THE PHILIPPINE

JOURNAL OF SCIENCE

C. BOTANY

VOL. IV. OCTOBER, 1909 No. 4

INDO-MALAYAN WOODS.

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(From the Botanical Section of the Biological Laboratory, Bureau of Science, Manila, P. I.)

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I. INTRODUCTION.

ERRONEOUS POPULAR NOTIONS WITH REGARD TO EASTERN TIMBERS.

The newcomer in the Orient is usually surprised at finding that soft woods are not uncommon and that a large part of the timber of the region is of medium or light weight. The popular notion of eastern timbers seems to be that they are mainly hard and heavy, ornamental, furniture or cabinet woods. This notion is probably due to the fact that, until recent years, the only eastern woods which have reached the European markets have been a few of the more valuable ones for furniture and cabinet work; as, ebony, satinwood, rosewood, etc. Most European and American works which mention eastern woods at all con-

sider only examples like satinwood, rosewood or teak and give little or no account of the woods of the great family of *Dipterocarpaceæ*, which furnishes much the largest part of the timber of this part of the world. This is as unreasonable as it would be to take a few of the furniture woods of North America, as black walnut (*Juglans nigra*) or the wild black cherry (*Prunus serotina*), as representative of the woods of the country. In the eastern tropics, the woods of the family *Dipterocarpaceæ* are to the trade what the pines, spruces, firs, hemlocks, oaks and beeches are to the trade in temperate North America and Europe. This family, while it supplies many valuable hardwoods, supplies also the most widely used soft and medium grade woods of the eastern tropics. So wide is its distribution and so general the use of its wood that I believe that all other woods could be spared from many eastern markets without seriously hampering work or affecting prices.

OBJECT OF THIS WORK.

There is a great deal of confusion in the use of the common names of the different woods. Many of the woods of the region are of wide distribution; but, they are known by different names in different countries. This work is undertaken with the object, first, of correlating Philippine woods with the related or identical forms in other sections and then of calling attention to the structure, uses and distribution of the eastern woods.

DEFINITION OF THE INDO-MALAYAN REGION.

This is taken to include all of Ceylon, British India, Burma, the Andamans, Siam, Cochin China, the Malay Peninsula, Sumatra, Java, Borneo, the Philippines, and all of the Malay and Indian Archipelago down to New Guinea. In other words, it is meant to include nearly all of the tropical East. It constitutes a region which geographically and commercially is quite distinct. Japan with its temperate-zone woods constitutes a very distinct group. Australia is also very distinct, with its eucalyptus and other characteristic woods. Wherever woods from either of these regions come into tropical markets to any considerable extent, they are considered in this paper. The number of cases in which woods of the temperate regions are of commercial importance in the eastern tropics is really very small. First of all would come the use in India of the woods grown in the temperate forests of the lower Himalayas. After this come the various eucalyptus species exported from Australia, the Oregon pine from the United States, and the camphorwood from Japan and Formosa.

REVIEW OF PREVIOUS WORK AND ACKNOWLEDGMENTS.

In the course of the comparative study of the woods of this region, collections of botanical and commercial material have been made in some of the countries considered and material from other countries has been

secured by exchange. Much assistance in the way of information and material has been given by various persons and institutions in Sarawak, Dutch Borneo, British North Borneo, the Straits Settlements and Federated Malay States, New Guinea, Australia, Cochin China, Burma, British India and Ceylon. Special acknowledgments for material furnished are due the following: Dr. M. Treub, director of agriculture, Buitenzorg, Java; A. M. Burn-Murdoch, conservator of forests, Federated Malay States and Straits Settlements, Kuala Lumpur; H. N. Ridley, director Botanic Gardens, Singapore; J. H. Hewitt, late curator, Sarawak Museum, Kuching; M. G. Bradford, municipal officer, Kuching, Sarawak; J. C. Moulton, curator of the museum, Kuching, Sarawak; R. S. Douglas, Resident, Baram district, Sarawak; M. Hagadorn, Samarinda, Dutch East Borneo; A. J. Cools, Berouw, Dutch East Borneo; G. J. Altman, Sandakan, British North Borneo; Dr. H. L. E. Luehring, Anglo-Chinese School, Penang; M. Haffner, director of agriculture, Saigon, Cochin China; R. S. Troup, Imperial Forest Research Institute, Dehra Dun, northwest provinces, India; C. E. Brasier, conservator of forests central circle, Madras, India; F. E. Lewis, Batticaloa, Ceylon; Rev. Copland King, Ambasi, Papua, British New Guinea; R. T. Baker, curator Technological Museum, Sydney, New South Wales; T. Kawakami, bureau of industry, Formosan government, Taihoku, Formosa.

Previous work on the woods of this region was as follows:

Gamble, J. S. A Manual of Indian Timbers. This is by far the most complete piece of work on eastern timbers. The notes are very full and I have quoted from them very largely in my species notes.

Van Eeden, F. W. Houtsoorten van Nederlandsch Oost-Indië.-Kol. Museum te Haarlem 1906. This gives very useful notes on a large number of species.

Ridley, H. N. Timbers of the Malay Peninsula. Agric. Bull. S. S. and F. M. S. (1901–2). Gives excellent notes on a large number of species of the Malay Peninsula.

Nördlinger, H. Holzquerschnitte. Gives very fine cross sections of a number of Indian woods and some very brief notes as to structure.

Wiesner, J. Die Rohstoffe des Pflanzenreichs. Vol. II. Describes in detail a few species and lists a number of others from this region.

Janssonius, H. H. Mikrographie des Holzes. Describes in great detail a number of Javanese species.

Laslett. Records tests of the strengh of a number of Indian timbers.

Stone, H. Timbers of Commerce. Includes a very few eastern timbers.

Boulger, G. S. Wood. Gives brief notes on quite a number of species.

Newton, H. In 1882 published the results of a number of tests on about twenty different timbers of the Straits Settlements. The botanical determinations for this work were very uncertain and it is often very difficult to determine just what wood was meant.

Gardner, R. Mechanical Tests of Thirty Different Philippine Woods. For. Bur. (Philip.) Bull. 4 (1907).

Beccari, O. Nelle foreste di Borneo. Florence, 1902. In this work, Doctor Beccari gave brief notes on the nature and uses of many of the woods of Sarawak. Detailed structural notes on these woods collected by Doctor Beccari were published in Malpighia by Dr. G. Bargagli-Petrucci, and these two works constitute the best contribution to our knowledge of the woods of Borneo.

Besides these there have been a number of individual articles on particular woods; but there has been very little done in the way of comparative study of the woods of the whole region.

II. PROPERTIES OF WOOD.

COMPARISON OF WOODS OF THE TROPICS WITH THOSE OF TEMPERATE REGIONS.

In general, tropical woods contain more of color than do those of temperate regions. Cognate with this is the fact of their greater weight and hardness. Distinct seasonal growth with the formation of definite rings of seasonal growth is much less common in the tropics than in the temperate regions.

WEIGHT AND HARDNESS.

These two qualities usually go together; but the weight can not be considered as an accurate measure of hardness. It is usually true that a very heavy wood is also very hard; but this is not always the case. Occasionally, also, a wood which is only moderately heavy will prove to be very hard; consequently, it is not possible to combine these two qualities in one table.

Weight.—The weight of a given wood is due to the density of the walls of the different elements together with the nature of the contained deposits and the closeness of crowding together of the elements.

In published statements of weight, there is a considerable factor of error due to natural variability in density, carelessness in using sapwood and heartwood indiscriminately, and to the fact that some workers have not used carefully dried wood. It is perfectly plain that any measurement of a moisture-containing wood which does not indicate the percentage of contained moisture is a source of confusion in comparative studies. Unfortunately, some workers have published weights of "air-dry" wood without indicating what percentage of moisture was meant.

In the following table only a rough comparison has been possible among the most used woods of this part of the world. Wherever possible, large numbers of samples of a given wood have been tested. In many cases this has not been possible and it has been necessary to rely on the work of others or on comparative estimates made by traders and timber workers.

It has seemed best to use only four classes, as outlined by Gardner and

already used by me, viz, very heavy, heavy, moderately heavy, and light. Unless specially indicated the weight has been determined in Manila.

Some of those listed in the *heavy* class are frequently found to furnish examples that are properly described as *very heavy*. I have indicated this by italics in the table.

As indicated in the table, the light woods are relatively few. Some of them, however, are found in considerable quantity. The table will not show all of the woods which will sink when green. Many of those in the heavy class are heavier than water when green. The number of woods which are really heavier than water when absolutely dry is relatively very small. Those woods of the *very heavy* class which are actually heavier than water when dry are indicated by italics. Some of those not so marked may occasionally have a weight in excess of that of water.

Table of comparative weights of eastern woods.

Very heavy. Sp. gr., 0.90 or more: 900 kilos or more per M³: 56 lbs. or more per cu. ft.	Heavy. Sp. gr., 0.70–0.90: 700–900 kilos per M³: 44–56 lbs. per cu. ft.	Moderately heavy. Sp. gr., 0.50–0.70: 500–700 kilos per M³: 31–44 lbs. per cu. ft.	Light. Sp. gr., 0.50 or less: 500 kilos or less per M³: 31 lbs. or less per cu. ft.
Mancono.	*Dungon.*	Acle.	Lauan.
Nani.[b]	*Ipil.*	Acleng-parang.[a]	Baticulin.
Dungon-late.[a]	*Mirabow.*[b]	Amuguis.	Calantas.
Ebony.[a]	*Yacal.*	Anubing.	Mayapis.
Billian.[b]	*Betis.*	Apitong.	Red lauan.
Anjan.[a]	*Bansalaguin.*	Balacat.	Dita.
Tapang.	*Aranga.*	Banaba.	Cupang.
Bacauan.[a]	*Sasalit.*	Bancal.	Teluto.
Pennagah.[a]	*Liusin.*	Banuyo.	Malapapaya.
Red sanders.[a]	*Agoho.*	Bansu.[a]	Meranti.[b]
Rohan.[a]	*Griting.*[b]	Balinhasay.	Seriah.
Bolongeta.	*Api-api.*[a]	Batino.	Jelutong.
Camagon.	*Jarrah.*[b]	Blimbing.[a]	Pincapincahan.[a]
Pototan.[a]	*Blue gum.*[b]	Butea.[a]	Kapok.[a]
Tangal.[a]	Mas-mora.[a]	Calumpit.	Silk cotton tree.[a]
Chengal.	Alupag.	Camanchilis.[a]	Tui.[a]
Selangan batu.	Ballow.	Camphor.[a]	Mangasinoro.
Kulim.	Banalo.[a]	Cato.	Kayu garu.[a]
Petaling.	Babul.[a]	Champaca.[a]	Saleng.
Anan.[a]	Batete.	Black wattle.[a]	Ratilis.
Malabera.	Batitinan.	Dalinsi.	Dapdap.[a]
Tampinis.	Blackwood.[a]	Dao.	Ilang-ilang.[a]
Peniow.	Calamansanay.	Duguan.	Dún.[a]
Kranji.[b]	Catmon.	Durian.[a]	Sterculia fœtida.[a]
Tamarind.[a]	Cay go.	Del.[a]	Gyrocarpus jacquini.[a]
Pynkadu.[a]	Chengal.	Bintangor.[a]	Barringtonia racemosa.[a]
Camuning.[a]	Chittagong.[a]	Guava.[a]	Duabanga sp.[a]
Satinwood.[a]	Eng.[a]	Guijo.	Tetrameles nudiflora.[a]
Sandal.[a]	Gurjun.[a]	Lanete.	Hymenodictyon excelsum.[a]
Boxwood.[a]	Hora.[a]	Makai.[a]	
Sappan.	Ingyin.[a]	Malasantol.	Sarcosperma arborenm.[a]
Saj.[a]	Kapor.[b]	Malugay.	Octomeles sumatrana.[b]
Harra.[a]	Kaunghmu.[a]	Lumbayao.	Gerunggang.

[a] These woods are placed according to their arrangement in Gamble, *l. c.*

[b] These woods are placed according to information given in Van Eeden, *l. c.*

Table of comparative weights of eastern woods—Continued.

Very heavy. Sp. gr., 0.90 or more: 900 kilos or more per M³: 56 lbs. or more per cu. ft.	Heavy. Sp. gr., 0.70–0.90: 700–900 kilos per M³: 44–56 lbs. per cu. ft.	Moderately heavy. Sp. gr., 0.50–0.70: 500–700 kilos per M³: 31–44 lbs. per cu. ft.	Light. Sp. gr., 0.50 or less: 500 kilos or less per M³: 31 lbs. or less per cu. ft.
Moka.[a]	Kolavu.[a]	Mango.[a]	Hernandia peltata.
Culis.[a]	Lanotan.	Mayapis.	
Khair.[a]	Leban.[b]	Narra.	
Longan.[a]	Mahogany.[a]	Nato.	
Cangu.[a]	Macaasin.	Nangka.[a]	
Thitya.[a]	Mangachapuy.	Palo maria.	
Talura.[a]	Molave.	Pili.	
Thitsi.[a]	Nedun.[a]	Mahogany.[a]	
	Nireh.[b]	Renghas.[a]	
	Padauk.[a]	Sacat.	
	Pagatpat.	Santol.	
	Petir.	Talisay.	
	Rassak.	Tamayuan.	
	Sal.[a]	Tanguile.	
	Piagao.[b]	Teak.	
	Siris.[a]	Toog.[a]	
	Sissoo.[a]	Thinkadu.[a]	
	Supa.	Silky oak.[a]	
	Tindalo.	Kumpas.	
	Thingan.[a]		
	Trincomali.[a]		
	Tucan-calao.		
	Ubar		

[a] These woods are placed according to their arrangement in Gamble, *l. c.*
[b] These woods are placed according to information given in Van Eeden, *l. c.*

Hardness.—It is much more difficult to get a satisfactory measure of hardness than it is to get the weight. No completely satisfactory method of determining relative hardness has come to my notice. There are, however, certain comparative values recognized and these I have endeavored to show in the following very imperfect table. I have been able to use only five categories, viz, very hard, hard, moderately hard, soft and very soft. Those woods classified by Gamble as extremely hard and extremely soft will naturally come under the very hard and very soft classifications in this table.

Many of the very hard and very heavy woods are very dark in color. In these cases the sapwood is usually very much lighter in color and weight and is softer. In these woods it is the deposit of the dark-colored substance in the wood elements when the sapwood changes to heartwood that causes the hardness and weight. This is, of course, not the sole cause. There are some woods where the sap and heart are not noticeably different in color. In these cases, there is very little difference in weight and hardness in the different parts of the tree. If such woods are heavy, it will usually be found to be due to the thickness of walls of the fibers and the close crowding together of the wood elements. This is the case in *agoho* and in *boxwood.*

Table of comparative hardness of eastern woods.

Very hard.	Hard.	Moderatcly hard.	Soft.	Very soft.
Anjan.	Guijo.	Teak.	Meranti.	Calantas.
Mancono.	Sal.	Banuyo.	Lauan.	Plai.
Anan.	Acle.	Banaba.	Pine.	Cotton tree.
Sissu.	Babul.	Kapor.	Champaca.	Silk cotton.
Ebony.	Ballow.	Deodar.	Balacat.	Red lauan.
Dungon-late.	Chittagong.	Jak.	Gerunggang.	Dapdap.
Dungon.	Nireh.	Kiamil.	Kappla.	Ratilis.
Billian.	Eng.	Bansu.	Lumbayao.	*Hibiscus* sp.
Agoho.	Molave.	Cashew.	Mayapis.	Nivar.
Tapang.	Tindalo.	Apitong.	Jelutong.	
Bansalaguin.	Yacal.	Malasantol.	Mangasinoro.	
Sasalit.	Batitinan.	Tanguile.	Black wattle.	
Liusin.	Macaasin.	Sacat.	Telambu.	
Betis.	Amuguis.	Santol.	Ilang-ilang.	
Aranga.	Palo maria.	Narra.	Makai.	
Miraboo.	Ipil.	Piney varnish.	Durian.	
Camagon.	Malugay.	Bintangor.	Blimbing.	
Kumpas.	Supa.	Kolavu.	Samadera.	
Bacauan.	Nedun.	Padouk.	Pili.	
Pototan.	Tamarind.	Simpor.	Mango.	
Tangal.	Mas-mora.	Gurjun.	Bancal.	
Chengal.	Siris.	Hora.	Tui.	
Selangan batu.	Acleng-parang.	Thinkadu.	Duguan.	
Kulim.	Camanchilis.	Dun.	Kayu garu.	
Petaling.	Thingan.	Thitka.	Toon.	
Malabera.	Caugu.	Guggar.	Pincapincahan.	
Peniow.	Talura.	Kharpat.	Teluto.	
Pennagah.	Mahogany.	Puna.	Malapapaya.	
Tampinis.	Kakira.	Guava.	*Tetrameles* sp.	
Plawan.	Talisay.	Jaman.	*Sonneratia* sp.	
Sudjung.	Thitsein.	Camphor.	*Duabanga* sp.	
Ballow.	Saj.	Toog.	*Gyrocarpus* sp.	
Tamayuan.	Dahu.	Banalo.	*Kleinhofia* sp.	
Alupag.	Griting.	Del.	*Octomeles* sp.	
Camuning.	Jarul.	Lanete.		
Red sanders.	Sandal.			
Trincomali.	Api-api.			
Blackwood.	Cato.			
Kranji.	Tucan-calao.			
Pynkadu.	Pagatpat.			
Thitya.				
Khair.				
Rohan.				
Satinwood.				
Kosum.				
Banderu.				
Thitsi.				
Harra.				
Kindal.				
Sappan.				
Thingyin.				
Box.				
Nani.				

STRENGTH AND RESISTANCE TO STRAINS.

It is not the purpose of this paper to go into the question of the resistance of different woods to different strains. Reference may, however, be made to the tests which have been made of oriental woods.

Skinner, Laslett, Balfour, and Gamble have published the results of tests on Indian timbers. In 1882, Howard Newton published a pamphlet showing the results of some work he had done on the timbers of the Straits Settlements. In 1906, Gardner published a bulletin giving the results of a number of careful tests on thirty different Philippine woods; and in a second edition of this bulletin, published a year later, added information concerning four additional woods. So far as I know, this is the most careful piece of this kind of work which has been done in the east.

ODOR, COLOR, TASTE, ETC.

Many woods have distinct and characteristic odors. Some of them are agreeable—as camphor, sandal, rosewood, etc. There are a few which are distinctly disagreeable, as kulim. The odor of a wood is often a very good means of identifying it; but it is extremely difficult to classify odors.

Color is a variable thing in wood. Usually the heartwood of a given species approximates closely a certain color at maturity; but individuals may not arrive at full maturity. Moreover, in some woods the mature heartwood may have quite a range of color change; and the occurrence or absence of heartwood in some may be a chance variation. Color alone is not often a sufficient means of identification of a wood. Naturally, after weathering, color is of still less value as a means of identification.

A few woods have characteristic taste; thus, *balino* and *dita* are bitter and *pagatpat* is salty.

III. SUITABILITY OF DIFFERENT WOODS FOR SPECIAL PURPOSES.

DURABILITY.

Tests of the durability of a wood are much more severe in the tropics than in the temperate regions because of the high humidity combined with uniform temperature, favoring fungus and bacterial growth and the far greater liability to insect attack. There seem to have been no complete tests made of the durability of any oriental woods; and, in most cases, the only information available for any particular wood is mere hearsay or tradition. There are large series of tests in progress under the direction of the Philippine Forestry Bureau; and these will, in time, clear up much that is now in doubt as to the suitability of special woods for special purposes. In the meantime, much is known in a general way of a number of the woods. The fact that a wood is durable in the temperate zone is no guaranty that it will prove useful in the tropics. Many tropical woods which are not durable in their native country would last very well and be very serviceable if used in a temperate region.

ENEMIES OF WOOD.

Fungus and bacterial growth.—The alternate exposure to moisture and dryness is the condition most favorable to such growth. This condition is found in all woods in contact with the ground—piling, bridge timbers, corner posts of houses, etc. In timbers in contact with the ground, as corner posts of houses, telegraph and telephone poles, fence posts, this condition is most marked at and just above the surface of the ground; and that is the region where decay most quickly takes place.

Dry rot is a form of decay to which some woods are particularly subject. It seems to start in from the end of the wood and may sometimes be prevented by capping the end of the post or beam with good thick paint.

Teredo.—This is a mollusk which bores into many timbers. It thrives in salt or brackish water and destroys piling, boat planking, etc., by boring into it in search of a home. It is exceedingly destructive to a large number of timbers and is the most serious problem in wharf construction.

Termites or *white ants,* known as "anay" or "anay-anay" by Filipinos and Malays, are particularly abundant in the eastern tropics. They attack a wide range of different kinds of wood and it may be doubted if any wood is entirely immune from their attacks. Many of the hard and heavy woods are very resistant to them; but it may be doubted if any of these can entirely resist them without the aid of impregnation. It is often claimed for some particularly hard wood that it is absolutely resistant to the termites; but it will usually be found that it is really only a fortunate chance of location which has prevented the attack.

Beetles.—Numerous small wood-boring beetles cause great destruction among the woods of the tropics. Sapwood is particularly liable to attack; but the heartwood is also liable to attack in many cases. Numerous hardwoods, however, seem to be entirely free from this pest. A number of woods with hard heart and trashy sapwood are regularly cleaned for the market by being felled and left in the forest, sometimes several years, till the beetles and termites have destroyed the sapwood.

In general, the very heavy and very hard woods are those least liable to insect attack. This is, however, not always true; some of the very hard woods are specially liable to the attacks of termites.

From what has been written and what seemed to be generally believed by the trade, the following summary of woods according to their use has been made.

WOODS EXPOSED TO SALT WATER.

Piling.—The use of a wood for piling is the extreme test of durability, principally because of the teredo, which speedily destroys most woods. It is to be doubted if there is any wood which is entirely immune from its attack. A pile presents considerable surface to the air and water alternately, furnishing a condition especially favorable to decay; and

no wood which rots quickly is suitable for piling. The use of sheathed or impregnated woods for piling is fairly common and will doubtless become more so where permanency is desired.

The different mangrove swamp trees are very satisfactory for temporary piling and have been known to last as much as seven or eight years exposed to teredo attack. Their best use, however, seems to be as supports for foundations on swampy or low ground. There seems no reason why they should not last for several hundred years in such places.

Quite another class of piling is used in many places as a support for foundations. The piles are driven down to at least $1\frac{1}{2}$ meters below the surface and are then capped with concrete and a concrete foundation placed on top of them. They are thus protected from the air and are beneath the level of insect work. For such a purpose it is only necessary to select wood strong enough to bear the weight, and otherwise useless woods may be used.

Woods used for piling are:

In the Philippines:	
Molave	*Vitex littoralis.*
Aranga	*Homalium* spp.
Agoho	*Casuarina equisetifolia.*
Betis	*Illipe betis.*
Dungon	*Tarrietia sylvatica.*
Dungon-late	*Heritiera littoralis.*
Liusin	*Parinarium griffithianum.*
Mancono	*Xanthostemon verdugonianus.*
Pagatpat	*Sonneratia pagatpat.*
Piagao	*Xylocarpus granatum.*
Tabao	*Lumnitzera littorea.*
Yacal	*Shorea* or *Hopea* spp.
In Borneo:	
Bedaru	*Urandra* sp.
Billian	*Eusideroxylon zwageri.*
Kapor	*Dryobalanops* spp.
Merbau	*Intsia bakeri.*
Nibong	*Oncosperma* spp.
Rassak	*Vatica* sp.
Selangan batu	*Shorea* spp.
Taruntum	*Lumnitzera littorea.*
In the Malay Peninsula:	
Bedaru	*Urandra* sp.
Billian wangi	*Palaquium obovatum.*
Ballau	*Parinarium oblongifolium.*
Bintangor	*Calophyllum* spp.
Gelam	*Melaleuca leucadendron.*
Kulim	*Scorodocarpus borneensis.*
Malabera	*Fagraea fastigiata.*
Merbau	*Intsia bakeri.*
Penagah	*Mesua ferrea.*
Tampinis	*Sloetia sideroxylon.*
Tembusu	*Fagraea fragrans.*

In India and Ceylon:

Sâl	*Shorea robusta.*
Teak	*Tectona grandis.*
Pynkadu	*Xylia dolabriformis.*

Usually the logs are peeled before being used as piles; but occasionally, as in *taruntum* (*Lumnitzera littorea*) and *malabera* (*Fagraea fastigiata*), it seems advantageous to use the log with the bark on it.

Of all known woods the *billian* or Borneo ironwood, is said to be the best and most durable for piling. It is probable that some of the less known woods are equally durable, but they are insufficiently known or do not occur in sufficient quantity to make them of equal importance.

