Passifloraceae (8), Pittosporaceae (3), Plantaginaceae (1), Plumbaginaceae (1), Primulaceae (1), Rosaceae (1), Rubiaceae (2), Rutaceae (2), Santalaceae (4), Scrophulariaceae (17), Solanaceae (54), Staphyleaceae (6), Suriniaceae (3), Theophrastaceae (5), Thymelaeaceae (18), Trochodendraceae (1), Umbelliferae (4), Vacciniaceae (15), Valerianaceae (4), Violaceae (3), Vitaceae (14).

To Mr. K. A. Chowdhury, Forest Research Institute, Dehra Dun, India, 50 samples: Amygdalaceae (3), Guttiferae (10), Leguminosae (32), Monimiaceae (1), Rutaceae (1), Sapindaceae (2), Tiliaceae (1).

To Prof. R. H. Wetmore, Harvard University, 66 samples: Akaniaceae (1), Chlaenaceae (1), Connaraceae (3), Hamamelidaceae (24), Melianthaceae (5), Moraceae (1), Myrothamnaceae (1), Passifloraceae (1), Rubiaceae (4), Ulmaceae (25), Urticaceae (1).

## CURRENT LITERATURE

**The reclamation of the Everglades with trees.** By JOHN C. GIFFORD. Pp. 92; 4¼ x 6¾. Books Inc., New York, Boston, 1935. Sold by University of Miami, Coral Gables, Florida. Price 50¢ net.

A discussion of natural conditions in the Everglades of Florida, with suggestions for use of native and introduced trees in their economic improvement. Among the principal trees discussed are Elderberry, Cocoplum, Custard Apple, Cypress, Pine, Pencil Cedar, native rubber trees, Australian Pine, Cajeput, Mahogany, Spanish Cedar, Cocopalm, Bam-

boo, Sweet Gum, and Candlenut. There is also a list of trees of minor importance that may in time find a place in Everglade economy. The book contains a large amount of interesting information regarding Florida physical conditions and trees.—P. C. STANDLEY.

**The rehabilitation of the Floridan Keys.** By JOHN C. GIFFORD. Pp. 79; 4¼ x 6¾. Books Inc., New York, Boston, 1934. Sold by University of Miami, Coral Gables, Florida. Price 50¢ net.

The book contains a large amount of information regarding the Floridan Keys, with incidental mention of trees occurring there. Chapters are devoted to the Floridan Keys, Floridan Barrier Reef, Everglades National Park, Bahaman Delta, the mission of Dinner Key, and various other subjects.—P. C. STANDLEY.

**Washingtonia.** By L. H. BAILEY. *Gentes Herbarum* (Ithaca, N. Y.) 4: 53-82; figs. 28-45; December 1936.

The palm genus *Washingtonia*, which has received varied treatment as to generic name and division into species, consists of two species, *W. filifera* Wendl. and *W. robusta* Wendl., of southwestern United States and northwestern Mexico. The species are discussed and described in detail, with many excellent and illuminating illustrations.

**Flora of Jamaica. Vol. VII. Dicotyledons, families Rubiaceae to Compositae.** By SPENCER LE MARCHANT MOORE and A. B. RENDLE. Pp. vi and 303; 100 figs. British Museum (Natural History), London; July 25, 1936.

This is the last in order of the volumes of Fawcett and Rendle's *Flora of Jamaica*, although several of the earlier numbered volumes remain to be published. In form the present part is like the earlier ones, which in scope and detail of treatment have no rivals among volumes devoted to vegetation of the West Indies. In fact, among all works of recent years devoted to the flora of tropical America, the *Flora of Jamaica* can be compared only with Pulle's *Flora of Surinam*, and both works may well serve as models for later floras.

The families treated in Volume VII are Rubiaceae, Caprifoliaceae, Campanulaceae (including Lobeliaceae), and Goodeniaceae (1 genus and species). One species of each genus is illustrated. Most plants of the 41 genera of Rubiaceae are trees and shrubs, the larger genera being *Psychotria*, *Portlandia*, *Rondeletia*, *Hamelia*, and *Palicourea*.—P. C. STANDLEY.

**Contribución al estudio de las palmas de Cuba. Género Copernicia II.** By HERMANO LEÓN. *Memorias de la Soc. Cubana Hist. Nat.* (Habana) 10: 203-226; pls. 9-12; November 1936.

The present paper is a continuation of the author's former account of the Cuban species of *Copernicia*, 24 species being now recognized. A key is provided for their segregation, and notes are published regarding many of the older species. New species and varieties are *C. longiglossa*, *C. Clarkii* (vernacular name Jato Macho), *C. Sueroana*, var. *semiorbicularis* (Jato), *C. Molinetti*, var. *cuneata*, *C. glabrescens*, var. *bavanensis* (Jata), *C. occidentalis* (Guano Blanco), *C. yarey*, var. *robusta*, *C. humicola* (Yarey), *C. Brittonorum*, var. *acuta* (Yarey de Costa), *C. Brittonorum*, var. *sabaloense* (Guano Yarey), *C. Baileyana*, var. *laciniosa*.—P. C. STANDLEY.

**Contributions to the flora of tropical America. XXVII. Notes on the Mexican species of the genus Bursera.** By A. A. BULLOCK. *Kew Bull. Misc. Information* 346-387; 1936.

A key is given for the Mexican species of *Bursera*, which are listed alphabetically with critical notes, and citation of specimens examined and vernacular names. There are brief economic notes, and a bibliography of literature relating to economic uses and anatomy. New species are *B. coyucensis*, *B. Hintoni*, *B. trifoliolata* (local names Quincanchire, Copal), *B. trimera*, and *B. velutina*.—P. C. STANDLEY.

**Contributions to the flora of tropical America. XXVIII. Species novae vel minus cognitae mexicanae Hintonianae.** By A. A. BULLOCK. *Kew Bull. Misc. Information* 387-392; 1936.

*Eurya Hintoni* is described from Mexico, a tree of 10 meters. Notes are given regarding several species of *Eurya* and



*Ternstroemia*. Vernacular names reported are Trompillo (*Ternstroemia Pringlei* Standl.) and Capulincillo (*Eurya syphilitica* Szyszyl.).

**Informe sobre las plantas de las Islas Mariás.** By JESÚS GONZÁLEZ ORTEGA. *Boletín de Pro-Cultura Regional* (Mazatlán, Mexico) 2: 2: 5-9; 1936.

A brief account of the author's visit to the Islas Mariás off the west coast of Mexico in February 1935. A list is given of plants known from the islands, based upon the author's collections and those of earlier visitors.

**Observaciones florísticas y geobotánicas en el valle de Actopan.** By HELIA BRAVO H. *Anales Inst. Biol.* (Mexico) 7: 169-233; 27 figs.; 1936.

The author gives chiefly tabular information regarding composition of characteristic plant societies of the Valley of Actopan, and includes a systematic list of plants known from the region. Vernacular names are listed for many species. Numerous excellent photographs afford a good idea of the general aspect of the vegetation of the area.

**Notes on North American Araliaceae.** By A. C. SMITH. *Brittonia* (New York) 2: 247-261; November 1936.

Notes regarding various species of North American Araliaceae, with numerous reductions to synonymy. New species are *Gilibertia oligantha* (Guatemala), *G. Schippii* (British Honduras), *Sciadophyllum robustum* (Costa Rica), *Oreopanax ramosissimum* (Martinique), *O. Standleyi* (Costa Rica).

**A note on the genus *Themistoclesia* K1.** By A. C. SMITH and W. H. CAMP. *Brittonia* 2: 263-264; November 1936.

Brief notes regarding the classification of the genus *Themistoclesia* (Ericaceae). A new combination, *Vaccinium laxum*, is based upon *Tbibaudia laxa* A. C. Smith.

**The genus *Cestrum* in Guatemala.** By C. V. MORTON. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 17: 341-349; October 1936.

*Cestrum* is represented in Guatemala by 16 species, 5 of which are described as new. A key is provided for their separation.

**A new species of *Acer* from Guatemala.** By ALFRED REHDER. *Journ. Arnold Arboretum* 17: 350-351; October 1936.

*Acer Skutchii*, a tree of 20 meters, described from Guatemala, is related to *A. nigrum* and *A. saccharum* of the United States.

**Arboles y arbustos notables o poco conocidos del Departamento del Atlántico. II serie.** By ARMANDO DUGAND G. *Boletín de Agricultura y Ganadería* (Barranquilla, Colombia) 2: 6: 27-40; illustrated; April 1936.

The author describes, often with economic notes, the following woody plants of northern Colombia: *Anona purpurea* (vernacular names Guanábano Pun, Matimba, Gallina Gorda), *Aspidosperma ellipticum* (Amargo), *Tabernaemontana psychotriifolia* (Huevos de Verraco, Cojón de Toro, Cojón de Fraile), *Rauwolfia heterophylla* (Cruceto), *Sciadodendron excelsum* (Madura Plátano), *Tabebuia carysea* (Roble, Roble Amarillo), *T. coralibe* (Alumbre, Coralibe, Arco, Coralibe de Arco, Polvillo), *T. Billbergii* (Coralibe, Lumbre, Alumbre), *Arrabidaea sanctae-marthae* (Bejuco Real, Pintabollo), *Cavanillesia platanifolia* (Macondo), *Cordia alliodora* (Canalete de Humo), *C. gerascantoides* (Canalete Prieto), *Bursera Simaruba* (Almácigo, Carate, Caratero, Resbala Mono, Indio Desnudo, Indio en Cuero), *Stuebelia nemorosa* (Calabazuelo, Calabacito, Calabazuero).—P. C. STANDLEY.

**Notas sobre algunas Euforbiáceas.** By H. DANIEL. *Boletín del Colegio de San José* (Medellín, Colombia) 37: 3-11; illustrated; 1936.

Descriptive and economic notes regarding various plants, chiefly Euphorbiaceae, of the Department of Antioquia, Colombia. Among the species listed are *Hura crepitans* (vernacular names Arenillero, Jabillo, Milpesos), *Rhus juglandifolia* (Manzanillo), *Hippomane mancinella* (Manzanillo),

*Sapium giganteum* (Caucho Blanco), *Erythrina edulis* (Chachafruto), *Acalypha bispida* (Gusano), *Acalypha heterodonta* (Barbas de Guasco), *Boehmeria caudata* (Barbas de Guasco), *Alchornea polyantha* (Escobo), *Croton* spp. (Drago), *Croton malambo* (Malambo), *Poinsettia pulcherrima* (Moño), *Phyllanthus salviaefolius* (Cedrillo).—P. C. STANDLEY.

**Consideraciones acerca de la destrucción de los bosques y del incendio de las sabanas.** By H. PITTIER. *Bol. Sociedad Venezolana de Ciencias Naturales* (Caracas) 26: 1-12; 1936.

"In none of the Spanish-American countries that I have had the opportunity of visiting have I noted such deplorable conditions in regard to destruction of forests and sterilization of soil as in the central valleys of Venezuela. The vandalism of fire and axe continues on every side; the devastated area increases from day to day, and if not controlled, within a few generations the whole country will have become an unproductive, semidesert region." The principal causes of this condition are the wasteful system of clearing land for agriculture, annual burning of the savannahs, and grazing by large numbers of goats. In some places the forests have been cut to the very summits of the mountains, with a consequent great diminution in permanent water supply.—P. C. STANDLEY.

**Studies of the vegetation of the Suriname savannahs and swamps.** By J. LANJOUW. *Med. Bot. Mus. Univ. Utrecht* 33: 823-851; 16 photos; 1936.

The author discusses the various uses of the term savannah and proposes the following definition: "Savannahs are plains in the West Indian islands and northern South America covered with more or less xeromorph herbs and small shrubs and with few trees or large shrubs." It is suggested that the Surinam savannahs originated from tropical rain forest, modified by edaphic and, to less extent, climatic conditions. The true savannah vegetation is a "fire climax."

There is a general description of the swamps in the western part of Surinam, together with lists of the species. Three main "associations" are recognized.

**Oiticica: the tree and its homeland.** By CHARLES HOLDT. *Drugs, Oils & Paints* (Philadelphia) 51: 11; November 1936.

The author, general chemical superintendent of Oiticica S.A., offers observations on *Licania rigida* based on a personal tour of inspection of the principal places in northeastern Brazil where this tree is found in considerable number, viz., the valley of the Yaguaribe in Ceará, and of Apody and Assú in Rio Grande do Norte.

The fruit consists of a nut similar in shape to the pecan, but more pointed at the ends and enclosed in a thin shell. The nuts vary from 2.5 cm. long on some trees to 6 cm. long on others. They consist of 27 to 40 per cent of shell (average about 35), the balance kernel, which contains approximately 60 to 63 per cent of oil. Even relatively small trees will yield 200 to 1000 pounds of nuts regularly.—B. E. DAHLGREN, *Field Museum of Natural History*.

**Plantas indigenas e exoticas provenientes da Amazonia, cultivadas no Jardim Botânico do Rio de Janeiro.** By P. CAMPOS PORTO. *Rodriguésia* (Rio de Janeiro, Brazil) 2: 93-157; illustrated; 1936.

The article consists of a systematic list of Amazonian plants cultivated in the Botanic Garden of Rio de Janeiro. Most of the species treated are trees and shrubs, for many of which descriptive or economic notes are provided, often with vernacular names. Many of the plants are illustrated.

**Woods of northeastern Peru.** By LLEWELYN WILLIAMS. *Field Museum Bot. Ser.* (Chicago) Vol. XV. Pp. 587; 6¼ x 9½; 2 maps, 18 text figs.; Dec. 31, 1936.

This large, well-printed report is based upon a study of about 2500 wood samples collected with herbarium material by the author in 1929-30. The first part (pp. 1-60) gives an account of the country visited—the geography, climate, population, forests, and the principal timbers and their uses. The bulk of the work (pp. 60-509) is devoted to the woods. "The sequence of the families is according to the classification of Engler and Prantl, and the genera and species within the families are arranged alphabetically. The general plan fol-

lowed is to describe each family on the basis of material collected, giving the principal characters of the leaves, flowers, and fruits. This is followed by a summary of the salient structural features of the dried woods, including descriptions of the physical properties, the macroscopic characters discernible without any other mechanical aids than a sharp knife and a simple lens magnifying fourteen diameters, and the main microscopic features—type of vessel perforations and vessel pitting, type of rays, fiber pitting, and extraordinary structure—which can be used as bases for identification. This is repeated for the genera. In the case of the species, consideration is given to the dimensions of the tree or shrub, its habitat, local uses, physical properties, and structure of its wood, and the place where collected, indicated according to department and locality, followed by the collector's number."

Following the descriptions are 16 "tables of anatomical characters of Peruvian woods," some of which give the results of the author's own observations while others are largely compiled from published reports and are not always in accord with the text. There is a check list of vernacular names (pp. 536-567), a bibliography of works pertaining to the Peruvian flora and forest products, and a general index. The book represents a great amount of work and adds much to the knowledge of a previously poorly known part of South America.

**Note sur deux Méliacées.** By J. BRIQUET. *Candollea* (Geneva) 6: 20-21; January 1935.

*Guarea yungasana* is described as new from Bolivia. *Trichilia fodinii* is a new name, having as synonyms *Celastrus fodinii* Steud. and *T. cuneifolia* Urb.

**Studies in the Apocynaceae. VI.** By ROBERT E. WOODSON, JR. *Philippine Journ. Science* (Manila) 60: 205-231; pl. 1; July 1936.

Relationships of the foveolate-leaved genera of Echioideae are discussed, and a systematic account is given of the genus *Kitabalia*, represented by 18 species of trees and shrubs of tropical Asia and Malaysia. New species are *Malouetia Bequaertiana* (Belgian Congo), *Kitabalia luzonensis* (Luzon),

*K. Elmeri* (Philippine Islands), *K. Merrilliana* (Leyte). Several species are transferred to *Kitabalia* from other genera.

**Notes on the genus *Schima* and on the classification of the Theaceae-Camellioideae.** By H. K. AIRY-SHAW. *Kew Bull. Misc. Information* 496-499; 1936.

The writer criticizes the treatment by Melchior (1935) in Engler's *Pflanzenfamilien*, of the genus *Schima*, indicating various corrections and describing as new *S. Forrestii* from Yunnan, China. Criticism is made also of the same author's treatment of the family as a whole. Anatomical work by Beauvisage has shown that the tribes Bonnetieae and Pelliceriae are each sufficiently distinct from the Theaceae (*sensu strictu*) to warrant family rank, and that the genus *Asteropeia* belongs in the Flacourtiaceae where it was originally placed. There is strong evidence that *Tetramerista* is a member of the Marcgraviaceae. The author offers a modified version of Melchior's arrangement of the brachyantherous Theaceae.—P. C. STANDLEY.

**Otto Kuntze's new genera and new species of Indo-China plants.** By E. D. MERRILL. *Brittonia* (New York) 2: 189-200; November 1936.

The author reports upon types of new species, many of them representing woody plants, collected by Otto Kuntze in Annam in 1875 and described by him in 1891.

**Timber tests: Meranti bakau (*Shorea rugosa* Heim).** By A. V. THOMAS. *Malayan Forester* (Kuala Lumpur) 5: 4: 183-188; October 1936.

"*Shorea rugosa* is the commonest tree in some of the fresh water swamps on the west side of the Malay Peninsula, as many as 12 to 15 mature trees (over 4 ft. 6 inches in girth) to the acre having been enumerated in one locality, while even over fairly large areas the stocking has been estimated as 7 trees per acre, though this is not by any means typical of all swamp areas."

"The timber of Meranti Bakau is not quite so attractive in appearance as the softer Merantis, and if it is liable to fre-

quent attack by boring beetles, as is believed to be the case, it is unlikely that this timber will ever be exported in any quantity, except for the lower grade market. On the other hand, the data for mechanical properties show that Meranti Bakau is considerably superior to Meranti of the *Shorea leprosula* type and ranks equal, if not superior, to *Shorea Curtisii*. There is no doubt that Meranti Bakau is suitable for moderately heavy constructional work, general building purposes, boatbuilding, etc., but in exposed positions, or where it came in contact with the ground, it would be necessary to protect it by preservative treatment. A few preliminary experiments indicated that it is not very amenable to preservative treatment, but that under pressure it might absorb preservatives as readily as Seraya (*Shorea Curtisii*), in which case it could be used as railway sleepers, provided the present service tests on the timber of *Shorea Curtisii* prove satisfactory."

**Terminal and initial parenchyma cells in the wood of *Terminalia tomentosa* W. & A.** By K. AHMAD CHOWDHURY. *New Phytologist* (Cambridge, Eng.) 35: 4: 351-358; 2 plates; Oct. 28, 1936.

"A study of the wood of *Terminalia tomentosa* W. & A. on living trees shows that the concentric bands of parenchyma which delimit the growth rings are formed as the first tissue of a seasonal growth. It is, therefore, incorrect to call them terminal parenchyma. Occurrence of parenchyma cells at the extreme early wood of a diffuse-porous wood is recorded for the first time, and it is proposed to call them initial parenchyma, indicating their position in a growth ring. A somewhat similar distribution has been known for a long time to occur in ring-porous woods but so far no special nomenclature has been applied to it. For the sake of uniformity in description it is also proposed to call it initial parenchyma. In diffuse-porous woods when the exact position of concentric parenchyma cells, which delimit the growth rings, is difficult to determine, it is advisable to describe them as *initial or terminal*. The final classification will always depend on the study of these woods on living trees. In view of the discrep-

ancies in the use of the terms paratracheal, metatracheal, diffuse and terminal, the characteristics on which the classification of the parenchyma cells are based are discussed in detail and certain suggestions are made regarding the restricted use of these terms in order to standardize the anatomical description of woods.—*Author's summary.*

**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.** By B. P. G. HOCHREUTINER. *Candollea* (Geneva) 6: 399-488; Jan. 9, 1936.

Most of the species listed and annotated are herbaceous plants, but there are included ligneous plants, chiefly from Java, in the families Myristicaceae, Saxifragaceae, Rosaceae, Connaraceae, Sabiaceae, Epacridaceae, Loganiaceae, Asclepiadaceae, Meliaceae, Rhizophoraceae, and Oleaceae.

**Ecological observations on the rain forest of Mount Dulit, Sarawak. Parts I, II.** By P. W. RICHARDS. *Journ. Ecology* (Cambridge, Eng.) 24: 1: 1-37, February 1936; 24: 2: 340-360, August 1936; 4 plates, 7 text figs.

"The ecological work described in the following paper was carried out from August to December 1932, when the author was a member of the Oxford University Expedition to Sarawak. A general account of the work of the Expedition has been given by T. H. Harrisson (1933). The chief aim of the ecological survey was to collect data for a detailed comparison of a typical area of rain forest in the eastern tropics with the area in British Guiana, which had previously been studied by T. A. W. Davis and the present writer (1933, 1934)."

#### SUMMARY

"An account is given of the chief types of primary forest in the neighborhood of a sandstone escarpment (height about 1400 m.) in the interior of northwestern Borneo (lat. 3°19' N.). Two climatic climaxes are recognized, the mixed lowland rain forest climax below and the montaine rain forest or moss forest climax above a line running at about 970-1100 m. The

lowland rain forest climate is typically equatorial; the mean temperature being 26–27° C. with an insignificant seasonal range, the rainfall heavy and evenly spread through the year, the humidity of the air usually high, though the saturation deficit may be of the order of 12 mm. at midday. The climate of the moss forest is cooler (mean temp. 21–22° C.) and probably even more humid under normal conditions, though during a dry spell a saturation deficit of as great as 17 mm. was reached. Cloud and mist are characteristic.

The structure of the mixed lowland rain forest is described and illustrated by means of scaled diagrams based on clear-felling plots. Three strata of trees of average heights about 34, 18, and 8 m., respectively, are present and below these there is an undergrowth of shrubs, herbs and young trees. Societies of climbers, epiphytes and saprophytes are also distinguished. Observations were made on the internal climate of the mixed forest and it was found that the gradients of temperature and saturation deficit were steady without any abrupt change at any level. The floristic composition of the two taller tree strata was investigated on a sample plot by listing all trees over 8 in. (20 cm.) diam. by their vernacular names. At least 98 species were found on the plot and no one species formed as much as 5 per cent of the total. A large proportion of the bigger trees belonged to the Dipterocarpaceae.

"In addition to the mixed forest, there was a peculiar type of primary lowland rain forest on white sand soils which is regarded as an edaphic climax and to which the name heath forest is provisionally given. It differs strikingly from the mixed forest in the denser, better illuminated undergrowth, scarcity of buttressed trees and very different floristic composition. Sample plots showed that the number of species per unit area was smaller and that there was a marked tendency towards the dominance of a single species, the most abundant species forming 15 per cent of the total on one plot and 12 per cent on the other. The conifer *Agathis alba* Lam. was a characteristic tree. This type of forest showed many remarkable analogies to the Wallaba forest of British Guiana.

"The moss forest clearly belonged to Schimper's class of temperate rain forests. The trees were never more than 15–18 m. high on the average and lacked buttresses and

other morphological features characteristic of tropical rain forest. The lower parts of the trunks were thickly covered with Hepaticae. In spite of the moist climate the foliage of the trees showed marked xeromorphic features. The floristic composition was entirely different from that of the lowland rain forest and a large proportion of genera of Australasian affinities was present. A closed forest, an open forest and a scrub facies are distinguished."

**Check-lists of the forest trees and shrubs of the British Empire. No. 2. Nyasaland Protectorate.** By Imp. For. Institute (Oxford) and Forest Dept. Nyasaland. Pp. 111; 5½ x 8½; December 1936.

"The present list is a first edition, based primarily on the extensive collection made by Dr. Burt Davy on the Imperial Forestry Institute expedition of 1929. To this have been added the large supplementary collections made by the Conservator and Assistant Conservators of Forests, Nyasaland."

"As it stands, the list contains much information of practical value, which will enable an officer to correlate the major portion of the vernacular names of trees with their botanical equivalents, and thus to speak and write of them intelligently."

"The description of the forests, which has been drawn up by Mr. P. Topham, Assistant Conservator of Forests, is simple and brief so as to conform with the general purpose of the first edition. Ecological notes are accumulating for a fuller account, to appear in a subsequent edition."

**New Angolan species of *Monotes*.** By HELEN BANCROFT. *Bol. Soc. Broteriana* 11 (2nd ser.); 43–45; 1936.

Two species of small trees of the Monotoideae section of the Dipterocarpaceae are described as new: *Monotes Dawei* Bancroft and *M. Pearsonii* Bancroft.

**New species of *Monotes* from Angola.** By HELEN BANCROFT. *Journ. Botany* (London) 74: 225–226; August 1936.

The new species, *Monotes Noldeae* Bancroft, is a large tree known in Angola as m'Bula.

A new *Coffea* from Portuguese East Africa, with ecological notes on the genus. By C. M. F. SWYNNERTON and W. R. PHILIPSON. *Journ. Botany* 74: 314-322; fig.; November 1936.

*Coffea salvatrix* is described as new. Extensive notes are given regarding ecology of this species, *C. ligustroides* and *C. Swynnertonii*.

Die Gattung *Clerodendrum* in Afrika. By BERTHOLD THOMAS. *Bot. Jahrb.* (Leipzig) 86: 1-106; 1936.

The genus *Clerodendrum* is discussed in great detail, especially as regards morphology, and a key is provided for separation of the 134 species known from Africa. These are listed with citation of literature and specimens examined. Fourteen species are described as new.

Tropical African Plants. XIV. *Kew Bull. Misc. Information.* 469-488; 1936.

Among the new species are *Dovyalis xanthocarpa* Bullock (Tanganyika), *Grewia filiformis* Bullock (Kenya Colony), *Pachystela subverticillata* Bruce (Kenya Colony, a timber tree), *Ixora ulugurensis* Brem. (Tanganyika Territory), *Lasianthus Wallacei* Bruce (Tanganyika Terr., the native name Mgemamondo), *Pavetta constipulata* Brem. (Tanganyika Terr., Lusigisi), *P. filistipulata* Brem. (Tanganyika Terr., Vutavuta), *P. sparsipila* Brem. (Tanganyika Terr., Mlengolengo), *Tarenna quadrangularis* Brem. (Tanganyika Terr., Mfiro), *Anisotes dumosus* Milne-Redhead (Tanganyika Terr., Msagara).

La flore forestière de la Côte d'Ivoire. (In three vols.) By A. AUBRÉVILLE. Paris: Larose Éditeurs. Pp. (I) 1-307, (II) 1-296, (III) 1-285; 9 x 11; 3 folded maps; 351 plates (drawings); 1936.

By virtue of his position as chief inspector of waters and forests of the French colonies and qualified both as a forester and a botanist, the author has had unusual opportunity for extensive field and laboratory investigations in collaboration with noted taxonomists and members of the forest service.

The result is a splendid work of great usefulness to all concerned with tropical West African forests, trees, and timbers.

Following an interesting introduction there is a concise summary of the general features of the Ivory Coast forest and the relationship to neighboring formations. Next comes an analytical key to the families, and 46 lists giving the occurrence of special characters of the trees. For each family in turn there is a general statement, followed by keys first to the genera and then to the species. About 600 tree species are described with reference to their morphology, ecology, range, utilization, and local and trade names. The 351 large plates show the general appearance and details of leaves, flowers, and fruits.

Natural compression-failures in timber. By B. J. RENDLE. *Empire Forestry Journal* 15: 2: 182-189; 1 plate; 1936.

"A number of well-known commercial timber trees are liable to be affected by cross-fractures, variously known to the trade by the names thunder-shake, lightning-shake, wind-shake, heart-shake, heart-break, cross-break, and upset. In the United Kingdom the defect is probably most familiar in certain grades of African Mahogany (*Khaya ivorensis*), but it is by no means confined to this species. Apparently it is especially prone to develop in tropical timber trees of relatively low strength, or at least in those parts of the tree which are below average strength, but it is also found in trees of the subtropical and temperate zones. . . .

"The examination of cross-fractures in specimens of a dozen or more species, in the form of sawn boards of various sizes, shows that the defect is nearly always of the same general nature. In its most pronounced form it appears as irregular zig-zag fractures running across the grain at intervals of a few inches to several feet apart. The intensity varies from a slight microscopic buckling of the cell walls to a complete cross-fracture of the fibers, such that when the timber is sawn into small dimensions a board may fall into two pieces along the line of the fracture. In severe cases longitudinal splits are associated with the cross-fractures. Failures which are not apparent to the naked eye can sometimes be observed if the

surface of the sawn timber is wetted; accordingly when suspicious consignments are being inspected it is the practice to sprinkle the boards with water from a watering can in order to detect defective material. So far as can be determined the failures invariably occur near the center of the logs. In every case microscopic examination shows that the so-called shake consists of a buckling of the fibers all in the same direction, exactly as occurs when wood yields under longitudinal compression (parallel to the grain). Such compression may not only be brought about by a load directly applied in the direction of the grain, but may also be produced on the concave side of a piece of wood subjected to a bending force, in which case the buckling is greatest at the surface (where the compression is most severe) and diminishes towards the center. It is important to note that the compression-failure manifests itself before the wood is completely fractured and whilst it is still capable of sustaining a considerable load. Having regard to the facts, it is proposed to use the term *compression-failure*, or *natural compression-failure*, for these defects, as being a more accurate description of their real nature than the names in general use.

"Various suggestions have been made, either directly or by implication, to account for compression-failures in freshly converted, green timber. . . . To sum up, natural compression-failures appear to be due to wind-action or other external force bending the trunk of the tree during the comparatively early years of its life. But there are still a few points which are not adequately met by that simple—perhaps too simple—explanation. . . . It is proposed to continue the investigation of further material as opportunity presents itself. In the meantime it is hoped that this record of laboratory observations will provoke foresters to put forward any relevant views based on field experience."

**Systematic anatomy of the woods of the Simarubaceae.** By IRMA E. WEBBER. *American Journ. Botany* 23: 9: 577-587; 77 figs. (photomicrographs); November 1936.

"The family Simarubaceae comprises approximately 32 genera and 200 species of tropical and subtropical woody

plants closely related to the Rutaceae. Many members of the family are characterized by bitter taste, but the family is often spoken of as characterless because of the absence of an external or internal morphological character that is constant throughout the group. The range of variation within the Simarubaceae has led to considerable divergence of opinion concerning the relationships of various genera within the family as well as to the limitations of the family. The present investigation was undertaken to ascertain the extent to which a knowledge of the structure of the woods might be helpful in solving questions concerning the classification of the group."

"The most recent comprehensive account of the Simarubaceae is that given by Engler (1931) and outlined below. In this list the asterisk (\*) marks genera which were represented by woods in the present investigation. . . .

"Subfamily 1. SURIANOIDEAE: *Suriana*\*, *Cadellia*\*, *Guilfoylia*\*, *Rigiotachys*. Subfamily 2. SIMARUBOIDEAE: *Mannia*\*, *Samadera*\*, *Hyptiandra*, *Simaruba*\*, *Simaba*\*, *Odyndea*\*, *Quassia*\*, *Hannoa*\*, *Eurycoma*\*, *Harrisonia*\*, *Castela*\*, *Holacantha*\*, *Brucea*\*, *Perriera*, *Picrasma*\*, *Aescbrion*\*, *Picrella*, *Picrolemma*, *Ailanthus*\*, *Soulamea*\*, *Hebonga*, *Amaroria*\*. Subfamily 3. KIRKIOIDEAE: *Kirkia*\*. Subfamily 4. IRVINGIOIDEAE: *Klainedoxa*\*, *Irvingia*\*, *Desbordesia*\*. Subfamily 5. PICRAMNIOIDEAE: *Picramnia*\*. Subfamily 6. ALVARADOIDEAE: *Alvaradoa*\*. Imperfectly known genera which apparently belong to the Simarubaceae: *Pteronema*, *Marupa*. Excluded genus: *Picrodendron*\*."

#### SUMMARY

"The characteristics of 117 wood specimens, representing 58 species of the Simarubaceae [obtained from the Yale University collections], have been studied in relation to Engler's major taxonomic divisions of the family. The anatomy of the woods representing each of the subfamilies Surianoideae, Simaruboideae, Kirkioideae, Irvingioideae, Picramnioideae, and Alvaradoideae, and the excluded genus *Picrodendron*, is described in detail and compared in key form. From the standpoint of wood anatomy each of the subfamilies Kirkioideae, Irvingioideae, and Alvaradoideae represents a distinct, homogeneous group, whereas the Surianoideae shows some diversity, and the Simaruboideae exhibits rather wide variation. Wood structure of the Surianoideae supports

Solereder's abolition of the monotypic family Surianaceae, his close grouping of *Suriana* and *Cadellia*, and his withdrawal of *Guilfoylia* from *Cadellia*. Within the Simaruboideae, the wood structure of *Holacantha* and *Castela* differs markedly from that of all other genera. However, the difference does not support Jadin's erection of the monotypic family Holacanthaceae, since *Castela* resembles *Holacantha*. The excluded genus *Picrodendron*, formerly included in the Irvingioideae, bears considerable resemblance to the members of this subfamily in wood structure."

#### KEY TO THE WOODS OF THE SIMARUBACEAE

- 1 a. Septate fiber-tracheids the dominant element of the wood. Vessels filled with tyloses. . . . . Kirkioidae.
- b. Septate fiber-tracheids absent or of scattered occurrence. Vessels without tyloses. . . . . 2
- 2 a. Libriform wood fibers the dominant element of the wood. . . . . 3
- b. Fiber-tracheids the dominant element of the wood. . . . . 6
- 3 a. Libriform wood fibers mostly more than  $1500\mu$  long. Vessels mostly moderate-sized to rather large; often filled with tyloses. . . Irvingioideae.
- b. Libriform wood fibers mostly considerably less than  $1500\mu$  long. Vessels mostly extremely small to small; empty or with gummy contents. . . . . 4
- 4 a. Rays often storied, mostly uniseriate, some biseriate. Fiber-tracheids of scattered occurrence. Libriform wood fibers with moderately wide lumina . . . . . Surianoideae.
- b. Rays not storied; of two distinct size classes, uniseriate and multi-seriate, the latter commonly as many as 5 cells wide. Fiber-tracheids lacking. Libriform wood fibers with lumina nearly obliterated. . . . 5
- 5 a. Vascular tracheids absent. Vessels without spirals.  
*Picrodendron* (excluded genus).
- b. Vascular tracheids rather common. Smaller vessels with spirals.  
*Holacantha* and *Castela* (Simaruboideae).
- 6 a. Vascular tracheids rather common. . . . . Alvaradoideae.
- b. Vascular tracheids absent or very rare. . . . . 7
- 7 a. Normal wood parenchyma readily visible with microscope, rather sparse to moderately abundant, adjoining vessels and also often in tangential bands; the cells frequently septate and crystalliferous.  
Simaruboideae other than *Holacantha* and *Castela*.
- b. Normal wood parenchyma lacking or not readily visible; small patches of traumatic parenchyma often present. . . . . Picramnioideae.



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# TROPICAL WOODS

NUMBER 50

JUNE 1, 1937

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## TROPICAL WOODS

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June 1, 1937

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

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

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### IDENTIFICATION OF WOODS WITH INCLUDED PHLOEM

By L. CHALK AND M. M. CHATTAWAY  
*Imperial Forestry Institute, Oxford*

De Bary (3) and Solereder (11) summarized the literature on anomalies in stem structure, and more recently Pfeiffer (6, 7) has given an admirable account of anomalous secondary growth and the forms associated with particular species. Pfeiffer recognized eight types of anomaly, depending on the organization and activity of the cambium. These are illustrated in fig. 1 and may be summarized as follows:

#### A. Abnormal growth of the normal cambium.

1. The "broadened" or "flattened" stem (*corpus lignosum fasciatum*). The secondary xylem is laid down unequally so that the stem becomes flattened or eccentric (fig. 1, a). Examples are common in lianes such as *Piper* spp.

2. The "lobed" stem (*corpus lignosum lobatum*). The secondary xylem is laid down unequally at different points round the stem, resulting in the de-

velopment of furrows and ridges, but the primary ring of cambium remains continuous (fig. 1, b). An example of this is the British Guiana Paddle Wood, *Aspidosperma* sp.

3. The "interrupted" stem (*corpus lignosum interruptum*). The cambial ring becomes broken into separate arcs as a result of the formation of unequal amounts of xylem and phloem in different parts of the ring. In certain places the cambium moves outward in the normal way, but in the intervening areas there is a decided reduction in the amount of xylem and a corresponding increase in the amount of phloem produced so that while the cambium remains at the base of a furrow the regular outline of the stem is maintained (fig. 1, c). The break in the cambium is not repaired, hence there is a line of cleavage between the xylem of the ridge and the phloem of the furrow. Examples of this type occur in some of the Bignoniaceae.

4. The "foraminate" stem (*corpus lignosum foraminatum*). The secondary xylem is normal except that it includes strands of phloem (fig. 1, d). In this type, which is the "interxylary phloem" of De Bary (3) and Solereder (11), a single permanent cambium continues to function throughout the life of the stem. The phloem strands become imbedded in the wood in one of two ways: in *Strychnos*, strips of the cambium cease to grow, but as the cambium at the sides moves outwards the gap is gradually healed over, leaving a strand of phloem in the xylem; in *Combretum*, strands of phloem are formed on the inner side of the cambium instead of xylem. It is not possible to distinguish between these two types in the ordinary wood sample.

#### B. Anomalous layers of cambium.

5. The "concentric" stem (*corpus lignosum circumvallatum*). The cambium is short-lived and is replaced by new meristematic tissue, which develops in either the pericycle or the cortex and repeats the structure of the young stem (fig. 1, e). Thus, whether the subsequent additions are in a continuous ring or in separate bundles depends upon the structure of the young stem. Most authors (3, 6, 11) describe all of the Nyctaginaceae as being of this type, but the material of *Neea*, *Pisonia*, and *Torrubia* that we have investigated is clearly of type 4. In some stems only a relatively small portion is inclosed by a new cambium; this modification of the "concentric" type is designated *corpus lignosum circumseptum*.

6. The "disperse" stem (*corpus lignosum diffractum*). The stem is cleft into irregular strands by the dilation of the parenchymatous elements of the xylem, namely, the pith and the rays (fig. 1, f).

