F. F. Chattaway

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TROPICAL WOODS

NUMBER 85 March 1, 1946

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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NOTE ON STARCH GRAINS IN SEPTATE FIBER-TRACHEIDS

By E. S. HARRAR

School of Forestry, Duke University

Incident to the preparation of permanent mounts of several semi-tropical Floridian timbers, great masses of starch were observed wholly occluding the lumina of septate fiber-tracheids in the wood of *Bursera simaruba* (L) Sarg. (Fig. 1).

Deposition of starch in prosenchymatous tissue has received but cursory mention in the literature. Solereder[1] has

[1]Solereder, Hans–Systematic Anatomy of the Dicotyledons. Translated from the German by Boodle L. A. and F. E. Fritsch, 2 vols., Clarendon Press, Oxford, 1908.

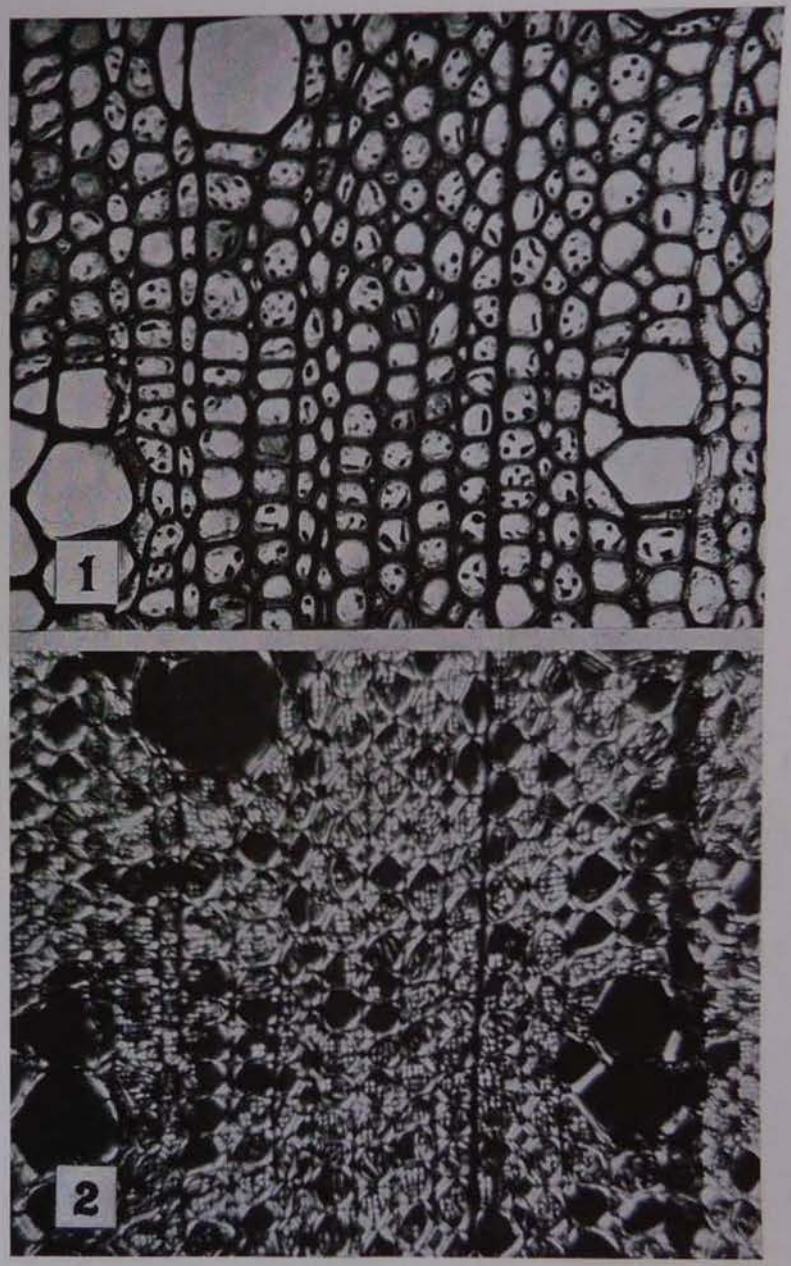
recorded the presence of this substance in septate fiber-tracheids of species from the Araliaceae, Leguminosae, and Sapindaceae; he has also reported the occasional presence of such material in fiber-tracheids from members of the Aceraceae. Record and Hess[2] have verified Solereder's observations and have added the Lythraceae to the list of families having species with starch-bearing septate elements.

The nature of these grains and the extent to which they may occur in prosenchymatous tissue was made the subject of investigation. Through the courtesy of the late Dr. S. J. Record, the Yale University collection of several thousands of permanent slides and wood specimens was made available to the writer. These materials were augmented by many hundreds of additional mounts and authentic wood samples of the Duke University collection. In all, examination was made of 2253 species of wood with septate fiber-tracheids included in 620 genera and representing 78 botanical families.

The usual IKI test for starch was used on all unmounted material examined. Stained and mounted sections, however, presented another problem. To determine the presence of starch in material of this sort, use was made of a petrographic microscope. Under crossed nicols the grains were readily detected by the appearance of a cruciform interference figure similar to that of the basal interference figure of a uniaxial mineral in convergent polarized light (Fig. 2).

Starch grains noted in various species from totally unrelated groups appear to be similar in form and character. For the most part they are so orientated in the cells that their longest axis nearly parallels the longitudinal axis of the cells in which they are deposited. In transverse sections of tissue, grains in the cell cavities simulate disk-like bodies and exhibit neither hilium nor rings. In longitudinal sections, however, the grains have the appearance of reniform to lenticular or broadly ellipsoidal particles usually with a medial, longitudinally disposed groove or cleft. The vast majority fall within the limits of from 3 to 8 microns in diameter and from 12 to 28 microns in length.

[2]Record, S. J. and R. W. Hess–Timbers of the New World, Yale University Press, New Haven, 1943.



EXPLANITION OF FIGURES

Fig. 1 Transverse section of wood from *Bursera simaruba* showing included starch grains X 125.

Fig. 2 Same section under crossed nicols. Note interference figures

Several longitudinal sections of fresh material of *Bursera simaruba* were placed in a Syracuse watch glass and subjected to the action of the enzyme diastase. Under the microscope a slight swelling of the grains was perceptible; soon they pitted and within a few hours were completely digested. After vigorous agitation the sections were removed and a few drops of Benedict's solution was added to the remaining fluid. Upon gently heating this mixture a light reddish-brown precipitate of cuprous oxide appeared, indicating the presence of a reducing sugar.

Vestal and Vestal[3] have observed the formation of septa in fiber-tracheids of *Hypericum androsaemum* L. They noted, that unlike other lignified elements in wood, the protoplasts of these cells remained functionally active for a considerable period of time after their maturation. It is reasonable to assume that a similar situation may exist for many other species with similar fibrous elements, although an attempt to discern residual cytoplasmic material in the septate fiber-tracheids of *Bursera simaruba* was unsuccessful. This may have been due in part to faulty fixing technique and in part to the presence of the starch itself which obscured other cellular contents.

It might be concluded from observation of starch in these elements that they function in a manner similar to longitudinal parenchyma, at least as long as they are a part of the sapwood. On the other hand, the presence of large quantities of starch in the heartwood of certain species suggests that these cells may serve merely as a reservoir for excessive elaborated food. Since physiological considerations were not a part of this study conclusions of this sort cannot be drawn at this time. One additional noteworthy observation should be mentioned at this point. Starch grains were observed only in those woods where longitudinal parenchyma was exceedingly sparse or wanting; again suggesting that in the absence of normal storage tissue septate fiber-

[3]Vestal, P. A. and M. R. Vestal—The Formation of Septa in the Fiber-tracheids of *Hypericum Androsaemum* L., Botanical Museum Leaflet, Harvard University 8, p. 169-188, 1940.

tracheids may and probably do serve in parenchymatous capacities.

Wood from representative species of the genera in the following lists were examined. Generic names preceded by an asterisk (*) are those in which starch grains were observed in one or more species. Those preceded by a dagger (†) included one or more species in which crystals were commonly present in the septate fiber-tracheids of heartwood material. Since sapwood was not available in the majority of samples examined, it is likely that the number of genera with included starch grains would have been larger if it had been possible to examine such material in each instance. Finally, had all materials examined been collected during the dormant season it is again reasonable to assume that several additional genera would have been added to this list.

Genera With Septate Fiber-Tracheids

ACANTHACEAE
*Anisacanthus
Aphelandra
Barleria
Beloperone
Bravaisia
Eranthemum
Graptophyllum
Himantochilus
Isoglossa
Lepidagathis
Mendoncia
Pachystachys
Pseuderanthemum
Ruellia
*Sanchezia
Strobilanthes
Trichanthera
Whitfieldia

ANACARDIACEAE
Anacardium
Antrocaryon
*Astronium
Buchanania
Campnosperma
Comocladia
Dracontomelum
Gluta
Koordersiodendron
Lithraea
Loxopterygium
Loxostylis
Mangifera
Mauria
Melanorrhoea
Metopium
Microstemon
Odina
Pentaspadon
Pistacia
Pleiogynium
Protorhus
Pseudospondias
Rhodosphaera
Rhus
Schinus
Schinopsis
Sclerocarya
Sorindeia
Spondianthus
Spondias
Tapirira
Toxicodendron

APOCYNACEAE
Conopharygnia
Ervatamia
*Odontadenia
Peschiera
Rejoua
Rhabdadenia
Stemmadenia
Stenosolon
Tabernaemontana
Voacanga

ARALIACEAE
Aralia
Aralidium
Arthrophyllum
Boerlagiodendron
Brassaia
Cussonia
†Dendropanax
†Didymopanax
Gamblea
Harmsiopanax

Hedera
Heteropanax
Macropanax
Meryta
Oreopanax
Pentapanax
Pseudopanax
Pterotropia
Sciadophyllum
Trevesia

AVICENNIACEAE
Avicennia

BIGNONIACEAE
Adenocalymma
Anemopaegma
Cybistax
Doxantha
Macrocatalpa
Macrodiscus
Martinella
Melloa
Memora
Petastoma
Pithecoctenium
Tecomaria

BIXACEAE
Bixa
Scottellia

BOMBACACEAE
Bombax
Bombacopsis
Pachira

BRUNELLIACEAE
Brunellia

BURSERACEAE
Aucoumea
Balsamodendron
Boswellia
*Bursera
Canariellum
Canarium
Commiphora
Crepidospermum
Dacryodes
Elaphrium
Garuga
Pachylobus
Protium
Santiria
Tetragastris
Trattinickia
Trigonochlamys

CACTACEAE
Harrisia
Lemaireocereus
Leptocereus
Nopalea
Opuntia
Pereskia

CAMPANULACEAE
Apetahia
Cyanea
Delissea
Lobelia
Rollandia
Scerotheca
Siphocampylus

CAPPARIDACEAE
Morisonia

CARYOCARACEAE
Caryocar

CELASTRACEAE
Cassine
Catha
Elaeodendron
Euonymus
Fraunhofera
Maytenus
Microtropis
Neopringlea
Perrottetia
Siphonodon

CHLORANTHACEAE
Chloranthus

COMBRETACEAE
Anogeissus
Calycopteris
Combretum
Conocarpus
Guiera
Quisqualis
Terminalia

COMPOSITAE
Eupatorium
Vernonia

CONNARACEAE
Byrsocarpus
Cnestis
Cnestidium
Connarus
Manotes
Rourea

CORNACEAE
Marlea

CUNONIACEAE
Belangera

ELAEOCARPACEAE
Aristotelia
Crinodendron
Dicraspidia
Echinocarpus
Elaeocarpus
Sloanea

ERICACEAE
Agapetes
Andromeda
Arbutus
Cavendishia
Comarostaphylos
Englerodoxa
Gaultheria
Macleania
Paphia
Vaccinium

EUPHORBIACEAE
Acalypha
Andrachne
Antidesma
Aporosa
Bischofia
Blumeodendron
Bridelia
Cleistanthus
Discocarpus
†Glochidion
Hyeronima
Hymenocardia

Phyllanthus
Ryparosa

FAGACEAE
Nothofagus

FLACOURTIACEAE
Abatia
Aberia
Ahernia
Asteriastigma
Azara
†Banara
Carpotroche
*Casearia
Dasylepis
Erythrospermum
Flacourtia
Gossypiospermum
Gynocardia
Hasseltia
Hecatostemon
Homalium
Idesia
Kiggelaria
Laetia
Lunania
Oncoba
Ophiobotrys
Osmelia
Pangium
Prockia
*Ryania
Samyda
Scolopia
Taraktogenos
Trichadenia
Xylosma
Zuelania

GESNERIACEAE
Alloplectus
Bellonia
Besleria
Cyrtandra
Drymonia
Gesneria
Pentarhaphia
Rhabdothamnus
Rhytidophyllum
Solenophora

GROSSULARIACEAE
Ribes

GUTTIFERAE
Calophyllum
Chrysochlamys
Clusia
Havetiopsis
Mahurea
Marila
Tovomitopsis

HERNANDIACEAE
Gyrocarpus
Hernandia

HIPPOCRATEACEASE
Cheiloclinium
Salacia

HYPERICACEAE
Hypericum

JULIANIACEAE
Amphipterygium
Juliania
Orthopterygium

LABIATAE
Coleus
Gomphostemma
Hyptis
Lavandula
Leucosceptrum
Phyllostegia
Pogostemon
Prasium

LAURACEAE
Acrodiclidium
Actinodaphne
Aiouea (Ajovea)
Alseodaphne
Aniba
Aydendron
Beilschmeidia
Cinnamomum
Cryptocarya
Dehaasia
Dicypellium
Endlicheria
Laurus
Lindera
Litsea
Machilus
Mespilodaphne
Misanteca
Nectandra
Nothaphoebe
Ocotea
Oreodaphne
Persea
Phoebe
Pleurothyrium
Sassafras
Sassafridium
Tetranthera
Tylostemon
Umbellularia

LEGUMINOSAE
Acacia
Acrocarpus
Afrormosia
Afzelia
Albizzia
Andira
Batesia
Bauhinia
Brasilettia
Brownea
Butea
Caesalpinia
Calpocalyx
Cassia
Ceratonia
Desmanthus
Enterolobium
Hymenaea
Inga
Leucaena
Mimosa
Neptunia
Ougeinia
Parkinsonia
Peltophorum
Pentaclethra

Piptadenia
Pithecolobium
Plathymenia
Platymiscium
Poeppigia
Prosopis
Robinia
Sabinea
Schrankia
Schizolobium
Sophora
Tipuana
Trachylobium
Xylia

LINACEAE
Reinwardtia
Sarcotheca

LOGANIACEAE
Fagraea
Geniostoma
Labordia
Nicodemia
Nuxia
Peltanthera

LYTHRACEAE
Crypteronia
Lafoensia
Lagerstroemia
Olinia
Punica

MAGNOLIACEAE
Manglietia

MALPIGHIACEAE
†Banisteria
†Banisteriopsis
Byrsonima
Glandonia
Hiraea
Lophanthera
Spachea

MALVACEAE
Adansonia

MARCGRAVIACEAE
Marcgravia
Norantea
Souroubea

MELASTOMACEAE
Astronia
Bellucia
Blakea
Centronia
Conostegia
Henriettea
Henriettella
Heterotrichum
Huberia
Leandra
Mecranium
Medinilla
Melastoma
Meriania
Miconia
Osbeckia
Ossaea
Pachyanthus
Rhynchanthera
Sonerila
Tetrazygia
Tibouchina
Tococa

MELIACEAE
Aglaia
Amoora
Cabralea
Carapa
Cedrela
Chickrassia
Chisocheton
Dysoxylon
Entandrophragma
Epicharis
Guarea
Heynea
Khaya
Lansium
Pseudocedrela
Soymida
Swietenia
Synoum
Vavaea
Xylocarpus

MONIMIACEAE
Bracteanthus
Daphnandra
Doryphora
Hedycarya
Laurelia
Kibara
Matthaea
Mollinedia
Peumus
Tambourissa
Trimenia

MORACEAE
Antiaris
Artocarpus
Castilloa
Ficus
Mesogyne
Noyera
Ogcodeia
Olmedia
Perebea
Prainea
Pseudolmedia
Sparattosyce

MYRISTICACEAE
Cephalosphaera
Coelocaryon
Compsoneura
Gymnacranthera
Iryanthera
Knema
Myristica
Osteophloeum
Scyphocephalium
Staudtia
Virola

MYRSINACEAE
Ardisia
Clavija
Conomorpha
Cybianthus
Discocalyx
Grammadenia
Maesa
Myrsine
Parathesis
Rapanea
Stylogyne

Suttonia
Wallenia

MYRTACEAE
Eugenia
Psidium

NEUMANNIACEAE
Neumannia

OCHNACEAE
Cespedesia

OLACACEAE
Octoknema

OLEACEAE
Olea
Notelaea
Schrebera

ONAGRACEAE
Fuchsia
Jussiaea

OXALIDACEAE
Averrhoa
Connaropsis

PAPAVERACEAE
Dendromecon

PASSIFLORACEAE
Acharia
Ceratiosicyos
Gynopleura

PHYTOLACCACEAE
Rivina

PIPERACEAE
Piper

PITTOSPORACEAE
Citriobatus
Pittosporum

POLYGONACEAE
Calligonum
†Coccoloba
Gymnopodium
Muehlenbeckia
Neomillspaughia
Podopterus
Ruprechtia
Symmeria
Triplaris

ROSACEAE
Holodiscus
Spiraea

RUBIACEAE
Alseis
Anisomeris
Bathysa
Bothriospora
Calycophyllum
Calycosia
Capirona
Carlemannia
Cephaelis
Chasalia
Chimarrhis
Cosmocalyx
Damnacanthus
Dialypetalanthus
Dolicholobium
Elaeagia
Eumachia
Faramea
Genipa
Gonzalea
Guettarda
Hamelia
Hamiltonia
Hippotis
Holtonia
Hypobathrum
Leptodermis
Macrocnemum
Mapouria
Neonauclea
Notopleura
Paederia
Palicourea
Pavetta
Pentagonia
Picardaea
Pogonopus
Psychotria
Rudgea
*Sickingia
Sommera
Straussia
Urophyllum
Warscewiczia

RUTACEAE
Chalcas
Erythrochiton
Raputia

SABIACEAE
Meliosma

SAPINDACEAE
Akania
Allophylus
*Arytera
Blighia
†Castanospora
†Chytranthus
Cupania
†Cupaniopsis
Deinbollia
†Diatenopteryx
Eriocoelum
Erythrophysa
†Euphoria
†Exothea
Filicium
Jagera
Koelreuteria
Laccodiscus
Lecaniodiscus
Lepidopetalum
Matayba
†Mischocarpus
Nephelium
Paranephelium
Paullinia
Phialodiscus
Pometia
Ratonia
†Sarcopteryx
Schleichera
†Schmidelia
Talisia
Tapiscia
Thouinia
Tristiropsis
Ungnadia
Xerospermum

SAXIFRAGACEAE
Deutzia
Ribes

SCROPHULARIACEAE
Dermatocalyx
Halleria

SIMARUBACEAE
Alvaradoa
Guilfoylia
Kirkia
Picramnia

SOLANACEAE
Acnistus
Brachistus
Dunalia
Juanulloa
Lycianthes
Salpichroa

SONNERATIACEAE
Sonneratia

STAPHYLEACEAE
Huertea

TURNERACEAE
Wormskioldia

URTICACEAE
Boehmeria
Gyrotaenia
Laportea
Leucosyke
Myriocarpa
Pipturus
Urera
Villebrunea

VERBENACEAE
Aegiphila
Callicarpa
Campylostachys
Chloanthes
Citharexylum
Clerodendron
Congea
Cornutia
Duranta
Euthystachys
Gmelina
Holmskioldia
Lantana
Lippia
Petitia
Petrea
Premna
Rhaphithamnus
Stilbe
Symphorema
Tectona
Vitex

VIOLACEAE
Paypayrola
Rinorea
Viola

VITACEAE
Cissus
Leea
Tetrastigma
Vitis

VOCHYSIACEAE
Qualea

ZYGOPHYLLACEAE
Larrea
Porlieria

DISTRIBUTION OF PARANA PINE IN BRAZIL

During preparation of the manuscript for *Timbers of the New World* (see *Tropical Woods* 73: 42) the feasibility of including range maps for important species was frequently discussed. The value of such maps was evident but in almost every instance detailed information was incomplete. With the exception of United States and Canada, the boundaries for even the better known commercial woods had not been delimited. Not infrequently conflicting information was available.

We decided, however, that publishing of a few maps might serve two useful purposes. First, they would be of some help to those requiring only general distribution for reference. Second, and more important, printing of such maps

Distribution of Parana Pine in Brazil

might induce those who are familiar with certain areas to send in corrections for these trees and details regarding others. It is encouraging to note that some such information is being received.

Early last year Mr. E. D. Marshall, Chief of the Division of Forest Products Research, Texas Forest Service, Lufkin, Texas, sent in a sketch correcting the southern boundary for Parana Pine as shown on Map 2, page 4, *Timbers of the New World*. This sketch was prepared by Mr. Paulo Annes Gonsalves, Instituto Rio Grandense Do Arror, Porto Alegre, Rio Grande do Sul, Brasil, who was visiting the Texas Forest Products Research Laboratory at that time.

Later in the year we had the good fortune to receive a visit from Dr. José Aranha Pereira, Chefe da Secçao de Identificaçao e Preservaçao de Madeiras, Instituto de Pesquisas Tecnologicas, São Paulo, Brasil. He proved to be most well informed about the distribution of Parana Pine and sketched it on a map. A copy of this map is included here. Comparison of the southern portion with that sketched by Mr. Gonsalves showed close correlation between the two. The range as given is intended to show the areas in which appreciable stands of timber occur. Scattered individual trees may be found well outside of these boundaries.

KEYS TO AMERICAN WOODS (CONTINUED)[1]

By Robert W. Hess

Following are four additional keys, numbers seventeen through twenty, in the series begun in *Tropical Woods* No. 72, December 1, 1942. These keys are intended for use with Record and Hess' *Timbers of the New World* (see *Tropical Woods* 73: 42). Those published in previous issues are: I. Ring-porous woods; II. Pores in ulmiform or wavy tangential arrangement; III. Pores in flame-like or dendritic arrange-

[1]This series of keys was initiated and the previous keys written by the late Samuel J. Record. Most of the information in keys No. XVII-XIX was compiled and arranged by him.

ment–in No. 72. IV. Vessels virtually all solitary; V. Vessels with spiral thickenings–in No. 73. VI. Vessels with scalariform perforation plates; VII. Vessels with very fine pitting–in No. 74. VIII. Vessels with opposite or scalariform pitting; IX. Woods with conspicuous rays–in No. 75. X. Woods with storied structure–in No. 76. XI. Woods with resin or gum ducts; XII. Parenchyma reticulate–in No. 77. XIII. Woods with septate fibers–in No. 78. XIV. Dicotyledonous woods with xylem rays virtually all uniseriate–in No. 79. XV. Fibers with conspicuous bordered pits; XVI. Woods with oil (or similar) cells–in No. 80.

XVII. *Woods with vasicentric tracheids.* These elements are typically short, heavily pitted, tracheary elements in association with vessels. They are not infrequently irregular in shape and may also be flattened around the vessel member. Vasicentric tracheids are not arranged in vertical series. The pits are characteristically vascular, with distinct borders and commonly with included apertures. Only woods which have these elements in significant abundance are included. Most of these woods have pores in more or less distinct radial or diagonal arrangement, occasionally dendritic or flame-like.

XVIII. *Fibers with spiral thickenings.* Spiral thickenings of the secondary wall characterize the wood fibers of relatively few dicotyledonous woods. They are a good diagnostic feature when present and can usually be determined without difficulty (see *Tropical Woods* 3: 12-16).

XIX. *Special fibers in parenchyma-like arrangement.* In a few woods aggregates of fibers form patterns resembling those of wood parenchyma. Commonly they are arranged in more or less definite concentric bands; occasionally they are paratracheal. Usually the fibers are septate and are distinct on the cross-section because of poor aggregation, thinner walls, larger lumina, or differences in cell contents. They range from very distinct to indistinct and poorly demarcated. It is probable that additional woods will be found containing cells of this type.

XX. *Woods with unilaterally paratracheal parenchyma.* As used here this form of parenchyma arrangement applies

to caps, hoods, or lines or narrow bands in contact with one face of the pore. They are typically in contact with the outer face, rarely with the inner face. Those woods with very sparingly paratracheal parenchyma, limited to a few cells in contact with the vessel, are not included here. With few exceptions woods with unilaterally paratracheal parenchyma are hard and heavy, and have heterogeneous rays.

XVII. WOODS WITH VASICENTRIC TRACHEIDS

1 a. Pores (at least in late-wood) in flame-like or dendritic arrangement 2
b. Pores not in flame-like or dendritic arrangement although often in more or less definite radial or diagonal arrangement. 8

2 a. Pores virtually all solitary. Northern species ring-porous. (Fagaceae) 3
b. Pores often in contact, at least in late-wood..... 5

3 a. Rays in part large and conspicuous. *Lithocarpus*, *Quercus* (Fagaceae).
b. Rays all small..... 4

4 a. Late-wood pores in 2-several radial rows, flame-like. *Castanopsis* (Fagaceae).
b. Late-wood pores in single radial rows, dendritic. *Lithocarpus* (Fagaceae).

5 a. Distinctly ring-porous. Vessels without spirals. Fiber pits distinctly bordered .....*Castanea* (Fagaceae).
b. Diffuse-porous. Small vessels usually with spirals. Fiber pits simple or indistinctly bordered..... 6

6 a. Vessel-ray pitting fine.....*Henoonia* (Sapotaceae).
b. Vessel-ray pitting coarse..... 7

7 a. Parenchyma paratracheal and reticulate or in fine closely spaced concentric bands.....*Bumelia* (Sapotaceae).
b. Parenchyma in coarse-celled concentric bands 1-3 cells wide. *Paralabatia* (Sapotaceae).

8 a. Septate fibers in parenchyma-like arrangement..... 9
b. Septate fibers absent..... 11

9 a. Rays uniseriate. Vessel-ray pitting coarse and irregular. Connaraceae.
b. Rays 2-sized. Vessel-ray pitting fine..... 10

10 a. Pores small to minute; arranged in radial or diagonal chains. Structure normal. Ground mass composed of fibers with very small, simple or indistinctly bordered pits. *Alvaradoa* (Simarubaceae).
b. Pores in part medium-sized to large; irregularly arranged. Structure sometimes anomalous. Ground mass composed of fibers with distinctly bordered pits.....Hippocrateaceae.

11 a. Pores in part in multiples or clusters..... 12
b. Pores virtually all solitary..... 13

12 a. Vessel-ray pit-pairs distinctly 2-sized. Parenchyma finely reticulate .....*Chaunochiton* (Olacaceae).
b. Vessel-ray pit-pairs all small. Parenchyma confluent in bands few to 15 cells wide.....*Castela* (Simarubaceae).

13 a. Ripple marks present, uniform and exceptionally fine (over 200 per inch).....*Guaiacum* (Zygophyllaceae).
b. Ripple marks absent..... 14

14 a. Fiber pits distinctly bordered..... 15
b. Fiber pits indistinctly bordered..... 16

15 a. Parenchyma reticulate to loosely aggregated. Vascular pits vestured; vessel-ray pitting fine.....Myrtaceae
b. Parenchyma in concentric bands 2-4 cells wide. Vascular pits not vestured; vessel-ray pitting coarse, tending to scalariform .....*Cyrillopsis* (Cyrillaceae).

16 a. Parenchyma in apotracheal bands few to several cells wide. Pores in part medium-sized to large; arranged in radial series .....*Calophyllum* (Guttiferae).
b. Parenchyma apparently absent. Pores small; few and scattered .....*Anchietea* (Violaceae).

XVIII. FIBERS WITH SPIRAL THICKENINGS

1 a. Perforations simple 2
b. Perforations multiple 5

2 a. Rays 1-7 cells wide and up to 100 cells high; homogeneous. Pores medium-sized in part and widely spaced in uniseriate rows in early wood.....*Koeberlinia* (Koeberliniaceae).
b. Rays 1-3 (4) cells wide and up to 25 (50) cells high; more or less distinctly heterogeneous. Pores all small to minute, often gradually decreasing in size during a season's growth. 3

3 a. Largest rays two or more cells wide. Parenchyma diffuse to finely reticulate. Fibers with large bordered pits.....Rosaceae.
b. Rays all uniseriate. Parenchyma very sparingly paratracheal. 4

4 a. Rays with all cells square to tall upright. Fibers with thick walls and numerous small bordered pits....*Menodora* (Oleaceae).
b. Rays with most of the cells short procumbent; tall upright cells absent. Fibers with rather thin walls and large bordered pits .....*Evonymus* (Celastraceae).

5 a. More or less ring-porous..... 6
b. Diffuse-porous 7

6 a. Rays 1 or 2 cells wide and up to 15 cells high. Parenchyma diffuse .....*Fendlera* (Hydrangeaceae).
b. Largest rays up to 4 (5) cells wide and 70 (100) cells high. Parenchyma sparingly paratracheal. *Philadelphus* (Hydrangeaceae).

7 a. Pores in distinct radial arrangement.....*Ilex* (Aquifoliaceae).
b. Pores not in distinct radial arrangement..... 8

8 a. Perforation plates with many bars....*Symplocos* (Symplocaceae).
b. Perforation plates with few to 15 bars..... 9

9 a. Rays 1-3 (4) cells wide and up to 25 (40) cells high; uniseriates often tall; pits to vessels small. Parenchyma abundant, diffuse to reticulate. Fiber pits numerous. *Escallonia* (Escalloniaceae).
b. Rays 1-6 cells wide and up to 50 (100) cells high; uniseriates low; pits to vessels elongated in part. Parenchyma rather sparingly reticulate. Fiber pits exceedingly numerous. *Garrya* (Garryaceae).

XIX. SPECIAL FIBERS IN PARENCHYMA-LIKE ARRANGEMENT

1 a. Rays heterogeneous, usually decidedly so..... 2
b. Rays homogeneous or nearly so..... 9

2 a. Vasicentric tracheids present..... 3
b. Vasicentric tracheids absent..... 6

3 a. Rays uniseriate. Vessel-ray pitting coarse and irregular..... 4
b. Rays 2-sized. Vessel-ray pitting fine..... 5

4 a. Minute vessels and tracheids with spirals. Radial latex tubes and vertical gum cysts sometimes present. Parenchyma-like fibers terminal, vasicentric-confluent, or diffuse. Pores in part in multiples or clusters.....*Connarus* (Connaraceae).
b. Spirals, latex tubes, and gum cysts absent. Parenchyma-like fibers in bands. Pores nearly all solitary....*Rourea* (Connaraeae).

5 a. Pores small to minute; arranged in radial or diagonal chains. Structure normal. Ground mass composed of fibers with very small simple or indistinctly bordered pits. *Alvaradoa* (Simarubaceae).

b. Pores in part medium-sized to large; irregularly arranged. Structure sometimes anomalous (included phloem). Ground mass composed of fibers with distinctly bordered pits. Hippocrateaceae.

6 a. Parenchyma-like fibers diffuse in ground mass of thick-walled fibers. Vascular pits not vestured....*Marila* (Guttiferae).
b. Parenchyma-like fibers variously aggregated. Vascular pits vestured 7

7 a. Parenchyma-like fibers loosely aggregated into patches or irregular bands with large interstitial spaces. Intervascular pitting rather fine to coarse, often more or less scalariform. Melastomaceae.
b. Parenchyma-like fibers otherwise arranged. Intervascular pitting fine, alternate 8

8 a. Parenchyma-like fibers in numerous fine concentric bands. *Ginorea* (Lythraceae).
b. Parenchyma-like fibers vasicentric to aliform. *Lafoensia* (Lythraceae).

9 a. Ripple marks present; 80-90 per inch. Vascular pits vestured. *Poeppigia* (Leguminosae).
b. Ripple marks absent..... 10

10 a. Crystalliferous parenchyma strands numerous. Vascular pits not vestured. Parenchyma-like fibers in poorly defined bands. *Allophylus* (Sapindaceae).
b. Crystalliferous strands absent. Vascular pits vestured..... 11

11 a. Parenchyma-like fibers in rather sharply defined continuous or interrupted, regular to wavy bands. *Physocalymma* (Lythraceae).
b. Parenchyma-like fibers in poorly defined bands..... 12

12 a. Fibers all abundantly septate; those in bands finely chambered .....*Triplaris* (Polygonaceae).
b. Fibers rather sparingly septate, not finely chambered; those in bands thinner-walled and more loosely aggregated than others .....*Capparis* (Capparidaceae).

XX. WOODS WITH UNILATERALLY PARATRACHEAL PARENCHYMA

1 a. Ripple marks present. Rays homogenous..... 2
b. Ripple marks absent. Rays usually heterogenous, sometimes homogeneous 4

2 a. Rays 1-6 cells wide; up to 100 cells high. *Lemea* (Leguminosae).
b. Rays uniseriate; up to 10 or 15 cells high..... 3

3 a. Pores medium-sized to minute in the same growth ring; commonly irregularly distributed; with rather few or irregular multiples .....*Pterocarpus* (Leguminosae).
b. Pores very small to minute; uniformly distributed; with very numerous, uniform radial multiples. *Paramachaerium* (Leguminosae).

4 a. Vessel perforations exclusively or predominately simple..... 5
b. All or many vessels with multiple perforations..... 21

5 a. Vessels virtually all solitary (pores rarely in contact radially) 6
b. Vessels (pores) not all solitary..... 11

6 a. Large radial gum ducts present.....*Mammea* (Guttiferae).
b. Radial gum ducts absent..... 7

7 a. Vessel-ray pitting fine. Rays homogeneous or nearly so. *Aspidosperma* (Apocynaceae).
b. Vessel-ray pitting coarse, often scalariform. Rays heterogeneous, often decidely so..... 8

8 a. Parenchyma in short tangential lines in contact with inner faces of vessels. Rays 1-3 (5) cells wide.....*Bonnetia* (Theaceae).
b. Parenchyma in contact around outer faces of vessels, frequently with lateral extensions. Rays mostly 1 or 2 cells wide 9

9 a. Fibers with small simple or indistinctly bordered pits. Heartwood brownish red to orange-red; hard and heavy. *Haploclathera* (Guttiferae).
b. Fibers with distinctly bordered fiber pits..... 10

10 a. Pores medium-sized to large, distinct without lens. Rays 1 and 2 cells wide, mostly uniseriate. Heartwood grayish brown to reddish brown; medium density to rather heavy. *Caraipa* (Guttiferae).
b. Pores small, not visible without lens. Rays 1-3, mostly 1 and 2, cells wide. Heartwood grayish yellow; extremely hard and heavy.....*Hebepetalum* (Linaceae).

11 a. Vessel-ray pitting very fine to medium..... 12
b. Vessel-ray pitting very coarse, at least in part..... 13

12 a. Rays decidely heterogeneous. Intervascular pitting very fine. Heartwood dull yellowish olive. *Gonypetalum* (Dichapetalaceae).
b. Rays homogeneous. Intervascular pitting medium. Heartwood purple or purplish brown.....*Peltogyne* (Leguminosae).

13 a. Intervascular pitting scalariform or with numerous irregularly elongated pits..... 14
b. Intervascular pits rounded in outline, not elongated..... 15

14 a. Rays conspicuous; with very coarse cells; without palisade cells. Large radial channels commonly present.....Cactaceae.
b. Rays large but not conspicuous; cells not coarse; with numerous palisade cells. Radial ducts absent.
Tovomita (Guttiferae).

15 a. Oil cells present in either rays or parenchyma strands. Lauraceae. 16
b. Oil cells absent..... 20

16 a. Oil cells present in either rays or parenchyma strands but not both 17
b. Oil cells present in both rays and parenchyma strands.
Aniba, Licaria, Ocotea (Lauraceae).

17 a. Oil cells in parenchyma strands only..... 18
b. Oil cells in rays only..... 19

18 a. Rays homogeneous or nearly so; up to 30 (60) cells high.
Anaueria (Lauraceae).
b. Rays decidedly heterogeneous; up to 15 (30) cells high.
Beilschmiedia (Lauraceae).

19 a. Pores rather small; thick-walled. Heartwood with spicy scent and taste.....*Dicypellium* (Lauraceae).
b. Pores medium-sized; thin-walled. Heartwood mildly fragrant; taste not distinctive.....*Pleurothyrium* (Lauraceae).

20 a. Intervascular pitting very fine. Rays distinctly heterogeneous. Heartwood deep orange-red[1].....*Haploclathra* (Guttiferae).
b. Intervascular pitting rather coarse to coarse. Rays weakly heterogeneous or homogeneous. Heartwood olive to dark olive-brown .....*Ocotea* (Lauraceae).

21 a. Largest rays 7 or more cells wide. Fibers with conspicuous bordered pits 22
b. Largest rays 2 to 4 cells wide. Fibers with distinctly bordered but not conspicuous pitting..... 24

22 a. Vessel perforations simple in part. Vessel-ray pitting coarsely scalariform. Pores small.....*Satyria* (Ericaceae).
b. Vessel perforations multiple. Vessel-ray pitting medium, not scalariform. Pores medium-sized to large..... 23

23 a. Vessel perforation plates in part reticulate. Largest rays up to 10 cells wide; cells not sclerotic....*Dendrobangia* (Icacinaceae).
b. Vessel perforation plates all scalariform. Largest rays up to 15 cells wide; interior cells frequently sclerotic.
Emmotum (Icacinaceae).

[1]Pores not in actual contact but frequently appearing to form radial multiples.

24 a. Vessel perforations simple in part. Rays 1-4 cells wide.
Sterigmapetalum (Rhizophoraceae).
b. Vessel perforations multiple. Largest rays 2 or 3 cells wide. 25

25 a. Fiber pits small, with extended apertures. Pores angular, small to very small.....*Kalmia* (Ericaceae).
b. Fiber pits medium-sized to large; apertures included or only slightly extended. Pores rounded in outline, small to medium-sized 26

26 a. Rays heterogeneous but with few upright cells.
Canella, Pleodendron (Canellaceae).
b. Rays with many upright cells..... 27

27 a. Vessel-ray pitting coarse, often scalariform.
Vantanea (Humiriaceae).
b. Vessel-ray pitting fine to medium, not scalariform.
Canella, Pleodendron (Canellaceae).

THE YALE WOOD COLLECTIONS

Accessions

At the end of the calendar year 1945 the total number of cataloged wood samples in the Yale wood collection amounted to 42,621, representing 12,016 named species of 2,811 genera of 232 families. There were 1,340 accessions during the year, the largest single contribution being from the Chicago Natural History Museum (1,125 woods collected in Venezuela by Mr. Llewelyn Williams). The sources of all the wood samples received are as follows:

Brazil: Dr. J. A. Pereira, Instituto de Pesquisas Tecnologicas, São Paulo.

China: Prof. Liang Hsi, Forest Chemistry Laboratory, National Central University, Chungking.

Colombia: Dr. E. P. Killip, Smithsonian Institution, U. S. National Museum, Washington, D. C.

British Honduras: The Conservator of Forests, Belize.

Solomon Islands: Mr. A. R. Entrican, State Forest Service, Wellington, New Zealand.

Surinam: Dr. Gerold Stahel, Director of the Agricultural Experiment Station, Paramaribo; Dr. H. N. Moldenke, New York Botanical Garden.

U. S. A.: Dr. A. H. Graves, Brooklyn Botanic Garden; Mr. H. Nogle, Port Arthur, Texas; Mr. W. F. Opdyke, Cleveland Heights, Ohio.

Venezuela: The Chicago Natural History Museum.

Sections for Microscopic Study

During 1945 there were added to the slide collection cross, radial and tangential sections of 56 specimens, representing 21 named species, making a total of 20,319 slides of 11,542 specimens of 6,858 named species, 2,684 genera, and 220 families.

Specimens Distributed

There were distributed during the year 101 wood specimens, all for use in connection with specific scientific projects, including 5 samples (to Professor Buchholz) not reported for the year 1944.

To Prof. J. E. Adams, University of North Carolina, 65 samples: Alangiaceae (8), Cornaceae (45), Nyssaceae (12).

To Prof. John T. Buchholz, University of Illinois, 5 samples of *Podocarpus*.

To Dr. J. A. Pereira, Instituto de Pesquisas Tecnologicas, São Paulo, Brazil, 31 samples: Combretaceae (8), Leguminosae (22), Proteaceae (1).

CURRENT LITERATURE

Check list of the native and naturalized trees of the United States, including Alaska. Forest Service, U. S. Department of Agriculture, Washington, D. C., April 1944. Pp. 325; 8 x 10½. Mimeographed.

This publication is a complete revision of Sudworth's "Check List of the Forest Trees of the United States, their Names and Ranges" (U. S. Dept. Agri. Misc. Pub. 92. 1927) which has long been out of print. The revision follows the International Rules of Botanical Nomenclature and agrees fairly closely with "Standardized Plant Names," second ed., 1942. The revised check list covers 79 families, 255 genera, 1,015 species and 167 varieties. This represents an increase of one family, 27 genera, and 42 species over Sudworth's 1927 check list.

When all changes resulting from criticism have been made the check list will be printed to supersede the mimeographed edition.

Some comments on the new check list and other things nomenclatural. By Wm. M. Harlow. *Jour. For.* (Soc. Amer. For., Washington, D. C.) 43: 6: 403-406; June 1945.

Constructive criticism is offered for some of the names and naming policies used in the "Check List of Native and Naturalized Trees of the United States, including Alaska." Comments and suggestions are also given for rules of botanical nomenclature.

Guide to southern trees. By E. S. Harrar and J. G. Harrar. Whittlesey House, McGraw Hill Book Co., Inc. (New York, London), 1946. Pp. 712; 4½ x 7; 201 figs. (full-page drawings). Price $4.50.

"In this book, the authors describe the more than 350 arborescent species native to the southern states (that region of the United States lying south of the Mason and Dixon line). The initial portion of this book introduces the reader to tree nomenclature and classification, and reviews the important botanical features of leaves, flowers, fruit, twigs and bark which are commonly used in field identification. Following this is a section devoted to the coniferous trees of the region. A third section deals with the many southern broadleaved species. A short glossary and bibliography of selected references complete the text material. The descriptions of individual tree species are presented in a clear and concise manner with minimum use being made of technical terminology. Included are notes of unusual interest or historical significance pertaining to many of the trees described, together with information on usage and the valuable products derived from the leaves, flowers, fruits, wood or bark.

"While botanically accurate, the simple language of this

book, together with its many illustrations makes it especially valuable to amateur naturalists, nature leaders, teachers of natural science, and others who have a real interest in the forests of the South."–*From publisher's announcement.*

Cork oak in the Southeast. By HENRY HOPP. Soil Conservation Service Publ. SCS-TP-54 (U. S. Dept. Agri., Washington, D. C.), August 1944. Pp. 25; 8 x 10; 20 figs.

The results of a survey of Cork Oak (*Quercus suber* L.) plantations are given under several headings including history, climatic distribution, site, tree form, diseases and insects. From the study the probable climatic range was delimited as northern Florida and the south-eastern coastal states. Many earlier failures are ascribed to improper site selection. While it is known that the tree will thrive under proper growing conditions in south-eastern United States it is not known whether it is practicable to grow it as a crop.

A set of suggestions for the growing of Cork Oak on farms in the Southeast are included.

Journal of the Arnold Arboretum (Jamaica Plain, Mass.), 26: 1-4: 1-518; January, April, July, October 1945.

CONTENTS

Studies in the Sapotaceae, III. *Dipholis* and *Bumelia.* By ARTHUR CRONQUIST. *Journ. Arnold Arboretum* 26:4: 435-471; October 1945.

This paper presents a revision of the genera *Dipholis* and *Bumelia*. Fourteen species of *Dipholis* and 23 species of *Bumelia* are recognized.

Studies in the Sapotaceae, IV. The North American species of *Manilkara.* By ARTHUR CRONQUIST. *Bull. Torrey Bot. Club* 72: 6: 550-562; Nov. 1945.

This paper completes the revision of the North American Sapotaceae. The genus is reduced to thirteen species with the possibility that some of these may be submerged when more material becomes available.

"The names Nispero and Bullet-wood are applied more or less indiscriminately to most of the species. *M. zapotilla*, and its close relatives *M. staminodella* and *M. meridionalis*, are commonly known as Sapodilla, but this name, alone or in various combinations or variations, is often used for other species as well. *M. emarginata*, for example, is known in Florida and the Bahamas as Wild Dilly. *M. bidentata* is often called Balata, for its gum."

El genero *Nyssa* en Mexico. By F. MIRANDA. *An. Inst. Biol. Mex.* 15: 2: 369-373; 1 fig.; 1944.

The author announces discovery in the State of Puebla of the genus Nyssa, represented by the species *N. sylvatica*

Marsh. The range of the American species of this genus had not previously been reported to extend into Mexico.

Trees some 15 meters high have been found in the region of Huauchinango on the road to Xilocuautla (1,650 meters above sea level) in the company of oaks *(Quercus)*, Red Gum *(Liquidambar)*, and Palmillo *(Podocarpus)*. The tree was also found along a river in Necaxa. The common name for the tree (called Black Gum in the United States) in Huauchinango is "Tetzicohuitl."

Studies in the Lauraceae, VI. Preliminary survey of the Mexican and Central American species. By CAROLINE K. ALLEN. *Journ. Arnold Arboretum* 26: 3 and 4: 280-434; July and October 1945.

"The present paper was undertaken as groundwork for the presentation of the Lauraceae in the Flora of Panama, which is being published in fascicles by Dr. Robert E. Woodson, Jr., in the Annals of the Missouri Botanical Garden. Dr. A. J. G. H. Kostermans has published in detail on the smaller genera of Lauraceae of this hemisphere. Consequently the present treatment of these genera will not be as detailed as those on which he has not worked."

There is a key to the Mexican and Central American genera of Lauraceae. The genera *Persea*, *Phoebe*, *Ocotea*, *Nectandra*, *Litsea*, *Beilschmiedia*, *Aiouea*, *Aniba*, *Endlicheria*, *Cryptocarya*, *Licaria*, and *Cassytha* are dealt with.

New or critical Euphorbiaceae from the Americas. By L. CROIZAT. *Journ. Arnold Arboretum* 26: 2: 181-196; April 1945.

"This paper consists of the description of various new species and varieties, a new genus *Moacroton* from Cuba, and critical notes and records, reductions, and transfers."

Plantas medicinales aromáticas o venenosas de Cuba. By JUAN TOMAS ROIG Y MESA. Pub. by Ministerio de Agricultura, Havana, 1945. In 2 vols.; pp. 872; 6 x 9; 39 figs.

The main body of the text is composed of accounts of individual plants arranged in alphabetical order according to their Cuban common names. Each account gives the scientific name and its synonyms, other common names, habitat and distribution, botanical description, part of the plant used, the uses of the material, and a bibliography.

There are also lists of the plants according to various uses, a glossary of terms, and a bibliography of Cuban pharmacology. Indexes are included for the Cuban common names, other common names, and scientific names.

Forest conditions in Haiti and their relation to the national economy. By MORTON A. KLEIN. Pub. by Institute of Inter-American Affairs, Washington, D. C., October 1945. Pp. 25; 8 x 10½; 10 figs.

The various forest areas of Haiti are described and their probable condition summarized. The general land use of the country and the problems of a forestry program are considered. Recommendations for a planned conservation policy are outlined.

Caldasia. Boletín del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia, Bogotá. Vol. III: 14: 345-418; September 1945.

CONTENTS (botanical)

Especies nuevas o notables de género *Inga* en Colombia (pp. 345-356; 2 plates), by LORENZO URIBE-URIBE.

Noticias botánicas columbianas, V (pp. 357-361; 1 fig.), by ARMANDO DUGAND.

Problemas forestales de Colombia. Pub. by Editorial Kelly, Ltda., Bogotá, 1945. Pp. 117; 6¾ x 9¾.

A collection of papers given at the First Forestry Congress of Colombia, dealing with all phases of forestry. Land use, protection, flood control, exploitation, reforestation, etc., are discussed.

Colombian *Cinchona* manual. Edition 2. By F. R. FOSBERG. Pub. by the Foreign Economic Admin., Bogotá, Colombia, 1944. Pp. 33; 9 x 11; 5 figs.

The text of the first edition has been expanded on the basis of new information. The species of *Cinchona*, *Ladenbergia*, and *Remijia* whose bark contain alkaloids are described and keys to the floral characters and the barks included. Methods of harvesting the bark are given. The distribution of the species in the various regions of Colombia are described.

A Monograph of the genus *Protium* and some allied genera (Burseraceae). By J. J. SWART. *Mededeelingen van het Botanisch Museum en Herbarium van de Rijksuniversiteit te Utrecht.* (Extrait du *Recueil des Travaux botaniques néerlandais*, Vol. 39, 1942) 90: 212-446; 8 figs.; 1942.