SHIP AND BOAT BUILDING.

Teak (*Tectona grandis*) is the standard by which shipbuilding woods are measured. It stands alone in the first line of Lloyd's Register. Other timbers of this region which are named in Lloyd's are as follows:

Second line:
- Morung saul (*Shorea robusta*).

Third line:
- Angelly (*Artocarpus hirsuta*).
- Thingan (*Hopea odorata*).
- Molave (*Vitex littoralis*).
- Dungon (*Tarrietia sylvatica*).
- Yacal (*Shorea* spp.).
- Mangachapuy (*Hopea acuminata*).
- Betis (*Illipe betis*).
- Ipil (*Intsia bijuga*).
- Guijo (*Shorea guiso*).
- Narra (*Pterocarpus* spp.).
- Batitinan (*Lagerstroemia piriformis*).
- Palo maria de la playa (*Calophyllum inophyllum*).

Fourth line:
- Those of the first and second line when secondhand.

Fifth line:
- Red cedar (*Toona* spp.).
- Banaba (*Lagerstroemia speciosa*).

This by no means indicates that these are the only or even that they are the best shipbuilding woods of the region. It merely means that they have been sufficiently well known to be given a rating. The list should certainly be revised to include a large number of the good woods of the region.

For the keels of boats, a number of the more durable woods are used: *aranga, banaba, bansalaguin, betis, dungon, guijo, liusin, molave, narra, palo maria, yacal, Bassia* spp., etc.

For the planking, *kapor* (*Dryobalanops* spp.), *guijo* (*Shorea guiso*), *thingan* (*Hopea odorata*), *molave* (*Vitex littoralis*).

For the knees, *palo maria, Ceriops* spp., etc.

For masts and spars, the most widely known and used wood seems to be *bintangor* or *poon* (*Calophyllum* spp.).

For small boats, bancas, cascoes, dugouts of various sorts, a large number of the relatively soft, light and easily worked woods are used.

WOODS IN CONTACT WITH THE GROUND.

RAILWAY TIES AND SLEEPERS.

The following woods are used:

In the Philippines:

Molave	*Vitex littoralis.*
Ipil	*Intsia bijuga.*
Acle	*Pithecolobium acle.*
Betis	*Illipe betis.*
Aranga	*Homalium* spp.
Dungon	*Tarrietia sylvatica.*
Yacal	*Shorea* spp.
Tindalo	*Pahudia rhomboidea.*
Sasalit	*Vitex* spp.
Supa	*Sindora supa.*
Anubing	*Artocarpus* spp.
Banaba	*Lagerstroemia* spp.
Bolongeta	*Diospyros pilosanthera.*
Agoho	*Casuarina equisetifolia.*

In Borneo

Pinapok	*Shorea* sp.?
Billian	*Eusideroxylon zwageri.*
Selangan batu	*Shorea* spp.
Resak batu	*Vatica* sp.
Red camphor	*Dryobalanops* spp.
Merabau	*Intsia bakeri.*

In the Federated Malay States:

Chengal	*Balanocarpus* spp.

In India and Ceylon:

Acacia arabica.
Acacia catechu.
Anogeissus latifolia.
Barringtonia racemosa.
Bassia latifolia.
Boswellia serrata.
Calophyllum inophyllum.
Careya arborea.
Cedrus deodara.
Cinnamomum glanduliferum.
Dalbergia latifolia.
Dalbergia sissoo.
Eucalyptus globulus.
Eugenia jambolana.
Hardwickia binata.
Hopea parviflora.
Lagerstroemia parviflora.

In India and Ceylon—Continued.
Melanorrhoea usitata.
Mesua ferrea.
Mimusops littoralis.
Odina wodier.
Pterocarpus marsupium.
Shorea robusta.
Tectona grandis.
Terminalia chebula.
Terminalia tomentosa.
Xylia dolabriformis.

The chief special difficulties which timbers used for railroad ties have to face are conditions of alternate moisture and dryness with exposure to the air and the attacks of termites.

PAVING BLOCKS.

Really very few woods have been fully tested for paving blocks. It seems undesirable to have woods for this purpose which are too hard, because they will become slippery. It seems undesirable also that the blocks should be very greasy. Several Australian woods which have been tried in Manila have not done well. They have lasted less than two years and were really the poorest of any of the woods tried. The best, very much the best, and most satisfactory wood tried here is Philippine *molave* (*Vitex littoralis*). On one of the bridges in Manila there are *molave* blocks that are said to have been in constant hard wear for over thirty years and they are still giving very good service.

The following woods of British India have been recommended for trial as paving blocks: *Pynkado* (*Xylia dolabriformis*), *saj* (*Terminalia tomentosa*), *nagesar* (*Mesua ferrea*), *Lagerstroemia* spp., *Shorea* spp., *Hopea* sp., *Hardwickia* sp., *Soymida febrifuga.*

TELEGRAPH AND TELEPHONE POLES.

Usually the same classes of woods that are suitable for railroad ties will be found to be suitable for this class of work and for fence posts and small bridges or culverts. In the Federated Malay States, *chengal* is quite commonly used for this class of work. In Manila, *ipil* (*Intsia bijuga*) posts are used to carry electric light and trolley wires. *Pagatpat, tindalo* and numerous others are used for telephone poles.

MINING TIMBER.

There is usually not very much care exercised in selecting this, but I have known specially good results to be obtained in the Borneo coal mines from the use of *leban* (*Vitex pubescens*), *kumpas* (*Koompassia* sp.), *billian* (*Eusideroxylon zwageri*), *griting* (*Lumnitzera littorea*), and *resak* (*Vatica* sp.).

CORNER POSTS OF HOUSES.

A very large number of different woods are found which are suitable for this class of work; but only a few of the best are mentioned. In the Philippines: *Molave* (*Vitex littoralis*), *ipil* (*Intsia bijuga*), *acle* (*Pithecolobium acle*), *agoho* (*Casuarina equisetifolia*), *alupag* (*Euphoria cinerea*), *anubing* (*Artocarpus* sp.), *aranga* (*Homalium* spp.), *banaba* (*Lagerstroemia speciosa*), *bansalaguin* (*Mimusops elengi*), *banuyo* (*Wallaceodendron celebicum*), *batitinan* (*Lagerstroemia batitinan*), *betis* (*Illipe betis*), *calamansanay* (*Nauclea* sp.), *dungon* (*Tarrietia sylvatica*), *dungon-late* (*Heritiera littoralis*), *liusin* (*Parinarium griffithianum*), *macaasin* (*Eugenia* spp.), *mancono* (*Xanthostemon verdugonianus*), *mangachapuy* (*Hopea acuminata*), *narra* (*Pterocarpus* spp.), *palo maria* (*Calophyllum inophyllum*), *sasalit* (*Vitex aherniana*), *supa* (*Sindora supa*), *tamayuan* (*Strombosia philippinensis*), *tucan-calao* (*Aglaia clarkii*), and *yacal* (*Shorea* spp.).

The list would be so long if completed for all the different countries that it seems best to leave it to the notes on the individual species.

FURNITURE AND ORNAMENTAL WOODS.

Woods with brilliant color and pretty grain and capable of taking a high polish are particularly numerous in this region.
These may be classified by color:

Black, dark-brown or purplish woods:

Ebony (*Diospyros* spp. and *Maba* sp.). Ceylon; India; Malay Archipelago.
Coromandel wood (*Diospyros quæsita* and other species). Ceylon.
Camagon (*Diospyros discolor* and other species). Philippines.
Bolongeta (*Diospyros pilosanthera*). Philippines.
Rosewood or blackwood of India (*Dalbergia latifolia*). India.
East Indian walnut (*Albizzia procera*). India and Philippines.
Sissu (*Dalbergia sissoo*). India.
Black wattle (*Acacia melanoxylon*). Planted in India.
Mirabow (*Intsia bakeri*). Malay Peninsula and Archipelago.
Ipil (*Intsia bijuga*). Seacoast forest throughout the whole region.
Cay-go (*Sindora cochinchinensis*). Eastern Cochin China.
Anjan (*Hardwickia binata*). India.
Tapang (*Koompassia excelsa*). Borneo.
Batitinan (*Lagerstroemia piriformis*). Philippines.
Acle (*Pithecolobium acle*). Philippines.
Catmon (*Dillenia* spp.). Philippines.
Teak (*Tectona grandis*). India; Java; Siam.
Supa (*Sindora supa*). Philippines.
Dalinsi (*Terminalia* sp.). Philippines.
Lanutan (*Bombycidendron vidalianum*). Philippines.
Pynkadu (*Xylia dolabriformis*). India.
Siris (*Albizzia julibrissin*). India.
Coconut (*Cocos nucifera*). Seacoasts everywhere.
Tamarind (*Tamarindus indica*). Widely cultivated.

Black, dark-brown or purplish woods—Continued.
Wa (*Cassia siamea*). Ceylon; India; Malaya.
Nedun (*Pericopsis mooniana*). Ceylon.
Palo maria or Bitaog (*Calophyllum inophyllum*). Seacoasts everywhere.
Banuyo (*Wallaceodendron celebicum*). Celebes; Philippines.
Dhaura (*Anogeissus latifolia*). India.
Jhand (*Prosopis spicigera* L.). India.
Red or reddish woods:
Tindalo (*Pahudia rhomboidea*). Philippines.
Narra (*Pterocarpus* spp.). India and Philippines.
Calamansanay (*Nauclea* spp.). Philippines.
Lumbayao (*Tarrietia javanica*). Philippines and Java.
Tanguile (*Shorea polysperma*). Philippines.
Pennagah (*Mesua ferrea*). India and Malaya.
Bintangor (*Calophyllum* spp.). Borneo; Malaya; India.
Gerunggang (*Cratoxylon* spp.). Borneo.
Renghas or Borneo redwood (*Melanorrhea* and *Swintonia* spp.). Borneo and Malaya.
Nireh (*Xylocarpus* spp.). Mangrove swamps, India to the Philippines.
Kranji (*Dialium* spp.). India; Malaya; Borneo; Sumatra; etc.
Red sanders (*Pterocarpus santalinus*). India.
Coral wood (*Adenanthera pavonina*). India and Malaya.
Banaba (*Lagerstroemia speciosa*). India and the Philippines.
Chittagong wood (*Chukrassia tabularis*). India.
Umbrella tree (*Thespesia populnea*). Ceylon to the South Sea Islands.
Indian almond (*Terminalia catappa*). India to the Philippines.
Bansalaguin (*Mimusops elengi*). India to the Philippines.
Toon (*Toona* spp.). India and the Philippines.
Cedar, pink or red (*Acrocarpus fraxinifolius*). India.
Jambolana (*Eugenia jambolana*). Widely planted.
Kaddam (*Stephegyne parvifolia*). India.
Mahogany (*Swietenia mahagoni*). India (planted).
East Indian mahogany (*Soymida febrifuga*). India.
Margosa (*Azadirachta indica*). India.
Oak, Indian (*Barringtonia acutangula*). India.
Stereospermum spp. India.
Sandan (*Ougeinia dalbergioides*). India.
Serayah (*Hopea* or *Shorea* spp.). Borneo and Malaya.
Bastard teak (*Pterocarpus marsupium*). India.
Thitka (*Pentace burmanica*). India.
Red lauan (*Shorea* sp.). Philippines and Borneo.
White or yellowish woods:
Boxwood (*Buxus sempervirens*). India.
Agaru (*Chisocheton* sp.). Philippines.
Bedaru (*Urandra* sp.). Borneo and Federated Malay States.
Bancal (*Sarcocephalus cordatus*). India and the Philippines.
Nangca (*Artocarpus integrifolia*). India; Ceylon; Java; Philippines.
Anubing (*Artocarpus cumingiana*). Philippines.
Sacat (*Terminalia nitens*). Philippines.
Camuning (*Murraya exotica*). Malaya and the Philippines.
Cayutana (*Fagara* sp.). Philippines.
Lanete (*Wrightia* spp.). Philippines.
Molave (*Vitex littoralis*). Philippines.

White or yellowish woods—Continued.

Catinga (*Citrus* sp.). India and Malaya; widely planted.
Champaca (*Michelia champaca*). Widely planted.
Camphor wood (*Cinnamomum camphora*). Formosa and Ceylon.
Sandalwood (*Santalum* spp.). India to South Sea Islands.
Snakewood (*Strychnos nux-vomica*). India.
Satinwood (*Chloroxylon swietenia*). India and Ceylon.
Canary wood (*Morinda citrifolia*). India and planted elsewhere.
Deodar (*Cedrus deodara*). India.
Chatwan (*Alstonia scholaris*). India to the Philippines.
Haldu (*Adina cordifolia*). India to the Philippines.
Santol (*Sandoricum indicum*). India to the Philippines.
Yellow sanders (*Ximenia americana*). India to the Philippines.
Culis (*Memecylon edule*). India to the Philippines.

CARVING AND WOOD ENGRAVING.

For wood engraving and instruments of precision boxwood is unequaled. In the manufacture of small articles, rulers, etc., ebony is often used because of its freedom from shrinking.

For carving, *lanete* (*Wrightia* spp.), *molave* (*Vitex littoralis*), *teak* (*Tectona grandis*), and *sandal* (*Santalum album*) seem most in favor. A number of other woods are used, one of them, the blackwood of India (*Dalbergia latifolia*), being used in considerable quantity for the manufacture of carved furniture.

TOOL HANDLES.

This kind of work requires a wood which is dense and of even grain and which will turn well.

Some of the woods most used are *Mimusops elengi, Psidium guajava, Memecylon edule, Murraya exotica, Mesua ferrea, Shorea obtusa, Eugenia tetragona, Dodonaea viscosa, Xylocarpus* spp., bamboos, etc.

CANES OR WALKING STICKS.

This requires a wood which is pretty, close-grained and capable of finishing well.

The species most used are *Balanites roxburghii,* various bamboo and palm stems, *Cassia siamea, Dichrostachys cinerea, Diospyros discolor, Diospyros pilosanthera, Diospyros* and *Maba* spp., *Dodonaea viscosa, Grewia populifolia, Murraya exotica, Parrotia jacquemontiana, Prinsepia utilis, Pterocarpus* spp., *Paludia rhomboidea, Sarcococca pruniformis, Zanthoxylum alatum, Taxotrophis ilicifolia.*

BOXES OR PACKING CASES.

Almost any wood which occurs in quantity, is easily worked and not too hard and heavy may be used for this purpose. In places, special industries have made it necesary to use large quantities of wood for boxes. Thus, in Ceylon, the tea industry has required a great number of cases. Mr. F. E. Lewis had a very interesting article on the tea-

box woods of Ceylon in the Trop. Agric. 18: 307–310, in which he listed the woods used for that purpose in Ceylon. In Borneo, the cutch companies have found that common grades of *seriah* are well suited for the manufacture of the packing cases in which they ship their product. In the Philippines, the wood of *cupang* (*Parkia roxburghii*) has been found to be very satisfactory for packing cases.

BARRELS AND COOPERAGE STOCK.

For loose barrels, much the same materials as for boxes may be used, if strong enough. Tight cooperage stock, however, is a much more difficult proposition. There are plenty of woods in this region which are strong enough and which will make tight enough barrels, but they are usually highly colored and will give up their color readily. Thus far, I know of no tropical wood which is the equal of white oak for this purpose. This is a subject which needs to be worked up, as either the barrels or the material to make them now have to be imported from Europe or America.

MATCH WOODS.

Where the soft coniferous woods of the temperate regions are not available, it is somewhat difficult to get really good match woods. A few of the tropical woods are satisfactory. The following are used at Manila: *Malapapaya* (*Polyscias nodosa.*) which is much the most satisfactory both for the boxes and the sticks; *teluto* (*Pterocymbium tinctorium; pincapincahan* (*Oroxylum indicum*); and *cupang* (*Parkia roxburghii*). Besides these, the wood of *Ganophyllum falcatum,* found in the Philippines, New Guinea, Australia, and Java, is said to be very good.

PAPER PULP.

Thus far the making of paper pulp has not become an important industry in this region; but, with the increasing scarcity of wood for pulping purposes in other regions, it is bound to become important. Thus far, we know that various ones of the soft dipterocarps, as well as several other woods, are well suited for this kind of work. There are probably a number of woods which occur in some quantity in the region which are worth investigating for this purpose.

DYEWOODS.

A number of the highly colored woods are useful as dyewoods. Examples of these are *sibucao* (*Caesalpinia sappan*), which furnishes a red or yellow dye; red sanders (*Pterocarpus santalinus*) and other species of *Pterocarpus,* which furnish red dyes; *Adenanthera pavonina,* a yellow or brownish dye; *ipil* (*Intsia bijuga*), a brown dye; some species of *Terminalia,* yellow dye; *tangal* (*Ceriops* spp.), yellowish-red dye.

The dyewoods are not of very great commercial importance, but they are used locally to a considerable extent.

IV. RARE ORNAMENTAL OR PRECIOUS WOODS.

Under this heading it is intended to include those woods which have a special popular interest aside from their commercial value. The principal ones of these are boxwood, camphorwood, corkwood, ebony, incense wood, ironwood, lignum-vitæ, mahogany, rosewood, sandalwood, satinwood, and zebrawood.

BOXWOOD.

This is produced by *Buxus sempervirens* L. (see p. 487) and is the best wood in the world for wood engraving. No thoroughly satisfactory substitute has been discovered. One of the best substitutes is a related African species of the same genus. The following list of woods which are sometimes used as substitutes for boxwood or which might be of service as such is given by Watt:

Atalantia monophylla.
Crataeva religiosa.
Celastrus spinosus.
Chloroxylon swietenia.
Dodonaea viscosa.
Gardenia gummifera.
Gardenia latifolia.
Hemieyelia sepiaria.
Homonoia symphylliaefolia.
Ixora parviflora.
Memecylon edule.
Murraya exotica.
Olea ferruginea.
Psidium guajava.
Punica granatum.
Santalum album.
Sonneratia acida.
Viburnum erubescens.

To this list might be added *Clausena excavata* Burm., *Aegle marmelos* Corr., *Fagara* spp. of the *Rutaceæ*, and a number of fine and even-grained *Rubiaceae*.

Stevenson 124–130; Holtzapffel 76; Watt Dict. 1:557; Boulger 147; Wiesner 2:962.

CAMPHORWOOD.

The camphorwood of Japan and Formosa is the product of *Cinnamomum camphora* Fr. Nees & Eberm. (see p. 454). All parts of the wood contain a considerable amount of the gum or oil and have a very pronounced odor of camphor. The wood is easy to work, polishes well and is much used in the manufacture of chests, drawers and insect-proof cases. The demand for such articles is so great that the makers find it difficult to get enough wood for their work. The cabinetmakers in Manila make a great many imitation camphorwood chests. Various soft, cheap woods, as white lauan, are used, after being first treated with oil to give them an odor like camphorwood. The imitation camphorwood chests are, naturally, not so durable as those made from the true camphorwood. After the effect of the oil with which they were treated wears off, they are likely to be attacked by insects.

Nepal camphorwood, produced by *Cinnamomum glanduliferum* Meissn., of British India, has brown tough wood with the odor of sassafras and is also used for cabinet work.

A number of other members of the family *Lauraceæ* produce wood

which has a strong odor of sassafras. Different ones of these are known as *kappla, ruan, medang lada* and *caliñgad* in the Malay Archipelago. It is probable that some of these at any rate would make good substitutes for camphorwood in the manufacture of insect-proof boxes.

The *Borneo camphorwood* is obtained from species of *Dryobalanops* (see p. 509), of the family *Dipterocarpaceæ,* and does not have an odor like camphor, except in the neighborhood of the camphor deposits. This wood is not used for cabinet work.

Holtzapffel 87; Boulger 153.

CORKWOODS.

A number of plants, from widely different families, and mostly tropical, are found to produce what is known as corkwood; i. e., a wood which more or less resembles true cork in its physical properties.

These woods show differences in structure but agree in having very thin-walled elements, which are empty or filled with air in the dry wood. These uniformly thin-walled elements cause the wood to have a very low specific gravity and to be exceedingly soft.

Very uniform corkwood is produced by *Ceiba pentandra* (L.) Gaertn. and *Bombax malabarica* DC. *Alstonia scholaris* (L.) R. Br. furnishes another type of corkwood. The structure is varied by numerous fine parallel concentric lines of wood parenchyma. *Erythrina indica* Lam. and other species have corkwood of a quite different type—wide concentric belts of wood parenchyma having between them rather narrow belts of denser tissue. The vessels are also rather large. Still another type of corkwood is that furnished by the roots of *Sonneratia pagatpat* Blanco and other species. Here the wood is very homogenous in structure and very like a fine white cork. Some other woods which furnish corkwood from their stems or roots are *Tetranthera amara* Nees, and species of *Xylopia, Anona, Hibiscus, Dyera,* etc.

The corkwoods are commonly used as floats for fishing nets and as material for the manufacture of the crude carvings so common among wild tribes in Borneo.

Wiesner 2: 1020–1023; Blits 51; Winton 253–255.

EBONY (see p. 543).

INCENSE WOODS.

Certain woods are valued because of their ability to produce a pleasant odor when burned. Several of these have, since the most ancient times, been employed in religious ceremonies. The best known of these is *Santalum album* L., mentioned in the Hebrew Scriptures as *algum* or *almug.*

The *lign aloes* or *lignum aloes* of the Scriptures is the same as the *eaglewood* of commerce and is produced by *Aquillaria agallocha* Roxb. (*Aloexylon agallochum* Lour.), and other related species, of India and Malaya.

The different incense woods of the Malay region are usually known as *kayu garu.* Besides those mentioned, there are various species of *Gonystylus* quite widely known and used.

A comparatively local incense wood is the *kayu laka,* which is obtained from the roots of *Dalbergia cumingiana* Benth., in Borneo. It is used mainly in China.

Besides the incense woods already named, there are a number of more or less local importance. Some of these are *Wikstroemia candolleana* Meissn., *Excoecaria agallocha* L., *Canarium* sp., *Alyxia stellata* R. & S., *Epicharis loureiri* Pierre, *Lepiaglaia bailloni* Pierre, etc.

Boorsma, G. W. Ueber Aloëholz und andere Riechhölzer.—Bull. Dept. Agric. Buitenzorg 7 (1907) 1–43. Ridley, H. N.; Garu and chandan.—Journ. Straits Branch Asiat. Soc. 35 (1901) 73–82; Flükiger-Pharmakognosie 216.

IRONWOOD.

This name or its equivalent is found applied to a number of different woods on account of their hardness; and any wood of conspicuous hardness is liable to be called by this name. Nearly all the ironwoods, and about eighty are known, have other local names, the name ironwood having evidently been introduced after the advent of English-speaking people. Usually the wood is extremely hard, dense and dark-colored and sinks in water.

A list of the ironwoods of this region follows:

1. Billian or Borneo ironwood (*Eusideroxylon zwageri* T. & B.). Found in Borneo and Sumatra. (See p. 452.)
2. Agoho or kayu ru (*Casuarina equisetifolia* Forst.). Seacoasts throughout the whole region. (See p. 444.)
3. *Casuarina montana* Jungh. Java and Borneo.
4. Ru ronan (*Casuarina sumatrana* Jungh.). Malaya. (See p. 444.)
5. Tampinis (*Sloetia sideroxylon* T. et B.). Federated Malay States and Straits Settlements; Borneo. (See p. 447.)
6. *Cryptocarya ferrea* Bl. Java.
7. Nagesah (*Mesua ferrea* L.). Ceylon; India; Malaya. (See p. 505.)
8. *Aglaia minahassae* T. et B. Celebes. (See p. 477.)
9. *Dodonaea* sp. Seacoasts. (See p. 493.)
10. *Cupania lessertiana* Cambess.
11. *Homalium foetidum* Benth.
12. Kayu besi (*Metrosideros vera* (Rumph.) Niedenzu). Moluccas to China. (See p. 535.)
13. Mancono (*Xanthostemon verdugonianus* Naves). Philippines. (See p. 536.)
14. Ipil (*Intsia bijuga* (Colebr.) O. Ktze.). Seacoasts. (See p. 461.)
15. Mirabow (*Intsia bakeri* Prain). Malaya. (See p. 461.)
16. *Baryxylum rufum* Lour. Cochin China.
17. *Acacia farnesiana* Willd. Tropics. (See p. 470.)
18. *Acacia ferruginea* DC. East Indies. (See p. 470.)
19. Pynkadu (*Xylia dolabriformis* Benth.). India. (See p. 463.)
20. *Imbricaria maxima* Poir. Moluccas.
21. *Sideroxylon nitidum* Bl. Java.