7. The "divided" stem (*corpus lignosum divisum*). Each of the vascular bundles of the primary ring develops into a small woody cylinder (fig. 1, g).

8. The "compound" stem (*corpus lignosum compositum*). There is a central primary cylinder surrounded by a ring of woody cylinders (fig. 1, h).

This paper has purposely been limited to the types of anomalous structure in which phloem is included within the xylem. The key has been designed primarily to indicate the family, but some further distinctions have been indicated in

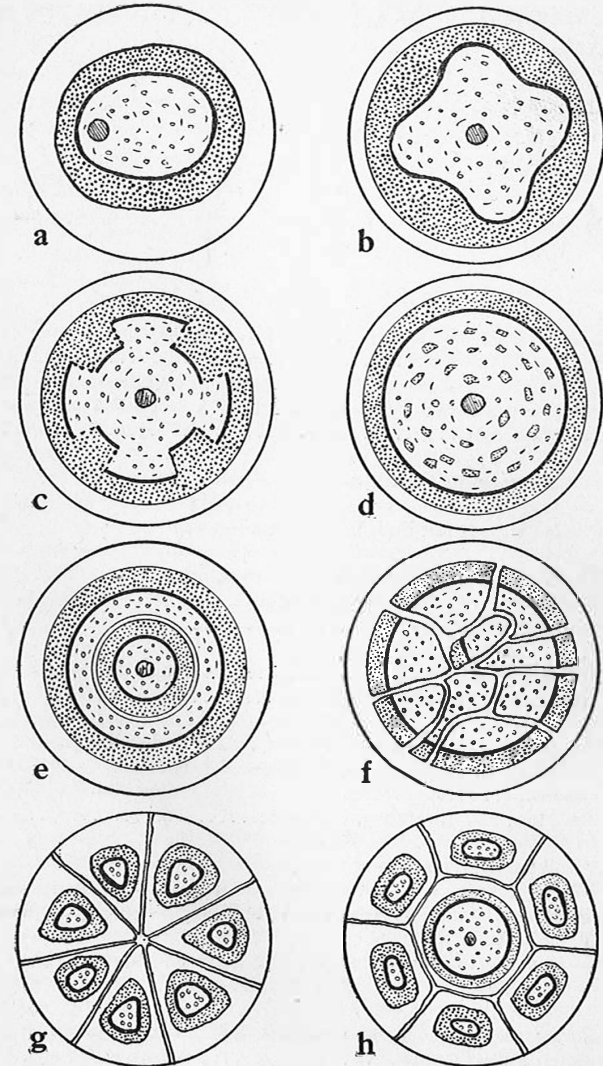


Fig. 1. Diagrams of eight types of anomaly in dicotyledonous stems. (After H. Pfeiffer.) Cambium indicated by a heavy line. Explanation in text.

the descriptions of the genera and species. It has not been possible to be entirely consistent in the treatment of the different families. In some of them, such as the Melastomaceae, the genera are so similar that they can all be included in one description, whereas in others the differences between genera or generic groups warrant their being treated separately. The terms of size used are those proposed by Chattaway (2) except in the case of vessel length, for which the more recent suggestions of Chalk (1) have been adopted.

### Key to Woods with Included Phloem

- 1 a. Xylem continuous from pith to cortex, being formed by a single persistent cambium. . . . . 2  
 b. Xylem laminated (layers of xylem separated by phloem and conjunctive parenchyma), being formed by a succession of short-lived cambiums. . . . . 10
- 2 a. Phloem strands situated just beyond groups of pores.  
*Neea, Pisonia, Torrubia* (Nyctaginaceae).  
 b. Phloem strands not in definite association with the pores. . . . . 3
- 3 a. Vessel pits to parenchyma cells not large, bordered. . . . . 4  
 b. Vessel pits to parenchyma cells large, simple or with large apertures and narrow borders. . . . . 8
- 4 a. Storied structure distinct. . . . . *Salvadora* (Salvadoraceae).  
 b. Storied structure absent or vague. . . . . 5
- 5 a. Rays often rather high and 4 or more cells wide. Vessels sometimes small and in radial and oblique patches between the phloem strands. . . . . *Strychnos* (Loganiaceae).  
 b. Rays low, 1 or 2, rarely 3, cells wide. . . . . 6
- 6 a. Wood parenchyma very sparse; in sheath around phloem strands and vasicentric. Wood fibres with thin or only moderately thick walls. *Aquillaria, Gyrinops* (Thymelaeaceae); *Bonyunia, Norrisia* (Loganiaceae).  
 b. Wood parenchyma usually abundant; paratracheal, metatracheal, or diffuse. Wood fibres thick-walled. . . . . 7
- 7 a. Paratracheal parenchyma abundant; metatracheal absent. Pores sometimes rather few. . . . . *Combretum* (Combretaceae).  
 b. Paratracheal parenchyma sparse to moderately abundant; metatracheal usually present. Pores numerous.  
*Memecylon, Mouriria* (Melastomaceae).

- 8 a. Ground tissue of fibre-tracheids; pits with conspicuous borders.  
*Pternandra* (Melastomaceae).  
 b. Ground tissue of libriform fibres. . . . . 9
- 9 a. Fibre pits few. Storied structure absent. Vessel pits vested.  
*Erisma* (Vochysiaceae).  
 b. Fibre pits very numerous. Storied structure present. Vessel pits not vested. *Laportea, Myriocarpia, Touchardia, Urera* (Urticaceae).
- 10 a. Stone cells in conjunctive parenchyma on outer side of phloem strands. . . . . 11  
 b. Stone cells absent. . . . . 17
- 11 a. Stone cells solitary; large, irregular. *Dioncophyllum* (Flacourtiaceae).  
 b. Stone cells in lines or patches; commonly isodiametric or rectangular. . . . . 12
- 12 a. Stone cells in a single continuous row between successive xylem rings. . . . . 13  
 b. Stone cells in more than one row (often mixed with bast fibres) or in broken lines or in patches. . . . . 14
- 13 a. Pores mostly solitary. Parenchyma metatracheal or diffuse.  
*Abuta, Cocculus, Hyperbaena, Tiliacora* (Menispermaceae).  
 b. Pores mostly in radial multiples. Parenchyma paratracheal.  
*Avicennia* (Verbenaceae).
- 14 a. Ground tissue of libriform fibres. . . *Cadaba, Maerua* (Capparidaceae).  
 b. Ground tissue of fibre-tracheids; pits numerous, borders conspicuous. . . . . 15
- 15 a. Perforations sometimes scalariform. . . . . *Doliocarpus* (Dilleniaceae).  
 b. Perforations always simple. . . . . 16
- 16 a. Rays predominantly narrow and low; large rays present, but not very numerous.  
*Polygala, Securidaca* (Polygalaceae); *Salacia* (Hippocrateaceae).  
 b. Rays predominantly very large; small rays sometimes present, but not very numerous. . . *Rhabdodendron amazonicum* (Phytolaccaceae?).
- 17 a. Ground tissue of fibre-tracheids; pits numerous, borders conspicuous. . . . . 18  
 b. Ground tissue of libriform fibres. . . . . 20
- 18 a. Pores very small to minute, seldom over 60 $\mu$ . . . . . 19  
 b. Pores medium-sized or large, often over 200 $\mu$ .  
*Elsota, Polygala, Securidaca* (Polygalaceae).

- 19 a. Large interfascicular rays very numerous. Pores very small.  
*Forchhammeria* (Capparidaceae).  
b. Large interfascicular rays absent or rare. Pores minute.  
*Simmondsia* (Buxaceae).
- 20 a. Raphides present.....*Bougainvillea*, *Colignonia* (Nyctaginaceae).  
b. Raphides absent..... 21
- 21 a. Rays absent or barely distinguishable from wood parenchyma.  
Phloem strands usually situated just beyond groups of pores.  
*Sarcobatus*, *Suaeda* (Chenopodiaceae).  
b. Rays present. Phloem strands not in definite association with the  
pores..... 22
- 22 a. Woods with storied structure. Chambered parenchyma present.  
*Macbaerium*, *Pueraria*, *Wistaria* (Leguminosae).  
b. Woods without storied structure. Chambered parenchyma ab-  
sent..... 23
- 23 a. Crystals absent. Vascular pits vestured.  
*Boscia*, *Cadaba* (Capparidaceae).  
b. Crystals present. Vascular pits not vestured..... 24
- 24 a. Crystals large, long, hexagonal. *Gallesia*, *Seguieria* (Phytolaccaceae).  
b. Crystals very small (crystal sand).....*Bosea* (Amarantaceae).

### Descriptions of Woods of Anomalous Structure

#### AMARANTACEAE

*Anomaly*: Type 5. Successive bundles of xylem and phloem, repeating the structure of the young stem, separated from one another by tangential bands of conjunctive tissue and large interfascicular rays.

*Vessels*: Pores small to very small; solitary and in radial pairs and multiples. Vessel members extremely to very short; perforations simple; intervascular pit-pairs moderate-sized, alternate, with transversely elongated apertures. *Rays* interfascicular only, often indistinguishable from conjunctive parenchyma, seldom continuous radially from one ring of bundles to another; cells similar to those of the conjunctive parenchyma, but slightly more regular; crystal sand common.

*Parenchyma*: Conjunctive in tangential bands separating the xylem and phloem bundles; cells square in cross section, erect or square on radial, often containing crystal sand. Normal

wood parenchyma very scanty, vasicentric; 2 to 4 cells per strand. *Wood fibres* thick-walled; pits simple, more numerous in radial than in tangential walls.

*Material*: *Bosea yervamora* L. (5313).

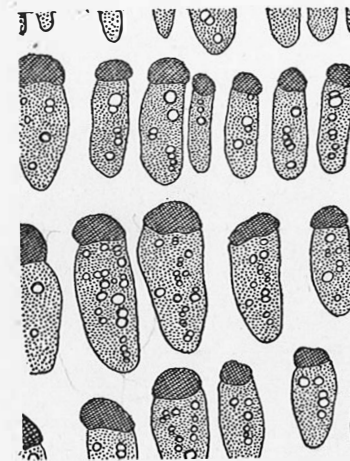


Fig. 2. *Bosea yervamora* L. (5313). Amarantaceae. X 20.

#### BUXACEAE

*Anomaly*: Type 5. Layers of xylem separated by phloem and conjunctive parenchyma; interfascicular rays usually rare; phloem strands round to oval in cross section.

*Vessels*: Pores extremely small, solitary, evenly distributed through the wood. Vessel members extremely short; perforations simple; pits to fibre-tracheids and to ray cells rather small, with round borders and lenticular apertures. *Rays*: Interfascicular few, up to 15 cells wide and very high. Fascicular uniseriate and low; cells small, square or procumbent, occasionally containing crystals. *Parenchyma*: Conjunctive only; cells rather thick-walled; 2 to 4 cells per strand; crystals sometimes present. *Wood fibres* very thick-walled; pits very numerous, small, with conspicuous borders and lenticular apertures.

*Material*: *Simmondsia californica* Nutt. (5198, 5199).

## CAPPARIDACEAE

*Boscia*, *Cadaba*, and *Maerua*.

*Anomaly*: Type 5. Layers of xylem separated by phloem and conjunctive tissue, the xylem often including several growth rings; phloem strands round or oval in cross section; conjunctive parenchyma containing fibres and stone cells in *Cadaba* and *Maerua*.

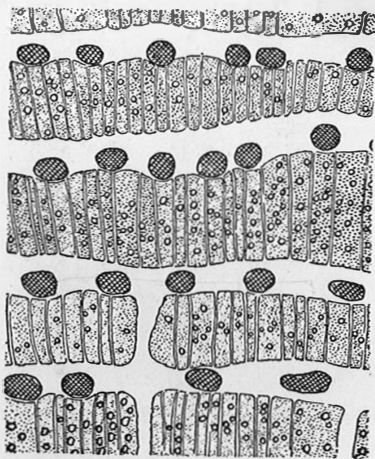


Fig. 3. *Simmondsia californica* Nutt. (5198). Buxaceae.  $\times 20$ .

*Vessels*: Pores small; in radial multiples of 2 to 20, accompanied by groups of extremely small pores and possibly some vascentric tracheids. Vessel members very short; walls very thick; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells small, alternate, obscurely vested. *Rays* small, 1-3-seriate, up to 30 cells high; heterogeneous. *Parenchyma*: Conjunctive in tangential bands between the successive layers of xylem, the cells square or erect; isodiametric, thick-walled stone cells, accompanied by sclerenchymatous fibres, abundant in *Maerua*, less so in *Cadaba*. Metatracheal (in *Cadaba* only) in continuous broad bands, mostly of cambiform cells. Paratracheal scanty, vascentric; 1 or 2 cells per strand. *Wood fibres* rather thick-walled; pits few, small, simple.

*Material*: *Boscia variabilis* Collett & Hemsl. (3057); *Cadaba trifoliata* W. & A. (176); *Maerua angolensis* DC. (4902); *M. rigida* R. Br. (2404); *M. rosmarinoides* (Sond.) Hochst. (4242, 5200).

*Forcbbammeria*.

*Anomaly*: Type 5. Successive bundles of xylem and phloem, repeating the structure of the young stem, separated by tangential bands of conjunctive parenchyma and by large interfascicular rays.

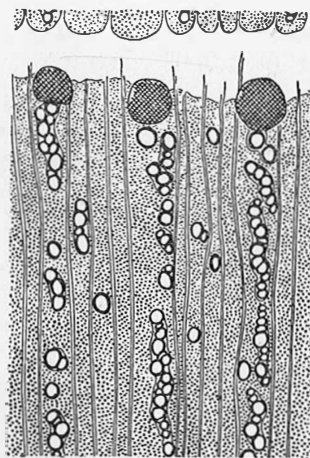


Fig. 4. *Boscia variabilis* Collett & Hemsl. (3057). Capparidaceae.  $\times 20$ .

*Vessels*: Pores very small, solitary; evenly distributed. Vessel members very short; perforations simple; pits to parenchyma small, alternate. *Rays*: Interfascicular predominant, very wide and high; cells variable in size and shape, square to erect, rarely procumbent. Fascicular narrow and low, rare. *Parenchyma*: Conjunctive in tangential bands, separating the xylem and phloem bundles; cells irregular, square or erect, sometimes hexagonal. Metatracheal in short tangential uniseriate lines; cells usually 2 per strand. *Wood fibres* with moderately thick walls; pits numerous, with small but distinct borders.

*Material*: *Forcbbammeria longifolia* Standl. (5316).

## CHENOPODIACEAE

*Anomaly:* Type 5. Successive bundles of xylem and phloem, surrounded by fibrous tissue; phloem strands commonly linked together tangentially by parenchyma to form concentric but irregular zones.

*Vessels:* Pores extremely small; in radial multiples and irregular clusters on the inner side of the phloem strands, the clusters sometimes triangular, the broad part towards the phloem. Vessel members extremely short; perforations simple; intervascular pit-pairs and pits to parenchyma very small, alternate. *Rays* usually absent or indistinguishable

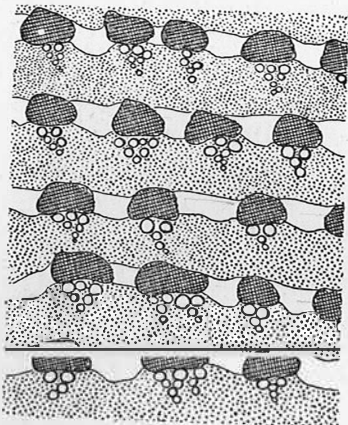


Fig. 5. *Atriplex canescens* Nutt. (5202). Chenopodiaceae.  $\times 20$ .

from the conjunctive parenchyma; conjunctive parenchyma sometimes extending a short distance radially in *Allenrolfea*, *Haloxylon*, and *Suaeda*. *Parenchyma:* Conjunctive linking the bundles; sometimes extending radially but seldom resembling rays. Paratracheal vasicentric, rather scanty; cells usually cambiform, sometimes 2 cells per strand; storied; chambered parenchyma containing 4 to 8 crystals per strand sometimes present. *Wood fibres* with very thick walls; pits very numerous, very small, simple.

*Material:* *Allenrolfea vaginata* (Griseb.) O. Kuntze (9658); *Atriplex canescens* Nutt. (5202, 5203, 5204, 5206); *Chenopodium sandwicense* Moq. (10775, 10776); *Eurotia lanata* (Pursh) Moq. (7986); *Grayia spinosa* (Hook.) Moq. (7978); *Haloxylon ammodendron* Bunge (7985); *Sarcobatus vermiculatus* (Hook.) Torr. (10779); *Suaeda Torreyana* Wats. (5205).

## COMBRETACEAE

*Anomaly:* Type 4. Strands of included phloem usually isolated, but occasionally linked by parenchyma; strands round or oval in cross section. Radial phloem strands occasionally occurring in the rays.

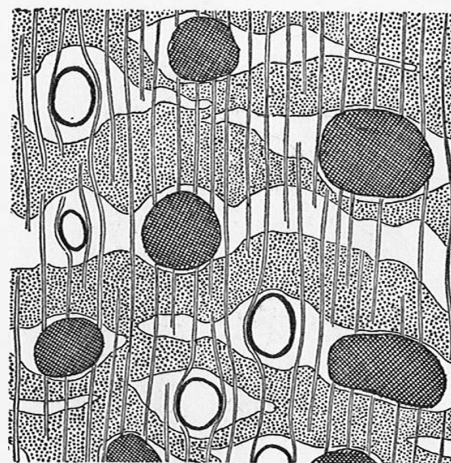


Fig. 6. *Combretum Hartmannianum* Schweinf. (3958). Combretaceae.  $\times 20$ .

*Vessels:* Pores small to moderate-sized; nearly all solitary; evenly distributed, but diminishing markedly in size through the ring. Vessel members moderately short to medium-sized; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells moderately large, alternate, vested. *Rays* usually uniseriate or partially biseriata (wholly biseriata rays common in one specimen), commonly up to 25 cells high; cells predominantly procumbent but sometimes square; numerous swollen idioblasts containing solitary crystals pres-

ent, except in *C. multispicatum*. Fusiform rays containing radial strands of phloem sometimes present. *Parenchyma*: Terminal with a few scattered cells on the boundary of the ring. Paratracheal moderately abundant to abundant, completely enclosing the vessels, often aliform, sometimes confluent. Surrounding the phloem strands, aliform. Cells per strand 4 to 8. *Wood fibres* thick-walled; pits sometimes in more than one row in the radial walls, few in the tangential walls; pit borders small and inconspicuous.

*Material*: *Combretum Hartmannianum* Schweinf. (3958); *C. multispicatum* Engl. & Diels (2385); *C. sp.* (4399, 4424).

#### DILLENIACEAE

*Anomaly*: Type 5. Successive bundles of xylem and phloem

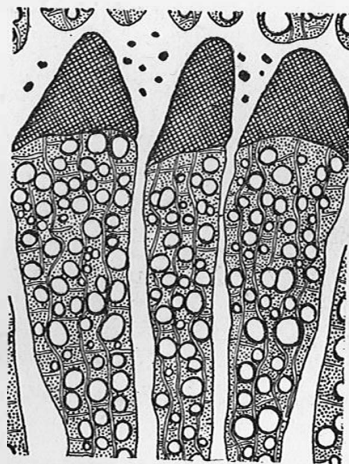


Fig. 7. *Doliocarpus* sp. (5389). Dilleniaceae.  $\times 9$ .

repeating the structure of the young stem, separated by tangential bands of conjunctive parenchyma and large interfascicular rays; phloem strands capped towards the outside by strands of hard bast.

*Vessels*: Pores very large; mostly solitary; evenly distributed. Vessel members moderately long; perforations simple,

but sometimes multiple (scalariform) in the smaller vessels; intervacular pit-pairs and pits to parenchyma and ray cells opposite to alternate, the apertures narrow, horizontal. *Rays*: Interfascicular large, many cells wide and of indeterminate height, often continuous radially through several layers of bundles; cells variable in size, often very large and containing raphides, though Hess (5) mentions raphides as occurring only in the conjunctive parenchyma. Fascicular uniseriate, commonly up to 10 cells high; cells erect, often 4 or 5 times as high as wide. *Parenchyma*: Conjunctive in tangential bands separating the xylem and phloem bundles; raphides present; stone cells few, scattered, and isodiametric. Diffuse as cells scattered among the fibre-tracheids; metatracheal in short,

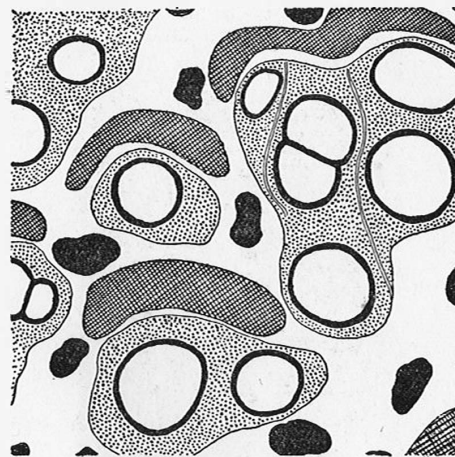


Fig. 8. *Dioncophyllum peltatum* Hutch. & Dalz. (4688). Flacourtiaceae.  $\times 20$ .

uniseriate, tangential lines; 4 to 8 cells per strand. *Tracheids and fibre-tracheids*: Cells of all gradations from imperforate vessel members to fibre-tracheids common; the former thinner-walled and shorter than the fibre-tracheids, with pits in more than one row. Fibre-tracheids with moderately thin walls; pits very numerous, with conspicuous borders.

*Material*: *Doliocarpus* sp. (5389).



## FLACOURTIACEAE

*Anomaly:* Type 5. Successive bundles of xylem and phloem, without regular arrangement.

*Vessels:* Pores very large; mostly solitary, sometimes in pairs or multiples; evenly distributed. Vessel members medium-sized; perforations simple; intervacular pit-pairs and pits to parenchyma large, oval, alternate, the apertures often coalescent. *Rays* uniseriate, moderately high, rather few; running through the individual bundles, but varying in direction from bundle to bundle. *Parenchyma:* Conjunctive moderately abundant; stone cells few, scattered, solitary, often spindle-shaped; the walls layered. Paratracheal scanty, vasicentric; 4 to 6 cells per strand. *Wood fibres* with moderately thick walls; pits large, with very conspicuous borders.

*Material:* *Dioncophyllum peltatum* Hutch. & Dalz. (4688).

## HIPPOCRATEACEAE

*Anomaly:* Type 5. Successive layers of xylem and phloem,

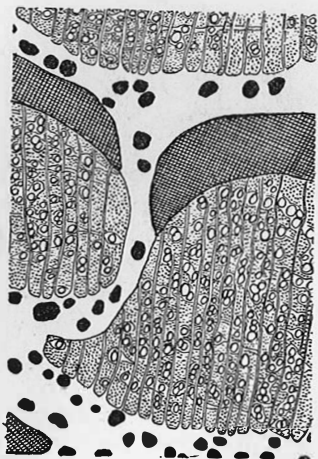


Fig. 9. *Salacia reticulata* Wight (700). Hippocrateaceae.  $\times 9$ .

repeating the structure of the young stem, separated by broad tangential bands of conjunctive parenchyma containing

round or irregular groups of stone cells; xylem and phloem layers only rarely interrupted by interfascicular rays.

*Vessels:* Pores very small to small; usually solitary, rarely in radial pairs; evenly distributed. Vessel members medium-sized; perforations simple; intervacular pit-pairs rare, pits to parenchyma and ray cells rather small, alternate. *Rays:* Interfascicular very few, large, multiseriate. Fascicular small, uniseriate, low; cells square or upright, often containing crystals. *Parenchyma:* Conjunctive between the successive layers of xylem and phloem; isodiametric or rectangular stone cells in round or oval groups outside the phloem layers. Paratracheal aliform, often confluent, sometimes forming continuous tangential bands 3 or 4 cells wide; 6 to 8 cells per strand. *Wood fibres* with moderately thick walls; pits numerous, with conspicuous round borders and oblique lenticular apertures.

*Material:* *Salacia reticulata* Wight (700).

## LEGUMINOSAE

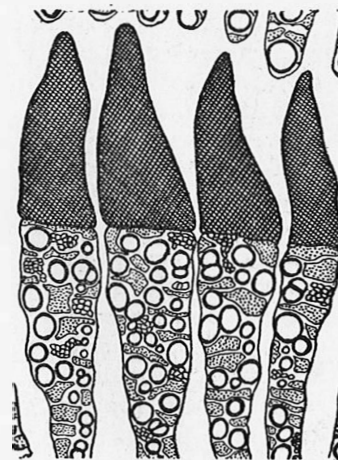


Fig. 10. *Pueraria triloba* Makino (5210). Leguminosae.  $\times 9$ .

*Anomaly:* Type 5. Successive bundles of xylem and phloem repeating the primary structure of the stem, separated by

tangential bands of conjunctive parenchyma and, except in *Machaerium*, by large interfascicular rays.

*Vessels*: Pores large to very large, accompanied, except in *Machaerium*, by groups of very small ones; large pores usually solitary, sometimes in radial multiples of 2 to 4; evenly distributed through the wood. Vessel members very short to medium-sized; perforations simple; pit-pairs between small vessels and pits to parenchyma and ray cells moderately large, alternate, vested; spiral thickenings present in small vessels of *Wistaria*. *Rays*: Interfascicular many cells wide and very high. Fascicular low, biseriate in *Machaerium*, uniseriate in *Wistaria*, absent from *Pueraria*; homogeneous, the cells all procumbent. *Wood fibres* thin-walled (except in *Pueraria*); pits small, simple, equally numerous in all walls.

*Material*: *Macbaerium glabratum* Pittier (5318); *Pueraria Thunbergiana* Benth. (6451); *P. triloba* Makino (5210); *Wistaria floribunda* DC. (6452).

#### LOGANIACEAE

##### *Strychnos*.

*Anomaly*: Type 4. Strands of included phloem isolated or linked together by terminal parenchyma; strands round in cross section; sometimes surrounded by parenchyma.

*Vessels*: Pores extremely small to small; typically in oblique patches between the phloem strands, the patches often running through successive rings; more evenly grouped in *S. mitis*, *S. nux-blanda*, and *S. nux-vomica*, occurring singly and in pairs and radial multiples. Vessel members short to medium-sized; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells very small, alternate, vested. *Rays*: Rather variable in size in different species, from 4- to 10-seriate and from 40 to 80 cells high; uniseriate rays inconspicuous and not numerous; cells variable in shape, usually procumbent, but occasionally square or upright in the middle of the ray; chambered procumbent cells containing crystals present, except in *S. arborea* and *S. mitis*. *Parenchyma*: Surrounding the phloem strands. Terminal varying from a few scattered cells to continuous biseriate bands. Paratracheal forming the matrix of the oblique vessel groups, and occasionally aliform as wavy tangential bands between the vessels. Cells 4 to 8 per strand; chambered parenchyma

containing crystals present in some species. *Wood fibres* with very thick walls; pits few to numerous, sometimes simple, sometimes with minute, very inconspicuous borders.

*Material*: *Strychnos arborea* A. W. Hill (5213); *S. Alberstonii* Harv. (5211, 5215); *S. mitis* Moore (5214); *S. nux-blanda* A. W. Hill (2694); *S. nux-vomica* L. (255); *S. potatorum* L. f. (5212); *S. sp.* (40, 6882).

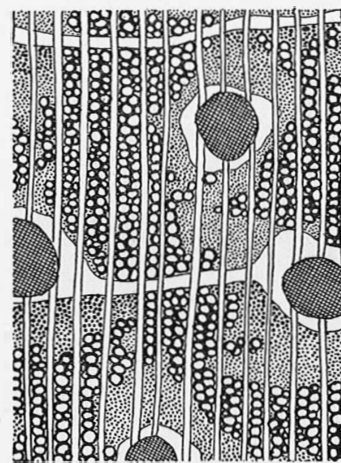


Fig. 11. *Strychnos* sp. (40). Loganiaceae. X 20.

##### *Bonyunia* and *Norrisia*.

*Anomaly*: Type 4. Strands of included phloem isolated, usually wider tangentially than radially; surrounded by a sheath of parenchyma.

*Vessels*: Pores small in *Bonyunia*, moderate-sized in *Norrisia*; usually in radial multiples of 2 to 6, evenly distributed. Vessel members medium-sized to moderately long; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells small, alternate, vested. *Rays* uniseriate, occasionally 2 or 3 cells wide in *Bonyunia*; low, up to 15, but mostly 4 to 8, cells high; heterogeneous, the marginal cells square, the interior procumbent. Fusiform rays containing radial strands of phloem present in *Norrisia*. *Parenchyma*: Surrounding the phloem strands, rather scanty in *Norrisia*. Paratracheal very scanty, vasicentric; 4 cells per strand.

*Wood fibres* with thin to moderately thick walls; pits numerous, in more than one row in the radial walls, the borders small but distinct.

The material of *Bonyunia* is indistinguishable from that of *Aquillaria* and *Gyrinops* (Thymelaeaceae) examined; the herbarium material has been checked by the Royal Botanic Gardens, Kew, and its position in the Loganiaceae confirmed. *Norrisia* can be distinguished by the radial strands of phloem.

*Material: Bonyunia aquatica* Ducke (10842); *Norrisia malaccensis* Gardn. (F.M.S. 1132).

#### MELASTOMACEAE

*Anomaly: Type 4.* Isolated strands of included phloem

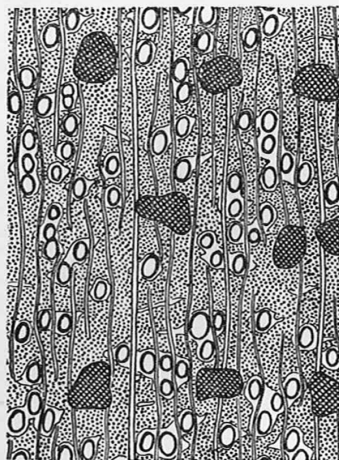


Fig. 12. *Memecylon parvifolium* Thw. (762). Melastomaceae.  $\times 20$ .

rather numerous, small, irregular in section, often wider tangentially than radially.

*Vessels:* Pores extremely small to small; solitary or in multiples of 2 to 4 and occasionally in irregular clusters; evenly distributed or in some species with marked radial or oblique arrangement. Vessel members very short to medium-sized; perforations simple; intervacular pit-pairs rather small, alternate, vested; pits to parenchyma and ray cells

similar to the intervacular in *Memecylon* and *Mouriria*, but irregular in shape, rather large, with narrow borders or simple in *Pternandra*. *Rays* very numerous; uniseriate in most species of *Mouriria*; 1 to 4 cells wide in *Mouriria Marshalli* and *M. pseudogeminata*, *Memecylon*, and *Pternandra*; usually rather low; cells of uniseriate rays commonly square or upright. *Parenchyma:* Paratracheal vasicentric or sometimes aliform in *Memecylon* and *Mouriria*. Metatracheal scattered as isolated cells among the fibres, or in short uniseriate lines; absent or very sparse in *Pternandra*, *Mouriria samanensis*, and *Memecylon Faucheri*; continuous biseriate bands sometimes present in *Mouriria Marshalli* and *M. pseudogeminata*. Cells per strand 2 to 6. *Wood fibres* with very thick walls; often arranged in very regular radial rows; pits numerous in both radial and tangential walls; borders small and inconspicuous in *Mouriria*, large and conspicuous in *Pternandra* and in most specimens of *Memecylon*.

*Material: Memecylon edule* Roxb. (806); *M. Faucheri* L. Danguy (5224); *M. parvifolium* Thw. (762); *M. melastomoides* Naud. (11029); *M. polyantbemos* Hook. (5228); *M. subfurfuraceum* Merr. (5217); *M. sp.* (7945); *Mouriria cyphocarpa* Standl.; *M. emarginata* Griseb. (5224); *M. Marshalli* Burt Davy & Sandwith (44, 6235, 7037); *M. parvifolia* Benth. (5218, 5221, 5225, 5226, 5231); *M. pseudogeminata* Pittier (5216); *M. samanensis* Urb. (5219); *Pternandra caerulea* Jack (5230).

#### MENISPERMACEAE

*Anomaly: Type 5.* Successive bundles of xylem and phloem repeating the structure of the young stem; bundles separated by tangential bands of parenchyma and large interfascicular rays.

*Vessels:* Pores very small to moderate-sized; nearly all solitary; evenly distributed through the wood. Vessel members very short in *Cocculus*, medium-sized in the other genera; perforations simple; pits to fibre-tracheids round, with oblique slit-like apertures; pits to parenchyma usually round, with slit-like apertures, but at the ends of the vessel members large, irregular in shape, elongate-oval, simple or with narrow borders. *Rays* interfascicular only; usually not continuous radially from one layer of bundles to the next; up to 16 cells wide and very high; cells procumbent, but not much elon-

gated radially, square, or erect. *Parenchyma*: Conjunctive between the successive layers of xylem and phloem bundles; isodiametric or sometimes radially elongated stone cells in layers 2 or 3 cells wide, with marked radial projections between the phloem strands, except in *Cocculus*. Metatracheal in numerous short tangential lines one cell wide; 2-4 (mostly 2) cells per strand. *Wood fibres* with moderately thick to thick

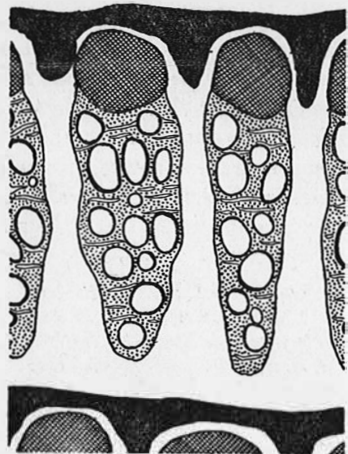


Fig. 13. *Tiliacora glycosmantha* Diels (7988). Menispermaceae.  $\times 20$ .

walls; pits numerous, with conspicuous round borders. Elements adjoining the vessels often with larger lumina and irregular in shape (especially in *Abuta* and *Tiliacora*) and shorter than in the rest of the wood, possibly vasicentric tracheids.

*Material*: *Abuta concolor* P. & E. (7989); *A.* sp. (5328); *Cocculus laurifolius* DC. (6455); *Hyperbaena domingensis* Benth. (5232); *H. Winzerlingii* Staud. (5233); *Tiliacora glycosmantha* Diels (7988).

#### NYCTAGINACEAE

*Neea*, *Pisonia*, and *Torrubia*.

*Anomaly*: Type 4. Strands of included phloem isolated, wider tangentially than radially; linked to form tangential bands in *Pisonia Nisbimurae*.

*Vessels*: Pores very small, the smallest sometimes difficult to distinguish from vasicentric tracheids; in radial multiples and irregular clusters, more or less centrally placed on the inner face of the phloem strands. Vessel members extremely short to very short; perforations simple; intervacular pit-pairs and pits to parenchyma small, alternate. *Rays* very small and low, uniseriate or occasionally biseriata; hetero-

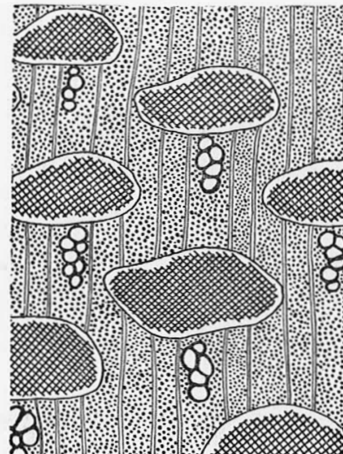


Fig. 14. *Neea psychotrioides* J. D. Smith (3662). Nyctaginaceae.  $\times 20$ .

geneous, the marginal cells erect, central cells procumbent; walls rather thick in some specimens. *Parenchyma*: Around the phloem strands; raphides rather common. Diffuse, a few isolated cells scattered among the fibres. Paratracheal very scanty, vasicentric. Terminal sometimes moderately abundant, in continuous narrow lines. Cells predominantly cambiform, sometimes 2 to 4 per strand; storied; large brick-shaped crystals very common. *Wood fibres* with thin to rather thick walls; storied; pits rather few, small, simple.

*Material*: *Neea amplifolia* Donn. Sm. (3458, 5252, 5255); *N. laetevirens* Standl. (5259); *N. Pittieri* Standl. (5248, 5249, 5251); *N. psychotrioides* J. D. Sm. (3662, 5250, 5253, 5256, 5258, 5260); *N. urophylla* Standl. (5254, 5257); *Pisonia aculeata* L. (5321); *P. albida* Britton (5234); *P. linguistifolia* Heimerl (5242, 5243); *P. macrantibocarpa* J. D. Sm. (5247); *P. Nisbimurae* Koid

(6454); *P. obtusa* Jacq. (5241); *P. sandwicensis* Hillebr. (5237); *P. subcordata* Sw. (5239); *Torrubia Broadwayana* (Heim.) Standl. (4941, 6200); *T. discolor* Britton (5240); *T.* sp. (5244).

*Bougainvillea* and *Colignonia*.

*Anomaly:* Type 5. Successive bundles of xylem and phloem, linked together tangentially by conjunctive parenchyma. Phloem strands round in cross section in *Bougainvillea*, wider tangentially than radially in *Colignonia*.

*Vessels:* Pores moderate-sized; solitary and evenly distributed in *Colignonia*; in irregular clusters nearly always associated with the phloem strands in *Bougainvillea*. Vessel members extremely short; perforations simple; intervascular pit-pairs and pits to parenchyma cells rather small, alternate, often with coalescent apertures. *Parenchyma:* Conjunctive tissue surrounding the phloem strands and extending radially in irregular lines; raphides commonly present; in *Bougainvillea* cells all erect, cambiform (rarely 2 cells per strand) and regularly storied; in *Colignonia* cells erect, hexagonal or oval, those of radial tissue less regular in shape than those of the tangential. *Wood fibres* with moderately thick walls; pits rather few, small, simple.

*Material:* *Bougainvillea spectabilis* Willd. (5238, 5246); *B.* sp. (8102); *Colignonia scandens* Benth. (5319).

#### PHYTOLACCACEAE

*Anomaly:* Type 5. Successive bundles of xylem and phloem, repeating the structure of the young stem, separated by tangential bands of conjunctive parenchyma and interfascicular rays.