A general description of the family, its history, geographical distribution, the literature are dealt with. The genera treated are *Protium*, *Hemicrepidospermum*, *Crepidospermum*, *Tetragastris*, and *Trattinickia*. Indexes of vernacular and scientific names are given.

Surinam timbers. By GEROLD STAHEL. Publ. by Agricultural Experiment Station, Paramaribo, Surinam, (?) 1945. Pp. 39; 4½ x 5¾.

"This booklet was compiled on request of some Surinam sawmill owners and timber exporters. It contains short descriptions of 34 of the better known native timbers and information about their use."

Métodos de ensaios adotados no I. P. T. para o estudos das madeiras nationais (2.a Edição).

Resultados obtidos para madeiras nacionais. By FREDERICO ABRANCHES BROTERO. Instituto de Pesquisas Technológicas (São Paulo, Brazil) Bull. 31: 7-28; 18 figs.; June 1945.

A well illustrated and detailed description of methods used for selection and testing of timbers is given in the first paper.

The second paper consists primarily of four folded tables, 10 x 20, containing shrinkage and standard mechanical properties test results for 250 logs representing 145 of the most important timbers.

Nomenclatura das madeiras nacionais. By José Aranha Pereira and Calvinho Mainieri. Instituto de Pesquisas Technológicas (São Paulo). Bull. 31: 29-57; June 1945.

Standard common names are selected for the 145 most important commercial timbers of Brazil. These are listed with their botanical names, other common names, and a numerical reference to the tables of mechanical properties (see ref. above). Index lists of common names of timbers, common names of trees, and botanical names are also included.

This study and that of the preceding reference do much to bring order to and increase our knowledge of the proper nomenclature and physical properties of the commercial timbers of Brazil. It is hoped that such work will be actively continued, and duplicated in other American countries.

The identification of Burma commercial timbers. By K. Ahmad Chowdhury. *Indian Forest Records* (n. s., Utilization) 3: 6: 1-27; 41 figs.; 1945.

This publication was prepared to meet the need for a means of identifying timbers in the field; it replaces Burma Forest Bulletin No. 30 (1932). "It includes the necessary information that is required for field identification. It starts with preliminary notes on timber identification, supplemented with drawings. It also gives a key for the identification of the timbers, descriptions of different species and their photomicrographs." Twenty-eight woods are covered.

How to identify timbers. By K. Ahmad Chowdhury. Indian Forest Leaflets (Utilization), Forest Research Institute, Dehra Dun.

Part I. Hints on the identification of Indian timbers. Leaflet No. 21, Ed. 2. 1944.

Part II. Identification of timber for helves and tool handles. Leaflet No. 25. 1943.

Part III. Timbers for motor lorry bodies. Leaflet No. 37. 1943.

Part IV. Identification of timbers for boxes and packing cases. Leaflet No. 46. 1943.

Part V. Timbers for gun and rifle parts. Leaflet No. 50. 1943.

Part VI. Timbers for camp furniture. Leaflet No. 51. 1943.

Indian woods for pencil making. By M. A. Rehman and S. M. Ishag. Indian Forest Leaflet (Utilization) No. 66; 1945. Pp. 6.

The only Indian timber suitable for first class pencils is Baluchistan Juniper *(Juniperus macropoda)*. A number of woods are recommended for second grade pencils.

Bamboo nails, their manufacture and holding power. By V. D. Limaye. *Indian Forest Records* (n.s. Utilization) 3: 3: 1-12; 3 figs.; 1943.

Properly used bamboo nails have greater holding power than iron nails in soft woods. They must be used in the proper size, glue-coated pre-drilled hole. Bamboo nails are not recommended for dense woods.

Suitability and selection of timbers for different uses. Parts I and II. By V. D. Limaye. *Indian Forest Records* (n.s. Utilization) 3: 5: 1-62; 1944.

Indexes and tables are used to express the suitability of various timbers and to compare their properties with other Indian and foreign timbers.

Tests on the suitability of Indian woods for the manufacture of textile and jute mill accessories. Part I. Substitutes for persimmon and cornel for cotton mill shuttles. By M. A. Rehman and Chheda Lal. Indian Forest Bulletin (n.s. Utilization) No. 121; 1943. Pp. 9.

Ebony *(Disopyros melanoxylon)* was found to be the best of the woods tested for shuttles, giving about 50 per cent of

the life of Cornel wood (Dogwood) shuttles. Other woods used for shuttles are described.

Tests on the suitability of Indian woods for the manufacture of textile and jute mill accessories. Part II. Care and seasoning of wood for bobbins, picker arms, and jute mill rollers. By M. A. REHMAN. Indian Forest Bulletin (n.s. Utilization) No. 122; 1943. Pp. 7.

Substitutes are suggested for Beech, Birch, and Maple in bobbins; for Hickory in picker arms; for Sycamore in jute mill rollers.

Indian woods for battery separators. By M. A. REHMAN and S. M. ISHAG. Indian Forest Buleltin (n.s. Utilization) No. 124; 1944. Pp. 20; 2 plates.

Of the Indian woods tested, Cypress *(Cupressus torulosa)* and Champ *(Michelia champaca)* were as good as the imported Port Orford Cedar *(Chamaecyparis lawsoniana)* for battery separators.

Studies in fire resistance. Part I. The fire resistance of some Indian timbers. By D. NARAYANAMURTI and R. GOPALACHARI. Indian Forest Bulletin (n.s. Utilization) No. 118; 1943. Pp. 17; 13 figs.

The burning rate of 52 species of Indian timbers is described.

Plantae Papuanae Archboldianae, XVI. By E. D. MERRILL and L. M. PERRY. *Journ. Arnold Arboretum* 26: 3: 229-266; 11 figs.; July 1945.

"The following genera are considered in this article: *Urophyllum, Pachystylus, Canthium, Antirhea, Timonius, Mastixiodendron, Coffea, Ixora, Versteegia, Coprosma, Coelospermum, Morinda,* and *Galium.* We still have *Psychotria* and its closely related genera to be included in another paper, and that, we hope, will complete the Rubiaceae until such time as certain specialists can give the collections their attention."

Anatomische bestimmungstabelle für die Javanischen hölzer. By H. H. JANSSONIUS. Pp. vii + 240; 6¼ x 9¼; 365 figs. Leiden: E. J. Brill, 1940.

A comprehensive key for the identification of the woods described in detail in the six volume work "Mikrographie des Holzes der auf Java vorkommenden Baumarten." This publication, prepared in the same careful manner as the preceding volumes, adds much to their usefulness. The major key (pp. 1-128) leads to species where-ever possible, or in some cases to the genus or a group of species when characters for separation are insufficient. Twenty additional keys are provided for separating the species of the major genera. The 365 line drawings from "Mikrographie des Holzes" are included in the appendix. All species in the key are indexed to the volume and page of "Mikrographie des Holzes" and to the figures, permitting ready cross-reference.

Those who are familiar with Janssonius' work need no more than notification of its availability to appreciate the value of the "Bestimmungstabelle."

Report on visit to the Mandated Territory of New Guinea, July—August 1944. By H. E. DADSWELL. Publ. by Div. Forest Products, Council for Sci. and Ind. Research, South Melbourne, 1944. Pp. 22; 13½ x 8¼; 33 figs., photographic prints. Mimeographed. Distribution restricted.

Brief descriptions of the forests and timber of the New Guinea Mangrove swamps and rain forests are accompanied by photographs of typical or interesting trees, logs, and sawmill set-ups. The useful timbers are segregated into classes (see *Tropical Woods* 83: 1) according to their properties.

Mededeelingen Nos. 79-90 van het Botanisch Museum en Herbarium van de Rijks Universiteit te Utrecht. Extraits du *Recueil des Travaux botaniques Néerlandais,* Vol. 37-39, 1940-42.

Novitates taxonomicae III (pp. 279-292, 3 plates, 1 fig.), by A. PULLE.

***Sciaphyllum*, genus novum Acanthacearum** (pp. 293-300, 1 fig.) by C. E. B. Bremekamp.

Untersuchungen an Niederändischen mooren (pp. 1-17, 1 folded map, 7 graphs), by H. Florchutz and E. C. Wassink.

Some notes on Charophyta collected in the Netherlands West Indies, North Venezuela and Colombia (pp. 141-146), by J. S. Zaneveld.

The genus *Jussieua* L. (Oenotheraceae) in Suriname (pp. 147-150, 1 fig.), by F. P. Jonker.

Remarks on the South American species of the genus *Cassipourea* (Rhizophoraceae) (pp. 373-377, 1 fig.), by F. P. Jonker.

New grasses from Suriname (pp. 141-146, 3 figs.), by J. Th. Henrard.

Notes on the Myrtaceae of Suriname (pp. 148-165, 4 figs.), by G. J. H. Amshoff.

The position of the genus *Thomandersia* Baill. (pp. 166-175, 3 figs.), by C. E. B. Bremekamp.

Uber die flora des mindel-riss interglazials in den Niederlanden. (pp. 176-188, 2 figs.), by F. Florschutz and F. P. Jonker.

Novitates Burseracearum (pp. 189-210), by J. J. Swart.

A monograph of the genus *Protium* and some allied genera (Burseraceae) (pp. 211-446, 8 figs.), by J. J. Swart.

East African Timber Production. By A. Rule. *Empire Forestry Journal* (London) 24: 1: 47-51; 1945.

A general summary of logging and lumbering problems is given along with a resume of the possible future market. The supplies, properties, and lumbering possibilities of some of the major species are enumerated.

"In hardwoods the main commercial species are Mvule *(Chlorophora excelsa)* from Uganda and Tanganyika, and the Mahoganies *(Khaya* spp. and *Entandrophragma* spp.) mainly from Uganda. These species do not occur in Kenya. Mvule supplies are getting scarce and present exploitation areas are, in fact, mere remnants of once extensive areas cleared by fire and cultivation. Butt logs not infrequently contain 'stone,' a form of calcium carbonate, and this should be eliminated as far as possible in conversion and subsequent grading." "The African Mahoganies, as exported from West

Africa, are equally well known abroad. Some of the East African species are relatively much more plentiful than Mvule, although export has been on a minor scale. Munyama *(Khaya anthotheca)*, for example, is one of the most abundant of Uganda Mahoganies, although occurring in marketable quantity only in the Bunyoro forests." "The well-known Sapele *(Entandrophragma cylindricum)* also occurs in Uganda, where it is known as Muyovu. This timber requires considerable care in seasoning and for the best results should be cut on the quarter. Now that exploitation in the main Mahogany areas of Uganda is being controlled on the basis of permanent yield, the outlook for both local and possibly export supplies is more reassuring. As to the immediate future, however, sawmillers looking for oversea markets would do well to stick to modest parcels of attractively figured material." "The East African Camphor *(Ocotea usambarensis)* is a very large tree, both in Kenya and in Tanganyika. On first appearances supplies would appear to be considerable, in Tanganyika particularly, but exploitation reveals that in the existing stands over-mature trees preponderate and intermediate age classes are hard to find." "Two closely related hardwoods of some local importance are Musheragi *(Olea hochstetteri)* and Lolliondo *(Steganthus welwitschii)*. Both are fair-sized timber trees, although wide sap-free boards are uncommon. In Musheragi the probable average width is around 6 inches. This is a heavy hardwood with good strength properties, but it is not easy to work and rather refractory to season." "Preliminary tests on Lolliondo indicate that it is superior to Musheragi in some strength values, and, having lower shrinkage, should behave better in seasoning. It is also extremely durable. In neither case can any significant export be visualized." "One other hardwood may be listed here, the Mninga *(Pterocarpus angolensis)* of Tanganyika, which occurs in savannah woodland from here to South Africa, where it is known as Kejaat or Kiaat. It is not a large tree and is of more or less scattered occurrence, but the timber merits special note for its attractive appearance which is often enhanced by an

irregularly interlocked grain." "Only the difficulty of supplies limit Mninga's export possibilities."

Silvicultural notes on some of the more important Gold Coast trees. By D. KINLOCH, edited by R. C. Marshall. Pub. by Gold Coast Forestry Department, Accra, 1945. Pp. 70; 1 map. Price 2 s. 6 d.

A preliminary description of the climatic and topographic features, and the classification of forest types is followed by pertinent silvicultural notes for each of 28 species.

La production éventuelle de pâtes à papier au Congo Belge. By ED. FRISON *Bul. Agri. du Congo Belge* (Brussels) 35: 1-4: 183-204; 12 figs.; March-Dec. 1944.

An enumeration and brief discussion of plant materials, including woods that may be suitable for the manufacture of paper. Twelve photomicrographs of cross-sections are included in the text.

Morphology and relationships of *Trochodendron* and *Tetracentron*, I. Stem, root and leaf. By I. W. BAILEY and CHARLOTTE G. NAST. *Journ. Arnold Arboretum* 26: 2: 143-154; 6 plates; April 1945.

"Owing to their retention of a primitive and a vesselless type of xylem, *Trochodendron* and *Tetracentron* are fully as significant as the Winteraceae, Degeneriaceae, and Himantandraceae in discussions regarding the origin and phylogeny of the angiosperms. Furthermore, as indicated by Dr. Smith in the preceding article in this Journal, the opinions of taxonomists and morphologists concerning the relationships and classification of the two monotypic genera are exceedingly diversified and contradictory. It seemed advisable, accordingly, to utilize the extensive collections assembled by Dr. Smith as a broad basis for morphological as well as taxonomic re-investigations of these unusually significant genera. In presenting the results of our observations, we shall deal largely with morphological features that are incompletely or inadequately covered in the extensive literature."—*Author's introduction.*

An investigation of the taxonomic value of shoot structure in Angiosperms with especial reference to Leguminosae. By K. J. DORMER. *Annals of Botany* (Oxford), N. S. 9:34: 141-153; 9 figs.; April, 1945.

"It is found that phyllotaxy and the arrangement of the primary vascular system are of value in the taxonomic and phylogenetic treatment of the Leguminosae. Contrasting pairs of primitive and advanced features are set out in Table I, and examples are given to show how the evolution of the characters is correlated, so that forms which are specialized in one respect are specialized also in others. The taxonomic value of phyllotaxy is shown to extend to many other angiosperm families."—*From author's summary.*

Forest products research guide in fundamental and applied research. Second ed. American Forest Products Industries, Washington, D. C., December 1945. Pp. 142.

"The purpose of this publication is to summarize and classify, and to show: (1) the sources of reliable scientific knowledge and technical information resulting from fundamental and applied research in forest products by research agencies, including educational institutions, and firms; and (2) the further research needed to round out more completely the knowledge on wood needed for maximum wood products development."—*From author's foreword.*

Raices gemiferas en el "Palo Santo." By ARTURO E. RAGONESE and DOMINGO COZZO. Pub. Tec. No. 3, Min. de Agr. de la Nacion, Direccion Forestal (Buenos Aires), 1945. Pp. 7-8.

It was ascertained that Palo Santo *(Bulnesia Sarmienti* Lor. ex Gris.) reproduces itself with shoots originating from root buds, generally at some distance from the base of the parent tree.

The known geographic distribution of the members of the Verbenaceae and Avicenniaceae. Supplement 3. By HAROLD N. MOLDENKE. *Castanea* 10: 2: 35-46; June 1945.

This is the third supplement to the author's original publication on the subject and adds 53 new country or island records, 78 state or province records, and 201 county or parish records. Four varieties and one species, *Verbena cochabambensis* Moldenke, are described as new.

H. H. Chattaway

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Yale University School of Forestry

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TROPICAL WOODS

NUMBER 86 June 1, 1946

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 ROBERT W. HESS, *Associate Professor of Forest Products, Yale University School of Forestry.*

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BRAZILIAN TULIPWOOD

By PAUL C. STANDLEY

Chicago Natural History Museum

The identity of Brazilian Tulipwood has long been in doubt, although in recent years it has been accepted as a species of *Dalbergia* (see *Tropical Woods* No. 20: 23-24, and No. 72: 6-7). For many years Professor Record attempted to obtain authentic material that would permit positive identification, but all the specimens he obtained were faulty in some important detail. A sterile specimen accompanied by a wood specimen was named by the writer as *Dalbergia variabilis* Vogel, but Professor Record did not accept the name because he believed it applied to a vine rather than a tree. Recently, through the efforts of Dr. D. G. de Almeida, Serviço Florestal (Brazil), a wood sample and herbarium

material from the same tree have reached Professor Hess, who forwarded them to the writer for study. The herbarium specimens are in fruit, and suitable for identification.

The tree represented is clearly *Dalbergia variabilis* var. *tomentosa* (Vogel) Benth., as that is treated in the *Flora Brasiliensis*. *D. variabilis* has a wide distribution, from Venezuela to Peru and Bolivia and over much of Brazil. In the typical form of the species the leaflets are glabrous or nearly so, in the variety abundantly pubescent beneath.

The genus *Dalbergia* has been monographed recently by Hoehne in the *Flora Brasilica* (Vol. XXV, III, 126. 1941). Looking over his key to the species and his treatment of the individual species, it is evident that he was in doubt regarding the relationships of some of them, particularly those belonging to the group of *D. variabilis*. There is at hand in the Herbarium of Chicago Natural History Museum a rather large amount of material of this group. Examining it with some care, it seems that this is satisfactorily referable to one species with one or more varieties, except that the specimens from the Peruvian Amazon may represent a distinct species or variety. The only recent segregate from this group is *D. cearensis* Ducke. In Hoehne's key to species this and *D. variabilis* are separated only on habit, the latter being a vine, *D. cearensis* a tree. In citing specimens of *D. variabilis*, Hoehne publishes the collectors' notes, some of which describe *D. variabilis* as a vine, others as a tree. The same lack of uniformity prevails among the specimens I have studied, and it therefore seems probable that *D. variabilis* is one of that group of plants, not uncommon in tropical America, which assume either form, dependent upon soil and moisture, and the availability of support for clambering branches. Certainly habit alone is scarcely to be regarded as a specific character.

Dalbergia cearensis is described as glabrous, and both glabrous and pubescent forms are found in Ceara. It seems probable that this species is to be united with the typical variety of *D. variabilis*.

Most authors have used for this tropical tree or vine the name *Dalbergia variabilis* Vogel, but apparently the proper

name for it is *D. frutescens* (Vell.) Britton. Vellozo's plate, like most that he published, is somewhat diagrammatic, but it seems to illustrate the species well enough. The proper name for the pubescent variety is *D. frutescens* var. *tomentosa* (Vog.), comb.nov. (*D. tomentosa* Vog., Linnaea 11: 197. 1837).

It is believed that this treatment of the Tulipwood and its relatives will be found a fairly satisfactory one, but a considerable number of further herbarium specimens supported by wood samples would help to elucidate the matter, and determine more clearly the true status of the names involved. Notes regarding the conditions under which the trees grow also would supply data that might explain the apparent variations in habit.

NOTES ON *HIRTELLA* IN EAST TROPICAL AFRICA

By J. P. M. Brenan

Imperial Forestry Institute, Oxford University

The species of *Hirtella* in East Tropical Africa fall into two readily distinguishable groups:

I. With the inflorescence eglandular, narrow bracts and bracteoles, the mouth of the receptacle more or less markedly oblique, porrect sepals, and the stamens only shortly or scarcely at all exserted.

II. With the inflorescence glandular, although rarely the glands may be few and difficult to discern, broad bracts and bracteoles, the mouth of the receptacle not markedly oblique, spreading sepals, and long-exserted stamens.

The first group corresponds with what Engler separated as the genus *Magnistipula*.

GROUP I. Hitherto this group has been unknown from East Tropical Africa, although it occurs in the Belgian Congo, and two species, *H. bangweolensis* (R.E.Fr.) Greenway and *H. eglandulosa* Greenway, have been described from Northern Rhodesia. It was therefore with great interest that I learned of the rediscovery in an unquestionably native

condition in the Usambara forests of Tanganyika Territory of a *Hirtella* of this group collected some years ago at Amani, which had been erroneously assumed to be a cultivated species of *Parinari*. This rediscovery we owe to Mr. P. J. Greenway of the East African Agricultural Research Station, Amani. Of this plant, which proves to be very close to a species already described from the Belgian Congo, a diagnosis follows:—

Hirtella Sapini (De Wild.) A. Chev. var. **Greenwayi** Brenan, var. nov.; a typo inflorescentiis divaricatim ramosis, sepalis brevioribus 2-2.5 mm. longis basi 1.1-1.75 mm. latis, petalis paulo minoribus 4-5.5 mm. longis 2-3 mm. latis differt.

TANGANYIKA TERRITORY. Amani, E. Usambaras, 850 m., 1 Apr. 1941, *P. J. Greenway* 6161 (typus varietatis in Herb. Kew., Herb. Imp. For. Inst., Oxon.):—an evergreen tree up to 30 m. tall with a fairly smooth grey bark and lengthily branched columnar crown: flowers white; rare in *Piptadenia, Parinari Holstii, Leptonychia, Macaranga, Anthocleista* rain forest in a clayey red loam on a steep mountain slope; vernacular name (Kishamb.) "Mlawila"; used in rain-making ceremonies. Amani, 5 Apr. 1922, *R. S. Soleman* G 6133 (Herb. Kew., Herb. Imp. For. Inst., Oxon.).

In spite of the great distance separating the Usambara Mountains from the Kasai region of the Belgian Congo—the type locality of *Hirtella Sapini*—, the differences shown by Mr. Greenway's plant are so slight and unimportant that they seem to be no more than varietal. From *Hirtella Butayei* (De Wild.) Brenan, comb. nov. (*Magnistipula Butayei* De Wild. in *Ann. Mus. Congo*, sér. 5, 2, 255: 1908), which was compared with *H. Sapini* by De Wildeman, our plant, like typical *H. Sapini*, differs in the leaves non-cordate at base and more or less pubescent on the nerves, and in the coarser indumentum of the inflorescence. For the loan of the types of *H. Sapini* and *H. Butayei* I am very grateful to Prof. Dr. W. Robyns, Director of the Jardin Botanique de l'État, Brussels.

A second species of this group is also to be added to the flora of Tanganyika Territory. In the Kew Herbarium there

is a sheet ("In bush, Mbozi," 2 Sept. 1932, *Jessel* 34) that appears referable to the Northern Rhodesian *H. bangweolensis* (R.E.Fr.) Greenway. Its occurrence in the S.W. of the territory, so close to the Rhodesian border, is by no means surprising. From *H. Sapini* var. *Greenwayi* it may be easily distinguished by its smaller leaves cordate or rounded at base and rounded or only subacuminate at apex.

It is perhaps worth noting that nowhere, apparently, in East Tropical Africa does the geographical range of this group overlap that of the next.

GROUP II. While examining material of this group during the preparation of a check-list of the woody plants in Tanganyika Territory, I was struck by the considerable variation shown by certain East African specimens. Their relationship with *H. zanzibarica* Oliv., the only species of this group hitherto described from continental Africa, was obvious and it became desirable to ascertain the range of variation and hence the taxonomic limits of the species. With this purpose I was enabled to examine the specimens of *Hirtella* from East Tropical Africa preserved in the herbarium of the Royal Botanic Gardens, Kew, and I must here thank sincerely the late Keeper, Mr. A. D. Cotton, O.B.E., for his help in sending this material to me on loan.

As a result of this investigation, there seems no doubt that *H. zanzibarica* must be regarded as a much more variable and widely spread species than has hitherto been generally supposed. Oliver's original description, based on only two sheets, gives but a limited idea of its range of variation; in the circumstances it appears desirable to redescribe the species. The writer believes that all the material of this group of *Hirtella* from East and South-east Tropical Africa that he has seen is referable to the single species, *H. zanzibarica*.

HIRTELLA ZANZIBARICA *Oliv.* in *Hook. Icones Pl.* 12, t.1193 (1876), descr. hic amplif, atque emend. *Arbor* parva usque magna, sempervirens, cortice nigro, alburno luteo, duramine obscure rubro (e sched. Dalei); ramuli ultimi novelli subteretes vel leviter longitudinaliter striato-sulcati, puberuli, pubescentes vel interdum dense villosulo-hirsuti

vel appresse araneosi; ramuli vetustiores teretes, nigro-purpurei vel interdum paululum griseo-purpurei, plus minusve vel nonnunquam vix glabrati, lenticellis parvis pallidis notati. *Folia* alterna, elliptica usque ovato-elliptica vel oblongo-elliptica vel interdum lanceolato-elliptica, ad apicem obtusum vel rare subacutum sollemniter breviter acuminatum angustata, basi cuneata usque rotundata vel emarginata vel subcordata nonnunquam leviter asymmetrica, 3.2-11.5 cm. longa, 1.4-5.2 cm. lata, rigide coriacea usque subcoriacea, supra nitida, juventute indumento araneoso albido facili detersu (an semper?) instructa mox glaberrima costa puberula nonnunquam excepta, subtus opaca vel leviter nitentia, ubique hirtella vel pubescentia vel costa pubescenti excepta glabra vel omnino glabra, nervis primariis utroque costae latere circiter 5-8 inter se versus marginem arcuato-anastomosantibus, costa supra paululum impressa vel leviter prominenti subtus valde prominenti, nervis lateralibus et rete venularum intricatissimo utrinque sed praesertim supra prominentibus vel interdum supra haud elevatis hinc pagina superiore folii applanato-sublaevi et valde nitenti, interdum etiam venulis subtus vix conspicuis; petiolus crassus, 1-2 mm. diametro, rugulosus, siccitate plus minusve nigrescens, supra rotundatus vel canaliculatus, subtus rotundatus, more ramulorum vestitus, 1.5-6.5 mm. longus; stipulae lineares, 2-5.5 mm. longae, persistentes vel caducae. *Inflorescentiae* terminales vel ex axillis foliorum exorientes, paniculatae, multiflorae, usque ad circiter 18 cm. longae et 14 cm. latae (inflorescentia terminali et iis ex axillis superioribus inclusis) sed saepe minores, plerumque plus minusve breviter pedunculatae, pedunculis ramis ramulis pedicellisque dense velutino-pubescentibus vel interdum villosis vel subtomentosis; pedicelli usque ad 4 mm. longi vel interdum subnulli; bracteolae inferiorae ovatae vel ovato-oblongae, 2.5-6.5 mm. longae, 2-4.5 mm. latae, plus minusve dense puberulae, apice angustatae, subeglandulosae vel glandulis paucis vel paucissimis subsessilibus vel brevissime stipitatis praesertim ad marginem obsitae, nonnunquam utrinque basis consociatione glandularum longiuscule atque inaequilonge stipitarum munitae; bracteolae superiores late ovatae usque suborbiculares vel reniformes, quam inferiorae minores, glandulis inaequilonge stipitatis praesertim ad marginem plerumque dense obsitae, raro glandulis paucis subsessilibus indumento occultis ad marginem solum adsentibus. *Flores* albi vel viridi tincti vel ? lutei. *Tubus calycis* 5-9 mm. longus, basi unilateraliter gibbosus, apicem versus leviter ampliatus, extra more pedicelli vestitus, sublaevis vel longitudinaliter striato-sulcatus; lobi alabastro imbricati, sub anthesi patentes, elliptici usque ovati, 3-6 mm. longi, 2-3 mm. lati, apice rotundati vel obtusi, extra dense pubescentes vel tomentelli, intus densissime ac brevissime cinereo—vel albido—tomentelli, exteriori plus minusve glanduloso-marginati, glandulis interdum paucis et inconspicuis. *Petala* elliptica vel oblongo-elliptica, circiter 5-6 mm. longa, 2.5-3 mm. lata, plus minusve torta ac sinuoso-undulata, basi breviter unguiculata (vel unguiculo nonnunquam vix distincto), apice ut videtur plus minusve erosa. *Stamina* antherifera 8-9, unilateralia, libera, filamentis glabris curvatis quam calycis lobi multo longioribus, antheris dorsifixis late ellipsoideo-quadratis. *Ovarium* densissime albido—vel stramineo—tomentosum, uniloculare, biovulatum, ovulis basalibus; stylus filiformis, elongatus, inferne plus minusve pilosus vel omnino subglaber. *Fructus* ovoideus vel subellipsoideus, circiter 1.8-2.6 cm. longus, 1.15-1.3 cm. latus, apice obtusus, basi in collum breve abrupte angustatus, monospermus, maturitate e viridi rubens et edulis, pericarpio extra (sub lente valido) pilis minimis valde nitentibus sparse puberulo, intus densissime ac molliter floccoso-tomentoso.

KENYA COLONY. Buda Forest, Digo country, 150 m., Nov. 1936, *I. R. Dale* 3579 (Herb. Kew. & Herb. Imp. For. Inst., Oxon.).:—large tree with black bark, yellow sapwood and dark red heart; an infusion from the heartwood is used as a cure for sores; C[orolla] white; the glandular hairs on the inflorescence bracts and on the outside of the calyx are noteworthy; vernacular name (Dig.) "Mwawa." Shimba Hills, May 1930, *G. H. Donald* 22, 2367* (Herb.

*Both these numbers refer to a single gathering; they appear in different positions on a single label.

Kew. & Herb. Imp. For. Inst., Oxon.):—fair-sized forest tree; flowers yellow: vernacular name (Swa.) "Mkone-Chacha."

TANGANYIKA TERRITORY. Mafia Island, Aug. 1873, *Kirk* s.n. (typus, Herb. Kew.):—bushy shrub, Mafia Island: Kilindoni, 14 July, 1932, *Schlieben* 2580 (Herb. Kew.):—"Waldreste auf Uferhöhen, Baum 10-15 m., zwischen Kopalbäumen, häufig, Blüte weiss, klebrich." Same locality, c.15 m., 6 Aug. 1937, *Greenway* 4996 (Herb. Imp. For. Inst., Oxon.):—a much branched tree up to 9 m. high with evergreen leaves and much branched panicles of small greenish white flowers and round green fruits, growing as a solitary in a planted grove of *Trachylobium verrucosum* trees; vernacular names (Kizaramo) "Mkole," "Mkolekole." Mafia Island: Tondwa, c. 9 m., 3 Oct. 1937, *Greenway* 5376 (Herb. Imp. For. Inst., Oxon.):—a much branched evergreen tree up to 12 m. tall with dense clusters of greenish white flowers and oval fruits which turn red when ripe; locally common with *Parinari* and *Vitex cuneata*, also with *Syzygium cordatum* in valley bottoms in brown and grey sandy soils.

PORTUGESE EAST AFRICA. Zimbiti, 23 miles from Beira, 15 Aug. 1908, *W. H. Johnson* 296 (Herb. Kew.):—medium-sized umbrageous tree, fls. white, M'zimbiti, Aug. 1911, *M. T. D[awe]* 401 (Herb. Kew.):—small tree. M'zumbiti, *T. Honey* 621 (Herb. Kew.):—large evergreen tree, smooth bark; fruit about size of a marble, edible: vernacular name "Chiboma." (This is the spelling on the written label; on the typed label it is spelled "Chibomba".) Savane River, Sept. 1921, *T. Honey* 654 (Herb. Kew.):—small tree. Ribaué Mountains, 14°50′ S., 38°20′ E., 900 m., Nov. 1931, *Gomes Sousa* 750 (Herb. Kew.):—"arbre (12-15 m.) de la galerie forestière d'une rivière." Same locality, Aug. 1931, *Gomes Sousa* 781 (Herb. Kew.):—"petit arbre; fleurs blanches; places humides."

NYASALAND. N'Chisi Forest Reserve, 7 Sept. 1929, *J. Burtt Davy* 21389 (Herb. Imp. For. Inst., Oxon.):—tall tree near water with *Faurea*, forming canopy under which various species are growing freely and regenerating.

As far as can be judged from the specimens seen, *H. zanzibarica* has a markedly discontinuous distribution. Though it is found on the mainland both in Kenya and Portugese East Africa, in the intervening territory of Tanganyika it has been collected only on Mafia Island; that it is really absent from the mainland of Tanganyika is improbable, especially in view of the record of *Acioa Goetzeana* from the "Sachsenwald," mentioned later on. This distribution suggests the possibility that we are dealing with a relict species.

The variation shown by the material referred here to *H. zanzibarica* is considerable. In spite of numerous attempts the writer has failed to find any correlation between the characters concerned, which seem to vary more or less independently. Between the extremes of glandular development in the inflorescence, which at first appeared to be taxonomically important, so many intermediate gradations occurred that it is desirable merely to regard them as falling within the range of intraspecific variation. It may be noted also that the length and degree of sulcation of the calyx tube and the shape and length of the lobes vary considerably. At present there is no obvious correlation between variation and geographical distribution in this species. The greatest variation is shown by the specimens from Portugese East Africa, which link up with those from the other three territories. No weakly glandular specimens have been seen from Mafia Island. The writer was thus faced with the choice either of separating varietally each combination of characters represented, or of choosing arbitrarily certain characters, or of treating *H. zanzibarica* in a wide sense and regarding it merely as a very variable species. On the present evidence there can be little doubt that the last is the correct procedure, though when the range of the species is accurately known and it has been adequately collected and observed in the field, it may be possible to establish geographical varieties. In one instance only, to be dealt with further on, the evidence appears sufficient to justify the separation of a distinct variety.

An odd discrepancy concerning one character will be noticed between Oliver's original description of *H. zanzibarica* and its accompanying plate. In the former it is stated: "Petala calycem aequantia concava late elliptica": in the plate, however, the petals are represented as only about half as long as the calyx lobes or even somewhat shorter. One of Kirk's two original sheets is annotated in ink: "Ic. Pl. t.1193 (type)": though there are not many petals visible, those that I have seen are as long as the calyx lobes and thus disagree with the plate, though they agree with the description and with those shown by the second sheet of Kirk's gathering. In fact I have not seen in open flowers petals such as are drawn in the plate. Whether this drawing is to be attributed to an error of observation (for the petals are usually twisted and their shape and size difficult to make out), or whether by mischance an abnormal flower was selected, or whether the petals are represented in the bud stage before they have attained their full size, is difficult to decide, though the shortly curled stamen filaments with all the anthers attached suggest that the last possibility is the right one.

In dealing with *H. zanzibarica*, it is necessary to take into consideration *Acioa Goetzeana* Engl. in *Engl. Bot. Jahrb.* 30, 315 and t.xii (1901). This was based on *Goetze* 1176, collected in ravines at about 500 m. on the western slopes of the Livingstone Mountains near Ikombe (in S.W. Tanganyika Territory). I have, unfortunately, not seen the type of this species, but from the description and the detailed plate there can be little doubt that it is congeneric with and very closely related indeed to *H. zanzibarica;* indeed, it is quite likely that the two are conspecific, though it should be noted that the flowers of *A. Goetzeana* are represented in the plate as having ten antheriferous stamens (the description reads, however, "staminibus circ. 9......"). In this connection it is, perhaps, significant that *Schlieben* 2580 (from the type locality of *H. zanzibarica!*) was determined at the Berlin Herbarium and issued thence as *A. Goetzeana*. Schlieben's specimen is certainly *H. zanzibarica*. There is also a record

of *A. Goetzeana* from the "Sachsenwald" near Dar-es-Salaam (Engler, *Pflanzenw. Afr.* 1 pt. 1, 241: 1910), and collectors will do well to look out for the plant in this area. It is curious that neither Engler nor De Wildeman (*Bull. Jard. Bot. Brux.* 7, 189, 216: 1920), both of whom remarked on the anomalous position of *A. Goetzeana* in *Acioa* on account of the free stamen filaments, even so much as mentioned *H. zanzibarica*. The last-named botanist even went so far as to suggest that *A. Goetzeana* might prove to be the type of a separate genus! Until the type of *A. Goetzeana* has been seen, or further material collected from the type-region, I am not prepared either to transfer it to *Hirtella* or to reduce it to synonymy under *H. zanzibarica*.

Among the material of *H. zanzibarica* examined, the following appears sufficiently distinct to be regarded as a variety of that species:—

var. **cryptadenia** Brenan, var. nov.; ob ramulos ultimos araneosos et minute puberulos, folia supra siccitate obscure brunnea, subtus cuprea, inflorescentias minute dense et brevissime velutino-puberulas comparate paucifloras ut videtur pendulas, bracteolas et calycis lobos glandulis paucis brevissimis omnibus indumento suboccultis insignis.

PEMBA ISLAND. Without more precise locality or date, *J. H. Vaughan* 652 (Typus varietatis in Herb. Kew. What is apparently the same gathering is in Herb. Imp. For. Inst., Oxon. but is said to be from Zanzibar).

I regard as the principal characters of this variety the extremely short indumentum on the inflorescence (including the calyx tube and lobes) and the very weak glandular development—so weak and inconspicuous indeed that, without using a powerful lens, the inflorescence appears eglandular.

In conclusion, I must thank Mr. A. C. Hoyle, who kindly looked at the material of *H. zanzibarica* and came independently to substantially the same conclusions as are put forward here.

NEW USES FOR BRAZILIAN TIMBERS

By Eugene F. Horn

The wood of Pau Marfim (*Balfourodendron Riedelianum* Eng., Fam. Rutaceae) is now being used for the construction of laminated airplane propellers. Most of the small planes used by the Civil Aviation Clubs in Brazil are equipped with laminated propellers made of this wood or of Feijjo (*Cordia Goeldiana* Huber, Fam. Boraginaceae). Propellers made of Pau Marfim are said to be superior to imported propellers made of Walnut or Mahogany.

Pau Marfim (Brazilian Ivorywood) has also been successfully tested for shuttles in silk looms in São Paulo. Shuttles made of this wood are reported to have given as satisfactory service in silk mills as those made of American Persimmon. The suitability of this wood for uses where the requirements are so exacting, as for airplane propellers and shuttles, is not surprising in view of its admirable mechanical and physical properties. Tests made by the Instituto de Pesquisas Technologicas of São Paulo gave the following results: Specific gravity (15 per cent moisture), 0.87; weight (15 per cent moisture), 54 lbs. per cu. ft.; Shrinkage: Volumetric, 16.2, Radial, 4.7, Tangential, 10.1. Crushing strength parallel to grain, 9, 884 lbs. per sq. in. Static bending: Modulus of rupture, 15,503 lbs. per sq. in.; Modulus of elasticity, 1,729,606 lbs. per sq. in. In impact bending tests its coefficient of resilience was exceeded only by Angico Preto (*Piptadenia macrocarpa* Benth., Fam. Leguminosae) among 130 species tested.

During the past few years Brazilian arsenals have been using Açoita Cavalo do Miuda (*Luehea divaricata* Mart., Fam. Tiliaceae) for gunstocks for army rifles with very satisfactory results. The wood of this species is light brown in color and is marked with longitudinal streaks of a darker color. In texture and general appearance it is not unlike Red Gum, although it is much heavier. Tests made by the Instituto de Pesquisas Technologicas of São Paulo gave the following results: Sp. gr. (15 per cent moisture), 0.61;

weight, 38 lbs. per cu. ft.; Shrinkage: Volumetric, 11.4, Radial, 3.6, Tangential, 8.2. Crushing strength parallel to grain, 4,650 lbs. per sq. in. Static Bending: Modulus of rupture, 11,400 lbs. per sq. in.; Modulus of elasticity, 1,311,000 lbs. per sq. in. Its coefficient of resilience in impact bending tests is greatly superior to all other species of the same density class tested.

There are at least two other species of *Luehea* native to South Central Brazil, namely, *L. paniculata* Mart. and *L. speciosa* Willd., but they are light colored woods without figure used locally for ox-yokes, saddle frames, pack saddles, sabots, heels for ladies' shoes, and woodenware. The latter species is locally Açoita Cavalo do Graúdo.

ANOTHER RUBBER-PRODUCING EUPHORBIACEAE

By Eugene F. Horn

Although Brazilian rubber gatherers have always mixed the latex of certain species of *Sapium* with the latex of *Hevea* in the preparation of rubber, it has only recently been proven that certain species of *Sapium* native to the Amazon Basin yield a rubber superior in mechanical properties to Hevea rubber. Tests made by the Bureau of Standards in Washington, D. C., show that Sapium rubber is not only stronger but also more elastic than Hevea rubber. Sapium rubber resisted a rupture load of 3,600 pounds per square inch and a maximum stretching load of 750 per cent as compared with 2,940 pounds per square inch and 660 per cent for Hevea rubber. The Sapium rubber tree is abundantly distributed throughout the Amazon Valley, being especially abundant on the Caviana Island in the Amazon estuary. In the State of Pará it is called Murupita or Curupita, while in the State of Amazonas and Peru it is called Tapuru or Seringarana. In British Guiana a species of this genus produces "sapium rubber" or "arinoco scrap," while in eastern Colombia and Ecuador a species of *Sapium* produces "caucho blanco."

The Instituto Agronomico do Norte at Belém, Para, is studying the economic possibilities of this new rubber producing plant including plantation possibilities.

IDENTIFICATION OF NEW WORLD TIMBERS

Part 1

By Robert W. Hess

This article is the first of a series dealing with anatomical and gross descriptions of the woods of the Western Hemisphere. The primary purpose will be the identification of individual woods. Various lists, keys, and illustrations will be included to assist in selection and elimination. The arrangement will follow closely that of *Timbers of the New World* (described in *Tropical Woods* 73: 42) so that it can be used to supplement the information contained in that volume.*

The terminology used follows that approved by the International Association of Wood Anatomists (*Tropical Woods* 36: 1-12; Dec. 1, 1933). Size classes for pores are those approved by the I. A. W. A. (*Tropical Woods* 59: 51-52; Sept. 1, 1939). Most other classifications are those proposed by Record and Chattaway (*Tropical Woods* 57: 11-16; March 1, 1939). The "Explanation of the Wood Descriptions" in *Timbers of the New World*, pp. 561-564, is applicable to the following descriptions.

*Incident to the preparation of *Timbers of the New World* a detailed study was made of all the available woods in each genus. The resultant descriptions were condensed as much as possible and prepared for inclusion in the book. The paper shortage brought on by the war and the voluminous character of the work necessitated removal of most of the generic anatomical descriptions leaving only the general descriptions in most families. For many families, and particularly the larger or more varied, such treatment is inadequate for specific or generic identification.

While the available information could be prepared for publication in a relatively short time it was decided that a more detailed treatment of the genera would be advantageous. This would permit inclusion of extremes of variation and smaller exceptions than was possible before. More measurements could be made and included. Many additional woods, recently received, are available for study also. For these reasons the woods and slides will be re-examined and the descriptions revised and extended wherever improvements are indicated.

Anatomical descriptions have been published in *Tropical Woods* for some of the families. In the interests of completeness of the series and because of the additional information that will be incorporated, these families will not be omitted despite partial duplication of description.

It is intended that the series "Keys to American Woods" will be continued, at least for a time. These keys will ultimately be revised and corrected for inclusion in "Identification of New World Timbers."

Acanthaceae

Only two genera of the Acanthus family, *Bravaisia* and *Trichanthera*, have species that attain tree size. A considerable number of others are small to large shrubs. Authentic specimens are available for 15 species of 7 genera.

Wood whitish, grayish or oatmeal colored; heartwood lacking or not distinguishable. Luster medium. Odor and taste not distinctive. Light and soft to moderately heavy and hard, mostly medium density; texture fine to medium; grain straight; easily worked. Inner bark of dried specimens often grayish green. Pith coarsely septate.

Growth rings distinct in *Anisacanthus*, absent or indistinct in the others. Pores commonly medium-sized in *Bravaisia* and *Trichanthera*, small in the others; solitary and with short, sometimes long, radial multiples and occasionally with small clusters or tangential pairs; in indistinct ring-porous arrangement in *Anisacanthus;* more or less radially disposed in *Aphelandra*, *Beloperone*, and *Pachystachys;* few to rather few in *Bravaisia* (exc. *B. tubiflora* Hemsl.), *Sanchezia*, and *Trichanthera*, very numerous (70 to 200 per sq. mm.) in the others; usually rather thick-walled, somewhat angular, with thickened corners. Vessels with simple perforations, commonly with wide rims, particularly in smaller vessels; fine spiral thickenings observed in *Anisacanthus;* thin-walled tyloses present in *Pachystachys;* pitting irregularly alternate, typically fine to very fine. Rays decidedly heterogeneous, composed mostly of square or upright cells, short procumbent cells infrequent; 1 to 4, sometimes up to 6, cells wide

and ranging in height up to 40 cells in *Bravaisia* and *Sanchesia*, up to 80 in *Anisacanthus*, and up to 100 or more in *Trichanthera;* 1 or 2, sometimes 3, cells wide and less than 30 cells high in *Aphelandra* and *Pachystachys;* all uniseriate and not over 15 cells high in *Beloperone;* palisade and sheath cells common; pits to vessels either all very small (*Anisacanthus, Aphelandra, Beloperone, Pachystachys*) or varying, often in the same crossfield, from small and rounded to elongated and in scalariform arrangement *(Bravaisia, Sanchezia, Trichanthera)*. Wood parenchyma typically very sparse, scarcely visible with lens; mostly sparingly paratracheal to narrowly vasicentric, occasionally diffuse or terminal *(Anisacanthus)*. Wood fibers with thin to medium walls and numerous, often irregularly distributed, small simple or indistinctly bordered pits; abundantly septate except in *Aphelandra*. Ripple marks absent. No gum ducts seen.

Anisacanthus. There are several species of the Chuparosa. All are shrubs, some are desert browse plants. The wood has no special uses.

Two specimens of *Anisacanthus Thuberi* (Torr.) Gray were available for the following description. Wood yellowish white. Luster rather low, odor and taste lacking, density and hardness medium, texture fine. Pith non-septate.

Growth rings distinct. Weakly ring-porous; early wood pores small, mostly solitary, forming a single tangential row; late wood pores decreasing in size to minute in outer part of growth ring, with tendency toward tangential arrangement, with numerous short and few long radial multiples. Vessels with fine spiral thickenings; vascular pits small (5μ). Radial multiples of very small (15 to 25μ) vessels in association with terminal parenchyma. Rays 1 to 4 or 5 cells wide; up to 30 or 100 cells high; decidedly heterogeneous with few short procumbent cells, sheath cells abundant; pits to vessels small. Parenchyma narrowly vasicentric with some vasicentric confluent, and in narrow irregular bands associated with very small vessels demarcating growth rings. Fibers with numerous coarse septa and very numerous small pits.

Aphelandra. None of the various species of shrubs in this genus have woods of commercial value.

Wood gray or light grayish brown. Luster medium; texture fine; odor and taste lacking; grain straight.

Growth rings indistinct. Pores very small (40 to 55μ), solitary or in short radial multiples, with fairly numerous small clusters and tangential pairs, with tendency to radial arrangement, numerous, well distributed (Fig. 1). Pores in radial arrangement, with long radial multiples in *Aphelandra superba* Lindau. Vascular pitting fine. Rays 1 to 3 cells wide; up to 25, or frequently fused and up to 70 cells high; decidedly heterogeneous, most cells square or tall upright; pits to vessels very small. Parenchyma very sparse, paratracheal. Fibers with thick walls, rather few septa; with very numerous minute pits. Septa lacking in *A. tetragona* (Vahl) Nees.

Beloperone. The wood of these shrubs has no particular use.

Wood yellowish, becoming yellowish white on exposure. Luster medium; odor and taste lacking; grain straight.

Growth rings absent or indistinct. Pores very small (40 to 50μ), few to rather numerous, in more or less radial arrangement, with few to fairly numerous long multiples (Fig. 2). Vascular pits very small (4μ) (Fig. 4). Rays uniseriate; maximum 12 to 18 cells high; composed of tall tangentially flattened upright cells; very small cubical crystals sometimes present; pits to vessels very small. Parenchyma very sparingly paratracheal. Fibers abundantly septate; with numerous irregularly distributed minute pits.

Bravaisia. The several species of this genus are small trees or large shrubs throughout most of its range from Mexico through Central America into north-western South America. In Colombia and Trinidad the Jiggerwood, *B. integerrima* (Spreng.) Standl., sometimes reaches a height of 75 feet and a diameter of 18 to 36 inches. The wood has no special uses but appears suitable for cheap construction lumber or box boards.

The following description applies particularly to *Bravaisia integerrima*. Wood grayish or oatmeal colored throughout specimens. Luster medium. Odorless and tasteless. Density medium to rather low; texture medium; easily worked; straight grained; poorly resistant to decay.

Growth rings indistinct or absent. Pores barely visible, lower medium-size (120μ); small and not visible without lens in *Bravaisia tubiflora* Hemsl.; 8 to 12 per sq. mm., solitary and in numerous short radial multiples, evenly distributed, sub-circular (Fig. 3). Vascular pits small (5 to 6μ) and crowded, the apertures coalescent. Rays 1 to 5 or 6 cells wide; uniseriates rather few, composed of one to several rows of tall, slender upright cells; multiseriates up to 35, in some specimens to 70, cells tall, with uniserate margins of variable height; procumbent cells often of two sizes in irregular strata alternating with square, upright or palisade cells; sheath cells irregularly distributed; procumbent cells infrequent in *B. tubiflora;* pits to vessels small and subcircular to elongated and parallel (Fig. 5). Wood parenchyma very sparingly paratracheal. Wood fibers thin-walled, abundantly septate; pits numerous, very small, slit-like.