22. *Sideroxylon tomentosum* Roxb. Coromandel. (See p. 542.)
23. *Sideroxylon ferrugineum* Hook. et Arn.). Tropical Asia. (See p. 542.)
24. Arang (*Maba buxifolia* Pers.). India to Philippines. (See p. 547.)
25. Anan (*Fagraea fragrans* Roxb.). (See p. 549.)

Boulger 191; Holtzapffel 88.

LIGNUM-VITÆ.

True lignum-vitæ does not occur outside of the tropical American region. It is the product of species of *Guajacum* and is of rather restricted range. It was first introduced into Europe by the Spaniards at about the end of the fifteenth century and has been very much in demand ever since. It is exceedingly hard and heavy. Its specific gravity varies between 1.17 and 1.39 and it is often credited with being the heaviest of all known woods. The fibers are very twisted and, as a consequence of this, it is extremely difficult to split the wood. It is very much used for bowling-alley balls, sheaves of pulleys, rollers, policemen's batons, and as bushing for propellers in salt water craft. It seems likely that the supply will approach exhaustion before long, and it is highly desirable that some satisfactory substitute be secured.

Some of the woods which have been tried as possible substitutes are *mancono* (*Xanthostemon verdugonianus* Naves) of the Philippine Islands; *Dodonaea viscosa* L., a widely distributed seacoast wood usually of small size; *Calophyllum inophyllum* L., another widely distributed seacoast plant, which has a very twisted grain and which is sometimes used for bowling balls.

Mancono (*Xanthostemon verdugonianus* Naves), of the Philippine Islands, is probably the best known and most thoroughly tested of the substitutes for lignum-vitæ. It is of much the same weight and is harder than lignum-vitae. It is of crooked grain and difficult to split. It seems to be immune to the attacks of termites and teredo. It has been tried in various places where it was subject to abrasion and to droppings of water and oil and has proved very satisfactory. The following test of *mancono* was made at the United States naval station, Cavite, Philippine Islands: "The wood was installed on side grain, as a bearing for journals rotating in salt water, in the stern bushing of a small launch which was in constant use. At the end of seven months the bearing was split out for examination. The wood was found to be but little worn, and was reported by the commander of the naval station to be 'quite the equal of lignum-vitæ, when both are used for bearings on the side grain.'"

It seems probable that, for several purposes, *mancono* is as serviceable as lignum-vitæ and a very satisfactory substitute for that wood.

Hutchinson, W. I. A Philippine substitute for lignum-vitae. Bureau of Forestry (Philip.) Bull. 9 (1908) 1–8; Stone 18–21; Wiesner 2: 950–952; Holtzapffel 90; Boulger 202.

MAHOGANY.

True mahogany does not occur in nature in the Orient. It is the product of *Swietenia mahagoni* L. and is found only in tropical America. It was introduced into Europe by the Spaniards in the sixteenth century. Since the middle of the eighteenth century it has been the most used and valued of cabinet woods. The much prized Chippendale and Sheraton chairs of the eighteenth century were made of this wood. The continual demand for this wood for piano cases, fine furniture, cabinet work, etc., has caused it to become scarce and high in price, and efforts have been made to substitute other woods for it. More than twenty substitute or imitation mahoganies are known, and some of them are such good woods that they could probably secure a good market under their own proper names. The true mahogany and the closely related *Swietenia macrophylla* King have done well in plantations in India (Gamb. 154). Young trees of both have also shown a fine rate of growth wherever tried in the Philippines. It is not improbable that these two species may some day be of commercial importance as plantation crops in this part of the world.

The best of the substitute mahoganies belong to the subfamily *Swietenioideæ*, the "mahogany subfamily" of the *Meliaceæ*. The following members of this subfamily are worthy of note:

Khaya senegalensis A. Juss. (*Swietenia senegalensis* Desv.). This is called *African mahogany* and has supplied a large part of the mahogany on the European and American markets for the last twenty years (Kew Bull. Misc. Inf. 1890, 168–170). Other species are also called African mahogany. The wood is lighter in color than the original mahogany and is also inferior to that wood in hardness and grain. However, it is very variable and pieces are found which are darker reddish-brown than the true mahogany.

Soymida febrifuga A. Juss. (*Swietenia febrifuga* Willd.), found in British India and Ceylon, known as *East Indian mahogany*. This is a very hard and very heavy wood, heavier than true mahogany and dark-red in color. It would be of great commercial importance if it could be produced in sufficient quantity.

Chukrassia (*Chickrassia*) *tabularis* A. Juss. (*Swietenia chickrassia* Roxb.). *East Indian mahogany* or *Chittagong wood*.—British India and Ceylon, Burma and southern China. This is not so hard nor so heavy as the preceding. It would probably be of importance if found in greater quantity.

In the subfamily *Cedreloideæ* of the *Meliaceæ*, there are a number of species in the genera *Cedrela*, of the West Indies, and *Toona*, of the East Indies, which produce odorous wood known as cedar and sometimes called mahogany. The *toon* of India, *Toona serrata* (Royle) Roemer, is sometimes called Indian mahogany and the *calantas*, *Toona calantas* Merr. & Rolfe, of the Philippine Islands, has sometimes been called *Philippine mahogany*. They are more often and more correctly known as *cigar-box* woods.

Besides those already mentioned, there are in the East several so-

called mahoganies which do not have any close relationship to the true mahogany, except, perhaps, that of color. Some of these are:

Padouk, Andaman redwood, narra, Philippine mahogany. This is the product of various species of *Pterocarpus.* It is a very choice furniture wood, but it is, of course, not a mahogany. It does not need to be called a mahogany to find a market.

Penagah, Palo maria, Bitaog, or *Borneo mahogany* (*Calophyllum inophyllum* L.). This wood does not closely resemble mahogany. It is, in some respects, superior to that wood.

The *tanguile* of Negros, a soft, red-wooded dipterocarp, has been sold in some places as Philippine mahogany. It is found to be a satisfactory substitute for mahogany in interior finish such as show windows, panels, and bank furniture. It should be suitable also for piano cases and good furniture.

Wiesner **2**: 958–962; Stevenson 225–249; Holtzapffel 91; Boulger 206–210; Stone 32–35.

POISONOUS WOODS.

Occasionally there are rumors of woods which contain sufficient of a poisonous principle to cause them to be injurious to whoever handles them. Such reports are usually found to be inaccurate, the poisoning being done by other parts of the plant.

The principal poisonous woods of this part of the world are a few *Anacardiaceæ* which cause a skin irritation similar to that produced by the "poison ivy" and "poison oak" (*Rhus* spp.) of temperate regions. These woods are produced by species of *Gluta, Holigarna, Melanorrhoea. Semecarpus,* and *Swintonia;* and they usually are known by the name of *"ringhas"* in the Malay region.

When seasoned, the wood is much less likely to cause poisoning than when fresh. The seriousness of such poisoning is often exaggerated, and many persons are entirely immune to this class of poisoning.

Besides the woods mentioned, that of *Excoecaria agallocha* L., the "eye-blinding plant" of India, is of evil repute. The wood contains an extremely acrid dark-colored gum which is very irritant in contact with the skin and is said to cause blindness if rubbed on the eyes. It is said that the coolies who work this wood for charcoal suffer a great deal from the effects of the fumes of the burning wood.

ROSEWOOD.

Rosewood is a term as generally applied as ironwood and to almost as great a variety of plants in different parts of the world. There are something more than thirty different rosewoods. Most of them have heavy, dark-colored woods and quite a number belong to the *Leguminosæ,* in such genera as *Dalbergia* and *Pterocarpus.* Some of them contain a fragrant resin or oil, from which the name has originated. They have nothing more to do with the rose.

Much of the rosewood of commerce comes from Brazil and is said to be the product of *Dalbergia nigra* Allem. and related leguminous species; but members of other families also produce true rosewood.

The East Indian rosewood is the product of *Dalbergia latifolia* Roxb. and *Dalbergia sissoo* Roxb. (See p. 465.) Another of the Indian rosewoods is the *padauk, Burmese rosewood* or *narra,* which is the product of *Pterocarpus indicus* Willd. and other species of *Pterocarpus.* The rosewood of the Seychelles is *Thespesia populnea* Corr. (See p. 499.) In some portions of India a certain species of *Millettia* is said to furnish small amounts of rosewood. *Cordia myxa* L., a small tree of tropical Asia and Australia, is said to furnish small amounts of rosewood. The *Borneo rosewood* or *renghas* is a beautiful red- and purple-streaked wood, which makes beautiful furniture. It is the product of various species of *Melanorrhoea* and *Swintonia.* (See p. 489.)

The woods known as *kingwood* or *violet wood* are special kinds of rosewood, probably from species of *Dalbergia* and best known under these names, from Madagascar and South America.

Wiesner 2: 1017, 1014; Stevenson 264; Holtzapffel 103; Boulger 263; Stone 62–64.

SANDALWOOD.

The white or yellow sandalwood is produced by *Santalum album* of India and Malaya. Other related species and genera in Australia furnish very good substitutes for it. The sandalwood of the Fiji Islands is produced by *Santalum freycinetianum* Gaud. and other species.

Exocarpus latifolia R. Br. which is said to produce a sandalwood in Australia extends as far north as the Philippines; but it is usually of very small size here and I have not known it to produce sandalwood.

The name *chandana* or *sandana* seems to be very generally used to indicate various kinds of sandalwood; but it is probable that the name is also applied to other woods which are more or less odorous. In the Philippines, the term *sandana* is known and is said to indicate an odorous wood; but, thus far, I have been unable to definitely find sandalwood produced in the Islands. In British North Borneo the term is also found, but sandalwood is surely very rare, if it occurs there at all. The red sandalwood or red sanders of India is the product of *Pterocarpus santalinus* L., and *Adenanthera pavonina* L.

Dysoxylum loureiri Pierre (*Epicharis loureiri* Pierre) and *Lepidaglaia baillioni* Pierre (*Epicharis baillioni* Pierre) are two species of meliaceous wood growing in Cochin China and forming large trees, the timber of which is used for ornament, while the oil derived from it is used for medicinal purposes. When rubbed or burnt it emits an odor of sandalwood, on which account it is employed as incense in the temples.

Trop. Agric. 1 (1882) 800; Pierre, For. Fl. Coch. China. 358; Jumelle 338.

In India, sandalwood is largely used in the manufacture of boxes, fans, and other ornamental articles of inlaid work, and to a limited extent in medicine as a domestic remedy for all kinds of pains and aches. The oil is largely used as a perfume, few native attars or essential oils being free from admixture with it. In the form of powder or

paste the wood is employed by the Brahmans for their distinguishing caste marks.

The *bastard sandalwood* of India is *Erythroxylon monogynum* Roxb. It is very fragrant and is used as a substitute for sandalwood. The *yellow sanders* (*Ximenia americana* L.), of tropical America, the Pacific Islands, Malaya, Australia, Asia and Africa, has a fragrant yellow wood which is used as a substitute for sandalwood.

Holtzapffel 105; Wiesner 2: 908–911; 937–940. Boulger 266–268; Stone 191.

SATINWOOD.

This is the product of *Chloroxylon swietenia* DC. (See p. 473.) It is found in India and Ceylon, where it has been rather common. Certain species of *Fagara, Zanthoxylum,* etc. are also known to produce satinwood in tropical America and Australia. Certain Philippine *Rutaceæ* have wood which would do very well as a satinwood, but they are usually of comparatively small size and rather scattered in occurrence. The name refers to the beautifully smooth and satiny luster which the wood shows when finished. This wood was probably introduced into Europe before mahogany. It was in request for rich furniture about the end of the eighteenth century, the fashion then being to ornament panels of it with painted medallions and floral scrolls and borders. Now it is used for inlaying or borders and small veneers and most largely in covering the backs of hair and clothes brushes and in making small articles of turnery, all kinds of furniture, railway carriages, writing and stationery fitments and toilet requisites.

Maba buxifolia Pers. is said to furnish a kind of satinwood, but I have never seen it so used.

There is frequently a curled grain which adds to the beauty.

Holtzapffel 105; Stevenson 267; Stone 29–31; Wiesner 2: 953; Boulger 281.

ZEBRAWOOD.

This is a name given to varieties of wood used as veneers, and striped so as to suggest a zebra's skin. The name has been used for some of the bright-streaked species of *Diospyros* and also for some woods which occur in small size and which have a conspicuously variegated appearance with bright colors. Such woods seem to be of little importance except for canes and other small articles.

One of the trees said to produce zebrawood in South America is *Guettarda speciosa* L. This same tree is not uncommon along the seacoast in this part of the world, but it seems usually to be of rather small size and but little used.

Another Philippine wood to which this name would seem to apply is *Taxotrophis ilicifolia* Vid. This wood is brilliantly streaked and makes most striking canes.

Holtzapffel 110; Boulger 302.

CHART OF COMMERCIALLY EQUIVALENT WOODS.

[Members of the *Dipterocarpaceæ* are indicated by **black-faced** type.]

Philippines.	Federated Malay States and Straits Settlements.	British North Borneo.	Sarawak.	Dutch Borneo and Netherlands Indies.	Cochin China.	Burma.	British India.	Ceylon.
Acle			Ringa		Cam-xé	Pyingadu	Jambu	
Acleng-parang				Ki-riang		Sit	Siris	Mara.
Agaru	Gerontang tengah							
Agoho	Ru	Ru	Ru	Aij-samara		Tinyu	Chouk	
Alupag	Rambutan		Rambutan	Lungsir Bedaroh		Kyetmouk	Asphal	Rasmora.
Amuguis				Djaran		Nabé	Kiamil	Hik.
Antipolo	Nangka	Jack	Nangka	Ambi		Peinne	Kanthal	Kos.
Anubing	Kledang		Mentawa	Ambi		Taungpeinné	Chaplash	Kanagona.
Api-api	Appi-appi	Appi-appi	Appi-appi	Api-api		Thamé	Bani	
Apitong	**Krewing**	**Kruen**	**Kruen**	**Tampoedouw**	**Dau-con-rai**	**Eng**	**Gurjun**	**Hora.**
Aranga	Petaling ayer Pantat ulat puti			Kayu poris		Myaukchaw		Liyan.
Bacauan	Bako	Bako	Bakao	Bako		Pyu	Bhara	Kadol.
Balacat	Bedara china			Balis-bukkol		Zi	Kul	Maha-debara.
Balinhasay	Rengas of poor quality.		Teringtang chiit	Ingas-burung		Lonbo	Kurku	Sara.
Banaba	Bongoh		Bongoh	Benger		Pyinma	Jarul	Muruta.
Banalo	Baru waru laut						Parsipu Poris Portia	Suriya.
Bancal			Silimpó	Kayu-mas		Ma-uletanshe	Vammi	Bakmi.
Bani-bani	Kachang kayu laut. (Malapari)		Bansu			Thinwin	Ponga	
Bansalaguin	Poko tanjong			Bunga tanjong		Kaya	Bukal	Munamal.
Banuyo				Mawewek				

Batete							Kolávu	
Baticulin	Medang	Medang	Medang	Madang		Ondon	Meda lakri	Bombi.
Batitinan						Leza		
Batino								
Betis	Belian		Nyatto pisang					
(Tambulian?)	Billian	Billian	Billian	Oelin, Ulin, Eijserhout				
Bitanhol	Bintangor	Bintangor	Entangor	Bintangor		Pantaga	Poon	Kina.
Bolongeta			Kayu malam					
Calamansanay	Pulasan utan							
Calantas	Suntang puti			Alossul		Thitkado	Toon	
Calumpit				Kloempit				
Camagon	Kayu malam	Kayu malam	Kayu malam					Calamander. Coromandel.
Camuning	Kamuning	Kamuning	Kamuning	Kamuning		Thanatka	Kamini	Etteriya.
Catmon	Simpor		Simpor			Thabyu	Chalta.	Hondapara.
Cato						Thitni	Rohituka	
Cayutana	Catinga							
Cupang	Gudayong, Kadayong, Kurayong		Gudayong, Kadaong, Kurayong	Gudah			Sapota	
Dao	Bengkuang			Dao, Buwa-rau				
Dita	Pulai	Plai	Plai	Pulei		Taungmeok	Chatwan	Rukattana.
(Anan) Dolo (Teea)	Tembusu			Ki-badak			Anan	
Duguan	Piango		Cumpang	Bawang		Maloh	Kanagi	
Dungon-late	Dungon	Dungun	Dungun	Dungun		Pinlikanayo	Sundri	Etuna.
Ebony	Kayu arang	Kayu arang	Kayu arang	Kayu arang			Ebony	Kalwara.
Guijo		**Selangan Batu Mireh.**				**Sal**		
Ipil	Merbau	Mirabow	Merbau paya	Merbau		Pyingadu	Shoondul	

CHART OF COMMERCIALLY EQUIVALENT WOODS.

[Members of the *Dipterocarpaceæ* are indicated by **black-faced type.**]

Philippines.	Federated Malay States and Straits Settlements.	British North Borneo.	Sarawak.	Dutch Borneo and Netherlands Indies.	Cochin China.	Burma.	British India.	Ceylon.
Acle			Ringe		Cam-xé	Pyingadu	Jamba	
Acleng-parang				Ki-riung		Sit	Sirls	Mara.
Agaru	Geromiang lengah							
Agoho	Ru	Ru	Ru	Alj-samara		Tinyn	Chouk	
Alupag	Rambutan		Rambutan	Lungsir Iledaroh		Kyetmouk	Asphal	Rasmara.
Amuguis				Djaran		Nahé	Klamil	Hik
Antipolo	Nangka	Jack	Nangka	Ambi		Pehme	Kanthal	Kos.
Aumbing	Kledang		Menlawa	Ambi		Tanngpeimné	Chapdash	Kaungona.
Api-api	Appi-appi	Appi-appi	Appi-appi	Api-api		Thamé	Bani	
Apitong	**Krewing**	**Kruen**	**Kruen**	**Tampordouw**	**Dau-rum-rai**	**Eng**	**Gurjun**	**Hora.**
Aranga	Petaling ayer Pantat niat puti			Kayn poris		Myankehaw		Liyan.
Bacauan	Buko	Buko	Bakao	Baku		Pyu	Bhara	Kadul.
Balacat	Bedara china			Bulls-bukkol		Zi	Kul	Mahu-debara.
Balinhasay	Rengas of poor quality.		Teringhong chili	Ingas-burung		Lonbo	Kurka	Saru.
Banaba	Bongoh		Bongoh	Benger		Pyhima	Jarul	Muruta.
Banalo	Baru warn laut						Parsipu Poris Portia	Suriya.
Bancal			Silimpó	Kayn-mas		Ma-ulelmanshe	Vanmi	Bakuli.
Bani-baul	Kuchang kuyn laut. (Malapari)		Banun			Thinwin	Ponga	
Bansalaguin	Peko tanjong			Banga tanjong		Kaya	Bukul	Munumal.
Bannyo				Mawewek				
Batete								
Balleulin	Melang	Medang	Medang	Madang		Ondon	Kulávu	
Baltinan							Meda lakri	Bomhl.
Batino						Leza		
Betis	Beliun		Nyatto pisang					
(Tambullan?)	Billian	Billian	Billian	Oelin Ulin Eljserbont				
Bitanhol	Bintangor	Bintangor	Entanger	Bintangor				
Bolongeta			Kayn malam			Pantaga	Poon	Kina.
Calumansanay	Pulasan utan							
Calantas	Simlang puti			Abssul				
Calumpit				Kloempit		Thlikado	Toon	
Camagon	Kayn malam	Kayn malam	Kayn madam					Calamander.
Camuning	Kamuning	Kamuning	Kumuning	Kumuning		Thanatka	Kumhl	Coromandel.
Catimon	Simpor		Simpor			Thubyn	Phalla	Eberiya.
Cato						Thltnl	Kohituka	Houdapara.
Caynilona	Catinga							
Cupang	Gudayong Kadayong Kurayong		Gudayong Kadaong Kurayong	Gudah			Sapota	
Dao	Bengkuang			Dao Ruwa-ruu				
Dita	Pulal	Plal	Plai	Pulel		Taungmeok	Chatwan	Rukattana.
(Anan)								
Dolo	Tembusu			Kl-badak			Anan	
(Teca)								
Dungun	Plango		Cumpang	Bawang		Maluh	Kanagi	
Dungon-late	Dungun	Dungun	Dungun	Dungun		Phulkanayo	Sundri	Etuna.
Ebony	Kayu arang	Kayu arang	Kayu arang	Kayu arang			Ebony	Kalwaru.
Guijo		Selangan Batu				Sat		
Ipil	Merbau	Mirabow	Merbau jayu	Merbau		Pyingadu	Shoondul	

Chart of commercially equivalent woods—Continued.

Philippines.	Federated Malay States and Straits Settlements.	British North Borneo.	Sarawak.	Dutch Borneo and Netherlands Indies.	Cochin China.	Burma.	British India.	Ceylon.
Kapor	**Kapor**	**Kapor**	**Kapor**	**Kapor** **Kamferhout**				
Lanete				Bientaus		Lettokthein	Dudhi	
Langaray	B'rus	B'eus	B'rus	B'eus Kajoe-soesoe				
Red Lauan	**Meranti**	**Seriah Merah**	**Meranti**	**Seriah Merah**				
White Lauan	**Meranti**	**Seriah Puti**	**Meranti**	**Meranti**				
Liusin	Merbatu layong Ballow Johore teak							
Lumbayao				Ki-manuk				
Macaasin	Klat Kelat jambu		Ubar	Djambu		Thabyebyu	Chambu	Mahadan.
Malapapaya								
Malugay	Kasai					Thabyay	Badoh	Galmosa.
Mancono				Kayu besi benar				
Mangachapuy	**Chengal** (2)	**Gagil** (1)	**Gium** **Tekam**	**Katiougan**				
Mangasinoro		**Seriah Puti**		**Bangkirai**				
Mayapis	**Mersawa**		**Meraca ?**	**Basoeng**		**Thinkadu**		
Molave								
Calipapa Molauin aso Leban	Leban	Leban Halban Calipapa	Leban Calipapa	Haleban Calapapang		Kyetyo	Myladi	
Narig	**Ressak**	**Resak**	**Rassak**	**Rassak**				
Narra	Angsana		Angsana	Angsana		Padauk	Andaman red-wood.	Gammala.
Nato	Niato		Nyatto	Njattoe				

Nigue	Niri	Niri	Niri	Niri		Pinleon	Poshur	
Pagatpat	Perupat	P'rapat	P'rapat	P'rapat		Tabyu	Keowra	
Pedada	Bedata		Pedada	P'dada				
Pagsainguin	Kadongdong hutan.							
Palo maria de la playa.	Penagah	Penaga	Pennagah	Penagah		Ponnyet	Puna	Domba.
Bitaog								
Piagao	Niri	Niri	Niri	Niri (Boeli-boeli)				
Pototan	Tumu	Lengadi (?)	Putut	Akat	Cay day		Kahra	
Saleng						Tinyu	Dingsa	
Santol	Sintol		Sintol	Aijulet		Thitto		
Sudjung								
Supa	Saputi?		Petir	Sapetir				
Talisay	Katapang		Catapang	Katapang			Badam	Kottamba.
Tamayuan	Petaling			Ki-katjang				
Tangal	Tengah	Tengah	Tengah	Hulit-tangah		Kabaing	Goran	
Tanguile		**Obar suluk**	**Sasak gurah**	**Klapak**				
Teak	Jati			Djati	Teck	Kyun	Sagun	Tekka.
Teluto			Telutu	Tulutu				
Tibao	Taruntum	Griting	Taruntum	Griting		Yinye	Kripa	Beriya.
Tindalo				Ki-djulang				
Toog				Bintungan		Boaungza	Pun	
Tucan-calao	Modu		Rim	Udang-udang			Kanna komper	
Yacal	**Ballow**	**Selangan batu**	**Peñiow**	**Selangan batu**		**Thingan**		
	Daru		Bedaru					
	Simumpat		Gerunggang	Ki-reming		Bebya		
	Kranji	Kranji	Krandji	Krandji			Kaddupuli	Gal-siyambala.
	Kumpas	Cumpas	Mingris					
		Mangaris	Tapang	Kayu raja				
	Tampines		Tampinis	Kapini				
	Kulim		Unsuna (?)					
	Pennagah				Vap	Gangaw	Nagesar	Na.

Chart of commercially equivalent woods—Continued.