*Vessels:* Pores small; solitary and in radial pairs in *Gallesia* and *Rhabdodendron*, in radial pore multiples and irregular clusters in *Sequiaria*. Vessel members very short (medium-sized in *Rhabdodendron*); perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells small to moderately large, with small round apertures; spiral thickenings sometimes present in *Gallesia*. *Rays* mainly interfascicular; large and very high in *Gallesia* and *Rhabdodendron*, often smaller in *Sequiaria* uniting in the outer part of the xylem; cells variable in size and shape, often square or erect; com-

monly containing large flat hexagonal crystals in *Gallesia* and *Sequiaria*. *Parenchyma:* Conjunctive cells often cambiform, merging into the tissue of the interfascicular rays; large flat hexagonal crystals present in *Gallesia* and *Sequiaria*; irregular groups of isodiametric or rectangular stone cells in *Rhabdodendron*. Paratracheal sometimes scanty, occurring as narrow borders round the vessels and vessel groups; cells

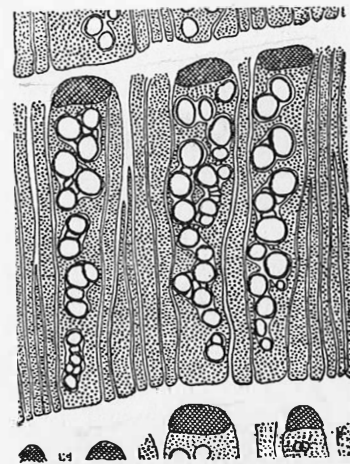


Fig. 15. *Sequiaria parvifolia* Benth. (9846). Phytolaccaceae.  $\times 20$ .

2 to 4 per strand. Diffuse in *Rhabdodendron*. *Wood fibres* in *Gallesia* and *Sequiaria* with moderately thick to thick walls; the pits simple, or with very indistinct borders, and more numerous in the radial than in the tangential walls; in *Rhabdodendron*, with thick walls, the pits numerous, with conspicuous borders and slit-like apertures.

*Rhabdodendron amazonicum* is placed in the Rubiaceae by Willis (12), in the Rutaceae by Harms (4), and in the Phytolaccaceae by Record (9, 10). It seems out of place in either of the first two families, but, as is pointed out by Record (9), it agrees very closely with the other genera of the Phytolaccaceae that have anomalous structure, differing from them only in having fibre-tracheids and stone cells. *R. macrophyllum* (Benth.) Huber is of normal structure. The smaller rays of

*Sequiaria* and their tendency to unite in the outer part of the xylem usually serve to distinguish that genus from *Gallesia*.

*Material*: *Gallesia scorododendrum* Casar. (5264); *G. sp.* (5323); *Sequiaria paraguayensis* Morong (9845); *S. parvifolia* Benth. (9846); *Rabdodendron amazonicum* (Benth.) Huber (7012).

## POLYGALACEAE

*Anomaly*: Type 5. Successive layers of xylem and phloem

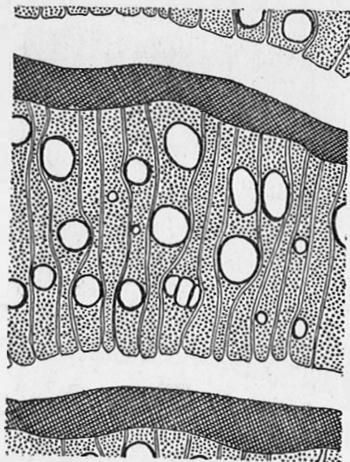


Fig. 16. *Securidaca virgata* Sw. (5324). Polygalaceae.  $\times 20$ .

repeating the structure of the young stem, separated by rather broad tangential bands of conjunctive parenchyma; xylem and phloem layers rarely interrupted by interfascicular rays.

*Vessels*: Pores moderate-sized, solitary, evenly distributed. Vessel members medium-sized; perforations simple; pits to parenchyma and ray cells moderate-sized, alternate. *Rays*; Interfascicular rare. Fascicular low, 1 to 3 (commonly 1 or 2) cells wide; heterogeneous; marginal cells square or erect, inner procumbent. *Parenchyma*: Conjunctive between the successive layers of xylem and phloem; isodiametric or vertically elongated stone cells in irregular groups in *Polygala* and one specimen of *Securidaca*. Metatracheal in *Polygala* in short uniseriate tangential lines; 4 cells per strand. Paratra-

cheal scanty, vasicentric in *Securidaca*; 2 to 4 cells per strand. *Wood fibres* with moderately thick walls; pits numerous, with conspicuous borders and oblique lenticular apertures.

*Material*: *Polygala sp.* (4164); *Securidaca diversifolia* (L.) Blake (5268); *S. pedunculata* Fres. (5325); *S. virgata* Sw. (5324).

## SALVADORACEAE

*Anomaly*: Type 4. Strands of included phloem, round or



Fig. 17. *Salvadora persica* L. (2383). Salvadoraceae.  $\times 20$ .

oval in section, surrounded and commonly linked together tangentially by parenchyma.

*Vessels*: Pores small to very small, mostly in radial pore-multiples of 2 to 4 and in irregular clusters; evenly distributed. Vessel members extremely short; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells small, alternate. *Rays* very numerous; 2 to 7 cells wide, variable in different specimens, and one to several stories high; small rays in regular stories; cells square to upright (predominately square in *S. oleoides*); crystals sometimes present in *S. persica*, extremely numerous in *S. oleoides*. *Parenchyma* very abundant, surrounding the vessels and phloem strands and linking them together tangentially; 2 to 4 cells per strand;

storied. *Wood fibres* with thick or moderately thick walls; pits more numerous in the radial than in the tangential walls, small, simple, with funnel-shaped cavities.

*Material: Salvadora oleoides* Dne. (596); *S. persica* L. (597, 781, 2383).

#### THYMELAEACEAE

*Anomaly:* Type 4. Strands of included phloem wider tangentially than radially, isolated or rarely confluent tangentially; usually containing a few bast fibres.

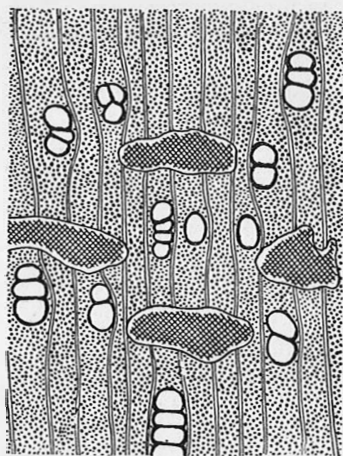


Fig. 18. *Aquilaria malaccensis* Lam. (5271). Thymelaeaceae.  $\times 20$ .

*Vessels:* Pores small, mostly in radial pore-multiples of 3 or 4, or in clusters, evenly distributed through the wood. Vessel members moderately short to medium-sized; perforations simple; intervascular pit-pairs and pits to ray cells very small, alternate, vestured. *Rays* moderately numerous to numerous; uniseriate, occasionally biseriate, and commonly with short biseriate portions in *Gyrinops*; usually 6 to 12 cells high; cells of uniseriate rays and uniseriate portions of biseriate rays predominately square or upright. *Parenchyma:* Sheaths around the phloem strands consisting almost entirely of cambiform cells. Paratracheal very scanty, vasicentric. *Wood fibres* with thin to moderately thick walls; pits bordered, numerous and

in more than one row in the radial walls, rare in the tangential walls.

*Material: Aquilaria agallocha* Roxb. (371, 4509, 5273); *A. crassna* Pierre (5274); *A. malaccensis* Lam. (5271); *A. sp.* (5275); *Gyrinops walla* Gaertn. (1396).

#### URTICACEAE

*Anomaly:* Type 4. Strands of unlignified parenchyma (apparently without phloem) isolated, commonly wider tangentially than radially, often confluent and sometimes forming almost continuous rings. Although the presence of phloem has not been demonstrated in the unlignified strands, the woods are included here because of their close resemblance to some others of type 4.

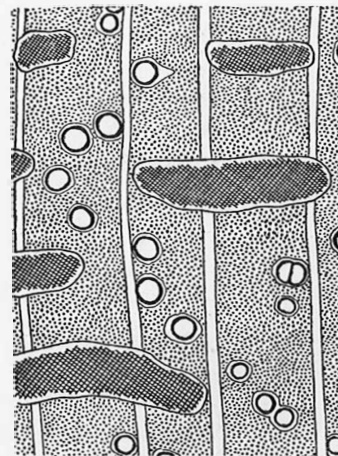


Fig. 19. *Myriocarpa obovata* Donn. Smith (5279). Urticaceae.  $\times 20$ .

tially than radially, often confluent and sometimes forming almost continuous rings. Although the presence of phloem has not been demonstrated in the unlignified strands, the woods are included here because of their close resemblance to some others of type 4.

*Vessels:* Pores small to moderate-sized; solitary or in radial pairs or small multiples; evenly distributed. Vessel members short; perforations simple; intervascular pit-pairs moderately large, alternate; pits to parenchyma and ray cells often irregular in shape, simple or with narrow borders. *Rays* very high, up to 8 cells wide (usually only 4 to 6 cells wide in *Myriocarpa*); heterogeneous, often with sheath cells; marginal

cells upright, interior cells square, rarely procumbent; crystal druses common in *Urera*, infrequent in *Myriocarpa*. *Parenchyma*: Unlignified strands; raphides present in *Laportea*. Paratracheal sometimes abundant and confluent, more commonly scanty and vasicentric; storied; 1 to 4 cells per strand, generally cambiform or 2 cells per strand; crystal druses common in *Urera*, infrequent in *Myriocarpa*. *Wood fibres* commonly septate in *Urera* and *Myriocarpa*, rarely so in *Laportea*; with thin to moderately thick walls; storied; pits simple, very conspicuous, lenticular, very numerous in all walls, sometimes in more than one row in the radial walls.

*Laportea* can be distinguished by the raphides, and *Urera* and *Myriocarpa* by the septate fibres. The rays of *Myriocarpa* are smaller than those of the other genera. *Touchardia latifolia* is similar in structure, but the patches of soft tissue are small and are always associated with the rays.

*Material*: *Laportea gigas* Wedd. (5276, 5280); *L. luzonensis* Warb. (5283); *L. sp.* (5284); *Myriocarpa obovata* Donn. Smith (5279); *M. yzabalensis* Killip (5277, 5286, 5287); *Touchardia latifolia* Gaud. (7991); *Urera elata* (Swartz) Griseb. (5278); *U. baccifera* Gaudich (5326); *U. caracasana* Griseb. (5327, 5492, 5496, 5498, 5499).

#### VERBENACEAE

*Anomaly*: Type 5. Layers of xylem separated by phloem and conjunctive tissue; each layer of conjunctive parenchyma containing a regular row of stone cells and isolated strands of phloem; phloem strands round or oval in cross section; xylem layers occasionally interrupted by interfascicular rays.

*Vessels*: Pores small to very small; sometimes solitary, more commonly in radial multiples of 2 to 12, and occasionally in irregular clusters; evenly distributed. Vessel members moderately short to medium-sized; perforations simple; intervascular pit-pairs and pits to parenchyma and ray cells rather small, alternate. *Rays*: Interfascicular rather rare. Fascicular very numerous; mostly 1 to 3, occasionally up to 6, cells wide and rather high; usually interrupted between each successive ring by the parenchyma and stone cells, but sometimes continuous radially from one ring to the next; cells variable in size and shape, usually square or erect but occasionally procumbent; crystals sometimes present. *Parenchyma*: Conjun-

tive between the successive layers of xylem and phloem, and separating the phloem strands tangentially; isodiametric or rectangular and radially elongated stone cells present in uniform tangential bands 1 to 4 cells wide. Paratracheal forming a sheath 2 or 3 cells wide round the vessels and vessel groups, sometimes aliform; 4 to 6 cells per strand. *Wood*

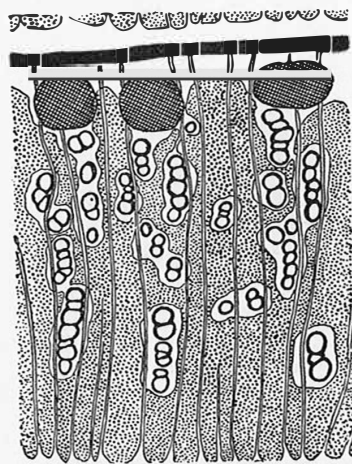


Fig. 20. *Avicennia nitida* Jacq. (5294). Verbenaceae.  $\times 20$ .

*fibres* septate, the septa thin and sometimes very few; walls moderately thick to thick; pits few, small, simple.

*Material*: *Avicennia alba* Blume (5302, 5303); *A. officinalis* L. (5289, 5295, 5298, 5301, 5305, 5306, 5307); *A. oblongifolia* Nutt. (5292); *A. nitida* Jacq. (5288, 5290, 5291, 5293, 5294, 5296, 5297, 5299, 5300, 5304).

#### VOCHYSIACEAE

*Anomaly*: Type 4. Strands of included phloem round or oval in section, occasionally wider tangentially than radially; surrounded and commonly linked together by parenchyma; strands sometimes present in the rays also.

*Vessels*: Pores moderate-sized, solitary or in radial pairs, occasionally in radial pore-multiples of 3 to 5 and in irregular clusters; evenly distributed. Vessel members moderately short to medium-sized; perforations simple; intervascular



pit-pairs rather large, alternate, vested; pits to parenchyma and ray cells large, often irregular in shape, simple or with narrow borders. *Rays* mostly 1 to 3 cells wide and 2 to 25 cells high; heterogeneous, with uniseriate margins of 1 to 6 square or upright cells; cells of multiseriate parts procumbent; fusiform rays containing phloem strands present. *Parenchyma* very abundant, surrounding the vessels and phloem strands

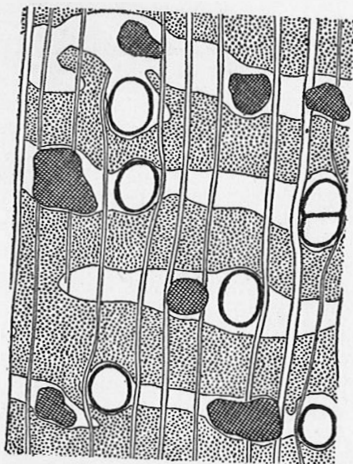


Fig. 21. *Erisma bicolor* Ducke (7992). Vochysiaceae.  $\times 20$ .

and linking them together tangentially, and forming tangential bands 3 to 6 cells wide; 4 to 8 cells per strand. *Wood fibres* with thick to moderately thin walls; pits few, simple, lenticular, oblique.

*Material:* *Erisma bicolor* Ducke (7992); *E. parvifolium* Gleason (F. P. R. L. 7125).

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### NOTE ON *ASTEROPEIA* DUP.-THOUARS

By J. BURTT DAVY

*Imperial Forestry Institute, Oxford*

*Asteropeia* Dup.-Thou., as now delimited, is a genus of 5 or 6 species endemic to Madagascar. Bentham and Hooker (*Genera plantarum* 1: 801. 1867) placed it at the end of Samydeaceae as a "genus anomalum"; it differs from the members of that family in the axile placentation. Baillon (*Histoire des plantes* 4: 315. 1872) placed it doubtfully in Bixaceae-Calanticeae, along with *Calantica* Jaub., with which he included, also doubtfully, *Dissomeria* Benth.

Szyszyłowicz, monographing the Theaceae in Engler and Prantl (*Die Pflanzenfamilien* 3, 6. 1895), combines with *Asteropeia* the genus *Rbodoclada* Baker, to form the Tribe

Asteropeieae, of which he makes two Sections: (1) *Euasteropeia* Szysz. with three species, and (2) *Rhodoclada* (Bak.) Szysz., including *A. rhopaloides* (Bak.) H. Baill. and *A. amblygonocarpa* Tul. He excludes all other genera from the Tribe, and observes (*l.c.* p. 179) that it connects Theaceae with Chlaenaceae.

De Dalla Torre and Harms (*Genera siphonogamarum*, 1900-1907) follow Szyszyłowicz in restricting the Asteropeieae to *Asteropeia* and *Rhodoclada*.

Thonner (*The flowering plants of Africa* 360. 1915) follows Szyszyłowicz in placing *Asteropeia* in Theaceae, Tribe Asteropeieae, but he associates with it two monotypic genera: *Nesogordonia* Baill. and *Tbomassetia* Linn. As delimited by Thonner, the Asteropeieae differ from the Tribes Theaeae and Ternstroemieae in having the flowers arranged in cymes or panicles (instead of solitary or in pairs in the axils of the leaves); from the Ternstroemieae they differ, also, in the capsular fruit. *Asteropeia* is described by Thonner as a genus of low trees or climbing shrubs; flowers in panicles; sepals enlarged and wing-like in fruit; stamens 15 to 10, united at the base; anthers versatile, turned inwards; ovary 3-locular.

De Dalla Torre and Harms unite *Tbomassetia* with *Brexia* Dup.-Thouars, a genus usually placed in Escalloniaceae (the Saxifragaceae-Escallonioidae of some systematists); *Nesogordonia* is treated by them as a "genus incertae sedis."

In the absence of botanical material, it appears as though the Theaceae was the proper affinity of the genus, but it would be interesting to see what the wood structure indicates.

**Verzeichnis der Flora von Liberia.** By M. DINKLAGE ("bearbeitet von J. MILDBRAED"). *Repertorium Specierum Novarum* (Berlin-Dahlem) 41: 235-271; Feb. 25, 1937.

The paper contains a brief account of botanical exploration in Liberia, followed by a condensed list of all species known from the region, for each of which are cited the available collections.

## NEW FOREST TREES OF THE BRAZILIAN AMAZON

By ADOLPHO DUCKE

*Jardim Botânico do Rio de Janeiro*

The trees described here represent a third series<sup>1</sup> of botanical novelties I have collected in the Brazilian State of Amazonas. The type specimens are preserved in the Jardim Botânico, Rio de Janeiro; cotypes, accompanied by samples of the heartwood, sapwood, and bark from the trunk of the type trees, have been sent to the Yale School of Forestry.

### LINACEAE

**Ochthocosmus multiflorus** Ducke, sp. nov. — A specie *O. barrae* Hallier f. differt foliis oblongis vel elongato-obovato-oblongis subintegris vel obsolete crenatis, coriaceis, nervis praeter costam medianam validam parum conspicuis, venulis reticulatis subobsoletis, inflorescentiis maxima ex parte subterminalibus ad axillam folii supremi, fasciculatis, vulgo folium subaequantibus, saepe sat ramosis floribundis, paucis ad reliqua folia secus ramulos superiores. Arbor parva trunco debili, foliis saepius 40-100 mm. longis 15-35 mm. latis, inflorescentiis vulgo 60-80 mm. rarius usque ad 110 mm. longis, floribus albis odoratis.

Rio Curicuriary (affluens Rio Negro superioris, in Brasiliae civitate Amazonas), super regionem cataractarum frequens in silvulis "catinga" locis humidis saepe secus ripas fluminis, legit A. Ducke 23-2-1936, Herb. Jard. Bot. Rio de Janeiro n. 29033, specimina cotypica cum ligno n. 258 (Yale 32634).

This small "catinga" tree is one of the characteristic elements of the flora of the upper Curicuriary, a rather small tributary of the Rio Negro, not far from the Uaupés but possessing a very peculiar vegetation. When in bloom, the plant has the aspect of certain species of *Myrcia* common in dry "capoeira" (low secondary wood) everywhere through the hylaea. The second Amazonian species, *O. barrae*, is found in drier woods near Manáos and in northwestern Matto Grosso; it is distinguished from our new species by its much thinner, strongly obovate and crenate leaves with more conspicuous

<sup>1</sup> See *Tropical Woods* 31: 10, September 1932, and 43: 19, September 1935.

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nervures, and by its inflorescences which are shorter than the leaves, poor ramified and of mean appearance, solitary or very reduced at the leaves along the superior twigs.

Dr. Sleumer (Berlin-Dahlem), who examined a sheet of *O. multiflorus*, wrote me: "Your new species is not identical with either *O. barrae* or *O. parvifolius* and is well characterized by its multiflorous inflorescence. The true *O. roraimae* Benth. must have, according to the description, much thicker leaves."

## MALPIGHIACEAE

*Lophanthera pendula* Ducke, sp. nov. — Arbor parva ramis longis, partibus novellis laticem album amarum parum abundantem praebentibus. Ramuli, stipulae et folia dimensionibus forma colore et indumento iis speciei vulgaris *L. longifolia* similia; primi vulgo aliquanto graciliores; ultima solum in petiolo, costa mediana et margine pilosa. Racemi accrescentes demum usque ad 500 mm. elongati, penduli et saepe leviter flexuosi, partibus omnibus rufopubescentibus, pedunculo in parte inferiore articulo et bracteis duabus magnis linearibus fulto, rhachi florifera gracili, supra sensim tenuiore, parte terminali tenuissima; cincinni dissiti, saepius uniflori rarius biflori, cum floribus 10–18 mm. longi, bracteis basalibus et bracteolarum una parvis subulatis, bracteola altera stipitiforimi et in glandulam terminata. Flores calice petalis (flavis) staminibusque ut speciei citatae, solum aliquanto minores, pistillo autem bicarpellato ovario cano-hispido, stilis 2 (filiformibus, glabris). Capsula matura 5–6 mm. longa 7–8 mm. lata, pilosa, lateraliter subcarinato-compressa, vertice inter carpella profunde emarginata, carpophoro destituta.

Habitat in silvulis humilioribus riparum inundatarum fluminis Curicuriary inferius, Rio Negro affluentis, in Brasiliae civitate Amazonas, 4–10–1935 legit A. Ducke, Herb. Jard. Bot. Rio de Janeiro n. 29041, cum ligno n. 226 (Yale 31953).

Species racemis gracillimis dissitifloris pendulis, pistillo bicarpellato, ovario hirsuto capsulaeque forma maxime insignis.

A very remarkable species which cannot be confounded

with any other. The young parts of the plant contain the same white and bitter latex as in *L. lactescens* Ducke, though in much smaller quantity. In the common *L. longifolia* this latex exists in feeble traces and is often difficult to observe.

## POLYGALACEAE

*Polygala scleroxylon* Ducke, sp. nov. — Ad sectionem *Acanthoclados*. Arbor circa 15 m. alta, ligno lutescente denso ac duro, ramulis vulgo oppositis, albido-cinereis, novellis angulosis et apice compressis, in bifurcationum medio saepe spinosis, partibus vegetativis omnibus glaberrimis. Folia saepissime opposita, petiolo 4–8 mm. longo valido super basin incrassato et articulo, lamina vulgo 60–140 mm. longa et 25–60 mm. lata, ovato-lanceolata vel lanceolato-oblonga, basi obtusa et complicata, apice brevius vel longius acuminata acumine ipso obtuso, margine integerrimo, subcoriacea, concolore (in siccis olivacea) supra magis nitente, costa mediana supra impressa subtus sat valide prominente, costis secundariis utrinque 6–10 in utraque pagina tenuibus ante marginem arcuato-anastomosantibus, venulis tenuibus at bene conspicuis. Inflorescentiae axillares (saepe ad folium delapsum), fasciculatae, bracteis basalibus parvis rigidis breviter pilosis, pedunculis 5–8 mm. longis erectis breviter puberulis apice dilatatis. Sepala 3 exteriora circa 3 mm. longa et 2 mm. lata extus convexa et apice puberula; 2 interiora (cito caduca) aliformia, patentia, 6–8 mm. longa et 4–5 mm. lata, obovata margine inflexo, basi longe unguiculata, glabra, aurea. Petala 2 inferiora vix 3 mm. longa anguste clavato-oblonga; 2 superiora 7–8 mm. longa anguste lineari-oblonga supra aliquanto rotundato-dilatata, pallide flava macula apicali obscure violacea, glabra marginibus basi minime ciliatulis; carina 6–8 mm. longa et parum minus lata, ecristata, subcucullato-orbiculari basi longe unguiculata, saturate aurea, glabra unguiculo minime ciliatulo. Tubus stamineus circa 7 mm. longus, flavus, glaber. Pistillum glaberrimum, ovario obscure viridi orbiculari compresso biloculari, stilo pallide flavo in parte basali et media sat late compresso, tertio apicali tenui subgeniculato-recurvato, stigmatibus subcapitatis. Fructus ignotus.

Habitat inter fluvii Madeira ripam oppido Humaytá oppositam et lacum Paraiso (in Brasiliae civitate Amazonas), silva periodice inundabili, 26-6-1936 legit A. Ducke, Herb. Jard. Bot. Rio de Janeiro n. 29038, cum ligno n. 287 (Yale 33814).

Species statura pro genere elata, ligno denso et duro, ramulis et foliis oppositis, floribusque aureis maxime insignis et inconfundibilis.

In foliage, inflorescence, and color of flowers, this curious tree resembles at first view certain yellow-flowering species of *Mouriria*. It represents, however, a new *Polygala* of the section *Acantocladus*, where it is related to *P. pulcherrima* Kuhl. from the State of Espirito Santo. It is certainly the tallest Polygalacea hitherto known in the world.

#### EUPHORBIACEAE

*Pera pulchrifolia* Ducke, sp. nov. — Ad sectionem VI, *Peridium*. Arbor dioica, 6-15 metralis. Ramuli novelli compressi dense rufo-tomentosi, vetustiores cylindrici, fistulosi, glabrati. Folia disticha opposita, petiolo 10-20 mm. longo valido depresso, rufo- (demum cano-) tomentoso, supra profunde canaliculato et demum glabrato; lamina vulgo 225-380 mm. longa 85-140 mm. lata, oblongo- vel elliptico-ovata, basi obtusa vel rarius rotundata, apice breviter acuminata et saepe mucronulata, herbaceo-coriacea, supra glabra nitida, subtus tomento submolli primum subcupreo-micante demum canescente induta, margine integerrima, costa mediana supra impressa subtus valide prominente, costis secundariis utrinque 20-25 supra tenuiter impressis subtus prominentibus longe ante marginem conspicue arcuato-reticulato-conjunctis. Involucra e nodis super petiolum vel petioli delapsi cicatricem insertis fasciculata, extus ut pedunculi rufosericea, primum aurantiaca demum coccinea, diametro in masculis usque ad 10 mm., in femineis ad 12 mm. (in vivis), pedunculis in masculis magis numerosis usque ad 10 mm., in femineis vix ad 8 mm. longis, bracteolis duabus subaequalibus subintegris. Calix in utroque sexu nullus. Involucrum masculinum florum femineorum rudimentis destitutum, staminibus 10-12, filamentis ad 1, 5 mm., antheris

circa 1 mm. longis flavidis. Involucrum femineum saepissime 4-pistillatum, ovariis dense rufo-velutinis, stigmatibus late trilobis glabris. Capsulae circa 15 mm. longae et 12 mm. crassae, subgloboso-obovatae vel subcubico-ellipsoideae, apice depressae, dense rufo-velutinae, vulgo 4 e pedunculo 4-12 mm. longo, pedicellis 2-4 mm. longis; semina nigra nitida caruncula coccinea.

Sat frequens circa Manáos in silvis non inundatis, solo arenoso humido vel leviter paludoso, legit A. Ducke, Herb. Jard. Bot. Rio de Janeiro n. 29036, cum ligno n. 241 (Yale 31968), arbor mascula, et H. J. B. R. n. 29037, arbor feminea. Mensibus Augusto ad Novembrem florifera, Decembre ad Februarium fructifera. Vidi arbores circa Borba in regione fluvii Madeira inferioris.

This is the third species with opposite leaves so far observed in the genus *Pera*, the other two being *P. oppositifolia* M. Arg., from Cuba, and *P. Mildbraediana* Mansf., of Eastern Peru. It is clearly differentiated, however, by its remarkably large leaves, the younger covered beneath with cupreous tomentum, and at first sight suggests certain *Vismias* or big-leaved *Eugénias* rather than a *Euphorbiacea*. The flowering trees often have the older twigs densely clothed with red involucre and offer a pretty aspect.

#### BOMBACACEAE

*Scleronema* Benth. is a well-defined independent genus and not a mere section or subgenus of *Catostemma*, from which it differs chiefly in its less numerous stamens with small, sessile anthers, and in its indehiscent fruit. The four species of *Scleronema*, described at the present, are: *Sc. Spruceanum* Benth., *Sc. grandiflorum* Hub., *Sc. praecox* Ducke, comb. nov. (= *Catostemma praecox* Ducke, Arch. Jard. Bot. Rio 5: 163. 1930) and *Sc. micranthum* Ducke, comb. nov. (= *Catostemma micranthum* Ducke, Arch. Jard. Bot. Rio 5: 164. 1930).

*Catostemma*, *Scleronema*, and the recently described monotypic genus *Aguiaria* Ducke, Ann. Acad. Brasil. Sc. 7: 4: 329. 1935, seem to form a proper subfamily *Catostemmateae*, equivalent to the *Matisieae* and not subordinate to the latter. Re-

garding their wood, Professor Record tells me that "the three genera, though readily separable, constitute a homogeneous group unique among the Bombacaceae, particularly in their laminated structure, distinct bands of thin-walled wood parenchyma cells alternating with layers of very thick-walled wood fibers." Comparative diagnoses of the three genera, made according to our herbarium material and field observations, are as follows:

**SCLERONEMA** Benth.: Folia glabra vel subtus pubescentia. Flores pauci in fasciculo vel solitarii. Calyx anthesi irregulariter 3-5-lobatus. Petala libera, basi unguiculata, anthesi reflexa. Petala et stamina rubra vel alba. Filamenta parum numerosa apice leviter dilatata, antheris parvis arcte sessilibus. Fructus magnus, exocarpio crasso solum putredine dehiscente, semine magno libero. Species 4 notae, e regionibus fluviorum Rio Negro, Japurá (Caquetá), Solimões et Madeira.

**CATOSTEMMA** Benth.: Folia glabra. Flores in fasciculo numerosi. Calyx anthesi irregulariter 3-lobatus. Petala libera, non unguiculata, post anthesin irregulariter reflexa et separatim decidua. Petala et stamina alba. Filamenta numerosissima tenuia, antheris sat magnis versatilibus. Fructus magnus, exocarpio tenui maturitate trivalvi, semine magno libero. Species 2 in Guiana britannica, tertia in Brasilia boreali secus Rio Negro.

**AGUIARIA** Ducke: Folia subtus tenuiter lepidota. Flores in fasciculo numerosi. Calyx anthesi regulariter 5- (rarissime 4- vel 6-) dentatus. Petala basi in tubum annularem connata et ibi cum filamentorum tubo basali concreta, post anthesin simul cum staminibus decidua. Petala et stamina alba. Filamenta numerosissima apice attenuata, antheris sat magnis versatilibus. Fructus profamilia sat parvus, exocarpio maturitate a vertice ad basin in segmenta vulgo 5 subcampanulato-stellato-potentia dehiscente, endocarpio indehiscente spongioso-suberoso longitudinaliter costato semen includente. Genus monotypicum; species unica, *A. excelsa* Ducke, regionis cataractarum Rio Negro arbor maxima.

The following wood samples accompanied by herbarium

material of the three genera have been forwarded to Yale: *Scleronema micranthum* Ducke n. 13 (Yale 20694), *Catostemma sclerophyllum* Ducke, sp. nov., n. 291 (Yale 33818), and *Aguiaria excelsa* Ducke n. 168 (Yale 22628).

**Catostemma sclerophyllum** Ducke, sp. nov. — Arbor statura vix medocri, trunco cortice albidocinereo, ligno sordide albido duro, partibus vegetativis omnibus glaberrimis. Folia apice ramulorum congesta, petiolo 20-50 mm. longo stricto parte media canaliculato, basi et apice incrassato, lamina 60-100 mm. longa et 40-75 mm. lata (in ramis sterilibus vulgo dimidio maiore), oblongo-elliptica, basi plus minus cordata rarius rotundata, apice rotundata et medio retusa, subtus tenuiter marginata, rigide coriacea et valde fragili, siccitate supra glaucescente subtus ferruginescente, in utraque pagina nitida (in junioribus saepe valde lucida), penninervia (costis secundariis utrinque 6-10) et reticulata. Pedunculi e nodis supra petiolorum insertiones inter bracteas parvas acutas rigidas fasciculati numerosi, 30-50 mm. longi stricti erecto-patentes, striati, cano-tomentelli, apice dilatati; calix tenuiter cano-tomentosus, praeffloratione clausus, anthesi trilobus 10-12 mm. longus; petala 5 alba glabra tenuia striato-venosa, circa 15 mm. longa obovato-oblonga, post anthesin reflexa; stamina alba glabra numerosa petalis aequilonga, tubo basali brevi, filamentis tenuibus undulato-crispis, antheris sat magnis; ovarium cano-tomentosum, stilo glabro longe et tenuiter triramoso. Fructus eo speciei *C. commune* simile (secundum descriptionem et iconem in Hooker, *Icones Plantarum* 1986), pericarpio tenui maturitate trivalvi.

Circa Manáos sat frequens in silva non inundabili locis humidis vel leviter paludosis solo silico-humoso; rarissime florens. Legit A. Ducke 20-5-1936 alabastris vix semiadultis, 29-5 floribus fere totis jam defloratis; adsunt fructus vetusti. Typus in Herb. Jard. Bot. Rio de Janeiro n. 29040; specimina cotypica cum ligno n. 291 (Yale 33818). Prope Santa Izabel (Rio Negro) visum.

This species resembles *C. fragrans* and *C. commune* (of British Guiana), according to the drawings in Hooker's *Icones Plantarum*, but its leaves are different, being very hard and exceedingly brittle.

## RUBIACEAE

*Gleasonia macrocalyx* Ducke, sp. nov. — A speciebus duabus reliquis hucusque notis differt glabritie partium fere omnium et floribus magnis. Arbor parva ramulis compressis et angulosis, glaberrimis. Stipulae sat magnae oblongae, glabrae marginibus parce ciliatis, demum caducae cicatricibus annulo piloso instructis. Folia glaberrima, petiolo usque ad 20 rarius 30 mm. longo, lamina ad 160 rarius 200 mm. longa et ad 90 rarius usque 130 mm. lata, saepissime obovata, basi acuta, apice obtusa et in medio brevissime obtusissime acuminata, rigidius herbacea, subconcolore, utrinque nitida sat dissite prominenti-penninervia et praesertim supra distincte reticulata. Cymae in axillis superioribus solitariae vel binae, rarissime trinae, pauciflorae, pedunculis 100 mm. et ultra longis compressis glabris bis vel ter bifidis, bracteis ovato-lanceolatis, supremis longe subulatis, sparsim ciliatis, caducis. Ovarium 6–8 mm. longum compressum urceolatum, longitudinaliter costulatum inter costulas adpresse flavido-pilosum, apice barbatum; calicis lobi 5 erecti parum inaequales 65–95 mm. longi spatulato-obovati, basi in unguem longum attenuati, apice rotundati, ante apicem 20–40 mm. lati, albi basi extrema rubra, glaberrimi, penninervii; corollae, stamina et styli in speciminibus nostris desunt. Capsula ut videtur fere adulta circa 25 mm. longa 20 mm. lata 15 mm. crassa, glabra, granulosa, compressa ovoidea marginibus lateralibus subcarinatis, medio in una facie longitudinaliter costata, basi obtusa, apice truncata calice destituta; semina sat magna plana nondum perfecte evoluta, modice numerosa.

Habitat ad ripas inundabiles fluminis Curicuriary superius (Rio Negro affluentis in Brasiliae civitate Amazonas), 26–11–1936 legit A. Ducke, Herb. Jard. Bot. Rio n. 29045, cum ligno n. 304 (Yale 33831). Arbores plurimae visae.

The present species is the third of this beautiful and interesting genus first discovered by the Tyler Expedition on the summit of Mount Duida (*Gleasonia duidana* Standl.). A second species (*Gl. uaupensis* Ducke) grows in the upland "catinga" of the lower Uaupés. Both differ from our new species in their abundant pilosity and much smaller flowers.

## CURRENT LITERATURE

Notes sur la répartition et l'écologie de Phanérogames Dicotylédones, nouvelles ou rares de la Guadeloupe et dépendances. By H. STEHLÉ. *Bull. Société Botanique de France* (Paris) 83: 623–637; Jan. 30, 1937.

Since the appearance of the flora of the French Antilles published in 1897 by Duss, changes have taken place in the flora of Guadeloupe. An annotated list is presented of rare or interesting species of the region, as well as of some not previously reported. Several new species are listed, but without descriptions. Local names are indicated for many of the plants, which include numerous trees and shrubs.

Las Cactáceas de México. By HELIA BRAVO H. Pp. xiv, 1–755; 325 figs.; Jan. 25, 1937.

Among all botanical publications that have appeared in Mexico, at least in recent years, this volume by Professor Bravo is easily first in scientific rank. Its author has taken into account all modern literature relating to Mexican cacti, and has done much original work in the field and herbarium, whose results are evident upon the printed pages. The many fine photographs that illustrate the text, nearly all originals, greatly simplify the task of naming plants in this difficult family.

Miss Bravo's monograph includes chapters upon the history of the group, the use of cacti by the ancient Mexicans, structure of the plants, and geographic distribution. The main part of the volume is devoted to a systematic account of all species known to occur in Mexico, with synonymy, brief descriptions, and citations of vernacular names, illustrations, and distribution, as well as data of economic interest. There are included many species of recent publication that do not appear in Britton and Rose's monograph of the Cactaceae. This handsome and well printed volume will prove invaluable to botanists interested in this peculiarly American group of plants, as well as to the host of horticulturists who in recent years have become so enthusiastic in their cultivation. Especially noteworthy are the numerous striking photographs of giant tree

cacti, of the *Cereus* group, which dominate the landscape in so many of the dry regions of Mexico.—P. C. STANDLEY.