Pachystachys. The specimen available for study, *P. Riedeliana* Nees, is a large shrub.

Wood whitish yellow. Luster medium, density rather low, texture fine, odor and taste lacking, grain straight.

Growth rings indistinct. Pores very small (48μ), in radial rows with numerous long radial multiples. Vascular pits very small (4μ); froth-like tyloses sometimes present. Rays 1 to 2, occasionally 3, cells wide; up to 40, few over 25, cells high; nearly all cells upright, in part palisade type; pits to vessels very small. Parenchyma sparse, paratracheal. Fibers with numerous coarse septations, numerous very small irregularly distributed pits.

Sanchezia. The wood of these large shrubs or small trees is not used.

Wood whitish or grayish. Luster medium; odor and taste lacking; density rather low; texture rather fine, grain straight.

Growth rings absent or indistinct. Pores small (100μ), uniformly distributed, rather numerous, with few short multiples, small clusters and tangential pairs. Vascular pits small (6μ). Rays numerous (18 per mm.); 1 to 3, sometimes to 5, cells wide; up to 40 or 60 cells high; composed mostly of square, upright and palisade type cells; pits to vessels small and rounded to elongated and in irregular scalariform arrangement; pits to other elements abundant, conspicuous. Parenchyma sparingly paratracheal. Fibers rather thin-walled; abundantly septate; with very numerous small irregularly distributed pits.

Trichanthera. The Palo de Agua is a small to medium sized tree, sometimes attaining a height of 50 feet. Its wood is not distinctive and has no particular uses.

Wood grayish or oatmeal. Luster rather high; odor and taste lacking; density medium, resembling that of Red Maple (*Acer rubrum* L.); texture medium; grain straight.

Growth rings absent or indistinct. Pores small to medium-sized, the larger barely visible without lens; rather numerous; uniformly distributed; with few short radial multiples, clusters, and tangential pairs; subcircular. Vascular pits small (6μ). Rays 1 to 4 cells wide; uniseriates 1 to 15 cells high; multiseriates up to 100, sometimes to 200 cells high, the body of the ray consisting of square, upright, sheath, and procumbent cells irregularly arranged without definite stratification; pits variable in the same crossfield, small oval to elongated. Wood parenchyma sparingly paratracheal. Fibers rather thin-walled; abundantly septate; with very numerous irregularly distributed small pits. Structure closely resembles that of *Bravaisia*, but the rays are generally higher and more conspicuous on the radial surface and the ray cells are not definitely stratified.

KEY TO THE GENERA

1 a. Ray-vessel pitting very fine, pits rounded with narrow apertures. Long radial pore multiples few to fairly numerous 2

b. Part or all ray pits to vessels oval or elongated, sometimes in irregular scalariform arrangement in part. Long radial pore multiples lacking 5

2 a. Rays uniseriate, maximum 12 to 18 cells high; cells flattened tangentially ..... *Beloperone.*

b. Largest rays 3 to 6 cells wide, 30 to 100 or more cells high; cells not significantly flattened tangentially 3

3 a. Weakly ring-porous. Largest rays 4 or 5 cells wide. Vessels with distinct fine spiral thickenings ..... *Anisacanthus.*

b. Pores with tendency toward radial arrangement otherwise well distributed. Largest rays 3 cells wide. Spiral thickenings lacking 4

4 a. Fibers thin-walled; with very numerous coarse septations. With fairly numerous small pore clusters and tangential pairs. *Aphelandra.*

b. Fibers thick-walled to moderately so; septations few or lacking. Pore clusters and tangential pairs very few or lacking. *Pachystachys.*

5 a. Rays having numerous procumbent cells forming distinct strata. Pores barely visible without lens (lower medium-sized); clusters and tangential pairs lacking or rare (Fig. 3). *Bravaisia.*

b. Rays without definite strata of procumbent and upright cells. Pores mostly small, rarely distinct without lens; commonly with some small clusters and tangential pairs 6

6 a. Rays with procumbent cells intermingled with square or upright cells; up to 100 or more cells high ..... *Trichanthera.*

b. Rays composed almost entirely of square and upright cells; up to 40-60 cells high ..... *Sanchezia.*

Aceraceae

Acer. The various species of Maple include several important trees and a few species of small trees or shrubs. The woods are used for furniture, flooring, veneers, turned articles, and numerous specialty articles. The denser woods are commonly used where a hard smooth surface or resistance to abrasion is desired. Much of the softer wood is used for slack cooperage, boxes, and crates.

The following description applies to all species except *Acer negundo* L. Heartwood pale brown, light greenish brown, or light reddish brown; sapwood gray or whitish, rather wide. Odorless and tasteless. Luster medium to high. Rather light to hard and heavy; sp. gr. (air-dry) 0.43 to 0.70; weight 26 to 44 lbs. per cu. ft.; texture medium to fine, uniform; grain usually straight, sometimes highly figured; easy to work, finishing very smoothly and taking a high polish; not highly resistant to decay.

Growth rings present; limited by narrow layers of flattened wood fibers. Pores small (70 to 110μ), not distinct without lens; generally very small (35 to 50μ) in extreme outer part of growth ring; numerous but not crowded; occurring singly or in radial multiples of 2 to 5, mostly 2 and 3; uniformly distributed. Vessels with simple perforations; spiral thickenings present (Fig. 13); intervascular pitting medium (7 to 9μ), alternate. Rays up to 3 to 5, sometimes 7, cells wide; generally less than 30, sometimes to 50 or even 100 cells high; multiseriate rays without extended uniseriate margins; cells small and rounded (tang.) but long (rad.), commonly containing gum; homogeneous or nearly so; pits to vessels small (4 to 6μ), rounded (Fig. 13). Rays darker than background on radial surface. Wood parenchyma very sparingly paratracheal, often with few scattered strands of diffuse, particularly on growth ring margins; not distinct with lens; pith flecks common in some species. Crystal strands sometimes present in diffuse parenchyma. Wood fibers with rather thin to rather thick walls; sometimes filled with starch in sapwood; pits small, fairly numerous, bordered. Ripple marks and gum ducts absent.

The heartwood of Boxelder, *Acer negundo* L. (=*Negundo aceroides* Moench), is yellow or light yellowish brown; sapwood yellowish or yellowish white. Odorless and tasteless. Luster mostly rather low. Density rather low, occasionally medium, commonly less than other Maples; texture rather fine; grain straight; easy to work; rather weak; not resistant to decay.

Growth rings present. Pores small (65 to 90μ), sometimes with tendency to ring-porous caused by single row of solitary early wood pores (Fig. 16), solitary and in short radial multiples. Vessels with simple perforations; spiral thickenings present; intervascular pitting rather fine (6 to 7μ); gum plates common. Rays 1 to 3 or 4 cells wide; up to 30, occasionally 50, cells high; homogeneous; pits to vessels

very small (4μ). Rays of same color as background on radial surface. Parenchyma very sparingly paratracheal. Fibers rather thin-walled with fairly numerous small bordered pits. Ripple marks and gum ducts absent.

The woods of the more important Maples can be divided into two groups on the basis of their anatomy and utility. Hard Maple or Rock Maple includes the woods of Sugar Maple (*Acer saccharum* Marsh.=*Acer saccharophorum* K. Koch) and Black Maple (*Acer nigrum* Michx.f.). The Soft Maple group includes the Red Maple (*Acer rubrum* L.), Silver Maple (*Acer saccharinum* L.), Bigleaf Maple (*Acer macrophyllum* Pursh.), and Boxelder (*Acer negundo* L.).

KEY TO IMPORTANT SPECIES

1 a. Larger rays wider than pores; uniseriate rays numerous (Fig. 12). Wood hard and fairly heavy (sp. gr. 0.57 to 0.64). Growth rings very distinct (Fig 14). *Acer saccharum* and *A. nigrum*.

b. Larger rays as wide as or narrower than pores (Fig 15); uniseriate rays few. Density low or medium (sp. gr. 0.47 to 0.54). Growth rings somewhat indistinct 2

2 a. Heartwood distinctive reddish brown, sapwood pinkish. Uniseriate rays very few. Pores mostly lower medium-sized 80 to 110μ). Crystal strands common in diffuse parenchyma. *Acer macrophyllum*.

b. Heartwood pale brown or yellowish, sapwood whitish. Uniseriate rays rather few. Pores small (65 to 90μ). Crystal strands generally absent 3

3 a. Heartwood yellow or yellowish brown, sometimes with pink or red fungus stain streaks. Rays of same color as background on radial surface. Sometimes with ring-porous tendency (Fig. 16). Pith flecks rare ..... *Acer negundo*.

b. Heartwood pale brown, often with greenish or grayish cast. Rays darker than background on radial surface. Pith flecks often present (Fig. 17) ..... *Acer rubrum* and *A. saccharinum*.

ACHATOCARPACEAE

Achatocarpus. The Mojan are small trees or shrubs ranging from southwestern United States through Mexico and Central America to Paraguay and Argentina. Their woods are little used.

Wood gray, ashy yellow, or brownish gray. Luster rather low. Taste definitely sweet in well developed heartwood, odor lacking or not distinctive. Hard, moderately heavy, mostly tough and strong; texture fine; grain somewhat roey.

Growth rings indistinct or absent. Pores small (largest 70 to 90μ) invisible without lens, numerous, mostly in pairs, thick-walled, rounded, well distributed (Figs. 6 and 7). Vessels with simple perforations, without spirals; pits minute (3μ). Rays fine, near limit of vision on cross-section, fairly distinct on radial; mostly 1 to 3 (4) cells wide; up to 30 cells high, occasionally fused; heterogeneous; pits to vessels minute (3μ). Wood parenchyma sparingly paratracheal, occasionally slightly confluent. Wood fibers with very small bordered pits; sometimes septate. Ripple marks and gum ducts absent.

AEXTOXICACEAE

Aextoxicon. The only species in this family is the Olivillo (*A. punctatum* Ruiz & Pavon), a medium-sized Chilean tree. The wood is in considerable local demand for general construction and cooperage.

Heartwood pale brown, with a reddish hue; merging gradually into somewhat lighter-colored sapwood. Not highly lustrous. Has the general consistency and appearance of Red Gum (*Liquidambar*). Of medium density and weight, tough and strong; of fine and uniform texture; grain fairly straight; easy to work, finishes very smoothly; rather durable.

Growth rings present but indistinct. Pores very small, (40 to 64μ), angular, scarcely distinct with the lens; sometimes decreasing in size toward late wood; very numerous, crowded, well distributed without definite pattern (Fig. 8). Vessels with scalariform perforation plates having many narrow and closely spaced bars; without spiral thickenings; pitting finely scalariform (Fig. 11). Rays very numerous, inconspicuous; 1 to 4 cells wide and mostly less than 30 cells high; decidedly heterogeneous, the uniseriates with all cells upright or square, the others with procumbent body cells and few to several marginal rows of large cells; scattered rhombohedral crystals

present, usually in enlarged cells (Fig. 9); pits to vessels small, rounded to narrow-elongated and in scalariform arrangement, mostly in square or upright cells (Fig. 10). Wood parenchyma finely reticulate, barely visible with lens. Wood fibers with rather thick walls and numerous large bordered pits. Ripple marks and gum ducts absent.

Explanation of Figures

No. 1. *Aphelandra superba* Lindau (Yale 32008). Cross section showing pore arrangement. A section of the pith is included in the lower portion. ×20.

No. 2. *Beloperone Rohrii* (Vahl) Nees (Yale 16434). Cross section showing pore arrangement and extremely fine rays. ×20.

No. 3. *Bravaisia integerrima* (Spreng.) Standl. (Yale 3964). Cross section showing relative pore sizes and pore arrangement. ×20.

No. 4. *Beloperone Rohrii* (Vahl) Nees (Yale 16434). Vessel member showing typical intervascular pitting. Tang. sect. ×500.

No. 5. *Bravaisia integerrima* (Spreng.) Standl. (Yale 10622). Wood parenchyma-vessel pitting showing various sizes and shapes typical of this and ray-vessel pitting. Rad. ×500.

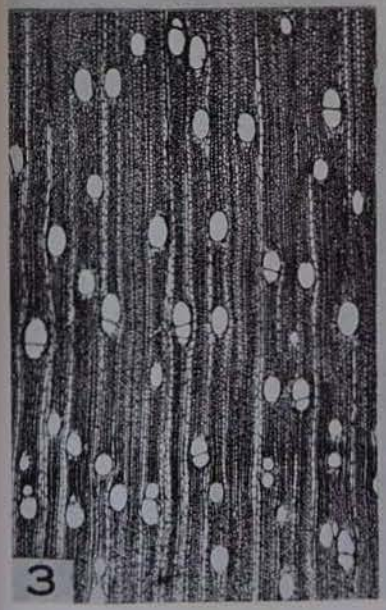
No. 6. *Achatocarpus praecox* Gris. (Yale 1689). Cross section showing pore arrangement and fine rays. ×20.

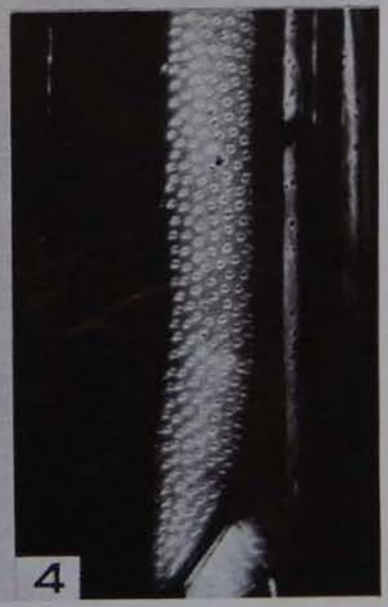
No. 7. *Achatocarpus mexicanus* H. Walt. (Yale 34790). Cross section showing lack of definite growth rings, somewhat coarser rays. ×20.

No. 8. *Aextoxicon punctatum* Ruiz & Pav. (Yale 3771). Cross section showing numerous small, angular pores and numerous, fine, gum-filled rays. ×20.

No. 9. *Aextoxicon punctatum* Ruiz & Pav. (Yale 3771). Large crystals common in square or upright ray cells; reddish gum abundant. Rad. sect. ×500.

No. 10. *Aextoxicon punctatum* Ruiz & Pav. (Yale 3771). Same ray as No. 9. Scalariform ray-vessel pitting. Rad. sect. ×500.



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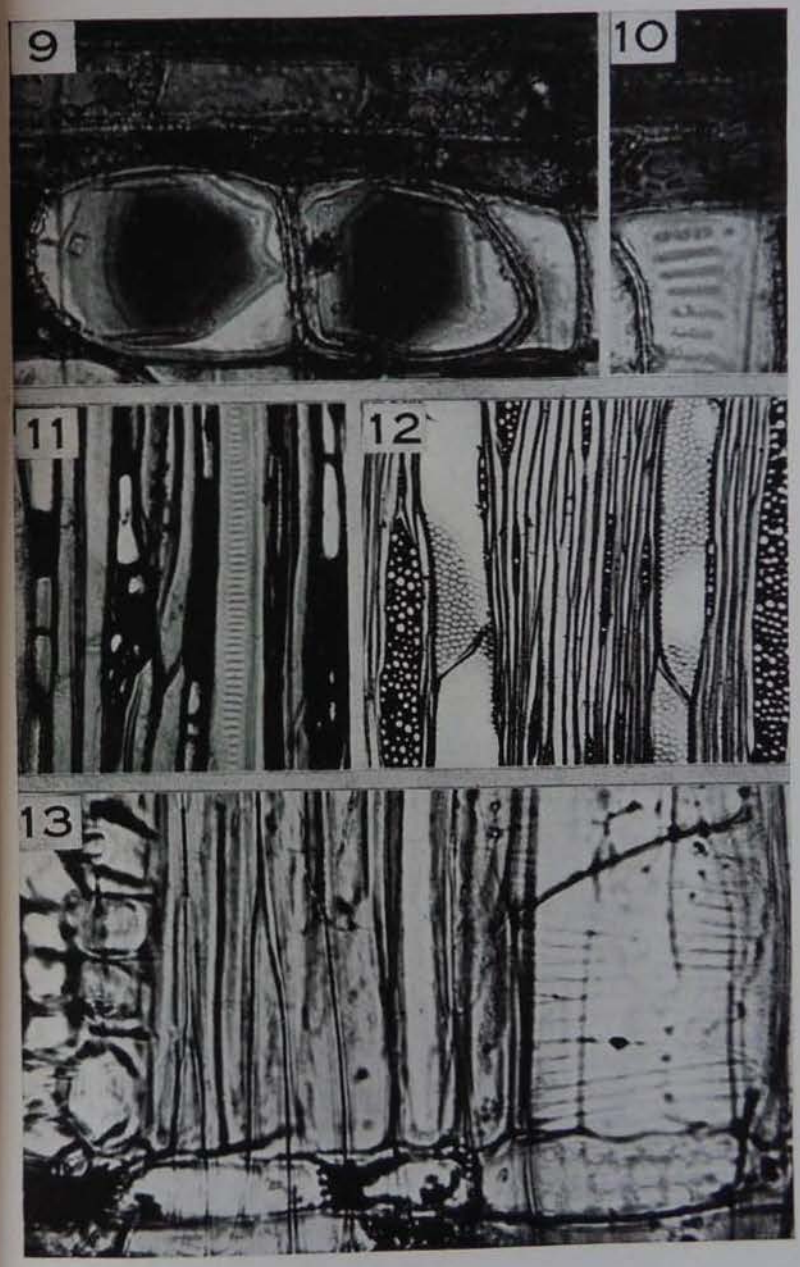
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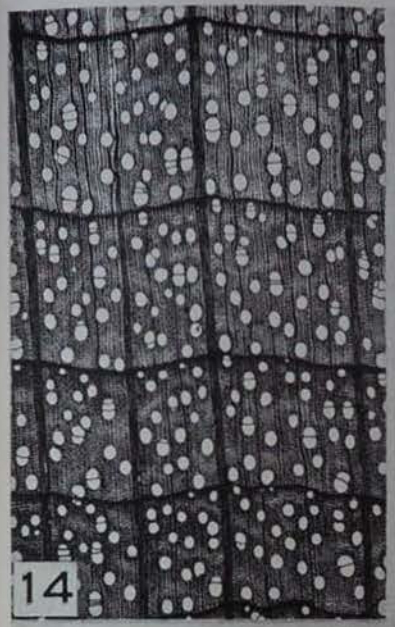
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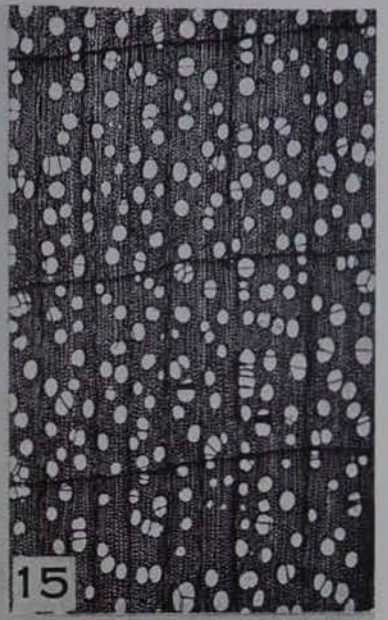
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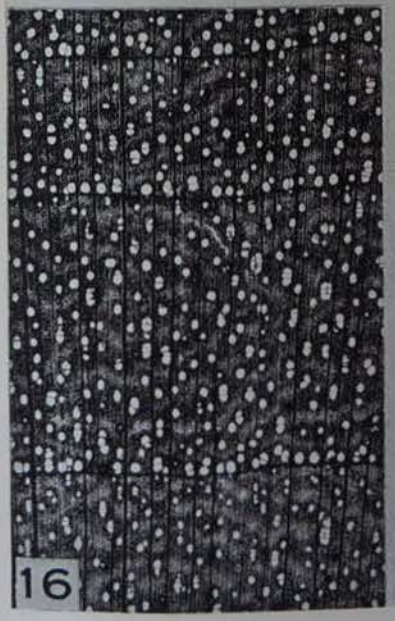
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No. 11. *Aextoxicon punctatum* Ruiz & Pav. (Yale 3771). Scalariform intervascular pitting and closely spaced rays are shown. Red gum abundant in procumbent cells. Tang. sect. ×200.

No. 12. *Acer saccharum* Marsh. Showing frequency of uniseriate rays; medium-sized, alternate intervascular pitting. Tang. sect. ×100.

No. 13. *Acer nigrum* F. A. Michx. (Yale 11444). Spiral thickenings and simple perforation rim in vessel (right side). Ray-vessel pitting (lower right). Parts of two crystal strands (left). Rad. sect. ×500.

No. 14. *Acer saccharum* Marsh. Cross section showing relative ray and pore sizes. ×20.

No. 15. *Acer macrophyllum* Pursh. (Yale 40002). Cross section showing pore and ray sizes; distinct growth ring demarcation. ×20.

No. 16. *Acer negundo* L. (Yale 26857). Cross section showing relative pore and ray sizes. ×20.

No. 17. *Acer rubrum* L. Cross section showing pore and ray sizes. Pith fleck in upper right corner. ×20.

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

A notice calling for nominations to the Council was posted to members on 20th February 1946. Any member who has not received this notice is requested to send his present address to:—

Dr. L. Chalk
Secretary-Treasurer
Imperial Forestry Institute
Oxford, England.

SPECIMENS DESIRED

Mr. Maynard F. Moseley, Jr., of the Department of Botany, University of Illinois, Urbana, Illinois, would like to obtain material of all species of *Casuarina*. Specimens for the anatomical investigation of the mature xylem, bark, young stems, nodal regions, roots and young floral buds would be appreciated.

CURRENT LITERATURE

A manual of southwestern desert trees and shrubs. By LYMAN BENSON and ROBERT A. DARROW. *Univ. Arizona Bul.* (Tucson) 15: 2: April 1944. Pp. 411; 115 plates. Price $3.00.

"The present work is intended to constitute a semipopular or semitechnical manual for identification of trees and shrubs growing in the deserts of the southwestern United States without the intentional aid of man. They include all the woody plants, and only the 'bushy' types, which are more or less transitional between shrubs and herbs, are excluded. However, a few relatively small bushes of especial interest are discussed.

"The text is designed for use in identification of trees and shrubs. The matters of more general interest, including the geographical distribution of species and their values to man or to other animals, appear in large type in order that they may have greater prominence. A few outstanding diagnostic characters of each plant or group of plants are given in likewise larger type in order to facilitate recognition of families, genera, and species. Although determination of the names of plants by use of keys and descriptions given in smaller type is the only thoroughly accurate method, it is hoped that many plants may be recognized by merely consulting the illustrations or by looking up in the index well-established English, Spanish, or Indian names. The floristic or vegetational types included are the creosote-bush (sometimes known locally as greasewood) desert and the desert grassland; and the geographical limits may be summed up roughly as from Palm Springs, California, to El Paso, Texas."—*From author's preface.*

The book is well organized and arranged, printed on excellent paper, copiously and beautifully illustrated. Concise descriptions and keys to the species are well designed for use in identification. The illustrations, a notable feature of the work, include distribution maps, drawings of selected parts, and many superb photographs (some in color) of the plants in their habitat.

Louisiana trees and shrubs. By CLAIR A. BROWN. *Louisiana Forestry Commission* (Baton Rouge) *Bul.* No. 1; August 1945. Pp. 262; 147 figs.

"All of the major forest trees known to occur in the State are included in this publication, along with a number of woody plants of lesser importance. The more common small trees and shrubs are included because of their importance as soil binders, and food for birds and because of their ornamental possibilities. Inasmuch as they are a component part of the forests, the question of their identity is of importance to foresters, botanists, nature lovers, and to people who casually come in contact with them.

"Most of the vines and half-shrubs have been omitted. A number of introduced species have been included because of public interest in them, or because they have escaped from cultivation or show a tendency to escape.

"The descriptions are brief, as non-technical as is possible to make them without rendering them valueless. The maximum or average sizes have not been given for the trees because they mean little nowadays when the majority of the original timbers has been cut. The following size groups have been recognized: small trees, those under 6 inches in diameter; medium-sized trees, those from 6 to 10 inches in diameter; and large trees, those over 10 inches in diameter. All illustrations are original and were taken by the author unless acknowledged."—*From author's preface.*

American species of *Amelanchier*. By GEORGE NEVILLE JONES. *Illinois Biol. Monographs* (Univ. Illinois, Urbana) 20: 2; 1946. Pp. 126; 23 plates; 14 maps.

"*Amelanchier* is a genus of shrubs and small trees belonging to the sub-family Pomoideae of the Rosaceae and including not more than two dozen species widely distributed in North America, Europe, northern Africa, and eastern Asia. Some kinds are highly ornamental and are planted for the showy early white flowers, as well as occasionally for the more or less edible fruits. Only the American species are included in this paper. Their number is eighteen. Two others formerly included in *Amelanchier*, inhabiting Guatemala and Mexico (and southern Texas), have been transferred to the genus *Malacomeles*, and are treated in another paper.

"The origin of the generic name *Amelanchier* is not definitely known, but probably it has been derived from the Provençal name of the European *Amelanchier ovalis* Medic. The American amelanchiers are known by the common names serviceberry, sarviceberry, sarvis, maycherry, juneberry, shadblow, shadbush, shadberry, shadblossom, shadflower, shadwood, sugar pear, wild pear, lancewood, boxwood, Canadian medlar, bilberry, snowy mespilus, saskatoon, and perhaps some others. These vernacular names are used as follows: serviceberry, because of the similarity of its fruit to that of the European service tree (*Sorbus torminalis* (L.) Crantz); juneberry because the berry-like fruits of certain species ripen in June; in the eastern part of the United States the names shadblow, shadberry, shadblossom, shadflower, and shadwood are used for certain species that are in bloom when shad begin to ascend the streams. Lancewood and boxwood have been applied to other species because their wood has been used for handles for tools. The name saskatoon, used in western Canada for the fruits of *Amelanchier alnifolia* Nutt. and the bushes on which they grow, originated with the Blackfoot Indians, who used the fruits either fresh or dried. The pemmican of the Indians was composed of dried and pulverized deer or buffalo meat to which was added saskatoon berries, the mixture then

being stirred into boiling fat, and when cooled molded into cakes. Explorers and prospectors found the fruits a welcome addition to their food supply, and it is recorded that the fruit of *A. alnifolia* was used by the members of the Lewis & Clark Expedition when they ran short of other food. The foliage of some of the western species is a palatable forage for grazing animals. Some of the eastern species make a satisfactory stock on which to graft the pear and quince."—*From author's introduction.*

This monograph of the genus recognizes 20 species and two varieties. Keys and distribution maps are included.

Journal of the Arnold Arboretum (Jamaica Plain, Mass.) 27: 1 & 2: 1-252; January, April 1946.

CONTENTS

Notes on *Betula* in Eastern North America. By M. L. FERNALD. *Rhodora* 47: 562: 303-329; 13 plates; October 1945.

A number of the problems of nomenclature and identification that have long existed within this genus are disposed of in the manner that characterizes the author's authoritative work. A key to the Series Albae and excellent plates are included. The article is to be continued.

Eastern North American representatives of *Alnus incana*. By M. L. FERNALD. *Rhodora* 47: 563: 333-361; 14 plates; November 1945.

The name of Swamp Alder is changed from *Alnus incana* to *Alnus rugosa* (Du Roi) Spreng. The various forms and varieties are cited. Excellent photographic plates are included.

Algunas plantas notables de Tepoztlan, Mor. By DÉBORA RAMÍREZ CANTU. *An. Inst. Biol. Mexico* (Chapultepec, Mexico, D.F.) 16: 2: 353-357; 1945.

Prunus Ochoterenae sp. nov. is described. The collection of species of several other genera is noted.

Structural timber for bridge construction in Central America. By JOHN A. SCHOLTEN. Reprinted from Proc. Twenty-fourth Annual Meeting Highway Res. Board; pp. 202-206; December 1944.

"The situation as regards the use of Central American woods for bridge or other construction may be summarized as follows: Large mixed stands of timber, mostly hardwoods, exist in Central America. A number of the woods undoubtedly have a favorable combination of the properties required for structural timber, and the required sizes could be obtained from the trees. Detailed data on the strength and other properties of the wood, however, are lacking, and in the absence of such data no direct comparison can be made between Central American woods and those used in the United States for structural purposes, nor can the Central American woods be used to best advantage. The mixed stands and the transportation of lumber or logs from the forest present difficult problems. Until these problems are solved and until more adequate data are available on the properties of the various woods, the use of Central American woods for structural purposes will be confined largely to localities near the forests, to the more readily available stands, and to the woods whose properties are best known."

"Specific gravity and modulus of rupture values for a number of Central American woods are shown in Table 1. The specimens on which the specific gravity values for species in Table 1 numbered 1, 4, 5, 9, 10, 11, 15, 16, and 19 are based were obtained from San Isidro del General, Costa Rica; those for species numbered, 3, 8, 21 from El Volcán, Panama, and the specimens of species No. 25 were obtained 36 kilometers south of Cartago, Costa Rica. The values for the remaining species in Table 1 are based on specimens from various sawmills in Costa Rica. The modulus of rupture values were obtained from specimens 1 by 1 by 15 in. tested over a 12-in. span on a homemade machine. The values have relative significance only and are not comparable with the results of standard tests made elsewhere."

TABLE 1

DETERMINATIONS OF SPECIFIC GRAVITY AND BENDING STRENGTH OF 25 SPECIES OF CENTRAL AMERICAN WOODS

Specimen number	Species	Specific gravity, based on weight when oven-dry and volume when green	Modulus of rupture when green
			Lb. per sq. in.
1	Alasán *(Ormosia toledoana)**	0.45	9,750
2	Amarillón *(Terminalia amazonia)*	0.59	
3	Bambito colorado *(Ocotea cuneata)**	0.43	
4	Bolador *(Persea Austin-Smithii)*	0.50	11,300
5	Campona *(Laplacea semiserrata)*	0.48	10,350
6	Cedro Amargo	0.38	
7	Cedro macho (2)	0.50	
8	Cenizo *(Chaetoptelea mexicana)*	0.61	
9	Chancho blanco *(Goethalsia meiantha)*	0.57	11,300
10	Colorado *(Nectandra concinna)*	0.72	13,350
11	Comenegro *(Hieronyma oblonga)*	0.73	11,750
12	Cristobal	0.62	
13	Fruta Dorada *(Virola Koschnyi)*	0.39	
14	Guayacán *(Sweetia panamensis)*	0.80	
15	Ira chiricana *(Vantanea Barbourii)*	0.62	13,800
16	Ira rosa *(Lauraceae)*	0.34	6,340
17	Laurel *(Cordia alliodora)*	0.34	
18	Magnolia *(Vochysia* sp.)	0.35	
19	Mariá *(Calophyllum brasiliense)*	0.45	9,780
20	Pilón or Zapatero *(Hieronyma alchorneoides)*	0.59	
21	Pizarrá *(Persea pallida)**	0.43	
22	Pochote *(Bombacopsis Fendleri)*	0.34	
23	Quina	0.58	
24	Quizarra	0.44	
25	Roble (Oak) *(Quercus copeyensis)*	0.74	

*Probable species. Information was insufficient for accurate identification.

Plants of Mexico and Central America—I. By CYRUS LONGWORTH LUNDELL. *Wrightia* (Dallas, Texas) 1: 2: 145-160; 3 figs.; April 1946.

Species referred to *Licaria* and *Acrodiclidium* are transferred to *Misanteca*. New species are described in the genera *Endlicheria*, *Nectandra*, *Persea*, and *Phoebe* of the Lauraceae. New species are also proposed for *Lonchocarpus*, *Celastrus*, *Maytenus*, *Microtropis*, and *Parthesis*.

"A broad study to redefine generic limits in the Lauraceae is an urgent need." (! Ed.)

Flora of Guatemala. By PAUL C. STANDLEY and JULIAN A. STEYERMARK. *Fieldiana: Botany* (Chicago Nat'l Hist. Mus., Chicago) 24: 4: 1-493; April 1946.

"The *Flora of Guatemala*, of which this is the first part to be published, has been in preparation for the past six years. It is based upon published records of Guatemalan plants and upon the earlier collections now available in the Herbarium of Chicago Natural History Museum. Principally, however, it records new information obtained by the authors during four botanical expeditions of the Museum. These expeditions were extended to all the twenty-two departments of Guatemala and to almost all corners of the country. This intensive exploration was possible because of the admirable network of Guatemalan roads, which enable one to reach by automobile almost every village except in a few sparsely settled areas. These the junior author has explored on foot or on horseback.

"Almost all the manuscript of the *Flora* has been written, at least in provisional form, and it was planned to publish it in systematic order. Because of conditions imposed by the war, this has been found impractical. Part I will include an account of the general features of Guatemalan vegetation, a résumé of the history of its exploration, and other pertinent matter.

"It is believed that the form in which the data are presented on the following pages will be found sufficiently obvious, but an explanation of some of the details will be

included in the introductory chapters. The flora of Guatemala, as here considered, includes that of British Honduras, which is continuous with that of the departments of Petén and Izabel. There is no reason to suppose that in British Honduras there exists more than a handful of species that will not be found eventually in Guatemala."—*Author's introduction.*

The concise descriptions, keys, and notations are typical of the senior author's excellent *Trees and Shrubs of Mexico.* The lucid commentary that is interspersed adds much interesting information, largely gleaned from skilled field observations.

Riqueza forestal Dominicana. Tomo II. By José Schiffino. Pub. by Sec. Estado de Agri. y Riego (Ciudad Trujillo, Dom. Rep.). Pp. 239; ill.; 1945.

This is the second of the three volumes which will describe the trees of the Dominican Republic. (See *Tropical Woods* 84: 26 for review of Tomo I.) The organization and content are similar to Tomo I. The volume is copiously illustrated with generally very poor photograph reproductions.

Studies in the Sapotaceae—V. The South American species of *Chrysophyllum*. By Arthur Cronquist. *Bul. Torrey Bot. Club* 73: 3: 286-311; May 1946.

"In continuation of my studies on the American Sapotaceae, under the auspices of the Chicle Development Company, I have undertaken a revision of the South American species of *Chrysophyllum*. Thirty species are here recognized, two of which are known to me only from the original descriptions. Three new species are described. The species are, in general, well marked and sharply defined, and, with the exception of *C. marginatum*, do not show an unusual amount of intraspecific variability. The number of species still known from only one or a very few collections suggests that others remain to be discovered."

Caldasia. *Boletín del Instituto de Ciencias Naturales de la Universidad Nacional de Colombia* (Bogotá), 3: 15: 421-474; December 1945.

Contents (Botanical)

Estudios sobre plantas Andinas, VI (pp. 421-437; 4 figs.), by Jose Cuatrecasas.

Plantae Austro-Americanae, IV (pp. 439-444; 1 fig.), by Richard Evans Schultes.

Revaluación de *Philodendron hederaceum* Schott (1829) como transferencia de *Arum hederaceum* Jacq. (pp. 445-452; 1 fig.), by Armando Dugand.

Plantae Austro-Americanae III. By Richard Evans Schultes. *Bot. Mus. Leaflets* (Harvard, Cambridge), 12: 4: 117-132; 8 plates; January 1946.

"A number of recently made collections, chiefly from eastern Colombia, represent hitherto undescribed concepts or range extensions. It appears advisable to present the following notes on the significance of these collections as a contribution to our rapidly growing understanding of the flora of the northwesternmost reaches of the Amazonian system."

Included are accounts of *Septotheca Tessmannii* Ulbrich, *Hevea viridis* Huber var. *toxicodendroides* R. E. Schultes & E. L. Vinton, *Sapium Cuatrecasasii* Croizat, *Mayna integrifolia* (Kuhlm.) R. E. Schultes comb. nov., *Mayna longifolia* Poeppig var. *phasmatocarpa* R. E. Schultes var. nov., and *Castilla Ulei* Warb. forma *lecithogalacta* R. E. Schultes forma nov.

Vocabulario de terminos vulgares en historia natural Colombiana. By Hermano Apolinar Maria. *Acad. Col. Cienc. Ex., Fis., & Nat.* (Bogotá) 6: 22 & 23: 172-204; 2 plates; January-August 1945.

The dictionary of names has now reached 1959 entries, listing names through "Centella." The usage and scientific equivalents are given for each name.

Sobre las quinas de los Estados Unidos de Colombia. By Nicolas Osorio. *Acad. Col. Cienc. Ex., Fis., & Nat.* (Bogotá) 6: 22 & 23: 244-273; 13 plates; January-August 1945.

The quinine industry of Colombia is described with respect to the species supplying the bark, their abundance and value, the alkaloid contents, methods of harvesting and processing, cultivation, export, etc. Three plates in color show the various types of bark.

Notas a la flora de Colombia, VII. By José Cuatrecasas. *Acad. Col. Cienc. Ex., Fis., & Nat.* (Bogotá) 6: 22 & 23: 274-299; 5 plates; January-August 1945.

Thirty-five species and four varieties are described as new to *Cecropia* (Moraceae).

Estudio preliminar del genero *Hevea* en Colombia. By Richard Evans Schultes. *Acad. Col. Cienc. Ex., Fis., & Nat.* (Bogotá) 6: 22 & 23: 331-338; 2 plates; January-August 1945.

A general description of the species of *Hevea* and their occurrence in Colombia. A key to the species is included.

Un informe sobre las reciente colecciones de Rubiaceas del Equador. By William Campbell Steere. *Flora* (Quito, Ecuador) 5: 13 & 14: 85-113.

A translation into Spanish from *Bul. Torrey Botanical Club* 72: 3: 295-311 by Prof. B. de Acosta Solis.

New or noteworthy Leguminosae of the Brazilian Amazon. By A. Ducke. *Boletim Técnico Inst. Agron. do Norte* No. 2; October 1944. Pp. 33.

Twenty-nine species and one variety are described as new. The author's interesting field observations and analyses are interspersed.

O gênero *Strychnos* L. na Amazônia Brasileira. By A. Ducke. *Boletim Técnico Inst. Agron. do Norte* No. 3; January 1945. Pp. 23; 1 fig.

The species of *Strychnos* and their occurrence in the Brazilian Amazon valley are discussed. Thirty-six species are dealt with. One new species, *Strychnos pachycarpa* Ducke, is described.

New forest trees and climbers of the Brazilian Amazon. By Adolpho Ducke. *Boletim Técnico Inst. Agron. do Norte* No. 4; March 1945. Pp. 29.

Seventeen new species are given in the genera *Brosimum* and *Helicostylis* (Moraceae); *Iryanthera* and *Virola* (Myristicaceae); *Sacoglottis* (Linaceae); *Vochysia* (Vochysiaceae); *Dendrobangia* (Icacinaceae); *Sterculia* (Sterculiaceae); *Matisia* (Bombacaceae); *Renggeria* (Guttiferae); *Buchenavia* (Combretaceae); *Chimarrhis* (Rubiaceae). Two new genera, *Aptandropsis* (Olacaceae) with two species and *Striolaria amazonica* Ducke (Rubiaceae), are described.

Album floristico. Serviço Florestal (Rio de Janeiro), June 1943. Pp. 67 plus 8; 33 color plates; 9 x 11.

"The Forest Service of Brazil distributed the first volume of the 'Album Floristico' in 1932. The album was designed to popularize the knowledge of the most conspicuous flowering trees of Brazil with special reference to their suitability for decorative and ornamental purposes. In the second edition of the album, published eight years later, the size of the illustrations was enlarged, and the botanic descriptions and text concerning aesthetic qualities were increased.

"By bringing together and coordinating the material on the subject, it is now possible to publish this second volume in the series as another step toward a more adequate knowledge of ornamental trees of Brazil. The volume does not represent the results of a complete botanical study of our decorative trees since the flora in Brazil are not yet perfectly known. It does, however, present a preliminary treatment of the subject and forms the basis for future publications of a more comprehensive nature."—*Introduction.*

Esquisse de mes voyages au Brésil et Paraguay. By AUGUST DE SAINT-HILAIRE. *Chronica Botanica* (Waltham, Mass.) 10: 1; 1946. Pp. 61; 4 figs. Price $2.00.

The introduction to Saint-Hilaire's "Histoire des plantes les plus remarquables du Brésil et du Paraguay" (1824) is printed verbatim. An introductory biographical sketch (pp. 5-21) by Anna E. Jenkins is included.

A revision of *Hancornia* (Apocynaceae). By JOSEPH MONACHINO. *Lilloa* (Tucuman, Arg.) 11: 1: 19-48; 1945.

"In this article an attempt is made to summarize all the important taxonomic information concerning the species and varieties of *Hancornia*, whereas all outstanding non-taxonomic references are at least included in the bibliography. The history and synonymy are complete, and all the names dealing with the genus are accounted for. The monospecific status of *Hancornia* is accepted; although no final disposition of the subspecific elements is advanced, the case for varietal treatment in the species is presented in full."—*Author's conspectus.*

The wood of *Ambelania laxa* Muell. Arg. By IRMA E. WEBBER. *Lilloa* 11: 1: 49-54; 2 plates (11 photomicrographs); 1945.

"Although Bentham reported in 1841 that on the Rio Negro the wood of *Ambelania laxa (Tabernaemontana laxa* A. DC.) 'from its excessive lightness, is used for various purposes instead of cork,' apparently no value has been attached to the wood of this genus in recent years. However, in view of the present demands of the refrigerator, radio, and aviation industries for light-weight woods, and consequent interest in Balsa *(Ochroma)* substitutes, the possible future importance of the wood of *Ambelania* should not be disregarded. Record and Hess report its weight as 9 lbs. per cu. ft. The woods of several species of the related genus *Alstonia* of Asia, Africa, and the Pacific Islands are among the lightest now known.

"The exceedingly light-weight wood of *Ambelania laxa* is unusually soft, and in common with many other light-weight woods it is nearly colorless, being whitish streaked with pale gray. It is rather lustrous, without distinctive taste or odor, and like the wood of *Alstonia spathulata* Bl. is velvety to the touch. It also resembles *Alstonia* wood in having homogeneous rather than laminated structure and widely scattered radial canals readily visible to the naked eye. It is diffuse-porous, with barely visible growth rings from 0.5 to 2 mm. wide marked by very narrow bands of slightly smaller tracheids. The pores are indistinct without a lens and inconspicuous with it because all of the wood elements are very thin-walled and the tracheids comprising the bulk of the wood are of about the same diameter as the pores. The rays are straight and, to the unaided eye, readily visible on radial, barely visible on transverse, and invisible on tangential sections. Wood parenchyma is visible with a hand lens on cross sections as very fine and closely spaced tangential lines."

Contributions to the flora of extra-tropical South America. VII. By HAROLD N. MOLDENKE. *Lilloa* 11: 2: 189-259; 1945.

This article is a continuation of a series published in this journal.

Estudio xilológico del *Drimys Winteri*. By LUCAS A. TORTORELLI. Pub. Tec. No. 2, *Min. Agri. Nacion, Direccion Forestal* (Buenos Aires), 1945. Pp. 11; 2 plates. (A reprint from Rev. Facultad Agron. y Vet. Univ. Buenos Aires 11: 1; November 1944.)

"The structure of the Dicotyledons, characterized by the presence of wood made up of tracheids, fibers, woody rays and woody parenchyma, is noticeably different from that presented by the wood of *Drimys Winteri*. In spite of this, this species of the dendrological flora of the subantartic forests is situated systemically in this large group.

"It shows on the other hand a great resemblance with the wood of the Conifers, since like them, it contains only

tracheids and woody rays; but these last are joined into multiseriates."—*Translation of author's summary.*

La disposición estratificada de los elementos leñosos en el "ibira-ita" *(Muellera Glaziovii)*. By Lucas A. Torrorelli. Pub. Tec. No. 5, *Min. de Agri. Nacion, Direccion Forestal* (Buenos Aires), 1945. Pp. 4; 1 plate. (A reprint from *Darwiniana*, Rev. Inst. Bot. Darwinion 7: 1: 58-61; 1945.)

A description of the wood of *Muellera Glaziovii* (Taub.) Chod. & Hassl. is presented.

Plants of the Manua Islands. By T. G. Yuncker. Bernice P. Bishop Museum (Honolulu) Bul. 184; 73 pp.; 1 map; 1945.

"The volcanic islands of Ofu, Olosega, and Tau are known collectively as Manua, now part of American (Eastern) Samoa. They are situated between 169 and 170 degrees west longitude and 14 and 15 degrees south latitude and are about 67 miles east of Pago Pago on the island of Tutuila. Tau, containing about 14 square miles, is the largest and attains an altitude of over 900 meters. It is more or less dome shaped with precipitous coasts on the northern and western sides. Ofu and Olosega, only a few miles distant, are rugged and picturesque and are separated from each other by a narrow and shallow strait."

"The original vegetation has now been exterminated to a large extent on the lowlands and lower hillsides to provide for coconut and banana plantations. It still persists, however, at the higher altitudes and in ravines and other areas too rough for cultivation. The vegetation in these regions, especially on Tau, is exceedingly dense and travel off the trails is difficult."

"The present list includes 37 species of mosses, 53 species of pteridophytes, 95 species of monocotyledons, and 236 species of dicotyledons, or a total of 421 species. More careful botanizing, particularly at high altitudes on Tau, will probably bring to light several species hitherto overlooked."

Japan, forest resources, forest products, forest policy. By W. N. Sparhawk. Forest Service, U. S. Dept. Agri. (Washington, D. C.), 1945. Pp. 89; mimeographed.

This is a compiled report describing Japan's forest resources, wood utilization and consumption, forest management and policy, and important trees.

Notes on forests and trees of the central and southwest Pacific area. By W. N. Sparhawk. Forest Service, U. S. Dept. Agr. Washington, D. C.), 1945 (?). Pp. 78; mimeographed.

Brief descriptions of the trees and woods, together with their uses when known, are given for woods of the principal islands. The bibliography is closely referenced to the text.

Forest products Laboratory. National Bureau of Industrial Research, Ministery of Economic Affairs, Kaiting, Sze., China; January 1946. Pp. 89; 1 map.

The work and the future program of the Chinese Forest Products Laboratory are outlined. There is a brief discussion of the forests, annual cut, and important species. Fifteen recent Laboratory reports are abstracted. (In English and in Chinese.)

New ligneous plants from eastern Szechwan. By Y. C. Yang. Reprint from *The Jour. of the West China Border Research Society* 15: Series B: 89-91; 1 plate; 1945.

Diospyros sutchuensis Yang, *Evonymus chloranthoides* Yang, and *Alangium Fabri* Oliv. var. *heterophyllum* Yang are described as new.

New species, varieties, and combinations of Lauraceous plants By Y. C. Yang. Reprint from *Jour. West China Border Res. Soc.* 15: Series B: 70-88; 13 plates; 1945.

A new genus, *Pseudolitsea*, and a number of new species, varieties, forms, and combinations are described and referenced.

Suitable species for dry and desert areas. By R. L. Badhwar. *Indian Forester* 72: 2: 64-73; February 1946.

A compiled list of 193 species of trees, shrubs, herbs, and grasses useful in afforestation. Their applications and the use of their products are given.

An anatomical study of *Tiliacora acuminata* Miers. By Balwant Singh. *Jour. Indian Bot. Soc.* 24: 3: 135-146; 13 figs.; August 1945.

The anatomical structure of the stem, leaf and root are described in detail. One drawing, one photograph and 11 photomicrographs are appended.

Ficus tsjahela. By Mary F. Barrett. *Bul. Torrey Bot. Club* 73: 1: 86-90; January 1946.

"The preceding study has collected and discussed synonyms listed by King and others, has differentiated *F. tsjahela* from the type of *F. lacor* Ham. and from *F. geniculata* Kurz, and has corrected some mistakes in determination, authorship, and spelling."—*From author's summary.*

The case of the vanishing *Ficus racemosa.* By Mary F. Barrett. *Bul. Torrey Bot. Club* 73: 3:312-325; May 1946.

"Evidence from descriptions of *Atty-alu* Rheede, the prototype of *Ficus racemosa* L.; from descriptions and reports of *F. racemosa;* from descriptions, herbarium specimens and observation of living trees of *F. glomerata;* and from opinions expressed in literature as to these species proves that *F. glomerata* Roxb. belongs to the species *F. racemosa* L."—*From author's summary.*

Ficus altissima. By Mary F. Barrett. *Bul. Torrey Bot. Club* 72: 4: 395-398; July 1945.

The largest trees of *Ficus bengalensis* may have a crown diameter of 90 to 180 meters and potential secondary trunks numbering up to 4350.

"The main differences between two tall 'banyans' with somewhat similar leaves and figs are as follows. *F. bengalensis* L. has a much more widely spreading crown than has *F. altissima* Blume, and infinitely more secondary trunks. Its leaves usually are obtuse at the apex and velvety to the touch. They commonly have two sets of large basal veins. The ripe figs are globose, red, velvety, smaller than those of *F. altissima*, and have three separate leafy basal bracts. *F. altissima* has glossy leaves with a conspicuous light-colored V made by its single set of large basal veins, and a rounded apex bearing an abrupt acumen. The figs are ovoid, usually yellow and bare, and rest on a thick pad of united basal bracts. Both species now have a wide distribution; but *F. bengalensis* probably is native only to India and neighboring states, while *F. altissima* has been found wild from India to South China."—*From author's summary.*

Some notes on ultilisation of timbers in the south-west Pacific. By Stewart Cameron. *New Zealand Jour. For.* 5: 2: 117-127; 2 figs.; 1945.