Philippines.	Federated Malay States and Straits Settlements.	British North Borneo.	Sarawak.	Dutch Borneo and Netherlands Indies.	Cochin China.	Burma.	British India.	Ceylon.
Kapor	Kapor	Kapor	Kapor	Kapor Kamferhout				
Lanete				Blentans		Letkokthein	Inthi	
Langaray	B'rus	B'eus	B'rus	B'eus Kajoe-soesoe				
Red Lauan	Meranti	Seriah Merah	Meranti	Seriah Merah				
White Lauan	Meranti	Seriah Puli	Meranti	Meranti				
Liusin	Merlutu layong Ballow Johore lenk							
Lumbayno				Ki-manuk				
Maransin	Kiat Kelat jamlin		Ubar	Djambu		Thabyebyu	Chamlu	Malmdun.
Malapapaya								
Malugay	Kasai					Thaliyay	Baloli	Galmosa.
Mancono				Kayu besi benar				
Mangachapoy	Chengai (2)	Gugil (1)	Glum Tekam	Kallungan				
Mangasinoro		Seriah Puli		Bangkirai				
Mayapis	Mersawa		Meraca 1.	Busoeng		Thinkadu		
Molave								
Calipapa Molauin aso Leban	Lehun	Leban Haiban Calipapa	Leban Calipapa	Haieban Calapapang		Kyetyo	Myhuli	
Narig	Hessak	Resak	Rassak	Rassak				
Narra	Angsana		Angsana	Angsana		Padauk	Andaman red-wood.	Gammalu.
Nato	Nlato		Nyaltu	Njattoe				

Nigue	Niri	Niri	Niri	Niri		Phuleon	Poshur	
Pagatpat	Perupat	P'rapat	P'rapat	P'rapat		Tabyn	Keowra	
Pedada	Bedata		Pelada	P'dada				
Pagsalingnin	Kadongdong hutan.							
Palo maria de la playa. Bitaog	Penugah	Penuga	Penungah	Penagah		Pomyet	Puna	Domlu.
Pingan	Niri	Niri	Niri	Niri (Boeli-boeli)				
Pototan	Tuan	Lengaii (?)	Putut	Akat	Cay day		Kahra	
Suleug						Tinyu	Dingsa	
Santol	Sintol		Sintol	Aijntet		Thitto		
Sudjung								
Supa	Saputi?		Pelir	Sapetir			Badum	Kottamlu.
Tallsay	Kulapang		Catapang	Kalapang				
Tamayuan	Pelalling			Ki-kuijang				
Tangal	Tengah	Tengah	Tengah	Hulit-tangah		Kabaing	Goran	
Tanguile		Obar sulak	Susak gurah	Klupak				
Teak	Jati			Djati	Teek	Kyun	Sagun	Tekku.
Teluto			Teluto	Tulutu				
Tibuo	Tarumtum	Gritling	Tarumtum	Grilling		Ylnye	Kripa	Berlya.
Tindalo				Ki-djulung				
Teog				Bintungan		Boungza	Pun	
Tuan-calao	Mobi		Kim	Udang-udang			Kanna komper	
Yacal	Ballow	Selangan batu	Peñaor	Selangan batu		Thingan		
	Daru		Bedaru					
	Slummpat		Berunggang	Ki-reming		Bebyn		
	Kranji	Kranji	Kramdji	Krandji			Kaddupuli	Gal-siyambalu.
	Kumpas	Cumpas	Mingris					
		Mangaris	Tupang	Kayu raja				
	Tampines		Tampalis	Kapbi				
	Kullau		Unsum (?)					
	Pennagah				Vaje	Gangaw	Nagesar	Na.

VI. TIMBERED AREAS AND FUTURE SUPPLY.

INDIA.

Tropical India is said to be a dry country. It contains many splendid woods, but the supply seems not to be great enough to do much more than supply the great population. It is not necessary for the owner of timber supplies to look farther when he has so great a home market. It is unlikely that India will ever do a very great timber-exporting business. It is true that quite a large number of very valuable ornamental woods are found in India, but the valuable ornamental woods can never be expected to provide a really great export trade. There are large sections of India where there is a chronic timber famine and where it has been necessary to undertake forest planting on a rather large scale to supply the needs of the local markets. There will doubtless be much more of this planting done in the future.

BURMA.

This section is more fortunately situated than is India proper. The sal and teak forests of Burma constitute most of its supply of export timber. The quantity of this is considerable and will stand exploitation for some years to come.

SIAM AND COCHIN CHINA.

These two countries are still but little known, but it is known that there are fine teak forests in Siam which are now being exploited, and there are considerable areas of dipterocarp forests in Cochin China. There are also a number of valuable ornamental woods still but little worked in these two countries.

MALAYA.

The Malay region is the part of the tropical east which is most rich in commercial timbers.

In the Malay Peninsula the best forests seem to be in the states of Keddah, Kelantan, Tringganu and Pahang. In the forests of Keddah and Tringganu are fine supplies of *chengal* (*Balanocarpus* spp.) and other dipterocarps. There is also a goodly quantity of *merbau* (*Intsia bakeri*) and there is a fair sprinkling of other valuable trees. The states of Kelantan and Pahang seem to offer some promise; although they are comparatively little known and offer considerable difficulties in the way of transportation.

SUMATRA.

This great island has extensive forests. It is reported to contain great quantities of the valuable *billian* (*Eusideroxylon zwageri*) and *chengal* (*Balanocarpus* spp.). It certainly does contain great quantities of dipterocarp woods. It sends considerable quantities of timber to the

Singapore market in small Chinese junks; but, thus far, it has not begun to be exploited by modern methods. There should be excellent opportunities for one or more large companies on the island.

JAVA.

The original forests of Java have been very largely cleared. Plantation teak is the most important timber.

BORNEO.

The forests of Borneo are extensive and comparatively untouched. It is true that the *billian* is very well worked out in some sections; but the dipterocarps are found in very great quantity and of all grades. At present the chief obstacle to the development of these forests is the distance from market and the meager facilities for transportation. As the demand for wood becomes greater, the transportation will surely be furnished and then the forests will be rapidly exploited. Borneo contains probably the most extensive and highly developed swamp forests in the world. These are now of comparatively little value; but they are sure to become of the first importance.

DUTCH INDIES.

The numerous islands of the Dutch East Indies are said, many of them, to contain valuable forests; but the nature and extent of these is largely a matter of guesswork. There is, however, a certain amount of export trade from the Dutch Indies in timbers which indicates that there may be extensive and valuable forests on some of the islands.

PHILIPPINES.

The exploitable forests of the Philippines comprise about 30,000,000 acres, a very much smaller commercial forest area than that of Borneo, Sumatra or several other places, but it is only in the Philippines that modern methods of exploitation are employed.

It is safe to say that there is a very great area of commercial forest in the tropical east, but it is by no means so great as many have supposed. Popular notions of dense jungle composed solely of valuable and exploitable trees need to be revised. It is true that the jungle is dense enough and that there are many valuable trees, but there are also many inferior trees mixed in and the valuable ones are so scattered that there are few places where a profitable enterprise can be started, if it aims at only one wood or one small group of woods.

VII. SPECIES NOTES.

In the following notes it is aimed to give first the accepted common name in the Philippines, then the common names in the other countries, the distribution, structure and special properties, uses, and references to the principal literature. The common names for Indian, Burmese and

Ceylon woods were taken from Gamble. Those from the Malay Peninsula from Ridley and those from the Dutch Indies from Van Eeden and from G. J. Filet's Dictionary of Plant Names. Many of the notes on structure are taken from Gamble.

I have not been able to prepare a key to the different woods of the region; but, with the aid of Gamble's Manual, it has been possible to prepare family summaries in some cases.

The term "seasonal or growth ring" has seemed preferable to "annual ring" and so is used. Also the term "pith-ray" is preferred to "medullary-ray."

Unless specially indicated, the structure described is that which is seen in the cross section, because it is in this section that the relationship of the different elements composing the wood is most clearly shown. The terms "pore" and "vessel" are used interchangeably.

The structural feature most often noted in the longitudinal section of the wood is the numerous parallel transverse lines or "ripple marks." These are due to regularly arranged pitting of the tracheids (see Plate XXVI, fig. 55) or to regular arrangement of small pith-rays. The latter condition is probably much the less frequent; and, when it occurs, gives the appearance of ripple marks only on the tangential section.

It will be remarked in following through these notes that a common or trade name usually applies to more than one species of plant. It frequently happens that the wood structure is identical for a large group of species. Occasionally the structure is seemingly identical for several genera, as in the *Ebenaceæ,* which seem to have only one type of structure for the whole family.

The following are the abbreviations which I have found it convenient to use in the species notes:

Gamb.	Gamble, J. S. A Manual of Indian Timbers. New and revised edition. London, 1902.
Phil. Woods	Foxworthy, F. W. Philippine Woods. This Journal 2 (1907) Botany 351–404.
Nörd.	Nördlinger, H. Holzquerschnitte. Stuttgart (1851–1888). Vols. 1–11.
Van Eed.	Van Eeeden, F. W. Houtsoorten van Nederlandsch Oost-Indië (3d ed. by J. J. Duyfjes). Cat. XII. van het Kol. Mus. te Haerlem. 1906.
Ridl.	Ridley, H. N. Timbers of the Malay Peninsula. In the Agricultural Bulletin of the S. S. and F. M. S. Singapore. Vol. 1 (1901).
Wiesner	Wiesner, J. Die Rohstoffe des Pflanzenreichs, 2d ed. Leipzig. 1903. Vol. 2.
Boulger	Boulger, G. Wood, 2d ed. London, 1908.
Stone	Stone, H. The Timbers of Commerce. London, 1905.
Lewis	Lewis, F. E. Ceylon Tea-box Woods. In Trop. Agric. 18. (1898) 307–310.
Gard.	Gardner, R. Mechanical tests of thirty species of Philippine Woods. Forestry Bureau (Philip.). Bull. 4, 2d ed., 1907.
Newton	Newton, Howard. Notes and Experiments on the different kinds of Timber in Ordinary Use in the Straits Settlements. Singapore, 1884.

K. & V.	Koorders, S. H., and Valeton, Th. Bijdrage tot de kenniss der Boomsoorten op Java. Batavia (1894–1909).
Janssonius	Janssonius, H. H. Mikrographie des Holzes. Leiden, 1906–. Two parts already issued.
Holtzapffel	Descriptive Catalogue of Woods. London, 1852.
Becc.	Beccari, O. Nelle foreste di Borneo. Florence, 1902.
Bargagli-Petrucci	Sulla struttura dei legnami raccolti in Borneo del Dott. O. Beccari. In Malpighia, 1902.
Semler	Tropische und nordamerikanische Waldwirtschaft und Holzkunde. Berlin, 1888.
Winton	Hanausek, Dr. T. F. The Microscopy of Technical Products., translated by Andrew L. Winton, Ph. D., with the collaboration of Kate G. Barber, Ph. D. New York, 1907.
Jumelle	Ressources Agricoles et Forestieres des Colonies Francaises. Marseille, 1907.
Safford	Useful Plants of Guam. Contrib. U. S. Nat. Herbarium, 9. 1905.
Pierre	Flore Forestiere de la Cochinchine. Paris.
Watt Dict.	Dictionary of the Economic Products of India. Calcutta, 1885–1896.
E.-Pr.	Engler, A., und Prantl, K. Die natürlichen Pflanzenfamilien.
Sp. gr.	Specific gravity.
M.	Malay.
Hind.	Hindustani.
Beng.	Bengali.
Tam.	Tamil.
Burm.	Burmese.
Cing.	Cingalese.
Phil.	Philippine.

PTERIDOPHYTA.

The only use to which members of this group are put as timber seems to be in the occasional use of the trunks of tree ferns as the corner posts of native houses. This is reported from Benguet in northern Luzon and from New Guinea. Such a use could only be very local, where tree ferns were very abundant or where other timber was scarce. The convenient size and location of these stems will probably account for their use.

Among the Bagobos, on the east slope of Mount Apo, in Mindanao, the tree ferns are used very extensively, in preference to other woods. They are said to be very durable; and, certainly, their shape is such as to make it possible to utilize them with very little effort.

GYMNOSPERMS.

This group, which contains the coniferous trees, furnishes the greatest part of the timber supply of the world, but it is only scantily represented in the eastern tropics. There are a few representatives which are used to some extent, as the Benguet pine of northern Luzon, the pines and cedars of the Himalayan slopes and some of the species of *Podocarpus,* which are rather widely distributed. However, none of these are used to such an extent as to be of very general interest in this region. Wherever met with, the wood may be readily distinguished by its nonporous structure.

TAXACEÆ.

Taxus baccata L.

Himalayas, upper Burma, China, Japan, the Philippines, etc. Forms of this species are found in the high mountains throughout the tropics of the East.

Wood hard, heavy (sp. gr. 0.74–0.94), close and even-grained, smooth. Sapwood white; heartwood orange-red, light-red, or white. Seasonal rings marked by a conspicuous line. Pith-rays very numerous, regular and long. Used for bows, carrying poles, and native furniture.

Stevenson 136–139; Gamb. 101; Nörd. I., Mech. Eigensch. d. Hölzer 542; Stone 245; Holtzapffel 110.

Podocarpus neriifolia Don.

British India, Burma, the Philippines, Borneo, Java, Sumatra; a mountain tree of very wide distribution.

Wood light-yellow or yellowish-gray; homogenous, even-grained, soft to moderately hard and moderately heavy. Seasonal rings distinct though faint. Pith-rays very fine, numerous. No resin ducts, but scattered cells with resin prominent on thin section. Used in general carpentry and is excellent to work, but would probably not resist white ants; also employed for oars, spars, masts, and to make tea-boxes. Seasons well and does not warp or shrink.

Gamb. 702, *tab. XVI, fig. 3;* Nörd. V. and X. (*P. bracteata* Bl.).

Numerous other species of *Podocarpus* occur in the Malay region, but they are usually extremely local and on high mountains. So far as known their wood resembles that just described. Australian species of *Podocarpus* are often known as "yellowwood" because of the color of the wood.

PINACEÆ.

Agathis alba (Lam.) (*A. dammara* Rich.) Plate XXII, fig. 1. Almaciga (Phil.); dammar (M.).

Malay Peninsula and Archipelago.

Wood soft and light, even-grained, easily worked, white, not very durable. Used for planks and temporary construction.

Cedrus deodara (Roxb.) Loud. Deodar; Himalayan cedar.

Himalayan region.

Wood moderately hard, light to moderately heavy, strong-scented, oily; sapwood white; heartwood light yellowish-brown. Seasonal rings distinctly marked by the darker autumn wood. Pith-rays fine, unequal and irregular, fairly numerous, not deep. Resin-ducts none, the oil contained in wood-cells in the heartwood. Railway sleepers, bridge work, building; rather brittle to work and does not take paint or varnish well. Has strong odor. Contains a good deal of oil, which prevents it from becoming water-logged, very durable. Resists wet, also white ants, and apparently does not suffer much from dry rot.

Gamb. 710–716, *tab. XVI, fig. 4;* Nörd. XI.

Pinus. Wood usually very resinous and homogenous, consisting of alternate layers of soft and often spongy spring wood, and of hard, darker colored autumn wood; heartwood distinct. Pith-rays fairly numerous, rather irregular, fine to moderate broad. Vertical resin-ducts large and numerous, visible on horizontal and vertical sections.

Pinus insularis Endl. Plate XXII, fig. 2. Saleng.
Philippines.

A wood much resembling that of some of the yellow pines in the United States; very resinous and of considerable local importance for planks, house building, etc.

Phil. Woods 354.

Pinus excelsa Wall. Blue pine.
Himalaya.

Light and moderately hard. Sapwood white; heartwood light-red. Railroad ties, planks, etc.

Gamb. 704; Nörd. VIII.

Pinus longifolia Roxb. Long-leaved pine.
Himalaya.

Light and moderately hard. Sapwood white; heartwood light-reddish-brown. Wood inferior to the preceding.

Gamb. 707, *tab. XVI, fig. 3;* Nörd. VII.

Pinus khasya Royle, *P. gerardiana* Wall., and *P. mȩrkusii* Jungh. & de Vr. are also used to some extent.

Cupressus torulosa Don. Himalayan cypress.
Himalaya.

Moderately hard and moderately heavy. Sapwood white; heartwood light-brown with darker streaks, very fragrant. Very durable. Used in building and for wood carving.

Gamb. 696, *tab. XVI, fig. 1;* Nörd. X.

ANGIOSPERMS.

MONOCOTYLEDONS.

The monocotyledons are not to be considered as of much importance in the production of commercial woods, but they do have some important uses which must not be overlooked.

PANDANACEÆ.

In some places the trunks of the arborescent pandans are used for rough or temporary work, and they furnish what is sometimes called "porcupine wood." They are probably of little, if any, more importance than the trunks of tree ferns.

PALMÆ.

Many palms have stems which, at least in their outer part, are very hard and strong. These palm stems are admirably suited for certain uses, as the flooring of native houses, the fashioning of bows and carrying poles, the making of ornamental pillars, etc. In Borneo the *nibong* palm (*Oncosperma* spp.) is the chief flooring material for both houses and boats. Several species of *Livistona* are used in the Philippines under the name of *palma brava*. The use of palm stems is usually purely local, although occasionally small amounts are sent to Europe for use in cabinet work. Because of the comparative infrequence of their commercial use and because their structure is of the type so well known in monocotyledons, it is not necessary to further consider them here.

GRAMINEÆ.

Bamboos of various sorts are the main reliance in many kinds of native structures, but their use is local. It is not customary to raise them for export, and their structure is very generally recognized.

DICOTYLEDONS.

CASUARINACEÆ.

Sapwood and heartwood not sharply differentiated, the color becoming gradually darker from sap to heart. Vessels moderately large, and often in radial or oblique rows. Wavy, concentric lines of wood parenchyma. Pith-rays small to very large; the large ones of very infrequent occurrence in *Casuarina equisetifolia*, but very general in the other species. Wood fibers very thick-walled and making up most of the mass of the wood.

Casuarina equisetifolia Forst. Plate XXII, fig. 3. Agoho (Phil.); ru (Borneo, Malaya); chouk (Tam.); tinyu (Burma); ironwood.

On sandy shores throughout the eastern tropics, where its resemblance in habit to the pines and firs makes it very marked.

Very hard and heavy or very heavy; difficult to work. Sapwood and heartwood differing in color only in degree of brown. A very durable construction timber and, perhaps, the best firewood in the world.

Phil. Woods 370, *fig. 38;* Gard. 68; Gamb. 665; Boulg. 233; Blits 12, 23–25; Wiesner 2:875–879; Becc. 583.

Casuarina sumatrana Miq. (ru ronan (M.), ironwood), and other species are occasionally found in the Orient. They differ from the preceding in having very large and distinct pith-rays. They are, consequently, better suited for cabinet work.

Blits 13; Bargagli-Petrucci 9, *tab. IV;* Becc. 583.

JUGLANDACEÆ.

This family is not found very abundantly in this region. The few representatives are usually scattered and comparatively unimportant. Pores scattered; pith-rays fine; wavy concentric lines of wood parenchyma.

Englehardtia serrata Bl. Plate XXII, fig. 4.
Malaya.

An easily worked wood of not much importance.

FAGACEÆ.

The members of this family are fairly numerous in the Orient, but they are of comparatively little importance. Many of the species of *Quercus* furnish a rather inferior quality of wood, which is said not to be durable. Some species are used in India, but their use can not be said to be at all general. Wood brownish, very hard and moderately heavy to heavy, generally with a distinct, darker-colored heartwood. Pores small to large, arranged in radial lines or elongated patches. Seasonal rings not distinct. Wood parenchyma in wavy concentric lines and more or less grouped about the vessels. Pith-rays small to very large.

Quercus. This genus is divided into two groups, according to the size of the pith-rays. First group, all the pith-rays very fine, very numerous, uniform and equidistant. Wood seasons well, does not warp or crack. Second group, pith-rays of two classes, very fine and broad, the latter very prominent on a vertical section, making a silver grain of rather large plates. Wood usually warps and splits in seasoning.

Quercus soleriana Vid. Plate XXII, fig. 5. Cateban (Phil.).
Philippines.

Used comparatively little; said not to be durable.

ULMACEÆ.

Celtis australis L.
Southern Europe, tropical and temperate Asia.

Rather local in hilly country.

Wood gray or yellowish-gray, with streaks of darker color, hard and heavy, tough and strong. Used for tool handles and other implements.

Gamb. 625, *tab. XIII, fig. 3;* Nörd. I.

Other species of *Celtis* furnish wood much like the above and which is used for the same purposes.

Trema amboinensis Blume. Anadiong (Phil.).
Tropical Asia to Australia.

Wood light-colored, soft or moderately hard; moderately heavy. Pores small or moderate-sized; pith-rays fine and moderately broad. Used in light or temporary construction.

Gamb. 630.

MORACEÆ.

Artocarpus. Heartwood moderately hard to hard, yellow, turning brown on exposure, seasons well, moderately heavy to heavy, usually containing a white substance in pores and pith-rays. Pores moderate-sized to large, often surrounded by circular patches of wood parenchyma. Pith-rays fine to moderately broad, distinct, not numerous.

Artocarpus integrifolia L. f. Jak tree; lanca; nanca.
India and Malaya; very widely cultivated.

Yellowish to yellowish-brown, darkening very decidedly on exposure to the air. Heavy, moderately hard, readily polishing. Used for the backs of musical instruments, furniture and fine carpentering. Softer and finer grained than is the wood of most other members of the genus.

Gamb. 652–654; Watt Dict. 1:332; Ridl. 257; Van Eed. 232; Stone 205; Holtzapffel 88.

Artocarpus hirsuta Lamk.
India and Malaya.

Yellowish-brown, hard and heavy durable wood. Used for house building, furniture, etc.

Gamb. 652, *tab. XIII, fig. 6;* Nörd. X; Watt Dict. 1: 329–333.

Artocarpus lancifolia Roxb. Keledang (M.).
Federated Malay States.

Heartwood hard and heavy, yellow, turning dark-red, close-grained, pores rather large partitioned, rays fine, conspicuous, lighter colored. Durable under ground and the favorite wood for Chinese coffins.

Ridl. 256; Newton 4.

Artocarpus nobilis Thw. Del (Cing.).
Ceylon and British India.

Furnishes a very readily worked wood similar to that of *A. integrifolia.*

Gamb. 654; Stone 204.

The following species are also of importance in the regions indicated:

Artocarpus chaplasha Roxb. British India. Gamb. 654; Nörd. X.

Artocarpus lakoocha Roxb. British India and Malaya. Gamb. 655; Nörd. X.

Artocarpus gomeziana Wall. Malaya. Morubi (M.). Bargagli-Petrucci 12; Becc. 583.

Artocarpus superba Becc. Mentawa (Borneo). Bargagli-Petrucci 12; Becc. 583.

Artocarpus cumingiana Trec. Plate XXII, fig. 6. Anubing (Philippines). Phil. Woods 372.

All the above furnish hard and durable wood similar to that of *A. hirsuta*.

Ficus. The species of this genus usually produce wood of inferior quality, and are of only local importance.

Ficus nervosa Heyne.
Ceylon.

Used for tea chests.

Lewis 310.

Sloetia sideroxylon T. & B. Plate XXII, fig. 7. Tampines (M.).
Malay Peninsula and Archipelago.

Very hard and heavy, brownish-yellow, fine-grained wood. Formerly much used at Singapore and considered one of the most durable woods of the region. Now very scarce. Used for corner posts of houses, heavy construction, carrying poles, etc.

Newton 3; Ridl. 254; Becc. 583; Bargagli-Petrucci 13, *tab. IV*.

Taxotrophis ilicifolia Vid. Plate XXII, fig. 8. Cuius-Cuius (Phil.).
Philippines.

A very hard and heavy wood; heartwood streaked with greenish or dark-brown, sometimes almost black. Frequently with scattered dark spots. Pores of medium size, scattered. Concentric, rather wide lines of wood parenchyma. Pith-rays fine but distinct. This is one of the most beautiful woods for walking sticks. (See p. 433.)

URTICACEÆ.

Boehmeria rugulosa Wedd.
British India.

The pretty, reddish, moderately hard, durable wood is used to make eating vessels, plates, vessels for milk and other drinkables.

Gamb. 657; Nörd. IX; Watt Dict. 1:484.

PROTEACEÆ.

Very large pith-rays always present and connected by narrow, continuous lines of wood parenchyma. Pores of moderate size.

Grevillea robusta A. Cunn. Silk oak.
Queensland and New South Wales, but cultivated throughout the tropical east.

Wood hard, light-reddish-brown; sapwood grayish-white. Suitable for fancy furniture.

Nörd. IX; Gamb. 576; Stone 185.

Helicia. This genus has quite a number of species in this region, but they are not commonly found with large numbers of individuals.

Helicia excelsa Bl. Membatu laiang.
Malay Peninsula.

A moderately hard and heavy wood.

Ridl. 248.

Helicia petiolaris Benn. Gong; putat tepi.
Malay Peninsula.

Very heavy and hard, used in house building.

Ridl. 248.