***Erythea, Brahea.*** By L. H. BAILEY. *Genes Herbarium* (Ithaca, N. Y.) 4: fasc. 3; Feb. 23, 1937.

Professor Bailey, continuing his monographic studies of North American palms, deals in this number with two genera of fan palms of Mexico. *Erythea* Wats. with its six species is redescribed and elucidated with aid of drawings and photographs, the main difficulty in this genus being "in clear specific diagnosis of the group known as *E. armata*." In the much older genus, *Brahea* Mart., with only four species now recognized, a much less satisfactory condition is exposed and found associated with a paucity of material in herbaria, lack of observations and photographs, Bartlett's rediscovery of *B. dulcis* being undoubtedly the most important event in the history of this genus since Martius. Professor Bailey's recognition of the importance of photographs in the study of palms and of the indispensability of drawings for the classification of the verbal descriptions helps to render this series particularly useful and illuminating.—B. E. DAHLGREN, *Field Museum of Natural History*.

**A new genus of Anacardiaceae.** By FRED A. BARKLEY. *Annals Missouri Bot. Gard.* (St. Louis) 24: 1-5; pls. 1-3; February 1937.

The genus *Actinocheita* consists of a single species, *A. filicina*, based upon *Rhus filicina* DC., a shrub or small tree of southern Mexico.

**Elementos de botánica general.** By ULISES ROJAS. Tomo III, pp. 677-1661; figs. 990-1542; Guatemala, August 1936.

In this thick volume Professor Rojas completes his textbook of the elements of botany, based in large part upon Guatemalan material. The first portion of the volume completes a running account of the higher groups of flowering plants. Chapter 37 consists of about 150 pages devoted to medicinal or otherwise economic plants, with special attention to those of Guatemala. This is followed by a highly detailed table of

the plants discussed in the work, arranged by families and higher groups, with citation of their vernacular names. There is included also an extensive glossary and a long index. From the standpoint of forestry, the volume is of interest because of the great number of vernacular names, and above all for the very numerous photographs of Guatemalan scenery and vegetation, which afford a good idea of the plant life of the republic.—P. C. STANDLEY.

***Chanekia*, a new genus in the Lauraceae.** By C. L. LUNDELL. *Phytologia* (New York) 1: 177-181; February 1937.

The new genus *Chanekia* consists of the following species: *C. campechiana* (based on *Ocotea campechiana* Standl.), *C. Peckii* (*Misanteca Peckii* I. M. Johnston), *C. caudata* (British Honduras), *C. coriacea* (British Honduras), *C. misantlae* (*Acrodiclidium misantlae* Brandeg.), *C. mexicana* (*A. mexicanum* Brandeg.). The trees of this group extend from British Honduras to Vera Cruz, Mexico.

**Additional notes on the genus *Aegiphila*.** I. By HAROLD N. MOLDENKE. *Phytologia* 1: 182-208; February 1937.

The author publishes extensive additional notes regarding species treated in his monograph (1934) of *Aegiphila*. New species are *A. alba* (Ecuador), *A. australis* (Santa Catharina, Brazil), *A. Hastingsiana* (Guatemala).

**The genus *Pausandra* Radlk.** By J. LANJOUW. *Recueil des Travaux Botaniques Néerlandais* 33: 758-769; 2 figs.; 1936.

The genus *Pausandra* (Euphorbiaceae) consists of 9 species of trees, ranging on the American continent from Nicaragua to southern Brazil. Three new species are described from Brazil.

**New or otherwise noteworthy Apocynaceae of tropical America.** V. By ROBERT E. WOODSON, JR. *Annals Missouri Bot. Gard.* (St. Louis) 24: 11-16; February 1937.

The new genus *Plumeriopsis* Rusby & Woodson contains a single species, *P. Abouai*, based upon *Cerbera Abouai* L. New species are *Tonduzia macrantha* (Guatemala), *Rauwolfia*



*indecora* (Costa Rica), *Vallesia antillana* (Florida, West Indies), *V. flexuosa* (Costa Rica), *V. Baileyana* (Sonora, Mexico), *Allomarkgrafia Brenesiana* and *A. subtubulosa* (Costa Rica).—P. C. STANDLEY.

**Lista provisional de las Gramíneas señaladas en Venezuela hasta 1936, con notas acerca de su valor nutritivo, etc.**

By H. PITTIER. Boletín Técnico No. 1, Ministerio de Agricultura y Cría (Caracas). Pp. 79; 1937.

An annotated list of the grasses known from Venezuela, 390 species being listed, among which are numerous woody bamboos. A table indicates the altitudinal range of the species, from which it appears that the number of species decreases with altitude, almost two-thirds of the total number occurring below 500 meters, and only nine species in the tierra gélida, at 3800–5000 meters.

**Über die Gattung *Metteniusa* Karsten (= *Aveledoa* Pittier).**

By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dablem* 13: 359–361; Dec. 30, 1936. *ICACIYCEP*

The genus *Aveledoa* of the Flacourtiaceae is a synonym of *Metteniusa*, of which three species are known, in Venezuela, Peru, and Colombia.

**Studies in the Boraginaceae. XII.** By IVAN M. JOHNSTON. *Journ. Arnold Arboretum* (Jamaica Plain, Mass.) 18: 1–25; January 1937.

Among new species are *Cordia cordiformis*, Guatemala; *C. decipiens*, Amazonas, Brazil; *C. lomitoloba*, Amazonian Brazil; *C. Mexiana*, Peru and Colombia.

**Revision of the Lauraceae. I.** By A. J. G. H. KOSTERMANS. *Recueil des Travaux Botaniques Néerlandais* 33: 719–757; figs. 1–3; 1936.

The genus *Acrodiclidium* consists of 27 species of trees of South America and the West Indies, which are discussed in detail, with a key for their separation, full descriptions, citation of material studied, and often lists of vernacular names.

New species are *A. endlicheriaefolium*, Peru; *A. multiflorum*, Rio Acre, Brazil; *A. Mutisii*, Colombia. *Phyllostemonodaphne* is a new genus, consisting of a single species, described as *Geoppertia geminiflora* Meissn., of Rio de Janeiro and Minas Geras, Brazil.

**Notes on an expedition to the Rupununi District British Guiana.** By T. A. W. DAVIS. *Kew Bull. Misc. Information* 526–530; 1936.

A brief account of a visit to the balata forests of the Rupununi District, primarily for the purpose of studying balata. The forests covering the plain between the Essequibo and the northern savanna are decidedly drier than the mixed forests of the Northwest District or those of the central part of the colony, being intermediate between evergreen tropical rain and monsoon forest. Dominant trees are *Mimusops balata*, *Swartzia* sp. (called Wamara), and locally *Aspidosperma excelsum* (Yaruru). Other abundant groups are Leguminosae, Sapotaceae, Rosaceae, Lecythidaceae, Anonaceae, and *Tapira*.

The forests of the Kanaku Mountains are similar to the *Mimusops-Swartzia* type, but rather more mixed. Here occur *Peltogyne* and *Mimusops excelsa*. Dominant species of the limited forests of the savanna region are *Curatella*, *Bowdichia*, *Antonia*, *Byrsonima*, *Plumeria*, *Psidium*, and *Acacia polyphylla*, often in association with numerous other groups.—P. C. STANDLEY.

**Boraginaceae.** By I. M. JOHNSTON. In Pulle's *Flora of Suriname* 4: 306–333. Amsterdam, 1936.

The Boraginaceae are represented in Surinam by three genera: *Cordia*, with 15 species; *Tournefortia*, 4; and *Heliotropium*, 4. Vernacular names are reported for many of the trees and shrubs.

**Additional notes on the Rubiaceae of Surinam.** By C. E. B. BREMEKAMP. *Recueil des Travaux Botaniques Néerlandais* 33: 705–715; December 1936.

Twelve species of Rubiaceae are reported for the first time from Surinam. New species of woody plants are *Tocoyena surinamensis*, *Tbieleodoxa notodula*, and *Psychotria Romboutsii*.

**Studies in Moraceae. III. Additional notes on the genus *Clarisia* Ruiz et Pavón emend. Lanj.** By J. LANJOUW and G. ROSSBERG. *Recueil des Travaux Botaniques Néerlandais* 33: 716-718; December 1936.

Additional notes are given regarding several species of *Clarisia* treated in Lanjouw's recent monograph. *C. ilicifolia* (Spreng.) Lanjw. & Rossb. (*Excoecaria ilicifolia* Spreng.) is the proper name for the species listed there as *C. strepitans* (Allem.) Lanjw.

**Les bois de la Guyane française. L'angélique et ses usages.**

By M. DEMOUGEOT. *Revue Internationale du Bois* (Paris) 3: 36: 527-538; December 1936.

Angélique (*Dicorynia paraensis* Benth.) is a large forest tree of French Guiana and its timber has many valuable properties which should lead to its most extensive utilization. Chief among these desirable attributes are attractive appearance, ease of working, and high resistance to decay and marine borers. The principal difficulties are in extracting the logs with primitive equipment, but these could be overcome readily enough if a market were assured.

**Vermischte Diagnosen. IV.** By H. SLEUMER. *Repertorium Specierum Novarum* (Berlin-Dahlem) 41: 117-128; Nov. 25, 1936.

New species of woody plants are *Macleania pentaptera* (Ecuador), *Psammisia coccinea* (Ecuador), *Lindackeria grewioides* (German East Africa), *Tetrathylacium nutans* (Ecuador), *Scolopia bainanensis* and *S. Henryi* (China), *Styrax anomalus* (Brazil), *S. Buchtienii* (Bolivia), *S. pseudargyrophyllus* (Colombia), *S. subargenteus* (Argentina), *Cinnamodendron angustifolium* (Haiti), *C. Ekmanii* (Dominican Republic).—P. C. STANDLEY.

**Species nonnullae brasilienses novae.** By R. PILGER. *Repertorium Specierum Novarum* 41: 222-224; Feb. 25, 1937.

Among new species described from Brazil are *Alseis Pickelii* (Pernambuco) and *A. reticulata* (Amazonas).

**Die Palmengattung *Morenia* R. et P.** By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 332-339; Dec. 30, 1936.

The South American palm genus *Morenia* is represented by nine species, of which there are described as new *M. macrocarpa* (Peru), *M. robusta* (Colombia), and *M. caudata* (Ecuador).

**Palmae neogaeae. X.** By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 339-347; Dec. 30, 1936.

New American palms are *Synechanthus ecuadorensis*, *Hyospathe Schultzzeae* (Ecuador), *Chamaedorea polyclada* (Ecuador, local name Palmito), *Geonoma gibbosa* (Ecuador), *Euterpe trichoclada* (Ecuador), *E. aphanolepis* (Colombia), *E. Langloisii* (Trinidad).

**Contribuição para o conhecimento das "oiticas."** By PH. LUETZELBURG. *Boletim, Inspectoria Federal de Obras contra as Seccas* (Rio de Janeiro) 5: 2; 1936.

From the study of a large but not comprehensive series of specimens of the Oiticica tree of northeastern Brazil, especially of Ceará, the author comes to the provisional conclusion that the vernacular name Oiticica, as well as the scientific binomial *Licania rigida* as used at present, is of the nature of a collective term, covering, he suspects, two genera and six species, still unnamed and undefined. This would account for a certain variability in the characteristics of the oil obtained from various lots of seeds. In support of this he supplies a table of measurements and differentiating characters of 22 specimens, all from Ceará localities, indicating a variation which is considerable (one might well be named forma *glomerata*), but apparently not greater than that found in various other species of this genus which ranges from Mexico to southern Brazil with numerous species in the Guianas and in the

Amazon.—B. E. DAHLGREN, *Field Museum of Natural History*.

**Neue Ouratea-Arten aus Südamerika.** By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dablem* 13: 349-356; Dec. 30, 1936.

New species of *Ouratea* are *O. amplifolia* (Peru), *O. frontium* (Brazil-Venezuela border), *O. Hoebnei* (Matto Grosso, Brazil), *O. phaeophylla* (Peru), *O. Pittieri* (Venezuela), *O. praecox* (Venezuela), *O. riparia* (Pará, Brazil), *O. septentrionalis* (Maranhão, Brazil), *O. subcaudata* (Pará, Brazil), *O. Trollii* (Bolivia), *O. Weberbaueri* (Peru), *O. Werdermannii* (Bolivia).

**Über die neue Flacourtiaceengattung *Spruceanthus*.** By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dablem* 13: 362-363; Dec. 30, 1936.

*Spruceanthus* is a new genus of trees of the Flacourtiaceae, native in Colombia, Amazonian Brazil, and eastern Peru. The single species has as synonyms *Banara grandiflora* Spruce and *Hasseltia grandiflora* Sleumer.

**Flora of Peru. Part II, No. 2.** By J. FRANCIS MACBRIDE. *Field Museum Bot. Ser. (Chicago)* 13: 257-661, i-ii; March 15, 1937.

The present installment of the *Flora of Peru* covers the families Chloranthaceae to Ranunculaceae, inclusive, of the Engler sequence. The chief groups of woody plants treated are Juglandaceae, Moraceae, Proteaceae, and Loranthaceae. Text of the Ulmaceae is contributed by Charles Baehni; of the Urticaceae by E. P. Killip; of *Ficus*, Olacaceae, Opiliaceae, Polygonaceae (except *Rumex*), Chenopodiaceae, Amaranthaceae, Nyctaginaceae, and Nymphaeaceae by Paul C. Standley.

**Las Mirtáceas del Uruguay.** By DIEGO LEGRAND. *Anales Mus. Hist. Nat. Montevideo* II: 4: No. 11; 70 pp.; 1 pl.; 1936.

A detailed account of the Myrtaceae known from Uruguay. They are represented by 29 species, distributed among 11

genera. For each species are cited synonymy and material studied, often with vernacular names. *Eugenia anomala* and *Myrciaria Boporeti* are described as new.

**Palmae gerontogaeae. VI.** By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dablem* 13: 347-348; Dec. 30, 1936.

*Pinanga banaensis* Magalon and *P. nanmospadix* Burret, both of Annam, are transferred to the genus *Nenga*.

***Lithocarpus Guinieri*, chêne nouveau du Cambodge.** By AIMÉE CAMUS. *Bull. Société Botanique de France (Paris)* 83: 419; December 1936.

A new species of *Lithocarpus* (Fagaceae) described from Cambodia.

**Contributions to the flora of Siam. Additamentum XLI.** *Kew Bull. Misc. Information* 26-44; 1937.

Twenty-seven new species of *Ardisia* are described by Fletcher, and new species in *Cbilocarpus*, *Melodinus*, *Rauwolfia*, *Alyxia*, *Kopsia*, *Alstonia*, and *Pagiantba* by Kerr.

**The Malaysian species of *Wendlandia* (Rubiaceae).** By J. M. COWAN. *Bull. Jard. Bot. de Buitenzorg* 3: 14: 8-46; figs. 1-26; December 1936.

The Malaysian representatives of *Wendlandia* are referred to 17 species, which are keyed and described in detail, with citation of material and extensive critical notes. *W. fulva* is described as new from Java.

**Rivisio Ebenacearum Malayensium.** By R. C. BAKHUIZEN VAN DEN BRINK. *Bull. Jard. Bot. de Buitenzorg* 3: 15: 1-49; December 1936.

The Malayan Ebenaceae are all referable to the genus *Diospyros* (including *Maba*), in which they are distributed among the subgenera *Maba*, with 3 sections; *Hierniodendron*, with 3 species; and *Eudiospyros*, with 31 sections and 157 species. A detailed key is provided for separation of species and larger groups, but the species are not listed separately.

Miscellaneous notes on Loranthaceae. By B. H. DANSER. *Blumea* (Leiden) 2: 34-59; illustrated; Aug. 31, 1936.

The article consists of seven sections, treating the following subjects: *Amylotbea micranthes*, a new species from Island Biak; a new classification of genera of the tribe Elytranthinae; Loranthaceae of Dr. Kaudern's Celebes Expedition, with a new species of *Macrosolen*; Clemens Loranthaceae from Borneo, with a new *Dendrophthoe*; Loranthaceae collected by George Forrest in Yunnan and adjacent regions; a new species of *Lepeostegeres* from the Philippine Islands; and a new species of *Dicymanthes* from Lombok.—P. C. STANDLEY.

**Archboldia**, a new verbenaceous genus from New Guinea.

By EVA BEER and H. J. LAM. *Blumea* (Leiden) 2: 31-33; 1 fig.; Aug. 31, 1936.

*Archboldia* is a new genus of shrubs, with a single species, believed to be related to *Faradaya*.

Fijian plant studies. By ALBERT C. SMITH. Bernice P. Bishop Mus. Bull. 141, 166 pp., 83 figs. Honolulu, 1936.

The paper is based on plants collected in 1933 and 1934 under the auspices of Bernice P. Bishop Museum and Yale University. The islands of Vanualevu, Kandavu, Koro, Taveuni, Vanua Mbalavu, Moala, Kambara, and Fulanga were visited, and 2,008 numbers of plants collected. The report consists of an annotated list of the plants collected, in which the author has been assisted by specialists in various groups. Among genera of woody plants represented by new species are *Pandanus*, *Balaka*, *Kermadecia*, *Ficus*, *Polyalthia*, *Fissistigma*, *Cyatbocalyx*, *Myristica*, *Cryptocarya*, *Endiandra*, *Zantboxylum*, *Aglaia*, *Endospermum*, *Baccaurea*, *Macaranga*, *Buchanania*, *Elattostachys*, *Alectryon*, *Elaeocarpus*, *Microcos*, *Casearia*, *Phaleria*, *Barringtonia*, *Eugenia*, *Acicalyptus*, *Mooria*, *Tristania*, *Astronia*, *Plerandra*, *Schefflera*, *Maba*, *Fasminum*, *Excavatia*, *Ervatamia*, *Pagiantba*, *Cyrtandra*, *Randia*, *Sukunia* (a new genus of Rubiaceae), *Canthium*, *Ixora*, *Hedstromia* (new genus of Rubiaceae), and *Northia*. Vernacular names are reported for many of the species.—P. C. STANDLEY.

The shrinkage of Australian timbers. Part I. A new method of determining shrinkage and shrinkage figures for a number of Australian species. By W. L. GREENHILL. Pamphlet No. 67, Council for Sci. & Ind. Research, Melbourne, 1936. Pp. 54; 6 x 9½; 11 text figs.

"The mechanism of shrinkage and the cause and effect of collapse are discussed. It is pointed out that various established present methods of determining shrinkage are open to criticism in that they neglect the effect of collapse and drying stresses. The shrinkage which would occur if collapse and drying stresses were entirely eliminated has been called 'basic' shrinkage, and a method has been developed whereby basic shrinkage can be approximated very closely. This method depends on the use of small samples which are cut so that the dimension along the grain is less than one and a half times the average fiber length. The relation of basic shrinkage to that found by other methods is discussed.

"The results are given of investigations to determine the effect on basic shrinkage of various factors, such as thickness, size, and shape of sample, and of subjecting samples to various treatments. Basic shrinkage figures determined from thin samples and longitudinal shrinkage figures determined from 1 inch x 1 inch x 4 inch samples are tabulated for different species."—*Author's summary*.

A revision of *Stoebe* L. By MARGARET R. LEVYNS. *Journ. South Afr. Bot.* (Kirstenbosch) 3: 1-35; figs. 1-10; January 1937.

Of the genus *Stoebe* (Compositae) the author recognizes 34 species, the majority centered in the southwestern corner of Africa. Two species occur in Madagascar and one in Reunion. The plants are chiefly shrubs, several of which are described as new.

**Carphalea et Dirichletia** (Rubiaceae). Valeur des caractères génériques et description d'espèces nouvelles. By A.-M. HOMOLLE. *Bull. Société Botanique de France* (Paris) 83: 613-620; illustrated; Jan. 30, 1937.

Study of new species referable to the genus *Carphalea* has

led to the conclusion that the genus *Dirichletia* Klotzsch should be united with it. Six new species are described from Madagascar.

**The genus *Cordyla* Loureiro.** By E. MILNE-REDHEAD. *Repertorium Specierum Novarum* (Berlin-Dahlem) 41: 227-235; Feb. 25, 1937.

The genus *Cordyla* of the Leguminosae has been considered by all recent writers as monotypic, but in the present study four species are recognized, widely distributed in tropical Africa. *C. densiflora* is described as new from Tanganyika Territory.

***Peterodendron*, eine neue Gattung der Flacourtiaceen in Ostafrika.** By HERMANN SLEUMER. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 356-359; Dec. 30, 1936.

*Peterodendron ovatum* (*Poggea ovata* Sleumer) is a new genus of Flacourtiaceae from German East Africa. It is a shrub related to the genus *Poggea*.

**Neue und seltene Arten aus Ostafrika (Tanganyika-Territ. Mandat) leg. H. J. Schlieben. XII.** Edited by J. MILDBRAED. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 406-428; Dec. 30, 1936.

Among new species described from Tanganyika are trees and shrubs of the genera *Xylia*, *Erytrophloeum*, *Cynometra*, *Copaifera*, *Hoffmannseggia*, *Millettia*, and *Ormocarpum*.

**Die Gehölze des abessinischen Hochlandea.** *Mitt. Deutsch. Dendrol. Gesell.* (Dortmund) 48: 128-132; pls. 15-22; 1936.

A brief account is given of the climate and geology of the Abyssinian highlands. Dominating trees over large areas are *Euphorbia abyssinica* and *E. Menelikii*, which are employed only for firewood. They are often accompanied by *Pterolobium lacerans*. Abundant in grasslands are Acacias, especially *A. albida*, *A. abyssinica*, *A. Seyal*, and *A. stenocarpa*. Other common trees are *Olea chrysophylla*, *Ficus Darob* (local name Worka), *Hagenia abyssinica* (Kosso), *Podocarpus gracilior*,

*Juniperus macrocarpa*, and *Erythrina*. Among smaller trees and shrubs are represented such genera as *Rosa*, *Jasminum*, *Heteromorpha*, *Indigofera*, *Pittosporum*, *Phoenix reclinata* (the only palm of the highlands), *Ormocarpum*, *Rhus*, *Allophylus*, *Cordia*, *Protea*, *Cluytia*, *Maesa*, *Dombeya*, *Heptapleurum*, and *Berberis*.—P. C. STANDLEY.

**Observations nouvelles sur l'okoumé du Gabon.** By HENRI WAAG and L. DUPLAQUET. *Revue de Bot. Appliquée & d'Agr. Tropicale* (Paris) 16: 184: 982-990; 1 plate; December 1936.

The first part of the paper is concerned with the dehiscence of the fruits and certain factors affecting the germination of the seeds and the development of the seedlings. The second calls attention to the diminishing supply of the timber and the need for conservative management of the forest.

**Beschreibung tropischer Hölzer aus dem Urwalde Kameruns.** By F. JENTSCH and E. APPEL. *Zeitschrift für Weltforstwirtschaft* (Neudamm & Berlin) 3: 110-120; 235-246; 331-341; 497-506; 72 figs.

The trees and woods described and illustrated are *Terminalia superba* Engl. & Diels, *Pycnanthus kombo* Warb., *Staudtia kamerunensis* Warb., *Symphonia gabunensis* Pierre, *Aucoumea Klaineana* Pierre, *Triplochiton scleroxylon* K. Schum., *Mimusops djave* Engl., *Ceiba pentandra* (L.) Gaertn., *Rhizophora mangle* L., *Lophora procera* A. Chev., *Chlorophora excelsa* B. & H., *Musanga Smithii* R. Br., *Irvingia gabonensis* Baill., *Sterculia oblonga* Mast., *S. rhinopetala* K. Schum., and *Pterygota macrocarpa* K. Schum.

**Check-lists of the forest trees and shrubs of the British Empire. No. 3. Draft of first descriptive check-list of the Gold Coast.** By Members of Gold Coast Forest Dept. and Imp. For. Institute, Oxford, March 1937. Pp. 152, mimeographed.

"This draft list is intermediate between a check-list and a flora; it does not aim at being a compendium of all available

information on the species included, but is designed to provide detailed notes likely to be useful to the forest officer. The main object has been to give a short, concise botanical description, where this is desirable, together with notes on habit, bark, color, habitat and so forth, by way of assisting identification in the field, while avoiding unnecessary bulk. Botanical characters which are not diagnostic have usually been omitted on purpose, such as leaf-measurements which are in no way exceptional. Records of uses are mostly confined to those dealing with wood, and have not been taken wholesale from published records but rather from labels on authentic herbarium specimens; important secondary products are mentioned if these are utilized solely or chiefly."

**Tropical African plants.** By J. HUTCHINSON and J. M. DALZIEL. *Kew Bull. Misc. Information* 54-63; 1937.

Latin descriptions are published of species that appeared in the authors' *Flora of West Tropical Africa*, in the families Ebenaceae, Sapotaceae, Myrsinaceae, and Loganiaceae. Among woody plants are *Maba Cooperi* (vernacular names in Liberia Drebah, Bluchu); *Cbrysophyllum metallicum* (Krankabe, Gold Coast); *Pachystela micrantha* (Sokei, Kpengilopio, Sierra Leone); *Gaertnera salicifolia* (Mohr-ehu; canoes are made from the wood, which is soft and works easily).—P. C. STANDLEY.

**The useful plants of west tropical Africa.** By J. M. DALZIEL.

An appendix to the flora of west tropical Africa, by J. HUTCHINSON and J. M. DALZIEL. Crown Agents for the Colonies, 4 Milbank, Westminster, London, March 1937. Pp. xii + 612; 6¼ x 10. Price 18 s.

The preparation of this valuable compendium of the economic uses and the vernacular names of the native plants employed for food, drugs, and other useful purposes serves to connect botanical knowledge and research with the work of those concerned with the administration, welfare, and economic development of tropical regions of West Africa. "The author's field notes, some of which date back to 1905, afforded a nucleus, which suggested that value and interest

might be added to the Flora by compiling an Appendix with the help of the multitude of useful notes and native names accompanying herbarium specimens, or recorded in past or current literature. Sources of information as to value and uses, etc., are indicated in brackets or in the references to bibliography. . . .

"It was not originally intended to include folk-lore, but as much of native medical practice cannot easily be separated from magic and superstition, it has been thought well to include also many of the popular beliefs and ways of thinking about plants and their influence, real or supposed, on human behavior and welfare. In West Africa, as elsewhere, there are probably few plants which have not at some time or place been credited with medicinal properties, and as there are signs at present of an effort to raise the standard of African herbal practice, it is possible that the notes here brought together from a wide area—even if trivial in themselves—may be in some cases at least suggestive for further investigation. The desirability also of learning more about the actual or reputed poisonous plants of the country need not be stressed.

"Financial and other considerations have made it necessary to eliminate much that it was originally hoped could be included, and to condense the remainder. A full Vocabulary of Names, giving language and botanical equivalents, has therefore had to give place to a vernacular index with pages for reference; list of plants, according to their popular or commercial uses, under economic, domestic, medical, and other headings, have also been omitted."

**Rutacée et Méliacée nouvelles de la Côte d'Ivoire.** By A. AUBREVILLE and F. PELLEGRIN. *Bull. Société Botanique de France* (Paris) 83: 488-491; figs. 1, 2; December 1936.

*Araliopsis tabouensis* (vernacular name Grenian) and *Trichilia Martineaui* (Mietandabo) are described from Ivory Coast.

**Ebénacées et Sapotacées de la Côte d'Ivoire.** By A. AUBREVILLE and F. PELLEGRIN. *Bull. Société Botanique de France* 83: 621-623; Jan. 30, 1937.

New species of woody plants from Ivory Coast are *Diospyros kekemi* (vernacular names Kékémi, Aboupro, Pitoue, Bridié), *D. ivorensis* (N'gavi), and *Maba Gavi*. *Manilkara Matanou* previously published by the authors is reduced to synonymy under *M. Welwitschii* Engler.

**Rhizophoracées nouvelles de la Côte d'Ivoire.** By A. AUBRÉVILLE and F. PELLEGRIN. *Bull. Société Botanique de France* 83: 704-706; 2 figs.; Jan. 30, 1937.

New species from Ivory Coast are *Anisophyllea Meniaudi* (vernacular name Arélié) and *Cassipourea nialatou* (Nialatou, Glatou, Hérétou).

**Sources of vegetable wax.** By F. N. HOWES. *Kew Bull. Misc. Information* 503-526; 1936.

Among plants discussed as the source of wax are the following trees and shrubs: *Brosimum Galactodendron*; *Ceroxylon*, *Cocos*, *Raphia*, and *Copernicia*, among palms; *Euphorbia cerifera*; East Indian species of *Ficus*; *Myrica*; and *Rhus*.

**A comparison of certain properties of timbers from tropical and north temperate regions.** By S. H. CLARKE. *Nature* (London) 139: 511; March 20, 1937.

"Examination of the results of standard mechanical tests on more than 300 species of timber reveals a striking difference in the properties of timbers from tropical and north temperate regions respectively. . . .

"Two strength properties of the timbers were considered, namely, the strength in impact bending, as measured by the maximum drop of a 50 lb. hammer, and the strength under compression parallel to the grain. When the species-averages of these two properties were plotted separately against specific gravity, it was observed that for both of them the values for tropical and north temperate zone timbers have quite distinct distributions. Although these distributions overlap, it is clear that, for any given specific gravity, tropical timbers are, on the whole, weaker in impact bending though stronger under compression parallel to the grain than north temperate zone timbers."

H.P.C.

M. M. CHITTAWAY

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# TROPICAL WOODS

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## TROPICAL WOODS

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

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

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### AIDS IN IDENTIFYING AMERICAN TIMBERS OF THE ORDER MALVALES

By S. J. RECORD and R. W. HESS

The natural order of plants known as the Malvales is of world-wide distribution and comprises more than 200 genera and about 2400 species of trees, shrubs, and herbs. It derives its name from *Malva*, the Mallow, but the member of greatest economic importance is *Gossypium*, the source of cotton. Other commercial fibers are jute from *Corchorus*, kapok from *Ochroma*, and silk cotton from *Bombax*. The best known food products are cocoa and chocolate from the seeds of certain species of *Theobroma*. Some of the trees are noted for their gigantic stature and the lightness and softness of their woods, but the only timber with a long established reputation in the trade is the Basswood or Linden (*Tilia*). More recent introductions include the tropical American Balsa (*Ochroma*), the lightest of commercial woods, and the tropical African Abachi,

Ayous, or Samba (*Triplochiton*) and Mansonia, Pruno, or Apruno (*Mansonia*). Several others are of local utility and efforts are being made to find a market for some of them in the United States and Europe.

The classification of the Malvales has engaged the attention of botanists for over 150 years, and while the general outline of the group has become fairly stable, many problems of relationship within the order are still unsolved. To what extent wood anatomy can assist in this matter remains to be seen, for no comprehensive systematic study has been made of the woods of the whole group. In fact, owing to insufficient material, only a preliminary survey is now possible. Enough has already been done, however, to indicate the taxonomic importance of work in this field and to emphasize the need for further research. (See *Tropical Woods* 38: 15; *New Phytologist* 31: 119 and 34: 1.)

The present paper is decidedly limited in its scope. It deals with the woods of 44 arborescent genera of Malvales in the western hemisphere and ignores family lines. The work was done in connection with the senior author's forthcoming book, *Woods of Latin America*. As aids to identification it attempts to classify the genera according to various anatomical characters and utilizes the principal features in the construction of an artificial key. Such classifications imply rather sharp distinctions and tend to ignore intergradations and twilight zones. Probably in no other group of timbers are matters of size, distribution, and relative abundance of elements more susceptible to the influences of environment. Much more material must be collected and studied before the limits of variation within a generic group can be defined.

#### COLOR

Most of the wood specimens examined have no distinctive heartwood and are yellowish white or pale brown, often with a reddish tinge. The term "oatmeal" is applicable to many of them because the dark ray flakes are in contrast with the white fibers. Several genera, however, have very distinct heartwood, that of *Hibiscus tiliaceus* L. (and the form *elatus*) being variegated dark olive brown, metallic blue, or purplish.

The following classification applies to the heartwood, if distinguishable:

White or yellowish in *Abutilon*, *Bastardiopsis*, *Cavanillesia*, *Matisia*, *Quararibea*, *Tetrasida*, *Werklea*, and *Vallea*. Pale brown or oatmeal in *Apeiba*, *Aristotelia*, *Belotia*, *Bernoullia*, *Bombax*, *Ceiba*, *Cborisia*, *Dicraspidia*, *Goetbalsia*, *Guazuma*, *Gyranthera*, *Hampea*, *Heliocarpus*, *Huberodendron*, *Luebea*, *Luebeopsis*, *Mollia*, *Ocbroma*, *Pachira*, *Sterculia* (in part), *Theobroma* (in part), *Tilia*, and *Tricuspidaria*. Reddish brown in *Carpodiptera*, *Catostemma*, *Christiania*, *Fremontia*, *Muntingia*, *Sloanea*, and *Sterculia* (in part). Deep reddish brown in *Aguaria*, *Bombacopsis*, *Montezuma*, *Theobroma* (in part), and *Thespesia*.

#### ODOR AND TASTE

The foliage and bark of *Quararibea* smell like the bark of Slippery Elm (*Ulmus fulva* Michx.) and this scent has been noted on a few specimens of the wood. Some lumbermen can distinguish Basswood by the odor and taste. In general, however, the dry woods of the order are practically odorless and tasteless.

#### TEXTURE AND FEEL

Many of the woods of this group are characterized by coarse to very coarse texture, e.g., *Bernoullia*, *Bombax*, *Catostemma*, *Ceiba*, *Pachira*, *Schleronema*, and *Sterculia*. At the other extreme are some with medium to rather fine texture, e.g., *Abutilon*, *Aristotelia*, *Carpodiptera*, *Guazuma*, *Tilia*, *Tricuspidaria*, and *Vallea*. The feel of the unfinished lumber is often characteristic, though variable and almost impossible to describe. Balsa (*Ocbroma*), at least in the lighter grades, feels velvety, and to some degree the same applies to *Hampea* and some specimens of *Cborisia*. Many others are harsh, sometimes rather wiry. A few of the dark-colored woods are somewhat oily or waxy to the touch.

#### DENSITY AND HARDNESS

There is an enormous range in density, namely, 0.10 to 1.14. The lightest of all commercial timbers is Balsa (*Ocbroma*), but it varies from less than 7 to over 20 pounds per cubic foot.

*Werklea* and *Cavanillesia* are lighter, on the average, than *Ocroma*, but they lack the strength and elasticity of *Balsa*. At the other extreme is *Aguiaria excelsa* Ducke with a weight of 71 lbs. per cu. ft. With a few exceptions, the light-weight woods are harder and tougher than their low density would indicate. This may be due to their laminated structure, the layers of large, thin-walled, weak parenchyma cells being reinforced by narrow bands of tough, often thick-walled wood fibers. There is much variation in some of the genera and species and even in different parts of the same tree. The genera with the densest woods, arranged in approximate order (descending series), are *Aguiaria*, *Theobroma Spruceanum* Bern., *Christiania*, *Carpodiptera*, *Sloanea*, *Abutilon Cbittendenii* Standl., *Montezuma*, *Tetrasida*, and *Fremontia*. The genera with the lightest and softest woods, arranged in approximate order (beginning with the lightest) are *Werklea*, *Cavanillesia*, *Ocroma*, *Heliocarpus*, *Belotia*, *Sterculia* (in part), *Bernoullia*, *Hampea*, *Bombax*, and *Pachira*.

#### VESSELS

Pores vary in size from small and indistinct without lens to large and readily visible to the unaided eye. There is often considerable range within a genus and even in different specimens of the same species. They are few to very numerous, generally occurring singly or in small multiples, and well distributed without definite pattern. *Fremontia* is more or less ring-porous, with a single row of comparatively large pores in the early wood and numerous very small pores in diagonal or ulmiform patches and bands in the late wood. Pores are more numerous in the outer parts of the growth rings in some specimens of *Bombacopsis*, *Bombax*, *Cavanillesia*, *Ceiba*, *Chorisia*, *Ocroma*, and *Pachira*. The woods with the smallest pores belong to the following genera: *Abutilon*, *Aristotelia*, *Bastardiopsis*, *Belotia*, *Carpodiptera*, *Christiania*, *Fremontia*, *Guazuma*, *Hampea*, *Heliocarpus*, *Luebea*, *Luebeopsis*, *Matisia*, *Mollia*, *Quararibea*, *Septotbeca*, *Sloanea*, *Tetrasida*, *Theobroma*, *Tilia*, *Tricuspidaria*, and *Vallea*.

The vessel perforations are exclusively simple. Spiral thickenings were found only in *Fremontia* and *Tilia*. Tyloses

are common in some genera. Vessel-parenchyma pitting is typically half-bordered and sometimes is much coarser than the intervacular. The latter is exceedingly fine in *Carpodiptera*, *Christiania*, *Guazuma*, *Luebea*, *Luebeopsis*, *Matisia*, *Mollia*, *Muntingia*, *Quararibea*, and *Septotbeca*, the pits being as small as or smaller than those of *Betula* and *Swietenia*. Next to these in fineness are *Catostemma*, *Goetbalsia*, *Hampea*, *Scleronema*, *Tetrasida*, and *Tilia*. The largest intervacular pit-pairs are found in *Chorisia* and *Werklea*. The arrangement is normally alternate, but there is a more or less pronounced tendency to opposite or scalariform in *Aristotelia*, *Carpodiptera*, *Christiania*, *Sloanea*, *Tricuspidaria*, and *Vallea*.

#### RAYS

The rays are 2-sized, uniseriate and multiseriate. The latter vary greatly in width and height not only in different genera and species but also in different specimens of the same species. Width 1 to 4 cells, height up to 50 cells: *Carpodiptera*, *Christiania*, *Tetrasida*, *Tricuspidaria*, *Vallea*, and *Werklea*. Width 1 to 10, same height: *Abutilon*, *Hibiscus* (in part), *Huberodendron*, and *Ocroma*. Width 1 to 5, height up to 100: *Aristotelia*, *Luebea*, *Luebeopsis*, *Mollia*, *Montezuma*, *Thespesia*, and *Tilia*. Width 1 to 15, same height: *Aguiaria*, *Belotia*, *Bombacopsis*, *Ceiba* (in part), *Chorisia*, *Guazuma*, *Gyranthera*, *Hampea*, *Heliocarpus*, *Hibiscus*, *Matisia*, *Muntingia*, *Quararibea* (in part), and *Scleronema*. Width 1 to 5, height over 100 (occasionally over 300): *Aristotelia* (in part) and *Dicraspidia*. Width 1 to 20, same height: *Apeiba*, *Bernoullia*, *Bombax*, *Catostemma*, *Cavanillesia*, *Ceiba*, *Fremontia*, *Goetbalsia*, *Hampea* (in part), *Matisia*, *Pachira*, *Quararibea*, *Sloanea*, *Sterculia*, and *Theobroma*.