An account is given of the Australian, American, and New Zealand army sawmill operations in the south Pacific islands, particularly New Guinea. The writer briefly describes the woods he encountered in the New Guinea territories of Manus, Los Negros, and New Britain. The future of commercial utilization in this area is discussed.

Catalogus en reglement van de bibliotheek. Staatsbosch-beheer, Utrecht, 1946. Pp. 167.

The catalogued references are systematically arranged and classified according to subject and author.

A propos des *Abies* des confins du Chen-si, du Se-tchouan et du Hou-pé. By O. Borderes-Rey and H. Gaussen. Extrait du *Bul. Société d'Histoire Naturelle de Toulouse* T. 79; 14 pp.; 2 figs.; 1944. (*Travaux du Laboratoire Forestier de Toulouse* 1: 4: 5: 1-14; 1944.)

The species and varieties of *Abies* and their botanical characteristics are discussed.

Le rameau phylétique: *Pinus, Pseudolarix, Keteleeria.* By Y. DE FERRÉ and H. GAUSSEN. Extrait du *Bul. Société d'Histoire Naturelle de Toulouse* T. 80; 11 pp.; 2 figs.; 1945. *(Travaux du Laboratoire Forestier de Toulouse* 1: 4: 8: 1-11; 1945.)

The various evolutionary characters of the genera are analyzed and tabulated. A new conception of the phylogeny of the Abietineae is proposed graphically.

L'evolution parallèle des Taxodinées et des Abiétinées. By Y. DE FERRÉ. Extrait du *Bul. Société d'Histoire Naturelle de Toulouse* T. 78; 13 pp.; 7 figs.; 1943. *(Travaux du Laboratoire Forestier de Toulouse* 1: 3: 22: 1-13, 1943.)

Evolutionary characters are discussed and graphically presented.

Une nouvelle espèce de *Pseudolarix: P. Pourteti.* By Y. DE FERRÉ. Extrait du *Bul. Société d'Histoire Naturelle de Toulouse* T. 79: 9 pp. 3 figs.; 1944. *(Travaux du Laboratoire Forestier de Toulouse* 1: 4: 4: 1-9; 1944.)

The various characters of the new species, including anatomical and morphological are analyzed.

Richesse en cendres et teneur en silice des bois tropicaux. By A. BESSON. *L'Agronomie Tropicale* (Nogent-sur-Marne, France) 1: 1 & 2: 44-56; 2 figs.; 3 graphs; 1946.

The amount of silica present in the wood and the ash is determined for numerous species.

"In the woods rich in silica, the silica particles are easily recognized on properly mounted preparations. Always localized naturally in the parenchymatous tissues of the wood, they are distributed as follows: throughout *(Cola attiensis, Dicorynia* sp.); or only in the ray cells, in nearly all the cells *(Parinari* sp. pl., *Uapaca* sp. pl.), or only in the cells of the outermost rows *(Pachylobus* sp. pl.); or only in the cells of the vertical parenchyma *(Distemonanthus* sp., *Dialium* sp. pl.)."—*Translation from author's summary.*

Les *Lannea* de l'Afrique occidentale Française. By A. AUBRÉVILLE. *L'Agronomie Tropicale* 1: 3 & 4: 125-137; 3 pl.; 2 figs.; 1946.

The various species of *Lannea* are described, illustrated, and tabularly arranged. Specimens are cited and distribution maps presented.

Les clés pour l'identification des bois et le systeme des fiches perforées. By D. NORMAND. *L'Agronomie Tropicale* 1: 3 & 4: 162-172; 5 figs.

The perforated card system of classification and identification of woods is discussed. The characters used are listed with examples.

Forêts vierges et bois coloniaux. By AUGUSTE CHEVALIER and DIDIER NORMAND. Pub. by Presses Universitaires de France (Paris). 1946. Pp. 127.

"The exploitation of the colonial forests presents many problems. We have been studying them for a long time. It seemed to us that the time had come to make a synthetic exposé of the subject. We have described, in the first chapter of this work, the principal aspects of the colonial forests paying particular attention to the dense equatorial forest of Africa which furnishes the principal woods exported to Europe at the present time." (Translation).

The problems are discussed in six chapters, including the colonial forests and their silviculture and characteristics, exploitation and utilization of the colonial woods.

Les Méliacees du Congo Belge. By P. STANER. *Bul. Jardin Botanique de l'Etat* (Brussels) 16: 2 & 3: 109-251; 13 figs., 13 plates; December 1941.

A comprehensive treatment of the family as it occurs in Belgian Congo. Species of twelve genera are described in detail. A key to the species is included with each genus. The plates and figures include numerous detailed drawings; two of the plates are colored.

Note sur le *Xylia Ghesquierei* Robyns. By W. Robyns. *Bul. Jardin Botanique de l'Etat* (Brussels) 16: 2 & 3: 253-258; 2 figs.; December 1941.

This is an expanded description based upon more complete material than the original.

Contribution a l'étude du genre *Afrormosia* au Congo Belge. By Jean Louis. *Bul. Jardin Bot. de l'Etat* (Brussels) 17: 1: 109-116; December 1943.

An analysis of the genus and a listing of the species found in this region.

Revision des Piperaceae du Congo Belge. By S. Balle. *Bul. Jardin Bot. de l'Etat* (Brussels) 16: 4: 367-405; December 1942.

The family (genera *Peperomia* and *Piper*), as it occurs in Belgian Congo, is dealt with in detail.

Note sur les Ulmacées du Congo Belge. By Lucien Hauman. *Bul. Jardin Bot. de l'Etat* (Brussels) 16: 4: 407-412; December 1942.

Species of *Hoptelea*, *Celtis*, *Trema*, and *Chaetacme* are noted.

Le genre *Protea* L. en Afrique tropicale. By Lucien Hauman. *Bul. Jardin Bot. de l'Etat* (Brussels) 17: 2: 163-176; December 1944.

Six new species of *Protea* are described. The species of the genus are arranged in a descriptive key.

Les *Loranthus* du Congo Belge. By S. Balle. *Bul. Jardin Bot. de l'Etat* (Brussels) 17: 2: 225-244; December 1944.

"Note préliminaire a l'étude des Loranthoidées d'Africa." Eleven new species and several varieties are described. A list of the species found in the Belgian Congo is included.

Essences forestières es bois du Congo: *Afrormosia elata.* By Jean Louis and Joseph Fouarge. *Publ. l'Inst. Nat. l'Etude Agron. Congo Belge* (Brussels) No. 2, 1943. Pp. 22; 6 plates.

A monograph of the species covering the botanical description, its position in the genus, its ecological and geographical distribution, sizes, volumes per individual and per hectare, and other general descriptive information. A detailed description of the wood is included. The photographic illustrations, including four photomicrographs and one color plate of the wood, are superb.

Essences forestières et bois du Congo: *Guarea Thompsoni.* By Jean Louis and Joseph Forarge. *Pub. l'Inst. Nat. l'Etude Agron. Congo Belge* (Brussels) No. 3, 1944. Pp. 38; 4 plates.

A monograph of the species very similar in treatment to that of the preceding review.

Le quinquina. By E. H. J. Stoffels. *Publ. l'Inst. Nat. l'Etude Agron. Congo Belge* (Brussels) Série Tech. No. 24, 1939. Pp. 51; 21 figs.

A study of *Cinchona* with respect to the establishment, maintenance, and harvest of plantations.

Directives pour l'établissement d'une plantation d'*Hevea* greffés au Congo Belge. By M. Ferrand. *Publ. l'Inst. Nat. l'Etude Agron. Congo Belge* (Brussels) Série Tech. No. 25, 1941. Pp. 47; 13 figs.

Instructions are given for the selection of site, establishment and management of the plantation, harvest and preparation of the rubber.

Additional notes on the Simaroubaceae. By Arthur Cronquist. *Brittonia* 5: 4: 469, 470; November 1945.

On the basis of additional material *Castela erecta* Turp. subsp. *typica* Cronquist, *C. erecta* Turp. subsp. *texana* (T.

& G.) Cronquist, and *C. erecta* Turp. subsp. *galapageia* (Hook.f.) Cronquist are proposed to replaced the former species.

A revised arrangement of the family, including the genus *Diomma*, is included.

A revision of *Ambelania*, inclusive of *Neocouma* (Apocynaceae). By Joseph Monachino. *Lloydia* 8: 2: 109-130; June 1945.

"In the preliminary study the two species described in *Neocouma* are transferred to *Ambelania*, resulting in the new combination *A. ternstroemiacea* and the new name *A. Markgrafiana*. *A. Sagoti* and *A. tenuiflora* are placed in synonymy under *A. acida*. *Ambelania* is regarded as containing the most heterogeneous specific elements in all the genera of Carisseae in America, but nevertheless as displaying sufficient unity and integration of its components to be maintained as a single comprehensive genus. A systematic treatment of the group is presented, with key, short descriptions, and bibliography."—*Author's summary*.

***Pinus*: a contribution of turpentine chemistry to dendrology and forest genetics.** By N. T. Mirov. *Journ. For.* (Washington, D. C.) 44; 1: 13-16; January 1946.

"Each pine species has its peculiar turpentine, the chemical composition of which is specific. Certain factors interfere with the specificity of the turpentines, but if these are taken into consideration knowledge of their chemical composition is valuable in taxonomic and genetic studies."

The various chemical compounds in turpentine which permit separation of species, or even some varieties, of *Pinus* are discussed.

A useful method for drying plant specimens in the field. By Cyrus Longworth Lundell. *Wrightia* (Dallas, Texas) 1: 2: 161-162; 2 figs.; April 1946.

The author describes the use of kerosene lanterns, a wood supporting framework, and a canvas skirt with a drawstring top for drying herbarium specimens in presses between stiff double-faced corrugated boards (aligned vertically) in direct contact with sheets containing the plant material. Temperatures are regulated by varying the number of lanterns.

Morphology of *Euptelea* and comparisons with *Trochodendron*. By Charlotte G. Nast and I. W. Bailey. *Journ. Arnold Arboretum* 27: 2: 186-192; 4 plates; April 1946.

"The morphological differences between *Euptelea* and *Trochodendron* are numerous and indicative of divergent trends of phylogenetic specialization in all organs of these plants. Significant structural similarities are few and are suggestive of common ranalian ancestry rather than of actual close genetic relationship between the two genera."

On the taxonomic position of *Eucommia ulmoides* Oliv. (Eucommiaceae). By W. W. Varossieau. Reprint from *Blumea* 5: 1: 81-92; 1 folded table; 1942.

The results of a comparative anatomical study of the species and related genera are discussed and listed in tabular arrangement. The author concludes that the species is strongly isolated and recommends it as a family in the order of Urticales. *Ulmus* is considered closest with only slight relation with Euphorbiaceae-Hippomaneae, less with Hamamelidaceae, none with Trochodendraceae (sensu van Tieghem).

On the development of the stem and the formation of leaves in *Coffea*-species. By W. W. Varossieau. Publ. E. J. Brill, Leiden, 1940. Pp. 88; 56 figs.

An anatomical and morphological study of the radicle, stem, leaf origins, periodicity of leafing; well illustrated by drawings.

Les liquides laticiformes des Guttiféracées. By E. DE WILDEMAN. *Acad. Royale de Belgique Memoires* 19: 6: 1-175; 1942.

The species of 32 genera are described with particular emphasis upon the presence or absence of latex, resins, or oils in the various plant organs. Native names of Belgian Congo representatives are included. A summary of the information is given in tabular form.

Observations sur les variations de la concentration du latex in situ par la microméthode de la goutte de latex. By M. FARRAND. *Inst. Nat. l'Etude Agron. Congo Belge* (Brussels) Sér. Sci. No. 22; 1941. Pp. 33; 1 fig.; 20 tables and diagrams. Price 12 fr.

A new technique allows small amounts of latex (drops) to be extracted from *Hevea brasiliensis*. By this method the concentration of the latex in situ and under different internal conditions are studied.

The concentration of industrial latex is only 60 to 70 per cent of that of latex in situ. The concentration of latex in situ does not change in trees whose foliage turns yellow or is being shed. Old trees contain more highly concentrated latex than young ones, but considerable individual differences occur within a population. In older parts of the cortex an increase of the yellow pigment in the latex was noticed.

The concentration of latex varies considerably with the meteorological conditions. Portions of the cortex shaded by the crown of the tree have a concentration different from those which were exposed to the rays of the sun. On very sunny days, the latex becomes diluted during the middle of the day, and during the night the concentration rises again. Generally darkness of the night, covered sky, cold fog lead to an increase in the concentration of latex, while heat and illumination seem to favor physiological activities which reduce the concentration.—ROBERT BLOCH, *Yale Dept. Botany*.

A color reaction of wood with methanol-hydrochloric acid. By I. H. ISENBERG and M. A. BUCHANAN. *Journ. For.* (Washington, D. C.) 43: 12: 888-890; December 1945.

Methanol containing a small amount of hydrochloric acid gives a purple color when mixed cold with the sawdust or shavings of certain species of wood. Samples from 277 species of 123 genera in 56 families (mostly American woods) have been examined.

The preliminary study indicates that *Acer negundo* can be separated from other species of *Acer;* some of the species of *Quercus*, *Pinus*, *Populus*, and *Carya* can be separated. In some species heartwood and sapwood react differently.

The amount of acid in the solution does not appear to be critical but more than five per cent of water in the methanol is detrimental.

The role of the microscope in botanical identification. By C. R. METCALFE. Reprint from *Jour. Quekett Microscopial Club* (4) 2: 2: 68-75; December 1945.

"It is to be hoped that this article will give some idea of the vast scope and practical applications of the study of systematic plant anatomy. There are still considerable gaps in our knowledge of the structure of the higher plants, particularly amongst those which occur in tropical countries and inaccessible parts of the world. In recent years the study of plant anatomy has, in some quarters, come to be regarded as unfashionable, especially by those who are interested in the more spectacular developments in plant physiology. These specialists would do well to remember that it is a dangerous practice to divorce the study of function from that of form."—*From author's conclusion.*

Classification of the structural elements of the secondary wood of dicotyledons, using decimal indices for classification and identification of wood species. By J. Ph. Pfeiffer and W. W. Varossieau. Reprint from *Blumea* 5: 3: 437-489; 1945.

"The literature gives various methods to compile a universal scheme for the classification and identification of wood species. To attain this object a new method is now given possessing various advantages over the methods that have been used so far.

"The wood structure is subsequently described using decimal indices. Each of five sections of features are divided into four groups, and these again in subgroups, which have been worked out by means of indices. In the treatment of various features literature data are discussed.

"The classifications of wood species aims at obtaining a grouping which, as far as possible, links up with the botanical groupings according to natural systems.

"On the grounds given in the introduction and the discussion, the classification has been applied to features which can be perceived both with the unaided eye and a hand lens. The desirability and the possibility of classifying microscopic features in a similar way are dealt with briefly.

"On the classification scheme an identification method is based employing loose cards. In this way, the number of woods included can be extended at will. Drawbacks attaching to the loose-card methods, used so far, have been obviated.

"It is suggested that the decimal indexing of features should be normalized internationally."—*Authors' summary*.

Chronica Botanica calender MCMXLV. *Chronica Botanica Co.* (Waltham, Mass.) 9: 2 and 3: 77-250; 29 plates; 1945.

A collection of more than 40 papers or notes on botanical or agricultural subjects. Reviews and notices are included and a portfolio of plates relating to Latin America are appended.

H. F. Chatteway

Price 25 cents

Yale University School of Forestry

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 ROBERT W. HESS, *Associate Professor of Forest Products, Yale University School of Forestry.*

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A CASE HISTORY OF A SHIPMENT OF IROKO DECKING*

By OSWALD TIPPO and WILLIAM SPACKMAN, JR.†

The anatomy of the wood of the genus *Chlorophora*, a member of the Moraceae or mulberry family, has been studied by a number of persons, including Boulton and Price,[4] Record and Hess,[10] and Tippo.[11] There are, how-

*The opinions contained herein are those of the authors and do not necessarily reflect the official views of the Navy Department.

Grateful acknowledgment is made to R. C. Hughes and D. F. Richardson of the staff of the Industrial Test Laboratory for their counsel during the course of the investigation.

†The former is Assistant Professor of Botany at the University of Illinois, and the latter is an Ames Fellow in Biology at Harvard University. Both were formerly on the staff of the Industrial Test Laboratory, Philadelphia Naval Shipyard, United States Navy.

ever, very few references in the literature to the physical properties or to service tests of the wood of Iroko or *Chlorophora excelsa* B. & H. For this reason it is thought that the present case history may be of some interest.

Teak (*Tectona grandis* L.) is recognized as the outstandingly suitable species of wood for the decking of ships.[1] Its excellent reputation for this use is due to its qualities of high resistance to decay, extreme durability, low shrinkage and swelling with changing moisture content, hardness and good wear resistance, ability to stay in place without warping, the uniform smooth nature of the wear which occurs under severe usage, and the relative freedom from checking, splintering, and raised grain.

Large requirements for Teak in naval construction during the recent war far exceeded the stock on hand. Consequently, considerable effort was made by the Navy to find or develop an acceptable substitute. Edge-grain Douglas Fir was employed to a considerable extent, particularly for the flight decks of aircraft carriers. A laminated composite decking, having a core of Redwood faced with laminated, resin-impregnated, compressed Birch faces, was used to a limited extent.

Among the several other materials proposed and tested as a substitute for Teak was Iroko, or African Teak, as it is sometimes called. Iroko is a dioecious tree of common occurrence in tropical Africa, and the weight, strength, and hardness of its wood have prompted favorable comparison with Teak. Brush,[5] for example, has indicated that Iroko is the best known Teak substitute, and has described the properties of Iroko as follows:

"It has interlocked grain which gives a striped figure to quarter-sawed surfaces . . . The weight of the air-dry wood (12% moisture) is about 41 pounds per cubic foot. The average weight of iroko is nearly the same as that of teak; the average strength values of iroko are, however, for the most part below those for teak . . . The shrinkage of iroko is low—about 8% in volume from the green to the oven-dry condition compared to about 16% for white oak. In this respect, iroko compares favorably with teak which has a volumetric shrinkage of about 7% . . ."

In view of the above and similar information, it appeared likely that Iroko might perform satisfactorily as ship decking.

Following preliminary laboratory studies which gave favorable results,[3] it was decided by the Navy Department's Bureau of Ships, which was directing and coordinating the search for Teak substitutes, that service trials of Iroko should be made. Accordingly, a shipment of 45,500 board feet of Iroko was procured. In February, 1944, about 37,500 board feet of this shipment was installed from starboard to port on the main weather deck of the battleship USS Wisconsin, at that time under construction at the Philadelphia Naval Shipyard. As laid, the Iroko planks were 2½"x5"x14' to 16' and were surfaced on all sides. The rest of the deck was Burma Teak.

As is customary in the construction of decks, the individual pieces were fastened down by nuts and washers on steel studs welded to the steel deck plates. The edges were tapered to form a calking seam. The seams were calked with one strand of cotton followed by two strands of oakum, driven to ½ inch below the deck surface. The seams were then filled ("payed" or "served") with hot marine glue, a bituminous composition. After the glue had cooled, the excess was scraped off flush with the deck surface. The Iroko had been shipped from Africa in a partially air-dried condition ("shipping dry"). At the time of installation it had dried to a moisture content of 12 per cent. The Teak employed for the remainder of the deck had been in storage for several years and was thoroughly air-dried. The grain of the Iroko approached flat-grain on about three-fourths of the pieces, and edge-grain on the remainder.

By May, 1944, the Iroko had shrunk considerably, and, in contrast with the Teak decking, the calking between the Iroko planks was loose and the level of the marine glue had dropped approximately ⅜". Some of the longer planks had shrunk enough lengthwise to loosen the calking at the ends or butts. In a few cases, warping had caused the ends of the planks to be pulled away from the metal deck studs,

necessitating the installation of new pieces. In still other cases, there were splits at the butts and at the fastenings.

In August, 1944, the Wisconsin returned from a shakedown cruise which included some exposure to tropical weather. At this time some two per cent of the butts had to be replaced.

At this point, laboratory studies were made of the volumetric shrinkage and of the moisture absorption of Iroko wood, and, for the sake of comparison, of Teak wood. Following the methods described in Bureau of Ships Ad Interim Specification 59D2(INT),[1] the tests were made on 2"x2"x6" specimens, which were weighed "as received," and the volume was determined by the immersion method. The samples were then dried in an oven at 100°C. until constant weights were reached. After removing from the oven and weighing, the blocks were immersed in a hot paraffin bath just long enough to secure a uniformly thin coating on the samples. The volumes of the paraffin-coated specimens were then determined by immersion in water. The shrinkage in volume was expressed as a percentage of the original volume of the test samples in the "as received" condition. For the moisture absorption calculations, the specimens were conditioned at 70°F. and 65% relative humidity for forty-eight hours. The samples were then weighed dry, following which they were dipped into a 4% salt solution. The blocks were wiped lightly on all surfaces and were then weighed. Next, the pieces were immersed for forty-eight hours in a 4% salt solution under a pressure of eight pounds per square inch. At the conclusion of this briny sojourn, the blocks were again wiped lightly and weighed. The per cent gain in moisture was based on the weight of the conditioned specimens before dipping in the salt solution, and the difference between the weights after immersion under pressure and the conditioned weights after dipping.[1]

The resulting data are given in Table 1.

TABLE 1

	Teak	Iroko
Volumetric shrinkage*	2%	5%
Moisture absorption	11.7%	25.2%

*Shrinkage from "as received" condition to oven-dry condition.

A similar comparison has been made on other lots of Iroko and Teak by the Materials Laboratory of the New York Naval Shipyard.[3] The data obtained by this Laboratory are set forth in Table 2.

TABLE 2

	Teak	Iroko
Volumetric shrinkage*	3.9%	3.7%
Moisture absorption	12.5 to 15.5%	32.1%

*Shrinkage from "as received" condition to oven-dry condition.

Additional investigations of the shrinkage of these two timbers have been conducted by a number of laboratories. The results of these studies, together with similar determinations made by the Industrial Test Laboratory are brought together in Table 3.

It will be observed that Iroko compares very favorably with Teak. However, it must be remembered that these figures are based on laboratory tests in which small samples were studied. In such tests it is the standard practice to make every effort to secure only clear wood, that is, wood free from defects such as cross-grain and the like. In general, this procedure has much to recommend it, as Markwardt and Wilson[9] have indicated in the following words:

"The tests reported here were made on clear wood, free from defects that affect the strength. Inasmuch as the strength of wooden members in structural and industrial use is affected by numerous variables, such as species of wood, variation in quality of the clear wood and in defects among pieces of the same species, character and distribution of load

TABLE 3

PER CENT DIRECTIONAL AND VOLUME SHRINKAGE FROM GREEN TO OVEN-DRY CONDITION

TESTING AGENCY (with refs.)	SHRINKAGE (in %)			
	Longitudinal	Radial	Tangential	Volume
Iroko				
Cambridge University[4]		1.88[a]	4.08[b]	
University of Michigan[8]				8.1
Duke University[6]	0.21	3.44	4.77	8.49
N. Y. Naval Shipyard[3]				7.4[c]
Forest Products Laboratory, England[2]		2.0[d]	3.0[e]	
Philadelphia Naval Shipyard		2.82	3.83	8.8
Teak				
Duke University[6f]	0.15	6.36	9.55	16.34
USDA Forest Service[5]		2.3	4.2	6.8
N. Y. Naval Shipyard[3]				7.8[g]
Philadelphia Naval Shipyard		2.15	3.07	7.2

[a]Actually given as 0.94% for shrinkage from green to 13% moisture content. This figure was doubled to give an estimate of the shrinkage from green to oven-dry condition.

[b]Actually given as 2.04%. See statement under the previous footnote.

[c]Given as 3.7% for shrinkage from air-dry to oven-dry condition. This figure was doubled to give an estimate of the shrinkage from green to oven-dry condition.

[d]The actual figure given is 1.0% for shrinkage from the green to the 12% condition. See previous footnote. The above values were obtained from small, clear specimens. This same reference[2] records the following shrinkage figures for commercial-sized planks and boards: for tangential shrinkage from green to 10% moisture content, 1.3 to 3.2% (thus, approximately 2.6 to 6.4% for green to oven-dry); for radial shrinkage, 1.2 to 1.7% (or 2.4 to 3.4% for green to oven-dry).

[e]Actually recorded as 1.5% for shrinkage from green to 12% moisture content. See previous footnotes for explanation.

[f]Java teak. This may explain the unusually high values.

[g]Given as 3.9%. See explanatory statement under previous footnote.

and duration of stress, temperature and moisture conditions, and size and shape of the piece, it may be asked, 'why make tests on clear woods?'

"Information for application to such uses may obviously be obtained by testing actual structural members or finished manufactured articles under such conditions as obtain in service and with defects as found in such pieces. Some earlier investigations by the Forest Service included tests of this character. However, the results of such tests accurately represent only the combination of variables existing in each instance, are difficult to interpret with respect to the separate effects of each variable, and cannot be applied to instances in which a different combination exsits. Furthermore, the combinations are so numerous that it is impossible to evaluate them all by such tests, consequently, the limited usefulness of the data was soon evident. The plan that has been largely followed by the Forest Service has been to obtain data that are more generally applicable by testing small clear specimens taken from a specific part of the tree and of a standard size and form according to standardized methods and supplementing the resulting basic data on each species by investigations in which the effects of the more important variables are as far as possible separately studied and evaluated."

However, with a species such as Iroko which has much interlocking grain and which exhibits such a wide range of variation,[4,7,8] the laboratory test figures are open to serious question as far as their representative nature is concerned. This fact was recognized in the New York Naval Shipyard report,[3] which concludes: "It is considered that the suitability of Iroko lumber for use as a deck covering cannot be determined by laboratory tests alone. The samples furnished for the tests reported herein consisted of relatively short lengths which may have been selected with considerable care. No information is at hand as to whether Iroko lumber will consistently meet standards of soundness in long lengths, i.e., whether planks cut from the log will tend to contain more than permissible limits of knots, shakes, and other defects."

The Philadelphia Naval Shipyard's stock pile of Iroko, consisting of the planks left over after the test installation, was examined, and it was discovered that there was a striking correlation between the nature of the grain and the condition of the pieces. As shown by Figures 1 and 3, the timbers which were twisted, bowed, badly checked, split, or with raised grain invariably had steep cross-grain; while the pieces which were in comparatively good condition possessed relatively straight-grain. (See Figures 2 and 4.) It was concluded, therefore, that the excessive shrinkage, splits at butts and fastenings, and twisting near butts on the USS Wisconsin were due to a high percentage of steep cross-grain in the Iroko.

Some data on the effect of this interlocking grain on longitudinal shrinkage were obtained from laboratory studies involving selected cross-grained and selected straight-grained pieces, both groups measuring 2"x2"x6". It was found that the cross-grained pieces were subject, on the average, to as much as 75 per cent more shrinkage than were the straight-grained blocks.

The subsequent history of this test installation of Iroko decking is interesting. In May, 1945, the commanding officer of the Wisconsin reported to the Bureau of Ships on the condition of the Iroko after one year of service. Many of the planks showed excessive longitudinal shrinkage, with the result that many of the butts had pulled loose from the fastenings and were protruding above the level of the deck. The decking showed an excessive amount of checking, and raised grain and splintering were common. It was reported further that, due to the shrinkage, the marine glue had settled, permitting water to enter between the wood and the steel deck. Several planks had warped badly. It was estimated that thirty per cent of the Iroko decking had pulled away from the studs. On the other hand, the Teak planks were in satisfactory condition in every particular. The report concluded with the request that authorization be given to replace the Iroko decking with Teak as soon as possible. This request was granted soon afterwards.

Several factors may account for the unsatisfactory performance of the Iroko. The excessive lengthwise shrinkage, resulting in sufficient tension to spring the deck studs from the weld and free the butt, was almost certainly due to the steep cross-grain present in a large proportion of the pieces. This excessive cross-grain introduces a component of the radial or tangential shrinkage into the lengthwise shortening, with the well recognized result that the shrinkage is greater than would occur in a straight-grained piece. The second factor contributing to the poor performance of Iroko is its more rapid absorption of water. This would indicate that Iroko, though not swelling appreciably more than Teak for a given increase in moisture content, would absorb moisture more rapidly under the suddenly changing moisture conditions normal to a ship's deck, and as a result could be expected to swell and shrink over a wider range. Finally, the roughened, splintered surface which develops in Iroko as a result of wear is probably due in large part to the wavy and interlocking grain.

In considering the general suitability of Iroko as a Teak substitute it must be remembered that ship decking is probably the most exacting use to which a wood can be put. For other uses where swelling will be less objectionable, or in which outdoor exposure is not involved and varnish would be employed, it is quite probable that Iroko would perform satisfactorily. Its attractive figure, strength, hardness, and reputed durability would make it a desirable species for many such protected uses.

It is recognized that the observations described herein are incomplete and need extension, but it is felt that they do suggest that although Iroko has several desirable features (notably resistance to wear) which, at first examination, make it appear like promising decking material, it is not an ideal substitute for Teak decking, since it does have much interlocking grain which leads to the defects already described, especially in decking which is exposed to alternate wetting and drying. One solution, of course, would be to select only the straight-grained pieces. Unforunately, such ideal timbers are apparently relatively rare in this species.[2,4,7]

It appears, therefore, that the following judgment of Iroko penned by Howard[7] has more than a little truth in it: "The name African teak is quite unjustifiable as it possesses no resemblance to the true teak *(Tectona grandis)*, even in appearance, while in quality and texture it is totally dissimilar, besides which, iroko, while not possessing those unique qualities which render teak valuable for special work, has a distinctive quality of its own, sufficient to justify its specific name."

Summary

1. Laboratory tests of shrinkage made on standard, clear test samples of Iroko yield results comparable to those for Teak.

2. Iroko does not live up to this promise in actual practice, at least in such exposed structures as ship decking, because of the large amount of interlocking and steep grain, which leads to excessive longitudinal shrinkage, twisting, bowing, checking, etc.

Description of Figures

Figure 1. Photograph of five Iroko timbers selected from the stock pile to illustrate the various types of defects which developed. Reading from top to bottom: A, bowed; B, checked and with raised grain; C, with side split; D, twisted and crooked; and E, with end splits.

Figure 2. Photograph of four timbers with relatively straight grain and with few if any defects.

Figure 3. Photograph showing a close-up view of the same timbers pictured in Figure 1. The excessively steep cross-grain is shown particularly well in timbers A, B, and C. In addition, B shows surface checks parallel to the grain and C has a side split, parallel to the steep cross-grain.

Figure 4. Photograph showing a close-up view of the same timbers pictured in Figure 2. The absence of defects and the relatively straight grain are noteworthy.


3
4

REFERENCES

1. Bureau of Ships Ad Interim Specification 59D2(INT), Decking, Weather (Teak Alternate). 1 April 1942.
2. Forest Products Research Laboratory, Princes Risborough, England. A Handbook of Empire Timbers. His Majesty's Stationery Office, London. 1945.
3. Material Laboratory, Navy Yard, New York. Report No. 4336-152. July 8, 1943.
4. Boulton, E. H. B., and T. J. Price. Notes on iroko *(Chlorophora excelsa)*. *Tropical Woods* 28:4-7. 1931.
5. Brush, W. D. Iroko. USDA Forest Service Leaflet. 1943.
6. Harrar, E. S. Some physical properties of modern cabinet woods—III. Directional and volume shrinkage. *Tropical Woods* 71:26-32. 1942.
7. Howard, A. L. A Manual of the Timbers of the World. Macmillan and Co., London. 1934.
8. Kynoch, W., and N. A. Norton. Mechanical properties of certain tropical woods, chiefly from South America. University of Michigan, School of Forestry and Conservation Bulletin No. 7. 1938.
9. Markwardt, L. J., and T. R. C. Wilson. Strength and related properties of woods grown in the United States. USDA Technical Bulletin No. 479. 1935.
10. Record, S. J., and R. W. Hess. American woods of the family Moraceae. *Tropical Woods* 61:11-54. 1940.
11. Tippo, O. Comparative anatomy of the Moraceae and their presumed allies. *Botanical Gazette* 100:1-99. 1938.

IDENTIFICATION OF NEW WORLD TIMBERS

Part II

By ROBERT W. HESS

ANACARDIACEAE

A considerable number of the many species in this family are of tree size, although frequently small, and often have poisonous juices in the bark and leaves. The woods are non-poisonous and generally of good quality. Many are attractively colored in various shades of red or olive, often variegated or striped. Except for *Astronium* and *Schinopsis* the woods are little used, commonly because of the small sizes available or the poisonous nature of the trees.

The woods of the genera are variable and often distinctive in appearance. Woods representing various shades of brown

are found in *Anacardium, Astronium, Lithraea, Loxopterygium, Malosma, Mauria, Metopium,* and *Thyrsodium;* reddish brown in *Astronium, Loxopterygium, Metopium,* and *Pseudosmodingium;* red or pink in *Comocladia, Malosma, Mosquitoxylon, Rhus, Schinopsis, Schinus,* and *Tapirira;* greenish, yellow, or olive, often variegated, in *Cotinus, Rhus, Thyrsodium,* and *Toxicodendron;* grayish or whitish in *Campnosperma* and *Spondias;* dark streaks commonly present in *Mauria, Rhus, Loxopterygium, Metopium, Astronium,* and *Toxicodendron.* Luster low, medium or high. Odor sometimes present but not very distinctive; taste of reddish woods sometimes astringent. Density 0.44 to 1.30; weight (air-dry) 27 to 81 lbs. per cu. ft.; texture coarse to fine, grain variable; working properties poor to excellent, generally good; durability very low to very high.

Growth rings present, not always distinct; in diffuse-porous woods formed by differences in wall thickness or flattening of fibers. Ring-porous structure in some or all species of *Cotinus, Pistacia, Rhus,* and *Toxicodendron;* the early-wood pores in a narrow to wide band, those in the late wood very small to minute and sometimes tending to form diagonal or tangential bands; ulmiform pattern in *Schinus* (in part); elsewhere the pores are mostly medium-sized or small, solitary or in radial multiples of two to several pores each. Vessels typically with simple perforations, often with wide rims, particularly in small vessels; scalariform plates with many narrow bars also present in some vessels of *Campnosperma;* spiral thickenings present in some or all vessels of *Cotinus, Lithraea, Pistacia, Rhus,* and *Schinus* (in part). Intervascular pits typically rather coarse (mostly 9 or 10μ), coarse or very coarse (12 to 20μ) in *Anacardium, Rhus* (rarely), *Spondias,* and *Tapirira;* sometimes rather fine (6 or 7μ) in *Rhus, Schinus,* and *Schinopsis;* alternate, usually rounded, infrequently crowded and angular, often with few irregularly shaped larger pits, commonly with included apertures. Rays in part with small to large gum ducts, the epithelial layer composed of one to several rows of very small cells, in some or all species of *Astronium, Campnosperma, Loxopterygium, Malosma, Metopium, Pistacia, Rhus, Schinopsis, Schinus, Spondias, Tapirira,* and *Thyrsodium;* other rays generally uniseriate and biseriate or 1 to 3, occasionally to 4 or 5, rarely 8, cells wide and mostly less than 30, occasionally to 50, rarely 100 cells high; weakly to decidedly heterogeneous; crystals common, often very numerous, sometimes large; pits to vessels large oval to much elongated, commonly irregular in shape, occasionally in scalariform arrangement. Wood parenchyma apparently absent in *Campnosperma;* sparingly vasicentric in the others; sometimes also finely terminal and occasionally diffuse *(Lithraea* and *Mauria);* commonly short aliform in *Anacardium;* crystalliferous strands present in a few genera, e.g., *Lithraea* and *Mauria;* pith flecks common in soft woods. Wood fibers with thin to very thick walls; septate, at least in part, in *Anacardium, Astronium, Campnosperma, Comocladia, Lithraea, Loxopterygium, Mauria, Metopium, Pseudosmodingium, Schinopsis, Schinus, Spondias, Tapirira,* and *Toxicodendron;* sometimes containing starch in sapwood; pits small to minute, simple or indistinctly bordered. Ripple marks absent. Vertical gum ducts not known to occur in any member of the family; radial canals few to numerous, visible with lens, sometimes (e.g., *Loxopterygium* and *Tapirira)* staining the surface of the wood with their dark-colored, oily exudations.

Anacardium. There are a number of species of large trees in this genus. Probably the best known for its timber is the Espavé (*A. excelsum* Skeels) of southern Central America and north-western South America. It grows to large size and is abundant in many areas. Espavé is considered a good general purpose carpentry and construction wood and is in general use in the countries where it grows.

Sapwood gray. Heartwood reddish brown, golden brown, or grayish brown; often streaked with darker reddish brown. Darker vessel lines prominent. Luster fairly high. Odor and taste lacking. Density medium to rather low. Grain commonly roey. Texture medium to fairly coarse.

Growth rings indistinct or absent. Pores variable in size, often in the same growth ring; large to very large (250 to 380μ), the largest readily visible; few, fairly evenly distributed; solitary and in pairs and small clusters; rather thin-walled. Vessels with simple perforations; pitting coarse (12 to 17μ); vessel lines conspicuous; thin-walled tyloses abundant in heartwood. Rays very numerous (about 70 per mm.); 1 or 2, sometimes 3, cells wide and up to 40, generally less than 20 cells high; coarse-celled; heterogeneous, procumbent and upright cells short, square cells numerous; large crystals abundant, often visible with lens on cross-section; gum deposits abundant in disassociated individual cells, giving rays a speckled appearance; pits to vessels mostly large and widely variable in outline. Wood parenchyma rather sparingly developed, not distinct without lens; mostly short, blunt aliform, sometimes diamond-shaped, sometimes narrowly vasicentric in part. Wood fibers sometimes septate, thin-walled, squarish, arranged in fairly definite radial rows; pits medium-sized, numerous, indistinctly bordered. Ripple marks and gum ducts absent.

The Cashew-tree (*A. occidentale* L.) is better known for its edible nuts and varnish-like gum than for its timber. The wood is somewhat denser and the heartwood is lighter-colored than Espavé. It is a good general purpose wood without distinctive appearance.

Heartwood light grayish brown, often with slight orange cast or yellow streaks; not distinct from lighter-colored sapwood. Luster medium to high. Odor and taste absent or not distinctive. Moderately hard and heavy; medium-textured; straight- to roey-grained; finishing smoothly.

Growth rings indistinct or absent. Pores medium-sized (140-200μ), visible without lens, often somewhat unevenly spaced, few to fairly numerous, solitary and in pairs or with few short multiples. Vessels with simple perforations and medium to large intervascular pits (9 to 14μ). Vessel lines are less prominent than in *A. excelsum*. Rays very numerous, uniseriate or locally biseriate; up to 30 cells, sometimes 15, cells high; heterogeneous with very short procumbent cells;

pits to vessels large, irregular; orange brown gum commonly abundant. Parenchyma narrowly vasicentric, sometimes with some short aliform, distinct with lens. Fibers non-septate; pits small, indistinctly bordered, numerous. No gum ducts seen.

Anacardium giganteum Engl. is similar to *A. occidentale* in anatomical structure. Vessel lines may resemble those of *A. excelsum*.

Astronium. Medium-sized to large trees, representing a number of species of this genus, are found distributed from southern Mexico through Central and South America into Argentina. The woods are highly valued for their strength, durability, and beauty. They are extensively used for railway crossties, posts, bridge timbers, building and other durable construction. They have long been used for fine furniture and cabinet work.

The genus is divided into two sections, the *Euastronium* section exemplified by *Astronium graveolens* Jacq. and *A. fraxinifolium* Schott (Gonçalo Alves) and the *Myracrodruon* section represented by *A. urundeuva* (Fr. Allem.) Engl. (Urunday or Aroeira). Despite a wide range of variation in color and figure the woods can be identified and separated into their respective sections.

The heartwood of Gonçalo Alves (*Euastronium* section*) is variable from light to dark brown or reddish, typically reddish brown; more or less conspicuously marked with vertical blackish or dark brown bands of various widths and spacing, commonly producing a prominent, often beautiful figure. Often with oily or waxy feel, becoming very noticeable on specimens darkened by exposure. Sapwood yellowish or grayish, sharply demarcated. Luster medium to rather high. Odor not distinctive or lacking; taste astringent. Hard and heavy to extremely so; sp. gr. (air-dry) 0.85 to 1.28; weight 53 to 80 lbs. per cu. ft.; texture rather fine; grain variable, commonly somewhat interlocked; fairly easy to

*Specimens of the following species were studied: *Astronium Conzattii* Blake, *A. fraxinifolium* Schott, *A. gracile* Engl., *A. graveolens* Jacq., *A. LeCointei* Ducke, and *A. Ulei Mattick*.

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Heartwood light grayish brown, often with slight orange cast or yellow streaks; not distinct from lighter-colored sapwood. Luster medium to high. Odor and taste absent or not distinctive. Moderately hard and heavy; medium-textured; straight- to roey-grained; finishing smoothly.

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rather difficult to work, turns and carves readily, finishing very smoothly and taking a high natural polish; noted for its durability. Deeper colored specimens contain a large amount of red or brown gum, are more oily, become very dark upon exposure, are harder and considerably heavier than lighter colored material. Available samples of *A. LeCointei* Ducke are generally more uniform reddish or coppery brown with fewer dark streaks.

Growth rings usually present, indistinct, formed by difference in wall thickness or flattening of fibers. Pores medium-sized (160 to 210μ), barely visible or indistinct without lens; rather few, solitary and with few to rather numerous short radial multiples, usually well distributed; sub-circular. Vessels filled with tyloses in heartwood; white substance sometimes present. Perforations simple; intervascular pits rather large (mostly 9 to 10μ). Rays numerous; 1 to 4, sometimes 5, cells wide; commonly less than 25, infrequently up to 40 cells high; heterogeneous; crystals numerous, often large, mostly confined to marginal square or upright cells, usually visible with lens on cross-section; gum abundant; pits to vessels large and irregular, oval to elongated. Wood parenchyma sparingly vasicentric. Wood fibers septate, at least in part; pits very small, simple or indistinctly bordered; gum deposits abundant, particularly in dark zones. Radial gum ducts numerous, visible with lens; surrounded by one or two rows of small epithelial cells.

The heartwood of Urunday, *Myracrodruon* section,* is deep brownish red to cherry-red, darkening on exposure. Prominent dark streaks usually lacking. Sapwood narrow, yellowish or grayish, sharply demarcated.

Rays 1 and 2, rarely 3, cells wide. Radial gum ducts few and scattered. Crystals observed in tyloses of *Astronium Balansae* Engl. Otherwise structure is similar to that of *Euastronium* section.

*Specimens of the following species were studied: *Astronium Balansae* Engl., *A. concinnum* Schott., and *A. urundeuva* (Fr. Allem.) Engl.

Campnosperma. The two species of Orey (*C. gummifera* L. and *C. panamensis* Standl.) are found in swampy lands of the lower Amazon and Atlantic coastal areas of southern Central America. There are no special uses for the moderately soft, easily worked wood. In general appearance it resembles Soft Maple (*Acer rubrum* L.) and could be used for similar purposes.

Heartwood grayish or light grayish brown, somewhat silver, noticeably marked with fine brown flecks (rays) on radial surface, grading into light gray or grayish buff sapwood. Odorless and tasteless. Firm, rather fine textured, tough and fairly strong for its weight; rather low density, sp. gr. (air-dry) 0.44 to 0.48; weight 27 to 30 lbs. per cu. ft.; very easily worked. Grain irregular to roey.

Growth rings absent or poorly defined. Pores not distinct without lens; rather small (115μ), numerous, solitary and in radial pairs, evenly distributed. Occasional vessels filled with thin-walled tyloses; both simple and multiple perforations present, the plates of the latter scalariform with numerous fine bars; pits rather large (10μ). Rays in part fusiform, with large intercellular canals surrounded by several layers of small cells; other rays 1 or 2, sometimes 3, cells wide; height generally less than 40, sometimes to 60, cells; heterogeneous, multiseriate typically with 1 or 2 marginal rows of upright or square cells; pits to vessels large, often elongated and in scalariform arrangement; dark gum deposits common to abundant. Wood parenchyma apparently absent. Wood fibers septate in part; walls thin; pits small, simple or indistinctly bordered. Radial gum ducts few to numerous; distinct with lens; exudations show as small specks on tangential surface. Woods of all species are similar in structure.

Comocladia. The Guao is a small tree of the West Indies and southern Mexico. It has extremely poisonous juices. Although of excellent quality and not poisonous, the wood is seldom used.

Heartwood uniform light red, deepening to brick-red upon exposure; sharply demarcated from the thin grayish or yellowish sapwood. Luster rather low. Without distinc-

tive odor or taste. Very heavy, hard, and strong; sp. gr. (air-dry) 1.10; weight 69 lbs. per cu. ft.; texture fine and uniform, grain irregular; rather difficult to work, but taking a glossy polish, suitable for turning or carving where sharp edges or corners are required; highly resistant to decay.

Growth rings present, often poorly defined. Pores not distinct without lens, medium-sized (120-160μ); solitary and in small multiples, often with tendency to diagonal arrangement. Vessels plugged with tyloses in heartwood; perforations simple; pits rather large (9μ), somewhat irregular. Rays all uniseriate, in part biseriate, or 1 to 3 cells wide; commonly less than 20, sometimes up to 40, cells high; heterogeneous; large crystals numerous, often forming radial rows visible with lens on cross section; gum deposits abundant; pits to vessels large, irregular. Wood parenchyma sparingly vasicentric. Wood fibers in part septate; bands of thin-walled septate fibers common in some specimens; pits small, simple or indistinctly bordered. No gum ducts seen.

Cotinus. The wood of the American Smoketree is seldom available in large enough sizes or sufficient quantity to permit its practical usage.

Heartwood rich golden yellow with slight greenish tinge, becoming superficially golden brown after exposure; sharply demarcated from the thin, nearly white sapwood. Heartwood contains yellow dye, readily soluble in water. Luster high. Without distinctive odor or taste. Medium density; rather coarse, uneven texture; straight grain; easily worked; resistant to decay.

Ring-porous, with several rows of barely visible, medium-sized (150-180μ) pores in early wood. Pores in late wood grading from small to minute (12μ), occurring in radial multiples and in clusters, tending to irregular diagonal or wavy tangential arrangement. Vessels filled with tyloses in heartwood; perforations simple; spiral thickenings present in smaller vessels; pits rather large (8 or 9μ). Rays uniseriate or biseriate, usually less than 30, sometimes up to 40, cells high; heterogeneous; crystals numerous; gum deposits abundant; pits to vessels rather large, oval. Wood parenchyma sparingly vasicentric. Wood fibers with medium walls and very small pits. No gum ducts seen.

Lithraea. The Aruera Blanca is a small poisonous tree or shrub of southern South America. Its hard, durable wood is used locally for fence posts and fuel, and to a limited extent for cabinet work and turning.

Heartwood blackish brown; sharply demarcated from the brownish, pinkish or greenish tinged sapwood. Fairly lustrous. Odor and taste not distinctive. Hard and heavy, especially the heartwood; texture fine, grain straight to irregular; easy to work, finishing very smoothly; highly resistant to decay.

Growth rings present. Pores small (65μ), not visible without lens, rather numerous; solitary and in small radial multiples, evenly distributed. Vessels with simple perforations (malformed foraminate plates sometimes present in small vessels), with fine spiral thickenings; rather large (9μ) intervascular pits; filled with gum in heartwood. Rays uniseriate or biseriate; up to 40, generally less than 30, cells high; heterogeneous; pits to vessels large, oval to elongated; gum deposits abundant. Wood parenchyma sparingly vasicentric and diffuse, the latter crystalliferous. Wood fibers septate, at least in part; sometimes containing starch; often filled with gum; pits very small. No gum ducts seen.

Loxopterygium. The Slangenhout (Snakewood) is best known in northern South America, particularly in the Guianas. It should not be confused with the denser Letterwood (*Piratinera* spp.), nor with the Snakebark (*Colubrina* spp.) both of which are sometimes called Snakewood. The trees reach saw-log size and the wood is of good quality, although not extensively used.

Heartwood brown or reddish brown, with dark laminations or streaks of varying width and regularity; usually flecked with oil specks, distinct on lighter faces, especially the tangential; not clearly defined from the fairly thick brownish gray sapwood. Luster medium. Odor absent or mildly unpleasant; taste not distinctive. Density variable; sp. gr. (air-dry) 0.60 to 0.75; weight 37 to 47 lbs. per cu. ft.;

texture medium, grain straight to very irregular; easy to work, finishing smoothly and taking a good polish, though likely to show oil specks; appears durable.