Helicia philippinensis Meissn. Plate XXII, fig. 9.
Philippines.

Usually well up in the mountains and does not occur in quantity.

Helicia robusta Wall.
British India and Malaya.

A hard and heavy wood which is used for house building.

Gamb. 575.

Helicia sp.? Plate XXII, fig. 10. K'runtum; Semaior daun basa (M.).
Sarawak.

I am not at all sure of the determination of this wood, but its structure seems closest to *Helicia*. This is an important wood in northern Sarawak. It is hard and heavy, reddish, coarse-grained and durable. It is used in house building.

SANTALACEÆ.

Exocarpus latifolius R. Br.
Australia and the Malay Archipelago.

Heartwood said to provide a substitute for sandalwood. (See p. 432.)

Santalum album L. White or yellow sandalwood; chandan, sandal (Hind.); santagu (Burm.); sandana (Philippines and Borneo).
British India and Malaya.

Wood yellow, reddish in spots, with alternate lighter and darker (reddish) zones and inconspicuous vessels and pith-rays. The wood has a strong, penetrating, aromatic odor when first cut and this is stronger the darker the wood. Uniformly dense, moderately hard and heavy. Used from the most ancient times as incense for idols and the manufacture of oil, as well as for the manufacture of small ornaments. (See p. 432 for discussion of sandalwoods.)

Gamb. 585–588; Wiesner 2:908; Nörd. XI; Stone 191.

Santalum freycinctianum Gaudich. and other species of the Hawaiian Islands also furnish some of the white and yellow sandalwood of commerce.

OLACACEÆ.

Wood usually hard to very hard and heavy; pith-rays very fine and regular; pores small and scattered; wood parenchyma in very fine broken and irregular lines, connecting the pith-rays.

Anacolosa luzoniensis Merr. Malabignay.
Philippines.

A pale reddish-brown wood. Hard and heavy. Used for house posts, etc. Several other species occur and are used in British India, the Malay Peninsula, and Java.

Ctenolophon parvifolius Oliv. Bungkal (M.).
Malaeca, Borneo, Sumatra.

Wood rather soft, brownish-white, with very fine rays and few large pores, which are filled with resin.

Ridl. 103.

Ochanostachys amentacea Mast. Petaling (M.).
Malaeca and Borneo.

Dark, yellowish-brown wood. Durable. Pores in short radial lines. Structure very much like that of *Strombosia* and wood used for the same things. Said to be proof against white ants.

Ridl. 102.

Ochanostachys bancana (Beec.) Valeton, of Banca, Liennga, and Sumatra, is also known as *petaling* and is used for the same things.

E.-Pr. Naehtr. 147.

Scorodocarpus borneensis Beec. Plate XXII, fig. 11. Kulim (M.).
Borneo and the Malay Peninsula.

Wood very dark-brown; very hard and heavy, and very durable in the water. Seems to resist the teredo remarkably well and is therefore much in demand for piling. Also used for bridges and house construction. The wood, when fresh, has a very strong odor of onions. If the wood is not used promptly after being cut, a kind of dry rot starts in at the end of the log. The behavior here is much like that of *liusin* (*Parinarium griffithianum*) under similar conditions.

Beec. 574; Ridl. 102; Bargagli-Petrueei 14, *tab. IV.*

Strombosia philippinensis (Baill.) Rolfe. Plate XXII, fig. 12. Tamayuan.
Philippines.

Very hard, moderately heavy to heavy. Dull-yellowish to pinkish; fine- and straight-grained. Posts, house building, joists, roofing, axe handles.

Phil. Woods 393.

Other speeies of *Strombosia* are found in Ceylon, British India, and Java. They mueh resemble the preeeding and are used for the same purposes.

Ximenia americana L. Bidara-laut (M.); kakira.
Tropical America, Africa, Asia, the Malay Archipelago and the Philippines.

A hard and very heavy yellow wood, in appearance and odor similar to the white sandalwood, and used for it in the East Indies.

Gamb. 163; Ridl. 103; Pierre 265.

MAGNOLIACEÆ.

Wood usually soft and not very durable, even-grained, white, gray, yellow or olive-brown. Seasonal rings distinct; pores small, fairly regular; pith-rays fine, numerous, regular. Not a group of much commercial importance. The wood is usually employed for work of only a temporary nature. The best known and generally used species is:

Michelia champaca L. Plate XXIII, fig. 13. Champaca: tjempaca-kuning (M.).
British India and Burma and cultivated everywhere in the tropics.

Sapwood white, heartwood bright-olive-brown. This soft but durable wood is used for house and carriage building, as well as for furniture, cabinet work, carving, carriage panels, and tea-boxes.

Gamb. 12; Nörd. VIII; Watt Dict. 5:243; Lewis 308; Ridl. 9; K. & V. 4:161; Van Eed. 4; Pierre 3; Janssonius 1:103.

Other species are used, but this seems to be the best.

ANONACEÆ.

This is one of the most sharply marked families in the structure of its wood. The pith-rays are moderately large and prominent, and they are connected by straight, parallel lines of wood parenchyma, which, with the pith-rays, give a distinctly ladder-like appearance to the wood. The color is often very light, though it is sometimes dark. The trees of this family are not commonly very large and the wood is often not very durable; moreover, the individuals are usually of scattered occurrence; consequently the wood is not ordinarily used in structural work or where large quantities of timber are required. The following are some of the better known *Anonaceæ*.

Canangium odoratum Baill. (*Cananga odorata* Hook. f. & Th.). Plate XXIII, fig. 14. Ilang-ilang (Phil.); kadatnyan (Burm.); kananga (M.).
British India and Malaya; cultivated in all tropical lands.

A light but tolerably hard wood; used for structural purposes and cabinet work. Sometimes used for house posts in the Philippines. Resonant and much used by Malays for tom-toms.

Gamb. 16; K. & V. 9:279–283; Van Eed. 7; Pierre 18; Ridl. 10; Janssonius 1:121.

Cyathocalyx zeylanicus Champ. Kekala (Cing.).
British India and Ceylon.

Wood moderately hard, yellowish-white, used for tea-chests.

Lewis 308.

Goniothalamus tapis Miq. Tapis (M.).
Malay Peninsula and Archipelago.

Moderately hard and heavy; said to be used for house building in Java.

Van Eed. 8; Ridl. 10.

Miliusa velutina Hook. f. & Th. Dom-sâl (Hind.); Thabutkyi (Burm.).
East Indies.

Light-brown, tolerably hard wood; easily worked and durable; used for carts, agricultural implements, spear shafts and oars.

Gamb. 21; Watt Dict. 5:545.

Mitrephora edwardsii Pierre.
Tropical Asia.

Yellowish, hard and very pliable. Used for balances, and small articles of furniture.

Pierre 35.

Polyalthia cerasioides Benth. & Hook. f.
British India and Burma.

Greenish-brown, moderately hard and heavy, wood for house-finishing, masts and spars.

Gamb. 17; Watt Dict. 6[1]:313.

Polyalthia longifolia (Lam.) Benth. & Hook. f. Indian fir; mast tree.
India and Ceylon; cultivated in all parts of India.

Produces white to yellowish, soft, very readily bent wood, for barrels, drum cylinders, boxes, lead pencils and matches.

Watt Dict. 6[1]:314; Gamb. 18.

Polyalthia suberosa (DC.) Benth. & Hook. f.
British India and Ceylon, Philippines.

A hard, heavy, tough and durable wood, used like the preceding.

Watt Dict. l. c. 314; Gamb. 17.

Polyalthia subcordata Bl.
Java and Borneo.

Produces, presumably, the very peculiar cabinet wood "Baloen adock."
Van Eed. 8; Janssonius 1:134.

Xylopia parvifolia Hook. f. et Thoms.
Ceylon.

Produces wood for tea-chests.

Lewis 308; Gamb. 20.

MYRISTICACEÆ.

Wood usually light, somewhat soft, reddish-brown, with regular prominent rings of hard wood without pores, looking like seasonal rings. Pores in short radial strings, moderate-sized, rather scanty, arranged en echelon. Pith-rays fine, numerous, irregular.

Myristica malabarica Lam.
British India.

Used for structural work but is not very durable.

Gamb. 555.

Myristica philippensis Warb. Plate XXIII, fig. 15. Duguan.
Philippines.

Wood moderately hard and moderately heavy, not durable, badly attacked by the beetles. Light or temporary construction.

Phil. Woods 381.

Other species of *Myristica* have wood of much the same structure and used for the same purposes as that here described. In Borneo, the wood of *Myristica* is often known as *cumpang*. *Bawang*, a fairly good wood of Dutch East Borneo, seems to belong here. This wood is shipped to the New York market, to be used in the making of cigar boxes. Some of the vessels are large and filled with a dark-red gummy deposit.

Lewis 309.

MONIMIACEÆ.

Wood soft or moderately hard, usually light and not durable. Pores small, fairly numerous, regular. Pith-rays broad, at irregular distances, with fine ones between. Usually of little importance.

Tambourissa quadrifida Sonn.
Mascarenes, Java.

Produces the very light "bois de tambour."

LAURACEÆ.

The woods of this family are exceedingly variable in structure and appearance, as well as in physical and chemical properties. Many representatives of the family have wood which has a very pronounced odor, usually agreeable, but markedly unpleasant in some, as e. g. the "stink wood" (*Ocotea bullata*) of South Africa.

The woods of the family can be grouped roughly according to several types which are probably best handled under the common names of their best known representatives.

BILLIAN.

Eusideroxylon zwageri T. & B. Plate XXIII, fig. 18. Billian (M.); kajoe besi (M.); Borneo ironwood; ulin (oelin) (E. Borneo); eijserhout (Dutch)
Borneo, Sumatra, Banka, possibly also in the Malay Peninsula.

Wood very hard and very heavy. Extremely durable. Yellowish to dark-brown, becoming almost black with age. Pith-rays fine; vessels medium-size to large, fringed with wood parenchyma which is continued tangentially into fine, usually discontinuous lines. Large vessels divided longitudinally into several compartments and filled with a yellowish, glistening crystalline substance, which also seems to fill many of the wood

parenchyma cells. Woody tissue very dark and giving a strongly glistening surface in fresh transverse cut.

Uses.—Piling, heavy construction, bridges, telegraph and telephone poles. Much used for shingles in Borneo. Said not to shrink on exposure to weather. Proof against termites. Perhaps the best wood in the world for piling. Resists termites and ship worm—perhaps because of the action of the substance filling the vessels and wood parenchyma cells.

Kinds of billian.—At most places where *billian* is worked, it is claimed that there are two or more kinds of this wood; e. g. *billian simpor, billian bulu, billian tembaga,* etc. It is certainly true that some *billian* is much lighter and less durable than the standard sort. Some *billian* is so light that it will float when dry. There is a difference between sap and heartwood and between rapidly grown and normal trees which will, I think, account for this. I have made efforts to examine the lighter grades of *billian* wherever they occurred and I have uniformly found those trees producing the lighter grades of *billian* to be very rapidly grown; in fact, they were second growth trees, having started as sprouts from old stumps. The young stump sprouts, being supplied with great quantities of nourishment by the established root system of the old stump, were able to make exceedingly rapid growth. In making this growth, there was not time for the deposit in the vessels and tissues of those substances which make for weight and durability in as great quantities as is the case where the tree grows at its normal and slower rate; consequently, the rapidly grown young wood is not so heavy nor so durable and, probably, not so strong as that of the normally grown tree.

Billian is one of the very few woods of Borneo which is known outside this region. It is exported to Europe in some quantity and has been used for piling at several places in Holland and France. It is deserving of wider use, but a few years vigorous exploiting will exhaust the available supply of it. It is one of the trees which is deserving of planting and careful handling.

Ridl. 247; Newt. 4; Bargagli-Petrucci 18; Becc. 581; Blits 27.

CAMPHORWOOD.

Cinnamomum camphora (L.) Nees & Eberm. Plate XXIII, fig. 17.
China, Formosa, Japan, and cultivated in many other regions.

Wood moderately hard and light to moderately heavy. Grayish to dark-red, often prettily marked. Grain rather coarse. Pith-rays fine, vessels moderately large to small. Distinct seasonal rings present, the larger vessels being arranged in the young wood and the smaller ones en echelon in the older wood. A rapidly growing wood. Durable, because of the very large amount of camphor it contains and which renders it distasteful to insects. It is used very extensively in the making of chests,

wardrobes, etc. It is so much in demand that it is very much imitated. Soft and absorbent woods are used in place of camphorwood very often, the wood being treated with a solution of camphor or other oil, which gives it, temporarily, an odor resembling that of the camphorwood. (See p. 426.)

Flückiger, Pharmakognosie, III, Aufl. (1891) 151; Van Eed. 201; Holtzapffel 78.

A number of other trees in the *Lauraceæ* furnish highly aromatic wood which sometimes resembles camphorwood in odor. Some of the Borneo and Philippine species of *Cinnamomum* and possibly other genera, have wood which is so strongly aromatic that it could probably be very well employed for the same kinds of work as the true camphorwood. The strongest scented one of these is a Sarawak wood known as *kappla* (Becc. 581), of which I have only sterile material and which I am unable to put in a genus. Another very strongly scented wood of the same region is known as *medang lada;* it is a species of *Cinnamomum,* and occurs locally in some quantity.

MEDANG.

This is a name applied to a large number of different species which show some resemblance in the structure of their wood. One of the best known of these is *Litsea perrottetii* F.-Vill. (Plate XXIII, fig. 19) of the Philippines, which is known in Manila as *baticulin.* The pith-rays of the different *medangs* are fine to moderately broad; vessels fine; seasonal rings not distinct. Fine-grained; soft or moderately hard woods; white or grayish in color; usually very easily worked and not very durable. They are used for light or temporary construction and are pretty widely known. Fifteen or twenty or more kinds of *medang* are found, but they are not clearly marked off one from another, because the trees producing them are usually more or less scattered. By cutting a number of different kinds of *medang* it is possible to get timber in some quantity in many localities, while, if only one particular kind of *medang* were used, it would not be possible to get sufficient of the wood for many purposes. This probably accounts for the composite nature of the wood supply known as *medang.* Sometimes dark-colored woods are found under this name, but the lighter-colored ones are much the more common.

Representatives of the following genera of this part of the world may occasionally be found under the name of *medang: Machilus, Phoebe, Notaphoebe, Actinodaphne, Neolitsea, Litsea, Dehaasia, Cryptocarya, Endiandra* and *Lindera.*

Occasionally dark-yellowish woods, species of *Beilschmiedia,* are found which seem to be really intermediate between *billian* and *medang. Beilschmiedia cairocan* Vid. (Plate XXIII, fig. 16) of the Philippines, known as *malacadios,* is a very good wood of this class. Some species of *Cryptocarya* probably belong also in this class.

HERNANDIACEÆ.

A very small family of scattered trees. Wood usually of poor quality, soft and light.

Gyrocarpus jacquini Roxb.
Tropics of both hemispheres.

Very soft and very light. Pores large and medium-sized, scanty, often subdivided, uniformly distributed. Pith-rays very short, moderately broad, the distance between them greater than the transverse diameter of the pores. Used for boxes, toys and small boats.

Gamb. 350.

Hernandia peltata Meissn. Palatu (Cing.).
Seacoasts of tropics everywhere.

Very soft and very light, gray. Pores moderate-sized to large; collected in oblong or linear more or less concentric dark scattered patches of loose tissue. Pith-rays very fine, numerous, with occasional broader ones. Cellular tissue soft.

Gamb. 575.

CAPPARIDACEÆ.

Wood white or yellowish-white, moderately hard or hard. The main character useful in determination is that of pores in radial lines, not between each pair of pith-rays, but at intervals, pairs without pores coming between those that contain pores.

Capparis grandis L. f.
British India, Burma and Ceylon.

A white, moderately hard, durable wood.

Gamb. 35; Nörd. X; Watt Dict. 2:130.

Crataeva religiosa Forst.
Widespread in the tropics.

Wood yellowish-white, when old turning yellowish-brown, moderately hard, even-grained. Used for drums, models, writing boards, combs and in turnery. Not durable and liable to the attacks of beetles.

Gamb. 32; Nörd. X.

PITTOSPORACEÆ.

Wood white, moderately hard, even-grained. Seasonal rings faintly marked. Pores small, rather scanty and irregularly distributed. Pith-rays fine, prominent, not numerous, pale.

Pittosporum ferrugineum Ait. Giramong (M.).
Malay Peninsula and Archipelago to Australia.

Light to moderately heavy and soft or moderately hard. Wood white, fine-grained, pores very small in clusters, fairly numerous, pith-rays fine but rather distinct, rings fairly distinct.

Ridl. 12; Janssonius 1:226.

HAMAMELIDACEÆ.

Wood close-grained, pores in radial rows, not very numerous, small and very small and only a few with wide lumen, uniformly distributed; pith-rays very fine, numerous.

Altingia excelsa Noronha. Rasamala (M.); nan-ta-yoh (Burm.).
British India, Burma, Java.

Wood hard, heavy, resinous, red, cross-grained. Pores small, uniform and uniformly distributed in lines between the pith-rays. Pith-rays fine, equidistant. Planks or indoor work in dry places.

Gamb. 332; Nörd. IX (*Liquidambar altingiana* Bl.); Watt Dict. 1: 201; Van Eed. 124.

Bucklandia populnea R. Br.
British India, Burma, Sumatra, Java.

Wood reddish-brown, rough, moderately hard and heavy, close-grained, durable. Seasonal rings marked by a dark line with fewer pores. Pores small, evenly distributed in radial lines. Pith-rays fine, very numerous, uniform and equidistant. Planking and door and window frames.

Gamb. 331, *tab. VII, fig. 2;* Nörd. IX; Van Eed. 125; Watt Dict. 1:545.

Fothergilla involucrata Falc. (*Parrotia jacquemontiana* Dene.).
Himalaya.

Very hard and very heavy, very close-grained; light pinkish-white; pores extremely small, rather scanty. Walking sticks, tent-pegs, charpoys, and rice-pestles, also for native bows for throwing pellets.

Gamb. 331; Watt Dict. 1:111.

ROSACEÆ.

The trees of this family have usually a very fine-grained and uniform wood; however, the only genera of importance from our present viewpoint, *Parinarium* and *Pygeum,* have wood of different structure; these have vessels of medium size to large. All of these rosaceous woods seem to be possessed of a more or less pronounced oxalic acid odor.

Parinarium. Wood very hard and heavy; vessels large and scattered; wavy thin lines of wood parenchyma usually present; the one exception known to me is *Parinarium oblongifolium* Hook. f., which seems to have wood of the structure of a *Pygeum.*

Parinarium griffithianum Benth. Plate XXIII, fig. 20. Liusin (Phil.); Merbatu layang (M.); Manoc (Java and Celebes).
Tenasserim or Andaman Islands, Malacca, Borneo, Philippines, to Australia.

Of wide distribution and rather scattered occurrence; a large tree. Wood very hard and heavy, light-red; an exceedingly durable wood, but

subject to dry rot at the heart. In demand for piles. Very much like the South American *P. guianense.* (Stone 101, *pl. VII, fig. 57.*)

Gard. 67; Phil. Woods 386; Ridl. 145; Van Eed. 122.

Parinarium oblongifolium Hook. f. Ballow (M.); Johore teak.
Malacca, Pahang.

Wood very hard and heavy, with the structure of *Pygeum* spp. This wood was formerly used for piling at Singapore, and exported from there to Ceylon, etc., but the supply of it was not great and seems to have become almost exhausted. I believe it impossible to procure it on the Singapore market at the present time. It has given way to a dipterocarp wood from Borneo, probably a species of *Shorea,* which is sold under the name of *ballow.*

Ridl. 144; Newton 3.

Pygeum maingayi Hook. f. Fafoo laut (M.).
Malacca.

Wood hard and heavy, pale-olive or olive-white with brownish striae and gamboge-colored stains; coarse grain. Construction work. Other species of *Pygeum* are also used; but, so far as known, they agree in structure with the preceding, and do not occur in any considerable quantity.

Ridl. 145.

Pygeum preslii Merr. Plate XXIII, fig. 21. Lago.
Philippines.

Wood moderately hard and moderately heavy, red; fine-grained, but with occasional concentric lines of large pores which contain red deposits. Used in house building.

LEGUMINOSÆ.

This is, next to the *Dipterocarpaceæ,* the most important family of plants in the Orient in the production of commercial wood. In the production of furniture and ornamental woods, it surpasses all others. Many representatives of the family have hard, heavy wood, which is often highly colored and shows good grain. Many of the woods are also good for structural work.

Several clearly marked types of structure are found in the family, but these structural types do not entirely correspond to the natural divisions of the family.

Gamble[1] has grouped the Indian members of the family in seven groups according to structure. I have followed him in the main, but have found it desirable to combine two of his groups, the *Ougeinia* and

[1] Manual of Indian Timbers (1902) 227.

Albizzia groups, because, in practice, I have not found them readily distinguishable. The different types of structure as I have recognized them are:

1. OUGEINIA-ALBIZZIA TYPE.

Vessels moderately large, scattered or more or less distinctly radially or concentrically grouped; distinctly fringed with wood parenchyma, which usually forms elongated patches, which are sometimes almost continuous concentrically. This is much the largest and most representative group in the family. Examples of this type of structure are: *Ougeinia dalbergioides, Intsia bijuga, Albizzia procera.*

2. ACACIA-CASSIA TYPE.

Vessels inclosed in irregularly shaped patches of wood parenchyma, which are more or less united into a reticulate pattern. *Cassia fistula, C. nodosa,* and many species of *Acacia.*

3. DALBERGIA TYPE.

Vessels ringed, rather scanty, usually independent of the narrow, wavy, numerous regularly distributed bands of wood parenchyma. *Dalbergia* spp., *Pterocarpus* spp., *Dialium* spp.

4. BAUHINIA TYPE.

Numerous, regularly distributed, rather broad, concentric bands of wood parenchyma, usually inclosing the pores. *Cynometra, Crudia blancoi, Bauhinia.*

5. HARDWICKIA TYPE.

Vessels scattered, not inclosed in patches of wood parenchyma, concentric bands of wood parenchyma usually wanting. *Sindora, Hardwickia, Caesalpinia sappan.*

6. ERYTHRINA TYPE.

Vessels large, scanty, unequal, irregular. Alternate broad bands of wood parenchyma and fibers making, with the pith-rays, a tesselated pattern. *Erythrina, Butea* and *Millettia.*

These different forms may be tabulated in a key as follows:

Wood parenchyma prominent about vessels or arranged concentrically.
  Wood parenchyma in patches surrounding the vessels.
    Wood parenchyma patches not continuous..... *Ougeinia-Albizzia* type
    Wood parenchyma patches connected and forming definite pattern.
      Patches united to form reticulate pattern..... *Acacia-Cassia* type
  Wood parenchyma forming concentric lines.
    Lines narrow, wavy, numerous usually not inclosing pores..... *Dalbergia* type
    Lines moderately broad, inclosing pores..... *Bauhinia* type
    Lines very broad, wood very soft..... *Erythrina* type
Wood parenchyma not prominent..... *Hardwickia* type

OUGEINIA-ALBIZZIA TYPE.

Acacia catechu Willd. Khair (Hind.); mgenda or mgunga; the cutch tree.
Tropical Africa and Asia.

Usually considered as one of the woods of the *Hardwickia* type (see p. 469.)

Very hard and heavy, durable. Sapwood yellowish-white; heartwood either dark- or light-red. Principal use, the preparation of cutch, which is extracted from the heartwood by boiling. Railway sleepers, rice-mortars, and agricultural implements.

Watt Dict. 1:27–44; Gamb. 296–298; Nörd. IX; Van Eed. 112.

Probably some other species of *Acacia* belong to this group, but they are not of sufficient importance to be worthy of mention here.

Acrocarpus fraxinifolius W. & A. Delimas (Java).
British India, Sumatra.

Moderately hard and moderately heavy. Sapwood white; heartwood red. Used for tea-boxes and furniture.

Gamb. 290; Nörd. IX; K. & V. 1:320–323; Van Eed. 113.

Adenanthera pavonina L. "Red wood"; "Condori wood"; "coral wood"; mas-moca (Cingh.).
Tropical Asia; introduced into tropical Africa and America.

Wood hard and heavy, close-grained, durable; sapwood gray; heartwood red. Used in house building and for cabinet work. A dye is also made from the wood. A substitute for the "red sanders."

Gamb. 287; Watt Dict. 1:107; Wiesner 2:926; Ridl. 142; K. & V. 1:281–283; Holtzapffel 82; Winton 242; Van Eed. 114.

Adenanthera bicolor Moon, of Ceylon and Malacca, and *A. intermedia* Merr., of the Philippines, show the same characteristics as the preceding.