When the large rays are darker than the fiber background, as they usually are, they show conspicuously, especially on radial surface, but suggesting Sycamore (*Platanus*) rather than Oak (*Quercus*), though some approach the latter class. In some instances, however, as in *Cavanillesia*, *Matisia*, and *Quararibea*, the large rays are not deeply colored and are not very prominent except in proper lighting to bring out differences in luster.

Tile cells of the ordinary type, that is, of approximately the same height as the procumbent cells, characterize *Guazuma*, *Luebea*, *Luebeopsis*, and *Mollia*. (The only other genera in which they are known to occur are *Boschia*, *Coelostegia*, *Cullenia*, *Durio*, *Grewia*, *Kleinbovia*, *Leptonychia*, *Microcos*, *Neesia*, *Reevesia*, *Scaphopetalum*, and *Triplochiton*.) Empty cells of the same general category, but much larger, occur in *Belotia*, *Hampea*, and *Ocbroma* (also in *Duboscia*, *Grewia*, *Melochia*, and *Pterospermum* of the eastern hemisphere), but they are not so distinct as the other type and may be confused with ordinary upright cells. (See *New Phytologist* 32: 4: 10; also *Tropical Woods* 37: 9 and 38: 9.)

The only wood examined in which the rays are homogeneous or nearly so is *Muntingia*. The rays in the others are heterogeneous, usually decidedly so. In the uniseriate rays the cells are typically upright or square; in the multiseriate there is much variation. Sheath cells are common, sometimes very abundant.

Pits to the vessels are all minute in *Guazuma*, *Luebea*, *Luebeopsis*, *Matisia*, *Mollia*, *Muntingia*, *Quararibea*, and *Septotbeca*. In *Carpodiptera* and *Christiania* they are in part minute and in part elongated and tending to scalariform arrangement. Genera in which the pits to vessels are large to very large are *Aguilaria*, *Bernoullia*, *Bombacopsis*, *Bombax*, *Catostemma*, *Cavanillesia*, *Ceiba*, *Chorisia*, *Gyranthera*, *Huberodendron*, *Ocbroma*, *Pachira*, *Scleronema*, and *Werklea*. In the soft-wooded species the pits from one ray cell to another or to wood parenchyma cells are often very large.

#### WOOD PARENCHYMA

Wood parenchyma is, as a rule, abundantly developed and of many different types and combinations. It is virtually all paratracheal, sometimes with wing-like extensions (but not confluent into bands), and occasionally terminal (or initial) in *Abutilon*, *Aristotelia*, *Bastardiopsis*, *Belotia*, *Hibiscus*, *Mollia*, *Tricuspidaria*, and *Vallea*. It is in distinct metatracheal or confluent paratracheal bands in *Aguilaria*, *Carpodiptera*, *Catostemma*, *Christiania*, *Heliocarpus*, *Scleronema*, *Sloanea*, *Sterculia* (undetermined spp.), and *Tetrasida*. In the majority

of the genera under consideration, however, some or most of the parenchyma is in tangential laminae 1 to 3 cells wide alternating with 1 to 6 rows of wood fibers, and forming with the rays a fine meshwork or reticulate pattern, not distinct without the lens and, in some of the softest specimens, scarcely visible with it. In the very soft specimens the radial diameter of the parenchyma cells may be from 2 to 6 times that of the fibers. In the early wood of some samples of *Cavanillesia*, *Ceiba*, *Hampea*, and *Ocbroma*, there are bands of parenchyma 4 to 8, occasionally up to 12, cells wide, but the compound microscope is often necessary to determine that wood fibers are absent. Often the reticulate pattern is composed of fairly regular lines, closely and uniformly spaced, but sometimes, e.g., *Luebea*, *Goethalsia*, and *Tilia*, the lines are irregular and confused with diffuse parenchyma. In *Luebeopsis* the lines are sometimes uniform and spaced about a pore-width apart, but more often the pattern is irregularly and coarsely reticulate. *Sterculia* has small to large masses of paratracheal parenchyma as well as the finely reticulated metatracheal. The genera characterized by finely reticulate parenchyma, at least in part, are *Apeiba*, *Bernoullia*, *Bombacopsis*, *Bombax*, *Cavanillesia*, *Ceiba*, *Chorisia*, *Dicraspidia*, *Fremontia*, *Goethalsia*, *Guazuma*, *Gyranthera*, *Hampea*, *Huberodendron*, *Luebea*, *Matisia*, *Montezuma*, *Muntingia*, *Ocbroma*, *Pachira*, *Quararibea*, *Septotbeca*, *Sterculia*, *Theobroma*, *Tbespesia*, *Tilia*, and *Werklea*.

The wood of *Apeiba* is unique in having few to many arcs or concentric bands, 1 to 4 mm. thick, of lustrous, cottony tissue composed almost entirely of large, thin-walled parenchyma cells elongated radially. Sometimes these bands comprise the bulk of the stem, but more often they are of sporadic occurrence. *Heliocarpus* also has broad layers of parenchyma, but the cells are mostly cubical and the rays are not interrupted.

#### WOOD FIBERS

The wood fibers vary greatly in thickness of wall and size of lumen, as is to be expected from the range in density. Some of the woods of light weight, e.g., *Chorisia*, *Bombax*, *Pachira*, and *Sterculia*, also have thick-walled fibers, though they com-

pose only a small proportion of the wood mass. They tend to make the feel of the woods harsh and fibrous or wiry.

Septate fibers characterize *Bombacopsis*, *Bombax*, and *Pachira*, but are absent or infrequent in the others.

The fiber pits are small to minute, few to abundant, simple or with small, usually indistinct borders.

#### STORIED STRUCTURE

The woods of most of the genera studied are characterized by storied structure, though ripple marks are often irregular or obscure because of the variation in height of the large rays. Ripple marks are absent or virtually so in the available specimens of *Aristotelia*, *Fremontia*, *Huberodendron*, *Matisia*, *Ocroma*, *Quararibea*, *Septotbeca*, *Sloanea*, *Theobroma* (in part), *Christiania*, *Tricuspidaria*, *Vallea*, and *Werklea*. In some instances, e.g., *Christiania*, *Luebea*, and *Hibiscus tiliaceus* (in part), the rays are nearly all low and occupy a single tier, and the ripple marks are regular and distinct.

The cells of the parenchyma strands are sometimes in secondary seriation, the number of markings being usually twice or four times that of the ordinary ripple marks. The cells are large enough to be distinct under the lens in *Bombax*, *Cavanillesia*, *Ceiba*, *Chorisia*, *Dicraspidia*, *Hampea*, *Muntingia*, and *Pachira*.

#### GUM DUCTS

Vertical traumatic gum ducts were observed in certain specimens of *Bombacopsis*, *Catostemma*, *Cavanillesia*, *Fremontia*, *Hibiscus*, *Scleronema*, *Sloanea*, *Sterculia*, and *Theobroma*. Large, widely separated radial channels were observed in all specimens of *Heliocarpus*.

#### Artificial Key to the Genera

- |  |   |
|--|---|
| 1 a. Intervascular pitting exceedingly fine.....   | 2 |
| b. Intervascular pitting not exceedingly fine..... | 8 |
| 2 a. Tile cells present.....                       | 3 |
| b. Tile cells absent.....                          | 6 |

- |  |  |
|--|--|
| 3 a. Metatracheal parenchyma absent or sparse.....                   | <i>Mollia</i> .  |
| b. Metatracheal parenchyma abundant.....                             | 4  |
| 4 a. Parenchyma coarsely reticulate.....                             | <i>Luebeopsis</i> .                                      |
| b. Parenchyma very finely reticulate.....                            | 5  |
| 5 a. Parenchyma pattern uniform, distinct with lens.....             | <i>Guazuma</i> .   |
| b. Parenchyma pattern irregular, often indistinct with lens.....     | <i>Luebea</i> .  |
| 6 a. Parenchyma distinctly banded.....                               | <i>Carpodiptera</i> , <i>Christiania</i> .               |
| b. Parenchyma reticulate.....  | 7  |
| 7 a. Rays nearly homogeneous. Ripple marks present.....              | <i>Muntingia</i> .                                       |
| b. Rays decidedly heterogeneous. Ripple marks absent.                | <i>Matisia</i> , <i>Quararibea</i> , <i>Septotbeca</i> . |
| 8 a. Large tile cells present.....                                   | 9  |
| b. Large tile cells absent.....                                      | 11   |
| 9 a. Ripple marks absent.....  | <i>Ocroma</i> .  |
| b. Ripple marks present.....   | 10   |
| 10 a. Reticulate parenchyma present.....                             | <i>Hampea</i> .  |
| b. Reticulate parenchyma absent.....                                 | <i>Belotia</i> .   |
| 11 a. Vessels with spiral thickenings.....                           | 12   |
| b. Vessels without spiral thickenings.....                           | 13   |
| 12 a. Ring-porous. Latewood pores in ulmiform pattern.....           | <i>Fremontia</i> .                                       |
| b. Diffuse-porous. Without definite pore pattern.....                | <i>Tilia</i> .   |
| 13 a. Reticulate parenchyma absent.....                              | 14   |
| b. Reticulate parenchyma present.....                                | 25   |
| 14 a. Parenchyma mostly vasicentric and aliform, sometimes terminal. | 15   |
| b. Parenchyma in metatracheal or confluent bands.....                | 20   |
| 15 a. Vessel-ray pitting fine.....                                   | 16   |
| b. Vessel-ray pitting medium to coarse.....                          | 18   |
| 16 a. Heartwood deeply colored, purplish and olive-brown.            | <i>Hibiscus tiliaceus</i> L.                             |
| b. Heartwood not distinct, white or yellowish.....                   | 17   |
| 17 a. Largest rays 5 cells wide.....                                 | <i>Abutilon Cbittendenii</i> Standl.                     |
| b. Largest rays 6 to 10 cells wide.....                              | <i>Bastardiopsis</i> .                                   |
| 18 a. Rays 1 to 5 cells wide and up to 100 cells high.....           | <i>Aristotelia</i> .                                     |
| b. Rays not over 3 cells wide and 50 cells high.....                 | 19   |
| 19 a. Rays 1 to 3 cells wide and less than 30 cells high.....        | <i>Tricuspidaria</i> .                                   |
| b. Rays 1 or 2 cells wide, up to 50 cells high.....                  | <i>Vallea</i> .  |
| 20 a. Vessel-ray pitting fine.....                                   | <i>Tetrasida</i> .                                       |
| b. Vessel-ray pitting medium to very coarse.....                     | 21   |
| 21 a. Largest pores barely visible. Vessel-ray pitting medium.....   | 22   |
| b. Largest pores distinct. Vessel-ray pitting coarse.....            | 23   |

- 22 a. Wood very hard and heavy. . . . . *Sloanea*.  
 b. Wood very light and soft. . . . . *Heliocarpus*.
- 23 a. Wood very dense. Heart dark reddish brown. . . . . *Aguiaria*.  
 b. Wood of medium to low density. . . . . 24
- 24 a. Density low. Largest rays 20 cells wide and over 200 cells high.  
     *Sterculia* (in part).  
 b. Density medium. Largest rays not over 6 cells wide and 120 cells high.  
     *Catostemma*, *Scleronema*.
- 25 a. Vessel-ray pitting coarse to very coarse. . . . . 26  
 b. Vessel-ray pitting fine to medium. . . . . 34
- 26 a. Intervascular pitting coarse. . . . . 27  
 b. Intervascular pitting fine to medium. . . . . 28
- 27 a. Density exceptionally low. Pores barely visible. Rays 1 to 4 cells wide  
 and up to 40 cells high. . . . . *Werklea*.  
 b. Density rather low. Pores distinct. Rays 1 to 8 cells wide and up to 80  
 cells high. . . . . *Cborisia*.
- 28 a. Septate fibers abundant. . . . . 29  
 b. Septate fibers absent or few. . . . . 30
- 29 a. Heartwood rich reddish brown; sharply defined. . . . . *Bombacopsis*.  
 b. Heartwood dull brown; not sharply defined. . . . . *Bombax*, *Pacibira*.
- 30 a. Parenchyma in wide bands in early wood; reticulate in late wood. 31  
 b. Parenchyma reticulate throughout; no wide bands. . . . . 32
- 31 a. Wood exceedingly light, soft, brash. Pores few. . . . . *Cavanillesia*.  
 b. Wood light, but firm and strong. Pores numerous. . . . . *Ceiba*.
- 32 a. Texture very coarse. Color oatmeal. Density low. . . . . *Bernoullia*.  
 b. Texture medium to rather fine. Color yellow to light brown. Density  
 medium. . . . . 33
- 33 a. Rays up to 100 cells high. Ripple marks present. . . . . *Gyrantbera*.  
 b. Rays up to 35 cells high. Ripple marks absent. . . . . *Huberodendron*.
- 34 a. Vasicentric parenchyma well developed. Metatracheal bands some-  
 times present. . . . . *Sterculia* (in part).  
 b. Vasicentric parenchyma not well developed. . . . . 35
- 35 a. Largest rays 10 to 20 cells wide. . . . . *Theobroma*.  
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     *Montezuma*, *Thespesia*.  
 b. Tallest rays up to 200 or more cells high. Heartwood light brown. 37
- 37 a. With wide, cottony bands of parenchyma, the cells elongated radially.  
     *Apeiba*.  
 b. Without such bands. . . . . 38
- 38 a. Largest rays 5 cells wide. . . . . *Dicraspidia*.  
 b. Largest rays 10 cells wide. . . . . *Goetbalsia*.

THE GENUS *AMPELOCERA* IN CENTRAL AMERICA

By PAUL C. STANDLEY

*Field Museum of Natural History*

To the genus *Ampelocera* of the Ulmaceae there have been ascribed six species: the type, *A. Ruizii* Klotzsch of Peru; *A. cubensis* Griseb. and *A. crenulata* Urban of Cuba; *A. glabra* Kuhlm. and *A. verrucosa* Kuhlm. of Brazil; and *A. bondurensis* Donn. Smith of Honduras. Professor Record recently called the writer's attention to the fact that the wood of *Celtis Hottlei* Standl. (see *Tropical Woods* 12: 23 and 20: 21) was associable with the genus *Ampelocera*, and examination of the now rather ample herbarium material of that species shows that this reference is correct. I suspected at once that the Central American tree would prove to be the Cuban *A. cubensis*, which was not represented in the Herbarium of Field Museum. Examination of material of that species, lent by the New York Botanic Garden, shows that this is not the case, the Cuban species being distinct in most of its characters. *A. bondurensis* Donn. Smith (*Bot. Gaz.* 54: 244. 1912) proves to be synonymous with *Achatocarpus nigricans* Triana, of the Phytolaccaceae, a fact overlooked in the recent account of that family in the *North American Flora*. The following transfer of name is necessary:

***Ampelocera Hottlei* Standl., comb. nov. (*Celtis Hottlei* Standl. *Tropical Woods* 20: 20. 1929).**

Recently accumulated material shows such a wide range for the species that it will not be surprising to find an earlier name for it, but so far I have been unable to discover one. The following collections are in the Herbarium of Field Museum:

BRITISH HONDURAS: Temash River, Schipp 1347, S903; Hillbank, C. S. Brown xvii (Yale 13035); Valentin, Lundell 6346, 6225. GUATEMALA: Entre Ríos, Kuylen G. 63 (Yale 8894); Uaxactún, Bartlett 12766, 12532. HONDURAS: Near Progreso, W. D. Hottle 32 (type), 108. PANAMA: Forests around Puerto Obaldía, San Blas Coast, Pittier 4319. COLOMBIA: La Mojama, Dugand 605 (Yale 27127); Canacoima, Dugand 665 (Yale 28486); El Pajar, Dugand 550 (Yale 27087).

VERNACULAR NAMES: Achote del monte, arepito (Col.); manteca (Hond.); chaperno (?) (Guat.); bullhoof (Br. Hond.).

All the material seems to be remarkably constant in general characters, except that in Colombian specimens the leaves are somewhat larger and broader-based than in Central American collections. It is possible that the Colombian tree may be distinct, but all the available specimens, unfortunately, are sterile.

#### A COLOMBIAN SPECIES OF *CERVANTESIA* R. & P.

By A. C. SMITH

*New York Botanical Garden*

*Cervantesia colombiana* A. C. Smith, sp. nov.—Arbor 5–8 m. alta, trunco 50–60 cm. diametro prope basin crassissimo; ramis primariis abrupte adscendentibus profuse spinosis, spinis rectis acute cuspidatis 2–4 cm. longis; ramis secundariis ex eis primariis horizontaliter orientibus spinosis; ramulis gracilibus cinereis saepe rugosis glabris (juvenilibus inconspicue puberulis), spinas rectas acutas demum lignosas ad 17 mm. longas in axillis foliorum saepe gerentibus; petiolis glabris gracilibus 5–10 mm. longis, supra complanatis; laminis papyraceis glabris utrinque viridibus, elliptico-oblongis vel anguste ovato-oblongis, 6–16 cm. longis, 2–4.5 cm. latis, basi acutis vel subattenuatis, apice obtusis vel subacutis, margine integris vel leviter undulatis et anguste recurvatis, costa supra subplana subtus elevata, nervis secundariis utroque 4–8 irregulariter patulis utrinque prominulis, venulis anastomo-santibus utrinque planis vel leviter prominulis; inflorescentiis spicatis vel anguste paniculatis, prope apices ramulorum defoliorum aggregatis, 1–2.5 cm. longis, rachide et ramulis lateralibus brevibus (plerumque nullis) dense et arcte cinereo-sericeis (pilis ad 0.1 mm. longis); floribus numerosis sessilibus odoratis, bracteis minutis et lobatis vel obsoletis subtentis, sub anthesi 2.5–3.5 mm. longis, ad 4.5 mm. diametro; calyce pallide viridi tenuiter carnosio, extus minute et inconspicue puberulo, lobis 5 valvatis ovato-

lanceolatis acutis ad 2 mm. longis et 1.3 mm. latis, prope basin supra stamen cirro parvo pilorum pallidorum 0.8 mm. longo barbatis; staminibus 5 basi loborum affixis, margini disci insertis, segmentis alternis, filamentis filiformibus 0.5 mm. longis, antheris didymis oblongis obtusis 0.5 mm. longis, per rimas laterales dehiscentibus; disco carnosio conspicue 5-lobato, lobis oblongis, 1–1.3 mm. longis, circiter 0.7 mm. latis, apice obtusis vel leviter emarginatis; stylo carnosio 0.7–1 mm. longo, stigmatate subpeltato 0.7 mm. diametro margine undulato; ovario disco coronato 1-loculare, placenta basali filiformi contorta, ovulis 2 vel 3 apice placentae suspensis.

Type, *A. Dugand G. 991*, collected April 5, 1936, in dense forest of the transition type (intermediate between upland and lowland forests) along the trail between Arroyo de Piedras and Luruaco, Department of Atlantico, Colombia, and deposited in the herbarium of The New York Botanical Garden; duplicate in Yale School of Forestry (Yale 32393). Other collections, also from the Department of Atlantico, are: in sandy forest near Guájaro Lagoon, alt. 60 m., *Dugand 563*; in xerophilous forest on sandy soil along the La Playa—Juan Mina trail, alt. 60–150 m., *Dugand 652*. The type is in flower; the other two specimens are sterile, but from their foliage and wood anatomy there is no doubt that they belong here. Leaves of the type are the smallest, the above description having been based on all three specimens. Axillary spines are lacking on the type and on *652*, while on *563* they are well developed.

Mr. Dugand writes: "The absence or presence of spines is dependent on the age of the branchlets, and I should add that the twigs are much spinier on young trees and become less and less armed as the tree grows older. The fruits, according to information I believe to be reliable, are borne in clusters and are globose, suggesting small limes, yellow or yellowish green in color, and contain a single large, round, hard seed. The fruits are relished by the large rodents known as ñeques—a species of agouti (*Dasyprocta*)."

A common name for the plant is Matamaiz (corn-killer). Natives of the region, where this species is not uncommon, say that no other plants will grow in the shade of the Matamaiz, a fact verified by the collector.

This interesting genus consists of four other species, limited to Peru and Ecuador. Three of these are densely tomentose on the inflorescence and lower surfaces of leaves, and cannot be confused with our species. The Ecuadorean *C. glabrata* Stapf has not been seen by me, but according to the description it has glomerulate flowers, as well as more broadly elliptic and proportionately much shorter leaves, shorter petioles, and longer anthers than *C. colombiana*.

The position of the genus *Cervantesia* has been uncertain. It is closely related to *Iodina* Hook. & Arn., and the two genera are placed in such reference works as Bentham and Hooker and Engler and Prantl in the Tribe Osyrideae of the Santalaceae. The flower structure, especially the ovule arrangement, substantiates this opinion. Baillon (*Adansonia* 3: 125. 1862) proposed the Tribe Cervantesieae for the two genera, placing them in the Olacaceae. Miers (*Journ. Linn. Soc.* 17: 78. 1878) expressed the opinion that the tribe belonged in the Styracaceae. However, *Cervantesia* and *Iodina* may well be left in Santalaceae, a family which perhaps should be divided, until future anatomical studies disclose a better place for them.

*Dugand 858*, collected in Atlantico on the forested ridges of Casacoima, near Aguaviva, alt. 300 m., also known as Matamaiz, closely resembles *C. colombiana* in habit and foliage. The leaves are ovate-lanceolate and the fruits are drupaceous, coriaceous, subglobose, 15-20 mm. in diameter, contracted at base and apex, with a single shrunken and apparently aborted seed. Possibly this represents the same species, but the fruits do not closely resemble those described for other species of the genus, and the wood, according to Professor Record, differs from that of the three cited specimens.

#### CHORISIA SOLUTA IS A SPECIES OF CEIBA

During a recent investigation of the woods of the Bombacaceae I found reason to question the accuracy of Donnell Smith's determination of a Guatemalan tree as a species of *Chorisia* (*Botanical Gazette* 16: 2) and referred the matter to

Dr. William R. Maxon, U. S. National Herbarium, who replied on June 28 as follows: "Mr. C. V. Morton has looked up the type specimen of *Chorisia soluta* Donn. Sm. and finds it to be an abnormal form of *Ceiba aesculifolia* (H. B. K.) Britt. & Baker. This type specimen has 10 instead of 5 filaments, but a second specimen called *Chorisia soluta* by Donnell Smith has the normal number and, in Mr. Morton's opinion, is wholly typical of *Ceiba aesculifolia*."—S. J. R.

#### THE MUIRAPIRANGAS OF BRAZILIAN AMAZONIA

By ADOLPHO DUCKE

*Jardim Botânico do Rio de Janeiro*

The vernacular name Muirapiranga (red wood), largely used in Brazilian Amazonia, is applied to various genera and species of trees furnishing handsome red-brown hard and heavy woods. These trees belong to three botanical genera including several species. I know, at present, the following:

#### MORACEAE

1. *Brosimum paraense* Huber is the true Muirapiranga of the timber dealers of Pará; at Manáos, however, it is more often called Páo Rainha<sup>1</sup> (queen wood). It is a rather tall tree, widely distributed through the Brazilian states Pará and Amazonas and perhaps the whole hylaea, growing in the upland rain forest, more frequently on sandy soils than on clay. Herbarium samples have been distributed by the Pará Museum and by our Jardim Botânico to the principal botanical institutions; to Yale with a wood sample (Ducke 105, Yale 21364).

The Guiana Satiné is identical with our Amazonian species, according to Professor Record and Mr. Standley (*Tropical Woods* 17: 8-11, March 1, 1929). These authors, to whom botanical research in tropical America is very much indebted, are inclined to admit in the place of *Brosimum* three distinct

<sup>1</sup> The Páo Rainha of the upper Rio Branco is a leguminous tree, *Centropodium paraense* Tul. It is unknown at Pará, despite its specific name.



genera, based chiefly on the wood structure: *Brosimum* Sw., *Piratinera* Aubl., and *Ferolia* Aubl. There seems to be no constant floral characteristic, however, to confirm such a division (*Arch. Jard. Bot. de Janeiro* 3: 23-30, 1929).

2. *Brosimum angustifolium* Ducke is a tall tree of the Breves Islands in the mouth of the Amazon; also found in the lower Xingú. Its wood, which is more yellowish brown than red, is seldom found in the timber commerce of Pará and the dealers there consider it as an inferior quality of Muirapiranga.

#### LEGUMINOSAE

3. *Eperua bijuga* Mart. ex Benth, is a middle-sized tree with large purplish rose flowers and handsome red-brown but resinous timber only found in local commerce. It grows usually in moist or swampy places of the upland forest, chiefly on sandy soil with black humus, in the Amazonian estuary and from the western part of the lower Amazon (Lake of Faro) as far as Manáos, where it is very abundant. The common Muirapiranga of Manáos is this species, and not *Haploclathra paniculata* as stated by some authors. There is an authentic wood sample from Manáos in the Yale collections (Ducke 14, Yale 20695).

This tree is called Muirapiranga in Soure, Island of Marajó, as in Manáos, but in the neighboring Breves Islands it is known as Ipé or Aipé, a name more generally applied in Amazonia to several species of *Macrobium*, *Crudia*, and sometimes *Peltogyne*, and in extra-Amazonian Brazil to *Tecoma (Tabebuia)*, fam. Bignoniaceae. In Faro, it is known as Espadeira, but the species so designated in the upper Trombetas is *Eperua falcata* Aubl., the common Wallaba of British Guiana.

4. *Eperua Schomburgkiana* Benth. is rather like *E. bijuga*, but the flowers are white and the wood is darker and much more resinous. The tree grows in swampy upland rain forest on acid sandy soil, being frequent in some localities near Manáos, but otherwise only observed in the upper Trombetas region and the neighboring southern part of British Guiana. There is an authentic wood sample from Manáos in the Yale collections (Ducke 244, Yale 31971).

#### GUTTIFERAE

5. *Haploclathra paniculata* (Mart.) Benth. is a tall tree of infrequent occurrence in swampy forests around Manáos and has never been found in other localities. It is sometimes called Muirapiranga; also Tamaquaré, as are the species of the allied genus *Caraipa*, common in the same region. There is an authentic wood sample at Yale (Ducke 306, Yale 33833).

I formerly confused the present species with the one described below as new, but in *H. paniculata* the leaves are always opposite, not verticillate, and are less coriaceous, and more or less ovate with emarginate base and generally rather long acuminate apex, while the inflorescences are much shorter, with opposite branches, nearly odorless flowers, and denser indument on the capsule. Our specimens look exactly like the colored figure in Martius' work.

6. *Haploclathra verticillata* Ducke, sp. nov.—A species *H. paniculata* (Mart.) Benth. differt praesertim foliis saepius verticillatis oblongo-obovatis rigidis, inflorescentiis elongatis, indumento brevioribus, in fructibus tenui. Arbor mediocris vel sat magna, ligno pulchre rufo valde denso bono. Ramuli juniores angulosi rufotomentosi. Folia vulgo triverticillata rarius opposita, 120-150 mm. longa, tertio superiore 40-70 mm. lata, oblongo-obovata, basi in petiolum 15-25 mm. longum sensim cuneato-attenuata, apice vulgo brevissime obtuse acuminata, rigide coriacea margine revoluta, glauca subconcolora supra parum magis nitida, costis lateralibus utrinque 12-15 subtus valide prominentibus, venulis transversalibus tenuibus. Panicula erecta stricta usque ad 300 rarius 400 mm. et ultra alta, multiflora, ramulis saepissime ternatis, breviter canoferrugineo-tomentosa, floribus albis odoratissimis, ut in *H. paniculata* constructis at parum maioribus, calicis et ovarii indumento brevioribus. Capsulae semia-dultae adsunt breviter ovatae abrupte acute apiculatae, dense minute granulosae, pilis griseis minimis squamulosis et fasciculatis tenuissime indutae.

Frequens in silva riparia rarius inundabili solo rupibus intermixto, regione Rio Negro superioris praesertim secus cataractas. Specimina typica legit A. Ducke loco Camanáos, Febuario 1936 florifera, Martio cum fructibus semia-dultis,

cum ligno n. 257 (Yale 32633), Herb. Jard. Bot. Rio de Janeiro n. 29035. Specimina florifera inter S. Gabriel et ostium fluminis Uaupés Januario 1932 lecta (H. J. B. Rio n. 23785) olim sub determinatione erronea *H. paniculata* distributa. Tamaquaré vel Muirapiranga appellatur.

Var. *catingae* Ducke, var. nov.—A typo differt statura humili, foliis oppositis (in speciminibus nostris) valde crassis venulis transversalibus subtus valide prominentibus, panicula brevior magis pauciflora ramulis oppositis, floribus circiter dimidio maioribus. Habitat in silvula "catinga" humili solo arenoso humido, prope ripas fluminis Curicuriary superius (Rio Negro affluentis), legit A. Ducke 29-11-1936, florif., Herb. Jard. Bot. Rio de Janeiro n. 30125.

The typical form of this species is a medium-sized to rather tall tree, frequent in scarcely flooded forest on rocky banks near the cataracts of the Rio Negro. It is very attractive when in flower. Var. *catingae* is evidently a form occurring in the low and often scrubby "catinga" which constitutes one of the most characteristic features of the vegetation in the upper Rio Negro basin.

7. *Haploclatbra leiantba* Benth. is a common, hardly middle-sized tree of deeply inundable "igapó" (swamp forest) of the whole Rio Negro, chiefly along small tributaries. It is easily recognizable by the baldness of all its parts. It has relatively small, oblong or oblong-obovate leaves, opposite or in whorls of three, small flowers, and oblong-ovate acuminate fruits. I distributed complete herbarium samples from Santa Izabel (Herb. Jard. Bot. Rio n. 23451); the wood sample at Yale (Ducke 158, Yale 22618) was collected with flowering material at Rio Curicuriary. The vernacular name of the tree is commonly Tamaquaré, seldom Muirapiranga.

#### NOTE ON *ERISMADELPHUS* MILDBRAED

During a study of the woods of the Vochysiaceae a question arose as to whether there was more than one species of the West African genus *Erismadelphus* Mildbraed. Dr. J. Burtt Davy, Imperial Forestry Institute, Oxford, has had the sub-

ject investigated and submits the following note for publication:

"Dr. H. H. Bancroft and Mr. A. C. Hoyle have compared the type of *Erismadelphus Baudoni* A. Chev. with *E. exsul* Mildbr. and are of the opinion that it should be considered only a geographical variety or form of *E. exsul*. The leaf is narrower and more acute at the base and the inflorescence is less hairy, but no differences of a truly specific character were found."

#### NOTE ON *ARGYRODENDRON* F. MUELL.

By J. BURTT DAVY

*Imperial Forestry Institute, Oxford*

In his paper, "A critical revision of certain taxonomic groups of the Malvales" (*New Phytologist* 34: 1: 1-20; 2: 122-143. 1935), H. L. Edlin restored the genus *Argyrodendron* F. Muell. *Fragm.* 1: 2. 1858 (not *Argyrodendron* Klotzsch, in Peters, *Reise Mossamb.* Bot. 100. 1861) for the Australian species referred by Bentham to *Tarrietia* Blume. Edlin noted that *Argyrodendron* differs from *Tarrietia* in having a distinct constriction separating the wing from the seed, suggesting a line of evolution from *Tarrietia* towards more effective wind distribution; that the wing is larger in proportion to the seed than in *Tarrietia*; and that the wood structure is of a type different from that of either *Tarrietia* or *Heritiera*. Edlin therefore restored the name *Argyrodendron trifoliolatum* F. Muell. (*Tarrietia Argyrodendron* Benth.) for the type of the genus, and renamed *Tarrietia actinophylla* Moore as *Argyrodendron actinophylla* (Moore) Edlin (*l.c.*, 34: 10).

Edlin did not deal, however, with the varieties of *A. trifoliolatum*; as some of these are recognized as distinct varieties by the Forestry Departments of Australia they require scientific names by which to refer to them, and these are supplied below. In the absence of herbarium specimens, the descriptions are taken from Bailey's *Queensland Flora*.

*Argyrodendron trifoliolatum*, var. *grandiflorum* (Bentham) Burtt Davy, var. nov.; *Tarrietia Argyrodendron* Benth., var. *grandiflora* Benth. Fl. Austr.

1: 231; Bailey Queensland Flora 1:140 (1899).—"Calyx 4 lines diam.; stigmas short and broad."

*Argyrodendron trifoliolatum*, var. *angustifolium* (F. M. Bailey) Burt Davy, var. nov.; *T. Argyrodendron*, var. *angustifolia* Bailey, Cat. Queensland Woods, No. 29b; Occ. Papers Queensland Flora, 1886; Queensland Flora 1:140 (1899). "Leaflets 3, 2-3 in. long, narrow, often under ½ in. wide; petioles of normal form, silvery or approaching coppery on the under side. Wood of light grey color, close-grained, hard and tough, suitable for making tool handles." Type locality, Endeavour River, Queensland.

*Argyrodendron trifoliolatum*, var. *macrophyllum* (F. M. Bailey) Burt Davy, var. nov.; *T. Argyrodendron*, var. *macrophylla* Bailey, Bot. Bull. 9: 5; Queensland Agric. Journ. 1899, p. 393; Cat. Queensland Woods, No. 29b; Queensland Flora 1:140 (1899).—"A large tree; leaflets 3, rarely 2, silvery with a slightly brownish tinge on the under side, oblong, often abruptly acuminate, 5 to 10½ in. long, 1½ to 3½ in. broad, on nearly terete, striate petioles, 3 to over 6 in. long; flower-panicles rather large and loose, flowers small; carpels not seen. Wood light-colored, prettily figured, tough and firm."

*Argyrodendron trifoliolatum*, var. *peralatum* (F. M. Bailey) Burt Davy, var. nov.; *T. Argyrodendron*, var. *peralata* Bailey, Occ. Papers Queensland Plants, No. 1; Cat. Queensland Woods, No. 29c; Queensland Flora 1:140 (1899). Common names: Johnstone River Red Beech, Red Tulip Oak.—"A large erect tree, the stem often exceeding 5 ft. in diam.; leaves trifoliolate, the petioles somewhat angular, mostly 2 or 3 in. long; leaflets lanceolate, from 4 to 7 in. long and from 1 to 2 in. broad towards the middle; the indumentum more silvery than usual in this species, but with the same numerous small brown scales; inflorescence not sent by collectors; samaroid carpels muricate, oval or globose, ½ to ¾ in. long by about ½ in. diam., furnished with an oblong, oblique erect wing 2 to 4 in. long by about 1¼ in. broad, clothed with the same rusty stellate scales as the under side of the leaves. Wood resembling Cedar in appearance, but harder; suited for indoor and cabinet work; soon decays if exposed to bad weather." Type locality: "Peirir," Upper Barron River, Queensland.

*Tarrietia Argyrodendron*, var. *trifoliolatum* Bailey Queensland Flora 1:140 (1899) is cited by Bailey as synonymous with *Tarrietia trifoliolata* F. Muell. Fragm. 9: 43. He re-describes it as follows: "A tall tree; leaves with slender petioles 2 or 3 in. long, usually bearing 3 lanceolate leaflets 3 or 4 in. long, often dark from the numerous small coppery-colored scales on the under side; fruit usually coppery like the leaves, the wing nearly 2 in. long. This tree is plentiful in many scrubs north and south. Wood similar to the foregoing kinds, but rather darker; known as Stavewood, Cat. Queensland Woods, No. 29a. Leaflets sometimes infested with the fungus *Dimersporium tarrietae* Cke. & Mass."

## STANDARD TERMS OF LENGTH OF VESSEL MEMBERS AND WOOD FIBERS

The Council of the International Association of Wood Anatomists has approved the following definitions for terms of length of vessel members and wood fibers (libriform fibers and fiber-tracheids) in dicotyledonous woods, as recommended by Dr. LAURENCE CHALK, Prof. IRVING W. BAILEY, Mr. S. H. CLARKE, Prof. PAUL JACCARD, Prof. SAMUEL J. RECORD, and Prof. G. VAN ITERSOM, JR., constituting a Committee on the Standardization of Terms of Cell Size:

Class	Subclass	Vessel members	Wood fibers
Short	Extremely short	Less than 175μ	Less than 500μ
	Very short	175- 250μ	500- 700μ
	Moderately short	250- 350μ	700- 900μ
Medium-sized		350- 800μ	900-1600μ
Long	Moderately long	800-1100μ	1600-2200μ
	Very long	1100-1900μ	2200-3000μ
	Extremely long	Over 1900μ	Over 3000μ

## CURRENT LITERATURE

Studi sull'ecologia del mogano (*Swietenia mahagoni* Jacq.) in San Domingo. By RAFFAELE CIFERRI. *Atti Istit. Bot. di Pavia* 4: ser. 4: 87-166; 20 figs.; 1933.

An excellent account of Mahogany in Dominican Republic with reference to commerce in the timber, the distribution of the trees, the plant associations, the factors influencing natural reproduction and development of the trees, and proposals for increasing the economic importance of the species.

The vegetation of Petén. With an appendix, *Studies of Mexican and Central American plants. I.* By CYRUS LONGWORTH LUNDELL. *Carnegie Inst. Washington Publ.* No. 478; ix+244 pp.; 39 pls.; 3 figs.; 3 tables; June 16, 1937. The major part of the volume is a detailed account of vege-

tation of the Department of Petén, Guatemala, the department being divided into 3 regions: Northern Petén, Central Petén savanna country, and southern Petén. Each of these is discussed from the standpoints of geology and topography, drainage, climate, soils; history of vegetation as influenced by Maya occupancy, agriculture and fire destruction, and chicle exploitation. A detailed but simple classification of vegetation is given for each region, based largely upon topographic features. For each of the three regions there is an annotated list of ferns and flowering plants observed, the known flora numbering about 1400 species. The account is terminated by a brief discussion of relationships of the Petén flora. Many new vernacular names appear throughout the paper.