Growth rings present, commonly indistinct. Pores medium-sized (150-210μ), barely visible to indistinct without lens; numerous; solitary and in short radial multiples, well distributed. Vessels with simple perforations; rather large (9 or 10μ) intervascular pits; moderately abundant tyloses and gum deposits. Rays in part with gum ducts; others uniseriate and biseriate; up to 30, commonly less than 20, cells, high; rather weakly heterogeneous; gum abundant; pits to vessels large, short to long oval. Wood parenchyma very sparingly paratracheal. Wood fibers septate; sometimes containing starch in sapwood; pits very small. Radial gum ducts visible as small specks on tangential and as dark lines on radial surfaces.

Malosma. The Laurel Sumach (*M. laurina* Nutt.) is a shrub or small tree of California and Baja California.

Sapwood brownish with tinge of pink; heartwood lacking from specimen (Yale 23961) or not distinctive. Luster medium. Odorless and tasteless. Moderately hard and heavy, suggesting Maple *(Acer);* texture fine and uniform, grain straight; easy to work, finishing very smoothly.

Growth rings present, poorly defined. Pores small (90μ), not visible without lens, fairly numerous; occurring mostly in radial multiples of 2 to 6; small clusters common; evenly distributed, without pattern. Vessels with simple perforations, rather large intervascular pits (9μ). Rays in part with small gum ducts, the surrounding cells very small; other rays 1 or 2, sometimes 3, cells wide and generally less than 15, sometimes up to 40, cells high; heterogeneous, but with few distinctly upright cells; pits to vessels large, often elongated and in scalariform arrangement. Wood parenchyma sparingly vasicentric. Wood fibers rather thin-walled, sometimes containing starch; pits very small. Radial gum ducts visible with lens.

Mauria. The small to medium-sized trees of this genus are found from Costa Rica to Peru. The woods are used to

a limited extent locally. Only one, the Chachique of Venezuela (*M. puberla* Tul.), produces a beautiful, figured wood.

Heartwood brownish, usually with distinct pinkish or greenish cast, more or less variegated and sometimes conspicuously streaked with dark brown or black; transition to sapwood usually gradual. Luster silky. Odor and taste not distinctive though sometimes present. Rather light to moderately heavy, firm and strong; texture fine and uniform, grain mostly straight; very easy to work, taking a fine natural polish; probably fairly durable.

Growth rings poorly defined. Pores not distinct without lens, lower medium-sized (100 to 125μ); solitary and in small multiples, well distributed or with tendency to zonate arrangement. Vessels with simple perforations, rather large (9μ) intervascular pits, tyloses and gum deposits. Rays 1 or 2, sometimes 3, cells wide and variable in height up to 50 cells; heterogeneous; gum abundant; pits large, oval to elongated, often in scalariform arrangement in upright cells. Wood parenchyma narrowly vasicentric and diffuse, the latter mostly crystalliferous; crystal strands visible with lens on cross-section; pith flecks common. Wood fibres septate, at least in part; filled with gum in dark zones; pits very small. No gum ducts seen.

Metopium. The two species of this genus are shrubs to rather small trees growing in southern Florida, the Greater Antilles, southern Mexico, and Central America. It is often called Poison Tree or Poison Wood because of its caustic juices. The attractive wood is non-poisonous, of good quality, and is used to a limited extent locally for furniture.

Heartwood variegated dark brown and reddish brown, with greenish tinge and golden luster; rather sharply demarcated from the yellowish white sapwood. Without distinctive odor or taste. Hard, heavy, and strong; sp. gr. (air-dry) 0.85; weight about 53 lbs. per cu. ft.; texture rather fine and uniform, grain variable; not easy to work, but capable of a high polish; durability high.

Growth rings fairly distinct to obscure. Pores rather small (120 to 165μ), barely visible, numerous, solitary and in small

multiples, evenly distributed. Vessels with simple perforations; pits rather large (mostly 9μ); tyloses abundant, often filled with red gum. Some of the rays containing small gum ducts with small epithelial cells; other rays 1 or 2, occasionally 3, cells wide and generally less than 20, sometimes up to 40, cells high; heterogeneous, usually with single marginal rows of square or upright cells; crystals common; pits to vessels large, rounded to long oval. Wood parenchyma rather sparingly vasicentric and locally confluent for short distances; also narrowly terminal; dark red gum deposits abundant. Wood fibers with thick walls, sometimes gelatinous in late wood; occasionally septate; gum deposits locally abundant; pits very small. Radial gum ducts visible with lens.

Mosquitoxylon. The Mosquito Wood (*M. jamaicense* Krug & Urb.) is a small to medium-sized tree found in southern Mexico and Central America. The excellent wood is little used because of its scarcity.

Heartwood pink, deepening to red-orange, with yellowish streaks; rather sharply defined from the yellowish gray sapwood. Without distinctive taste, but with faint odor. Fairly lustrous. Moderately hard and heavy; texture rather fine, uniform; grain irregular to roey; not very easy to work, but takes a smooth finish; not highly resistant to decay.

Growth rings present, but often poorly defined. Pores medium-sized (140 to 165μ), indistinct or barely visible without lens, rather numerous; solitary and in short radial multiples, evenly distributed. Vessels with simple perforations; pits rather large (9μ); tyloses present. Rays 1 to 3, occasionally 4, cells wide, sometimes all uniseriate; up to 40, generally less than 20, cells high; decidedly heterogeneous; pits to vessels large and irregular; crystals numerous. Wood parenchyma sparingly paratracheal or very narrowly vasicentric. Wood fibers with medium walls and very small pits. No gum ducts seen.

Pistacia. The single American species of Pistache (*P. mexicana* H.B.K.) is a large shrub or small tree growing from western Texas through Mexico to Guatemala.

Sapwood grayish or yellowish white; heartwood apparently dark brown (judging from small knot). Luster medium. Odor and taste slight. Fairly hard and moderately heavy. Texture rather fine.

Growth rings distinct. Ring-porous with solitary row of rather small (130μ) early-wood pores, indistinct without lens; late-wood pores very small (50μ), numerous, mostly in short or long radial multiples. Vessels with spiral thickenings; perforations simple; intervascular pits rather large (9μ). Rays in part fusiform, containing radial ducts having small epithelial cells; other rays 1 to 3, rarely 4, cells wide; uniseriates few, up to 10 cells high, others to 35 cells high; cells variable in size (tangential); weakly heterogeneous, with single rows of marginal square cells; pits to vessels rounded to oval. Wood parenchyma very sparingly paratracheal. Wood fibers with medium walls, pits very small; starch sometimes present. Radial gum ducts visible with lens.

Pseudosmodingium. The Cuajiote are shrubs or small trees of Mexico having poisonous resin in the bark. The following description is of a small twig of *P. perniciosum* (H.B.K.) Engl.

Wood reddish brown, hard. Pores small (70μ), solitary and in short radial multiples. Vessels with simple perforations; intervascular pitting fairly coarse (pits 9μ), alternate. Rays 1 to 3, rarely 4, cells wide; up to 40 cells high; decidedly heterogeneous; pits to vessels large, elongated. Parenchyma sparse. Fibers in part thin-walled and septate; pits very small; starch and orange gum abundant. No gum ducts seen.

Rhus. The various species of Sumach are shrubs or small trees growing in extra-tropical regions. The woods are often of good quality, lustrous, variegated or otherwise attractively colored. They are rarely used because of the small sizes available.

Specimens of the subgenus *Sumac** available for study have typically lustrous olive-green or greenish yellow, commonly streaked or variegated, heartwood which frequently

**Rhus copallina* L., *R. glabra* L., *R. typhina* Torner (= *R. hirta* [L.] Sudw.).

becomes superficially russet-brown on exposure, and contains water-soluble yellow dye. Sapwood whitish or grayish, often with yellowish or greenish streaks, usually thin (thicker in *R. copallina* L.), distinctly but not very sharply demarcated from the heartwood. Luster high. Odor and taste lacking or not distinctive. Density medium or rather low; texture medium to rather coarse; straight-grained; easily worked, finishing smoothly.

Growth rings distinct without lens, formed by pore size differences and often by color variations. Ring-porous; early-wood pores medium-sized (150-200μ, mostly 170μ), barely visible without lens, solitary or in radial pairs, in bands 3 to 6 pores wide; late-wood pores grading from small to minute outward; smallest pores angular, in clusters arranged in irregular diagonal and wavy broken tangential bands in extreme outer portion of growth ring. Vessels with simple perforations, rather large intervascular pits (8 to 12, mostly 9μ); spiral thickenings present in smaller vessels; thin-walled tyloses abundant. Rays uniseriate and biseriate; up to 25 cells high; heterogeneous; pits to vessels rounded, oval, or elongated, all usually present in same cross-field; gum abundant, scattered small crystals usually present. Wood parenchyma very narrowly vasicentric, not distinct with lens. Fibers with rather thin walls, very small pits. No gum ducts seen.

Woods of the subgenus *Schmaltzia*, section *Lobadium* (*R. aromatica* Ait. and *R. trilobata* Nutt.) have greenish variegated heartwood lighter in color but resembling woods in the *Sumac* subgenus. Sapwood whitish or grayish, commonly with yellow streaks. Luster medium to high. Odor and taste lacking or not distinctive. Density medium (somewhat higher than most of the *Sumac* subgenus,) rather fine-textured.

Ring-porous with rather small (90 to 120μ) early-wood pores arranged in bands 1 to 3, occasionally more, cells wide; other pores very small to minute, in clusters, forming irregular diagonal and broken wavy tangential bands in outer late wood. Vessels with simple perforations, smaller vessels with spiral thickenings, rather large (8 or 9μ) intervascular pits. Thin-walled tyloses abundant. Rays uniseriate and locally biseriate, up to 25 cells high, heterogeneous, pits to vessels oval to elongated, small crystals numerous. Parenchyma very narrowly vasicentric, not distinct with lens, small crystals numerous in *R. aromatica*. Fibers with very small pits. Few small radial gum ducts present in *R. aromatica*, none observed in *R. trilobata*.*

The Mahogany Sumachs include species of the *Styphonia* section (*R. integrifolia* B. & H.f. and *R. ovata* Wats.) and the *Pseudosmaltzia* section (*R. microphylla* Engl. and *R. virens* Lindh.). Heartwood uniform salmon color or yellowish red. Sapwood rather thin, grayish, sometimes with yellowish or greenish tinge. Luster fairly high. With slight bitter taste, odor not distinctive. Fairly hard and moderately heavy, rather fine-textured, straight-grained, easy to work and finishing smoothly.

Pseudosmaltzia section: Weakly or indistinctly ring-porous; early-wood pores small, (about 100μ), not visible without lens, not crowded; in the late wood of *R. microphylla* very small, solitary and in pairs intermingled with clusters of minute pores forming irregular patches and broken tangential bands; in late wood of *R. virens* radially arranged in clusters and short to long radial multiples of intermixed small and minute pores. Vessels with simple perforations, spiral thickenings in small vessels, rather large (9μ) intervascular pits, abundant thin-walled tyloses. Rays uniseriate and biseriate and up to 25 cells high in *R. microphylla;* 1 to 3 cells wide and up to 50, mostly less than 25, cells high in *R. virens;* heterogeneous; procumbent cells short; pits to vessels oval to elongated; crystals often numerous. Large fusiform rays containing resin ducts present in *R. microphylla*. Parenchyma very narrowly vasicentric, not distinct with lens. Fibers with very small simple or indistinctly bordered pits. Radial gum ducts present in *R. microphylla*, visible with lens.

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*Radial ducts were reported in the rays of *Rhus trilobata* Nutt. by Heimsch in WOOD ANATOMY AND POLLEN MORPHOLOGY OF RHUS AND ALLIED GENERA, *Journ. Arnold Arboretum* 21: 3: 279-291. July, 1940.

Styphonia section: Growth rings present. In *R. ovata* pores barely visible or indistinct (120μ), weakly ring-porous, with numerous pairs and few multiples scattered rather irregularly through most of growth ring, with clusters of minute pores forming patches, radial or short broken tangential bands in extreme outer part. Appearing diffuse-porous under hand lens in *R. integrifolia* with rather small (110μ) solitary pores and short pore multiples uniformly distributed throughout most of growth ring, with clusters of minute pores forming patches or broken tangential band at growth ring margin. Vessels with simple perforations, spiral thickenings in smaller vessels, small (6 or 7μ) intervascular pits; thin-walled tyloses abundant. Rays uniseriate or biseriate, up to 25 cells high, heterogeneous with short procumbent cells; pits to vessels oval to elongated; crystals numerous. Parenchyma very narrowly vasicentric. In *R. integrifolia* pore clusters and associated parenchyma sometimes resemble terminal parenchyma bands under hand lens. Fibers with very small pits. No gum ducts seen.

KEY TO RHUS SPECIES

1 a. Heartwood uniform salmon color or yellowish red, with slight bitter or astringent taste. Weakly ring-porous..... 2

b. Heartwood variegated olive-green, golden, greenish yellow, or superficially russet; yellow stain obtained when rubbed with moistened cloth; taste slight or not distinctive. Markedly ring-porous 4

2 a. Radial gum ducts present. Intervascular pits rather large (9μ). Rays uniseriate and biseriate.....*Rhus microphylla.*

b. Radial gum ducts absent..... 3

3 a. Rays 1 to 3 cells wide. Intervascular pits rather large (9μ). *Rhus virens.*

b. Rays uniseriate and biseriate. Intervascular pits small (6 to 7μ). *Rhus integrifolia* and *Rhus ovata.*

4 a. Early-wood pores medium-sized (150 to 200μ); late-wood pores grading from small to minute outwards....*Sumac* subgenus.

b. Early-wood pores rather small (90 to 120μ); late-wood pores very small to minute..... 5

5 a. Radial gum ducts present.....*Rhus aromatica.*

b. Radial gum ducts absent.....*Lobadium* section.

Schinopsis. The two most important Quebracho trees are Quebracho Colorado Santiagueño (*S. Lorentzii* Engl.) and Quebracho Chaqueño (*S. Balansae* Engl.). It is from the heartwood of these that tannin is extracted. They are also extensively used for railway crossties, poles, posts, and construction timbers. Quebracho is found in northern Argentina, western Paraguay, southern Brazil, and to a limited extent in Bolivia. The Baraúna of southern Brazil is *S. brasiliensis* Engl. The woods are similar and are considered together in the following description.

Heartwood light red, deepening to brick red, becoming dark reddish brown on exposure; usually with narrow stripes caused by interlocked (roey) grain. Sapwood rather thick, yellowish or grayish, distinct but not sharply demarcated from the heartwood. Luster low to medium, decreasing as color deepens. Odor not distinctive; taste astringent. Extremely hard, heavy, and strong, but brittle; sp. gr. (air-dry) 1.15 to 1.30; weight 70 to 80 lbs. per cu. ft.; texture fine and uniform; grain irregular, commonly roey; difficult to cut, becoming flinty when dry. Capable of taking a high natural polish; subject to warping in seasoning; extremely durable.

Growth rings present, formed by flattened fibers, thinner-walled fibers, or narrow parenchyma bands. Pores medium-sized or rather small (125 to 150μ, rarely to 170μ); barely visible or indistinct without lens; solitary and in short radial multiples; few or rather few; evenly to unevenly distributed, sometimes with tendency toward diagonal arrangement; subcircular, with thick walls. Vessels with simple perforations, intervascular pits medium-sized or rather small (7 to 8μ); filled with tyloses in heartwood and inner sapwood, rarely thick-walled in part, frequently containing crystals; gum deposits numerous. Rays in part with small to rather large gum ducts, the epithelial layer composed of 1 or 2 rows of very small cells; other rays 1 to 3, occasionally 4, cells wide; and usually less than 20, sometimes to 30 or 40, cells high; heterogeneous, usually with 1, sometimes with 2, rows of square or short upright cells on margins; large crystals common, often numerous; pits to vessels large, oval and elongated. Wood parenchyma sparingly paratracheal or

narrowly vasicentric, with narrow band apparently demarcating growth rings in some specimens. Wood fibers with very thick to medium walls, the latter type typically septate; pits very small. Radial gum ducts moderately numerous, usually visible with lens.

Schinus. The Molle and other related species are usually small trees or shrubs, sometimes medium-sized trees. While the heartwood appears to be of excellent quality the small size of the tree prevents its extensive use. *S. molle* L. (Molle or Pepper Tree) is widely planted as a shade tree.

Heartwood dull light red deepening on exposure and becoming more or less purplish and oily looking; distinct but not sharply demarcated from the brownish gray sapwood which suggests Elm *(Ulmus)*. Odor and taste not distinctive. Moderately hard and heavy; sp. gr. (air-dry) 0.54 to 0.68; weight per cu. ft. 34 to 43 lbs.; texture medium to fine, uniform; grain variable, often irregular; very easy to work, especially the heartwood of *S. weinmannifolius* Engl. and *S. praecox* (Gris.) Sprg. which cut like Red Cedar *(Juniperus)*; durability high.

Growth rings present, demarcated by flattened fibers or a row of early-wood pores. Pores mostly small (50 to 100μ), occasionally medium-sized (140μ), numerous; mostly in multiples and irregular groups arranged in wavy tangential bands visible without lens and giving rise to fine pattern on tangential surface. Pores solitary and in few to numerous short multiples, well distributed without pattern in *S. terebinthifolius* Raddi and *S. rhoifolius* Mart. Vessels with simple perforations and rather coarse spiral thickenings (lacking in *S. terebinthifolius)*; intervascular pits small (6μ in *S. terebinthifolius*) to rather large (9μ in *S. molle*), mostly rather small (7μ); tyloses abundant, occasionally containing crystals. Rays in part with rather small to very large gum ducts, the epithelium composed of 2 to 5 rows of very small cells; other rays 1 to 3 or 4 cells wide and up to 50, generally less than 25, cells high, weakly to strongly heterogeneous; crystals common, often abundant, variable in size, in part large, usually confined to marginal square or upright cells;

gum deposits often abundant; pits to vessels large, oval to elongated. Wood parenchyma very sparingly paratracheal. Wood fibers septate; with very small pits; containing starch in sapwood of *S. rhoifolius* Mart. Radial gum ducts generally visible with lens, sometimes without it.

Spondias. The few species of Jobo are found throughout the tropical Americas; the most common are *S. mombin* L. (Hog Plum) and *S. purpurea* L. (Spanish Plum). They are often planted for their plum-like fruits. Although the light-colored wood is of good quality and easily worked it is little used.

Wood whitish, yellowish white, or slightly grayish throughout; subject to blue stain or other fungus discoloration if not properly seasoned. Luster medium. Odorless and tasteless. Rather light in weight, but firm; sp. gr. (air-dry) 0.50 to 0.60; weight 31 to 37 lbs. per cu. ft. Texture medium to rather coarse, grain fairly straight; not difficult to work, finishing smoothly.

Growth rings distinct to indistinct, formed by a band of thick-walled fibers. Pores variable, rather large or large (largest 170 to 300μ, usually 190 to 270μ), visible or readily visible without lens; rather few; solitary and in small multiples and clusters, fairly well distributed. Vessels with simple perforations; intervascular pits large to very large (12 to 20, mostly 15μ), typically rounded to angular in the same vessel element, with horizontal included narrow aperture. Thin-walled tyloses sometimes present. Rays distinctly two-sized; in part with large gum ducts, the epithelial layer composed of 1 or 2 rows of very small cells; other rays 1 to 6, sometimes only to 4 or 5, occasionally to 8, cells wide; uniseriates commonly few; generally less than 40, sometimes up to 100 cells high; heterogeneous; crystals often present in square or upright cells; pits to vessels large and irregular, oval and elongated, with wide to narrow border. Wood parenchyma sparingly vasicentric. Wood fibers thin-walled, septate; with small, simple or indistinctly bordered pits. Radial gum ducts visible with lens, few to numerous.

Tapirira. The several species, of which the best known is *T. guianensis* Aubl., are found from southern Mexico through northern South America to eastern Brazil. The small to rather large Tapiriri trees yield a pinkish brown wood of good quality that is used for general carpentry and interior construction work. Resinous exudations commonly mark the surface with many fine oily-like specks.

Heartwood uniform pinkish becoming light pinkish brown upon exposure; not sharply demarcated from the pinkish or grayish sapwood. Luster medium. Odorless and tasteless. Density variable from light and rather soft to rather hard, the denser kinds suggesting Birch *(Betula)*; sp. gr. (air-dry) 0.50 to 0.75; weight 31 to 47 lbs. per cu. ft. Texture medium, uniform; grain generally straight; finishes smoothly, holds nails firmly; poorly resistant to decay.

Growth rings present, often indistinct. Pores medium size (largest 150 to 170μ), barely visible without lens, rather few; solitary and in short radial multiples, well distributed. Vessels with simple perforations; intervascular pits large (10 to 15, mostly 13μ), alternate. Thin-walled tyloses present. Many of the rays contain large to very small gum ducts, the epithelial layers composed of 1 or 2 layers of very small cells; other rays 1 and 2, occasionally 3 cells wide and up to 40, generally less than 25, cells high; uniseriate rays heterogeneous; multiseriate generally heterogeneous with 1 to several square or upright marginal cells, occasionally homogeneous; crystals common in square or upright cells; pits to vessels large and irregular, oval to much elongated, border very narrow or lacking. Wood parenchyma sparingly vasicentric, often indistinct with lens. Wood fibers thin-walled with large lumina, abundantly septate, with very small simple or indistinctly bordered pits. Radial gum ducts visible with lens; exudations distinct without lens.

Thyrsodium. The American species are apparently confined to the Amazon valley. Presumably the tree is rare and the wood has no known uses. Four samples are available for study.

Sapwood light grayish brown with pinkish cast imparted by the rays and vessel lines, greenish streaks common; heartwood olive-brown and sharply demarcated in *T. paraense* Huber, lacking or not distinguishable from the sapwood in *T. Schomburgkianum* Benth. samples. Luster medium. Odorless and tasteless. Moderately hard, heavy, and compact; texture medium and uniform, grain somewhat irregular to roey; working properties fair.

Growth rings absent or very indistinct. Pores rather small (120 to 150μ), indistinct or barely visible without lens, solitary and in small multiples, rather few, well distributed. Vessels with simple perforations, intervascular pits rather large (8 or 9μ), mostly rounded with enclosed apertures, alternate; thin-walled tyloses common. Some rays have large to very small gum ducts with 2 or 3 layers of small epithelial cells; other rays uniseriate and biseriate, mostly less than 20 cells high; heterogeneous, with marginal rows of 1 to 4 square or upright cells; crystals common; pits to vessels large and irregular, oval to elongated, with large apertures and narrow borders. Wood parenchyma sparingly vasicentric, fairly distinct with lens. Wood fibers non-septate, with very small simple or indistinctly bordered pits. Radial gum ducts moderately numerous, the larger readily visible with lens.

Toxicodendron. The Poison Sumach, *T. Vernix* (L.) Kuntze, is well known in the eastern half of the United States and the Poison Ivy, *T. radicans* (L.) Kuntze, throughout the United States and Mexico, for the poisonous nature of their leaves and bark. Specimens of a similar small tree, *T. striata* (R. & P.) Kuntze, are not available for study. Due to the small sizes and poisonous character of the plant the colorful woods are not used.

Heartwood variegated olive and orange; sharply demarcated from the whitish sapwood. Luster low to medium. Without distinctive odor or taste. Rather light weight but firm; texture coarse to very coarse, grain mostly straight; easy to work, finishing smoothly.

Ring-porous, the pores in early wood rather large (190 to 220μ), distinct, and in narrow to wide band; pores in late wood grading from small (85μ) to minute (35 to 17μ), not very numerous, uniformly distributed, solitary and with few

short multiples, sub-circular, thick-walled. Vessels with simple perforations; rather large (9μ) intervascular pits; filled with tyloses in heartwood. Largest rays 5 or 6, rarely 4, cells wide and up to 70 to 120 cells high; heterogeneous with many square cells; crystals and gum deposits numerous; pits to vessels rather large and oval to much elongated. Wood parenchyma sparingly vasicentric. Wood fibers septate in part; pits very small, simple or indistinctly bordered. No gum ducts observed.

KEY TO THE GENERA

1 a. Woods ring-porous 2
b. Woods diffuse-porous 7

2 a. Largest rays 3 to 6 cells wide..... 3
b. Rays uniseriate and biseriate, rarely all uniseriate..... 5

3 a. Radial gum ducts present. Rays weakly heterogeneous, typically with single row of marginal square cells; uniseriate rays few, multiseriates 2 and 3, rarely 4, cells wide.....*Pistacia.*
b. Radial gum ducts lacking. Rays distinctly heterogeneous with many square cells..... 4

4 a. Heartwood uniform salmon color or yellowish red, with slight bitter or astringent taste. Rays 1 to 3 cells wide, uniseriates very numerous. Weakly ring-porous, pores in early wood not visible without lens; with numerous long multiples in late wood.....*Rhus virens.*
b. Heartwood variegated olive and orange, without distinctive taste. Largest rays 5 or 6, rarely 4, cells wide. Conspicuously ring-porous, pores in early wood readily visible without lens (190 to 200μ); multiples few and short in late wood. *Toxicodendron.*

5 a. Heartwood uniform salmon color or yellowish red; with slight bitter or astringent taste. Weakly ring-porous. *Rhus* (Mahogany Sumachs).
b. Heartwood variegated olive-green, golden, greenish yellow, or superficially russet; yellow stain obtained when rubbed with moistened cloth; taste slight not distinctive. Markedly ring-porous 6

6 a. Heartwood rich golden color with slight greenish tinge. Sapwood very thin.....*Cotinus.*
b. Heartwood olive-green or greenish yellow, often variegated. Sapwood sometimes thin, often only moderately so.....*Rhus.*

7 a. Radial gum ducts present..... 8
b. Radial gum ducts absent..... 20

8 a. Pores in diagonal and wavy tangential bands of multiples and clusters. Vessels with spiral thickenings. Heartwood dull light red, more or less purplish.....*Schinus.*
b. Pores not in distinctive arrangement; usually well, occasionally irregularly, distributed; rarely with tendency toward diagonal arrangement. Spiral thickenings lacking..... 9

9 a. Vessels with both scalariform and simple perforations. Wood parenchyma absent. Wood grayish or light grayish brown. Density low.....*Campnosperma.*
b. Vessels with simple perforations. Wood parenchyma sparingly paratracheal to narrowly vasicentric..... 10

10 a. Density high to very high. Heartwood red to dark brown..... 11
b. Density medium to rather low. Heartwood brownish, pale reddish brown, pinkish brown, or scarcely distinct from sapwood 16

11 a. Heartwood color uniform yellowish red, light red, or superficially deep red..... 12
b. Heartwood variegated or with prominent dark streaks..... 15

12 a. Dry heartwood flinty in cutting across the grain; color light red or superficially deep red. Intervascular pits medium-sized (7 to 8μ).....*Schinopsis.*
b. Heartwood readily cut across the grain..... 13

13 a. Pores medium-sized (160 to 210μ), visible without lens. Heartwood dense; brownish red or red. Fibers septate. Tyloses frequently containing crystals. *Astronium (Myracrodruon).*
b. Pores small (50 to 100μ), not visible without lens. Heartwood moderately dense..... 14

14 a. Rays uniseriate and biseriate. Intervascular pits rather large (9μ). Fibers non-septate. Tyloses without crystals. Heartwood salmon color or yellowish red.....*Rhus microphylla.*
b. Rays up to 3 or 4 cells wide. Intervascular pits rather small (6 to 7μ). Fibers septate. Tyloses often containing crystals. Heartwood dull light red, more or less purplish and oily looking .....*Schinus.*

15 a. Heartwood reddish brown marked with sharply defined stripes. Rays 1 to 4, rarely 5, cells wide *Astronium (Euastronium).*
b. Heartwood variegated light and dark reddish brown, with greenish tinge; stripes, when present, poorly defined. Rays 1 to 3, mostly 1 and 2, cells wide.....*Metopium.*

16 a. Pores small (90μ), not visible without lens. Fibers non-septate .....*Malosma.*
b. Pores medium-sized to large (120 to 300μ), barely visible to readily visible without lens. Fibers septate (except *Thyrsodium*) 17

17 a. Largest rays 4 to 6, occasionally more, cells wide. Wood whitish, yellowish white, or light grayish. Intervascular pits large (12 to 20μ) ..... *Spondias.*
b. Rays uniseriate and biseriate, rarely 3 cells wide 18

18 a. Heartwood olive-brown (sapwood light grayish brown with pinkish cast); not characteristically gum specked. Fibers non-septate. Intervascular pits rather large (8 or 9μ) *Thyrsodium.*
b. Heartwood characteristically gum specked. Fibers septate 19

19 a. Heartwood light brown or reddish brown with prominent dark stripes. Intervascular pits rather large (9 or 10μ). *Loxopterygium.*
b. Heartwood uniform pinkish to light pinkish brown. Intervascular pits large (10 to 15μ) ..... *Tapirira.*

20 a. Rays very numerous, spaced about ¼ to ½ pore-width apart. Pores mostly large to very large, sometimes medium-sized (140 to 380μ), often irregular in size and distribution, commonly few. Intervascular pits rather large or large (9 to 17μ) ..... *Anacardium.*
b. Rays generally spaced about one pore-width apart. Pores small or medium-sized. Intervascular pits usually rather large (9μ), rarely larger 21

21 a. Pores small (65 to 70μ), not visible without lens 22
b. Pores medium-sized (100 to 200μ), barely visible or indistinct without lens 23

22 a. Vessels with fine spiral thickenings. Rays uniseriate and biseriate. Diffuse parenchyma containing crystals. Heartwood blackish brown ..... *Lithraea.*
b. Vessels without spiral thickenings. Rays 1 to 3 or 4 cells wide ..... *Pseudosmodingium.*

23 a. Small vessels with spiral thickening. Heartwood uniform salmon color or light yellowish red ..... *Rhus*
b. Spiral thickenings lacking 24

24 a. Fibers non-septate. Heartwood pink to red-orange, with yellowish streaks ..... *Mosquitoxylon.*
b. Fibers septate 25

25 a. Heartwood uniform light red to brick red. Rays containing numerous large crystals frequently in radial rows, visible with lens on cross-section; crystals few or lacking in wood parenchyma ..... *Comocladia.*
b. Heartwood brownish, more or less variegated or streaked. Crystal strands numerous in diffuse parenchyma, often visible on cross-section with lens; crystals few or lacking in rays. *Mauria.*

Note: Photomicrographs showing distinctive features of the Anacardiaceae will appear in *Tropical Woods* No. 88.

ZAPALLO CASPI

The use of Zapallo Caspi for box-making and general building construction is enthusiastically supported in a short report prepared by Dr. Juan A. Dominguez, Instituto Nacional de Botanica "Julio A Roca," Facultad de Ciencias Medicas, Buenos Aires, Argentina. Because of its wide distribution, the large size of the tree, and the useful properties of the wood, he suggests that it should be of considerable economic importance.

Zapallo Caspi, *Pisonia Zapallo* Griseb. (Nyctaginaceae), attains a height of 20 meters and a diameter of 1.2 meters. The wood is light brownish gray, prominently marked by bast strand openings which resemble large, partially filled vessels. Luster low; texture very coarse, even surfaced boards being rough to the touch. Taste and odor lacking or not distinctive, unless the slight musty odor (presumably originating from decomposition of the included phloem strands) is characteristic. Density rather low, sp. gr. (air-dry) 0.37 to 0.41. Grain irregular to interlocked, producing a distinct wavy stripe figure on quartered surfaces. Despite its rather low density the wood is comparatively strong, tough and resistant to splitting. Its nailing characteristics are very good.

GLOSSARY OF TERMS USED IN DESCRIBING WOODS

A second reprinting has been made of "Glossary of Terms Used in Describing Woods" by the Committee on Nomenclature, International Association of Wood Anatomists, *Tropical Woods*, No. 36, December 1, 1933. These are available at a price of $0.15 each, to cover printing and postage costs.

The glossary was approved by the Council of the Association as standard for wood descripjtions. It is used by many instructors of botany and forestry as a supplementary reference.

ERRATUM

The four plates of photomicrographs between pages 24 and 25, *Tropical Woods*, No. 86, June 1, 1946, were omitted from a few copies. A complete number will be sent in exchange for any imperfect copy received.

Professor Oswald Tippo, Department of Botany, University of Illinois, Urbana, Illinois, U. S. A., wishes to obtain wood samples of the ulmaceous genus *Barbeya*, a tree native to Arabia and Abyssinia.

CURRENT LITERATURE

Shade and ornamental trees for south Florida and Cuba. By David Sturrock and Edwin A. Menninger. Stuart Daily News, Inc. (Stuart, Florida), 1946. Pp. 172; 6 x 9; 15 figs. Price $2.50.

The first part of this book, for which Dr. David Fairchild has written a foreword, classifies Florida's trees from aspects of their usefulness—for timber, for flowers, for pasture planting, for windbreaks, for dry land plantings, for wet lands, for salt-spray resistance, etc. The rest of the volume is made up of brief descriptions of many species of introduced shade and ornamental trees found in southern Florida.

Estado actual de las plantaciones de cedro *(Cedrela mexicana)* en la Isla de Cuba. By Juan T. Roig y Mesa. *Caribbean Forester* 7: 1: 93-97 (Spanish), 97-101 (English); January 1946.

"1) In Cuba all large cedar plantations planted with no companion species or without shade, have ended in failure. 2) The most suitable soil seems to be red clay of Matanzas and Francisco types and brown or white clay of Habana type, rich in calcium and with a pH of 7 or more. 3) Soil fertility is important but soil drainage more so, as is protection against the wind during early years. This may be provided by planting on protected slopes or with companion species affording light shade. 4) Pests and diseases may be controlled in Cuba and are only detrimental on unfavorable sites. 5) Ideal conditions are afforded by fertile, calcareous soil, good drainage, planting with a companion species such as fruit or forest trees providing a lateral shade and protection against strong winds."—*Author's conclusions.*

The genus *Eschweilera* in Trinidad and Tobago. By A. C. Smith and J. S. Beard. *Jour. Arnold Arboretum* (Jamaica Plain, Mass.), 27: 3: 305-313; July 1946.

"In his Flora of Trinidad and Tobago, R. O. Williams recognizes two species of *Eschweilera* (Lecythidaceae), one occurring in Trinidad and one in Tobago. The present writers, although agreeing with Williams in referring the common lowland Trinidad form to *E. subglandulosa*, believe that a species occurring in the montane rain-forest of Mt. Tuchuche is undescribed. Furthermore, we cannot concur in referring the Tobago plant to *E. decolorans* Sandwith, of British Guiana; this Tobago entity appears to us to be undescribed and we present a description of it."

E. trinitensis ("Mountain Guatecare") and *E. Sandwithiana* ("Devilwood") are described as new species. The ecological data and general descriptions of the timbers are given for these as well as for *E. subglandulosa* (Steud.) Miers ("Guatecare") and an un-named species ("Guatecare petite feuille").

The mora forests of Trinidad British West Indies. By J. S. Beard. *Jour. of Ecology* (London) 33: 2: 173-192; 6 figs., 2 tables; July 1946.

"The mora forests of Trinidad in which *Mora excelsa* Benth. is dominant and gregarious occupy certain restricted areas. No environmental factors appear to account for the alteration of mora forest and mixed crappo-guatecare *(Carapa-Eschweilera)* forest. Mora is believed to be a recent arrival in the island and to be actually invading the mixed forests. Mora is of wide distribution in Guiana, where it is occasional in most types of rain forest, becoming gregarious

only on swampy flats where competition is lessened. Mora is believed to have crossed over to Trinidad from Guiana by a land bridge in late Pleistocene to subrecent times. Mora is thought to have become gregarious in Trinidad because the moist forests are not typical rain forests, but have a more open structure. Shade is sufficiently thin to enable mora readily to become established, after which its great reproductive power makes it gregarious and its greater height suppresses the mixed forest."—*Author's summary*.

Detailed descriptions and tabular analyses of forest compositions (including common names) are given for both the Mora and the "Crappo-Guatecare" forests.

The physical-mechanical properties of certain West Indian timbers. By R. W. Wellwood.

Part I

Caribbean Forester 7: 2: 151-173 (English), 174-189 (Spanish); figs. 1-9; April 1946.

"In order to develop an integral economy in the Caribbean area there is a definite need for more complete knowledge of the properties of woods native to that vast region. This paper concerns the properties of tabonuco *(Dacryodes excelsa* Vahl), a native of the montane forests of Puerto Rico, and the most important timber tree of that Island.

"The sphere of usefulness of any wood is defined in large measure by its physical and mechanical properties, which are in turn determinable by standard testing methods. A summary of averaged results for tabonuco is presented in tabular form, and discussed in some detail. A positional effect is noted wherein strength increases with distance from the pith. There is some correlation between strength and specific gravity although insufficient measurements preclude showing a strong relationship; in general, strength varies directly as the specific gravity. Wherever possible, graphs and photos are used to illustrate pertinent properties and relationships.

"Tabonuco wood has interlocked grain and a ribbon-type figure. Seasoned heartwood, which has a lustrous brown color, planes and finishes well. At present it is used locally

for furniture, carpentry and construction. Although it is not highly regarded as a first class timber its superior strength properties and attractive appearance merit wider use in cabinetry, furniture, and interior trim. In common with many other West Indian woods, tabonuco should produce attractive veneers, for which a definite market exists."—*Author's summary*.

Part II

Caribbean Forester 7: 3: 191-206 (English), 229-238 (Spanish); figs. 10-12, tables 2 & 3; July 1946.

"This paper presents the results of physical and mechanical tests made on the wood of motillo *(Sloanea berteriana* Choisy), a native Puerto Rican species offering possibilities as a commercial timber.

"The average results for each test are listed in tabular form, and are discussed in some detail. Measurements are insufficient to show good strength-specific gravity correlations. The relationship between end hardness and side hardness is illustrated graphically; failures in compression and in shearing are shown in photo form.

"When the wood of motillo is compared with that of greenheart, *Ocotea rodiaei* (Rob. Schomb.) Mez, the two woods prove similar in general structure, in density, and in strength properties. One of the outstanding qualities of greenheart when used in salt water is its resistance to marine borers which property has not been tested in motillo. The strength properties of motillo and of American black walnut are presented on the common basis of strength-density indexes. Motillo has less resilience than black walnut, is weaker in shearing when green, and in cleavage when green and air-dried. In all other properties motillo has superior strength in the green condition but is inferior when air-dried.

"The wood of motillo must be seasoned carefully, but it is not difficult to machine, and takes a good finish. It lacks a prominent figure and has no particular merit as a cabinet wood. Motillo seems best suited as a heavy construction timber."—*Author's summary*.

Part III

Caribbean Forester 7: 3: 206-228 (English), 238-246 (Spanish); figs. 13-21, tables 4-8; July 1946.

"Haitian pine (*P. occidentalis* Swartz), the most important timber tree of the island of Haiti or Hispaniola is closely related to slash or Cuban pine (*P. caribaea* Mor.) in structure and in physical-mechanical properties.

"Annual growth is characterized by bands of earlywood and latewood and often by secondary rings of latewood that do not terminate the growing season. The wood has excellent strength properties, being comparable to the southern pines, and to *Pinus caribaea* grown in Central America, except in stiffness and compression parallel to grain, which properties have a lower value. Strength-density relationships are presented graphically, and examples of the wood failure are shown in photo form. Specific gravity was found to be highly correlated to the percentage of latewood.

"Basic stresses were determined for design purposes. Working stresses are found by applying a correction to basic stresses for comparable density grades of southern pine. The wood is in good favor for local use and its markets should increase as stands become accessible."—*Author's summary.*

Notes on forty-two secondary hardwood timbers of British Honduras. By A. F. A. Lamb. Forestry Dept. Bul. No. 1, British Honduras (Belize), April 1946. Pp. 123; 1 folded map.

"For many years information has been collecting about the secondary hardwood timbers of British Honduras; but until recently interest in these timbers has been slight and sporadic. The increased attention now being paid to them is due to various causes among which may be mentioned improved knowledge of their qualities and availability, improved communications, the demand for veneers which permits the utilization of a variety of timbers, the stricter control of mahogany stocks after extensive overcutting during the war and exchange regulations which have focussed the attention of British importers on hardwood forests in British Colonies. For these and other reasons this bulletin has been published.

"The volume of timber of all species in the forests of British Honduras is low compared with commercial hardwood forests in Africa or Europe. Over most of the Colony the volume of utilizable secondary hardwoods varies from 150 to 350 board feet per acre. This is close to the volume of Mahogany and Cedar in good virgin forest. It is probable that the volume of Mahogany alone exceeds that of all other species (excluding palms) where the forest is virgin and the soil conditions are favourable to Mahogany.

"The best secondary hardwood forest occurs on the well-drained sandy soils of crystalline origin in the central highlands and south where Mahogany is not so plentiful. Whereas Mahogany and Cedar find their optimum conditions on the northern plain and western rolling country where the soils are derived from limestone and the forest canopy is not so dense.

"The information about the quantities of each timber available has been obtained from sample plots laid down in each forest type. This data will be supplemented, when the interpretation of the aerial photographs has been completed, by more accurate figures for each species based on the extent of the major forest types checked by ground surveys. The completion of the maps and their reproduction has been held up by lack of staff during the war."—*From author's introduction.*

The individual descriptions for each of the forty-two species includes names, range, description of tree, description of wood, physical properties, mechanical properties, working qualities, local uses, results of laboratory tests (when available), minor products, distribution, and references.

Palmáceas do Brasil—I. By Claudio Cecil Poland. Bul. of Serviço Florestal, Jardim Botânico, Rio de Janeiro, Brasil, 1945. Pp. 55; 23 figs.

Twenty-three species are briefly described and illustrated by full-page photograph reproductions.

Alkaloid distribution in the bark of some Peruvian chinchonas. By W. H. Hodge. *Caribbean Forester* 71: 1: 79-86 (English), 86-91 (Spanish), 2 tables; January 1946.

"The analyses of selected bark samples of wild cinchona trees growing in Peru indicate that alkaloid content varies appreciably in ascending from the base of a tree towards the top. In some types of cinchonas alkaloids are higher in quantity at the base of the trunk than in the upper parts of the tree, but in still other types of cinchonas the reverse condition exists with alkaloids lower in quantity at the base of the trunk than in the upper parts of the tree. Samples of wild trees taken for purposes of estimating commercial yields must include therefore bark from these two parts of the tree.

"A relationship also appears to exist between the quantity of alkaloids present in a tree and the girth (or age) of the tree. Alkaloids either increase or decrease in quantity with increase in girth of the tree and this increase or decrease depends upon the alkaloid and upon the type of cinchona involved."—*Author's summary.*

Notes on the vegetation of the Paria Peninsula, Venezuela. By John S. Beard. *Caribbean Forester* 7: 1: 37-46 (English), 46-55 (Spanish); January 1946.

The general topography of the peninsula is described and the vegetation discussed in considerable detail. Besides an enumeration of mainly woody species found in the various areas, the ecological and economic aspects are also dealt with in a lucid manner. The forests of the peninsula are compared with those of Trinidad in a separate section.

Bamboo in Ecuador's highlands. By F. A. McClure. *Agriculture in the Americas* 6: 10: 164-167; 6 figs.; October 1946.

"Highland bamboos occur most abundantly and in relatively pure stands generally at elevations between 5,000 and 11,000 feet, where the topography and orientation to prevailing winds produce a relatively high atmospheric humidity and ample-to-heavy rainfall more or less well distributed throughout the year. Such situations exist principally along the exterior slopes of the outer ranges of the sierra, and in the gorges that traverse these ridges. In general, the occurrence of bamboo is relatively rare along the more arid inner slopes and inner drainage basins of the sierra. According to present knowledge bamboo is also rare at elevations of 12,000 feet or over, even where moisture is ample. Low prevailing or minimal temperatures apparently enter here as a limiting factor.

"The highland regions in Ecuador visited by the writer where the bamboo flora was observed to be most abundant, most dominant ecologically, and most varied are: the well-watered slopes between Paja Blanca and Loma Larga, in Carchi Province; the valley of the Saloya River, in Pichincha Providence; the valley above Macuchi; and the valley above Babahoyo through which passes the road to Guaranda, in Bolívar Province.

"In all these regions the predominant bamboo species belong to the genus *Chusquea*. In fact, according to indications of present knowledge, the major part of the bamboos of Ecuador's highlands, both in number of species and in area occupied, belong to this genus.

"Most of the known *Chusquea* species are plants of small-to-medium stature, with culms less than 1 inch in diameter. A few are erect and some of these have culms as much as 2 inches in diameter, but most are more or less scandent, or climbing, forming impenetrable tangles where there is no support provided by other plants. All have solid stems, but most of them are soft and pithy, shrinking greatly upon drying and being relatively low in strength and durability."

The genus is known locally as Suro or Moya. The culms are used for house construction, basket making, ladders, and fences. Two unidentified genera commonly used to make various articles are known as Tunda and Tundilla.

Acacia negra industry in Rio Grande do Sul. By Joseph L. Dougherty. *Agri. Americas* 6: 9: 139-141, 147; 3 figs.; September 1946.

The growing of Acacia Negra (*Acacia mollissima* Willd.) is becoming an important part of the farming industry in east-central Rio Grande do Sul. A ready market is found for the bark among the state's 223 tanning plants where it is used for the tanning of soft leathers. The wood supplements that from Eucalyptus plantations as a fuel source. It has been found that the depleted farm lands can be re-built to a high state of fertility by growing this leguminous tree.

Vegetation of the coast of Ecuador and Peru and its relation to the Galapagos Islands. By Henry K. Svenson. *Amer. Jour. Bot.* (Burlington, Vt.).

I. Geographical relations of the flora. 33: 5: 394-426; plates 1-5, figs. 1-20; May 1946.

II. Catalogue of plants. 33: 6: 427-498, plates 6-22; June 1946.

"The vegetation of the Galapagos Islands is closely related to that of the South American mainland, but analysis does not suggest continental land connections in the past."

"Stewart's estimate of 40 per cent endemism in the plants of the Galapagos Islands seems too large. It was based on the assemblage not only of species, but of the varieties and forms, of which there is no end if subdivision is carried to an extreme. Thirty-five species, treated as endemic by Stewart and later writers, are considered as not being confined to the Galapagos Islands. Probably the Galapagos endemism is not relatively greater than that of the rain-green forests, and associated arid scrublands about the Gulf of Guayaquil in Ecuador and Peru, with which the vegetation of the Galapagos Islands has much in common.

"Vegetation in the Galapagos Islands is characterized by 'dwarfing,' which involves reduction of leaf surface from locality to locality, probably in response to ecological conditions. This situation does not appear markedly in the analogous zone of the mainland, but is characteristic of some West Indian islands. It is strikingly seen in *Croton*, *Sida*, *Alternanthera*, *Lantana*, *Acacia*, and some other genera. The Galapagos Islands have the same general temperature, rainfall, and fog conditions encountered in the arid region of the Gulf of Guayaquil (illustrated by comparative charts in the text), but they differ in one climatic respect. They have only in small part the intensely drying southwest winds which blow steadily from the Pacific Ocean across the continental lowlands. In comparison with the desert flora from Santa Elena, on the Ecuadorean coast, and from the coast of Peru, the Galapagos flora is luxuriant. In the Galapagos Islands, plants exist on seacoasts and recent lava flows, that could not live at all on the dry Peruvian coast. Once established, they survive in the Islands, though often in a state where transpiration must be reduced to a minimum. Or they may spread out into the wealth of ecological environments open to them. A xerophytic forest, similar to that of the Guayaquil region, though greatly reduced in number of species, occupies the windward slopes of the higher islands in the Galapagos Archipelago. This zone is followed, higher up, by a scrub forest rich in ferns, and on one or two of the islands, by a dry grassy zone above the general cloud level.

"The coastal area of the South American continent which agrees with the climate of the Galapagos Islands—except perhaps for local spots in the Ica to Mollendo region of southern Peru in the zone of heavy mists or garuas—is the coast of Ecuador from Cape Pasado, just below the equator, to Santa Elena, encompassing only two degrees of latitude. The Galapagos Islands cover approximately three degrees. The Islands are geographically intermediate bteween the dry coast of Ecuador and Peru and the dry northern coasts of Colombia and the xerophytic islands of the West Indies. Thirty species are recognized as occurring only in the Galapagos Islands—Gulf of Guayaquil region, while only two (*Psidium galapageium* and *Cyperus pycnostachyus*) are confined to Mexico and the Galapagos Islands, and a single species (*Euphorbia viminea*) to the Galapagos and the West Indies (Bahamas). None are restricted to the Galapagos Islands and the north coast of South America. Nevertheless,

it is evident in *Alternanthera*, that, although the bulk of the Galapagos species are from the adjacent coast of South America, one of the species *(A. ficoidea)* is from the Caribbean region. The Bahama species of *Borreria* though superficially similar to those of the Galapagos Islands, are entirely distinct. With the rain-forest coast of South America from the equator to Panama, the vegetation of the Galapagos Islands has almost nothing in common, except for widely-distributed plantation weeds. The flora of the Galapagos Islands would seem to be of comparatively recent introduction.