Albizzia amara Boiv.
Tropical and subtropical Asia and Africa.

Produces a pretty, heavy, and exceedingly hard wood. Heartwood purple-brown, light- and dark-banded. Said to have a transverse strength in excess of either *teak or sál.* Used for house building and for agricultural implements.

Watt Dict. 1:153.

Albizzia julibrissin Durazz.
Tropical and subtropical Asia and Africa.

Seasonal rings distinctly marked by a sharp line. Prettily marked dark-brown to black heartwood: used for furniture.

E.-Pr. 3^3:106; Watt Dict. 1:156.

Albizzia lebbeck Benth. Siris (Hind.); ki-toke (Java); "East Indian walnut" of the London market.
Tropical and subtropical Asia and Africa to Australia.

Wood hard; sapwood white or yellowish; heartwood dark-brown, streaked with lighter or darker streaks. House and boat building, agricultural implements, furniture, and the finest cabinet work.

Gamb. 303; Watt Dict. 1:157; Nörd. V (*Acacia speciosa* Willd.), IX (*Albizzia lebbeck* Benth.); Van Eed. 114; K. & V. 1:297–299; Stone 74, *pl. V, fig. 40.*

Albizzia lebbekoides Benth.
Java, Sumatra, Malay Peninsula, Philippines.

Heartwood very dark-brown.

Pierre 399; Van Eed. 115; K. & V. 1:306–308.

Albizzia littoralis T. & B. Kelor-pante (M.).
Philippines and Malaya.

Not much used.

Van Eed. 115; K. & V. 1:301–303.

Albizzia moluccana Miq. Sengon-laoet (Java).
Java and the Moluccas.

Strasburger Hist. Beitr. 3:166–176; Ridl. 143; Van Eed. 115; Bürgerstein Bericht. Deutsch. Bot. Ges. (1894) 170–172.

Albizzia montana Benth. "Caju Ticcos major;" kemlandingan (Java).
Java, Sumatra, New Caledonia, Australia.

The odor of the hard and durable wood (*lignum murinum*) attracts mice.

E.-Pr. 3[3]:106; Van Eed. 116; K. & V. 1:292–295.

Albizzia odoratissima Benth. Suriya-mara.
India, Ceylon.

Hard, very durable; sapwood white, heartwood dark-brown, brightly banded. Agricultural implements and furniture. Looks like rosewood.

E.-Pr. 3[3]:106; Watt Dict. 1:159; Stone 73, *pl. V, fig. 40;* Pierre 398.

Albizzia procera Benth. "White siris"; acleng parang (Phil.).
India and Burma, Andaman and Cocos Islands, to the Philippines.

Wood hard and moderately heavy to heavy. Sapwood large, yellowish-white, not durable; heartwood brown, shining, with alternate belts of darker and lighter color; very like that of *A. lebbek* and often indistinguishable from it. Sugar cane crushers, rice pounders, wheels, agricultural implements, bridges, and house posts. Often used in the Philippines as a substitute for *acle* (*Pithecolobium acle* (Blanco) Vid.), which it much resembles.

Gamb. 305; Watt Dict. 1:159; Nörd. XI, V (*Mimosa elata*); Van Eed. 116; Pierre 398.

Albizzia saponaria Blume. Gogong casay (Phil.).
Malaya.

Wood whitish, not durable, capable of producing a lather when rubbed with water.

Albizzia stipulata Boiv.
Tropical and subtropical Asia and Malay Archipelago.

Sapwood large, white; heartwood brown, soft. A good insect-proof wood. House building, agricultural implements, furniture, and cabinet making.

E.-Pr. 3[3]:106; Van Eed. 117; K. & V. 1:303–305.

Dichrostachys cinerea W. & A. Poeng (Java).
India.

A red, extraordinarily hard wood; valued for walking sticks and tent pegs.

Watt Dict. 3:109; Van Eed. 117; K. & V. 1:283–285.

Gliricidia sepium (Jacq.) Steud. Madre cacao; cacahuate.
Commonly cultivated and escaped in the Philippines; introduced from tropical America.

Produces an excellent wood, much like *acle*. Vessels containing yellow deposits. Used in house building and for agricultural implements. This wood furnishes a much more glistening surface when cut than does *acle*.

Intsia bijuga (Colebr.) O. Ktze. (*Afzelia bijuga* A. Gray). Plate XXIV, fig. 26. Ipil; ypil; epel; miraboo laut; merbau apil; ifi-lele (Samoa); ifil (Guam); go-mioc (Annam).
Distributed throughout the eastern tropics from Madagascar to the Sandwich Islands. A littoral tree.

Heavy and hard (sp. gr. 0.758 to 0.909). Sapwood whitish or light-yellow; heartwood dark-reddish-brown. Sent to Europe as furniture wood. Also used as a dyewood.

Wiesner 2:928; Gard. 59; Phil. Woods 384; Gamb. 280; Van Eed. 101; Watt Dict. 1:128; E.-Pr. 3[8]:140; K. &. V. 2:31–35; Pierre 388; Becc. 577; Bargagli-Petrucci 32–34, *plate VI*.

Intsia bakeri Prain (*Afzelia palembanica* Bak.). Merbau; mirabow; miraboo; "ironwood."
A very large tree of Sumatra, Borneo, the Malay Peninsula, Riouw, and Banka, growing inland.

This and the preceding, together with other species of the genus, furnish one of the best woods of the whole region. It is very much in demand for furniture, heavy structural work, bridges, corner posts of houses, telephone and electric light posts, and, in fact, anywhere that an insect- and decay-resisting wood is needed. The wood is distinguished by the copious sulphur-yellow deposits in its vessels. There is little, if anything, to choose between *ipil* and *mirabow*. The *ipil*, at least when fresh, is a shade the darker in color, otherwise the two are indistinguishable.

Van Eed. 102; Ridl. 140; Newton 4.

Ormosia calavensis Blanco. Bahay; ala-saga.
Philippines.

Moderately hard and heavy. Sapwood grayish-white; heartwood red. A very good wood, which is used locally as a substitute for *tindalo* (*Pahudia rhomboidea* (Blanco) Prain).

Other species of the genus occur in India and Malaya, but they are of only local importance.

Ougeinia dalbergioides Benth. (*Dalbergia ougeinensis* Roxb.).
India.

Sapwood small, gray; heartwood mottled, light-brown, sometimes reddish-brown. Used for furniture, agricultural implements and construction. Very prominent parallel transverse markings in longitudinal sections.

Gamb. 237; Nörd. IX, VIII (*Dalbergia ougeinensis* Roxb.); Watt Dict. 5:657.

Pahudia rhomboidea (Blanco) Prain (*Afzelia rhomboidea* Vid.). Tindalo.
Philippines.

Heavy and hard. Sapwood white; heartwood saffron or red, becoming very much darker with age. One of the finest furniture woods; also used for structural work, railroad ties, etc.

Gard. 62; Phil. Woods. 395.

Pahudia javanica Miq. Ki-djoelang (Java).
Java and the Sunda Archipelago.

Very much like the preceding. Sp. gr. 0.70 to 0.77.

Van Eed. 106; E. Pr. 3^3:141; K. & V. 2:28–30.

Parkia roxburghii G. Don, Plate XXIV, fig. 32. Cupang (Phil.); kurayong; gudayong; kadoeng (M.).
India, Indo-China, and Malaya.

Light and soft. Light color, disagreeable odor when first cut. Not durable. Light or temporary construction, matches, shoes, boxes.

Gamb. 289; Phil. Woods 381; Gard. 69; Ridl. 142.

Parkia speciosa Hassk. Petai.
Malay Peninsula, Sumatra, Java.

Much like the preceding and used for the same purposes.

Ridl. 142; Van Eed. 119.

Peltophorum ferrugineum Benth. (*Baryxylum inerme* Pierre). Lim-vangh (Cochin China).
Andaman Islands, Ceylon, Malay Peninsula and Archipelago, Cochin China, Philippines.

Wood light-reddish-brown, soft, durable. Pores moderate-sized, often subdivided, scanty; inclosed singly, or in groups of twos or threes, in patches of wood parenchyma which often join together concentrically. Pith-rays very fine, very numerous, closely packed. Said to be very good for house building, furniture, cabinet work, and small boats.

The heartwood also gives a dye used for dyeing cloth.

Gamb. 268; K. & V. 2:3–6; Van Eed. 106; Ridl. 137; Pierre 390.

Peltophorum dasyrachis Kurz (*Baryxylum dasyrachis* Pierre). Lim-xet (Cochin China).
Indo-China, Siam, Malay Peninsula, Sumatra.

Much like the preceding and, like it, used for furniture etc., in Cochin China. Recommended for wood pavement.

Pierre 391; Jumelle 336–339.

Pithecolobium acle (Blanco) Vid. Acle.
Philippines.

Moderately heavy and hard. Sapwood whitish; heartwood dark-brown, like English walnut. Decidedly peppery odor when worked. Very fine furniture wood.

Gard. 63; Phil. Woods 369.

Other species of *Pithecolobium*, so far as seen, may be grouped here: *P. dulce* Benth; *P. acutum* Benth.; *P. lobatum* Benth., Becc. 576; *P. montanum* Benth., E.-Pr. 3[3]:105; *P. prainianum* Merr.; *P. scutiferum* (Blanco) Benth., and *P. subacutum* Benth.

Tamarindus indica L. Tamarind.
Africa, India, Burma, Ceylon, Malaya; widely cultivated in the tropics.

Hard and very heavy. Sapwood yellowish-white, sometimes with red streaks; heartwood dark-purplish-brown. Ripple marks on longitudinal section. Very durable, insect proof. Turnery and charcoal.

Gamb. 278; Nörd. V; Watt Dict. 6[4]:409; E.-Pr. 3[3]:140.

Wallaceodendron celebicum Koord. Banuyo (Phil.); kayu-besi-prempuan (M.).
Celebes and the Philippines.

Moderately heavy and moderately hard. Similar to *acle* in appearance and sometimes substituted for it.

Phil. Woods 376; Gard. 65; Koorders Meded. 's Lands Plant. 19 (1898) 446–448.

Xylia xylocarpa (Roxb.) Taub. (*X. dolabriformis* Benth.). Pyingadu; "iron-wood;" cam-xé (Cochin China).
India and Burma to Cochin China.

After teak the most important wood of Burma. Very hard and very heavy, cross-grained. Heartwood dark-brown or reddish-brown. In fresh condition, the vessels secreting an adhesive substance. Not attacked by termites. A splendid material for ship and house construction, railway sleepers, paving blocks, tent-pegs, telegraph poles, agricultural implements, carts, tool handles, piling, bridge building, etc.

Watt Dict. 6[4]:320, Agricultural Ledger (1899) no. 11, 1–21; Semler 691; Gamb. 285–287, *tab. VI, fig. 5;* Nörd. IX, IV (*Inga xylocarpa*); Boulger 123.
Sometimes said to be the same as *acle*. It is much heavier than that wood and is suited for different purposes.

ACACIA-CASSIA TYPE.

Cassia fistula L. Caña fistula (Phil.); "Indian laburnum;" sundali (Beng.).
India, China and Malaya; widespread and widely cultivated.

Wood very hard and very heavy. Sapwood large; heartwood varying in color from gray or yellowish-red to brick-red; darkens much on exposure. Durable but brittle, difficult to work, apt to splinter. The wood is distinguished from that of the otherwise similar *Ougeinia dalbergioides* by the arrangement of the parenchyma in unbroken, girdle-forming zones, while that of the last named forms distinctly divided

groups. In Java said to last longer in the ground than teak and to be untouched by insects. Posts, carts, agricultural implements, rice-pounders, bows and boat-spars and bed-plates for machinery.

Gamb. 271, *tab. VI. fig. 3;* Nörd. VIII; Van Eed. 103; Ridl. 136; Watt Dict. 2:219; K. & V. 2:11–13.

Cassia javanica L. Trenggoeli.
Malaya.

Moderately hard and heavy. Sapwood light; heartwood grayish or reddish. Used in house construction.

Van Eed. 104; E.-Pr. 3[3]:159; K. & V. 2:8–11.

Cassia nodosa Ham. Plate XXIV, fig. 27. Turukop bumi.
India and Malaya.

Moderately hard and moderately heavy. Sapwood light-brown; heartwood red. Not a very useful wood.

Gamb. 273; Ridl. 136.

Cassia siamea Lam. (*C. florida* Vahl). Sibusuk (M.); wa (Cing.).
Ceylon, India and Malaya.

Hard and heavy, durable. Sapwood whitish, rather large; heartwood dark-brown to nearly black, in stripes of dark and light. Wood for building, helves, walking sticks, mallets, fuel.

Gamb. 274; Van Eed. 105; Ridl. 136; Watt Dict. 2:223.

Cassia timorensis DC. Anemene.
India, Malaya, Australia.

Very hard and heavy. Dark-brown, nearly black—much resembling the wood of *C. siamea.* Used for house building and furniture.

Gamb. 274; Van Eed. 105; Watt Dict. 2:224; K. & V. 2:13–15.

Prosopis spicigera L. Jhand.
British India.

Wood very hard and very heavy. Sapwood large, whitish, perishable; heartwood purplish-brown. Firewood. Structural work, furniture. Not durable.

Gamb. 288, *tab. VI, fig. 6;* Nörd. VIII; Watt Dict. 4:341.

DALBERGIA TYPE.

Ripple marks on tangential surface.

Dalbergia cultrata Grah. Yindaik.
Burma.

Very hard and very heavy. Sapwood pale-brown; heartwood black with dark-purple streaks.

Watt Dict. 3:6.

Dalbergia latifolia Roxb. "Indian rosewood;" "blackwood" in southern India.

British India, Java, Andaman Islands.

Wood very hard and very heavy. Sapwood yellow, small; heartwood dark-purple, with black longitudinal streaks. Wood with distinct rose-like odor. The best wood of India for furniture and cabinet work. Exported to the London market. Seems to be the material used in the manufacture of blackwood furniture in Hongkong and Canton.

Gamb. 250–252, *tab. VI, fig. 1;* Nörd. VII; Van Eed. 94; Stone 63, *pl. V. fig. 37;* Watt Dict. 3:9; E.-Pr. 3^3:336; K. & V. 2:77–82; Holtzapffel 83.

Dalbergia oliveri Gamble. Tamalan.

Burma.

Hard and very hard, close-grained. Sapwood white; heartwood dark-red-brown, in color like good *padouk*. A very handsome wood very like some of the South American rosewoods. It is used for ax handles.

Gamb. 256.

Dalbergia sissoo Roxb. Sissu.

British India.

Very hard and heavy. Sapwood small, white; heartwood brown, with darker longitudinal veins. Shipbuilding and furniture.

Gamb. 247–249; Nörd. IV; Watt Dict. 3:15; E.-Pr. 3^3:336; Holtzapffel 106.

Dialium indum L. Kranji.

Java.

Very hard and heavy wood, durable. Heartwood usually of a reddish color. Used for heavy structural work and in places where great strength and hardness are required. A number of other species of *Dialium* occur in British India, the Malay Peninsula and the Malay Archipelago. They usually occur as scattered individuals.

Newt. 5; Ridl. 138; E.-Pr. 3^3:155; Gamb. 275; Van Eed. 105; Bargagli-Petrucci 30–32, *tab. VI.*

Koompassia beccariana Taub. Kumpas; mingris.

Borneo.

Very hard and heavy; pale-reddish, not durable.

Bargagli-Petrucci 28–30; Becc. 577.

Koompassia excelsa (Becc.) Taub. (*Albauria excelsa* Becc.). Tapang; kayu rajah; mangaris.

Borneo.

Very heavy and very hard. Sapwood yellowish-white; heartwood dark-red, becoming almost black with age. The buttresses of this tree are used for table tops. Wood used for carving paddles and for making the pans used in the hand washing of gold. Strong but very brittle.

Becc. 576; Bargagli-Petrucci 24, *pl. VI.*

Koompassia malaccensis Maingay. Kumpas.
Malay Peninsula.

Reddish, very hard and moderately heavy, coarse-grained, not durable. Charcoal.

Newt. 5; Ridl. 137; E.-Pr. 3[3]:156.

Koompassia parviflora Prain. Tualang or sialang (M.).
Malay Peninsula.
Ridl. 138.

Pterocarpus. Wood hard to very hard, moderately heavy to very heavy; yellowish-brown, red, or purplish-red. Pores variable, small to large, scanty, in patches of wood parenchyma joined by more or less fine, wavy, concentric lines of the same tissue. Pith-rays very fine, uniform, equidistant. In color, the different species differ; *P. santalinus* has its wood of a very dark claret-red color; *P. indicus* and *P. macrocarpus* of a dark brick-red color; *P. dalbergioides* has a bright-red wood, often streaked with black; while the wood of *P. marsupium* is of a brown color with a yellowish tinge. All the species are valuable as furniture and ornamental woods and all contain a certain amount of a substance which gives them an aromatic odor.

Pterocarpus dalbergioides Roxb. "Andaman redwood" or Andaman padauk.
Andaman Islands.

Wood moderately hard and heavy; sapwood gray, small; heartwood bright-red, streaked with brown and black. Pores scanty, moderate-sized to large, filled with resin, surrounded with pale rings and joined by narrow, wavy, concentric lines of wood parenchyma. Pith-rays very fine, very numerous, uniform and equidistant. *Padauk* is used in Europe and America for furniture, parquet-floors, railway carriages, door-frames, balustrades, etc. Most successfully used in the building of Pullman cars in America. One of the most important export furniture woods of the whole region.

Gamb. 257–259; Van Eed. 97.

Pterocarpus echinatus Pers. Narra (Phil.).
Philippines and Celebes.

Much like the preceding.

Phil. Woods 390.

Pterocarpus hypostictus Miq. Tarpandi.
Sumatra.

Masts.

Van Eed. 97.

Pterocarpus indicus Willd. Plate XXIV, fig. 28. Narra (Phil.); angsana (M.).

Southern India to the Malay Archipelago and southern China, Philippines.

Heartwood of a splendid red; moderately hard and with slightly aromatic odor, durable, not attacked by termites, easily worked and polished. Furniture and wagon building.

Watt Dict. 6[1]:356; E.-Pr. 3[3]:341; Ridl. 135; Culbertson in Bot. Gaz. 21 (1894) 498; Gamb. 257; Van Eed. 98; Gard. 57; Phil. Woods 390; K. & V. 2:83–88; Stone 75, *pl. V, fig. 41;* Stevenson 247–249; Becc. 576.

Pterocarpus macrocarpus Kurz. Padauk; padu; padoo; "inland padauk."

India and Burma.

Produces a very hard and very heavy wood. The wood of roots and stem-knots resembles dark mahogany, and is made up into small boxes.

Culbertson Bot. Gaz. 21 (1894) 498; Gamb. 259.

Pterocarpus marsupium Roxb. Biji (Hind.); gammala (Cing.).

India and Ceylon.

The brown- and dark-striped, very hard, durable and easily polished wood serves for window frames, posts, furniture, agricultural implements, wagon and boat building, and railroad ties. The heartwood is full of gum resin and stains yellow when damp.

Watt Dict. 6[1]: 357; Nörd. X; Gamb. 261, *tab. VI, fig. 2.*

Pterocarpus santalinus L. f. East Indian sandalwood; red sanders; caliaturholz.

Southern India.

Wood very hard and very heavy; sapwood white, heartwood dark-claret-red to almost black, but always with a deep-red tinge, orange-red when first cut, the shavings giving an orange-red color. Used for house posts, agricultural implements, carved work, and dyewood. The value of redwood as a dye is due to a red coloring principle, "santalin," which is soluble in alcohol and ether, but not in water. Dissolved in alcohol, it dyes cloth a beautiful salmon-pink color.

Van Eed. 99; Wiesner 2:937–939; Gamb. 259; Holtzapffel 103.

BAUHINIA TYPE.

Bauhinia acuminata L.

India Malaya, China.

Produces the pretty and durable "mountain ebony."

E.-Pr. 3[3]:149.

Bauhinia malabarica Roxb. Alabangbang (Phil.).

India and Burma to Cochin China, the Philippines, and Malaya.

Moderately hard and moderately heavy. Not very durable. Prominent parallel transverse lines on tangential section. Wood rather poor quality. Fuel.

Gamb. 282; Van Eed. 102; K. & V. 2:24–26; Pierre 400.

Bauhinia purpurea L.
India, Ceylon, Java.

A moderately hard structural wood.

Watt Dict. 1:422; E.-Pr. 3³:151; Gamb. 283, *tab. VI, fig. 4;* Nörd. X.

Bauhinia retusa Ham. Semla.

Wood hard and very heavy, red, with irregular dark-red or black patches and streaks near the center.

Gamb. 282; Nörd. X.

Bauhinia tomentosa L.
India and Ceylon to China and the Malay Archipelago; Africa.

The firm white wood is used for handles and sheaths for weapons.

E.-Pr. 3³:149.

Bauhinia variegata L.
India and China.

Gray, moderately hard wood, used in making agricultural implements.

Watt Dict. 1:426; E.-Pr. 3³:151.

Crudia blancoi Rolfe. Big-biga.
Philippines.

Hard and heavy, not durable. Used locally in house building.

Cynometra inaequifolia A. Gray. Bulankan; melankan katong (M.).
Philippines and the Malay Peninsula.

Hard and heavy, durable. House building.

Ridl. 139.

Cynometra ramiflora L. Shungra (Beng.); myinkabin (Burm.); gal mendora (Cing.).
Southern India and Ceylon to Burma and the Andaman Islands.

Wood red, hard, close-grained, very heavy. House and cart building.

Pierre 389; Watt Dict. 2:682; Gamb. 275; K. & V. 2:49–51.

Derris cumingii Benth. Malacadios.
Philippines.

Hard and heavy, light-colored, durable. House building, etc.

Derris robusta Benth. (*Deguelia robusta* Taub.).
India and Burma.

Wood light-brown, hard and heavy. Tea chests.

Gamb. 263; Watt Dict. 3:81.

Pongamia glabra Vent. (*Galedupa pinnata* Taub.) Bansu (M.).
Tropical forests, Ceylon to Australia.

White, turning yellow on exposure. Moderately hard and moderately heavy. Not durable. Very distinct transverse markings on longitudinal section.

Watt Dict. 3:81; Gamb. 262; Ridl. 135; Van Eed. 97; K. & V. 2:93–96; Bargagli-Petrucci 22, *tab. V;* Becc. 576.

Millettia pendula Benth. Thinwin (Burm.).
Southern India and Burma.

Dark-colored, purplish-black, prettily marked, dense, very heavy and hard wood. Agricultural implements.

Watt Dict. 5:247; E.-Pr. 3[3]:271; Gamb. 233.

Other species are also used, but they do not seem to furnish much wood, and the quality of the wood is indifferent.

Pericopsis mooniana Thw., Plate XXIV, fig. 25.
Ceylon.

Pale-orange-brown, streaked with darker hues. Hard, heavy, smooth, with very pretty grain. Furniture, carts, etc. The finest furniture wood in Ceylon.

Gamb. 265.

HARDWICKIA TYPE.

Acacia arabica Willd. Babul (Hind.).
Tropical Asia and Africa.

An excellent, durable, extensively used wood. Hard and heavy; sapwood large, whitish; heartwood pinkish-white, turning reddish-brown on exposure, mottled with dark streaks. Vessels with red deposits. Agricultural implements, cart wheels, house building, furniture, fuel and charcoal. When used for furniture the timber is carefully seasoned in water.

Watt in Agric. Ledger (1902) 2:73; Gamb. 292; Nörd. XI; F. v. Mueller 2; Van Eed. 111.

Acacia catechu Willd. Khair (Hind.).
British India, Burma, and Ceylon; tropical Africa.

Sapwood yellowish-white, heartwood either dark- or light-red, extremely hard and very heavy. Seasons well, takes a fine polish and is extremely durable. Used for all kinds of agricultural implements, bows, spears, sword-handles, and wheelwright work. Employed for house boats in Burma and very largely used as fuel for the steamers of the Irawaddy flotilla. The fuel of dead *khair* is much valued by goldsmiths. Said to be good for railway sleepers. Said to be proof against the attack of teredo and termites. The chief product of the tree is the cutch, which is extracted from the heartwood by boiling.

Watt in Agric. Ledger (1902) 2:80; Gamb. 296–298; Van Eed. 112.

Acacia eburnea Willd.
India and Ceylon.

Hard and heavy. Yellowish-white, often with a red heartwood. Used only as fuel.

Gamb. 294; Nörd. IX.

Acacia excelsa Benth.
East Australia.

Produces a kind of rosewood (E.-Pr. 3[3]: 110), which is also called "ironwood" (G. A. Blits Bull. Kol. Mus. Harlem **19** (1898), and is used

for construction and furniture (F. Mueller, Select Extra-tropical Plants (1881) 1).