This carefully prepared discussion, based upon extensive field work by the author, is the most exhaustive treatment that has been accorded to any part of Central America, and will be found both useful and suggestive to those interested in regions of Mexico and Central America far distant from Petén. It is gratifying to know that plans are made for extending field work of similar nature to the whole Mayan area.

The Appendix includes descriptions of various new species: *Torrubia petenensis* (Petén), *Mabonia pinifolia* (San Luis Potosí, Mexico), *Acacia mayana* (Petén; local name Cruze-tillo), *Rbacoma Gentlei* (British Honduras), *R. riparia* (Petén, with a variety in British Honduras), *Eugenia Gentlei* (British Honduras). There is also an account of the Mexican and Central American species of *Ampelocissus*, recognizing 3 species, *A. costaricensis* being new; and an account of the *Diospyros* species of the Yucatan Peninsula, of which 8 are recognized, 2 of them new.—P. C. STANDLEY.

Contributions toward a flora of Panama, based upon collections by expeditions from the Missouri Botanical Garden Tropical Station, Balboa, C.Z. I. Collections in the provinces of Chiriquí, Coclé, and Panamá, by R. J. Seibert during the summer of 1935. By ROBERT E. WOODSON, JR. and RUSSELL J. SEIBERT. *Annals Missouri Bot. Gard.* (St. Louis) 24: 175-210; pls. 5-8, fig. 1; April 30, 1937.

A brief account of recent expeditions to Panama, followed by a list of new or otherwise interesting plants collected.

Among new species of woody plants are four species of *Piper* by Trelease; *Ocotea Whitei* Woodson; *Cissus Martiana* Woodson & Seibert; *Daphnopsis Seibertii* Standl.; *Mouriria brunneicalyx* Standl.; *Fuchsia Hemsleyana* and *F. pulchella* Woodson & Seibert; *Gilbertia stenodonta* Standl.; *Ardisia Seibertii* Standl.; *Appunia Seibertii* Standl.

Some new or noteworthy melastomes. By H. A. GLEASON. *Brittonia* 2: 319-327; June 1937.

New species from Central and South America are described in the genera *Leandra*, *Miconia*, *Clidemia*, *Ossaea*, *Blakea*, and *Topobea*.

Resumen de mi actuación en Colombia con motivo del II centenario del nacimiento de Mutis. By JOSÉ CUATRECASAS. *Trabajos Mus. Nac. Ciencias Nat. y Jard. Bot.* (ser. bot.) 33: 1-158; 8 pls.; 9 figs.; Madrid, July 30, 1936.

A condensed account of the author's visit to Colombia in 1932, upon the occasion of the celebration of the 200th anniversary of the celebrated Colombian botanist, Mutis. A brief description of regions visited is followed by a systematic list of plants collected, about which several papers have been published previously. Most of the new plants obtained have been described in earlier papers, but a number of new names, principally varieties and minor combinations, appear in this one, and eight new species of *Piper* are described (in English) by Trelease.—P. C. STANDLEY.

Contributions to the flora of tropical America. XXX. New species and records from British Guiana. By N. Y. SANDWITH. *Kew Bull. Misc. Information* 100-112; 1937.

New woody plants described from British Guiana include *Swartzia longipedicellata* (vernacular name Serebedan), *Voucapoa macropetala* (Sarabebeballi), *Paloue induta*, *Licania cuprea* (Aruadanni, Muri Kautaballi, Unikiakia, Kunoko), *Ixora Davisii*. Among old species listed are *Swartzia Jenmani* Sandw. (Parakusan), *S. grandifolia* Bong., var. *leiogyne* Sandw., var. nov. (Kerunite), *Geissospermum sericeum* Miers (Manyokinaballi), *Virola venosa* (Benth.) Warb. (Hill Dalli).

Beitrag zur Kenntnis der amerikanischen Moraceen. By G. ROSSBERG. *Repertorium Specierum Novarum* (Berlin-Dahlem) 42: 59-61; April 25, 1937.

New species are *Ficus Werckleana*, Costa Rica; *F. Ulei*, Amazonas, Brazil; *F. Sodiroi*, Ecuador. In addition, there are several transfers to *Ficus* from *Pharmacosycea* and *Urostigma*.

Espèces nouvelles de Phanérogames sudaméricaines. By R. BENOIST. *Bull. Soc. Bot. France* (Paris) 83: 802-809; 1937.

Among new species described from Ecuador are the following woody plants: *Palicourea Josephi*, *Vernonia nonoensis*, *V. tungurabuae*, *V. yamboensis*, *Haplopappus albicans*, *Baccharis angelica*, *B. balearia*, *Senecio simulans*, and *S. ingens*.

Notes on plants of northern Brazil collected by Dr. Francis Drouet. By LYMAN B. SMITH. *Contr. Gray Herb.* (Cambridge, Mass.) 117: 33-38; June 28, 1937.

Woody plants described as new from Brazil are *Helicteres beptandra* (Ceará), *Clusia Drouetiana* (Pará).

Einige bemerkenswerte Pflanzen des Münchner Staatsherbars. By KARL SUESSENGUTH. *Repertorium Specierum Novarum* 42: 14; 43-49; April 25, 1937.

Among the notes and descriptions published, relating largely to South American plants, are descriptions of the following woody plants: *Hirtella vesiculosa* and *Meriania ferruginea*, both from Rio Negro, Brazil.

Anatomia do lenho do "pau mulato". By FERNANDO R. MILANEZ. *Archivos do Instituto de Biologia Vegetal* (Rio de Janeiro) 3: 1: 111-129; 14 pls.; December 1936.

Pau Mulato or Capirona, *Calycophyllum Spruceanum* Benth., is a tree 25 to 45 feet high and 16 to 32 inches in diameter of very common occurrence in the Amazon region. The grayish white wood is of fine and uniform texture, sp. gr. 0.85. It is used locally to some extent for general construction, but principally for fuel. The only exports were 453 tons in 1927.

The present paper is in two parts, the first describing the anatomy of mature wood, the second dealing with immature tissues taken from the living tree and studied with reference to the development of the elements.

Notes on the botanical components of curare. By B. A. KRUKOFF and A. C. SMITH. *Bull. Torrey Bot. Club* (Menasha, Wisc.) 64: 401-409; 1937.

A comparison of botanical components of curare as prepared by the Tecuna and Java Indians of Amazonian Brazil reveals that *Strychnos Castelnaii* is the only ingredient used by both tribes. Three species of *Piper* used by the Tecunas are replaced by two other species among the Javas. *Dieffenbachia Seguina*, var. *viridis* is used by the Tecunas, another araceous plant by the Javas. *Anona Ambotay* used by the Tecunas is replaced among the Javas by two species of *Duguetia*. No Menispermaceae are used by the Javas, while *Cbondodendron polyanthum* and *Anomospermum reticulatum* are important elements of curare as prepared by the Tecunas. —P. C. STANDLEY.

A monograph of the genus *Rhaphithamnus*. By HAROLD N. MOLDENKE. *Repertorium Specierum Novarum* 42: 62-82; April 25, 1937.

The genus (Verbenaceae) consists of two species, *R. spinosus* (A. Juss.) Moldenke, and *R. venustus* (R. A. Phil.) B. L. Robinson, occurring in Peru, Chile, and Argentina.

Una nueva especie de *Prosopis* del "monte" occidental argentino. By ARTURO BURKART. *Revista Argent. Agronomía* (Buenos Aires) 4: 39-42; ill.; April 1937.

*Prosopis argentina* is described as new from the Province of Catamarca, Argentina.

Glosario de terminos usados en anatomia de maderas (versión castellana). By LUCAS A. TORTORELLI. Reprinted from *Revista Argent. Agronomía* 4: 51-66; 41 figs.; April 1937.

An illustrated and indexed Spanish version of the "Glossary

of terms used in describing woods" adopted by the Council of the International Association of Wood Anatomists. (See *Tropical Woods* 36: 1-12.)

El "maricá," interesante Leguminosa cultivada en Corrientes para formar cercos vivos. By ARTURO BURKART. *Revista Argent. Agronomía* 4: 69-71; ill.; April 1937.

Maricá, *Mimosa bimucronata* (DC.) Kuntze, is planted commonly in Corrientes, Argentina, along the Brazilian border, to form living hedges. Because of its prickles and rapid growth it is excellent for the purpose, attaining a height of 4 meters, and a trunk diameter of 10 cm. In Buenos Aires *Cinacina* (*Parkinsonia aculeata*) and Napindá are much used for the same purpose.—P. C. STANDLEY.

Anatomía de la madera de *Arechavaletaia uruguayensis* Spegazz. By CLOTILDE C. MOLLE. *Revista Sudamericana de Botánica* (Montevideo) 3: 4/6; 105-109; 2 figs.; 2 pls.; December 1936.

*Arechavaletaia* (fam. Flacourtiaceae) is a monotypic genus of little trees apparently endemic to Uruguay. The wood specimen described was grown in the botanical garden of Montevideo. Growth rings present. Pores very small to minute, very numerous, solitary or more often in radial multiples of 2 to 8, fairly uniformly distributed. Vessels with simple perforations and without spirals; intervascular pitting fine, mostly alternate. Rays heterogeneous; of two sizes, uniseriate and 2 to 4 cells wide in part; uniseriate rays and margins and connective parts of the multiseriate rays composed exclusively of square and upright cells; rhombohedral crystals of calcium oxalate common; pits to vessels very small. Wood parenchyma absent or very sparingly developed. Wood fibers thick-walled, arranged in definite radial rows.

Notes on new and noteworthy American plants. By HAROLD N. MOLDENKE. *Revista Sudamericana de Botánica* 4: 15-20. January 1937.

*Basistemon brasiliensis* is described as new from Porto

Alegre, Brazil. Several new combinations are proposed in the genera *Aloysia*, *Arrabidaea*, *Duranta*, and *Siparuna*.

Una excursión botánica a la Sierra de Mahoma (Uruguay, Departamento de San José). By J. CHEBATAROFF. *Revista Sudamericana de Botánica* 4: 54-58; January 1937.

A brief account of the vegetation of Sierra de Mahoma, Uruguay. Among trees and shrubs listed are *Salix Humboldtiana*, *Cephalanthus glabratus*, *Eugenia cisplatensis* (called Guayabo Colorado), *Rapanea laetevirens* (Canelón), *Fagara biemalis* (Tembetarí), *Sebastiania Klotzschiana* (Blanquillo), *Scutia buxifolia* (Coronillo), *Eugenia glaucescens* (Murta), *Schinus dependens* (Molle), *Xylosma Warburgii* (Espino Corona), *Sapium haematospermum* (Curupí), *Celtis spinosa* (Tala), *Citbarexylum barbinerve* (Tarumán), *Allophylus edulis* (Chal-chal), *Myrtus mucronata* (Arazá Rastrero), *Colletia cruciata* (Espina de la Cruz), *Dodonaea viscosa* (Chirca del Monte), and numerous others.—P. C. STANDLEY.

Addimenta ad floram uruguayensem. Pars III. By W. G. HERTER. *Revista Sudamericana de Botánica* 4: 179-231; March 1937.

In the flora of Uruguay published in 1930 by the author there were listed 2793 species of vascular plants. The present list of additions increases that number to 2998, of which 2218 are native plants. The list of additions includes citation of many local vernacular names.

Useful plants and drugs of Iran and Iraq. By DAVID HOOPER, with notes by HENRY FIELD. *Field Mus. Nat. Hist. Bot. Ser.* (Chicago) 9: 73-241; June 30, 1937.

An account of medicinal uses of plants in Persia and Iraq, with mention of numerous species of shrubs and trees. Vernacular names are reported for all or most of the species listed.

Vegetation of Flint Island, central Pacific. By HAROLD ST. JOHN and F. RAYMOND FOSBERG. *Bishop Mus. Occas. Papers* 12: 24: 3-4; Jan. 5, 1937.

Flint Island in the south-central Pacific (Lat. 11° 25' 43"

S., Long.  $151^{\circ} 48'$  W.) is a tiny coral island 2.5 miles long and 0.5 miles wide, whose original vegetation has been practically destroyed. A list is given of 36 vascular plants known from the island, several of which are shrubs or small trees.

**A new Hawaiian species of Rutaceae.** By O. DEGENER and C. SKOTTSBERG. *Brittonia* (Lancaster, Penn.) 2: 362; June 1937.

*Fagara waiianensis* of the island of Oahu is described as new.

**Miscellaneous Hawaiian plant notes. I.** By F. RAYMOND FOSBERG. *Bishop Mus. Occas. Papers* 12: 15: 1-11; pl. 1; Sept. 28, 1936.

New names for Hawaiian woody plants are *Cryptocarya oahuensis* (*C. Mannii*, var. *oahuensis* Deg.), *Antidesma platyphyllum*, var. *bamakuaense*, *Diospyros sandwicensis* (*Maba sandwicensis* A. DC.), *D. Hillebrandii* (*M. Hillebrandii* Seem.). A key is given for separation of the species of *Antidesma* of the islands.

**Resin cells in a pine.** By C. Y. CHANG. *Bull. Chinese Bot. Soc.* 2: 1: 43-44; 1 pl.; June 1936.

Wood parenchyma cells, commonly supposed to be absent in *Pinus*, except in association with resin ducts, were found in the first three annual rings in specimens of the wood of *P. Massoniana* Lamb. grown in widely separated localities in China. "In general, they are abundant in the first ring, somewhat less in the second, and few in the third; from the fourth ring on they are altogether absent. They occur also more abundantly in the summer wood than in the spring wood. They occur with no reference to the resin ducts, being scattered irregularly in the wood. In a few specimens resin cells are few, but in no specimens are they entirely absent."

**A century of Philippine Meliaceae.** By A. D. E. ELMER. *Leaflets Philip. Bot.* (Manila) 9: art. 128: 3273-3395; May 1, 1937.

A systematic account of Meliaceae collected by the author

in the Philippine Islands, listing 103 species of 18 genera. There are published as new (with English descriptions only) 44 species of various genera. Notes are given regarding many trees of the group, and there are cited numerous native names for them.

**Contributions to the flora of Siam. Additamentum XLII.**  
**Two new genera of Verbenaceae from Siam.** *Kew Bull. Misc. Information* 71-75; 2 figs.; 1937.

*Garrettia siamensis* Fletcher and *Paravitex siamica* Fletcher are types of two new genera of shrubs of the family Verbenaceae from Siam.

**Contributions to the flora of Siam. Additamentum XLIII.**  
*Kew Bull. Misc. Information* 87-94; 1937.

Among woody plants described as new from Siam by Kerr are species of *Ervatamia*, *Parsonsia*, *Wrightia*, *Strobilanthus*, *Ichnocarpus*, *Aganosma*, and *Anodendron*, of the family Apocynaceae.

**Palmae Malesiaca. VI, VII.** By C. X. FURTADO. *Gard. Bull. Straits Settlements* (Singapore) 9: 152-186; May 4, 1937.

The first paper is devoted to "Notes on some *Daemonorops* of the section *Cymbospathae*," with a discussion of methods of preparing useful specimens for study. Four new species and varieties are described. In the second paper two new species of *Calamus* are described from plants growing in the Buitenzorg Gardens.

**Timber tests: Geronggang (*Cratoxylon arborescens* Bl.).**  
By A. V. THOMAS. *The Malayan Forester* 6: 2: 142-145; April 1937.

"This species . . . frequently forms thickets of young trees along open stream beds, but it finds its optimum habitat in the coastal swamp Dipterocarp forests, where there may be as many as three mature trees in two acres."

"Geronggang has an attractive color and is easily worked, except for some tendency to dull sharp tools; it is often free

from borer holes, and takes quite a good polish. It has therefore many qualities that recommend it for use for cheap furniture, ornamental work, and small wooden household utensils, though its comparative softness might detract from its usefulness in certain instances. . . . Its strength is somewhat below that of Scots Pine, but it could be used for temporary planking, provided it was not in contact with the ground. If impregnated with a suitable preservative it might make a satisfactory shingle wood. In Burma and the Philippine Islands timber of this genus is reported to be popular for fuel and charcoal."

**Gurjun, apitong, keruing, kapur and allied timbers.** By S. H. CLARKE. *Forest Products Research Records* No. 16 (Timber Series No. 5). H. M. Stationery Office, London, May 21, 1937. Pp. 11; 6 x 9½; 1 pl.; 1 text fig. Price 6d net.

"The moderately heavy, moderately hard timbers furnished by the genera *Dipterocarpus* and *Dryobalanops*, though not very durable under exposed conditions in tropical climates, are well suited to many requirements in temperate regions, where they are used for constructional purposes, particularly for flooring, sills, and railway carriage members. The most familiar examples on the United Kingdom market are Gurjun, Apitong, Keruing, and Kapur or Borneo Camphorwood, all of which are regularly imported in considerable quantities. These timbers are described in the present publication."

**Zur Kenntnis einiger Arten der Gattung *Chisocheton* der Meliaceae aus Celebes.** By H. HARMS. *Repertorium Specierum Novarum* 42: 7-9; April 25, 1937.  
*Chisocheton Sarasinorum* and *C. Warburgii* are described as new from Celebes.

**Einige bemerkenswerte Arten der Steinschen Sammlung aus Timor.** By J. VON MALM. *Repertorium Specierum Novarum* 42: 14; April 25, 1937.  
*Pygeum Steinii* is described as new from Timor.

**Die Palmengattungen *Nengella* Becc. und *Leptophoenix* Becc.** By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 312-317; Dec. 30, 1936.

The palm genus *Leptophoenix* is reduced to sectional rank under *Nengella*, which is represented by 17 species of New Guinea.

**Neue Palmen aus Neuguinea. IV.** By M. BURRET. *Notizblatt Bot. Gart. Berlin-Dahlem* 13: 317-332; Dec. 30, 1936.

From New Guinea and Papua new palms are described in the genera *Calamus*, *Paralinospadix*, *Cyrtostachys*, *Hydriastele*, *Kentia*, *Ptychosperma*, and *Areca*.

**Transfer of the Papuan *Gouldia* to the genus *Psychotria*.** By HAROLD ST. JOHN. *Bishop Mus. Occas. Papers* (Honolulu) 12: 7: 3-4; pl. 1; July 28, 1936.

*Gouldia papuana* Wernham, described from the Sogeri region, New Guinea, is transferred to the genus *Psychotria*.

**Matériaux pour la flore de la Nouvelle-Calédonie. XLI. Revision des Elaeocarpaceés.** By A. GUILLAUMIN. *Bull. Société Botanique de France* (Paris) 83: 485-488; December 1936.

Keys are given for separating species of the three genera of Elaeocarpaceae known from New Caledonia; *Dubouzetia* (5 species), *Antholoma* (3), *Elaeocarpus* (17). New species are *Elaeocarpus coumbouiensis* and *E. Lecardii*.

**Matériaux pour la flore de la Nouvelle-Calédonie. XLII. Revision des Capparidacées.** By A. GUILLAUMIN. *Bull. Société Botanique de France* 83: 577-578; Jan. 30, 1937.

The family Capparidaceae is represented in New Caledonia by the genera *Gynandropsis* with one species and *Capparis* with three.

**Vermischte Diagnosen.** By E. KNOBLAUCH. *Repertorium Specierum Novarum* (Berlin-Dahlem) 41: 150-152; Nov. 25, 1936.



New woody plants are *Jasminum Dänikerii* and *J. paagoumenum* (New Caledonia), *Linociera Marlothii* (Natal).

The occurrence of a number of varieties of *Eucalyptus radiata* (*E. numerosa*) as determined by chemical analyses of the essential oils. Part II. By A. R. PENFOLD and F. R. MORRISON. *Journ. & Proc. Roy. Soc. N. S. W.* 70: 375-377; Apr. 27, 1937.

"In continuation of our investigation into the varieties of *Eucalyptus radiata* (*E. numerosa*), as determined by chemical analyses of the essential oils, we raised a number of plants from seed. . . . A remarkable observation was made with a tree planted from seed of the form called Variety A. In this particular instance two stems grew from the one root system. The leaves and terminal branchlets from each stem were separately distilled, when the essential oils were found to differ from one another in chemical composition. . . . In our original paper we stressed the fact that the varieties of *Eucalyptus radiata* could not be separated from the type on morphological evidence. . . . Despite this evidence, Mr. W. F. Blakely, in a subsequent publication, "A key to the Eucalypts" (1934), described our Variety A as *Eucalyptus Lindleyana*, var. *stenophylla*. . . . The evidence submitted shows that *E. radiata* (*E. numerosa*) and Blakely's variety *stenophylla* have been found growing together on one and the same plant."

Sur la distribution et les affinités des Phyllanthées de Madagascar. By J. LÉANDRI. *Bull. Soc. Bot. France* (Paris) 84: 61-72; 93-98; 1937.

The Phyllanthaceae of the family Euphorbiaceae in Madagascar include trees with or without large adventive roots, tall shrubs, shrubs sometimes with spiny leaves, and suffrutescent plants. They are well represented in coastal forests and thickets of the East, the oriental forest, the central forest with herbaceous undergrowth, and the tropophilous forest of the West. They are less plentiful in lichen forests of the mountain tops, ericoid thickets of high elevations, and forests of western slopes of the central regions. Structure of the fruit usually is unfavorable for dispersal of seeds; most of the endemic species

are narrowly localized, and some are rare. Study of the genera shows that these also often are localized. Two genera are endemic, like 63 of the 75 species. From a floristic standpoint the elements are not homogeneous, but show great affinities with the African flora, and less marked ones with the floras of India, central and equatorial America, and tropical Australia.

Comparative study of the present areas of genera or groups and of the continental connections of Madagascar suggested by the stratigraphy indicate an Australian-Indian-Madagascar element existent before the Upper Cretaceous; an African-Brazilian complex that arrived during emergence of the Mozambique Canal; and an endemic element of different age.—P. C. STANDLEY.

Arbres à kapok et fromagers. By AUG. CHEVALIER. *Rev. Bot. Appliquée & d' Agr. Tropicale* 17: 188: 245-268; 3 pls.; April 1937.

According to the author, the name *Ceiba pentandra* Gaertn. (*Eriodendron anfractuosum* DC.) should be reserved for the kapok-producing tree of Indo-Malaysia; the large African Fromager is named *C. Thonningii* A. Chev., sp. nov. (*Bombax pentandrum* Thonn., *Eriodendron guineense* A. Chev., *Ceiba pentandra*, var. *debiscens* Ulbrich.); the unarmed Fromager of the Gulf of Guinea becomes *C. guineensis* (Thonn.) A. Chev., comb. nov. (*Bombax guineense* Thonn., *Ceiba pentandra*, var. *clausa* Ulbrich., *Eriodendron inerme* A. Chev.), with two varieties, *ampla* and *clausa*; and the Fromager of the West Indies is designated *C. caribaea* (DC.) A. Chev., comb. nov. (*Eriodendron anfractuosum*, var. *caribaeum* DC., *Ceiba pentandra*, var. *caribaea* [DC.] Bakuizen.; *C. occidentale* [Sprengemend.] Burkill). The specific classification of the Amazon *Ceiba* is uncertain, but close relationship to *C. Thonningii* is indicated.

New species from tropical Africa. *Journ. Bot.* (London) 75: 163-169; June 1937.

In part I by A. W. Exell new species of woody plants are *Enneastemon angustifolius* (Nigeria), *Dioscoreophyllum podandrium* (Nigeria), *Combretum kabadense* (Sudan), *C. Green-*

*wayi* (Tanganyika and Kenya), *C. Grotei* (Tanganyika); in part 2 by Cecil Norman, *Polyscias Letestui* (Gaboon); in part 3 by A. C. Hoyle, *Hymenodictyon oreophyton* (West Tropical Africa), *H. reflexum* (S. Nigeria).

#### Structure, occurrence, and properties of compression wood.

By M. Y. PILLOW and R. F. LUXFORD. Techn. Bull. 546, U. S. Dept. Agr., January 1937. Pp. 32; 6 x 9 $\frac{1}{4}$ ; 8 figs.; 9 pls. Price 10¢ (Supt. of Documents, Washington, D. C.).

"Compression wood is an abnormal type of wood occurring as a rule on the lower sides of non-vertical trunks and branches among all coniferous species of trees. Increase in the amount of deviation of trunks from a vertical position, or increase in rate of diameter increment of individual trees, or both, increases the formation of compression wood.

"Under a microscope the summerwood tracheids of compression wood appear to be nearly circular in cross section, whereas those of normal wood are more or less rectangular. The fibrils of the secondary cell walls in compression wood make a higher angle in relation to the longest axis of the cells than do the fibrils in normal wood and these walls contain microscopic checks.

"The lignin content of compression wood, as indicated by the species investigated, is slightly higher and the cellulose content slightly lower than normal wood. The weight of pronounced compression wood is from 15 to 40 per cent greater than normal wood. The longitudinal shrinkage of compression wood from the green to oven-dry condition varies from about 0.3 to 2.5 per cent, whereas normal wood has a shrinkage from about 0.1 to 0.2 per cent. The transverse shrinkage of compression wood is less than that of normal wood.

"When adjustments are made for differences in weight, compression wood is lower in practically all strength properties as compared to normal wood. The differences in the slope of fibrils in compression wood as compared to normal wood appear to have a close relation to the differences in strength properties. The increase in strength properties accompanying drying of the wood is not so great for compression wood as for normal wood. Compression wood is under compression in the

log and when the stresses are released, such as by sawing, extension of the compression wood portion occurs.

"Compression wood when manufactured into lumber is accountable for much bowing and twisting and is unsatisfactory for uses where strength and neat workmanship are essential requirements. Proper forest-management measures will hold compression wood formation to a minimum."—*Authors' Summary*.

#### True and false mahoganies. *Kew Bull. Misc. Information* 274-276; 1937.

"Since the publication of the 'List of true and false Mahoganies' (*K. B.* 1936, p. 193) a question has been raised as to the exact significance of the words 'true' and 'false' when used in this connection. The present note is intended to remove any ambiguity which may exist owing to different interpretations of these words by botanists, timber merchants, and others.

"The appellation 'true' was restricted to the timbers of the several species of *Swietenia* on purely botanical and historical grounds. The first species to be exploited was *S. Mabagoni* Jacq., from Jamaica, Cuba, and other West Indian Islands. The timber was known as 'Spanish Mahogany' but other geographical adjectives, to indicate the place of origin, were used as well. The timber from the mainland of Central America, exploited shortly afterwards, was from *S. macrophylla* King, now known as 'Honduras Mahogany.' These two species were probably the only *Swietenias* used, at least in any quantity, up to the year 1850. This is evident from a pamphlet entitled 'The Mahogany Tree' published in 1851 by Messrs. Chaloner and Fleming, Mahogany and timber brokers of Liverpool. Nicaragua, where *S. bumilis* Zucc. occurs, is mentioned only as an untouched region. Nor is there any reference to Mahogany from Africa. Two Mahogany substitutes, *Soymida febrifuga* A. Juss. and *Chloroxylon Swietenia* DC., are mentioned on the authority of an encyclopedia. Both were placed in the genus *Swietenia* by early botanists, but are of no importance as Mahogany substitutes in this country. It is, therefore, evident that in 1850, both to bota-

nists and to timber merchants, the name 'Mahogany' meant the wood of a species of *Swietenia*, which can thus be regarded as the 'true' or 'original' Mahogany.

"Expansion of the Mahogany trade and a gradual depletion of supplies followed slowly on the repeal of the import duties in 1845. A large number of timbers were offered later as Mahogany substitutes. Many of these are inferior to Mahogany in strength, durability, and other qualities, and do not even belong to the Mahogany family (Meliaceae). Their substitution should be discouraged if Mahogany is to retain its position as one of the most popular timbers for cabinet work.

"It remains to consider whether the trade use of the name 'Mahogany' can be extended to the timbers of any other genus without prejudice to the good name of the true Mahogonies. The only timbers of high quality (besides *Swietenia*) that are widely marketed under the name 'Mahogany' belong to the genus *Kbaya* and are known as 'African' Mahogonies. Only this genus, which belongs to the Meliaceae and is closely related botanically to *Swietenia*, will therefore be discussed in this connection.

"The timbers of several species are imported in large amounts from West Africa both to this country and to the U. S. A. The more important are *K. ivorensis* A. Chev., *K. antbotbeca* C. DC., and *K. grandifoliola* C. DC. The timber is of high quality, resembling *Swietenia* Mahogonies very closely in color, mechanical properties, durability, and microscopic structure. The two genera are distinguished from one another by relatively small differences. In view of these facts, there can be no reasonable objection to the use of 'Mahogany' as a trade description for *Kbaya* timbers, providing the usual trade practice of prefixing a geographical adjective is followed. The argument that *K. senegalensis* A. Juss., formerly a source of West African Mahogany, was at one time placed in the genus *Swietenia* is of no value in this connection, since this applies also to plants now classified in the following genera of the Meliaceae: *Cedrela*, *Chloroxylon*, *Entandropbragma*, *Chickrasia*, and *Soymida*."

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# TROPICAL WOODS

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## TROPICAL WOODS

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

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### A COMPARISON OF CERTAIN PROPERTIES OF TEMPERATE AND TROPICAL TIMBERS

By S. H. CLARKE

*Forest Products Research Laboratory, Princes Risborough*

Detailed investigations of the wood of Elm (1), Ash (2), Oak (10), and Beech (3) have indicated that the properties of timber frequently depend more on the physico-chemical nature of the cell walls than on specific gravity or the more obvious anatomical features. In order to extend these observations over a wider range a comparison has been made of selected timbers similar in density but differing in strength properties (4). Taking as a basis the tabulated results of mechanical tests on more than 300 species, made in various timber testing laboratories (6, 7, 8, 11), the mean values for strength in impact bending (as measured by the drop of a 50-lb. hammer) and for strength under compression parallel to the grain were plotted separately against specific gravity (oven-dry weight/green volume). The results are shown in

Figures 1 and 2, from which it may be observed that on the whole the tropical timbers are weaker in impact bending (a measure of toughness), though stronger in compression parallel to the grain, than temperate zone timbers of the same density.

When two large groups of species differing in geographical origin are observed to differ so markedly in mechanical properties it is reasonable to expect that they will also show some common difference, either in anatomical structure or in the physico-chemical nature of the cell walls or in both. Anatomical variations are undoubtedly associated with variations in strength, but since there appear to be no constant differences in gross anatomical structure between temperate and tropical timbers which might account for the observed differences in their strength properties, it appeared probable that the two groups might show a common difference in the physico-chemical nature of the cell walls.

In Figures 1 and 2 it may be observed that both temperate and tropical timbers show a wide range of variation in strength at any specific gravity, and in order to investigate the relation between cell wall composition and strength, species of similar specific gravity but showing a great difference in strength were selected for examination. Particulars of the species selected for comparison are given in Table I. Sections for microscopic examination were cut from specimens in the Laboratory type collection, and in most cases two or more samples of each species were examined. It was not supposed that the density and strength of the samples would be exactly the average of the species as recorded in Table I, but the samples were fairly typical of their species, and, as these had been selected to show extreme differences of the types under consideration, it was expected that the samples would reveal any important differences.

### Methods

Transverse sections were cut on a sliding microtome. For comparative purposes a standard, uniform thickness was found to be essential, and a thickness of  $10\ \mu$  was used throughout the investigation.

Various combinations of standard stains and reagents were used, but the best results were obtained with iodine green followed by safranine (1 per cent aqueous solutions; five minutes immersion in each stain), or with safranine (1 per cent aqueous) followed by fast green FCF (1 per cent in alcohol); the former combination does not give such beautiful preparations as the latter, but under certain conditions appears to be much more effective in differentiating between degrees of lignification.

Boiling water has a partially delignifying action (9), and it was confirmed that wood after prolonged boiling in distilled water shows an increased tendency to react with so-called cellulose reagents and stains rather than with so-called lignin reagents. It was found that after boiling thin sections for four hours practically all the temperate timbers showed distinct signs of delignification, whereas the staining reactions of most of the tropical timbers were not appreciably altered. The delignifying action of boiling water was employed in differentiating between the temperate zone and tropical timbers, sections of each species being boiled in distilled water for various lengths of time. It is interesting to note that after short boiling periods (e.g., 4 or 5 hours) iodine green and safranine were usually more effective in detecting changes in lignification than safranine and fast green FCF, but after longer periods (e.g., 20 hours or more), safranine and fast green FCF were usually the more satisfactory, as there was a tendency for the safranine to overstain in the iodine green and safranine combination.

### Results

#### EXAMINATION OF SECTIONS

In practically all the species examined the walls of the vessels, parenchyma and ray cells, and the intercellular layers and primary walls of the fibres, were lignified.<sup>1</sup> Such differences as were observed between the different species were apparently not distinctive between the two major groups under

<sup>1</sup> Throughout this paper the word is used in the traditional botanical sense unless the contrary is specifically stated.

TABLE I  
COMPARISON OF TEMPERATE AND TROPICAL TIMBERS OF SIMILAR SPECIFIC GRAVITY BUT DIFFERING IN STRENGTH

Species	Origin	Source of strength data	Specific gravity. Oven-dry wt. green vol.	Impact bending. Ht. of drop of 50-lb. hammer	Compn. parli. to grain	Reaction of secondary walls of fibres with saf. and fast green, after prolonged boiling
<i>Salix nigra</i>	Temp.	Ref. No. 6	0.34	Inches 36	Lbs. per sq. in. 1520	green
<i>Tilia glabra</i>	"	8	0.32	16	2220	green
<i>Alistonia scholaris</i>	Trop.	8	0.36	16	2790	greenish, some with traces of red chiefly red
<i>Alistonia congensis</i>	"	6	0.33	17	2600	green (red in late wood)
<i>Magnolia grandiflora</i>	Temp.	8	0.46	54	2700	green
<i>Betula papyrifera</i>	"	8	0.48	49	2360	greenish, with traces of red, or red
<i>Virela merendonis</i>	Trop.	6	0.43	14	3050	red
<i>Artocarpus chaplasha</i>	"	7	0.45	26	4820	red
<i>Rhamnus purshiana</i>	Temp.	8	0.50	58	3270	green
<i>Carpinus betulus</i>	"	6	0.54	50	3770	green
<i>Fraxinus excelsior</i>	"	6	0.57	50	3730	Pale green
<i>Ulmus racemosa</i>	"	8	0.57	54	3780	Pale reddish or greenish
<i>Ocotea usambarensis</i>	Trop.	6	0.52	26	4370	red
<i>Chlorophora excelsa</i>	"	6	0.55	27	4900	red
<i>Guarea Thompsonii</i>	"	6	0.54	30	6030	red, a few with greenish tinge
<i>Mansonia altissima</i>	"	6	0.54	40	6160	red, a few with greenish tinge
<i>Ostrya virginiana</i>	Temp.	8	0.63	73	3570	green
<i>Betula lenta</i>	"	8	0.60	48	3740	green, many with pale reddish tinge
<i>Cornus florida</i>	"	8	0.64	58	3480	green, some with pale reddish tinge
<i>Licoria alba</i>	"	8	0.64	58	3480	green
<i>Dipterocarpus cornutus</i>	Trop.	6	0.62	27	4480	red, some with greenish tinge
<i>Pterocarpus dalbergioides</i>	"	7	0.62	30	6820	red
<i>Sarcocephalus Diderichii</i>	"	6	0.63	32	7210	red, with traces of green, or green
<i>Anogeisus latifolia</i>	"	7	0.76	56	5170	red, with traces of green
<i>Melanorrhoea usitata</i>	"	7	0.74	53	5325	red, with traces of green

TABLE II  
COMPARISON OF TEMPERATE AND TROPICAL SPECIMENS OF THE SAME, OR CLOSELY RELATED, SPECIES

Species	Origin of specimens	Reaction of secondary walls of fibres with saf. and fast green, after prolonged boiling
<i>Aesculus hippocastanum</i>	England	green (mid. lam. green)
" <i>punduana</i>	India	pink (mid. lam. red)
<i>Ailanthus altissima</i>	Cyprus	green
"	Japan	green
"	India	chiefly red; some with greenish tinge
<i>Catalpa bignonioides</i>	England	green
"	St. Lucia (B.W.I.)	red; some with greenish tinge
<i>Chrysophyllum macrophyllum</i>	England *	very pale red, often with traces of green
" <i>pruniforme</i>	W. Africa	red
<i>Cinnamomum camphora</i>	England	green
"	India	red
"	Formosa	red
<i>Embothrium coccineum</i>	England	green
" <i>Wickhamii</i>	Australia	green, with traces of red
<i>Erythrina rosea</i>	England *	green
" <i>lithosperma</i>	India	chiefly red; some with greenish tinge
<i>Euonymus europaeus</i>	England	green
" <i>javanicus</i>	Burma	red
<i>Ficus elastica</i>	England *	pink to red
" <i>exasperata</i>	W. Africa	pink to red
<i>Gymnocladus canadensis</i>	England	green
" <i>burmanicus</i>	Burma	traces of red in greenish wall
<i>Ilex aquifolium</i>	England	green
" <i>dipyrena</i>	India (Himalayas)	green
<i>Juglans regia</i>	England	pale green
"	India	pale red
<i>Magnolia acuminata</i>	U. S. A.	green
" <i>Campbellii</i>	India (Himalayas)	greenish, with traces of red
<i>Nyssa sylvatica</i>	Canada	green
" <i>sessiliflora</i>	India (Himalayas)	green
<i>Pachira aquatica</i>	England *	chiefly red, some with greenish tinge
<i>Ochroma</i> sp.	British Honduras	chiefly green, some red
<i>Prunus padus</i>	Finland	green
"	India (Himalayas)	green
<i>Salix fragilis</i>	England	green
" <i>tetrasperma</i>	India	pink
<i>Viburnum opulus</i>	England	green
" <i>sambucinum</i>	Sumatra	green with reddish tinge

\* Grown in temperate house at the Royal Botanic Gardens, Kew.

consideration, although there was a tendency for lignification to be more general and more strongly marked in the tropical than in the temperate zone species. Significant differences were observed, however, in the staining reactions of the secondary walls of the fibres. The evidence of all the stains or reagents employed was in agreement, and indicated that on the whole the secondary walls were much more strongly lignified in the tropical than in the temperate zone timbers. The reactions of the secondary walls of the fibres with safranine and light green, after the sections had been boiled in distilled water for at least 20 hours are described in Table I. In every instance it was possible on this basis to distinguish between the timbers of the two geographical zones.