"The annotated catalogue comprises 328 species of which six are new: *Opuntia melanosperma*, *Brachistus Haughtii*, *Solanum amotapense*, *Solanum talarense*, *Heliotropium piurense* and *Ruellia pacifica*. Several genera–especially *Alternanthera*, *Prosopis Tephrosia*, *Sida*, and *Ipomoea*–include a comparative study of West Indian species."–*From author's summary*.

La riqueza forestal en la gobernación de la Pampa. *M. A. N.* Publ. of Ministerio Agricultura Nacion (Buenos Aires) No. 79, December 1945. Pp. 6.

This short article on the abundance, qualities, and uses of "Calden" in La Pampa, Argentina, is surrounded by photographs illustrating the appearance of the growing tree, and the various steps in its conversion: felling the trees, hewing the logs, transportation of the logs, and the finished boards.

"The large forests to be found in the National Territory of La Pampa are distributed like a park to the north and south-east of the Territory, and are mainly composed of a tree called 'calden' *(Prosopis Caldenia* Burk). The measurements of the tree generally run from 20 to 80 centimeters in diameter, and up to eight meters height, though giant trees have been found with a diameter of 1.50 meters and a height of 12 meters.

"The 'calden,' the specific weight of which is 600 kilograms per cubic meter, has exceptional qualities. The wood is very tough, and the various ways in which it can be used range from fuel–it has high calorific power–to parquet flooring, in which the variety and beauty of the graining may be appreciated. In Argentina, 'calden' parquet is replacing satisfactorily the former parquet of imported oak."

The Calden also possesses notable qualities for wooden paving blocks and has been used thus with good results. Other common uses of this wood are: door and window frames, fence posts, piles for mines, carriage bodies, barrel staves, general carpentry, foundation forms, pulleys, hatter's blocks, support for stereotype plates, and general uses.

Common latex bearing woody plants of India. By K. L. Budhiraja and R. Beri. Indian Forest Leaflet No. 70, Forest Research Institute (Dehra Dun), 1944. Pp. 18.

"With a view to discovering rich indigenous sources of rubber, the examination of possible rubber yielding woody plants has been undertaken and over 150 latex samples covering 6 families and 46 species have been examined. With the exception of *Cryptostegia grandiflora*, none of the species have been found to contain high proportion of caoutchouc with proportionately low resin, but a few species, e.g., *Palaquium (Dichopsis) ellipticum*, *Madhuca (Bassia) latifolia*, *Ficus glomerata*, *Wrightia tinctoria*, *Tabernaemontana heyneana*, *Wrightia tomentosa* and *Poinsettia pulcherrima*, though they have high resin consent, have also 15% or more of rubber and might, therefore, find some use where rubber content of more than 10-30% is not required, for example, in code wire insulations, jar rings, floor covering, ground sheets, coating to rope soled shoes, adhesives, etc., especially on dilution with para rubber."–*Authors' summary*.

Preliminary studies on improved wood. Part III. Compregnated wood. By D. Narayanamurti and Kartar Singh. Indian Forest Leaflet No. 77, Forest Research Institute (Dehra Dun), 1945. Pp. 11; illus. 9.

"Experiments carried out at the Forest Research Institute, Dehra Dun, indicate that compregnated wood comparing favorably with foreign samples can be produced from Indian timbers. After describing the preparation of com-

pregnated wood the results of tests done on several species of timbers and combination of species and resins are recorded. In addition to strength data, results of tests on thermal and other properties are also recorded. The applications of compregnated wood in industry are indicated."—*Authors' summary*.

Dipterocarp timbers of the Malay Peninsula. By H. E. Desch. *Malayan Forest Records* No. 14, Forest Research Institute, Kepong, 1941. Pp. 171; 7½ x 9¾; 63 plates (photomicrographs), 63 tables. Price $7.50 or 17 s. 6 d. Post free.

"This Record is a continuation of Malayan Forest Record No. 12, *Commercial timbers of the Malay Peninsula, No. 1. The genus Shorea*. In view, however, of the additional material of *Shorea* now available for study, and the desirability of some modifications in the matter of presentation of the data, a revised account of *Shorea* is included here. Further, as a more general study of all Malayan timbers has been undertaken, the title of the former Record is not applicable to the present work, which is confined to the dipterocarp timbers of the Peninsula, and a new title has been selected.

"This volume is divided into nine parts: parts I to VIII are descriptions of the timbers of the genera, arranged in order of commercial importance, and part IX contains a discussion of the significance of the anatomical structure of the wood within the *Dipterocarpaceae*. Citation of material, a bibliography, and an index constitute the appendices.

"The timbers have been classified into trade groups on their anatomical structure, general appearance, and physical properties. The method followed was to examine the species of each genus in turn. In *Shorea* the timber groups follow the botanical divisions recognized by Mr. C. F. Symington (*vide* Malayan Forest Record No. 16), but in *Hopea* I have made two arbitrary divisions for reasons of commercial usage, and I have included *Balanocarpus Heimii* King as a group within this genus, although Mr. Symington is not prepared at this stage to go so far as to recognize *B. Heimii*

as a species of *Hopea*. I have treated *Cotylelobium, Vatica,* and *Upuna* together because their timbers belong to the same trade group. The timbers of *Anisoptera* are related to those of the last three genera mentioned, but they belong to a commercially distinct group. It would be more consistent, and certainly more logical on scientific grounds, to recognize these four genera as different groups within a single framework, or alternatively, to raise the rank of the groups of *Shorea* to that of separate genera. *Upuna borneensis* Sym. is included because of its special interest anatomically and botanically, but it is not a Malay Peninsula species. In view of the treatment adopted for *Cotylelobium* and *Vatica*, it would have been more consistent to regard both *Parashorea* and *Pentacme* as additional groups within the *Shorea* framework, but the necessity for proceeding with the setting up of the type as the work progressed has made this amendment impracticable.

"Attention is drawn to the limited significance to be attached to vernacular names. Such names as damar laut merah, seraya, meranti bakau, meranti tembaga, etc., are monospecific tree names, but when applied to the timbers of those trees their application is frequently more flexible. For example, seraya is the vernacular name of trees of *S. Curtisii*, but in Singapore it is used for any timber of a particular type, irrespective of species or even family. In Malacca, on the other hand, when referred to timber, seraya denotes a superior grade of meranti (the F.M.S. equivalent of Singapore's seraya) and embraces the timbers of a few species: those of *S. Curtisii*, *S. pauciflora*, and some *S. acuminata*. Failure to recognize the difference in the use of a vernacular name for a tree and its timber is at the root of much of the misconception regarding nomenclature of timbers in this country. To make the distinction in the text, romanized type has been used for vernacular names when they refer to timber classes, and italics when those names are used in a monospecific sense and applied either to the tree or its timber."—*From author's preface*.

This authoritative work on a large and important family will be highly valued by all workers concerned with tropical

woods. It will prove indispensable to dealers in dipterocarp timbers.

Manual of Malayan timbers. Vol. I. By H. E. Desch. *Malayan Forest Records* No. 15, Forest Research Institute, Kepong, 1941. Pp. 328; 7½ x 9¾; 69 plates (photomicrographs), 65 tables. Price $10.00 or 24 s. Post free.

"When it was decided to undertake a revision of Malayan Forest Record No. 1 *(Commercial Woods of the Malay Peninsula)*, no hard and fast limits regarding the scope of the project were laid down, beyond a recommendation that the completed text should not exceed 300 pages. It early became apparent that it would be difficult to decide what should and what should not be included."

"In an endeavor to determine what species were being exploited, District Forest officers were asked to send in specimens from logs found in the sawmills and sawpits in their districts. Study of the specimens sent in disclosed some interesting facts: in some districts almost any tree of saw-log size (20 inches in diameter or over) was being taken without question, whereas in other districts many not uncommon species were rejected because of reputed recalcitrant sawing qualities.

"It was, therefore, decided to enlarge the scope of the studies to include all species that attain sawmill size. As the work progressed, however, it became apparent that there were several small-tree species with useful or potentially useful wood, and a further revision of the scope of this Record was made to include any tree (as opposed to a shrub) of which material was available for study.

"Arrangements were made for botanically authenticated logs to be accumulated at the sawmills, where the writer could study on the spot their condition, ease of conversion, and quality of the outturn. The empirical nature of these observations was a distinct drawback, and the co-operation of the Officer-in-Charge, Timber Research Laboratory, Sentul, F. M. S., was enlisted to secure more scientifically accurate data for the commonest species. A 'pilot test' was devised to provide information on wood working qualities, seasoning, preservation, and some of the more important mechanical properties, the tests being carried out on logs from three different trees, each log being 8 to 10 feet long and 5 to 8 feet in girth.

"As regards the text, an alphabetic sequence, by families, has been adopted as being the most satisfactory compromise in a work of this nature, although the writer would have preferred a phylogenetic sequence, based on anatomical considerations, but this is a vast project which would have entailed many years of fundamental research. With very few exceptions the families are those defined by Hutchinson in his *Families of Flowering Plants*. Within each family the different timbers are arranged in alphabetic sequence of vernacular names, except when the majority of species in a family have no established vernacular names and botanical names have had to be used.

"A type family description has been followed throughout, except when circumstances warranted minor departures for the sake of brevity. Information is given under the following heads:—

(1) General.

(2) Trade and vernacular names.

(3) The timbers. (a) General properties. (b) Features visible to the naked eye. (c) Mechanical properties. (d) Working qualities. (e) Seasoning. (f) Preservation. (g) Defects. (h) Importance and uses.

"The information under (1) above is presented fully because the writer visualizes the Record being used in places less well equipped than a research laboratory with library facilities. With this information the shortest cut to finding possible substitutes for special-purpose woods in any country is to investigate the nearest relatives of these woods that are represented. The summarized accounts of the anatomical structure of the woods of each family have been included to draw attention to the numerous taxonomic contradictions that exist in the hope that students turning these pages may be persuaded to investigate some of the problems requiring solution.

"The information under 3 (c) to (h) has been culled from published experimental work carried out at accredited research laboratories, and is presented in considerable detail so that the reader can judge for himself just how much significance should be attached to it. The alternative of presenting the statements of all authors has not been adopted, because many of the earlier writers followed no recognized standards of accuracy when recording their observations. Moreover, many of these statements were originally recorded on herbarium sheets, the identity of which may subsequently have been changed when subjected to critical study."

"This Record (No. 15) will, on completion, contain descriptions of more than eighty families of which forty-five (including an abridged account of the Dipterocarpaceae), are included in volume I and the remaining families will constitute volume II. It is not entirely satisfactory to publish a reference work of this nature in two parts, with an interval between of two or three years, but this course appeared preferable to holding up available information until the whole work was completed. In the circumstances, however, volume one is complete in itself, except that the appendices are omitted. Pagination will be continuous throughout both volumes so that one index will ultimately suffice, but a separate index to volume I is provided. The following appendices will be included with volume II: (1) bibliography, (2) figures for mechanical properties collected from pilot tests, (3) uses of Malayan timbers, (4) citation of material, (5) card-key to lens characters, (6) glossary of Malay words, (7) list of plates, and (8) indices for volumes I & II."—*From author's introduction.*

When complete, this manual together with the preceding publication will undoubtedly be the standard reference for timbers of this region for many years to come.

Icones plantarum omeiensium. Edited by WEN PEI FANG. National Szechuan Univ., Chengtu, Szechuan, China. 2: 1: December 1945 and 2: 2: May 1946.

These issues each describe 50 species, some new. A full page of English text and one of Chinese accompanies a full page plate (drawing) for each species. References and specimens are cited.

Die stellung der forstwirtschaft in den tropen. By JUSTUS WILHELM GONGGRYP. *Intersylva*, Zeitschrift der Internationalen Forstzentrale (Berlin-Wannsee) 1: 3: 324-341; 6 figs., 9 tables; July 1941.

"Next to the coniferous forests of the northern temperate zone, the tropical forests are of the ultmost importance for world-economy as wood-reserves. Tropical forests differ, in the first place, from those of the temperate zones by the great variety of tree species and by their luxuriant vegetation. The total number of tropical tree species is estimated at about ten thousand. It is extremely difficult to define these "species" for commercial purposes on account of the great differences found in the characteristics of the same botanical species. The dimensions of timber exploited in the tropics are larger, as a rule, than in the temperate zone. Although tropical forests usually show a great variety of species in their composition, there are forests that may be considered as practically unmixed. Statements as to the areas covered with the different species are best avoided. The rapidity of growth of the quickest-growing European species is about equal to that of the quick-growing species on Java.—The technical side of forestry in the tropics is mainly concerned with unexploited forests. The irregular combination of field-crops and forestry by natives plays an important part in tropical forestry. The importance of minor produce is often overestimated. Along with the classical method of exploiting tropical forests by shelterwood selection cutting, other methods are being introduced. In Surinam the average yield of timber over 40 cm. in diameter in managed mixed forests is only 2 to 6 $m.^3$ per hectare. The yield varies however in different regions. The technique of wood utilization is mainly influenced by the world market.—Tropical forestry is characterized by the fact that forest management is inexistent in the great majority of tropical forests and that sustained working is problematical in the highest degree. A sound organization of forestry

in the tropics would be largely equivalent to a general agricultural reorganization of native and general economic conditions in the area concerned. Forest exploitation is always very extensive. Even in the outer provinces of the Dutch Indies a forest district averages some 4 million hectares of forest. For a general survey of the importance of tropical forestry the known data and figures are far from sufficient. Java forms an exception and data for Javan forestry are quoted as examples: the possible production of teak per hectare and year is assessed at 3.7 m.^{3} of wood having over 7 cm. in diameter at the smaller end, of which 1.6 m.^{3} represent intermediate yields and 2.1 m.^{3} the final cutting, or, otherwise, 1.2 m.^{3} of building timber and 2.5 m.^{3} of firewood."—*English abstract.*

Die holzzufuhr aus den tropen nach Europa. By Justus Wilhelm Gonggryp. *Intersylva*, Zeitschrift der Internationalen Forstzentrale 2: 2: 232-246; 8 figs., 9 tables; April 1942.

"Importation of timber from the tropics began concurrently with the development of the overseas trade; it remained for centuries, however, within narrow limits; tropical timber was a precious commodity. In the 18th century exports increased, although their volume has often been overestimated in later publications owing to confusion in the naming of the different kinds of wood and to the differing measurements used. Exploitation was limited to individual trees, due to ignorance, in many cases, of the qualities of the various woods, as only a few of the many tree species of the tropical monsoon forests were considered marketable and suitable. The use of European or North-American timber in tropical countries seemed in many cases also more easy or more economical.—Present timber exportation from the tropics to Europe can be ascertained by means of the foreign trade statistics of the import and export countries; these statistics, however, show grave deficiencies in many respects. In this article the export statistics of French Equatorial Africa and the import statistics of Great Britain, France and Germany have been taken into consideration. Importation of tropical timber to Europe is estimated at 1 million m.^{3} per year, to countries outside Europe at approximately the same amount.—Possibilities for a future increase of importation are certainly given; tropical forests produce in many instances as much as 100 m.^{3} exploitable timber per hectare. Actual exports comprise only a fraction of the timber exploited, and this, in turn, only a fraction of the fellings. Notwithstanding the small quantity exported, the danger of forest devastation and soil erosion is, nevertheless, present. Conserving the production capacity of the tropics and balancing the needs of tropical populations with those of Europe will be the task of the future."—*English abstract.*

Die frage der holzbilanzen in bezug auf die Africanishe forststatistik. By Justus Wilhelm Gonggryp. *Intersylva*, Zeitschrift der Internationalen Forstzentrale 3: 4: 536-550; 2 figs., 7 tables; October 1943.

"The African forestry statistics of the International Institute of Agriculture in Rome: Annuaire International de Statistique Forestière, Volume III, Afrique, form an important contribution to the discussion of Africa's position as producer and consumer of forest raw materials. An attempt is made to find out in what manner an improvement of the statistics should be attained and in how far basic material for a timber balance in the sense of the data demanded by the International Forestry Center is already available.—As the newer numerical data on forest areas did not show enough uniformity to permit a comprehensive survey of African afforestation, older figures have also been used. From forest area and possible timber production per unit of surface it appears that Africa has so far contributed only an insignificant fraction of its total timber yield. Added hereto should be the rubber, tan, oil, and cork yield which in many instances are to a greater extent than timber the main products of the forests. Although not quite complete, these data show a passive timber balance, while Europe, erroneously spoken of as poor in timber, has always placed a by

far greater surplus of raw timber at the disposal of the world.—A rational working of the African forests is imperative not only for reasons of remunerativeness but also for the preservation of agriculturally used areas. Provided an adequate organization, extraordinary possibilities would develop for the African forests. On the other hand, the worst catastrophes and the devastation of whole regions would have to be envisaged in case of neglect and abusive exploitation. This will in the first place depend on human activity, and the responsibility of forest administrations and of the Governments is tremendous.—The opening up of the forest's riches will make great demands on forestry personnel: it should not be executed in a bureaucratic manner without the initiative of private enterprise or the aid of the scientist, the industry and the co-operation of the natives. The remunerativeness of capital destined for silvicultural purposes should not be overrated. Therefore the danger of abusive exploitation is obvious, and the means are lacking to convince the Governments of this danger and of the great value of the forests. Correct production and consumption balances of timber and forest products, which so far do not exist for any part of Africa, would be of great importance. The suggestion made by the International Institute of Agriculture to enlarge and complete the African forestry statistics giving due consideration to the various sylvicultural viewpoints is, at any rate, highly commendable."—*English abstract.*

Table générale des matières des 1910 à 1945. Supplement to *Bul. Agricole du Congo Belge* (Direction Générale de l'Agriculture, Brussels) Vol. 36. Pp. 100. Price 15 francs.

Lists of titles are classified according to subject categories. These are followed by alphabetical indexes of subjects and authors.

Sur la présence de latex chez quelques Compositacées. By É. DE WILDEMAN. Reprint from *Bul. Classe des Sciences*, Académie Royale de Belgique (Brussels), Series 5: 28: 1-3: 17-34, January 1942.

The occurrence of latex in nine genera is discussed.

Les latex des Euphorbiacées. I—Considérations générales. By É. DE WILDEMAN. Inst. Royale Colonial Belge (Brussels) 12: 4: 1-68; 1944. Price 25 francs.

The problems connected with the study of latex occurrence and composition in the various genera and species of the Euphorbiaceae are discussed in some detail. Lists of species are included.

De l'origine de certains éléments de la flore du Congo Belge et des transformations de cette flore sous l'action de facteurs physiques et biologiques. By É. DE WILDEMAN. Inst. Royal Colonial Belge (Brussels) 10: 1: 1-355; 1940. Price 60 francs.

The author recognizes 10 botanical districts of which 7 bear forest vegetation and 3 support grassland vegetation. Consideration is given to the origin of certain elements of the flora and to the physical and biological agents responsible for their dispersal.

The flora consists of:

1. A nucleus of species which are tentatively designated as "endemics." The distribution of these conforms, in a general way, to the botanical or floristic districts.
2. A rather large number of species, clearly African, which in primitive times were more or less localized in their distribution but which have since extended their range into diverse districts of the Congo by virtue of such agents of dispersal as wind, water currents, animals and man.
3. A relatively high percentage of exotic plants, particularly of Asiatic, European and American origin. The number of these species is constantly increasing.

Notulae Systematicae. Edited by H. HUMBERT, Museum National d'Histoire Naturella (Laboratoire de Phanerogamie), Paris, France.

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Sous-espèce asiatique nouvelle du *Dactylis glomerata* L., by Mlle. A. Camus. Pp. 207-209.

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Sur les Commelinacées, by M. Pichon. Pp. 217-242.

Sur quelques Anonacées indochinoises, by Mme. S. Jovet-Ast. Pp. 243-246.

Boniodendron Gagnep. n. g. Sapindacearum, by F. Gagnepain. Pp. 246-248.

Le genre *Tristellateia* du Petit Thouars dans la flore malgache, by J. Arenes. Pp. 248-256.

Notes on terms for use in vegetation description in southern Nigeria. By A. P. D. Jones. *Farm and Forest* (Ibadan, Nigeria) 6: 3: 130-136; 2 figs.; July-December 1945.

The author has revised and extended existing classifications in an attempt to satisfy the need for a workable field classification of the woodland vegetation types in southern Nigeria.

Timbers of West Africa. Publ. by Timber Development Assoc. Ltd. (75 Cannon St., London, E.C.4), 1945. Pp. 80; 5 x 7¼; 1 folded map.

The woods are listed alphabetically according to common name. Descriptions include other names, distribution, "the tree," "the timber," seasoning, strength, durability, working qualities, uses, sizes, and supplies. A "use guide," bibliography and index are included. Fifty-four timbers are listed.

World timbers. Publ. by Timber Development Assoc. Ltd. (London), 1946.

Descriptions of various timbers follow the order of those described in the preceding reference. They are issued as separate leaflets, perforated for loose-leaf binding. Volumes I and II plus ten additional leaflets have been published thus far.

Phytologia. Pub. by H. A. Gleason and Harold N. Moldenke (N. Y. Bot. Gard.). Vol. 2: 4; June 1946. Mimeographed.

Contents

A Spanish-English glossary of forestry terminology, I. By Carmen García-Piquera. *Caribbean Forester* (Rio Piedras, Puerto Rico) 7: 2: 103-120; April 1946.

In order that the work may become available as it is completed the glossary is being published in provisional form in groups of 100 terms. The scope of the study is largely defined by the recent glossary of forest terminology of the Society of American Foresters.

Factors in the natural resistance of woods to termite attack. By George N. Wolcott. *Caribbean Forester* 7: 2: 121-134; April 1946.

"Of the major constituents of wood, cellulose is readily digested by the enzymes of protozoans living in the digestive tract of termites, while lignin is entirely undigestible. Thus woods with a high cellulose content have a high food value for termites, while they invariably avoid those with a high lignin content. In the case of all timbers tested, the sapwood is invariably more acceptable, as it contains starch and sugars, while the heartwood, being also more lignified in many tropical hardwoods, is avoided, or attack on it is postponed until all available sapwood has been consumed.

"Besides cellulose and lignin, woods have other specific extraneous constituents, some of which may be decisive in determining whether the wood can be eaten by termites."—*From author's summary.*

The lignin, ash, and protein content of some neotropical woods. By F. J. MARCHAN. *Caribbean Forester* 7: 2: 135-138; April 1946.

The data, obtained in conjunction with the study of the preceding reference, is tabulated for 43 species.

Color measurement and its application to the grading of agricultural products. By DOROTHY NICKERSON. U. S. Dept. of Agriculture (Washington, D. C.) Misc. Publ. No. 580, March 1946. Pp. 62; 47 figs.

Sub-titled "A Handbook on the Method of Disk Colorimetry," this publication will be of interest to workers in biological fields who have problems of color evaluation and classification.

Library catalogue. Timber Development Assoc., 75 Cannon St., London E. C. 4. Pp. 15, March 1946.

This catalog of references in the Association's library is unique in that the publications are available from numerous branch libraries. The references are listed according to the decimal system of classification published by the Association, "Index of Information," December 1945.

An introduction to historical plant geography. By E. V. WULFF. (Trans. by Elizabeth Brissenden) *Chronica Botanica Co.* New Series Vol. 10; pp. 223; 35 figs. 1943.

"The present volume consists of eleven chapters opening with one covering the scope of the subject, the relationships to allied sciences, and methods of investigation, and closing with an excellently prepared one on the concept of floral elements. Between these two chapters, in much detail, is considered the history of the science, areas: their types and origins, parallelisms in the geographical distribution of plants and animals, artificial and natural factors in relation to the geographic distribution of plants, migrations of species and of floras and their causes, and the historical causes for the present structure of areas and the composition of floras."—*From foreword by Elmer D. Merrill.*

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H. H. Chattaway

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Yale University School of Forestry

TROPICAL WOODS

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

The editor of this publication and the writer of any articles therein, the authorship of which is not otherwise indicated, is ROBERT W. HESS, *Associate Professor of Forest Products, Yale University School of Forestry.*

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THE EFFECT OF WATER-SOLUBLE EXTRACTIVES FROM THE HEARTWOOD OF TROPICAL AMERICAN WOODS ON THE GROWTH OF TWO WOOD-DECAY FUNGI

By ALMA M. WATERMAN[1]

In 1943, during the development of Latin-American Forestry projects connected with war emergency construction, U. S. Forest Service field parties collected samples of wood from selected trees of various species in Central America and Ecuador for a study of the properties that might indicate

[1]Associate Pathologist, Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, United States Department of Agriculture, in coöperation with Osborn Botanical Laboratory, Yale University, New Haven, Conn.

their usefulness in service. Part of the material was referred to the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, to be tested for relative decay resistance. As a part of these tests a study was made of the effect of the hot-water-soluble extractives from the outer heartwood on the growth of wood-decay fungi in culture media containing the extractives, to determine whether a simple rapid technique for the preparation of the media and the measurement of the growth rate of the fungi could be devised that would give results indicative of relative decay resistance.

The possibility of evaluating decay resistance of North American woods by determining the toxicity of water-soluble extractives from sapwood and heartwood to decay fungi in culture has previously been investigated. The results have been summarized in connection with recent studies of the toxicity of hot-water-soluble extractives from the heartwood of Western Redcedar. (*Thuja plicata* D. Don) (9), Ponderosa Pine (*Pinus ponderosa* Laws.) (1) and Black Locust (*Robinia pseudoacacia* L.) (8). In an earlier study, Hawley, Fleck and Richards (2) reported the results of toxicity tests with the hot-water-soluble extractives of Black Locust and White Oak (*Quercus alba* L.).

In the experiments here described the toxicity of various concentrations of the hot-water-soluble extractives from the outer heartwood of 35 selected trees representing 11 species of tropical woods was tested by means of the effect upon the growth rate of two decay fungi,[2] *Lenzites trabea* Fr. and *Poria microspora* Overh., both of which cause brown rot in a number of North American wood species. Similar tests

[2]The isolations of *Lenzites trabea* (Madison #617) and *Poria microspora* (Beltsville #106) used in these tests were received from the Madison, Wisconsin Branch of the Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, and were used in laboratory decay tests that formed another part of the tropical woods durability project.

were made with extractives from the outer heartwood of 10 trees of Black Locust from the northeastern United States, 5 trees of White Oak from North Carolina, and 7 trees of Douglasfir [*Pseudotsuga taxifolia* (Poir.) Britt.] from the Pacific Northwest.[3] It was thought that a comparison of the results from the tropical woods with those from the North American woods representing various degrees of known durability might afford a basis for evaluating the toxicity tests as a rapid means of determining decay resistance. All tests were made with extractives from the outer heartwood only, which in previous studies with Black Locust (8) proved more resistant to decay than inner heartwood.

Methods

The material selected[4] was from the outer one-third of the heartwood in all trees in which it was possible to distinguish between sapwood and heartwood. In trees of four species no such distinction was possible and an arbitrary allowance for sapwood was made. The test sample was then taken from the outer third of the remaining trunk cylinder. The allowance for these species was as follows:—*Terminalia amazonia* (Gmel.) Exell. 2.5-3 inches; *Brosimum utile* (H.B.K.) Pittier 2-2.5 inches; *Rhizophora mangle* L. 1.5-4.5 inches; *Humiria* sp. 2-2.5 inches.

In general, the experimental procedure followed that described by Scheffer, Lachmund and Hopp (8). The extractives were obtained by heating 2 grams of sawdust, oven-dry weight, in 100 cc. of distilled water in an autoclave for 3 hours at 100° C. The hot mixture of extractive in solution and sawdust was immediately filtered through a tared alundum crucible by means of a vacuum filter pump, and the remaining sawdust was carefully washed with hot distilled

[3]The Black Locust wood was provided by Henry Hopp of the Soil Conservation Service, U. S. Departmtnt of Agriculture, and the White Oak and Douglasfir by members of the Division of Forest Pathology.

[4]The test samples were selected and ground to the fineness of coarse wood flour by C. G. Duncan of the Branch Office of the Division of Forest Pathology, located at the Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wisconsin.

water in order to filter off all extractive possible. The sawdust was then oven-dried and weighed. The reduction in weight represented the amount of hot-water-soluble extractive obtainable from the 2 grams of sawdust. The filtrate containing the extractive was evaporated at a temperature not exceeding 50° C. to a volume corresponding to 100 cc. for each 2 grams of sawdust used. This concentration of extractive, designated as 1 ×, was used as the standard from which was prepared a series of weaker and stronger solutions of extractives, from ⅛ the strength of the 1 × concentration, by dilution with distilled water, to 8 times its strength, by evaporation at 50° C. Each of these extractive solutions was made into test medium by the addition of 2.5% of malt extract and 2.5% of agar. The mixture was prepared in an amount slightly less than the final required amount and was steamed in an autoclave for 20 minutes at 100° C. to liquify the agar. The hot medium was then thoroughly mixed by blowing air into the liquid through a pipette, and hot distilled water was added to make the required amount of liquid. Ten cubic centimeters of medium were pipetted into each test tube, the latter being of the type devised by Scheffer (6) with an indentation in the wall at one side near the mouth. Six tubes of medium were made from each extractive concentration and likewise a control series of tubes was prepared, each tube containing 10 cc. of freshly made malt agar medium (2.5% malt extract and 2.5% agar) without the wood extractive. The tubes were plugged with cotton and the medium was sterilized 15 minutes at 15 pounds pressure. The tubes were then placed in a horizontal position while the agar was hardening so that an agar strip was formed the entire length of the tube to the indentation in the wall.

The midpoint of the agar strip was marked on each tube and at this point was placed a small square of inoculum (about 5 mm.) consisting of the mycelial growth of the test fungus on malt agar. Three tubes of each extractive concentration were thus inoculated with *Lenzites trabea* and three with *Poria microspora*. Three of the control tubes were similarly inoculated with each of the test fungi.

All tubes of inoculated media were placed in an incubator and maintained at a temperature of 26-28°C., varying slightly with the outside room temperature. A period of 4 days was allowed for the growth of the mycelium from the inoculum block onto the extractive agar and at the end of that period the exact limits of linear growth were marked on each tube. The cultures were then replaced in the incubator. Five days later the limits of growth were again marked and the linear extent of the mycelium during this 5-day period was measured to 0.5 mm. The average growth rate of the test fungi on each concentration of extractive medium in the 5-day period was computed as percentage of the corresponding growth rate in the accompanying controls, the latter being rated as 100%.

Scheffer, Lachmund and Hopp (8) found that differences in toxicity occured most clearly in media containing 0.25% to 1.00% extractive from the heartwood of Black Locust. In the present study a concentration four times the strength of the 1 × or standard concentration gave percentage values approximately within this range. Therefore only the growth rate of the test fungi on this concentration, equal to the total amount of extractive from 2 grams of sawdust in 25 cc. of water, is used in this report.

Results

The amount of hot-water-soluble extractive obtained from the wood was found to vary considerably among the individual trees of a species and among the species, as indicated in Tables 1 and 2. Therefore the 4 × concentration did not represent a definite percentage of extractive in solution but varied from 0.18% in one tree of *Humiria* sp. to 1.20% in one of *Quercus copeyensis* C. H. Mull. Previous investigators (2, 8) found a similar variation among 7 species of North American trees and among individual trees of Black Locust. In general, this variation in amount of extractive among individual trees of a species corresponded positively with the variation in the effect of the extractive upon the

growth of the fungi, the extractive from the woods yielding higher percentages being more toxic than that from the woods yielding the lower percentages. However, in those tropical trees from which only small amounts of extractive were obtained, such as *Brosimum utile*, *Carapa guianensis* Aubl., *Rhizophora mangle*, and *Humiria* sp., the extractives from the woods giving higher percentages were sometimes less toxic than those from the woods giving the lower percentages (Table 1). In those species in which 5 or more individual trees were tested, some individuals yielded one and a half or two times as much extractive as others (Table 2). This suggests that the results from only 3 individuals of most of the tropical species may not give a comprehensive indication of the amount of extractive obtainable from the respective species. Moreover, the response of the two fungi to variations in amount of extractive among individual trees of a species was not always identical. This was particularly noticeable in the case of the extractive from the 10 trees of *Robinia pseudoacacia* (Table 2). The toxic effect upon the growth of *Lenzites trabea* decreased with corresponding decrease in amount of extractive, but the toxic effect upon *Poria microspora* remained fairly uniform among all 10 trees.

Variation in amount of extractive among the genera of tropical woods usually corresponded with variation in toxicity. However, the extractive from *Chaetoptelea mexicana* Liebm., which was relatively low in percentage, 7.32% showed a high toxicity, and that of *Rhizophora mangle*, which was only slightly lower than that from *Quercus alba*, resulted in a negligible reduction of growth of *Poria microspora* and a stimulation of the growth of *Lenzites trabea*. Among the North American species there was no correlation between percentage of extractive and toxicity. The results obtained by Hawley, Flex and Richards (2) also indicate this lack of corelation.

From the data in Table 1, the extractives from the tropical woods might be rated as follows: Very toxic–*Clarisia racemosa* R. & P. Toxic–*Chaetoptelea mexicana*, *Quercus copeyensis*. Intermediate–*Persea pallida* Mez and Pittier, *Termi-*

TABLE 1. RELATIVE TOXICITY OF THE WATER-SOLUBLE EXTRACTIVES OF SOME AMERICAN WOODS

Species	No. of trees	Source	Extractive from 2 grams of sawdust: Average for species	Growth on 4× concentration[a]: For species: Maximum	For species: Minimum	For species: Average	Poria microspora: Maximum	Poria microspora: Minimum	Poria microspora: Average	Lenzites trabea: Maximum	Lenzites trabea: Minimum	Lenzites trabea: Average	Ave. for 2 fungi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)[b]	(9)[b]	(10)	(11)[b]	(12)[b]	(13)	(14)
			percent	grams			percent			percent			percent
Tropical American[c]													
Clarisia racemosa	3	Ecuador	13.34	.299	.245	.267	0	0	0	0	0	0	0
Chaetoptelea mexicana	3	Panama	7.32	.167	.125	.146	7	15	10	13	34	27	19
Quercus copeyensis	5	Costa Rica	10.49	.302	.137	.210	0	61	45	5	69	37	41
Persea pallida	3	Panama	8.14	.185	.127	.163	44	84	61	46	121	85	73
Terminalia amazonia	3	Ecuador	7.04	.152	.127	.141	54	67	65	18	82	60	63
Nectandra rectinervia	3	"	6.01	.149	.103	.120	77	76	76	84	78	81	79
Ocotea tonduzii	3	"	4.18	.109	.049	.083	70	99	81	90	107	93	87
Brosimum utile	3	"	4.21	.101	.071	.084	91	72	83	100	82	92	88
Carapa guianensis	2	"	4.06	.089	.074	.081	82	86	84	117	125	121	103
Rhizophora mangle	4	"	5.86	.121	.108	.117	99	93	95	100	121	125	110
Humiria sp.	3	"	2.81	.072	.046	.056	97	97	97	105	99	101	99
North American													
Pseudotsuga taxifolia	7	U.S.	7.27	.196	.106	.145	0	14	2	0	0	0	1
Robinia pseudoacacia	10	"	10.07	.234	.160	.201	33	31	42	0	72	39	41
Quercus alba	5	"	6.04	.164	.084	.121	57	93	72	84	89	82	77

[a] 4× concentration equals the total amounts of extractives as indicated in columns (5) and (6), in 25 cc. of water.
[b] The figures in columns (8) and (11) indicate percentages of normal growth of fungi in media containing the maximum grams of extractives in column (5), and those in columns (9) and (12) the minimum grams in column (6). Normal mycelial growth is the average growth in the control tubes of each series, rated as 100%.
[c] Tropical species are arranged in the order of decreasing toxicity of extractives, as indicated by the average growth of *Poria microspora*.

nalia amazonia, *Nectandra rectinervia* Meissn., *Ocotea tonduzii* Standl., *Brosimum utile*. Nontoxic—*Carapa guianensis*, *Rhizophora mangle*, *Humiria* sp. The effect of the extractives from the first five species mentioned resulted in an average growth rate for the two fungi of 0 to 73%. In comparison with the average growth rate of 1% to 77% for the two fungi on the extractives from the North American species, which are known to be durable in service, the five tropical species might be considered as relatively durable. Of these five species, Record and Hess (5) reported durability in service as follows: *Clarisia racemosa*, not very durable in contact with the soil; *Chaetoptelea mexicana*, locally used for railroad ties; *Quercus copeyensis*, not reported; *Persea pallida*, this species not reported but genus durability reported as low to fairly high, wood useful in interior construction; *Terminalia amazonia*, durability usually high.

The highly toxic effect of the extractives from the Douglasfir trees and the moderate toxicity of those from the Black Locust trees, as indicated in Table 2, is of interest in view of the fact that Douglasfir is usually rated as less durable in service than Black Locust (4). It is possible that variations in decay resistance among individual trees of a species such as those indicated by Hirt (3) and Scheffer (7) for Black Locust and White Oak may be present in Douglasfir, with the particular trees tested in the present study being highly resistant. On the other hand, laboratory and field decay tests with additional Douglasfir trees might indicate that the species is more resistant to decay than previously reported. It is also possible that the process of extraction and the preparation of the culture media may have changed the chemical nature of the extractives to such an extent that the fungi failed to respond as they would upon these wood species in nature. Moreover, some of the chemical compounds that in nature affect decay resistance may not be hot-water-soluble.

The data here presented indicate that neither the amount of hot-water-soluble extractives nor their toxicity to fungi in culture offers a reliable basis for ascertaining the decay resistance of wood. Both factors, however, seem to be in-

TABLE 2

VARIATION IN TOXICITY WITHIN SPECIES

Species	Tree No.[a]	Source	Extractive from 2 grams of sawdust		Growth on 4× concentration[b]		
					Poria microspora	*Lenzites trabea*	Average for 2 fungi
			percent	grams	percent	percent	percent
Robinia pseudoacacia	LF-1	N. J.	11.72	.234	33	0	17
	LB-3	Vt.	11.42	.228	44	38	41
	LB-1	Vt.	11.10	.222	37	15	26
	LG-1	N. Y.	10.91	.218	50	27	39
	LSG-1	Conn.	10.45	.209	46	41	44
	LB-4	Vt.	10.15	.203	50	30	40
	LW-1	R. I.	9.60	.192	48	55	52
	LO-2	N. Y.	8.82	.176	39	44	42
	LB-2	Vt.	8.52	.170	39	70	55
	LO-4	N. Y.	8.01	.160	31	72	52
Average			10.07	.201	42	39	41
Pseudotsuga taxifolia	DF-1	Wash.	9.80	.196	0	0	0
	DF-2	Wash.	8.85	.177	0	0	0
	DF-7	Ore.	7.60	.152	0	0	0
	DF-3	Wash.	7.06	.141	0	0	0
	DF-5	Wash.	6.28	.126	0	0	0
	DF-6	Ore.	5.97	.119	0	0	0
	DF-4	Wash.	5.31	.106	12	0	6
Average			7.27	.145	2	0	1
Quercus alba	QO-3	N. C.	8.18	.164	57	84	71
	QO-2	N. C.	7.27	.145	57	82	70
	QO-5	N. C.	6.18	.124	69	61	65
	QO-1	N. C.	4.37	.087	86	94	90
	QO-4	N. C.	4.18	.084	93	89	91
Average			6.04	.121	72	82	77

[a]Individual trees are arranged in the order of decreasing percentage of extractive within the species. Normal mycelial growth is the average growth in the control tubes of each series, rated as 100%.

[b]4× concentration equals the total amounts of extractives in 25 cc. of water.

volved. The study also indicated that a further refinement of technique and equipment for the purpose of decreasing the amount of exacting and time-consuming routine, as well as a parallel study of decay resistance by other laboratory and field methods, is necessary to determine the value of the toxicity tests in interpreting decay resistance.

Summary

As a part of a study on the relative decay resistance of certain tropical woods from Central and South America, tests were made of the toxic effect on the decay fungi, *Lenzites trabea* and *Poria microspora*, of the hot-water-soluble extractives from the outer heartwood of selected trees representing 11 species of tropical woods, in comparison with 3 species of North American woods. The latter species were selected as indicative of various degrees of durability in service.

Finely ground sawdust of the selected trees was heated in water and the filtrate obtained was made into a series of concentrations. To each of these were added malt extract and agar and, after sterilization, test-tube cultures of the media were inoculated with the test fungi, together with control cultures of malt extract and agar only. The growth rate of the fungi during a 5-day period was measured and the average percentage of mycelial growth as compared with the controls was computed.

On the basis of the data obtained from the tropical woods the toxicity of their extractives might be rated as follows: Very toxic—*Clarisia racemosa*. Toxic—*Chaetoptelea mexicana, Quercus copeyensis*. Intermediate—*Persea pallida, Terminalia amazonia, Nectandra rectinervia, Ocotea tonduzii, Brosimum utile*. Nontoxic—*Carapa guianensis, Rhizophora mangle, Humiria* sp. The results from the tests with extractives from *Pseudotsuga taxifolia, Robinia pseudoacacia* and *Quercus alba* indicate a decreasing toxicity in the order mentioned. According to service data, however, *R. pseudoacacia* is rated as highly durable, *Q. alba* as durable and *P. taxifolia* as intermediate. The high toxicity of the extractives from the 7 trees of the last-named species, tested in this study, may indicate that these trees represent highly resistant individuals in the species or that the species as a whole may be more resistant to decay than has been reported in service data. Also, changes in the chemical composition of the extractives in the process of the preparation of the media, or failure to extract by the hot water method all the toxic chemicals that influence resistance may contribute to the disparity between the laboratory toxicity tests and service data. The results of the extractive tests with the tropical woods can be considered only as a very general indication of their relative decay resistance.

Literature Cited

1. Anderson, B. A. The toxicity of water-soluble extractives of western yellow pine to *Lenzites sepiaria*. Phytopath. 21:927-940. illus. 1931.

2. Hawley, L. F., Fleck, L. C., and Richards, C. A. The relation between durability and chemical composition in wood. Indus. and Engin. Chem. 16:699-700. 1924.

3. Hirt, R. R. A progress report on laboratory tests of the relative durability of different varieties of black locust subjected to certain wood decay fungi. Jour. Forestry 36:53-55. 1938.

4. Hunt, G. M., and Garratt, G. A. Wood preservation. 457 pp. illus. New York, N. Y 1938.

5. Record, S J., and Hess, R. W. Timbers of the new world. Yale University Press. 640 pp. illus. 1943.

6. Scheffer, T. C. A tube for culturing fungi. Science (n.s.) 82:467-468. illus. 1935.

7. ———. The decay resistance of oak wood. Forest Pathology Special Release 13. 5 pp. illus. 1943. (mimeographed).

8. ———, Lachmund, H. G., and Hopp, H. Relation between hot-water extractives and decay resistance of black locust wood. Jour. Agr. Res. 68:415-426. Illus. 1944.

9. Southam, C. M., and Ehrlich, J. Effects of extract of western redcedar heartwood on certain wood-decaying fungi in culture. Phytopath. 33:517-524. illus. 1943.

IDENTIFICATION OF NEW WORLD TIMBERS

Part II (continued)

By ROBERT W. HESS

The first part of this series of descriptions appeared in *Tropical Woods* 86 and Part III is included in this issue.

The photomicrographs intended to accompany the descriptions of the Anacardiaceae published in *Tropical Woods* 87 are included here.

EXPLANATION OF FIGURES

No. 1. *Anacardium excelsum* (Bert. & Balb.) Skeels (Yale 3966). Cross section showing pore arrangement and very numerous fine rays. × 20.

No. 2. *Astronium fraxinifolium* Schott (Yale 688). Cross section showing arrangement of tyloses-filled vessels and the fine rays. The late wood in this instance is dense, gum-filled, and dark colored. × 20.

No. 3. *Anacardium occidentale* L. (Yale 17590). Cross section showing arrangement of pores and very numerous fine rays. × 20.

No. 4. *Campnosperma panamensis* Standl. (Yale 6924). Cross section showing pore sizes and distribution. × 20.

No. 5. *Comocladia dentata* Jacq. (Yale 2127). Cross section showing size and arrangement of tyloses-filled vessels. Rows of crystals in the rays can be observed in the upper center of the photomicrograph. × 20.

No. 6. *Lithraea caustica* (Mol.) Miers (Yale 34045). Cross section showing distribution of small pores. × 20.

No. 7. *Loxopterygium Sagotii* Hook.f. (Yale 5090). Cross section showing pore sizes and arrangements. × 20.

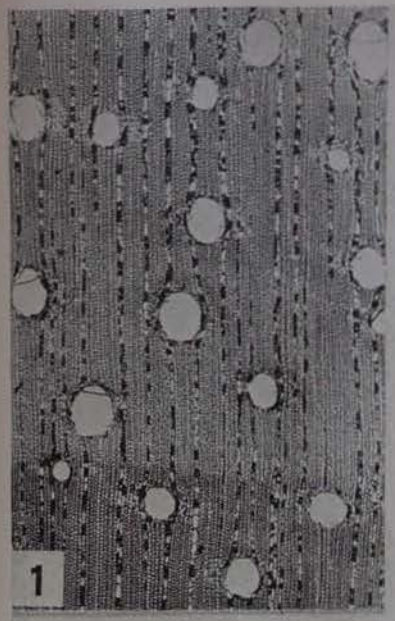
No. 8. *Loxopterygium Sagotii* Hook.f. (Yale 32934). Cross section through denser, dark colored streaks that characterize this species. × 20.

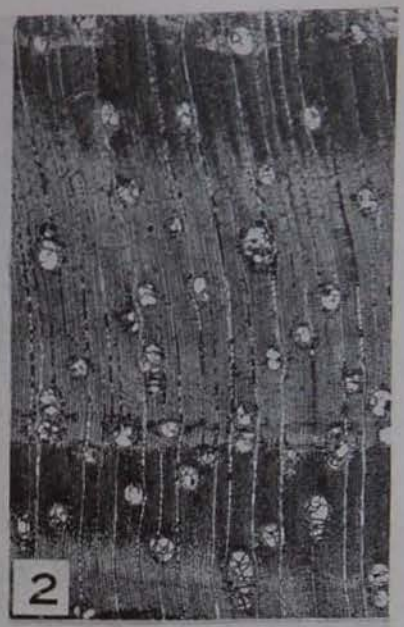
No. 9. *Cotinus americanus* Nutt. (Yale 11468). Cross section showing character of this species. Note the similarity to *Rhus*, Figures 13 and 14. × 20.

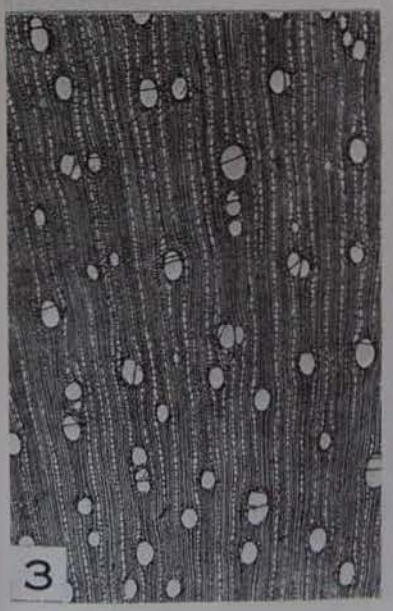
No. 10. *Malosma laurina* (Nutt.) Nutt. (Yale 23961). Cross section showing the numerous radial multiples and small size of pores. × 20.