Acacia ferruginea DC. Ironwood.
India.
Blits l. c.; Gamb. 298; Watt Dict. 1:50.

Acacia farnesiana Willd. Ironwood.
Throughout the tropics; original home uncertain.

Acacia koa Gray. Koa wood.

The most important furniture wood of the Hawaiian Islands.

Acacia leucophloea Willd. Pilang (M.).
British India, Ceylon, Burma, Malay Archipelago.

Wood hard and heavy; sapwood large; heartwood reddish-brown with lighter and darker streaks. Seasons well, takes a good polish, but is often eaten by insects. Fuel.

Gamb. 295; Watt Dict. 1:52; Van Eed. 112; K. & V. 1:286–289.

Acacia melanoxylon R. Br. Plate XXIII, fig. 23. Black wattle.
Southeastern Australia; naturalized in India.

Soft to moderately hard and moderately heavy. Sapwood light brown; heartwood dark brown and beautifully mottled, shining, even-grained. Fine furniture and veneer, also carriage building.

E.-Pr. 3^3:110; Semler 620; Watt Dict. 1:53; Gamb. 301; Hough Amer. Woods 7:155; Stone 81, pl. V, fig. 44.

Acacia modesta Wall.
Himalaya, Punjab.

Beautiful, dark-brown, black-striped heart. Very hard, firm and durable. Wheels, sugar presses, agricultural implements, etc.

Watt Dict. 1:53.

Acacia planifrons W. & A.
India.

Agricultural implements.

Watt Dict. 1:54.

Acacia tomentosa Willd. Klampis (M.).
British India, Ceylon, and Malaya.

Hard and heavy, but not durable. Used only for fuel.

Van Eed. 112; K. & V. 1:289–291.

Caesalpinia sappan L. Plate XXIV, fig. 31. Sappan wood; sibucao (Phil.).
India and Ceylon to Malaya and the Philippines, widely cultivated.

Very hard and heavy. Sapwood white, heartwood dark orange-yellow. Fine-grained, takes a fine polish; useful for cabinet work and inlaying, but chiefly used for dyeing. (See p. 425.)

Gamb. 267; Wiesner 2:934; Van Eed. 103; Ridl. 137; Stone 70; Holtzapffel 105.

Hardwickia binata Roxb. Anjan.
Southern India.

Very hard and very heavy. One of the hardest and most durable of Indian woods. House and bridge building and cabinet work.

Gamb. 276; Nörd. XI; Watt Dict. 4:13.

Kingiodendron alternifolium (Elm.) Merr. & Rolfe (*Hardwickia alternifolia* Elm.). Plate XXIV, fig. 29. Batete.
Philippines.

Moderately heavy and hard. Reddish-brown, much stained by the oil contained in the wood. Easily worked, but not very durable. Used for furniture and house building.

Phil. Woods 275.

Kingiodendron pinnatum (Roxb.) Harms. (*Hardwickia pinnata* Roxb.) Kolavu.
British India.

Moderately hard and moderately heavy. Sapwood large; heartwood dark-red or reddish-brown, exuding a red stieky resin. Building.

Gamb. 277.

Sindora cochinchinensis Baill. Plate XXIII, fig. 24. Cay-go; go-mat; go ta-hi.
Cochin China.

Uneommonly hard, blaek or dark-brown, and valuable wood. Used wherever strength and durability are desired. One of the most valuable woods of Coehin China; very fine furniture, house posts, bridges, boats, earriage building. Most valuable for cabinet work beeause of its very fine eolor and the ease with whieh it polishes.

E.-Pr. Nachtr. 195; Pierre 385.

Sindora intermedia Baker. Petir; sapetir.
Borneo.

Wood hard and moderately heavy; light reddish-brown. House building; said to be very durable.

Sindora sumatrana Miq. Sindoer; saparantu; sapetir.
Borneo, Sumatra, Malay Peninsula.

Moderately hard and moderately heavy. Sapwood rather large; heartwood reddish or yellowish-brown, with oceasional lines marked by oil. Said to be quite durable. Used in house eonstruetion. Oil eollected by use of fire.

Van Eed. 108; K. & V. 2:45–47.

Sindora supa Merr. Supa.
Philippines.

Dark brownish-yellow, heavy and hard. Wood used for furniture and eonstruetion. Oil eolleeted as in the preeeding.

Gard. 60; Phil. Woods 393.

Sindora wallichiana Benth. Saputi.
Straits Settlements and Federated Malay States.
Prain in Journ. As. Soc. Beng. 66² (1897) 480–483; Ridl. 140.

Sophora tomentosa L. Ki-koetjing (M.).
Malay Archipelago.

Wood hard and heavy, dark-grayish or purplish, not much used.
K. & V. 2:100.

ERYTHRINA TYPE.

Butea frondosa Roxb. Palas (Sanskrit); Plasa (Java).
India, Burma, Ceylon, Malay Archipelago.

Soft and light, not durable. Gray or gray-brown, white or brown if cut up fresh and quickly seasoned. Durable in water. Boxes.
Gamb. 243; Van Eed. 94; K. & V. 2:72–75.

Erythrina indica Lam. Plate XXIV, fig. 30. Dapdap; dadap.
India to Australia; much planted.

Very soft and easily lacquered. Used for knife sheaths, toys, etc.
Watt Dict. 3:269; Gamb. 242; K. & V. 2:58–61.

Erythrina suberosa Roxb. Pangia (Hind.).
Himalaya.

White, very soft wood, used for sheaths, planks, etc.
Watt Dict. 3:270; Gamb. 241.

OXALIDACEÆ.

Averrhoa carambola L.

Widely cultivated throughout the tropics.

Wood bright-red, hard; used for structural work and furniture.
Watt Dict. 1:359; Van Eed. 54; Janssonius 2:9.

Averrhoa bilimbi L. Blimbing.
Same range as the preceding.

Grayish, soft, little used.
Van Eed. 53; Janssonius 2:13.

Connariopsis spp. Pianggu.
Borneo and the Malay Archipelago.

Small trees with white and moderately soft wood.
Becc. 573; Bargagli-Petrucci 34, *tab. VII.*

LINACEÆ.

Ixonanthes icosandra Jack. Plate XXIV, fig. 33. Pagar anak (M.).
Malay Peninsula.

Hard and heavy, yellowish-brown; used for piling, construction, etc.
Ridl. 95.

ERYTHROXYLACEÆ.

Erythroxylum cuneatum (Wall.) Kurz. (*E. burmanicum* Griff.) Medang; lagundi; chintah; mulah.

Malay Peninsula and Archipelago, Philippines.

Wood heavy and compact, dark-red or brown with distinct but irregular rings; rays very fine and numerous; pores copious and small. A good ordinary building timber.

Ridl. 95.

RUTACEÆ.

Vessels and pith-rays fine; very even-grained woods.

Ægle marmelos (L.) Correa. "Bel fruit tree;" "Bengal quince."

British India and Burma; widely cultivated.

Yellowish-white hard and heavy wood, which has a sharply aromatic odor when fresh; not durable. Seasonal rings marked by distinct lines, and often by a continuous belt of pores. Construction, pestles of oil and sugar mills, naves and other parts of carts, and agricultural implements.

Watt Dict. 1:123; Gamb. 131, *tab. II, fig. 5;* Nörd. IX; Van Eed. 54; Janssonius 2:69.

Atalantia monophylla (L.) Correa.

British India to Tenasserim, Ceylon.

Yellow, very hard and heavy wood, with numerous annular zones marked by bright lines. A boxwood substitute. The wood much resembles that of *Murraya exotica.* Used for engraving, cabinet work, and turning.

E.-Pr. 3[4]:192; Watt Dict. 1:349; Gamb. 129.

Atalantia missionis (Wight) Oliv.

British India and Ceylon.

The moderately hard, yellowish-white wood with distinct seasonal rings is used for furniture and cabinet work.

E.-Pr. 3[4]:192; Watt Dict. 1:349; Gamb. 129.

Chloroxylon swietenia DC. Plate XXIV, fig. 34. East Indian satinwood.

British India and Ceylon.

Hard and very heavy; pale yellow with a satiny sheen when smoothed; very durable. Furniture and picture frames. Used locally for railroad ties and general construction work. With distinct parallel transverse lines on tangential section. (See p. 433.)

Wiesner 2:953; Gamb. 160–162; Nörd. X; Stone 29–31; Van Eed. 67; Brown in Trop. Agric. 19 (1899) 118.

Very similar to the West Indian satinwood (*Fagara flava* (Vahl) Krug & Urb.), which belongs to the same family.

Citrus aurantium L. The orange; limau manis (M.).
British India; cultivated throughout the tropics and subtropics.

Wood yellowish-white. Pores small, scanty, joined by white tangential lines, which occasionally join, forming concentric circles. Used in carving small ornaments.

Gamb. 130; Nörd. IV; also XI (*C. vulgaris* Risso, and *C. nobilis* Lour.); Ridl. 96; Van Eed. 55.

Other species of the genus show similar structure and are similarly used.

Feronia elephantum Correa. "Elephant" or "wood-apple;" kapittha; bilin.
India, Ceylon.

Yellowish-white, hard, structural wood.

E.-Pr. 3[4]:193; Watt Diet. 3:327; Gamb. 131; Nörd. IX.

Flindersia amboinensis Poir.
Moluccas (Ceram).

Produces a good wood for some purposes.

Murraya exotica L. Plate XXIV, fig. 36. Camuning; kamuning (M.).
British India, Burma, Malay Peninsula and Archipelago, Philippines.

Bright-yellow, very hard and very heavy, similar to boxwood and said to be a suitable substitute for it. Used for canes, kris handles and carvings.

Watt Diet. 5:288; Gamb. 125; Ridl. 96; Van Eed. 57; Janssonius 2:51.

Murraya koenigii (L.) Spr.
Himalaya, Bengal, and Ceylon.

Grayish-white, hard, durable wood; serves for agricultural purposes.

Watt Diet. 5:288; Gamb. 126.

Murraya paniculata Jack. Satinwood; cosmetic-bark tree.
British India, Burma, Java, Sumatra, New Guinea.

The bright yellow, firm, durable wood is used for cabinet work.

E.-Pr. 3[4]:188.

Other *Rutaceæ* which may possibly furnish substitutes for boxwood are species of *Micromelum, Limonia, Triphasia, Paramignya, Tetractomia, Fagara* (Plate XXIV, fig. 35), *Melicope, Pelea, Lunasia, Glycosmis,* and *Thoreldora.*

SIMARUBACEÆ.

Ailanthus malabarica DC.
British India and Ceylon.

Wood for dishes and tea chests.

Lewis 307; Janssonius 2:81.

Irvingia malayana Oliv. Plate XXV, fig. 37. Pauh kijang (M.).
Malacca.

A hard, heavy and readily worked wood; very straight-grained.

Pierre 263.

Irvingia oliveri Pierre, of Cochin China, is used for the same things as the above. Other genera needing investigation are *Samadera, Simaruba, Quassia, Eurycoma, Brucea, Picrasma,* and *Soulamea.*

BURSERACEÆ.

Wood soft to moderately hard (*Filicium* very hard). Pores small or moderate-sized, uniformly distributed. Pith-rays fine, distant.

Balanites aegyptica Delile.
Senegambia, through north tropical Africa to India and Burma.

Yellowish-white to golden-brown, beautifully marked, hard, heavy wood; used for furniture and walking sticks.

E.-Pr. 3[4]:355; Watt Dict. 1:363.

Boswellia serrata Roxb. Guggar.
British India.

Wood moderately hard, light or moderately heavy, smooth; sapwood white; heartwood brown (dark greenish-brown), sometimes very small, so that the wood has been described as white; but, when present, rather handsome, often streaked in darker and lighter bands. Pores scanty, moderate-sized, often subdivided and often containing resin. Pith-rays moderately broad, very short, not very numerous. Not very durable. Used for structural work and fuel.

Gamb. 137, *tab. III, fig. 1;* Nörd. VIII.

Bursera serrata Colebr. (*Protium serratum* Engl.)
British India and Burma.

Wood hard, moderately heavy; sapwood light-brown; heartwood red, close-grained. Pores small, uniformly distributed. Pith-rays fine, red, numerous. Used for furniture.

Gamb. 140.

Canarium commune L. Plate XXV, fig. 38. "The Java almond;" pili (Phil.).
Malay Peninsula and Archipelago, cultivated in British India and Ceylon.

Wood soft and light to moderately heavy; grayish-white, soft, smooth; pores moderate-sized, scanty. Pith-rays brown, moderate-sized, not numerous. Light or temporary construction.

Gamb. 141; K. & V. 4:30–33; Van Eed. 60; Janssonius 2:108.
Many other species of *Canarium* are used for light or temporary construction work, as the wood is soft and easily worked.
Lewis 307.

Filicium decipiens Thw.
British India and Ceylon.

Wood very hard and very heavy; heartwood red. Pores small, in groups or short radial lines. Pith-rays fine, numerous, at unequal distances. A strong structural timber.

Gamb. 142.

Garuga pinnata Roxb. Kharpat.
Northwestern India.

The reddish-gray, very heavy, but not durable wood, with darker heart, serves for interior finishing and cabinet work.

Watt Dict. 3:484; Gamb. 138; Nörd. IX; Janssonius 2:87.

Protium javanicum Burm. Trengaloen.
Java.

Hard and heavy; sapwood whitish, small; heartwood reddish-brown, fine-grained. Pores moderate-sized, evenly scattered. Pith-rays very small. A good strong and durable structural timber.

K. & V. 4:22–25; Van Eed. 61; Janssonius 2:93.

Santiria oblongifolia Bl.
Malay Peninsula, Sumatra, Java, Borneo.

Wood grayish, not hard and not very durable; used for temporary construction.

K. & V. 4:26–28.

Trigonochlamys griffithii Hook. f. Kadondong mata hari; kijai; kumpat ruman (M.).
Malay Peninsula.

Wood dark-yellow, red, or yellowish-white, grain medium, fairly hard, heavy; does not split; durable; used in house building.

Ridl. 99.

MELIACEÆ.

Wood usually red, sometimes yellow or gray, more rarely white, sometimes with irregular concentric bands of loose texture. Pores various, rather scanty, generally moderate-sized. Pith-rays usually moderate-sized.

Aglaia. Wood usually red or reddish-brown, hard to very hard and heavy. Seasonal rings often distinct; sometimes ring-porous. Pores small to medium size, often connected by concentric wavy lines of wood parenchyma. Pith-rays fine, numerous, evenly distributed.

Aglaia clarkii Merr. Plate XXV, fig. 39. Tucan-calao.
Philippines.

Hard and heavy, durable. Furniture and structural work.

Phil. Woods 395.

Aglaia eusideroxylon K. & V. Lotong; langsat-loetoeng (Jav.); ijzerhout (Dutch).
Java.

Extremely hard and heavy, aromatic, dark red, durable. Used for house and bridge building.

K. & V. 3:128–132; Van Eed. 62.

Aglaia minahassae Koord. Pisek; malinsot; ijzerhout.
Celebes, Ceram, Saparoea, Haroeka, Noesalant.

Possibly the same as the preceding species; house and bridge building.
Van Eed. 62; Blits 30–32.

Aglaia odorata Lour.
China and the Indo-Malayan region.

A very good wood for cabinet work.

Aglaia pyramidata Hance. (*A. cochinchinensis* Pierre).
Cochin China.

Dark red wood, hard, agreeable odor, durable. Used for planks and furniture.

Pierre 334.

Aglaia roxburghiana Miq.
Java, Sumatra, Moluccas, Ceylon, Burma.

Hard and very heavy, bright red. Used for spokes.
Van Eed. 63; K. & V. 3:147; Gamb. 149.

Amoora. Wood hard, close-grained, red, with a darker-colored heartwood. Pores small to large, often subdivided, visible or prominent on vertical section. Pith-rays moderately broad, uniform.

Amoora aherniana Merr. Plate XXV, fig. 40. Cato.
Philippines.

Dark red; very hard and very heavy. Used for structural work. Vessels with whitish diaphragms or deposits which show very plainly on the longitudinal section. Occasional dark-red deposits in vessels.

Amoora cucullata Roxb.
Indo-Malayan region.

Red, hard, heavy wood. Pores joined by narrow concentric lines of wood parenchyma.

Pierre 344; Gamb. 151; Watt Dict. 1:224.

Aphanomyxis grandifolia Bl. (*Amoora aphanomyxis* R. & S.). Goela (Jav.).
Java, Banka, Timor, Malay Peninsula.

Wood moderately hard and heavy, pale red, not durable, does not split readily. Not much used.
Van Eed. 63 K. & V. 3:119–123.

Aphanomyxis rohituka (Roxb.) Pierre.
Indo-Malayan region.

Red, hard, and heavy wood, with concentric bands in cross-section. Boat building.

Watt Dict. 1:224; Pierre 344.

Azadirachta indica A. Juss. Neem; "margosa tree;" "margosier."
India and Ceylon, Malaya; also in east Africa. Often planted.

The mahogany-like, very hard and resistant, strongly scented wood is used by carriage makers, carpenters and joiners, and also in ship-building.

E.-Pr. 3[4]:288; Watt Dict. 5:221; Van Eed. 71; K. & V. 3:21–24.

Chisocheton. Wood moderately hard or soft, light. Pith-rays distinct; vessels of medium size or large, often divided; wood parenchyma in very regular concentric lines.

Chisocheton philippinus Harms. Malatumbaga.
Philippines.

Not durable and not much used.

Chisocheton divergens Bl. Garonton tangah (M.).
Malay Peninsula.
Ridl. 100.

Chukrassia (Chickrassia) tabularis A. Juss. "Bastard cedar;" "East Indian mahogany;" "white cedar;" "Indian redwood;" "Chittagong wood."
British India to southern China; widely distributed.

Hard and heavy, yellowish to reddish-brown, with a beautiful satiny luster. Seasons and works well. Sapwood of a lighter color. Pores scanty, moderate-sized, often oval and subdivided, isolated, uniformly distributed. Pith-rays fine, uniform, mostly equidistant, slightly undulating, distance between the rays generally equal to the transverse diameter of the pores. Seasonal rings distinctly marked by a sharp line. Fine silver grain with a satiny luster. Like *Soymida,* it is difficult to plane owing to the fibers running in different directions. Used in making fine furniture.

Gamb. 156; Nörd. X; E.-Pr. 3[4]:273; Watt Dict. 2:268; Semler 631; Ridl. 101; Pierre 357.
(See p. 430.)

Cipadessa fruticosa Bl.
India, Ceylon, Java.

Wood red, hard, heavy, with a faint odor resembling that of *toon* wood. Pores prominent as red lines on a vertical section. Seasonal rings marked by a white line.

Gamb. 146.

Dysoxylum. Wood reddish, rough, moderately hard. Pores prominent on a vertical section, moderate-sized to large, often subdivided, or in short strings. Pith-rays fine. Concentric lines in some species fairly prominent.

Dysoxylum amooroides Miq.
New Guinea, Java.

Wood for matches.

Wiesner 2:96; Janssonius 2:153.

Dysoxylum binectariferum Hook. f.
British India and Ceylon.
Gamb. 147; Nörd. IX.

Dysoxylum hamiltonii Hiern.
British India.

Used for planks and for small boats.

Gamb. 148, *tab. III, fig. 3;* Nörd. X.

Dysoxylum turczaninowii C. DC. Agaru.
Philippines.

A very ornamental wood known as *agaru* is furnished by this and other species of the genus and possibly also by some species of *Chisocheton*. The wood is light-colored, fine-grained, hard and moderately heavy and takes a beautiful finish like that of satinwood. Used for fine furniture and frequently found in the Manila market.

Epicharis loureiri Pierre (*Dysoxylum loureiri* Pierre). Huynduong or "sandal."
Cochin China, Province of Thu-dau-mot.

A very fine wood for the construction of coffins, knicknacks, and wood carving, also ground up into a powder and used in pharmacy. The wood has an odor resembling that of sandalwood and it is used as a substitute for sandalwood in incense, etc.

Jumelle 338; Pierre 352.

Lepidaglaia bailloni Pierre (*Dysoxylum bailloni* Pierre).
Burma and Indo-China.

Carriage work and turnery. Sometimes sold as sandalwood.

Pierre 352; Wiesner 2:910.

Melia azedarach L. "Persian lilac;" "bead tree;" "lilac des Indes;" "sykemore;" "Laurier grec."
Much cultivated in the warmer parts of the whole world.

Sapwood yellowish-white, heartwood reddish, very easily polished and worked; serves mainly for furniture.

K. & V. 3:12–17; Watt Dict. 5:223; Gamb. 144; Nörd. VI; Hough Amer. Woods 5:105; Janssonius 2:128; Stone 31; Van Eed. 71.

Melia dubia Cav. "White cedar."
East Indies.

Reddish heart; soft and light wood. Structural work and the making of shelves and tea-chests.

Watt Dict. 5:223; Lewis 308.

Melia indica Brandis.
British India and Burma.
Gamb. 143, *tab. III, fig. 2;* Nörd. V (*M. azedarach*); Stone 31.

Pseudocarapa championii Hemsl.
Ceylon.

Wood very much like that of *Amoora*.

E.-Pr. 3[4]:297.

Sandoricum indicum Cav. Plate XXV, fig. 42. Santol; "wild mangosteen."
Indo-Malayan region, Mauritius.

Sapwood gray; heartwood red, moderately hard, close grained. Takes a beautiful polish. Pores small, oval or subdivided. Pith-rays fine, undulating, not prominent. Wood with a faint camphor-like odor when fresh. Easily worked; suitable for the making of models.

Gamb. 149; Watt Dict. 6[2]:458; Phil. Woods 392; Van Eed. 72; K. & V. 3:27–30; Janssonius 2:131; Becc. 574; Pierre 353.

Sandoricum vidalii Merr. Malasantol.
Philippines.

Wood harder and heavier than the preceding. Sapwood white or pinkish; heartwood brownish-red. Used for general construction purposes, small boats, roof timbers, etc.

Gard. 60; Phil. Woods 388.

Soymida febrifuga A. Juss. "Bastard cedar;" "redwood de Coromandel;" "Indian redwood;" "East Indian mahogany;" rohan.
India and Ceylon.

Sapwood small, whitish; heartwood extremely hard and close-grained, very dark, red-brown, very durable, with numerous fine, concentric lines of lighter color, often closely packed. Pores moderate-sized, scanty. Pith-rays moderately broad, distinctly visible on a radial section as dark shining plates, making, with the sections of the dark pores, a very pretty silver grain having a satiny luster. Wood somewhat cross-grained, like *sál* and some others, owing to the fibers in different vertical layers going in different directions, so that it is difficult to plane. Very hard and heavy. Fine furniture, etc., wood carving in temples.

Watt Dict. 6[3]:318; E.-Pr. 3[4]:272; Gamb. 155.
(See p. 430.)

Sphaerosacme spectabilis Wall. (*Amoora wallichii* King; *A. spectabilis* Miq.?).
Eastern Assam and Burma.

The reddish, hard, durable, very readily polished wood is worked up into boats and furniture.

Gamb. 151; Watt Dict. 1:225.

Swietenia mahagoni L. Mahogani; acajou.
West Indies and Central America; also planted and doing well in India.

Hard and heavy; bright or dark cinnamon-brown to reddish-brown, either uniform in color or well marked. Parallel transverse lines very prominent in longitudinal section. Principal uses, furniture and cabinet work. (See p. 430.)

Wiesner 2:959; Gamb. 153–155; Stevenson 225–239; Stone 32.

Swietenia macrophylla King.
Introduced from the West Indies. Grows well in cultivation in this part of the world.

Wood moderately hard and moderately heavy.

Gamb. 155.

Toona. Wood pale reddish, light and soft, ring porous and with distinct cedary odor.

Toona serrata (Royle) Roemer (*Cedrela serrata* Royle). "Toon tree;" "Indian mahogany;" "Moulmein cedar;" "cedre rouge;" "cedre de Singapore."
India.

Light, shining, soft but durable; termite proof. A very valuable wood, used for furniture, framing, wood carving, tea-chests, cigar boxes.

Watt Dict. 2:232; Lewis 307; Gamb. 160, *tab. III, fig. 6* (*Cedrela serrata* Royle); Nörd. IX (*Cedrela serrata* Royle); Van Eed. 66; K. & V. 3:204–207; Stone 37; Holtzapffel 108.

Toona ciliata Roem. (*Cedrela toona* Roxb.). Toon; "Moulmein cedar;" "Indian mahogany."
British India and Burma.

Wood durable, termite proof, and used for all kinds of furniture.

Gamb. 157–159, *tab. III, fig. 5;* Nörd. IV; Stone 37; Watt Dict. 2:233.