COMPARISON OF TEMPERATE ZONE MATERIAL WITH THE SAME, OR RELATED, SPECIES GROWN IN THE TROPICS

The tropical and temperate timbers employed in the investigation described above were drawn from different genera, and in order to decide whether the observed differences in degree of lignification were associated with geographic location or were due to generic constitution, similar tests were made on pairs of timbers of the same, or closely related, species, one member of each pair being of temperate, and the other of tropical, origin. Particulars of the specimens and the staining reactions of their fibre walls are summarized in Table II. So great was the difference in affinity of the fibre secondary walls for light green that in practically every instance it was possible to distinguish the temperate zone and tropical members of the pairs without a microscope, simply by holding the slides up to the light and noting the general color. The only instances in which doubts were entertained (see Table II) were the species of *Ficus*, *Ilex*, *Nyssa*, *Prunus*, and *Pachira* and *Ochroma*. No completely satisfactory explanation of these discrepancies can be offered, but it is pointed out that in two instances (*Ficus*, and *Pachira* and *Ochroma*) the English specimen was grown under artificial conditions in the temperate house at Kew, and that in the others the Indian specimens were from the Himalayan regions of northern India and grew under conditions that are not strictly tropical.

It is concluded that the observed differences in the staining reactions of the fibre walls are to be attributed to the geographical factor.

THE CORRELATION OF STRENGTH IN IMPACT BENDING AND UNDER COMPRESSION PARALLEL TO THE GRAIN

The two strength properties under consideration are both related to specific gravity (see Figs. 1 and 2) and it follows that they are indirectly related to each other. It is possible, however, to allow for the influence of specific gravity statistically, and so to observe the relation existing between strength in impact bending and in compression parallel to the grain at constant values of specific gravity.<sup>2</sup> The partial regression equation computed from the data incorporated in Figs. 1 and 2 was:

$$C = 11630 S - 27 D - 797$$

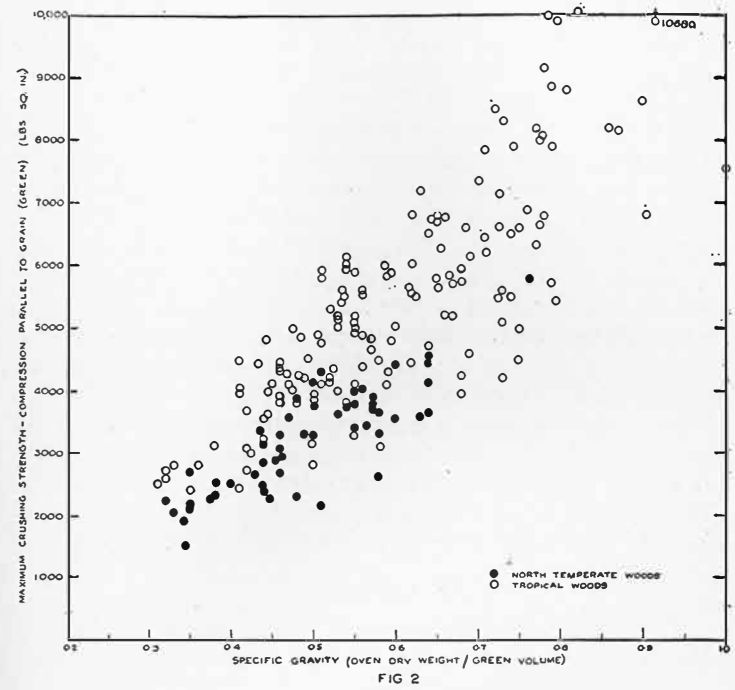
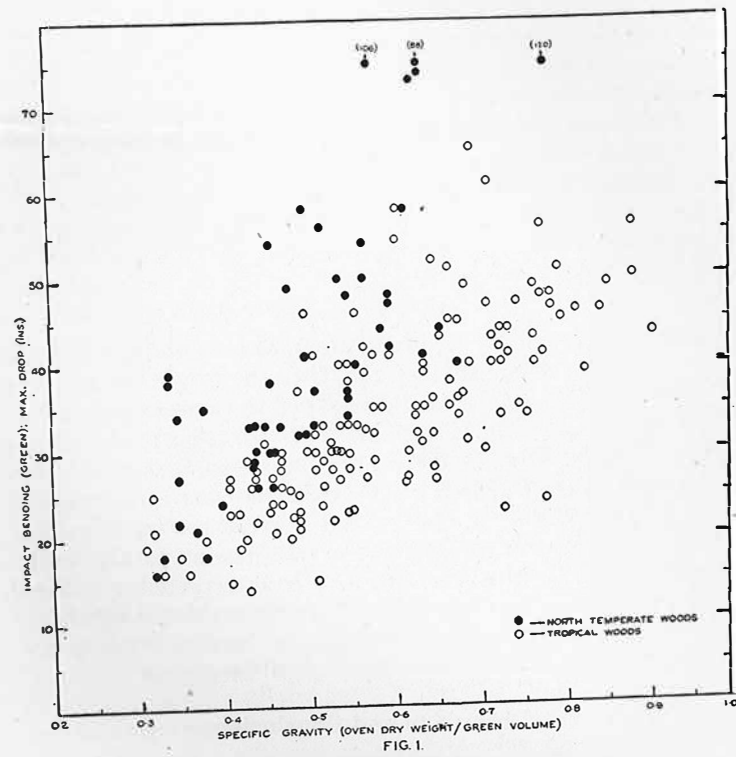
where  $C$  is maximum crushing strength in pounds per square inch,  $S$  is specific gravity, and  $D$  is the height of drop (in inches) of a 50-pound weight required to cause complete failure of the specimen. The point that claims particular attention is the negative coefficient of  $D$ , the significance of which is shown by the fact that it is 6.8 times as great as its standard deviation. Moreover the partial correlation coefficient of strength in impact bending and in compression parallel to the grain is  $-0.32$ . In words, this may be interpreted as follows: At constant values of specific gravity there exists a significant inverse relation between strength in impact bending and strength under compression parallel to the grain.

Discussion and Conclusions

Although various workers have demonstrated conclusively that micro-staining reactions do not yield a reliable indication of the chemical composition of wood, it is equally clear that the traditional "lignin reagents" of the botanist at least reveal the presence of some material or some condition of the cell walls which exerts an important influence on the properties of timber. Tropical growth conditions appear to intensify

<sup>2</sup> The statistical treatment of the data was undertaken by Mr. E. D. van Rest of the Forest Products Research Laboratory.





the changes in the cell wall known to botanists as lignification, and as a result the wood produced is stronger as a post or strut but is less tough than material of equal density grown under temperate conditions. It is well known in interested circles that, when specific gravity is taken into account, no tropical timber of outstanding toughness has been discovered, and it would now appear unlikely that any such timber will be found, and that timbers of the Hickory class, which are extremely tough for their density, cannot be grown under tropical conditions.

The literature contains various references to the possible influence of the chemical nature of the cell wall on mechanical properties, though many are apparently not supported by adequate experiment. Dadswell and Hawley (5), however, report an abnormally high lignin content (in the chemical sense) in certain brash specimens of Oak, and the present writer has observed a relation between response to the phloroglucin reaction and compressive strength in random samples of Ash (2) and Beech (3). These observations are consistent with those now recorded, and although it has not been possible to show a definite connection between the degree of lignification and the inverse relation between strength in impact bending and strength under compression parallel to the grain, the observations strongly suggest that such a connection exists and that it is influenced by the locality of origin of the timber.

#### Summary

Tropical timbers are generally weaker in impact bending but stronger under compression parallel to the grain than temperate zone timbers of the same specific gravity.

The reactions of standard micro-stains and reagents indicate that on the whole the secondary walls of the fibres of tropical timbers are more heavily lignified (in the botanical sense) than are those of temperate zone timbers.

The negative partial correlation of strength in compression parallel to the grain and in impact bending is compatible with the suggestion that increased lignification may result in increased strength under compression but in decreased toughness.

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#### GELATINOUS WOOD FIBRES

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Wood fibres with gelatinous inner walls have long been familiar to students of wood anatomy. Sanio notes that they were first cited by Hartig and subsequently described by Von Mohl (18) in 1844. He gives a detailed account of their microscopic structure, staining reactions, and remarkably irregular distribution, and lists the species in which they were observed (15, 16). Gelatinous fibres can usually be recognized in transverse section by the fact that the inner layer of the wall is highly refractive and has a gelatinous or mucilaginous appearance, and by the staining reactions which suggest a cellulosic composition instead of the normal lignified condi-

tion. This layer is frequently detached and lies crinkled in the lumen of the cell in such a way as to suggest that it is only loosely held to the rest of the wall and has been separated by the action of the microtome knife. The relative thickness of the different layers is variable, and the frequent occurrence of a distinct intercellular layer and a primary and a secondary wall in addition to the gelatinous layer has led authors to describe the latter as a tertiary layer.

Gelatinous fibres have been recorded in many hardwood genera belonging to widely separated families. Since the time of the early German anatomists they have been referred to by several other investigators, but their full significance from the physiological point of view and their important effect on the technical properties of timber have not been generally appreciated.

The presence of gelatinous fibres has been noted in a number of wood specimens which have been examined at different times in this Laboratory to account for their abnormal behavior in several entirely different respects. Investigation of their distribution revealed that gelatinous fibres tend to occur on one side of the stem, and subsequent studies have shown that they are characteristic of the tissue generally known as *tension wood* (bois de tension, Zugholz, Weissholz), the hardwood counterpart of compression wood (bois de compression, Druckholz, Rotholz) in softwoods. In a study of tension wood Jaccard (8) noted that the wood fibres are characterized by a thick, highly refractive inner layer which gives a cellulose reaction with chlor-zinc-iodide. Böning (1, 2) has recorded similar observations, and Priestley and Tong (13) have shown that lignification is retarded in wood elements formed on the upper side of inclined stems and branches. But these observations have apparently not been correlated with the widespread occurrence of gelatinous fibres in hardwoods generally. The object of this note is to place on record a number of chance observations which point to the conclusion mentioned above, and also to draw attention to the important effect of gelatinous fibres on the technical properties of hardwoods. An account of a more detailed investigation confined to one particular species is in preparation.

### Occurrence and Distribution of Gelatinous Fibres

There is reason to believe that gelatinous fibres are of commoner occurrence in both temperate and tropical hardwoods than is generally realized; in fact there are probably very few species in which they never occur. It may be that they are especially characteristic of certain families (e.g., Leguminosae) possibly because their woods are more sensitive to the influence of the factors responsible for modifying the structure of the fibres.

Considering first the distribution of gelatinous fibres in the individual tree, reference may be made to Potter's (12) statement that they may occur singly, in isolated groups, or in broad bands concentric with the annual rings, but seldom pass round the whole stem. He adds that they are generally more frequent in the first few growth rings, and in later rings are more common on one side of the tree. In an investigation of English Elm carried out in this Laboratory (3) a similar distribution was observed, but it was also noted that the distribution of the fibres varied at different heights in the tree and that their general occurrence in any one radius was most irregular, as they were sometimes well developed in one growth ring and practically absent from the next. They appeared to be more frequent in broad than in narrow rings.

Gelatinous fibres were found to be of common occurrence in English Oak, being particularly well developed in very dense wide-ringed timber where the abundance of fibrous tissue in the late wood gives the end grain a peculiarly hard, horny appearance. In a recent account of this species (14) it was stated that the distribution of gelatinous fibres bore no apparent relation to their position in the tree, but a re-examination of the material investigated has shown a definite tendency for these fibres to be strongly developed near the base of the trunk and to be concentrated on one side of the stem at any one period of growth, although their distribution varies at different heights in the tree. One specimen has been observed which shows a progressive shifting of this abnormal tissue from one sector to another in successive periods of growth. A concentration of gelatinous fibres on one side of the stem at any particular height above ground level has been

observed in a number of other hardwoods, including *Robinia pseudoacacia* (see below). Finally, a comprehensive study of English Beech, with special reference to the growth of the tree, has shown conclusively that the occurrence of gelatinous fibres in this species is associated with the formation of tension wood.

At this point reference must be made to the work of certain investigators who have claimed that the gelatinous layer of a wood fibre, in some species at least, is of the nature of reserve cellulose (hemicellulose) which is laid down during the growing season and re-absorbed in the following spring to supply the needs of the growing shoot. This conclusion was reached by Leclerc du Sablon from his observations on Willow twigs (7, p. 362). In a more comprehensive series of investigations, Schellenberg (17) found no signs of absorption of the gelatinous layer in *Aesculus*, *Betula*, *Fagus*, *Quercus*, *Fraxinus*, *Corylus*, and *Alnus*. In one-year shoots of *Vitis vinifera* and *Robinia pseudoacacia*, however, he satisfied himself that a partial absorption of the gelatinous layer takes place in the spring. He further observed that the protoplast of the wood fibres in these two species remains active for a long time and that the fibres contain starch grains which are also absorbed in the spring. The wood fibres of the species which showed no absorption of the gelatinous layer contained no living protoplast or starch grains. Schellenberg formed the reasonable conclusion that the unlignified inner layer of wood fibres may be partially re-absorbed if the protoplast remains active for a long time, but if the protoplast is dead no re-absorption of the cell wall can take place. It is conceivable that the findings of Du Sablon and Schellenberg are due to the sporadic occurrence of gelatinous fibres, which might well account for their absence from some of the material examined and might lead to a false conclusion. Further investigation of this question is desirable. In the meantime the main body of evidence indicates that it is the exception rather than the rule for the gelatinous layer of a wood fibre to function as a reserve material.

Although it has not been possible in all the cases investigated to correlate the presence of gelatinous fibres with cir-

cumstances conducive to the formation of tension wood, the recorded observations appear to justify the conclusion that there is a direct connection between the two phenomena. It is not proposed to discuss the theories that have been put forward to account for the formation of tension wood and for the characteristic structure and composition of its cell walls. It is of interest to note, however, that the distribution of tension wood, or gelatinous fibres, in the individual tree is generally similar to that of compression wood in conifers (17), with the notable difference that the two types of tissue are normally found on the tension and compression side of the stem respectively. The prevalence of gelatinous fibres in the first few growth rings, laid down at a time when the tree is particularly susceptible to the influence of external factors, strongly suggests that unilateral stresses are the principal cause of their formation. Their remarkably irregular distribution in later formed growth rings is not so easily explained and further research is required to elucidate the problem in full.

#### Properties of Wood with Gelatinous Fibres

No attempt will be made in this short note to give a full account of the distinctive properties of wood with gelatinous fibres. It is only intended to record a few cases in which their presence in converted timber or manufactured articles has proved to be directly associated with some technical defect or abnormality.

#### GENERAL APPEARANCE

The presence of gelatinous fibres seldom affects the superficial appearance of timber sufficiently to constitute a serious blemish, but streaks or patches of darker color may prove to be due to this cause. A clean-cut cross section through a zone of gelatinous fibres sometimes has a bright, horny appearance, but in some species, e.g., Beech, Poplar, and Sycamore (*Acer pseudoplatanus*), the end grain of timber which has been cross-cut with a fine-toothed saw has a peculiar silky lustre which often enables the presence of gelatinous fibres to be detected without further examination. It is noteworthy that, although gelatinous fibres are often associated with

broad growth rings, this is not invariably the case and, in some species at least, they may be abundant and well developed on one side of a stem without any indication of eccentric growth.

#### STRENGTH

The significance of gelatinous fibres in regard to the strength of timber was discovered by Clarke in an investigation of Elm (3). In correlating the crushing strength of this timber with its anatomical structure he found that the general occurrence of gelatinous fibres results in the crushing strength of the wood being abnormally low in proportion to its specific gravity. Clarke has recently investigated these strength relations in more detail, using Beech trees specially selected for the purpose. As regards crushing strength in compression parallel to the grain, the results of tests on this species agree with those on Elm in that wood with gelatinous fibres is apt to be weaker than normal. In tension it is appreciably stronger than normal wood of the same specific gravity, at least in the green condition, but as regards toughness, which depends on both tensile and crushing strengths, the quality does not appear to be appreciably affected. This last conclusion is of interest as it is in general agreement with a series of observations on the cause of brashness in American White Oak, which showed no relation between the toughness of the wood and the proportion of gelatinous fibres (10).

#### MACHINING PROPERTIES

One of the most striking effects of gelatinous fibres on the technical properties of timber is in regard to its machining properties. When the wood is rip-sawn, planed, recessed, or worked on a lathe or spindle moulder, the presence of gelatinous fibres frequently manifests itself in an abnormally rough, woolly finish of the longitudinal surfaces. This was first noticed in some specimens of *Kbaya*, the sawn surface of which resembled nothing so much as a pile carpet. Similar effects have since been observed in a number of other tropical and temperate hardwoods, the peculiarly woolly nature of the finished surface being associated in every case with a well de-

veloped gelatinous fibre wall. The phenomenon may be due to the rubbery nature of the fibres, which are presumably pressed down or torn by the cutter instead of being cut cleanly. This woolly finish is not so marked when the affected portion of the wood is extremely dense and the lumen of the fibres is completely occluded by the gelatinous layer. It is more distinct in specimens which to outward appearance are perfectly normal.

Another interesting feature was observed in preparing turned specimens of Beech on an automatic lathe. The turnings from specimens taken from the tension side of the tree came off in long, unbroken ribbons, whereas those from the compression side were short, brittle chips.

#### SEASONING PROPERTIES

It has been stated that the presence of gelatinous fibres in wood prevents undue shrinkage and swelling with changes of moisture content (9, p. 34), but there appears to be no experimental evidence in support of this assertion. In order to examine this point a series of observations was made on matched pairs of wood specimens from several different trees of *Robinia pseudoacacia* and common English Elm (*Ulmus procera*), selected so that gelatinous fibres were present in one member of each pair and absent from the other. The results showed no definite advantage in favor of the specimens with gelatinous fibres (4). More recent (unpublished) observations on Beech tension wood with gelatinous fibres have shown that although the radial shrinkage of this type of wood is of the same order as that of normal wood, the tangential shrinkage is appreciably greater and the longitudinal shrinkage very much greater than normal. In this last respect tension wood resembles the compression wood of conifers and gives rise to similar defects (11). Thus, in converted timber and manufactured articles the presence of abundant gelatinous fibres in one part of the specimen is liable to cause distortion and splitting (5). Instances of the special type of internal checking known as honeycombing in kiln-seasoned Chestnut (*Castanea sativa*) have also been traced to the excessive shrinkage of zones of gelatinous fibres (6, p. 7).

## Summary

Gelatinous wood fibres are characterized by a highly refractive, gelatinous-looking inner wall, which appears to be unligified. They occur sporadically in many hardwood genera belonging to widely separated families. They tend to be concentrated on one side of the stem at any one period of growth and their general occurrence is shown to be associated with the formation of tension wood.

Other theories regarding gelatinous fibres are briefly considered.

The effect of gelatinous fibres on the properties of wood—its general appearance, strength, machining and seasoning properties—is described.

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## CONIFEROUS FOREST TREES OF CHILE

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*Caja de Colonización Agrícola, Santiago*

## PODOCARPACEAE

*Podocarpus nubigenus* Lindl., known as Mañío or Mañiu, or in the Araucanian language Manilhuán, is irregularly distributed from Río Toltén, about 39° 20' south latitude, to Río Backer (Smith Canal) in the Territory of Magallanes, though the southern limit is poorly known. It occurs singly or in little groups on swampy land in the rain forests, commonly in association with various Myrtaceae (*Myrceugenia*, *Tepualia*, etc.) and Alerce (*Fitzroya*), with a ground cover of ferns, mosses, and marsh grasses. Mature trees vary in height from 30 to 80 feet and in diameter from 24 to 36 inches.

The timber is logged in certain localities in Valdivia, Llanquihue, and Chiloé Provinces, especially on the Isle of Chiloé, and is one of the best and most valuable in the South. The pale yellow or whitish wood is fine-textured, comparatively heavy, and highly durable. The lumber is utilized in carpentry, cabinet and furniture making, flooring, ceiling, cooperage (particularly honey barrels), ship and boat building (masts, rudders, decks, and storerooms), and for railway crossties. The annual production is small because of the scarcity of the trees. There is no information available concerning the silvicultural requirements, methods of reproduction, or forest management of the species.

*Podocarpus salignus* D. Don, also called Mañío and Mañiu, or Mañiu de la Frontera, extends from about 35° 30' (Río Maule) to the Province Llanquihue, the southern limits not being exactly known. In the northern part of its range it occurs along streams in the understory of evergreen rain forests which are composed principally of *Persea lingue* Nees, *Laurelia aromatica* Juss., *Guevina avellana* Mol., *Myrceugenia apiculata* Med., and *Peumus boldus* Juss. In the Provinces Cautín, Valdivia, and Llanquihue the dominant trees in its forest association are *Weinmannia trichosperma* Cav., *Eucryphia cordifolia* Cav., and *Laurelia aromatica*. It grows singly or in small clumps on hillsides and along streams where the atmosphere is always humid. Nowhere does it attain large dimensions, the usual heights being between 30 and 60 feet. The leaves are long and narrow, suggesting Willow (*Salix*.) The trunk, which frequently is crooked or twisted, rarely attains a diameter of 18 inches. Timber from well-formed trees is of excellent quality, but most of it is used locally for making doors, window sash, ceilings, and honey barrels. Only a small quantity of lumber is exported from the southern virgin forests because the logs are slender and the average number of exploitable trees is less than one per acre.

*Podocarpus andinus* Poepp., Araucanian name Lleúque, is sparingly distributed in the Andes Cordillera from Río Maule to about 40° 30', and in the Coast Cordillera from about 37° 30' to 41° south latitude. It is a short, generally crooked tree, 20 to 30 feet high and rarely attaining a trunk diameter of 20 inches. It occurs as scattered individuals in association with *Notofagus Dombeyi* Blume and *N. pumilio* Reiche on stony hillsides and in gulches at moderate elevations, usually remote from highways and railroads. Although the wood is similar to that of the other Podocarps, the timber has very little economic importance, its utilization being limited to occasional farm purposes.

*Saxegothea conspicua* Lindl., commonly called Pino, as well as Mañío and Mañiu, grows in swampy areas in the rain forests from Río Maule to 45° (Río de los Manuales) and probably farther south. In Provinces Cautín and Valdivia the chief associates are *Weinmannia trichosperma*, *Eucryphia*

*cordifolia*, *Laurelia aromatica*, *Aextoxicum punctatum* R. & P., *Lomatia ferruginea* R. Br., and *Myrtus luma* Barn.; in Valdivia, Llanquihue, and Chiloé they are *Pilgerodendron wuiferum* (Don) Florin, *Fitzroya cupressoides* (Mol.) Johnston, *Notofagus Dombeyi*, and *N. antarctica* Oerst. The usual heights are between 30 and 60 feet and the number of exploitable trees per acre is too low in most localities to permit extensive utilization. The wood is similar to that of *Podocarpus* in appearance, properties, and uses.

*Dacrydium Fonkii* (Phil.) Benth., one of the smallest coniferous plants in the world, is mentioned here to complete the generic list of Chilean Podocarpaceae. It is less than a foot high and its foliage has the general aspect of *Juniperus virginiana* L. It occurs in the ground cover of swampy areas and sphagnum bogs from 40° (Coast Cordillera of Valdivia) to Tierra del Fuego.

#### ARAUCARIACEAE

*Araucaria araucana* (Mol.) Koch, commonly called Pino, Pino Chileno, Piño Piñonero, Araucaria, and Pehuén (Araucanian), has two well defined areas of distribution: one in the Coast Cordillera (Cordillera Nahuelbuta) between 37° 20' and 38° 40', the other in the Andes Cordillera from about 37° 50' to 39° 40' (Lago Reñihue) and thence in Argentine territory to the northern part of the Lago Nahuel-Huapi. It is a typical tree of stony hillsides and ravines at elevations of 2700 to 5400 feet above sea level in the northern part and at 1200 to 3600 feet in the southern part of its range. Near Angol, 37° 50' south latitude and 73° west longitude, in the Cordillera Nahuelbuta, the Araucaria forests have the following composition: At 3000 feet the principal associate is *Notofagus Dombeyi*, with an undergrowth of *Chusquea* sp., *Baccharis magellanica* Pers., and *Berberis Darwinii* Hook. At higher elevations *N. Dombeyi* gives place to *N. pumilio* Reiche and *Drimys Winteri* Forst., and at 3900 feet the Antarctic Beeches are only shrubs of the undergrowth along with *Maytenus disticha* Urb., *Embotrium coccineum* Forst., and *Pernettya pumilia* Hook. In the highest part of this Cordillera (4500 feet) the undergrowth consists principally of *Notofagus*

*pumilio* (which in other regions in Chile is a large forest tree), *Desfontainea chilensis* G. Gay, and *Berberis linearifolia* Phil.

The Chilean Araucaria attains a height of 90 to 135, occasionally up to 150, feet, and a diameter (breast high) of 45 to 60 inches. Trees growing in the open have a large crown and rather pendulous branches covering more than half of the stem, but those in the forest have a small spherical or ellipsoid crown which extends less than a third of the way down the long cylindrical trunk and is composed of branches that are nearly vertical near the stem but curve toward the extremities. The bark, which is thick and broken into polygons of various sizes, has a very distinctive appearance; it secretes a resin that is collected and used medicinally by the Araucanian Indians. The scale-like, imbricated leaves are very stiff and sharp-pointed. The cones are as large as a man's head, and each contains from 120 to 180 large seeds, called "piñones," which ripen in March and form an important article of commerce in all parts of Chile, as they have a delectable aroma and flavor upon roasting.

The pale yellowish, fine-textured timber is of good quality and is used for general construction, ceiling, flooring, doors, window sash, furniture, and boxes, and is considered suitable for paper pulp, although there is no pulp industry in the region. The lumber is obtainable in the markets of Temuco, Mulchen, Victoria, and Angol, but the annual consumption is small because of the difficulties attending the logging and extraction of the timber. It has been roughly estimated that there are about 600,000 acres of Araucarian forest in Chile having an average of 36 trees per acre, with a total possible yield of 1,215,000,000 cubic feet of timber, but most of the trees are scattered or in open stands in high and hardly accessible mountainous regions. As the tree is readily grown from seed and is common in southern parks and gardens, it is probably suitable for forest planting within its natural range.

#### CUPRESSACEAE

*Libocedrus chilensis* (Don) Endl., called Ciprés in central and southern Chile and Cedro in Patagonia, grows on dry, sterile, rocky hillsides and mountains, where no other trees

can thrive, in the Andes Cordillera between 34° 25' and 44° south latitude. In the locality of the Río de los Cypreses (Province Colchagua), its northern limit, the species is found at elevations of 4500 to 4800 feet; at 35° in the valley of the Río Teno (Province Curicó), 3900 feet; at 36° 40' in the Cordillera de Chillán, 2700 feet; at 38° 3' south latitude and 72° 35' west longitude, at Hacienda Nupangue (Province Malleco), it occurs at about 1000 feet, while still farther south it descends to 300 feet or less. It often grows gregariously, forming small, nearly pure stands, sometimes several acres in extent.

Young trees are pyramidal and resemble *Chamaecyparis Lawsoniana* Parl.; old ones are flat-crowned and have a thick trunk usually clear of limbs for two-thirds of its length and covered with a thick, furrowed, grayish brown bark. The juvenile leaves are about half an inch long and sharp-pointed, but those developed later are comparatively broad and scale-like. The cones, which are small, ripen in February or March and soon fall to the ground; they are borne only on old trees. The seeds have a broad wing and germinate readily.

The wood is fine-textured, straight-grained, light in weight, and easy to work. Growth rings are distinct and usually rather broad. The sapwood is thin and nearly colorless, the heartwood reddish brown, scented, and highly resistant to decay. Owing to the inaccessibility of the trees, the timber is not exploited commercially, but is suitable for a great many purposes requiring ease of working and durability rather than great strength.

*Pilgerodendron uviferum* (Don) Florin, also known as Ciprés, sometimes as Ciprés de las Guaytecas, bears the Araucanian name of Lahuán. Taxonomists are not in agreement as to the classification of the tree, which has been referred to three other genera, namely, *Juniperus*, *Chamaecyparis*, and *Libocedrus*. Its range extends from latitude 40° (Río Valdivia) to Tierra del Fuego, including the various islands and archipelagos. Its vertical distribution is from near sea level to 3300 feet. Near Valdivia it is associated with *Fitzroya*, *Eugenia correaefolia* Hook. & Arn., *Baccharis magellanica*, and *Oreobolus clandestinus* Phil. Near San Pedro (41° south, 73° 50'



west), the following vegetation was observed: at 2400 feet in the Coast Cordillera, *Fitzroya cupressoides*, *Drimys Winteri*, *Tepualia stipularis* Gris. (a myrtaceous tree typical of southern swamps), *Podocarpus nubigenus*, *Philestia buxifolia* Lam. (a shrub); on the side of Volcan Osorno at 3300 feet, three Antarctic Beeches, *Nothofagus pumilio*, *N. Dombeyi*, and *N. betuloides* (Mirb.) Blume, the last two evergreen. On the Isla de Chiloé the species occurs in small groups along with *Fitzroya*, *Nothofagus antarctica* (deciduous), *N. nitida* Reiche (evergreen), *Saxegotbea*, *Podocarpus nubigenus*, *Tepualia stipularis*, and *Drimys Winteri*. On Tierra del Fuego the chief associates are *Nothofagus betuloides* and *Drimys Winteri*.

This Ciprés is of slow growth but attains a height of 90 feet or more. The crown is small and pyramidal in youth, becoming open and irregular and tending to be dry-topped at maturity. The dull green, scale-like leaves are 4-ranked, making the twigs characteristically squarish in section. The cones, which ripen in April, consist of two pairs of scales, bearing four small-winged seeds.

The sapwood is creamy yellow, the heartwood brownish and very durable. The timber is of the first class and is much exploited in the South, particularly on the Isla de Chiloé and the Patagonian islands, for house construction, flooring, doors, window sash, and furniture. The smaller sizes are in demand for fence and vineyard posts and telephone poles and are noted for their lasting quality in moist soil.

*Fitzroya cupressoides* (Molina) Johnston, also called Lahuán by the Indians, is known in Spanish as Alerce (Larch), the name given the tree by the Conquistadores, though having nothing to do with *Larix*. So far as definitely known, the area of its distribution begins near the city of Valdivia (39° 45') and ends near the Río Futalelfú (43° 29'). It is typically a species of low swamps, but grows at higher elevations on Isla de Chiloé and in the Territory of Aysen in Patagonia. It is unique among Chilean conifers in forming dense, nearly pure forests over thousands of acres. In Chiloé there are occasionally interspersed clumps of *Podocarpus nubigenus* and *Saxegotbea*. In the extensive forests between Lake Llanquihue and the coast at Puerto Montt one finds *Drimys Winteri*, *Guevina*

*avellana*, *Tepualia stipularis*, *Embotrium coccineum*, *Sphagnum*, and *Juncus*.

The tree bears considerable resemblance to the California Redwood (*Sequoia sempervirens* [Lam.] Endl.). On Chiloé and in the Cordillera de Piuchué the average height of maturity is about 100 feet, but near Puerto Montt the old trees are mostly from 130 to 150 feet tall and one specimen measured 240 feet. The famous "Silla del Presidente," which formerly stood near Puerto Montt, was 15 feet in diameter; others in the same region reach a diameter (breast high) of nine feet. On Chiloé the average diameter is about four feet. The tree grows slowly and attains an age of more than 1000 years.

Young trees have a conic-pyramidal form and very dense, dark green foliage; old ones have a small crown at the top of the long, straight bole, and so many of the branches are dry that the forest, seen from a distance, appears to be dead. The leaves, which are ericoid and pointed, are limited to the young twigs. The cones are small, terminal, with six scales and nine winged seeds. The bark is several inches thick, corky, and, upon incision, exudes a resin of agreeable odor. The inner bark, called "estopa de Alerce," is harvested in the summer by men, women, and children who make bales of the thin strips and carry them on their backs to the nearest towns or harbors for use in calking boats and ships. The same people also collect the resin and burn it as incense.

The wood is of fine and uniform texture, straight and fine grain, low density (less than that of *Populus nigra* L.), and is strong and elastic for its weight. The sapwood, which is thin and white, is not utilized; the heartwood is red and long-lived under exposure.

Alerce is exploited throughout its range. Usually the logs are not hauled to mills and sawed, but are worked in the forest by natives who cut the big trees and split them into boards and shingles with wedges made of the hard wood of *Myrtus luma*. In the "alercas," or great Alerce forests of the South, the woodsmen are specialists in this timber and produce rived boards of uniform thickness by means of a single wedge inserted at one end of a log. Men carry the lumber and shingles to market on their shoulders, often for many miles over poor

roads through the swamps. On the Isla de Chiloé similar packing is done from the Cordillera Piuchué to Ancud, a very old town founded by the Spaniards. The cities of Puerto Montt and Osorno get their supply of Alerce in the same way from the distant forests in the Cordillera. The woods operations are limited to the dry season, from spring to autumn, during which time the woodsman lives with his family in a temporary dwelling, or "rancho," built entirely of rived Alerce.

The timber is the finest produced in Chile and ranks with the best and most useful in the world. It is ideal for carpentry and light and durable construction of all kinds, and for honey barrels and musical instruments; limited quantities are exported for making pencils and cigar boxes. The lumbermen also make and sell troughs that are noted for their durability. The price of the lumber in the Province Llanquihue is about 10 pesos (50¢, U. S. A.) per "pulgada" (10 board feet), which is higher than for any other native timber. The total consumption is not large, however, owing to the present inaccessibility of most of the Alerzales.

NOTES UPON WOODY PLANTS OF TROPICAL  
AMERICA, WITH DESCRIPTIONS OF TWO  
NEW SPECIES

By PAUL C. STANDLEY

*Field Museum of Natural History*

The notes and descriptions here collected relate chiefly to plants received for study from Professor Samuel J. Record of the Yale School of Forestry. The specific names of the shrubs described as new commemorate two collectors whose substantial collections of well prepared material have added much detailed information to what was previously known of the floras of the countries in which they have worked so profitably.

*Albizzia Lundellii* Standl., nom. nov. *A. rubiginosa* Standl. Carnegie Inst. Wash. Publ. 461: 58. 1935, non Miquel, 1855.  
*Acacia Guacamayo* (Britt. & Killip) Standl., comb. nov.

*Senegalia Guacamayo* Britt. & Killip, Ann. N. Y. Acad. Sci. 35: 142. 1936.

*Acacia Eliasana* (Britt. & Killip) Standl., comb. nov. *Senegalia Eliasana* Britt. & Killip, Ann. N. Y. Acad. Sci. 35: 145. 1936.

*Homalium Schippii* Standl., nom. nov. *H. riparium* Standl. Carnegie Inst. Wash. Publ. 461: 74. 1935, non Gilg, 1908.

*Mayna longicuspis* (Standl.) Standl., comb. nov. *Sloanea longicuspis* Standl. Field Mus. Bot. 4: 229. 1929.—Professor Record has called my attention to the fact that the wood of this Panama tree is not referable to the Tiliaceae, and examination shows that it belongs really to the Flacourtiaceae. All the species of *Mayna* are closely related, and it is doubtful that more than a very few can be maintained when ample material is available for study of specific variations. The Panama plant is closely related to some of the species described from Colombia and the Amazon Valley, but if characters relied upon for separating them are dependable, which is doubtful, it also is a distinct species. Besides the type from Progreso, Chiriquí, Panama, *M. longicuspis* is represented also by Pittier 4296 from Puerto Obaldía, San Blas Coast.

*Grias Fendleri* Seem. Bot. Voy. Herald 126. 1854. *Gustavia integrifolia* Standl. Field Mus. Bot. 4: 240. 1929. Rather ample and recently collected material referable to *G. integrifolia* shows that it is really a species of *Grias*, as first suggested by Professor Record, and upon further study I find no characters by which to separate it from the Panaman *Grias Fendleri*. At present the species is known from Panama, Nicaragua, Honduras, and British Honduras, and very recently it has been collected as far north as Mexico: Ubero, Oaxaca, at 30-90 meters, June 1937, *L. Williams* 9443. In Oaxaca the tree is called Morro Cimarrón. It is described as an unbranched tree of 7.5-10.5 meters, conspicuous for its densely clustered, long and narrow leaves, sometimes more than a meter in length. It is the first member of the family Lecythidaceae to be reported from Mexico.

*Eugenia coloradoensis* Standl., nom. nov. *E. melanosticta* Standl. Journ. Arnold Arb. 11: 126. 1930, non Koord. & Valet., 1900.

*Eugenia Dugandii* Standl., sp. nov.—Arbuscula 3-4-metralis omnino glabra, ramulis ferrugineis subcompressis, internodiis foliis brevioribus; folia modica brevissime petiolata coriacea, petiolo crasso vix 3 mm. longo; lamina oblongo-elliptica 5-7.5 cm. longa 2.5-4 cm. lata, apice obtusa vel anguste rotundata et brevissime emarginata, basi obtusa, supra in sicco griseo-viridis lucida densissime minute punctata, costa impressa, nervis venisque manifestis sed vix elevatis, subtus opaca fere concolor dense minute nigro-punctata, costa gracili elevata, nervis lateralibus utroque latere ca. 9 tenerimis prominulis angulo lato divergentibus fere rectis prope marginem irregulariter arcuato-conjunctis; flores cymosi, cymis axillaribus solitariis 3.5-4.5 cm. longe pedunculatis paucifloris ad 4.5 cm. latis, floribus centralibus cymarum sessilibus, lateralibus crasse ad 6 mm. longe pedicellatis; calyx dense punctatus extus glaber, hypanthio late turbinato 2.5 mm. longo, sepalis 3-3.5 mm. longis intus sericeis late ovatis obtusis; petala rotundata ciliata punctata sepalis longiora.—COLOMBIA: Near Medellín, Central Cordillera, 1800 meters, October 1935, *A. Dugand* G. 904 (type in Herb. Field Mus.; duplicate at Yale).