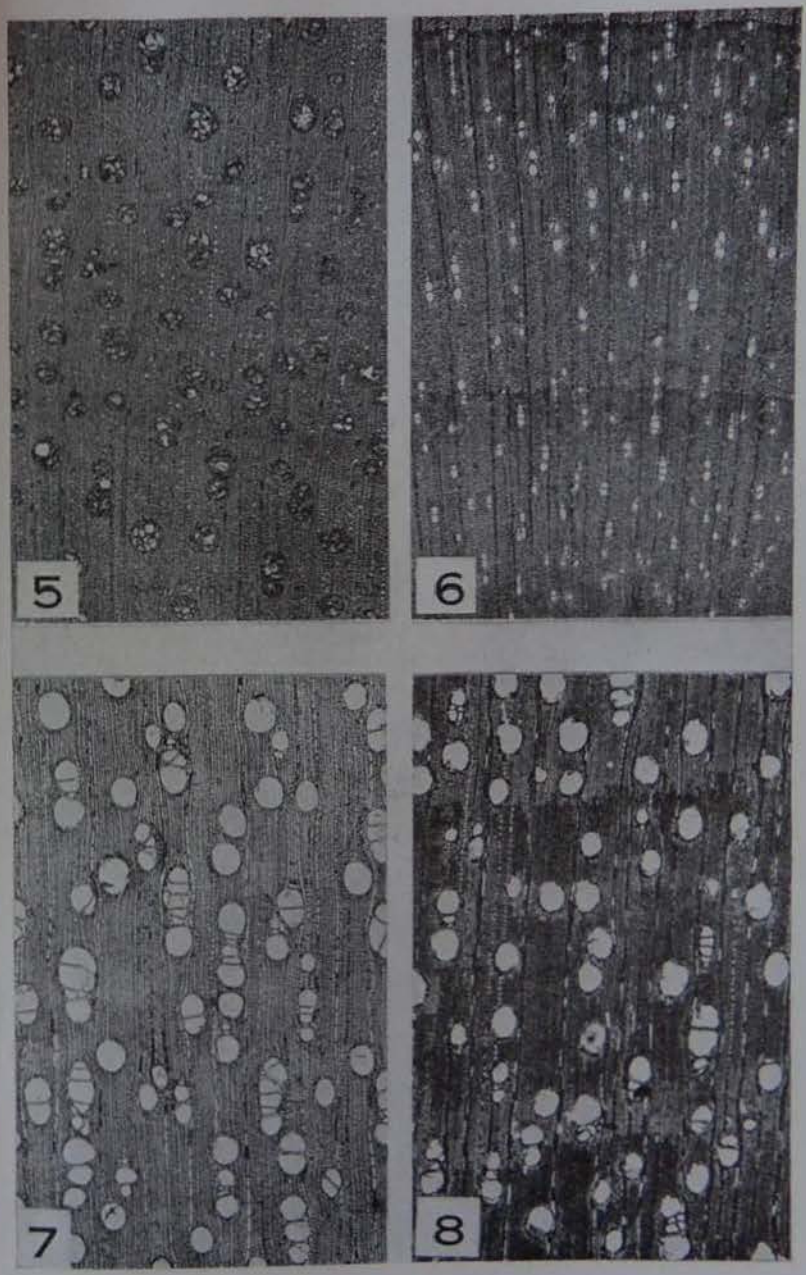
No. 11. *Metopium Brownei* (Jacq.) Urb. (Yale 9828). Cross section showing arrangement and size of pores. Vessels in the upper part of the photomicrograph are in the sapwood and contain little of the tyloses and gum that characterize the heartwood of this species. × 20.

No. 12. *Metopium toxiferum* (L.) K. & U. (Yale 15857). Cross section in heartwood showing tyloses-filled vessels and abundant gum deposits. × 20.





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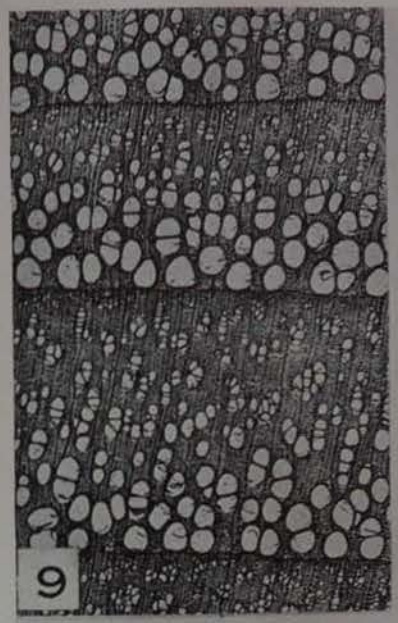
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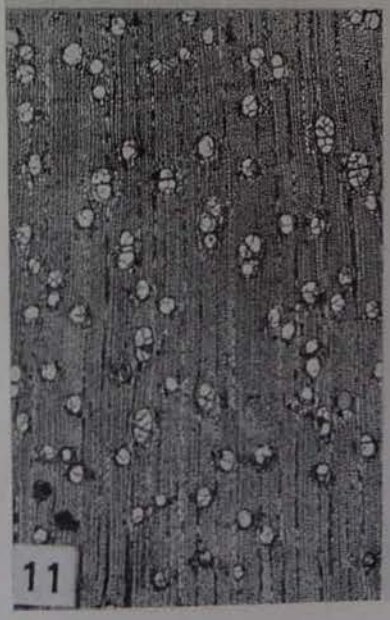
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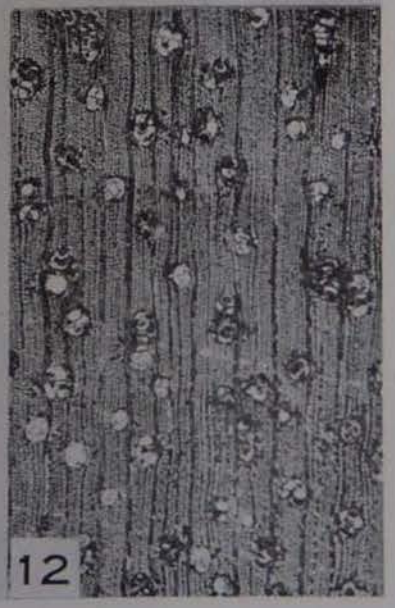
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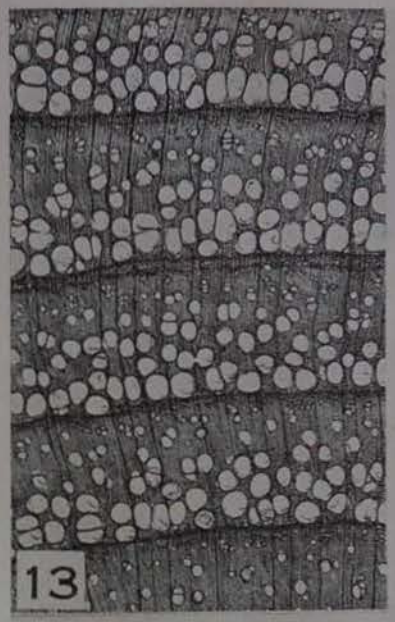
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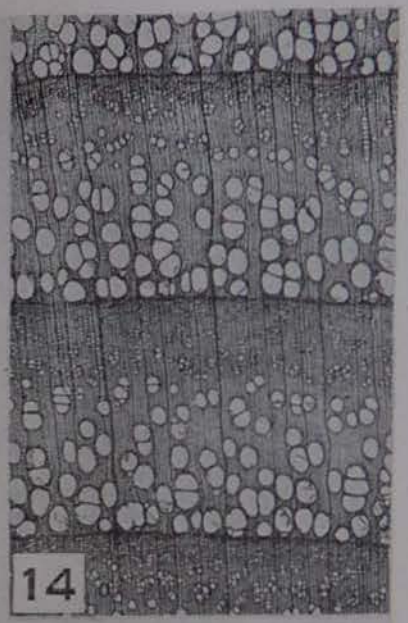
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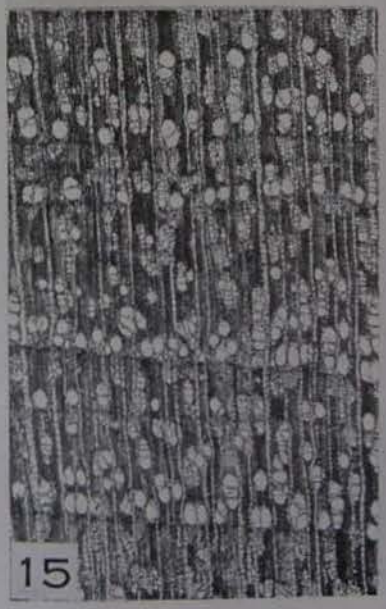
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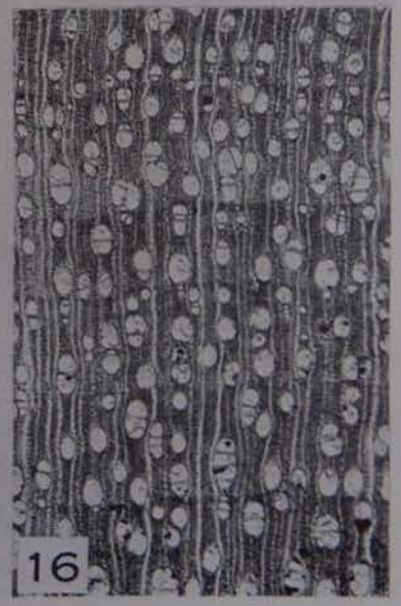
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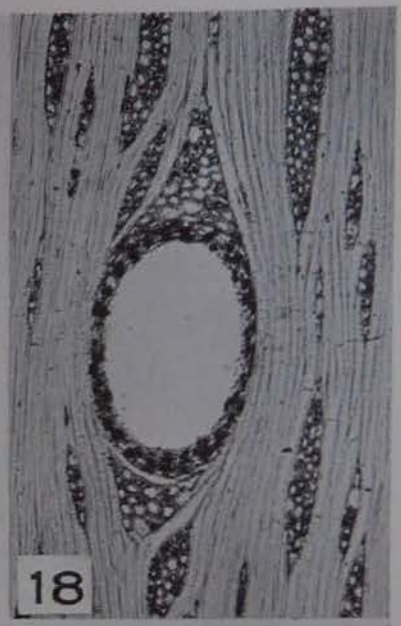
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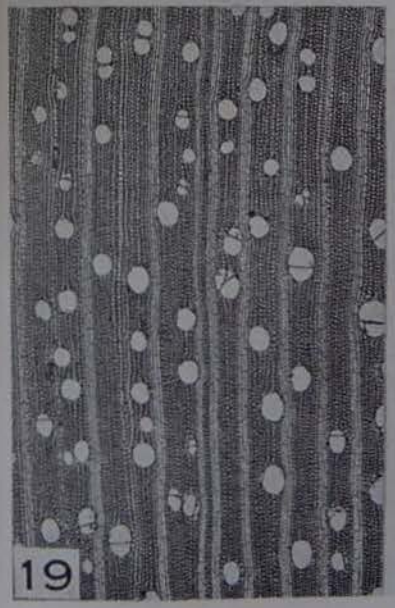
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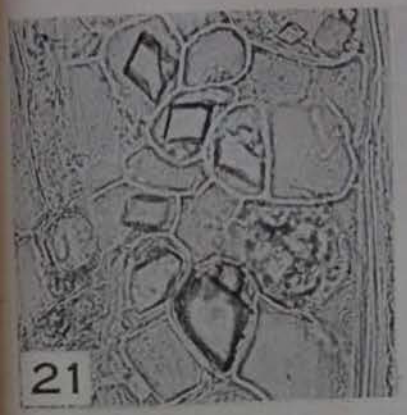
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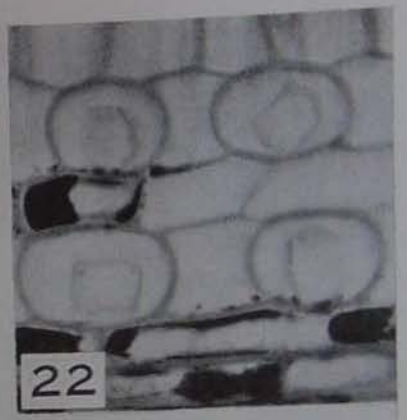
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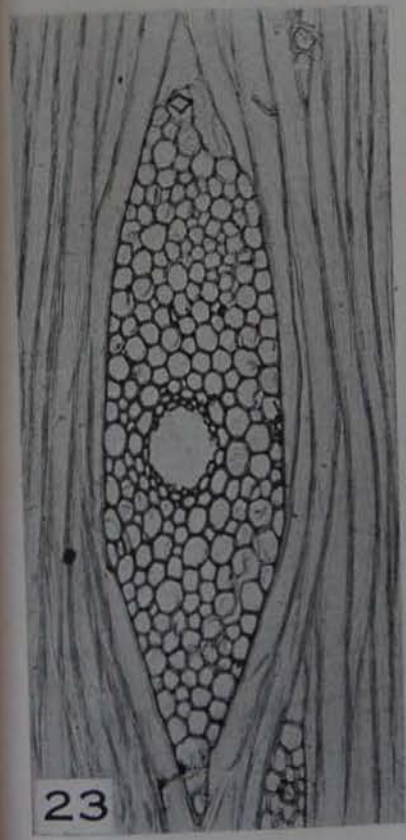
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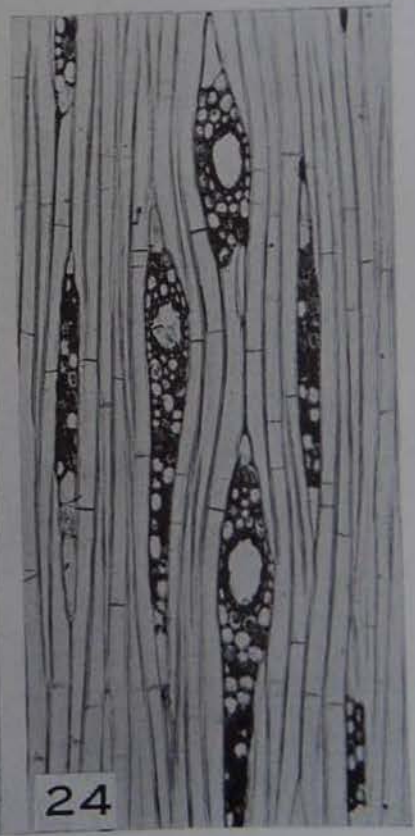
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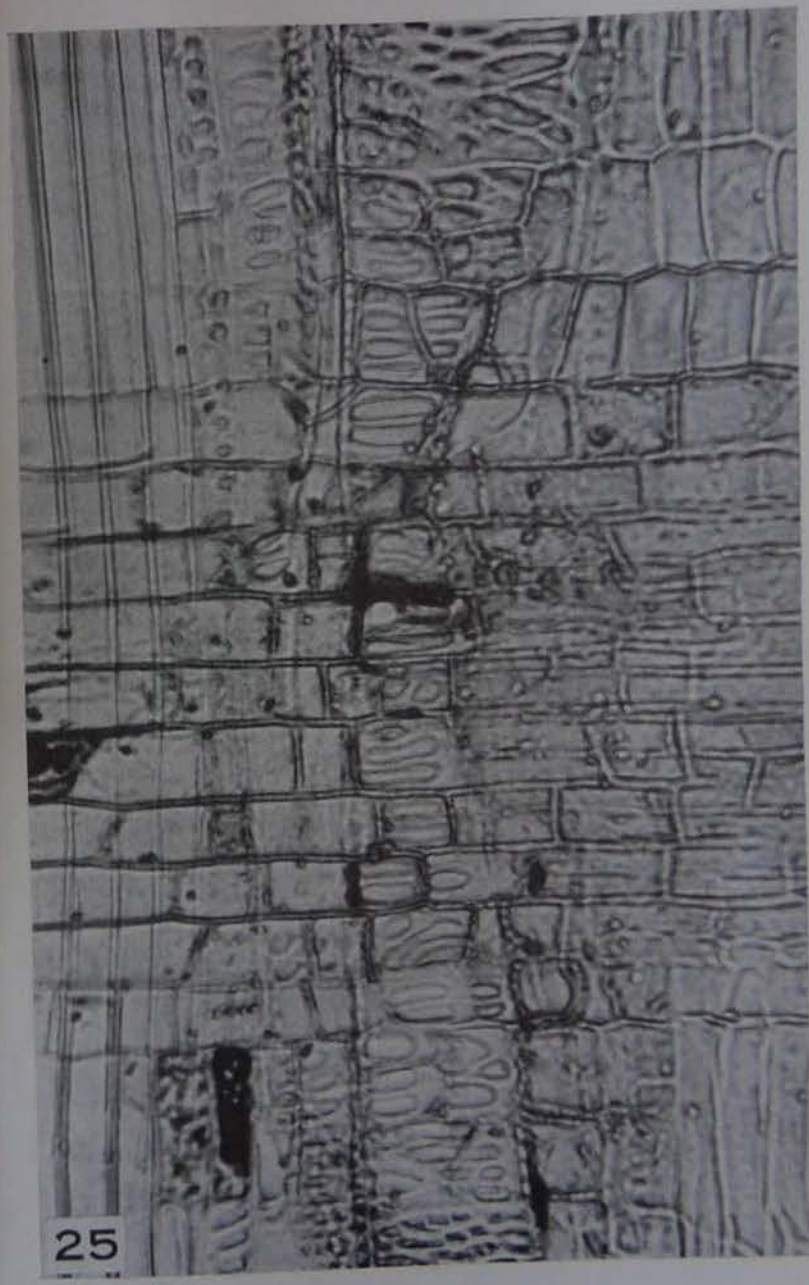

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No. 13. *Rhus glabra* L. (Yale 14418). Cross section showing pore arrangement. Note irregular tangential bands of minute pores in the extreme late wood. × 20.

No. 14. *Rhus typhina* L. (Yale 11470). Cross section showing pore arrangement. × 20.

No. 15. *Rhus virens* Lindh. (Yale 14441). Cross section showing typical weakly ring-porous early wood and the clusters of mixed small and minute late-wood pores. × 20.

No. 16. *Schinopsis balansae* Engl. (Yale 14958). Cross section showing arrangement and number of tyloses-filled heartwood vessels. × 20.

No. 17. *Schinus Molle* L. (Yale 6248). Cross section showing arrangement of the numerous pore multiples in wavy tangential bands. × 20.

No. 18. *Schinus Molle* L. (Yale 6248). Large radial gum duct. Tang. sect. × 100.

No. 19. *Spondias Mombin* L. (Yale 17041). Cross section showing rather large pores and two-sized rays (few uniseriate rays). × 20.

No. 20. *Tapirira guianensis* Aubl. (Yale 9430). Cross section showing pore sizes and arrangement. Rays are rather fine. × 20.

No. 21. *Astronium balansae* Engl. (Yale 1046). Crystals in tyloses. Rad. sect. × 300.

No. 22. *Astronium fraxinifolium* Schott. (Yale 4676). Large crystals in marginal cells of rays. Dark masses are gum. Rad. sect. × 300.

No. 23. *Spondias Mombin* L. (Yale 2671). Radial gum duct in large ray. Note crystals in ray cells (upper part of photomicrograph). Tang. sect. × 100.

No. 24. *Tapirira Marchandii* Aubl. (Yale 9450). Tangential section showing three rays containing small gum ducts. Fiber septations abundant. × 100.

No. 25. *Spondias Mombin* L. (Yale 7709). Ray-vessel pitting characterizing this and many other Anacardiaceae genera. Rad. sec. × 300.

IDENTIFICATION OF NEW WORLD TIMBERS

Part III

By Robert W. Hess

Annonaceae

Members of the Custard Apple family are widely distributed through the tropics of the world. Many of them have edible fruits and a few are cultivated for this purpose. Woods from the trees of the following 21 American genera were studied: *Anaxagorea*, *Annona*, *Asimina*, *Bocageopsis*, *Cym-*

bopetalum, Desmopsis, Diclinanona, Duguetia, Fusaea, Guatteria, Heteropetalum, Hornschuchia, Malmea, Onychopetalum, Oxandra, Pseudoxandra, Rollinia, Sapranthus, Stenanona, Unonopsis, and *Xylopia.* Most of these are small trees or shrubs, a few attain medium or rather large size; frequently they are slender trees 15 to 25 feet high.

The woods vary from light weight, soft and spongy to heavy, hard, and compact but have a number of characteristics in common. The inability of the botanists to achieve a satisfactory natural classification of the genera is reflected in the range of wood characters and properties which is as great in some of the larger genera as in the family as a whole.

The bark is generally smooth, finely laminated, and fibrous and, in most species, exhibits wedge-like widening of phloem rays similar to that found in the Bombacaceae, Sterculiaceae, and Tiliaceae.

Heartwood, found only in larger trees or in association with wounds or knots, dark reddish brown, dark olive brown, or almost black. Sapwood yellowish, light grayish, or brownish, commonly with more or less pronounced greenish cast. Rays often noticeable or fairly conspicuous light-colored flakes on radial surfaces, not contrasting markedly with background. Luster rather high to low. Heartwood occasionally with disagreeable odor when fresh; dry wood without distinctive odor or taste. Density generally medium to high; wood soft and light weight in part or all of *Annona, Asimina, Guatteria, Heteropetalum, Pseudoxandra, Rollinia,* and *Unonopsis.* Texture generally medium to fine, occasionally rather coarse. Grain straight to irregular.

Growth rings usually present, occasionally indistinct or absent; usually formed by a band of thicker-walled fibers; ring-porous structure in *Asimina.* Pores mostly small to medium-sized, large in *Onychopetalum, Unonopsis Pittieri* Safford, and sometimes in *Rollinia;* solitary and in short radial multiples, sometimes mostly 2's or 3's; rather thick-walled, sub-circular; typically few; often not in contact with larger rays; fairly well distributed without pattern. Vessels with

exclusively simple perforations, often with wide rims in smaller vessels; elements sometimes slightly constricted at the ends; spiral thickenings present in *Asimina;* fine striations sometimes present; greenish yellow gum deposits common; pitting typically alternate, often irregular or locally opposite; pits mostly small (4 to 7.5μ), in part minute (e.g. *Anaxagorea, Desmopsis, Diclinanona,* and *Oxandra*), in part medium to rather large *(Annona, Asimina, Cymbopetalum penduliflorum* [Dunal.] Baill., *Desmopsis, Guatteria,* and *Rollinia);* apertures often coalescent. Rays homogeneous to heterogeneous, often variable in the same genus; squarish cells often irregular in shape, upright cells infrequent and relatively short, procumbent cells variable in size (tang.) and height (rad.) and sometimes short; typically more or less heterogeneous with single marginal rows and irregularly interspersed squarish cells; variable in width, rays 6 to 11, mostly 6 to 8, cells wide occur in seventeen genera, not over 4 or 5 cells wide in part or all of *Annona, Cymbopetalum, Duguetia, Heteropetalum, Hornschuchia, Malmea, Oxandra, Rollinia,* and *Xylopia,* up to 12 to 14 cells wide in *Anaxagorea, Annona, Asimina, Guatteria, Stenanona,* and *Unonopsis;* uniseriate rays often few and very low, rays less than 4 cells wide rather few in genera with widest rays; maximum heights variable, from 30 to 200, most frequently within the range of 60 to 130; scattered crystals occasionally present; oil cells observed in *Cymbopetalum, Duguetia, Unonopsis* (?), and *Xylopia,* cells whose contents and disposition resemble oil cells sometimes occur (e. g. *Hornschuchia* and *Oxandra);* ray-vessel pitting very fine to medium, rarely rather coarse, occasionally unilaterally compound. Wood parenchyma in uniseriate or biseriate metatracheal bands spaced ½ to 2 pore-widths apart, also sparingly paratracheal in some instances; cells of uniseriate bands generally rounded in cross section, those of biseriate bands flattened only on tangential sides of mutual contact; crystals rare *(Rollinia);* oil cells observed in *Bocageopsis, Cymbopetalum,* and *Xylopia.* Wood fibers non-septate; walls thin to thick, often varying in the same growth ring; more or less radially

aligned; pits mostly small, occasionally medium-sized, typically with narrow border and extended slit-like apertures. Ripple marks absent. No gum ducts observed.

Anaxagorea. About a score of species of this genus are found in the forest lowlands of Central America and northern South America. The Amoura are typically large shrubs or small trees, 10 to 25 feet tall.

Wood light grayish, with more or less yellowish cast, distinctly marked on radial section by prominent light-colored or brownish ray flakes. Luster medium. Odor lacking, taste not distinctive. Density medium; wood firm and strong, grain somewhat irregular.

Growth rings absent or indistinct. Pores small (largest 70 to 120μ), not visible or individually indistinct without lens, with tendency toward radial arrangement, rather few, angular, in short radial multiples and solitary, rarely in contact with large rays and infrequently with small rays. Vessel elements with simple perforations, constricted ends; intervascular pits small (3 to 4.5μ). Rays 1 to 12 or 14, with very few 1 to 4 or 6, cells wide; up to 200 cells high; essentially homogeneous but with single marginal rows of square or short upright cells; pits to vessels small. Wood parenchyma in uniseriate or biseriate metatracheal bands about one pore-width apart and sparingly paratracheal. Fibers with medium to thick walls and very numerous small, indistinctly bordered pits.

Annona. There are many species of Annona distributed throughout the tropical and sub-tropical Americas. They are widely cultivated for their fruit and frequently become naturalized. The light and soft woods are sometimes used for fish net floats and bottle stoppers; somewhat denser material is sometimes used for ox yokes. The small sizes available and the comparatively poor quality of the wood limit its application.

Heartwood pale yellow, or gray with yellow or greenish cast; not always distinct from grayish or whitish outer sapwood. Brown "heartwood" sometimes present near wounds, probably associated with early stages of decay. Luster medium or low. Without distinctive odor or taste. Density medium to very low; texture medium to rather coarse; grain straight or irregular. Very susceptible to fungus stain and decay.

Growth rings indistinct. Pores medium-sized (largest 100 to 220μ), solitary and in short multiples, evenly distributed or more numerous in early wood few to fairly numerous, sub-circular. Vessels with simple perforations rather small to medium-sized (7.5 to 9μ) intervascular pits; pitting alternate or with tendency to opposite. Maximum ray width varying for different species, largest 4 to 8, sometimes to 12 cells wide, uniseriates few; maximum height 30 to 120, sometimes to 200, cells high; nearly homogeneous with short procumbent and few to fairly numerous squarish cells; pits to vessels medium-sized or rather small. Parenchyma in numerous uniseriate or biseriate metatracheal lines spaced ⅔ to 1 pore-width apart, and sparingly paratracheal; sometimes tending to horizontal seriation; metatracheal cells rounded in cross section. Fiber walls thin or of medium thickness; pits medium-sized, indistinctly bordered, numerous.

Asimina. The Pawpaw (*A. triloba* [L.] Dunal) is the only one of six species found in the United States that attains the stature of a small tree. It is best known for its large edible fruit.

Heartwood greenish, or greenish yellow, becoming superficially brown upon exposure; not sharply demarcated, and often not distinct from the lighter colored, sometimes grayish, narrow, sapwood. Luster medium to rather high. Odor lacking, taste not distinctive. Generally light weight, soft, brittle, and coarse-textured.

Growth rings distinct. Ring-porous; early-wood pores medium-sized, barely visible without lens, in a single more or less continuous row, followed by a narrow band of closely associated somewhat smaller pores, decreasing to minute outwards; initial row mostly solitary, others mostly in clusters with few solitary and in short multiples; thin-walled,

sub-circular. Vessels with simple perforations; medium-sized (7 to 8μ) intervascular pits, alternate with tendency to opposite; with spiral thickenings at least in smaller vessels. Largest rays 6 to 12 cells wide; with few small rays; uniseriates and biseriates low, infrequent on cross-section; nearly homogeneous, with few squarish marginal cells; procumbent cells irregular, small and rounded (tang.), mostly long (rad.); small globules of yellowish brown gum abundant. Wood parenchyma sparingly paratracheal and in tangential or concentric bands 1 or 2 cells wide, scarcely distinct with lens; metatracheal strands more or less storied; oil cells absent. Wood fibers with thin walls and numerous, small indistinctly bordered pits.

Bocageopsis. Two samples of *B. multiflora* (Mart.) R.E. Fries, a tree or shrub of the Amazon valley, are available for study. The wood is grayish with strong greenish cast, luster rather low, without distinctive odor or taste, moderately hard and heavy, medium-textured, straight-grained.

Growth rings indistinct. Pores medium-sized (170μ), barely visible without lens, solitary and in short multiples, rather few, well distributed, sub-circular. Vessel elements with simple perforations, constricted ends, striate, small (5μ) alternate intervascular pits. Rays 1 to 6 or 8 cells wide; up to 90 to 175 cells high; uniseriate rays fairly numerous; heterogeneous to homogeneous, with many to few square cells; pits to vessels small. Wood parenchyma in uniseriate and biseriate bands 1 to 1½ pore-widths apart; small, slender oil cells common. Fiber pits very small, simple or indistinctly bordered.

Cymbopetalum. The nine species comprising this genus are rather small trees or shrubs found in Mexico, Central America, and northern South America. The flower petals of the Orejuelo, *C. penduliflorum* (Dunal) Baill., are used as beverage spice and the bark is sometimes used as cordage; the woods have no known special uses.

Wood light grayish with mild to pronounced greenish cast. Luster rather low to medium. Without distinctive odor or taste. Density rather low (e.g. *C. penduliflorum)* to medium; texture medium to fine; grain straight.

Growth rings absent or indistinct. Pores medium-sized (170μ) and barely visible in *C. penduliflorum*, small (70 to 85μ) in others; solitary and with few small clusters and numerous short multiples (in dense material short multiples are often radially aligned and separated only by single parenchyma cells, appearing rather long), well distributed, rather few to fairly numerous, sub-circular. Vessel elements with simple perforations having wide rims; with slightly constricted ends; intervascular pits small (6 to 7.5μ) or medium-sized (8μ in *C. penduliflorum);* alernate. Rays 1 to 5 cells wide (1 to 3 in *C. longipes* Diels, 1 to 8 in *C. penduliflorum);* up to 50 to 100, mostly less than 35, cells high; uniseriates very low, commonly few; pits to vessels small and rounded to narrow and elongated. Rays heterogeneous, with numerous square cells in *C. longipes* and *C. Tessmannii* Fries (oil cells absent from wood parenchyma); rays homogeneous in *C. costaricense* (Donn.Smith) Fries and *C. penduliflorum* (oil cells numerous in wood parenchyma). Wood parenchyma in concentric bands 1 or 2 cells wide, spaced 1 to 2 pore-widths apart; slender oil cells common. Fibers, more or less radially aligned; with small indistinctly bordered pits.

Desmopsis. Of the dozen species of typically small trees or shrubs found in Central America and north western South America, only one sample of *D. stenopetala* (Donn.Smith) R.E. Fries (Yale 14889; N.S. Stevenson 105) is available for study. The wood (sapwood) is light grayish with a greenish yellow cast and shows the rays prominently on radial surfaces. Moderately dense, medium-textured, straight-grained.

Growth rings poorly defined. Pores small (90μ), not visible without lens, fairly numerous, solitary and in short multiples, rarely in contact with rays. Vessels with simple perforations; very fine (3μ) alternate pitting. Rays 1 to 7 cells wide, up to 95 cells high; uniseriates low and few; heterogeneous, with comparatively few interspersed and

marginal square cells; pits to vessels very small. Wood parenchyma in bands 1 or 2 cells wide, spaced about one pore-width apart. Fibers with numerous small, indistinctly bordered pits.

Diclinanona. Two species of small trees are found in the upper Amazon basin. One specimen, *D. calycina* (Diels) R.E. Fries (Yale 17996; Williams 2756) is available. The sample is badly stained but apparently was light gray with a greenish yellow cast, with noticeable rays on radial surfaces. Of medium density and texture, straight-grained.

Growth rings present. Pores medium-sized (170μ), barely visible, rather few, solitary and in short multiples. Vessel elements with simple perforations, constricted at ends; intervascular pitting medium (8μ), alternate with tendency to opposite. Rays 1 to 6, mostly 3 and 4, cells wide; up to 115, mostly less than 50, cells high; heterogeneous with single marginal and few interspersed rows of square cells; pits to vessels rather small. Wood parenchyma bands mostly uniseriate with few biseriate, spaced about ¾ pore-width apart, flanked on either side by wood fibers of larger size than usual. Fibers with numerous rather small indistinctly bordered pits.

Duguetia. The numerous species range from small shrubs to medium-sized trees. They are found mainly in the northern half of South America. The woods of the various species vary considerably in density and attendant properties. Local use of denser woods for tool handles has been reported.

Woods yellowish or yellowish gray, with more or less brownish or greenish cast, with noticeable light colored or brownish ray markings on radial surfaces. Black streaks or patches of gum-filled wood are sometimes found adjacent to wounds, resembling traumatic heartwood formation in *Diospyros* (Ebenaceae). The wood of *D. Sandwithii* R.E. Fries is light brown, superficially resembling *Fusaea*. Luster medium to rather low. Odorless and tasteless. Hard and

rather heavy[1] to medium[2] or rather low density.[3] Medium to fine texture. Straight to irregular grain.

Growth rings usually present. Pores small or medium-sized (70 to 155μ), solitary and in short multiples or radial pairs, fairly numerous to few (e.g. *D. Spixiana*). Vessel elements with simple perforations; pitting fine to minute (4.5 to 1.6μ), more or less alternate, with coalescent apertures. Rays mostly 1 to 5 or 6 cells wide (1 to 8 in *D. Spixiana*, 1 to 4 in *D. amazonica*), uniseriates few; up to 80 to 140, mostly less than 60, cells high; homogeneous or nearly so; large oil cells present; pits to vessels very small or minute. Wood parenchyma in uniseriate or biseriate bands about one pore-width apart. Wood fibers with thick walls in late wood; pits small, indistinctly bordered.

Fusaea. Only one of the three Amazon Valley species, *F. longifolia* (Aubl.) Saff. (Yale 35700; A.C. Smith 2779) is available for study. The wood of this sample (from a small tree) is brown, hard, heavy, and medium-textured. Small black streaks due to injury present, similar to those in *Duguetia*.

Growth rings present, indistinct. Pores small (100μ), fairly numerous; solitary with numerous radial 2's and 3's; sub-circular, rather thick-walled; rarely in contact with rays. Vessel elements slightly constricted ends; simple perforations; fine (4.5μ) intervascular pitting, more or less alternate, with coalescent apertures; gum deposits numerous. Rays 1 to 8, mostly 5 to 7, cells wide; up to 100, mostly over 40, cells high; heterogeneous with many squarish cells scattered throughout, procumbent cells short; pits to vessels very small. Wood parenchyma in uniseriate and biseriate bands spaced about one pore-width apart. Wood fibers thick-walled; pits small, indistinctly bordered.

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[1] *D. caudata* R.E. Fries, *D. cauliflora* R.E. Fries, *D. hadrantha* (Diels) R.E. Fries, *D. latifolia* R.E. Fries, *D. quitarensis* Benth., *D. Sandwithii* R.E. Fries, *D. vallicola* MacBride.

[2] *D. asterotricha* (Diels) R.E. Fries, *D. panamensis* Standl., *D. Spixiana* Mart., *D. uniflora* Mart.

[3] *D. amazonica* R.E. Fries, *D. Spixiana* Mart.

Guatteria. There are over two hundred species of trees or shrubs of this genus in tropical America. The woods vary through about the same range of properties as *Duguetia* but tend to be more grayish or brownish gray with less yellow or greenish.

Wood grayish or light brownish gray, sometimes with yellowish or greenish yellow cast. Occasional specimens have black streaks or patches of dense black gum-infiltrated wood near wounds. Luster low to medium. Without distinctive odor or taste. Density mostly medium, occasionally low (e.g. *G. aeruginosa* Standl. and *G. Slateri* Standl.); texture medium to rather coarse; grain straight.

Growth rings usually present, marked by bands of thicker-walled fibers. Pores medium-sized to large (120 to 255μ), mostly few, solitary with rather few or few short multiples, sub-circular. Vessels with simple perforations; intervascular pits typically rather large (8 to 10μ), large (12 to 15μ) in *G. aeruginosa*, more or less alternate, apertures commonly coalescent. Rays variable, largest usually 8 to 13 cells, sometimes only 6, cells wide; uniseriates, and often other narrow rays, few; up to 75 to 170, mostly less than 50, cells high; heterogeneous to nearly homogeneous; cells coarse and variable in size; pits to vessels medium-sized to rather large. Parenchyma in uniseriate and biseriate bands spaced about ½ to 1 pore-width apart; also sparingly paratracheal or narrowly vasicentric. Wood fibers with numerous medium-sized to rather large pits, with narrow distinct or indistinct borders.

Heteropetalum. Two samples of *H. brasiliensis* Benth. are available for study. The specimens are stained but were probably grayish or light brownish. The wood is light and soft, approximately of the same density as light-weight specimens of Balsa *(Ochroma)*.

Growth rings fairly distinct, due to slight thickening and smaller diameter of a few rows of fibers and to more regular bands of parenchyma. Pores small (70 to 100μ), angular, few and scattered; solitary and in radial pairs. Vessels with simple perforations; rather small (7·5μ) alternate intervascular pits. Rays 1 to 4, mostly 1 to 3; cells wide; up to 65 cells; heterogeneous, with large square or irregularly shaped cells, mostly on margins; pits to vessels very small. Wood parenchyma bands uniseriate, spaced 1 or 2 pore-widths apart; cells fine, flattened radially. Pith flecks common. Fibers very thin-walled and very large with blunt or shortly tapered ends; pits small, extremely numerous, mostly irregularly distributed but often in horizontal rows, bordered with extended slit-like apertures.

Hornschuchia. A few species of shrubs or small trees are found in Brazil and the Guianas. The wood of *H. caudata* R.E. Fries (Yale 35467; A.C. Smith 2130) is dull greenish yellow throughout. Luster medium. Odor lacking, taste not distinctive. Density medium; texture rather fine; grain straight.

Growth rings indistinct. Pores small (85μ), not very numerous, infrequently in contact with rays; solitary and in small multiples. Vessels with simple perforations, constricted ends; small (4·5μ), alternate pits, with coalescent apertures. Rays 1 to 4; uniseriates up to 5, others up to 80, mostly less than 50, cells high; heterogeneous, procumbent cells mostly short and irregular; large oil cells absent, scattered smaller cells with oil-like contents present; pits to vessels small. Wood parenchyma in narrow bands 1 to 3 cells wide spaced about 1½ or 2 pore-widths apart; not paratracheal. Wood fibers with numerous medium-sized pits having narrow borders and extended slit-like apertures.

Malmea. The several species of small trees or shrubs occur in southern Mexico, Central America and north-eastern South America. The wood is light yellowish, or slightly brownish throughout. Luster medium. Odor and taste lacking. Density and texture medium.

Growth rings distinct, being terminated by a band of thicker-walled fibers. Pores variable from small (70μ) and fairly numerous to medium-sized (170μ) and rather few. Vessels with simple perforations having wide rims; with more or less constricted ends; fine (4 to 4·5μ), irregularly

alternate intervascular pitting, the apertures coalescent. Rays nearly homogeneous in *M. hypoglauca* (Standl.) R.E. Fries, and *M. cuspidata* Diels; heterogenous in *M. depressa* (Baill.) R.E. Fries and *M. lucida* Diels; 1 to 5 or 6 cells wide (to 10 in *M. cuspidata);* up to 60 to 130 cells high; pits to vessels small to very small. Wood parenchyma bands uniseriate and biseriate, spaced 1½ or 2 pore-widths apart. Fiber pits numerous, rather small, with narrow borders and extended slit-like apertures.

M. depressa (Baill.) R.E. Fries (Yale 14877; N.S. Stevenson 103) referred to in Standley and Steyermark's *Flora of Guatemala** is hard and heavy, fine-textured, with yellowish sapwood sharply demarcated from the dark greenish brown heartwood. The vessels of the heartwood and part of the sapwood are filled with white deposits of calcium carbonate; intervascular pitting very fine (3.3μ). Structure otherwise similar to others of this genus. This sample more nearly resembles available specimens of *Oxandra.*

Onychopetalum. One specimen of *O. lanceolatum* R.E. Fries (Yale 36971; Krukoff 6909) is available for study. The wood is pale olive-brown with prominent ray markings on the radial surface. Luster rather high. Density medium; texture fairly coarse; easily worked.

Growth rings demarcated by a narrow band of thick-walled fibers. Pores large (230μ), distinct without lens; few and scattered; frequently in radial pairs. Vessels with simple perforations, small (7μ) intervascular pits. Rays of two sizes, the uniseriates very few; multiseriates up to 10 cells wide and 180 cells high; homogeneous, though with occasional single rows of cells larger and shorter than the others; pits to vessels small. Wood parenchyma in numerous narrow bands spaced about ½ to ⅔ pore-width apart. Wood fibers with numerous rather small pits having narrow borders and somewhat extended slit-like apertures.

*Flora of Guatemala by Paul C. Standley and Julian A. Steyermark, Fieldiana: Botany, 24:4:288. April 11, 1946.

Oxandra. The true Lancewood of commerce, *O. lanceolata* (Sw.) Baill., is one of two species found in the West Indies. Eighteen other species grow in South America, mostly in the Amazon basin.

There is a considerable range of variation among the specimens of the available species and most of them do not have wood of the Lancewood type. Sapwood pale yellow, or, in some species, light grayish. Heartwood dark greenish brown or blackish, commonly absent from small specimens. Luster rather low. Wood of *O. lanceolata* hard, heavy, fine-textured, straight-grained, tough, and strong; sp.gr. (air-dry) about 1.00, weight about 62 lbs. per cu. ft. Wood of other species variable from medium density to rather hard and rather heavy, medium to rather fine-textured.

Growth rings present, demarcated by a band of thicker-walled fibers and a band of more uniform terminal parenchyma. Pores all small or in part medium sized (largest 70 to 150μ); solitary and in short multiples, fairly numerous, well distributed. Vessels with simple perforations; pitting very fine (2 to 4.5, mostly 3 to 3.7μ), finest (2μ) in *O. euneura* Deils (Yale 36870; Krukoff 6784); alternate, often with coalescent apertures. Rays two-sized, uniseriates commonly few; largest 4 to 7, usually 5 or 6, cells wide; up to 80 to 120 cells high; homogeneous or weakly heterogeneous with few square cells; pits to vessels very small, sometimes unilaterally compound. Wood parenchyma in uniseriate or biseriate metatracheal bands spaced ½ to 1½ pore-widths apart. Wood fibers with numerous small pits having narrow, generally indistinct, borders and extended slit like apertures.

In *O. lanceolata* the pores are small, thick-walled, with numerous radial pairs or 3's; intervascular pits small (4.5μ). Rays 1 to 5 or 6 cells wide, uniseriates few; up to 120, most rays less than 70, cells high; homogeneous or nearly so; pits to vessels small. Otherwise as in the generic description above.

In the rays of *O. Riedeliana* R.E. Fries are scattered procumbent cells whose contents and disposition suggest oil cells. Wood fiber pits with distinct borders.

Pseudoxandra. Only one of the six described species of shrubs or trees, *P. guianensis* R.E. Fries (Yale 35651; A.C. Smith 2665) is available for study. The wood is light yellowish green with rather conspicuous rays on radial section; moderately lustrous, light weight and rather soft, medium-textured.

Growth rings present. Pores rather small (110μ), in radial pairs and solitary, rather few. Vessels with simple perforations, and small (4.5μ) alternate intervascular pits with coalescent apertures. Rays 1 to 8 cells wide, uniseriates fairly numerous; up to 120 cells high; nearly homogeneous; pits to vessels small. Wood parenchyma in numerous uniseriate and biseriate bands spaced 1½ to 2 pore-widths apart. Wood fibers mostly thin-walled, with numerous small pits having narrow borders and extended slit-like apertures.

Rollinia. About 55 species of trees and shrubs have been described in this genus. The woods are light grayish, pale brownish or greenish; luster mostly medium, texture rather coarse to medium without distinctive odor or taste. Of medium density or light and soft.

Growth rings present, often distinct, formed by a band of thicker-walled fibers. Pores medium-sized to large (largest 145 to 300μ, usually 160 to 220μ), barely visible to distinct without lens, solitary and in short multiples or radial pairs, few. Vessels with simple perforations; intervascular pits medium-sized to rather small (9 to 7.5μ), mostly alternate. Rays more or less heterogeneous; largest typically 6 to 8, cells wide,* uniseriates generally few; maximum height variable from 30 to 95 cells high; infrequently in contact with vessels; pits to vessels medium-sized, crystals sometimes present. Wood parenchyma in uniseriate or biseriate bands spaced ½ to 1½ pore-width apart, also sparingly para-

*Rays of *R. permensis* Standl. (Yale 12278; G.P. Cooper 645) 1 to 8 cells wide, up to 200 cells high; *R. subracemosa* Pitt. (Yale 36273; L. Williams 10260) 1 to 11 cells wide, up to 45 cells high; *R. annonoides* R.E. Fries (Yale 36926; Krukoff 6856) and *R. exsucca* (Dun.) A. DC. (Yale 9431; Persaud 12) 1 to 4 cells wide, up to 45 and 85 cells high, respectively.

tracheal in most species; scattered crystals sometimes present. Wood fibers mostly with thin walls and numerous medium-sized bordered pits.

Sapranthus. The seven species of shrubs or comparatively small trees in this genus are limited to Mexico and Central America. Only one specimen of Palanco, *S. nicaraguensis* Seem. (Yale 10083; Record 132), is available. The wood is rather dense greenish yellow with very dark brown (traumatic) heartwood. Luster and texture medium.

Growth rings present, formed by an indefinite band of thicker-walled fibers. Pores small (90μ), solitary and with very numerous radial pairs and 3's. Vessels with simple perforations; small (4.5μ), irregularly alternate intervascular pits, apertures coalescent. Rays heterogeneous, with many cells squarish; 1 to 8 cells wide and up to 70 cells high; pits to vessels small. Wood parenchyma bands uniseriate or biseriate and 1 or 2 pore-widths apart. Wood fibers becoming increasingly thick-walled toward the outer part of the growth ring; with numerous small bordered pits.

Stenanona. The only species is a small tree found in Panama. The wood of the sample, *Stenanona panamensis* Standl. (Yale 12046; G. P. Cooper 427), is light grayish with a strong greenish yellow cast, with blackish areas adjacent to wounds. Density and texture medium.

Growth rings present, pores small (80μ), solitary and in pairs and 3's, rarely in contact with rays. Vessels with simple perforations and small (4.5μ), alternate intervascular pits, apertures coalescent. Rays 1 to 12 cells wide, uniseriate rays very few; up to 60 cells high; heterogeneous, with many squarish cells; pits to vessels small. Wood parenchyma in uniseriate and biseriate bands 1 or 2 pore-widths apart. Wood fibers with numerous medium-sized bordered pits.

Unonopsis. There are about 22 species distributed from the West Indies and Central America to Southern Brazil. The woods are light gray or brownish with a greenish cast, with noticeable ray flakes on radial sections. Low to rather low density, rather coarse-textured.

Growth rings present or absent. Pores medium-sized (110 to 145μ), barely visible without lens; solitary and in short multiples, occasionally paired; few. Vessels with simple perforations; intervascular pits small (5 to 6μ), more or less irregularly alternate, with coalescent apertures. Rays 1 to 7 or 8 cells wide; up to 80 to 120 cells high; heterogeneous, with many squarish cells; pits to vessels small; small oil cells (?) numerous in *U. floribunda* Diels. Wood parenchyma in uniseriate and biseriate bands spaced about one pore-width apart. Wood fibers with numerous small bordered pits.

The wood of *U. Pittieri* Safford (Yale 10551; G.P. Copper 198) is of low density and coarse texture. Pores large (270μ), distinct without lens; intervascular pits rather small (7μ); rays 1 to 14 cells wide, up to 100 cells high, homogeneous or nearly so.

Xylopia. The Polewood (*X. frutescens* Aubl.), as it is known in British Honduras, is the mostly widely distributed of the numerous species found in tropical America. A few are medium-sized trees but most are small trees or shrubs. The heartwood, when present, is blackish brown; the sapwood is light grayish or light brownish with more or less distinct greenish cast. Luster medium, texture medium or rather coarse. Heartwood of *X. frutescens* with fetid odor when cut, dry wood without distinctive odor or taste. Density medium to rather low.

Pores medium sized (100 to 185μ), barely visible without lens, solitary and in short multiples, well distributed, few. Vessels with simple perforations; intervascular pits small (5 to 7.5μ), irregularly alternate, often with coalescent apertures. Rays homogeneous to heterogeneous; 1 to 4 cells wide,* uniseriates often few; up to 40 to 110 cells high (to 180 cells high in *X. brasiliensis* Spreng., Yale 23836; Hoehne 310); pits to vessels small; oil cells sometimes present. Wood parenchyma in uniseriate and biseriate bands 1 to 2 pore-

*Rays up to 8 cells wide in *X. aromatica* (Lam.) Mart., 1 to 3 cells wide in *X. Benthami* R.E. Fries (Yale 35472; A.C. Smith 2150), 1 to 5 cells wide in *X. discreta* (L.f.) Spr. & Hutch.

widths apart, oil cells present in *X. frutescens* Aubl. (Yale 10736; C. Gallusser 16) and *X. peruviana* Fries (Yale 18925; L. Williams 6225). Fibers with numerous small bordered pits.

Key to the Genera

With the available specimens (305 samples) and the present botanical classification it is not possible to make a complete workable key to the genera. All of the woods are of the same general structure so that characters of distinction are necessarily small and subject to relative variability. With a number of species appearing to be misplaced as to genus the range of characters within some of the genera covers a large portion of the total for the family. It appears that a much more extensive collection of accurately named species and a careful study of the present botanical classification will be required before all the American woods of this family can be identified to the proper genus.

Most of the woods can be placed in the family without difficulty on the basis of distinct to conspicuous rays forming a spider-web pattern with the fine, uniformly spaced bands of metatracheal parenchyma.

Explanation of Figures

No. 1. *Annona scleroderma* Safford (Yale 15650). Cross section of a low density specimen showing large thin-walled fibers and pore arrangement. The fine parenchyma lines are scarcely visible. × 20.

No. 2. *Asimina triloba* (L.) Dunal (Yale 11478). Cross section showing ring-porous character and late-wood pore clusters. × 20.

No. 3. *Cymbopetalum penduliflorum* (Dun.) Baill. (Yale 34555). Cross section showing pore sizes and arrangement, and scarcity of small rays. Oil cells may be observed in the parenchyma bands. See Figures 10 & 13. × 20.

No. 4. *Duguetia panamensis* Standl. (Yale 12037). Cross section showing the parenchyma pattern typical of the family. Fine rays infrequent, pores seldom in contact with large rays. Oil cells may be observed in large ray to left of center. × 20.

No. 5. *Guatteria Slateri* Standl. (Yale 10530). Cross section showing the coarse rays and thin-walled cells of a rather low density specimen. × 20.

No. 6. *Heteropetalum brasiliense* Benth. (Yale 33830). Cross section showing thin-walled fibers and the few scattered vessels of this low density wood. Dark horizontal lines are parenchyma. × 20.

No. 7. *Oxandra lanceolata* (Sw.) Baill. (Yale 35398). Cross section showing numerous small pores, rather coarse rays and numerous fine parenchyma lines. × 20.

No. 8. *Rollinia permensis* Standl. (Yale 12278). Cross section showing lack of contact between vessels and large rays. × 20.

No. 9. *Xylopia Quintasii* Engl. & Diels (Yale 15243). Cross section showing pore arrangement, rather fine rays, and typical parenchyma pattern. × 20.

No. 10. *Cymbopetalum penduliflorum* (Dun.) Baill. (Yale 34555). Oil cells in parenchyma. Rad. sect. × 100.

No. 11. *Duguetia Sandwithii* R.E. Fries. (Yale 35593. Intervascular pitting; pits 1.6μ in diameter. Tang. sect. × 1500.

No. 12. *Guatteria Slateri* Standl. (Yale 10530). Radial section showing small bordered pits commonly found in the fibers of this family. × 300.

No. 13. *Cymbopetalum penduliflorum* (Dun.) Baill. (Yale 34555). Cross section showing oil cells (4) in parenchyma bands. Cells contain yellow oil or gum. See Figures 3 & 10. × 200.

NOMENCLATURAL TRANSFERS AND CORRECTIONS IN THE EUPHORBIACEAE*

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It was the writer's privilege to have access to these pages in publishing a number of new Euphorbiaceae from the African island of Mauritius. Among them was a plant described with doubt as *Cleidion ? Cafcaf (Tropical Woods* 77: 16; 1944), with the comment that it might prove a distinct genus when the ♂ flower could be studied.

The characteristic ♀ flower of this putative *Cleidion* and various descriptive notes and illustrations by the writer's good friend Léandri of the Parisian Museum *(Lecomte Not. Syst.* 9: 156, fig. 10 etc.; 1941) make it evident that *Lautembergia* Baill. not *Cleidion* Bl. is the genus. Heretofore *Lau-*

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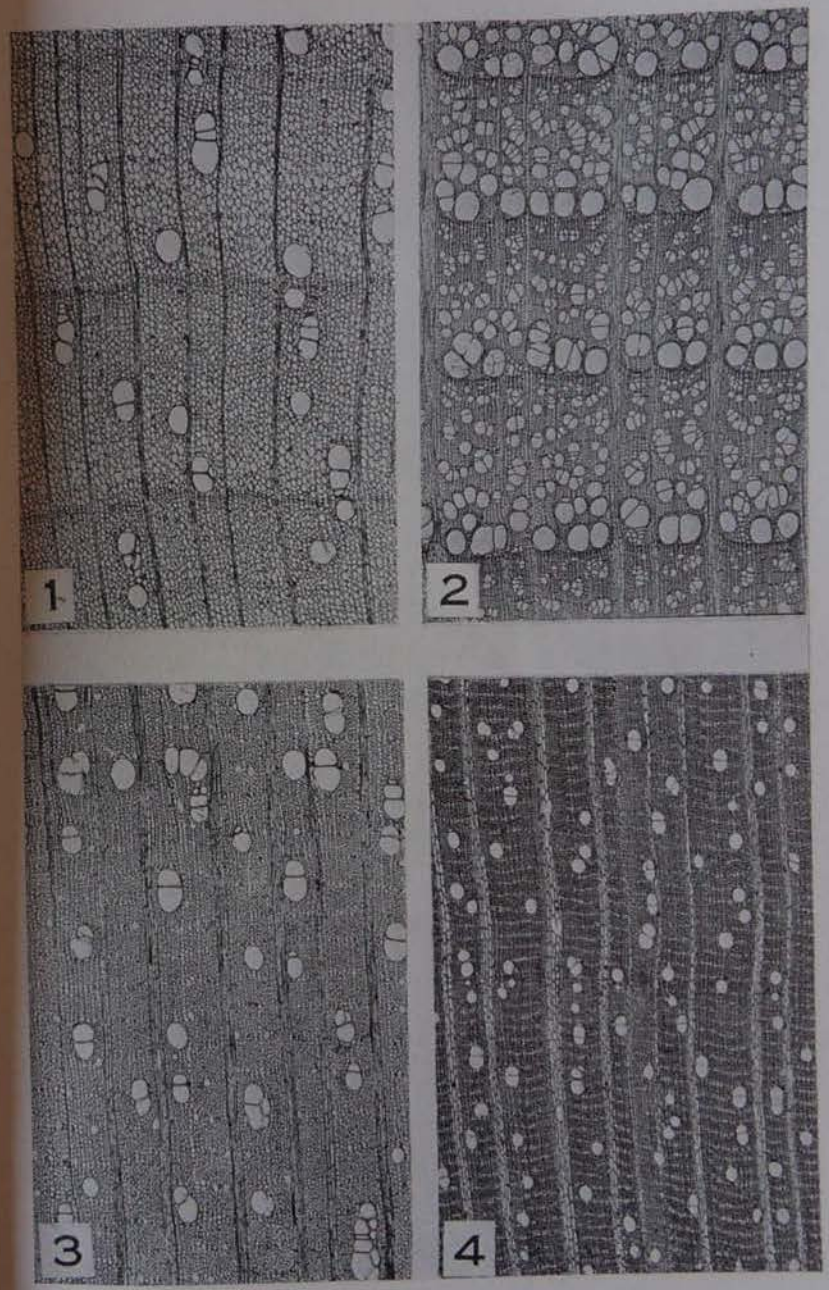

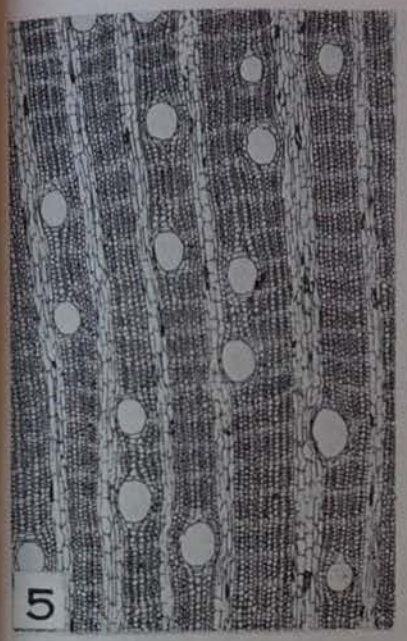
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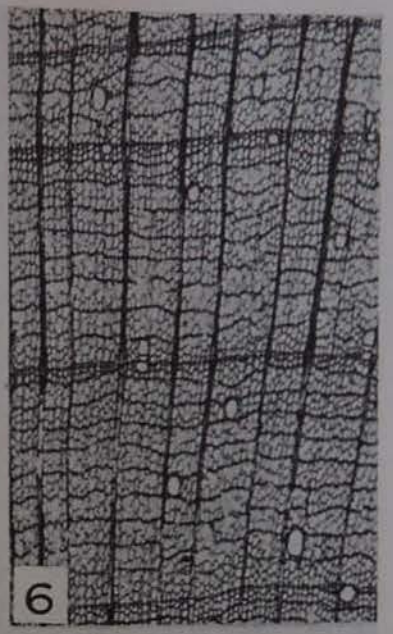
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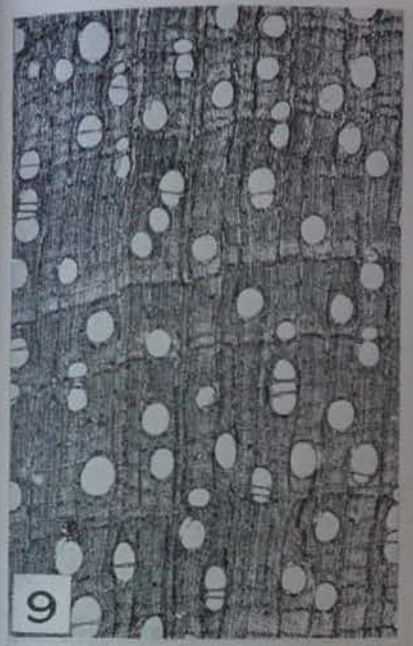
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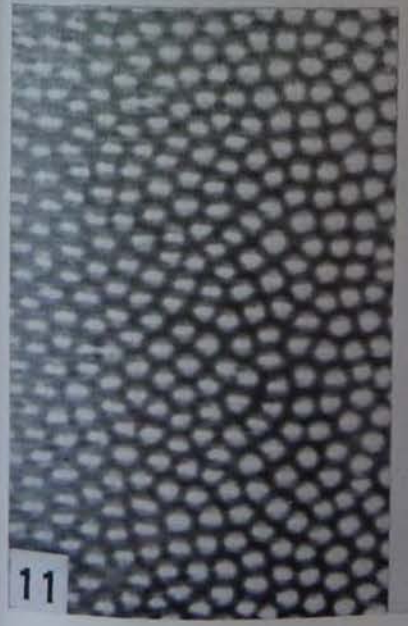
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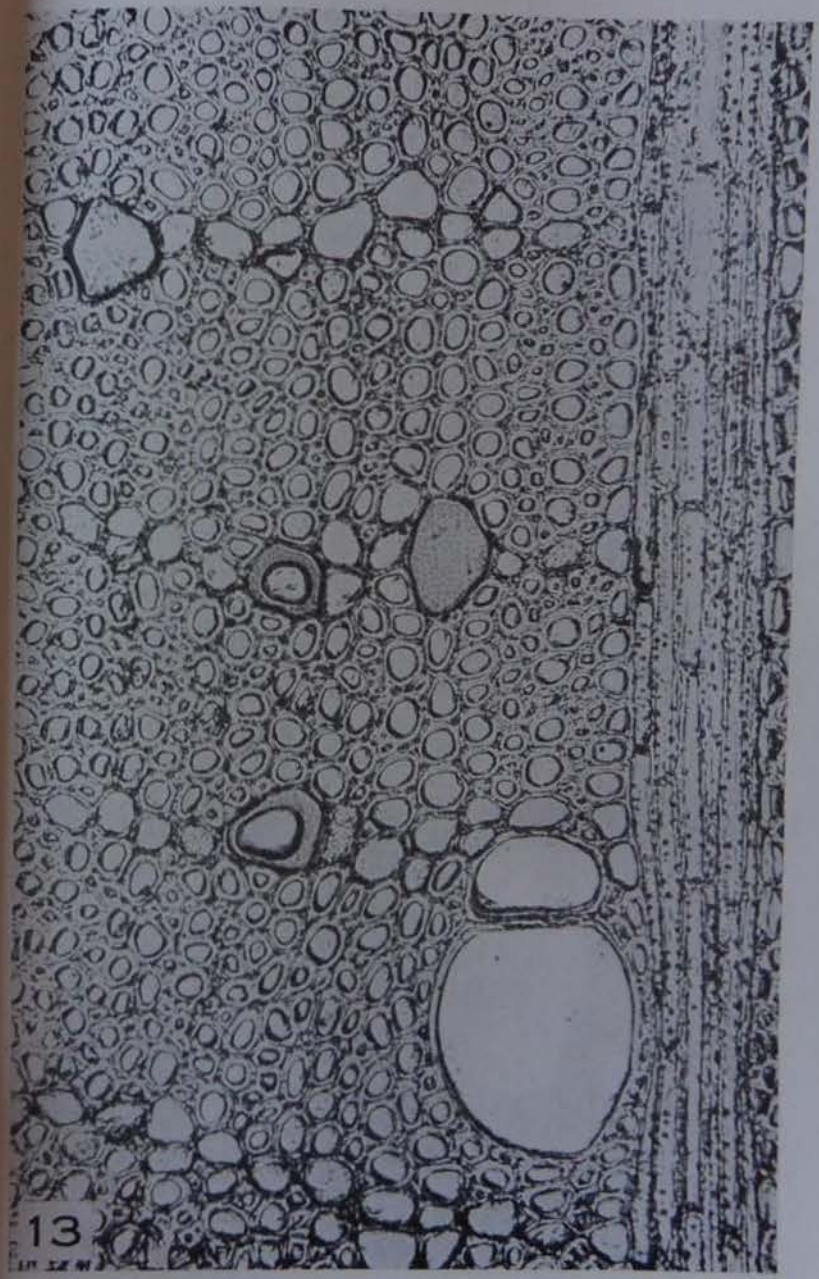

tembergia was believed to be restricted to Madagascar, and its extension of range to the Mascarenes, though not unexpected, is interesting.

The following new combination is accordingly in order:

(1) ***Lautembergia Cafcaf*** (Croiz.) Croiz. comb.nov.—*Cleidion ? Cafcaf* Croizat in *Tropical Woods* 77: 16; 1944.

As the writer remarked when first publishing *Cleidion ? Cafcaf*, the generic limits in this affinity are hazy, consequently the choice of generic name is often a matter of individual judgment and convenience. A study of certain South American Euphorbiaceae later caused the writer to consider again the limits of *Cleidion*, and to give especial attention to *Adenophaedra* Kl., a genus of unsettled affinities but beyond doubt close to *Cleidion*, endemic to the Guianas and adjacent Amazonas.

It seems probable that all the collections thus far identified under *Cleidion* in America belong to *Adenophaedra*. The material now available in herbariums is indifferent, and it will be the task of future monographers to verify this surmise in detail. Acting upon present knowledge, nevertheless, the writer presents the following new combinations:

(2) ***Adenophaedra praealta*** (Croiz.) Croiz.comb.nov.—*Cleidion praealtum* Croiz. in *Jour. Arnold Arbor.* 24: 167; 1943.

(3) ***Adenophaedra Woodsoniana*** (Croiz.) Croiz. comb. nov.—*Cleidion Woodsonianum* Croiz. in *Jour. Arnold Arbor.* 24: 167; 1943.

Although the writer is fairly sure that other species of *Cleidion* in Tropical America belong to *Adenophaedra* he refrains from effecting new combinations, suggesting that coming monographers give the matter their attention. It is with genera like *Adenophaedra*, as a matter of fact, that two large affinities in the Euphorbiaceae, the *Mercurialis-Acalypha* and *Tragia* group, come together, and it remains to be seen to what extent *Adenophaedra* is related to *Githara* and similar genera.

The writer must rectify a mistake of which he was the victim, believing that *Myrica pubescens* Willd. was *Alchornea cerifera* Croiz. (in *Caldasia* 2: 128; 1943). Female specimens of this well known entity, which were turned over to him repeatedly as an "euphorbiaceous" plant by a botanist who had collected the flora of Colombia extensively, led him by macroscopic means to key this putative "euphorbiaceous" form under *Alchornea* which it simulates to perfection, *A. castaneifolia* (Willd.) A. Juss. in particular. This error adds one more example to the already long series of indifferent records credited to taxonomists, both illustrious and not, who have tried to deal with Euphorbiaceae without having at their disposal ♂ and ♀ flowers. Gambles of this kind succeed in perhaps 99% of the cases, but the 1% in which they fail is neither very useful nor very pleasing.

BRAZILIAN TANNING MATERIALS

By EUGENE F. HORN

Two species of *Schinopsis* occur in limited quantities on the flood-plain of the Paraguay River in the Territory of Ponta Porã in southwestern Brazil. Quebracho Colorado *(S. Balansae* Engl.), also called Quebracho Femea, yields 28 per cent of tannin as compared to a yield of 18 per cent for the Quebracho Macho *(S. Lorentzii* Engl.), which is sometimes called Quebracho Cornillo. The trees of Quebracho Colorado are small, yielding only 400 to 500 kilos of heartwood as compared with average yields of 1500 to 2000 kilos for the Quebracho Macho. Occasional trees of the latter species yield from 10 to 20 metric tons of heartwood. The Quebracho Colorado is much less abundant than the Quebracho Macho and furnishes only 9 per cent of the extract wood used by the two factories now operating in Brazilian territory. Brazilian extract factories therefore require 555 kilos of extract wood to produce the same quantity of tannin extract as the extract factories in Paraguay and Argentina produce with only 357 kilos of extract wood, which is largely *S. Balansae*. The heartwood of Aroeira Vermelha *(Astronium urundeuva* [Fr.All.] Engl.), sometimes called Urundeuva or Urunday, yields 15 per cent of a catechol tannin similar to Quebracho and is used to a limited extent for the manufacture of tannin extract by the Brazilian extract factories previously mentioned.

Barbatimão *(Stryphnodendron barbatimao* Mart.) is widely distributed throughout the dry forests and "campos cerrados" (savanna forests) from Rio Grande do Sul Ceará. It is especially abundant in some sections of Mato Grosso, Goiaz, and Minas Gerais. The bark yields 35 per cent of a catechol tannin which produces a light-colored leather of excellent quality. It is preferred over all other native tanbarks by the tanneries operating in southern and central Brazil.

Angico Preto *(Piptadenia macrocarpa* Benth.) is widely distributed throughout the seasonal and dry forests from southern Brazil to Ceará. The bark of this species yields 34 per cent of a catechol tannin. The leather produced is somewhat darker in color than that produced by Barbatimão. Nonetheless, it is widely employed by the tanneries throughout its entire range.

Paricá de Cortume *(Niopa peregrina* [L.] Britt. & Rose) is widely distributed throughout the dry forests and "campos cerrados" from São Paulo to the Amazon Valley. In northeastern Brazil this species is called Angico Branco, while in south central Brazil its most common name is Angico do Cerrado. The bark contains 16 per cent of tannin and is employed locally by the tanneries where Barbatimão and Angico Preto do not occur. It produces a good colored leather and in Pará it is preferred over all other Amazonian tanbarks by the local tanneries.

Red Mangrove *(Rhizophora mangle* L.) is very common on the tidal marshes and in the swamps along the coast of northeastern and northern Brazil, especially along the coast of Maranhão and around the estuary of the Amazon where

it is called Mangue Vermelho. The bark yields 24 per cent of tannin but up to the present it has not been utilized extensively. These vast mangrove swamps offer interesting possibilities for development on a large scale as the timber frequently occurs in almost pure stands with a high volume per acre. The logging of these mangrove swamps presents problems similar to the logging of cypress and swamp hardwoods in southern United States. An overhead method of logging is indicated owing to the great mass of tangled roots on the ground. Donkey engines for skidding out the logs could be mounted on scows of shallow draught which could be floated to the edge of the mangrove swamps at high tide. The logs could be peeled mechanically at the mill and the bark sold to tanneries, or tannin extract could be manufactured. The wood of Red Mangrove is very hard, heavy, strong, tough, and durable. It has an air-dry specific gravity of 1.00 to 1.10 and weighs 62 to 69 pounds per cubic foot. It is recommended for all purposes requiring strength, toughness, resilience, and resistance to wear, insects, and decay. It is especially recommended for cross-ties. Tests made by the Pulp and Paper Section of the Forest Products Laboratory at Madison, Wisconsin, revealed that Red Mangrove is a promising pulp material by the soda process owing to the exceptionally high yield of cellulose on the volume basis as a result of the high density of the wood. The exportation of the products resulting from the utilization of these mangrove forests to the world's markets presents no difficult transportation problems owing to their location on tidewater.

Mangue Branco *(Laguncularia racemosa* [L.] Gaertn.) and Mangue de Botão *(Conocarpus erecta* L.) are associated with Red Mangrove throughout its range in Brazil. The bark of both species contain 16 per cent of tannin but neither are utilized.

Black Wattle *(Acacia decurrens* Willd.) has been successfully introduced into southern Brazil and ten million trees have been planted in Rio Grande do Sul where it is called Acacia Negra. The bark of this species contains 40 per cent of a catechol tannin.

A RAPID METHOD OF SOFTENING WOOD FOR MICROTOME SECTIONING

By G. L. Franklin

Forest Products Research Laboratory, Princes Risborough

In the course of experiments on the softening of so-called "improved wood" (wood-resin composites) for sectioning prior to microscopic examination, it was found that heating in a mixture of glacial acetic acid and hydrogen peroxide softened both the wood and the resin.[1] As a result of further experiment the method has now been adapted for the softening of hard woods and has been found to have distinct advantages over other methods in general use.

A squared block of suitable dimensions (e.g. ½ inch cube) is placed in a mixture of 1 part by volume of glacial acetic acid and 2 parts by volume of hydrogen peroxide in a glass flask fitted with a reflux condenser, and is heated for 1 to 3 hours according to the kind of wood. (The proportions of the two reagents can probably be varied considerably without affecting the efficacy of the treatment.) The block is then washed in running water for a few minutes after which it is ready for sectioning in the microtome. Dense temperate zone woods such as Persimmon, Black Locust *(Robinia)* and Rock Elm, are softened sufficiently after one hour's treatment. Dense tropical and sub-tropical hardwoods are rather variable in their reaction but excellent sections have been cut of Lignum Vitae, Ekki or Bongossi *(Lophira alata* var. *procera)*, Iroko *(Chlorophora excelsa)* and others after two or three hours' softening.

As in other rapid methods of softening wood by chemical action, the outer layers of the block are softened considerably more than the center. It is an advantage, therefore, to start with a block slightly larger than would normally be used so that if the outer layers are found to be too soft they can be trimmed off, leaving the harder core for sectioning. The outer layers may be used for making preparations of macerated wood fibers without further treatment. They are

simply shaken up in water, removed with a pipette and mounted in the usual way. If macerations only are required these may be prepared more conveniently by immersing chips of the wood (about the size of half a matchstick) in a mixture of equal parts of the acid and peroxide in a corked tube for about two days at 60° C.

The effect of the treatment is to partially delignify the wood, as indicated by the reaction of sections to standard cellulose and lignin staining reagents. In this respect it is comparable to a prolonged treatment in boiling water.[2] Thus the method is not suitable for work involving critical microchemical investigations of the cell wall; it is very useful, however, for purely anatomical studies, and enables sections of even the hardest woods to be cut at short notice.

REFERENCES

1. Franklin, G. L. Preparation of thin sections of synthetic resins and wood-resin composites, and a new macerating method for wood. *Nature* 155: 51. January 13, 1945.
2. Clarke, S. H. Comparison of temperate and tropical timbers. *Tropical Woods* 52: 1-11. December, 1937.

INTERNATIONAL ASSOCIATION OF WOOD ANATOMISTS

Dr. L. Chalk reports that his request for nominations by the council members of a Secretary-Treasurer to succeed him in office resulted in a virtually unanimous selection of Dr. H. E. Dadswell. There was, therefore, no need to hold a formal election. Dr. Dadswell has accepted the post and the records and funds are being transferred to him.

The new Secretary-Treasurer may be addressed as follows: Dr. H. E. Dadswell, Officer-in-Charge, Section of Wood Structure, Council of Scientific and Industrial Research, 69-77 Yarra Bank Road, S. Melbourne, S. C. 4, Australia.

The Members of Council are as follows: Prof. Irving W. Bailey, Dr. Laurence Chalk, Mr. K. Ahmad Chowdhury, Prof. Jean Collardet, Dr. H. E. Dadswell, Mr. Joseph D. Hale, Prof. Robert W. Hess, Prof. Fernando Romano Milanez, Mr. J. B. Rendle, Dr. Y. Tang, Prof. G. Van Iterson, Prof. Dr. Albert Frey-Wyssling.

CURRENT LITERATURE

Progress in tropical forest legislation. *Caribbean Forester* 7:4: 275-278 (English), 279-284 (Spanish); October 1946.

An ordinance to provide for the conservation of the private forests of British Honduras is given. This is followed by a "program for forestry and forest lands in Puerto Rico". A brief article in Spanish gives the apportionment of income derived from the sale of various forest products.

Orientando al agricultor en selvicultura. By José A. Gilormini. *Caribbean Forester* 7: 4: 295-296, 328; October 1946.

The article contains a discussion of the value of trees on the farm, silvicultural practices in felling timber, and tree planting methods.

Les palmiers de la Guadeloupe et dependances. By Adrian Questel. *Caribbean Forester* 7: 4: 297-302 (French), 303-308 (English), 308-314 (Spanish); October 1946.

The native and introduced palms are listed. Some additional notes concerning distribution, uses, and description are included.

A list of woods arranged according to their resistance to the attack of the West Indian dry-wood termite *Cryptotermes brevis* (Walker). By George N. Wolcott. *Caribbean Forester* 7: 4: 329-334 (English), 335-336 (Spanish); October 1946.

The list includes many species of woods grouped into five classes according to their resistance to attack by the dry-wood termite. The per cent of lignin is given for many.

Contributions to the study of the Cuban palms. VII. The genus *Calyptrogyne* in Cuba. By Brother León. *Contribuciones Ocasionales* (Museo de Historia Natural del Colegio "De La Salle", Havana), No. 3, April 1946. Pp. 12, 2 plates.

An account is given of the species of Manaca palms from Cuba. A new species from Jamaica and two new species from Cuba are described.

Excursión botánica a la bahía de Nuevas Grandes y hallazgo de una especie de cachalote nueva para la fauna cubana. By Hno. León and C. G. Aguayo. *Contribuciones Ocasionales* (Museo de Historia Natural del Colegio "De La Salle", Havana), No. 5, December 1945. Pp. 7, 8 figs.

The brief account of the expedition includes general descriptions of the flora in various areas.

Notes on the vegetation of Sierra Surotato in northern Sinaloa. By Howard Scott Gentry. *Bul. Torrey Bot. Club* 73: 5: 451-462; September 1946.

The vegetation of mountains forming the Sierra Suratato complex is described in considerable detail. The major zones of vegetation are given as follows:

Pine Oak Forest	4500 - 7000	feet elev.
Oak Forest–Grassland	2000 - 4500	" "
Tropical Montane Forest	3000 - 4500	" "
Short-tree Forest	500 - 3500	" "
Thorn Forest	0 - 1000	" "

A preliminary study of the vegetation of the region between Cerro Tancitaro and the Rio Tepalcatepec, Michoacan, Mexico. By William C. Leavenworth. *Amer. Midland Nat.* 36: 1: 137-206; 20 figs., 1 map; July 1946.

A detailed description of the vegetation of the region is accompanied by a list of species collected. Vegetational zones are described on the basis of the field collections and these zones correlated with other vegetational zones of Mexico.

Flora of Guatemala. Part V. By Paul C. Standley and Julian A. Steyermark. *Fieldana: Botany* (Chicago Nat'l Hist. Mus., Chicago) 24: 5: 1-502; August 1946.

The continuation of this valuable work (see *Tropical Woods* 86: 63) contains descriptions of 12 additional families, including the Leguminosae, Zygophyllaceae, Rutaceae, Simaroubaceae, Burseraceae, and Meliaceae.

The vegetation of San José Island, Republic of Panamá. By C. O. Erlanson. *Smithsonian Misc. Col.* 106: 2: 1-12; 1 fig., 2 plates; July 1946.

An interesting general description of the plant associations that occur in the various parts of the island.

El problema maderero de Venezuela. By Joaquin Avellan. *Revue Internationale du Bois* 13: 109 & 110: 131-139; 1946.

A comprehensive general analysis of the forestry problem in Venezuela. Past and anticipated exploitation are discussed. The composition of the forest, the merchantable species and their utilization are summarized.

Henri Pittier — a man with a dream. By Tobias Lasser. *Agric. Americas* (Washington) 6: 11: 183-184; 1 fig.; November 1946.

This is the story of Henry François Pittier, who at 89 years of age is recognized as one of the world's great leaders in the field of plant science. Born in Bex, Switzerland, of a mountaineer family, he was early attracted by the Tropics "with their exuberant vegetation, their immense climbers, and their rare orchids". A man with great physical and mental powers, he has centered his interest on the flora and forest of Venezuela. He has served that country well and among his outstanding accomplishments are the Manual de las Plantas Usuales de Venezuela, published in 1926, and the establishment of the National Herbarium at Caracas. His

publications number more than 300 books, pamphlets, and articles on botany, agriculture, geography, and ethnography.

Notas a la flora de Colombia, VIII. By José Cuatrecasas. *Rev. Acad. Col. Cienc. Ex., Fis. & Nat.* (Bogotá), 6: 24: 533-551; 4 plates, 4 figs.; September 1945—March 1946.

Forty-nine new species and one new genus, *Phragmotheca* (Bombacaceae), are described in the Araliaceae, Sterculiaceae, Vochysiaceae, Bombacaceae, and Melastomaceae.

Nuevas nociones sobre el genero *Ficus* en Colombia, V. By Armando Dugand. *Caldasia.* 4: 17: 113-120; August 1946.

Three species and one variety are described as new. The distribution of other species is discussed. Part VI in *Caldasia* 4: 18: 229-230, October 1946, deals with two additional species, one new.

Adiciones a las Leguminosas de Colombia. By Lorenzo Uribe-Uribe. *Caldasia* 4: 18: 211-213; October 1946.

The occurrence of several species is discussed and a new combination reported.

Noticias botanicas Colombianas, VII. By Armando Dugand. *Caldasia* 4: 18: 231-241; October 1946.

Eleven species of Moraceae, Flacourtiaceae, and Bignoniaceae are discussed.

Wooden boats of Ecuador. By L. V. Teesdale. *American Forests* 52: 9: 410-412, 444, 445; 5 figs.; September 1946.

A brief account is given of the fabrication of wooden boats at Posorja, Bahia de Caraquez, and Esmeraldas.

Mahogany industry of Peru. By Harry E. Hoy. *Economic Geography* (Clark University, Worcester, Mass.) 22: 1: 1-13; 13 figs.; 1946.

"More than one-half or approximately 400,000 square miles of Peru's total area of 659,000 square miles is forested.

Most of this is tropical lowland; all of it is located east of the main ranges of the Andes on the steep-sided foothills and the broad, flat to undulating plain of the upper Amazon and its tributaries. Even though this vast area has been traversed time and again, little of a quantitative character is known of its forest resources. After completing a brief survey of the forest resources of Peru in 1943, Cox concluded that the range of mahogany is great in the 'montaña' although its density varies from place to place. In some areas there may be one or more mahogany trees to the acre but more often they are a mile or more apart."

"It is claimed that the finest area of caoba, as well as rubber, occurs in the Department of Madre de Dios in the southeast of Peru. This is a part of the Acre region which Peru shares with Brazil and Bolivia. At present there is no cutting of mahogany there. The region is a part of the watershed of the Rio Madeira and is tributary to Brazil."

The two sawmills at Iquitos cut both Cedro *(Cedrela)* and Mahogany lumber. Most of the Cedro is shipped via the Amazon and the Panama Canal to the west coast of Peru; nearly all of the Mahogany is shipped to the United States. Although the annual capacity of the two mills is about 7,000,000 board feet, the output is usually less than half this figure.

Flora of Suriname (Netherlands Guayana). Edited by A. Pulle. Vol. 3, part 2, pp. 1-48; Amsterdam, 1942. Price f2.50.

The families treated are: Erythroxylaceae (pp. 1-12), by V. Westhoff; Oenotheraceae (pp. 13-34), Rhizophoraceae (pp. 35-43), and Oxalidaceae (pp. 44-48), by F. P. Jonker.

Notes on British Guiana timbers. By F. S. Danks. Pp. 28. Pub. by Forest Department, Georgetown.

This pamphlet describes in non-technical language the tree and its distribution, the wood and its properties and uses. Sixteen species are dealt with.

A história taxonômica do "imirá-eém" do brasilíndio. By F. C. Hoehne. *Arquivos Bot. do Estado de S. Paulo* 2: 3: 33-60; September 1946.

The literature from 1839 to 1946 is reviewed for that group of the Brazilian Sapotaceae represented by the genera (or genus) *Chrysophyllum*, *Pradosia*, *Glycoxylon*, *Pouteria*, *Lucuma*, et al. The following species are proposed as correct for Imirá-Eém *Chrysophyllum Buranhem* Riedel & Martius (= *Pradosia glycyphloea* [Mart. & Eichl.] sensu Kuhlmann; *P. glycyphloea* [Casar.] Liais, sensu Eyma; *P. Kuhlmannii* Toledo), and *Chrysophyllum lactescens* (Vell.) Baehni, sensu F. C. Hoehne (= *Pometia lactescens* Vell.; *Pradosia lactescens* [Vell.] Radlik., sensu Kuhlmann; *P. lactescens* [Vell.] sensu Eyma).

Samuel J. Record. By F. R. Milanez. *Rodriguésia* 9: 19: 1-7; September & December 1945.

A resumé of Record's work as a wood anatomist and a tribute to his extraordinary scientific achievements. (In Portuguese.)

Samuel James Record, M. F., M. A., Ph. D. By Paulo F. Souza. *Rodriguésia* 9: 19: 117-123, 1 photograph; September and December 1945.

A biographical sketch. (In Portuguese.)

Glossário dos nomes vulgares das plantas do Herbário da Seção de Botânica. By Henrique Delforge. Pub. by Serviço Florestal, Rio de Janeiro, Brazil, 1945. Pp. 80.

A list of approximately 1800 common names taken from the herbarium of the Section of Botany. With each common name is given the scientific name and herbarium number.

A carnaubeira. By Pimental Gomes. Pub. by Ministerio da Agricultura, Serviço de Documentação, Rio de Janeiro, Brazil, 1945. Pp. 62.

A description of the Carnauba Palm *(Copernicia cerifera)* industry, including its culture, products, and economic considerations.

Tecnologia da madeira seu significado para o Brasil. By Lino Tatto. Pub. by Ministerio da Agricultura, Serviço de Documentação, Rio de Janeiro, Brazil, 1945. Pp. 9.

A discussion of the problems of wood technology and their need for solution in Brazil.

The forest resources of Paraguay and their possible industrial utilization. By Eugene C. Reichard. Pub. by Inter-American Development Commission, Washington, July 1946. Pp. 26, mimeographed.

The forest resources and wood production of Paraguay are discussed and plans for improvements outlined.

The evergreen ghat rain-forest of the Tunga and the Bhadra River sources. By Kadambi Krishnaswamy. *Indian Forester* 68: 5: 233-240; 2 plates; May 1942 and 68: 6: 305-312, June 1942.

"The evergreen forest which forms the subject of this note is part of the almost continuous stretch of the evergreen zone covering the crest of the Western Ghats (Sahyadri mountains) all along the mountainous western frontier of Mysore. It includes portions of, hitherto incompletely explored, virgin evergreen forest of the most magnificent type found in the State and embraced by the reserve forests Tungabhadra and Narasimhaparvatha."

The forest composition and types are described and the utilization and silvicultural practices discussed for the principal species, Hadascale *(Palaquium ellipticum)* and Balagi *(Poeciloneuron indicum)*.

New or noteworthy Apocynaceae from India and Burma. By M. B. Raizada. *Indian Forester* 68: 7: 361-368; 1 plate; July 1942.

One new species *(Aganosma Lacei* M. B. Raizada) is described and 11 previously unreported species are noted.

A new *Pygeum* from Bastar State, Orissa. By M. B. Raizada. *Indian Forester* 68: 8: 421; 1 plate; August 1942.

A small evergreen tree, *Pygeum mooneyi* Raizada, is described.

The forests of Ramdurg State (Deccan). By Kadambi Krishnaswamy. *Indian Forester* 69: 1: 3-10; January 1943.

"The growth type is 'dry-deciduous'. Pronouncedly xerophytic species predominate in the growth. The forest is patchy and open on hill-tops and ridges. In sheltered valleys trees generally grow close together to form a coherent forest canopy."

"The principal woods are *Albizzia amara* (tugli), *Chloroxylon swietenia* (meshwal) and *Wrightia tinctoria* (halagatti). Their associate species are *Acacia* spp., *Melia azadirachta* (nim), *Anogeissus latifolia* (dindal), *Albizzia lebbek* (shirsal), *Zizyphus jujuba* (bari), etc."

Sandalwood regeneration in Sambrani Range in the Kanara northern division. By S. V. Gulwadi. *Indian Forester*. 69: 2: 67-74; February 1943.

The natural distribution of Sandalwood *(Santalum album* L.) and its artificial propagation in this region are discussed.

Indian kapok. By T. P. Ghose. *Indian Forester* 69: 4: 155-165; April 1943.

"The demand for kapok has increased considerably both for the manufacture of life-belts and other life-saving appliances as well as for its newer uses like the manufacture of felted kapok and kapok textilor yarn. The Java kapok *(Ceiba pentandra* floss) used to meet the bulk of the demand, and the Indian kapok *(Bombax malabaricum* floss), which at one time used to be considered as of inferior quality, has now been recognized as equal to the Java kapok in buoyancy, weight-bearing capacity and freedom from water-logging and its use in making life-belts, etc., has been approved of both by the Mercantile Marine Department, Calcutta and the Marine Surveyors of the British Ministry of Transport." *–From author's summary.*

Helves and tool handles. By V. D. Limaye. *Indian Forester* 70: 6: 175-177; June 1944.

"The following timbers have established themselves as first-class hammer handle and helve timbers and have been included in their list of approved timbers by His Majesty's Forces and the Railway Departments. *Anogeissus pendula* (kardhai), *Anogeissus latifolia* (axle wood), *Anogeissus acuminata* (yon), *Cynometra polyandra* (ping), *Ougeinia dalbergioides* (sandan), *Sageraea listeri* (chooi), *Celtis australis* (cellis), *Olea* spp. (kao), *Parrotia jacquemontiana* (parrotia), *Diospyros* spp. (light coloured wood of ebony, tendu), *Acacia arabica* (babul), *Grewia* spp. (dhaman), *Heritiera* spp. (Sundri), *Kayea* spp. (Kayer), *Dalbergia* spp. (sissoo, rosewood), solid bamboos etc. etc."

"For the handles of carpentry tools such as planes, chisels, screwdrivers, etc., such woods as *Buxus sempervirens* (box), *Betula alnoides* (birch), *Acacia* spp., *Dalbergia sissoo* (sissoo), *Dalbergia latifolia* (rosewood), *Gmelina arborea* (gamari), *Pongamia glabra, Murraya exotica, Ougeinia dalbergioides* (sandan), and many others are used and found suitable."

For "high class articles such as handles for hair brushes, mirors, shaving brushes, various kinds of knives, etc. ornamental timbers or timbers that can be easily stained are required. *Dalbergia latifolia* (rosewood), *Chloroxylon swietenia* (satin wood), *Diospyros* spp. (ebony), *Cedrela toona* (toon), *Adina cordifolia* (haldu), *Saccopetalum tomentosum* (hoom), *Michelia* spp. (champ), *Chukrasia tabularis* (chickrassy), *Mangifera indica* (mango heartwood), *Juglans* spp. (walnut) and many others can be used.

Timber extraction in Sierra Leone. By Roy Duffell. *Wood* (London) 11: 2: 48-50; 9 figs.; February 1946.

A brief description of a logging operation, first without tractors and later with them. Photographs illustrate some of the operations.

L'identification des bois de la Côte d'Ivoire. By D. Normand. *L'Agronomie Tropicale* (Nogent-sur-Marne, France) 1: 7 & 8: 361-374; 4 plates; 1946.

The woods of the Ulmaceae, Moraceae, Olacaceae, Icacinaceae, Octoknémataceae, and Annonaceae are described. Keys are included for separation of the genera both by macroscopic and microscopic character. Drawing of cross-sections illustrate principal features.

Merrilleana. A selection from the general writings of Elmer Drew Merrill, Sc.D., LL.D. *Chronica Botanica* 10: 3 & 4: 1-393; 1946.

This volume, published as a testimonial to Dr. Merrill, contains a biographical chronicle, his bibliography of published articles, and a reprinting of 23 of his principal, general articles.

Studies in the Sapotaceae — VI. Miscellaneous Notes. By Arthur Cronquist. *Bul. Torrey Bot. Club* 73: 5: 465-471; September 1946.

"My revisions of several American groups of the Sapotaceae, under the auspices of the Chicle Development Company, are now concluded. During the course of that work various notes on other groups in the family have been accumulated. These are here presented, in order to make them available to future students of the family, and to make certain names available for use. An artificial key to the American genera of the family, as I understand them, is followed by notes and comments alphabetically arranged by genera."

Distribution of the Dipterocarpaceae. By F. W. Foxworthy. *Jour. Arnold Arb.* 27: 4: 347-354; October 1946.

"There has been a good deal of study of this family during the past quarter century, and it is now possible to give a somewhat more detailed survey of its distribution than that made by Merrill in 1923. Extensive studies of the family have been made in the regions where it is most highly developed. There have been changes in the notions of generic and

specific limits, in records of distribution, and in the numbers of species recognized."

Preliminary revision of the genus *Lonicera* in Malaysia. By C. G. G. J. van Steenis. *Jour. Arnold Arb.* 27: 4: 442-452; 2 figs.; October 1946.

A provisional revision of the genus is proposed and a key to the species presented.

Phytologia. Pub. by H. A. Gleason and Harold N. Moldenke. (N. Y. Bot. Gard.). Vol. 2: 5 & 6; September & October 1946.

Contents, No. 5

Contents, No. 6

Tropical rain trees. By Edwin A. Menninger. *Jour. New York Bot. Garden* 47: 564: 296-299; December 1946.

"Scattered through the tropics of every region in the world there are trees of various kinds which are known as 'rain trees' because drops of moisture fall to the ground beneath them, sometimes almost like a shower. This phenomenon has fascinated many observers. A few writers have attributed the 'rain' under these trees to a condensation of dew, but the majority of scientists who have studied the matter have proved that the 'rain' is generally a liquid secreted by insects which are sometimes present in such enormous numbers that they actually produce a shower under the tree while the sun shines brightly all around."

A revision of *Dyera* (Apocynaceae). By JOSEPH MONACHINO. *Lloydia* 9: 3: 174-202; September 1946.

"In this paper a detailed bibliographical revision of *Dyera* is presented. All data available to the author which might bear taxonomic significance for the genus or its species are elaborated, and all the important non-taxonomic references are at least cited in the bibliography. This treatise is chiefly a compilation and lacks taxonomic finality."

A propos de medicaments antilépreux d'origine végétale. By E. DE WILDEMAN. *Inst. Royal Colonial Belge* (Brussels).

Part III. Les plantes utiles du genre *Strychnos*. (*Mémoires* 13: 5: 1-105; 1946)

Part IV. Des *Strophanthus* et de leur utilisation en médecine. (*Mémoires* 15: 4: 1-70; 1946)

Part V. Des *Ephedra* et de leur constitution chimique. (Reprint from Bul. 16: 2: 396-412; 1945)

The known medicinal values and chemical constituents of the various species in these genera are reviewed and their possible use as a leprosy cure discussed. Additional study of the chemical constituents in the various species and varieties is advocated for the more promising.

Notes on the anomalous structure of a species of *Bauhinia*. By KENNETH A. WAGNER. *Amer. Midland Nat.* 36: 1: 251-256, 1 fig., 1 plate; July 1946.

"The strap-shaped stem of this Bauhinia is the result of the restriction of the activity of the regular cambium to two localized regions on the periphery of the stem. The segmentation of the pith and wood as reported for other Bauhinias does not occur in this species. The formation of the wings is always at right angles to the two-ranked alternate tendrils. There is also a consistent orientation relative to the position of the cruciform pith. The periaxial vessels are unusually large in diameter, reaching .35 mm. Continuity of the pericycle is maintained by the production of stone cells." —*Author's summary*.

The formation of growth rings in *Entandrophragma macrophyllum*. A. Chev. and *Khaya grandifoliola* C.DC. By F. C. HUMMEL. *Empire Forestry Rev.* 25: 1: 103-197; 1946.

"Blocks of wood were removed at monthly intervals for twelve months from two trees in the Gold Coast, one of *Entandrophragma macrophyllum* A. Chev. and one of *Khaya grandifoliola* C.DC. *Entandrophragma* spp. have definite growth rings consisting of concentric bands of parenchyma. In the tree of *Entandrophragma macrophyllum* such bands were formed at the beginning of each of two consecutive growing seasons and at no other time. It appears, therefore, that ring counts may be expected to give a fairly reliable estimate of age in most species of this genus. In *Khaya* spp. growth rings are often discontinuous and in the tree of *Khaya grandifoliola* it was not possible to correlate their formation with seasonal periodicity of growth; their value for estimating age thus appears to be very doubtful." —*Author's summary*.

Influence of fibril angle on longitudinal shrinkage of ponderosa pine wood. By R. A. COCKRELL. *Jour. For.* (Washington) 44: 11: 876-878, 2 figs.; November 1946.

Results indicate that factors other than fibrillar orientation in the secondary wall are involved in longitudinal shrinkage of wood. "In (a previous) study it was explained that the cellulose in the secondary wall is probably a 'continuous matrix of overlapping chain molecules which is perforated by a continuous system of intermicellar capillaries'. The coming together of these chain molecules as a result of loss of adsorbed water from the intermicellar capillaries must be accompanied by a pushing apart of the affixed ends. The mass effect of this phenomenon on the longitudinal dimensional changes of wood would be inversely proportional to the average length of the chain molecules. Thus, the shorter the chain molecules between fastenings, the greater the

increase in length upon drying. This effect apparently occurs principally during the change from the green to the air-dry state. The net longitudinal dimensional change in wood, therefore, would be the resultant of both fibrillar orientation and chain molecule length, as well as the composite effect of summerwood and springwood."

Steps in the silvicultural control of wood quality. By Benson H. Paul. *Jour. For.* (Washington) 44: 11: 953-958, 2 figs.; November 1946.

"In hardwoods a well-maintained or accelerated growth in diameter gives the best results." "A growth pattern recommended for conifers is a medium, uniformly sustained, ring width from the center outward."

Timber identification as a campaigning problem. By H. E. Desch. *Wood* 11: 7: 186-189, 5 figs.; July 1946.

A resumé of the identification of wood using the card-key system and, particularly, the work done by Dr. H. E. Dadswell.

Die Toxizität der phenolischen Inhaltsstoffe des Kiefern-Kernholzes gegenüber einigen Fäulnispilzen. By Erik Rennerfelt. *Svensk Botanisk Tidskrift* 37: 1: 83-93; 1943.

The fungicidal properties of the phenolic compounds pinosylvin and pinosylvin monomethyl ether, which occur in the heartwood of pine, were investigated. Pinosylvin, especially, possesses antiseptic properties toward wood-destroying fungi. The phenol coefficient of pinosylvin is ca. 5-10; that of the monomethyl ether, <1.

Small wood blocks, containing about 0.7—0.8 per cent pinosylvin monomethyl ether, were significantly resistant to attack by *Letinus squamosus*—Robert Bloch, *Yale Dept. Botany*.

The influence of the phenolic compounds in the heartwood of Scots Pine (*Pinus sylvestris* L.) on the growth of some decay fungi in nutrient solution. By Erik Rennerfelt. *Svensk Botanisk Tidskrift* 39: 4: 311-318; 1945.

Of the two phenolic compounds in the heartwood of Scots Pine *(Pinus sylvestris* L.), pinosylvin and pinosylvin monomethyl ether, the former is the more universal poison. Pinosylvin in a nutrient solution is active in a concentration of 0.02-0.002 per cent. Pinosylvin monomethyl ether is the more specific problem, of great toxicity for example to *Coniophora puteana* and *Merulius lacrymans*, of much smaller toxicity to ther fungi such as *Lentinus lepideus* and *Polyporus annosus*.—Robert Bloch, *Yale Dept. Botany*.

L'utilisation dans le royaume-uni des bois tropicaux et subtropicaux britanniques. By S. E. Chandler. *Revue Internationale du Bois* (Paris) 30: 109 & 110: 126-130; July-August 1946.

Dr. Chandler, Secretary of the Advisory Committee on Timbers, Imperial Institute, London, discusses the tropical and subtropical species of trees of the British United Kingdom that have proved to be good sources of wood for the following uses: decorative work, carpentry, flooring, furniture and cabinet-making, heavy construction, platforms for piers and bridges, wagons, and various special uses. The country of origin and both the common and scientific names of the trees are given.—Mary Record.

Developing the colonies. By W. A. Robertson. *Wood* 11: 7: 183-185, 4 figs.; July 1946.

The problems of the tropical timber industry in the various British colonies and the prospects for the future are outlined.

The contribution of tropical forests in post-war reconstruction. By H. E. Desch. *Australian Timber Jour.* 12: 6: 328, 331, 333; July 1946.

"Five essential conditions must exist before new ventures dependent on tropical forests are embarked upon: these are (1) adequate supplies of suitable timber, measured in hundreds of, not tens of cubic tons, (2) adequate supplies of labour prepared to work under industrial conditions, (3) skilled supervision, (4) ample capital, and (5) a local market for what is not suitable for export. The last of these conditions may well be up to seventy-five per cent of the total output!"

GENERAL INDEX

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