*Lycianthes Rimbachii* Standl., sp. nov.—Frutex 2-metralis, ramis gracilibus subangulatis, vetustioribus subfuscis striatis, novellis ochraceis sparse pilosulis, internodiis brevibus; folia alterna petiolata membranacea, petiolo gracili 5-8 mm. longo breviter patenti-pilosulo; lamina forma variabilis elliptica, ovato-elliptica vel oblongo-elliptica 3-6 cm. longa 1.5-3.5 cm. lata apice obtusa ad rotundata, basin versus paullo angustata, subito contracta atque longe decurrens, integra, supra viridis subdense pilis brevissimis ex parte stellatis pallidis pilosula, subtus pallidior subdense albido-tomentosa; flores in axillis vel ad ramulos abbreviatos fasciculati pauci, pedicellis gracilibus plerumque 1-2.5 cm. longis sparse breviter pilosulis; calyx late campanulatus ca. 2 mm. longus sparse patenti-pilosulus truncatus, appendicibus 5 filiformibus viridibus erectis vix ultra 1.5 mm. longis onustus; corolla laete coerulea 3 cm. lata fauce lutea glabra; antherae aurantiacae 2 mm. longae crassae; fructus depresso-globosus 12 mm. latus basi et apice subtruncatus glaber.—ECUADOR: Interandine

highland near Riobamba, 2800 meters, among shrubs, December 1935, *A. Rimbach* 632 (type in Herb. Field Mus.; duplicate at Yale).

“Wood yellowish white. Bark brown, with small warts. Plant ornamental because of the numerous large, brightly colored flowers.”

*Drymonia belizensis* Standl., nom. nov. *D. ochroleuca* Standl. Field Mus. Bot. 12: 413. 1936, non Poepp. & Endl. 1845.

*Psychotria Jamesoniana* Standl., nom. nov. *P. Rimbachii* Standl. Trop. Woods 45: 17. 1936, non Standl. Trop. Woods 42: 32. 1935.

#### CURRENT LITERATURE

**Estudios sobre la flora de Puerto Rico. Con un prólogo de Carlos E. Chardón. Segunda edición.** 2 vols., 343 and 165 pp.; frontispiece. Publ. Federal Emergency Relief Administration, San Juan de Puerto Rico, 1936.

This is a reprint of a series of pamphlets issued privately by Stahl from 1883 to 1888. While the author had a good field knowledge of the plants of Puerto Rico, and his notes and descriptions were useful at the time of publication because no other collective account of the Puerto Rican flora was available, since that time two excellent floras of the island, by Urban and Britton and Wilson, have been published. The present publication is, therefore, obsolete and incomplete, and its editing was done evidently by some person without knowledge of modern practice in systematic botany.—P. C. STANDLEY.

**A monographic study of *Rhus* and its immediate allies in North and Central America, including the West Indies.** By FRED ALEXANDER BARKLEY. *Ann. Mo. Bot. Gard.* (St. Louis, Missouri) 24: 265-466; pls. 10-26; Sept. 27, 1937.

On the basis of critical morphological study, 6 genera, 52 species, and 21 varieties are recognized in the *Rhus* complex of North America. The recognized genera are *Actinocbeita*, *Cotinus*, *Malosma*, *Metopium*, *Rhus*, and *Toxicodendron*.

Nine new species and five new varieties are described. All species are described in detail and the material studied is cited.

**Observaciones florísticas y geobotánicas en el valle del Mezquital, Hidalgo.** By HELIA BRAVO H. *Anal. Inst. Biol. (Mexico)* 8: 3-82; 24 figs., numerous tables; 1937.

A detailed discussion of the ecology and geobotany of the Valley of Mezquital, state of Hidalgo, Mexico, with numerous tables and illustrations in explanation of the plant societies represented. The paper includes a systematic list of plant species observed in the region.

**Notas acerca del aprovechamiento de algunas plantas de importancia económica en la región del valle del Mezquital, Hgo.** By ANTONIO RAMÍREZ LAGUNA. *Anal. Inst. Biol.* 8: 83-115; 1937.

Extensive notes regarding economic plants of the Valley of Mezquital, Hidalgo. Many of the species treated are shrubs and trees, for which local names are cited.

**Contributions to the flora of tropical America. XXXI. Plantae mexicanae Hintonianae. III.** *Kew Bull. Misc. Inf.* (London) 291-310; pls. 10; 1937.

Descriptions of new species and notes upon older ones by A. A. Bullock, T. A. Sprague, and N. Y. Sandwith, the plants treated being Mexican. Among species described are *Malva-viscus Hintoni* Bullock (local name Monacillo), *Triumfetta heliocarpoides* Bullock (Guasima, doubtless a corruption of Guácimo) and several other species of the genus; *Malpigbia Hintoni* Bullock; *Nissolia leiogyne* Sandwith; *Caesalpinia Hintoni* Sandwith (Trompetilla); *Inga Hintoni* Sandwith (Jacaniquil); *Bouvardia Hintoni* Bullock; *Deppea Hintoni* Bullock. — P. C. STANDLEY.

**Studies of Mexican and Central American plants. II.** By C. L. LUNDELL. *Phytologia* (New York) 1: 212-222; June 1937.

Among new species described are *Podocarpus Matudai*,

*Coccoloba escuintlensis*, *Eugenia Matudai*, *Clebra glaberrima*, *C. Matudai*, *C. parvifolia*, and *Sideroxylon Matudai* (Chiapas); *Baubinia gigas*, *Erythroxyton helizense*, *Tapirira macrophylla* and, *Ilex belizensis* (British Honduras); *Clusia suborbicularis* (British Honduras and Guatemala).

**Studies of Mexican and Central American plants. III.**

By C. L. LUNDELL. *Phytologia* 1: 241-247; September 1937.

New species are published in *Picramnia*, *Meliosma*, *Souroubea*, *Ruyschia*, *Myrtus*, and *Jacquinia*. *Talisia diphylla* Standl. is transferred to *Exothea*.

**Studies in Mexican and Central American plants.** By CORNELIUS H. MULLER. *Amer. Midland Naturalist* (Notre Dame, Indiana) 18: 842-855; September 1937.

*Ulmus multinervosa* is described as new from Coahuila, Mexico. Detailed notes are given regarding the Oaks of the mountains of Coahuila, *Q. endemica*, *Q. carmenensis*, *Q. Marsbii*, and *Q. sentenelensis* being new species. Notes are given also upon Oaks of Guatemala, various new forms being named as well as the new species *Q. hemipteroides* and *Q. pannosifolia*.

**The properties of British Honduras pitch pine (slash pine) — *Pinus caribaea* Mor.** *Forest Products Research Records* No. 20 (Timber ser. No. 6), H. M. Stationery Office, London, 1937. Pp. 9; 6 x 9½; 1 pl. Price 7 d. postpaid.

"Of recent years considerable attention has been directed to the possibility of developing an export trade in the secondary woods of British Honduras, and in furtherance of this scheme a number of these woods have been subjected to tests at the Forest Products Research Laboratory at Princes Risborough. Among the species tested was a Pitch Pine, *Pinus caribaea*, which was chosen partly on account of its close resemblance to the wood of the Longleaf Pine, *Pinus palustris*, from the Southern Pine belt of the United States and partly because the Pine areas in British Honduras are capable, under proper management, of a sustained yield large enough for export purposes. For the investigation of its

properties a consignment of 149 logs having a total volume of approximately 2900 cubic feet was shipped to the Laboratory in 1934."

"In British Honduras, forest of this Pine occurs as isolated well-marked zones separated by belts of rain forest which occupy the deeper, richer soils. It is found on the northern plains and extends along the southern coastal plain and also the mountain ridges at an average elevation of about 2000 feet. In the coastal belt the soil is sandy and the ground often swampy. At the higher elevations the soil is derived from the disintegration of granite and porphyry."

"The tree attains a height of about 100 feet with a corresponding diameter of about 3 feet, and is often free from branches for 50-70 feet. Its habit of growth when young is similar to that of the Loblolly Pine, *Pinus taeda*, but with increasing age it develops heavy horizontal branches and a rounded crown approaching more closely in appearance to the Longleaf Pine, *Pinus palustris*, or to old Scots Pine."

"The wood is moderately heavy (average weight 44 lbs. per cubic foot at 15 per cent moisture content, with an observed variation of 35-50 lbs. per cubic foot), somewhat coarse in texture, generally with a more or less pronounced resinous odor, but possessing no distinctive taste. The grain is typically straight. The heartwood, constituting 42 per cent by volume of the eight logs selected from the consignment for examination, is reddish brown, the depth of color varying with the amount of resin present. The pale yellowish brown sapwood forms a zone 2-3 inches in width. Growth zones are clearly defined by bands of dense tissue and are conspicuous on all surfaces. As in the wood of pines of temperate regions a relatively wide band of late wood appears to terminate the annual growth, but in addition from one to several lines of dense wood forming secondary rings are commonly present and the late wood also very frequently shows stratification. The transition from the light-colored early wood tissue to late wood is abrupt. The average number of primary rings per inch varies from about 5 in the first few inches from the pith to about 16 near the bark, 7-10 inches from the pith."

"The timber air-seasons slowly in this country with some

splitting but little distortion apart from bowing. Kiln-seasoning requires considerable care. In strength it compares favorably with Longleaf Pine and is decidedly superior to Shortleaf and Loblolly Pines. It has good working qualities. Heartwood is moderately resistant to fungal attack. Sapwood readily absorbs creosote; absorption by heartwood is satisfactory by pressure methods."

#### Revision der Arten einiger Annonaceen-Gattungen. IV.

By ROB. E. FRIES. *Acta Hort. Bergiani* (Uppsala) 12: 221-228; pls. 1-8, figs. 1-11; 1937.

*Pseudoxandra* is a new genus comprising six South American species, two of which are new. A monographic account of *Unonopsis* recognizes 22 species, the new ones being *U. Williamsii* (vernacular name Espintana), *U. gracilis* (Anonilla), and *U. obovata* (eastern Peru); *U. Schippii* (British Honduras). Other new species are published in *Hornschuchia*, *Onychopetalum*, *Oxandra*, *Anaxagorea*, *Malmea*, *Fusaea*, *Duguetia*, *Guatterioopsis*, *Xylophia*, *Annona*, *Rollinia*, and *Crematosperma*. The paper maintains the same high standards of treatment that have characterized the author's earlier papers devoted to Annonaceae, which means that it has few equals among systematic publications of recent years. Especially admirable are the excellent drawings and photographs illustrating many of the species. — P. C. STANDLEY.

#### British Guiana. Report on the Forest Department for the year 1936. By B. R. WOOD. Pp. 9; 8¼ x 13¼. Georgetown, 1937.

"Although exotics give considerable promise for the first few years after planting, the probability is that growth later falls off very considerably and that the typical forest soils of the interior are insufficiently fertile to enable good crops of useful exotics to be obtained. Under these circumstances it is not proposed to establish further plantations at present, but to watch the growth of these already established in order to determine finally whether exotics will be useful in restocking worked out areas. . . . The experiments in planting indigenous species, particularly Tonka Bean (*Dipteryx odorata*)

and Locust (*Hymenaea courbaril*) were continued, and it is now clear that it will be possible to re-afforest denuded areas of loose barren sand with these species. Determa (*Ocotea rubra*) and Kartang (*Centrolobium orinocense*), the Redwood of the Rupununi, are also under trial. . . . The Kartang shows much promise, but so far the Determa has made little progress. . . . It is now possible to undertake routine improvement operations in Greenheart forest that has been worked over which will greatly improve and increase the future crop. . . . The success attending the work on Greenheart, with the comparative difficulty of establishing useful exotics by plantation methods, indicates that the future policy in working the forest will be the re-establishment of crops of indigenous species, particularly Greenheart and Wallaba."

"Efforts were made to interest various local firms in the use of Hububalli (*Loxopterygium Sagotii*) for furniture making. Small sales were made with some success, but the fashionable demand is for Crabwood stained dark, and it will take some time to popularize a lighter colored wood. Various sample and experimental shipments were made to the United Kingdom during the year. The Morabukea (*Mora Gonggrijpii*) strips sent to the Colonial Forest Resources Development Department for trial for flooring were kiln-dried, manufactured, and laid down in a floor in the London Docks for service tests. These strips were well received and reported on and the expectation is that they will prove suitable for flooring tracking ways in warehouses, as well as for better work. Approximately 200 ft. B.M. of seasoned Crabwood strips were also sent to a firm in England for trial for flooring. There is a considerable consumption of Brazilian Andiroba, which is the same species as Crabwood (*Carapa guianensis*), for this work at prices which would enable Crabwood to be produced profitably for the same purpose. These strips were well received and their appearance favorably commented on, and the expectation is that after trial they will prove just as suitable as Andiroba."

"The exports to the U. S. A. showed a steep rise. This can practically be described as a new market. Formerly Greenheart was little known and hardly used, the small and fluctu-

ating exports being periodic orders for the Panama Canal, bulk samples being sent, and occasional small orders for special purposes. An important market in a less selective quality than is demanded by Europe is now rapidly being established, which will be of great importance to the export trade in the Colony. . . . What has recently occurred and is occurring in the export trade can be characterized as something more than a revival — it is almost a new departure. The rise in exports of manufactured timber which greatly increased in 1936 will greatly increase still more in 1937, whilst the total exports based on orders known to have been booked, if no major difficulties occur between now and the end of the year, will be a record for all time to date, and will probably double those of 1936 and treble the annual average of the 1930-1935 quinquennium."

**Three new species of Vacciniaceae.** By A. C. SMITH. *Phytologia* (New York) 1: 209-212; June 1937.

*Thibaudia albiflora* and *Cavendishia Mexiae* are described from Ecuador, and *C. confertiflora* from Costa Rica.

**Flora.** *Revista de botánica y farmacognosia. Organó oficial del Instituto Botánico de la Universidad Central, Quito, Ecuador.* Año 1, No. 1; 147 pp.; ill.; May 1937.

The first number of a magazine issued by the recently established Botanical Institute, under the directorship of Prof. M. Acosta Solís, of the Central University of Quito, Ecuador. The contents are as follows: an editorial regarding the Botanical Institute and Flora; brief phytological notes upon the Province of Carchi, by H. Medina; an account of an agricultural and edaphological excursion to the North by the students of the third course in agronomy, by P. E. Macias; reasons why the Quina Roja (*Cinchona succirubra*) is a phytological representative of Ecuador, by M. Acosta Solís; agricultural riches of the Ecuadorian littoral, by P. E. Macias; a botanical and pharmacological study of *Sida rhombifolia*, by M. Acosta Solís and E. Pastor C.; improvement of agricultural lands, by Samuel Hidalgo; the importance of graft stocks in the culture of fruit trees, by Luis A. Gattoni; bib-

liography and commentaries; and a brief account of Sodiro and the Ecuador flora, by M. Acosta Solís. — P. C. STANDLEY.

**Clave analítica de las familias de plantas superiores de la América tropical.** Nueva edición, enteramente revisada y corregida. By H. PITTIER. Pp. 90; Caracas, 1937.

An analytical key to the families of phanerogams and vascular cryptogams of tropical America, accompanied by a glossary of the technical terms employed. The work is unique in the field that it covers, and will prove, like the earlier but less extensive editions, of great value to all interested in the systematic botany of the region.

**Additional notes on the genus *Aegiphila*. II.** By HAROLD N. MOLDENKE. *Phytologia* (New York) 1: 222-240; June 1937.

Extensive notes are given regarding distribution of many species of *Aegiphila*. *A. Hoebnei* is described as new from Amazonas, Brazil.

**Additional notes on the genus *Aegiphila*. III.** By HAROLD N. MOLDENKE. *Phytologia* 1: 248-272; September 1937.

Extensive notes regarding species of *Aegiphila* (Verbenaceae). New species are *A. Mortonii* (Peru), *A. pernambucensis* (Brazil), *A. Rimbachii* and *A. Schimpffii* (Ecuador).

**Species nonnullae brasilienses novae. II.** By R. PILGER. *Repert. Sp. Nov.* (Berlin-Dahlem) 42: 173-181; June 30, 1937.

In the Malpighiaceae new species are *Mascagnia thaumato-neura*, *Byrsonima euryphylla*, and *B. discolor* (Amazonas); *Stigmatophyllum Kublmannii* (Peru).

**Studies of American plants. VII.** By PAUL C. STANDLEY.

*Bot. Ser. Field Mus. Nat. Hist.* (Chicago) 17: 155-224; Sept. 28, 1937.

Descriptions of new species of tropical American plants, chiefly trees and shrubs, particularly Moraceae of the Amazon Valley. Trees for which vernacular names are reported, from

Amazonian Brazil unless otherwise indicated, are: *Brosimum Krukovii*, Muiratinga; *B. myristicoides*, Murure; *Coussapoa araneosa*, Apui; *C. boliviana*, Higo del Monte (Bolivia); *C. Eggersii*, Matapalo (Ecuador); *C. embirana*, Apiu; *C. hypochlora* and *C. Lawrancei*, Caraco (Colombia); *Ficus Eliadis*, Matapalo (Colombia); *F. Gameleira*, Gameleira; *F. Gleasonii*, Bird Fig, Kumaka-balli (British Guiana); *F. Haughtii*, Nisperillo (Colombia); *F. malacocarpa*, Kumaka-balli (British Guiana); *F. Mexiae*, Matapau (Minas Geraes, Brazil); *Perebea xinguana*, Muiratinga; *Pourouma elliptica*, Mapaty; *Pourouma Lawrancei*, Cormi (Colombia); *P. populifolia*, Mapaty; *Pseudolmedia Murure*, Murure; *Neea madeirana*, João Mole; *Prunus Gentryi*, Wasiki (Mexico); *Manibot isoloba*, Pata de Gallo (Mexico); *Randia mollifolia*, Sapuchi de la Sierra (Mexico). *Reichenbachia colombiana*, collected by Armando Dugand G. in Colombia, is a second species of this genus of Nyctaginaceae, the other occurring from Matto Grosso to Argentina. *Hamamelis mexicana* is the first species of its genus reported from Mexico (Nuevo León). *Ilex Rimbachii* from Ecuador was collected by Dr. A. Rimbach. *Millea ecuadorensis* is the only species of a new genus of Bombacaceae described from Guayaquil, Ecuador, where it was collected by Rev. Luis Mille.

**Estudos e observações sobre as mattas de Pernambuco.**

By VASCONCELLOS SOBRINHO. Reprinted from *Fronteiras*, No. 23, Pernambuco, February 1937. Pp. 40; 5¼ x 7½; 9 pls.

An exceptional opportunity to study the trees of one of the few remaining stands of virgin forest in the State of Pernambuco was afforded through the accidental destruction of all underbrush and smaller vegetation by a swift forest fire which left the woody plants standing. A burnt over area of 5000 square meters was selected for survey. The 704 trees on this area of a little less than 1¼ acres were found to be of 49 species, including 30 species with 380 trees yielding "madeiras de lei," hard wood, or other marketable timber, and 19 species with 324 trees with white or soft wood. The average distance between trees was estimated at seven meters. The dominant

species, represented by 35 trees or 4.8 per cent, was found to be "Camaçari" (*Carapa* sp.), followed by 31 trees or 4.3 per cent of Canudo de Cachimbo (*Heliotropium* sp.) with white or soft wood, and 27 trees or 3.7 per cent of Almecega (*Protium* sp.).

Although it is admittedly difficult to determine the age of tropical trees, the author divides these roughly into four age groups: the first comprising those which have attained their full development and may be said to have reached or passed their prime; the second including those which are well along toward maturity; the third consisting of young plants of woody development far enough advanced to be classed as trees; the fourth comprising all the still younger plants from time of germination through the underbrush or shrub stage. The passage of an individual from one group to the next might be considered to require about 20 years. One hectare (2.47 acres) of such forest in Pernambuco would have an average of 45 plants of the first age group, of which 25 are likely to produce some 250 cubic meters of lumber. The wood from the tops and branches of these, plus that of the other 20 trees not fit for timber, will yield almost as many more cubic feet, but valuable only as firewood. Though full development of tropical trees may require an average of 80 years, many species may be utilized to advantage at half that age, and some, e.g., Cedro, at 20 years. At ten years of age any of them will yield firewood.

On the basis of his findings, the author attempts to arrive at an estimate of the economic value of an hectare of such forest, and of the income which a given area of such forest might be made to yield under a system of rational exploitation. — B. E. DAHLGREN, *Field Museum*.

**Curso pratico de anatomia de madeiras.** By ARTHUR DE MIRANDA BASTOS. *Jornal do Commercio* (Rio de Janeiro); Apr. 8, 1937, p. 3.

For the benefit of those interested in learning something of the structure of wood as a means to its identification and better utilization, a five-day course of practical instruction in wood anatomy was offered in the month of April by the Minis-

terio de Agricultura in Rio de Janeiro. This course, given by Sr. Arthur de Miranda Bastos, of the federal reforestation service, was attended by almost 50 persons including students, professors, engineers, and executives representing important lumber firms, railway and navigation companies, military, naval and aviation services, and polytechnic and agricultural schools. One introductory session was devoted to a description of the structural elements of wood and of their characters in accordance with the glossary of the International Association of Wood Anatomists. This was followed by three days of practical demonstrations and observations on macroscopic and microscopic characters of wood with a comparative study of selected species. The closing session was given to discussion of methods and of the correlation existing between anatomical characters and physical or mechanical properties of wood. As an unexpected result of this course the Director-General of Engineering of the Army determined to establish a section for wood anatomical studies in connection with the military timber-testing laboratory. At the conclusion of the sessions, a letter signed by all participants in the course was sent to the Secretary of the International Association of Wood Anatomists in appreciation of the assistance rendered by that organization to the success of the local undertaking. — B. E. DAHLGREN, *Field Museum*.

**The Cerro Cuadrado petrified forest.** By G. R. WIELAND.

Pp. ix+180; 49 figs., 33 pls. Pub. 449, Carnegie Institution of Washington, April 1935.

In scope a text-book, this might well be a forerunner of more works of its general type. It covers a broad field, omits much of repetitious detail, and becomes even a handy work of reference for botanist, chemist, and forester. Few, if any, other publications contain as much information about the Araucarians.

The Cerro Cuadrado petrified Araucarian forest of north central Patagonia is regarded as quite the most remarkable fossil forest in all South America, just as the Fossil Cycad forest of the southwest Black Hills Rim is outstanding in North America. Both are now set aside and protected as Na-



tional Monuments. The Araucarians of the Cerro Cuadrado include several generic types of slightly archaic feature, though essentially modern. Their geologic age is variously set from the close of the Trias to early Eocene or Oligocene as now held the more likely. The collections described were made by Dr. E. S. Riggs of the Field Museum, Chicago, in a singularly short space of time for such a striking result, so amazing was the abundance of the petrified material about the Cerro Cuadrado, with scattered occurrence westerly and as later found to the northward.

Mr. Wieland was asked by Field Museum to make an at least preliminary study of the Riggs collection because years before its discovery, following his field work and publication on the Mexican Jurassic cycads and with something of a gage to the future, he had made on his own instance a fairly extended reconnaissance about the Piedra Pintada of Neuquén, and through the long series of Mesozoic-Tertiary rocks (both sedimentary and eruptive and carrying much petrified conifer wood) as especially well seen along the Picun Leufu and the valley of the Collon Cura in behind the Patagonia plateau. Thence he had crossed the Andine range in the lake region, widely seeing the Araucarian forests of the Bio Bio valley and the Cordillera de Penhué. The resultant notes are of significant interest in any more extended views of North American forestation. Also, Wieland plainly regards his study as an integral part of his older theme — the origin of floral types *per se*. But with a care that is exemplary he reaches no defined conclusion as to the actual forest canopy which, as he sets the case, must in Paleozoic times have given rise to the conifers and dicots. Though admitting his own conviction that the conifers are fundamentally inflorescent, with the "seed ferns" separately antecedent to both conifer and dicot, he is evidently much taken aback by the open insistence of Hagerup and Hirmer on Lepidophytes as sequent elements in the greater long upward course. The broad comparison drawn from the inflorescent habitus of the conifers and Cordaites as set over against the free-flowering Cycadeoids of the genus *Monanthesia*, with certain likenesses between the fruiting of the latter and *Ginkgo*, fixes attention. While the subjects dis-

cussed are in the present stage of knowledge of the fossil record difficult, there is in the text little of noticeable error, and the illustrations are excellent, those of the Araucarian forests striking. By mishap illustration from New Zealand was lost in the wreck of the "Tahiti."

**Polynesian botanical bibliography, 1773-1935.** By E. D. MERRILL. Bull. 144, Bishop Museum, Honolulu, 1937. Pp. 194; 7 x 10.

"In 1924 I published a bibliography of Polynesian botany (Bishop Mus. Bull. 13: 1-68). . . . It listed approximately 1300 titles as contrasted to about 2600 in the present work. . . . The basis of the present work is the original publication of 1924, with additions from various sources. Many of the additions are papers published between 1923 and 1935, but a considerable number have been added from an actual examination of the older literature. . . . An attempt has been made to examine each paper admitted to this bibliography. . . . An innovation is a brief abstract indicating the general scope of the papers. . . . The region covered is . . . the islands of the Pacific basin lying between 30° north latitude and 30° south latitude, excluding the Bonin Islands."

**The genus *Gouldia* (Rubiaceae).** By F. RAYMOND FOSBERG. Bull. 147, Bernice P. Bishop Mus. (Honolulu). Pp. 82; 3 pls.; July 8, 1937.

*Gouldia* consists of three species of trees and shrubs confined to the Hawaiian Islands. These are treated in detail, nearly 100 varieties and forms of these species being described, besides a large number of hybrids.

**Notes on the Rubiaceae of tropical Asia.** By C. E. B. BREMEKAMP. *Blumea Suppl.* 1: 112-122; June 29, 1937.

*Rutidea mollis* Bl. ex DC. of Penang is a synonym of *Pavetta naucleiflora* R. Br. *Cbasalia sangiana* Miq. of the island of Sangian is a synonym of *Pavetta sylvatica* Bl. The genus *Aphaenandra* Miq. of the Mussaendeae consists of two species, *A. uniflora* (Wall.) Brem. and *A. parva* (Wall.) Brem. of the East Indies, which have been referred variously to *Mussaenda* and *Acranthera*.

**Timber tests: Keruing mempelas (*Dipterocarpus crinitus*) and keruing sol (*D. Lowii*).** By A. V. THOMAS. *The Malayan Forester* 6: 3: 217-222; July 1937.

"It is clear from this report that the timber of *D. crinitus* is appreciably different in quality from that of *D. Lowii*, *D. cornutus*, and *D. Baudii*, and probably of the other more commonly utilized species, as it has better mechanical properties, is more durable, and is more difficult to impregnate with preservatives. While all Keruings are undoubtedly suitable for heavy constructional work, when not used in tropical climates, in exposed positions, or in contact with the ground, the timber of *D. crinitus* would be best adapted for this purpose on account of its extra strength and durability. On the other hand, this timber, not being so easy to work, is less suitable for flooring, internal fittings, carriage and wagon construction, etc., than the lighter, more easily worked species, though care should be taken to avoid timber with too much resin. All forms of Keruing, if properly impregnated with preservatives, will probably give very good service as railway sleepers, and results to date of service tests in the main lines are very encouraging."

**Abnormal tissue in kempas timber, and its diagnosis in the log.** By D. H. HODGSON. *The Malayan Forester* 6: 3: 223-224; 2 pls. July 1937.

"The increasing use of Kempas (*Koompassia malaccensis*) timber has drawn attention to a defect that seems to be characteristic of this species, namely the occurrence in the wood of layers of abnormal tissue, which has been identified by Dr. L. Chalk, of the Imperial Forestry Institute, as including phloem. These layers vary considerably in extent, may occur anywhere in the log and, as the tissue crumbles out when the timber is cut up and seasoned, are potentially a bad defect, the seriousness of which depends not only on their extent, but also on whether they occur deep in the heartwood or merely near the surface of the log in the sapwood. It is therefore important to be able to detect the presence or otherwise of this defect before the log is converted.

"This, fortunately, is fairly easy. . . . As a result of our

inspection we came to the following conclusions: (a) A log with a smooth surface is almost certainly clear of the defect. (b) The occurrence of swellings or ridges with sharply defined borders on the surface of the log indicates the presence of layers of phloem near the surface—most probably not deeper than the sapwood. (c) Less sharply defined swellings (giving the log a lumpy appearance) indicate that the defect lies deeper in the heartwood."

**Native trees of Australia.** By JAMES WALES AUDAS. Pp. 296; 6 x 9; 113 plates (6 in color); many text figs. Melbourne: Whitcombe & Tombs, Ltd.; 1937.

"The object of this book is to supply the general public, in a popular yet comprehensive manner, with a condensed description of the principal trees constituting the Australian forest. . . . Information regarding the habitat, size, form, color, and utility of the leaves, flowers, and fruit, bark and timber, of the principal species is given." The book is profusely and beautifully illustrated. The explanations of specific names will be welcomed by many to whom such terms as "holopetalous," "monostylis," "actinophylla," "trichosiphon," etc., appear strange and unfamiliar, but the omission of any reference to the families to which the trees belong detracts somewhat from the value of the work to scientific workers. — M. M. CHATTAWAY.

**A guide to the seasoning of Australian timber. Part 2.** By W. L. GREENHILL and A. J. THOMAS. Pamphlet 68, Council for Sci. & Ind. Research, Melbourne, 1937. Pp. 41; 6 x 9½.

"The work of determining suitable kiln schedules for various species and sizes of timbers is being carried out in small laboratory kilns and, in addition, much useful information is being obtained from the commercial kiln installed and operated by the Queensland Forest Service. Based on the results of work carried out since the publication of Part 1 of this series [Pamphlet 40, 1933], seasoning notes and suggested schedules for 22 additional species are given in the present pamphlet and further information is included on four species previously mentioned." — *Author's summary.*

**Natural succession in the pencil cedar forest of Kenya Colony.** By S. H. WIMBUSH. *Empire Forestry Journal* 16: 1: 49-53; 3 pls.; 1937.

"The natural succession to the climax type of evergreen high forest of broadleaved trees in the highlands of Kenya has in some places been diverted in past time by fire to a sub-climax of pure African Pencil Cedar (*Juniperus procera*) or a mixture of Cedar with broadleaved trees. The vegetational succession from a burnt forest area to this sub-climax, and thence to the true climax type, can be studied in the Kinangop forest on the western slopes of the Aberdare Range. Here protection of the forest from fire in the past twenty years has prevented further regeneration of Cedar in forest, but has encouraged its colonization of grassland round the forest edge. This process is extremely slow and continuity in the restocking of the forest with Cedar is being ensured by planting."

**The occurrence of compression wood in African pencil cedar.**

By E. W. J. PHILLIPS. *Empire Forestry Journal* 16: 1: 54-57; 1 text-fig.; 1937.

An investigation of warp in African Pencil Cedar (*Juniperus procera*) shows that it is due to tissue similar in many respects to the compression wood (Rotholz) of light-colored softwoods. Since compression wood does not appear to be related to the flutings common in this species, and may be developed even in regular logs, the author considers that there is, at present, little justification for assuming that eccentric growth necessarily indicates the presence of compression wood on the better developed side; further that rejection of wood from eccentric logs may involve waste of much good quality material. Warping of the timber during drying remains the first indication of the presence of compression wood, and microscopic examination is the only means of definite confirmation.—M. M. CHATTAWAY.

**Zwei neue Arten aus Liberia.** By M. DINKLAGE. *Repert. Sp. Nov.* (Berlin-Dahlem) 42: 157-159; June 30, 1937.

*Macrolobium Ernae* and *Cantium libericum* are described as new from Liberia.

**The forests of West Africa and the Sahara. A study of modern conditions.** By E. P. STEBBING. W. & R. Chambers, Ltd., London and Edinburgh. Pp. 245; 5½ x 8¼; ill. with maps, diags., and 95 photos. Price 15 s. 6 d. (postpaid).

"This book is the outcome of a tour made during 1934 through some of the British and French Colonies in West Africa. A month was spent with the French in the Ivory Coast, where a study of the administrative methods and the silvicultural and other operations being undertaken proved of high interest. Whilst no criticism is made or intended, an attempt has been made to contrast some of the British and French practices, especially in the more professional sides of forestry work.

"Some study was carried out, in both British and French parts of the country, of the savannah or bush forest and its utilization by the farmer and stock owner, and the results of such usage on the water supplies and desiccation. The question of the Sahara, its southward movement and the bearing on desiccation, is considered, since this matter would appear of increasing importance to the West African region."

**The development of more intensive use of mixed tropical forest.** By J. N. OLIPHANT. *Empire Forestry Journal* 16: 1: 29-39; 3 plates; 1937.

This paper describes the means by which mixed tropical forests can be more extensively used for the local market by the introduction of sawmills and wood-working machinery of a simple type, by technical instruction in the use of such machinery, and by the local utilization of low-grade material which is left untouched by selective exploitation.—M. M. CHATTAWAY.

**The phylogenetic value of certain anatomical features of dicotyledonous woods.** By L. CHALK. *Annals of Botany* (n.s.) 1: 3: 409-428; 1 text fig. July 1937.

"Out of a total of 1272 genera of Dicotyledons studied, 11 per cent had scalariform perforation plates, 27 per cent fibre-tracheids, 55 per cent libriform wood fibres, 18 per cent septate fibres, and 18 per cent storied structure.

"The proportion of genera with fibre-tracheids is high in the group of woods with scalariform perforation plates and low in the group with storied structure. Septate fibres are relatively more common in association with scalariform perforation plates than with storied structure.

"Two main types of parenchyma (other than terminal) are distinguished: (1) associated with the vessels (paratracheal), and (2) independent of the vessels (for which the term 'apotracheal' is suggested). The former is relatively more common in woods with fibre-tracheids and scalariform perforation plates. It is suggested that these types represent separate series of development, but that both tend towards the same ultimate form in highly specialized woods.

"The proportion of woods with scalariform perforation plates appears to be higher among the recorded fossil Dicotyledons than among modern genera.

"The parallelism between wood anatomy and taxonomy tends to disappear in the taxonomic groups larger than the family. Evidence of the degree of specialization in the wood is used to compare the sequences adopted in three taxonomic systems—those of Bentham and Hooker, Engler, and Hutchinson. Hutchinson's arrangement of the Archichlamydeae agrees more closely with the evidence obtainable from wood anatomy than that of Engler. The Monochlamydeae of Bentham and Hooker appears to be slightly less highly specialized than the Polypetalae, but neither group differs very markedly from the average for all the Dicotyledons examined. The Metachlamydeae (Sympetalae) includes a mixture of specialized and unspecialized woods, but these can be separated by means of the type of parenchyma present. The woods of Engler's Primulales, Plumbaginales, Contortae (part), Tubiflorae, and Campanulatae have paratracheal parenchyma and constitute a very highly specialized group.

"A list is given of the families arranged in groups according to the degree of specialization of their woods; the type of parenchyma present is also indicated."—*Author's summary*.

**On the primary groups of dicotyledons.** By J. BURTT DAVY.  
*Annals of Botany* (n.s.) 1: 3: 429-437; July 1937.

"The need for a system of classification in which the series of dicotyledonous orders is collected into groups of orders has led the writer to propose a revised system of classification. This has been in process of construction during a period of several years. The researches of Dr. Chalk on the wood anatomy of a large number of genera, scattered through many families ranging over the whole series of the Dicotyledons, have supported much of the rearrangement based on floral morphology. The method of trial and error has been adopted, with various groupings, to determine which characters indicated the greatest advance, and which of them could be used effectively. The position of a group has been determined by the presence in it of one or more members having the relatively least advanced character occurring in the group, irrespective of the presence of other members which have lost that character while retaining other features characteristic of the group. On this basis the sequence shows uniformly progressive development of the 28 cohorts of Dicotyledons."—*From author's summary*.

**A note upon the depletion of starch from timber immersed in water.** By E. A. PARKIN. *Empire Forestry Journal* 16: 1: 27-28; 1937.

The results of this preliminary experiment indicate the possibility of rendering timber immune from powder-post beetle infestation by immersion of the newly-felled logs in water for a few months. The method should be especially applicable in tropical and sub-tropical countries where the water temperature is relatively high.

**The growth and structure of wood.** By B. J. RENDLE.  
*Forest Products Research Records* No. 21. H. M. Stationery Office, London, Aug. 30, 1937. Pp. 24; 6 x 9½; 1 pl., 8 text figs. Price 7 d. postpaid.

"Members of the timber-using trades and professions sometimes find themselves unable to make full use of technical information through lack of familiarity with the fundamental properties of wood and with the technical terms employed in describing them. The main object of this publication is to

overcome that difficulty by providing an introduction to technical literature on timber. It is believed that this purpose can best be achieved by defining the principal terms that will be met with in publications of the Forest Products Research Laboratory, and by indicating how the structure of wood and its physical and chemical composition determine the properties and uses of timber."

**Overseas plant products.** By J. H. HOLLAND. John Bale, Sons & Curnow, Ltd., Oxford House, London. August 1937. Pp. 279; 4¾ x 7¼. Price 6 s. net.

The material for this highly useful book was compiled for the author's own use during the many years he was on the staff of the Museums Department at the Royal Botanic Gardens, Kew, and prepared for publication after his retirement. In his prefatory remarks, he says:

"The overseas plant products here enumerated comprise all the natural products of vegetable origin imported on a commercial scale into the docks under the control of the Port of London Authority and into other ports for the landing and delivery to the consignees in the markets of the United Kingdom. Others of economic value in the countries of production, including many that have been sent to Kew from time to time for identification, are also included.

"The trade and vernacular names are correlated with the botanical (specific and family) names and the trade sources or countries of production, and some indication is given as to uses. . . . The arrangement is alphabetical, the more important trade names being in capitals and those of minor or local importance in ordinary type; hence no list of contents is required. The book, however, includes under each of the general headings of the main commercial commodities an enumeration of the particular products dealt with. . . . It will be realized, in view of the wide scope of the book, how impossible it would be to give full details within the space available. Reference to the works mentioned in the bibliography will indicate where to obtain further information on the products recorded."