Toona febrifuga (Bl.) Harms (*Cedrela febrifuga* Bl.). Soeren.
Burma, Cochin China, Java, etc.

Structure and uses much the same as in the preceding.

Van Eed. 65; K. & V. 3:197–204; Pierre 358.

Toona calantas Merr. & Rolfe. Plate XXV, fig. 41. Calantas.
Philippines.
Phil. Woods 379; Gard. 61–62.

Very much like *Toona febrifuga* (Bl.) Roem.

Several other closely related species of the genus are found in the range and their use and structure is much the same as that indicated for the species named. The genus is very closely allied to the American *Cedrela*.

Xylocarpus. Wood dark, red, hard and heavy. Concentric lines of wood parenchyma seeming to mark regions of growth. Pores medium-sized to small, scattered. Pith-rays fine.

Xylocarpus obovatus A. Juss. (*Carapa obovata* Bl.) Nigue; nigi; tabigue (Phil.); niri; nireh (M.).

East Africa to the Fiji Islands, in mangrove swamps.

Wood very fine-grained and durable. Finishes well and is often used for fine furniture. It shrinks very little and is often made into furniture while still very fresh; used also for sandals. An excellent firewood.

Becc. 574; Gamb. 153; Ridl. 100; K. & V. 3:189–193; Van Eed. 64; Pierre 358; Bargagli-Petrucci 37.

Xylocarpus granatum Koen. (*Carapa moluccensis* Lam.) Plate XXV, fig. 43. Piagao (Phil.); niri (M.).

Same distribution as the preceding.

Wood darker than that of *X. obovatus*. Used for piling, furniture, sandals, etc.

Gamb. 153; Watt Dict. 2:142; Van Eed. 63; K. & V. 3:193–196; Pierre 359.

A third species, *X. borneensis* (Becc.), is found in Borneo and the Philippines. It is very much like *X. granatum* and is used for the same purposes.

Becc. 574; Bargagli-Petrucci 38.

POLYGALACEÆ.

Xanthophyllum. White or yellow, moderately hard and moderately heavy, fine-grained woods.

Xanthophyllum vitellinum Nees. Kitelor.

Java.

Very durable wood.

K. & V. 5:294–298; Janssonius 1:238.

EUPHORBIACEÆ.

The wood of the trees of this order has no very marked general distinguishing characteristic; but still it may be said that it is noticeable for the pores being usually more scanty than in many other orders. In some genera they are characteristically arranged in short radial lines. In almost all genera the pith-rays are fine, close and uniform; in some they are very indistinct. In other genera transverse ladder-like bars are conspicuous. In respect to color, there are three classes, the white or gray, the red, and the brown or grayish-brown. In respect to weight, some are very light, most moderately so, few or none very heavy. Among white-wooded genera the most noticeable are:

(1) Soft woods: *Euphorbia, Jatropha, Givotia, Ostodes, Trewia, Sapium, Excoecaria.* Of these *Givotia* and *Trewia* show transverse bars;

Excoecaria rather numerous and *Euphorbia, Sapium* and *Jatropha* very few pores.

(2) Moderately hard woods: *Sarcococca, Daphniphyllum, Cyclostemon, Croton.* Of these *Daphniphyllum* has numerous and *Croton* very few pores, while *Croton* and *Cyclostemon* show transverse bars.

(3) Hard woods: *Hemicyclia, Lasiococca* and *Gelonium. Hemicyclia* has conspicuous, *Lasiococca* and *Gelonium* faint transverse bars.

The red-wooded genera are fairly uniform in their structure, so that *Phyllanthus, Glochidion,* and *Cleistanthus* are characterized by pores in short radial strings between regular numerous fine pith-rays. *Fluggea* has a harder close-grained wood, and *Bischofia* has rough open-grained wood with rather broad pith-rays.

In the genera with brown or grayish- or olive-brown wood, *Macaranga* is very soft, *Mallotus* pale-colored and rather soft, *Bridelia* has a hard wood of characteristic appearance, and *Putranjiva* and *Baccaurea* present transverse bars, the latter wood being lighter and softer.

The better known genera can be roughly placed in synoptical form as follows:

a. White or gray woods.
- *b.* Soft or very soft: *Euphorbia, Jatropha, Givotia, Ostodes, Trewia, Sapium, Excoccaria, Mallotus.*
- *bb.* Moderately hard: *Sarcococca, Daphniphyllum, Cyclostemon, Croton, Baccaurea, Mallotus.*
- *bbb.* Hard: *Hemicyclia, Lasiococca, Gelonium.*

aa. Red.
- *b.* Soft: *Macaranga.*
- *bb.* Moderately hard: *Glochidion, Bischofia, Mischodon, Chactocarpus, Aporosa, Macaranga.*
- *bbb.* Hard: *Phyllanthus, Cleistanthus, Fluggea, Antidesma, Mallotus.*

aaa. Brown or grayish-brown.
- *b.* Soft: *Baccaurea, Macaranga.*
- *bb.* Moderately hard or hard: *Mallotus, Bridelia, Putranjiva, Aporosa, Daphniphyllum, Cyclostemon.*

Although no member of the family is of very great importance as a timber tree, it may be worth while to indicate the better known species.

Aleurites moluccana (L.) Willd. Lumbang (Phil.); belgaum; "Indian walnut;" "candle-nut."

Tropical and subtropical regions of the world, the Antilles, Brazil, and widely distributed in cultivation.

Wood gray and soft. Used for tea-chests.

Lewis 310.

Antidesma bunius Spr. Bras-bras hitam (M.); boeni (Jav.).
British India, Ceylon, Java, and Malaya.

Wood red, hard, similar to that of *A. ghaesembilla*. Used for beams, rafters and the like, but not durable if exposed to the weather.

Ridl. 250; Gamb. 610; Van Eed. 219.

Antidesma ghaesembilla Gaertn. Baniyuyo (Phil.); kasumba (M.); horroe-batoe (Jav.).
Same range as preceding.

Wood red, with darker-colored heartwood, smooth, hard, close and even-grained. Seasonal rings indistinetly marked by eoncentrie lines. Pores small and moderate-sized, uniformly distributed. Pith-rays of two sizes, few moderately broad rays with numerous fine rays between them. Interior work, not a durable wood.

Gamb. 610; Ridl. 250; Van Eed. 220.

The different species of *Antidesma* are hard, usually red, smooth, apt to split and warp and not durable.

Aporosa dioica (Roxb.) Muell. Arg.
British India and Burma.

A very hard wood with dark-brown heart and white sapwood. Used for tool handles.

Watt Dict. 1:278.

Other species of *Aporosa* furnish good wood of brown or reddish color, but the pieces are usually of small size.

Baccaurea sapida Muell. Arg.
British India, Burma, Andaman Islands.

Wood grayish-brown, soft, with transverse lines of wood parenehyma very numerous. Pores small, in short radial lines. Pith-rays moderately broad to broad, the distance between the rays being from one to three times the transverse diameter of the pores. Easily worked and fairly durable.

Gamb. 611.

The timber of other species is also good and varies in color from light yellowish-white to dark-brown.

Ridl. 251; Van Eed. 220.

Bischofia trifoliata (Roxb.) Hook. (*B. javanica* Bl.). Plate XXV, fig. 44. Toog (Phil.); gadok (Sumatra).
Tropical Asia, Malay Archipelago, Pacific Islands.

Red, coarse-grained, moderately hard wood, with strong scent of vinegar when first cut. Used for structural work and bridges. It is elaimed that although it warps and craeks and is attacked by white ants when used above ground, it is almost imperishable in wet ground or under water, so that it is partieularly fitted for pile foundations and railway sleepers.

Gamb. 607, *tab. XII, fig. 5;* Nörd. X; Van Eed. 221; Watt Dict. 1:454.

Bridelia retusa (L.) Spreng.
British India, Burma, and Ceylon.

Wood moderately hard to hard, gray to olive-brown, close-grained, seasons well. Seasonal rings marked by pale lines. Used for cattle-yokes, agricultural implements, carts and building; stands well under water.

Gamb. 595; Watt Dict. 1:536.
Other species are used, whenever they are of sufficient size.
Ridl. 248.

Chaetocarpus castanicarpus (Roxb.) Thw.
East Indies, Malay region.

A bright red, moderately hard, structural wood.

Gamb. 623; Watt Dict. 2:262.

Claoxylon sp.
East Indies.

Furnishes the "bois cassant."

Wiesner 2:98.

Cleistanthus collinus Benth.
British India and Ceylon.

Wood dark reddish-brown, tough, hard, close-grained, heartwood small. Produces very durable house posts.

Gamb. 597, *tab. XII, fig. 4*; Nörd. IX (*Lebedieropsis orbicularis*).

Cyclostemon griffithii Hook. f.
British India and Burma.

Wood light brown, hard. A durable timber for local use.

Gamb. 606.

Excoecaria agallocha L. Buta-buta (M.).
Tidal forests, Ceylon to the Philippines and Australia.

Soft and white wood, which is used for some kinds of furniture and toys. (See p. 431.)

Gamb. 626; Watt Dict. 3:306; Ridl. 253; Beec. 583.

Givotia rottleriformis Griff.
British India and Ceylon.

Wood white, exceedingly light, very soft but even-grained. Used for catamarans and cabinet work.

Gamb. 615; Watt Dict. 3:503.

Glochidion acuminatum Muell. Arg.
British India.

Wood red or reddish-gray, hard. Splits badly.

Gamb. 602; Nörd. X (*Phyllanthus bicolor*).
Other species of *Glochidion* are used when large enough and are fairly durable
Ridl. 249; Van Eed. 223.

Hemicyclia sepiaria W. & A.
British India and Ceylon.

Wood white with a grayish-brown heartwood, very elose and even-grained, resembling boxwood. Recommended as a possible substitute for boxwood.

Gamb. 605.

Lasiococca symphylliaefolia Hook. f.
British India.

Wood yellowish-white, hard, smooth, elose-grained. Recommended for trial as a substitute for boxwood.

Gamb. 622.

Mischodon zeylanicus Thw.
Ceylon.

Wood pink or pinkish-white, moderately hard, elose- and even-grained. Used for building and said to be durable in water.

Gamb. 607.

Phyllanthus emblica L. Amlabaum; mirobalanenbaum.
Mascarenes, East Indies, Sunda Islands, China, Japan, also cultivated.

Wood red, hard, elose-grained, warps and splits in seasoning; no heartwood. Carrying poles, agrieultural implements, building and furniture; durable under water.

Gamb. 599, *tab. XIII, fig. 3;* Nörd. X; Watt Dict. 6^1:221; Van Eed. 227.

Several other species of *Phyllanthus* furnish small amounts of wood resembling the preceding.

Putranjiva roxburghii Wall.
British India, Burma, and Ceylon.

Wood gray, moderately hard, close-grained. A struetural wood, also used in turning.

Gamb. 604; Nörd. X; Van Eed. 228; Watt Dict. 6^1:372.

Sapium sebiferum Roxb.
China, Japan, East Indies, cultivated in the tropics everywhere.

Wood white, moderately hard. Furniture and toys.

Gamb. 625; Nörd. VIII; Watt Dict. 6^2:472.

Trewia nudiflora L.
British India, Burma and Ceylon, to the Sunda Islands.

Wood white, soft, not durable. Used for native drums and agrieultural implements.

Gamb. 617; Watt Dict. 4:76; Van Eed. 228.

BUXACEÆ.

The most uniform in grain of any known wood, planing almost equally well in any direetion. Very hard and very heavy (sp. gr. 0.99–0.86). The best qualities of boxwood are the best known for wood engraving, drawing instruments, etc. The sawdust is very free from gritty matter, and on that account it is much used for cleaning jewelry. Numerous

attempts have been made to find a suitable substitute for this wood, but, thus far, unsuccessfully. (See article on boxwood substitutes, p. 426.)

Buxus sempervirens L. Boxwood.
India and western Asia to the Mediterranean region.
Stone 102; Wiesner 2:962; Gamb. 592–594; Nörd. II, also Mech. Eigensch. Hölzer 514.

ANACARDIACEÆ.

The woods of this family are very variable as to color, weight, and hardness. *Pistacia,* some species of *Rhus, Gluta, Melanorrhoea, Odina,* and *Drimycarpus* have hard woods, red or yellow; those of *Semecarpus, Mangifera, Spondias, Holigarna,* and *Buchanania* are more or less soft, and light-gray or brown. In some, the pith-rays are numerous, in others scanty, but the chief general character is that of large pores which are scanty and prominent on vertical section, and pith-rays soft, dark and inconspicuous. Concentric lines occur in some species.

Anacardium occidentale L. "Cashew nut;" "acajoubaum;" "acajou a fruits;" "acajou a pommes;" "acajou de Guadeloupe."
South America; cultivated in all tropical regions.

Red, moderately hard wood. Boats and tea-chests.

Watt Dict. 1:223; Ridl. 108; Gamb. 214.

Bouea burmanica Griff. Rauminiya.
Burma and Malaya.

Light-colored sapwood, dark-reddish heartwood, sometimes dark-brown; rings distinct, pores small, few, scattered; concentric lines numerous, wavy, distinct. Durable and very heavy; posts and beams.

Ridl. 107; Gamb. 214; Pierre 366.

Bouea macrophylla Griff. Kadongan.
Malaya.

Wood yellowish-white, becoming brown toward its center. Moderately hard; does not split in drying. Kris scabbards.

Ridl. 107.

Buchanania florida var. **arborescens** Engl. Balinhasay (Phil.).
Philippines and the Malay Archipelago.

Moderately hard and moderately heavy, pale-reddish; rather fine but not straight-grained. Light or temporary construction; not durable. Often substituted for the wood of *Koordersiodendron,* to which it is much inferior.

Phil. Woods 374; Pierre 371.

Buchanania latifolia Roxb.
India, Burma, Malacca.

Brownish-gray, moderately hard, not durable. Used for boxes, tables, etc.

Watt Dict. 1:545; Gamb. 216.
Other species of *Buchanania* are used, but none of them furnish very high grade wood.

Campnosperma zeylanicum Thw.
Ceylon.

A light and rather inferior wood, used for tea-chests.

Lewis 309.

Campnosperma wallichii King. Terungtang.
Malay Peninsula.

Wood soft, rather light silvery-gray or white, fine-grained. Pores rather large and numerous. Pith-rays fine and brown, obscure. Suitable for some grades of cabinet work.

Ridl. 111.

Dracontomelum mangiferum Bl. Daoe, dahoe (Sumatra); raoe (Java).
Borneo, Celebes, Sumatra, Java, Burma, Malay Peninsula, Andaman Islands.

Wood dark-gray, moderately hard and moderately heavy; fairly durable.

Gard. 69; Van Eed. 85; K. & V. 4:114–117; Pierre 374.

Dracontomelum cumingianum Baill., known as *lamio*, and *Dracontomelum dao* Merr. & Rolfe, of the Philippines, have wood which is practically indistinguishable from that of *D. mangiferum*.

Drimycarpus racemosus Hook. f.
Eastern Himalaya.

Wood yellowish-gray, hard. Much prized for shipbuilding in India (Chittagong).

Gamb. 221; Watt Dict. 3:195.

Gluta. Wood dark-red and more or less streaked with orange and black. Pores few, often filled with resin, large, prominent on vertical sections. Pith-rays very fine. Interrupted, very narrow, undulating, concentric bands. Structure of the wood in this genus much the same as in *Melanorrhoea* and *Swintonia*.

Gluta renghas L. Renghas (M.).
Malay Archipelago and Peninsula.

Wood with decidedly irritant properties. House building, boats, furniture, sheaths of weapons.

Van Eed. 86; Ridl. 110; K. & V. 4:94–97; Wiesner 2:1017.

Gluta tavoyana Wall. and *G. travancorica* Bedd. of British India and Burma and *G. velutina* Bl. (*G. coaretata* Hook.) of Malacca, Banka and Sumatra are all said to furnish wood much like that of *G. renghas* and used for structural work and furniture. *G. velutina* is said to be resistant to termites and to sea water.

Pierre 368.

Holigarna. Wood soft, grayish. Pores large, prominent on vertical section. Pith-rays very fine, short.

Holigarna arnottiana Hook. f.
British India.

Wood containing a poisonous gum. Used for house and boat building.

Gamb. 221.

Koordersiodendron pinnatum (Blanco) Merr. (*Helicteres pinnata* Blanco). Plate XXV, fig. 45. Amuguis (Phil.).

Philippines, Celebes, and New Guinea.

Wood moderately hard, and heavy, fine-grained, dark-red. Much in demand for construction and cabinet work.

Phil. Woods 371; Gard. 62.

Lannea grandis (Dennst.) Engl. (*Calesiam grandis* O. Ktze; *Odina wodier* Roxb.). Kiamil (Hind.); wodier (Tam.); nabhay (Burm.); hik (Cingh.).

India, Ceylon, Burma.

A generally useful wood, which is not to be distinguished from that of *Koordersiodendron*.

Watt Dict. 5:445; Ridl. 108; Van Eed. 88; Gamb. 218–220, *tab. V, fig. 6;* Nörd. IX; Pierre 375.

Mangifera. No heartwood, grayish to brownish in color. Pores large, prominent on a vertical section. Pith-rays fine, generally closely packed. Occasionally fine, wavy, concentric lines.

Mangifera indica L. The mango.

British India, Burma, Ceylon and Malaya; widely cultivated.

Planking, doors and window frames, packing cases, canoes. Other species of *Mangifera* are used in much the same way.

Gamb. 111–114; Nörd. V; Ridl. 108; Watt Dict. 5:146–157; Van Eed. 87; K. & V. 4:75–93; Lewis 309; Pierre 361.

Melanochyla spp.

Various fairly good woods of the Malay Peninsula and Borneo, which are usually of rather small size and not in great quantity.

Becc. 575; Ridl. 110; Bargagli-Petrucci 40.

Melanorrhoea. (Plate XXV, fig. 46.) Wood dark-red, with yellowish streaks, turning very dark after long exposure, very hard and heavy. Pores moderate-sized, scanty, often subdivided, each pore or group of pores inclosed in a small patch of light tissue. Pith-rays very fine, wavy, very numerous. Numerous undulating, often interrupted, very narrow, concentric lines of soft tissue, unequally distributed in the wood. Contains a poisonous gum, which may even affect a person after the wood is made up into furniture.

Melanorrhoea maingayi Hook. f. Rengas manau (M.); "Straits mahogany."

Malay Peninsula, Sumatra, and Borneo.

Beams and furniture.

Ridl. 109.

Melanorrhoea usitata Wall. "Black varnish tree," thitsi (Burm.).

British India.

Tool handles, anchor stocks, building, railway sleepers, gunstocks.

Gamb. 217, *tab. V, fig. 5;* Nörd. VIII; Watt Dict. 5:210; Pierre 367.

Several other species occur in the Malay region and are known by the name of *ringas* (Becc. 575), or "Borneo rosewood." Their uses are

like those given above. Their poisonous properties have occasioned so much inconvenience that the wood is gradually going out of use. Where this wood is used, it is customary to fell it and then to leave it in the jungle until the beetles, termites, etc., have completely destroyed the sapwood.

Pistacia integerrima J. L. Stewart.
British India.

Wood very hard; sapwood white; heartwood yellowish-brown, beautifully mottled with yellow and dark veins. Seasonal rings marked by a belt of large pores. Pores in the rest of the wood very small, forming irregular patches, which are frequently arranged in zigzag lines. Pith-rays fine, very numerous. Used for furniture, carvings and all kinds of ornamental work.

Gamb. 210, *tab. V, fig. 4;* Nörd. X.

Rhus. Wood gray, often streaked, with a yellow or brown heartwood. Pores small, but often large and in continuous porous belts in the earlier-formed wood. Pith-rays fine and moderately broad.

Several species occur scattered in the highlands through this range; but they are of little importance commercially because of their small size and scattered occurrence.

Semecarpus. Wood usually of poor quality. Used locally for light or temporary construction. The wood has poisonous properties, like *Melanorrhoea, Swintonia, Gluta,* etc., which interfere with its usefulness.

(See p. 431.)
Gamb. 220; K. & V. 4:122–230; Van Eed. 90; Lewis 309.

Swintonia. Wood much like that of *Melanorrhoea,* but not so prominently streaked. Usually a more even, reddish or whitish color. Equally poisonous. Large trees in the Malay Peninsula, but reaching their best development in Borneo.

AQUIFOLIACEÆ.

Ilex spp. Numerous species of this genus occur throughout the orient, but they are usually of small size and not of any very general usefulness. Wood fine-grained, white, hard.

CELASTRACEÆ.

Wood compact, even-grained, white. Pores very or extremely small. Pith-rays very fine and very numerous.

Euonymus hamiltoniana Wall.
Northern India, central Asia, Japan.

The yellowish-white, soft wood is used in India for wood carving.

Watt Dict. 3:292.

Euonymus crenulata Wall.
Southern India.

The white, very hard wood is considered in its native country the best substitute for box.

Watt Dict. 3:291.

Kurrimia robusta Kurz.
Cochin China.

The wood, with a structure similar to that of *Dalbergia* spp., produces excellent material for cabinet work.

Kokoona zeylanica Thw.
Ceylon.

Wood for tea chests.

Lewis 309.

Cassine glauca (Pers.) O. Ktze.
Tropical Asia.

Clear-brown to reddish, often beautifully marked, moderately hard, readily polished wood for framing and cabinet work.

Watt Dict. 3:207.

Lophopetalum. Wood light, soft to moderately hard, even-grained, somewhat shining. Pores small to moderate-sized. Pith-rays very fine, very numerous. Concentric very narrow dark lines of wood parenchyma, prominent, interrupted, wavy.

Lophopetalum wightianum Arn.
British India, Cochin China.

Reddish-gray, moderately hard, close-grained. Pores large, usually subdivided, sometimes in short strings. Pith-rays fine, conspicuously bent around the pores when they meet them. Parallel narrow concentric lines prominent. House building.

Gamb. 174; Nörd. X; Pierre 307.

Gymnosporia. Wood close- and even-grained. Pores small or very small. Pith-rays fine and very numerous. Concentric bands prominent in most species, caused by variations in the size of the wood cells, some of the cells being filled with a dark resin-like substance.

Gymnosporia montana Lawson (*Celastrus senegalensis* Lam.).
British India.

Light-reddish-brown, soft, close-grained, durable.

Gamb. 177; Nörd. XI.

ICACINACEÆ.

Gonocaryum sp. Swamp trees of the forests of Burma.

Urandra apicalis Thw.
Ceylon.

Wood used for tea-chests.

Lewis 309.

Urandra sp. Plate XXV, fig. 47. Bedaru, pedaro (Sarawak); daru, daroo-daroo (M.).

Sarawak.

Wood hard and heavy, fine- and straight-grained. Sapwood narrow, yellowish; heartwood somewhat darker. Pores moderate-sized, narrowly fringed and containing glistening deposits. Pith-rays medium-sized, whitish, very distinct, giving fine grain in quartered material. This wood is very durable, works readily and is used for canes, furniture and piling. It has a very distinct and pleasing odor. This wood is to be found in some quantity in the markets at Singapore and is said to come from Sumatra as well as Borneo. Newton credited it to *Apodytes*, another genus of this family, and later it was considered one of the *Sapotaceae*. (See p. 542.) I collected herbarium material and wood samples from a tree of this in Sarawak and later obtained material of the same wood from dealers in Singapore. My flowering material was not mature and I could not be sure of the genus until I received good flowering material from Mr. J. C. Moulton, curator of the museum at Kuching. This material establishes the fact that the plant belongs to the genus *Urandra* and probably to an undescribed species.

Newton 2; Ridl. 214; Beec. 584.

ACERACEÆ.

Wood moderately hard and close-grained; no heartwood; white or yellowish. Pores small and very small, uniformly distributed. Pith-rays fine and very fine, often of two sizes. Concentric medullary patches frequent. Usually in the high mountains. Not of commercial importance in this region.

SAPINDACEÆ.

Wood generally soft or moderately hard, occasionally very hard, even-grained. Pores small or very small, generally uniform and uniformly distributed. Pith-rays very fine or fine, rarely moderately broad, often closely packed. Concentric bands occur in *Sapindus* and some other genera but not in all.

Aphania montana Bl.

Java.

Used in house building, etc.

K. & V. 9:158–160.

Aphania paucijuga Radlk. Pukan jantan; mumpilai klat; tulang putih (M.).

Malay Peninsula.

Wood hard and heavy, flexible. Used in house building, for posts, etc.

Ridl. 106.

Arytera littoralis Bl. Kulu layo hitam (M.).
Malay Peninsula and Archipelago to the Philippines.

Wood pale, reddish-white, moderately heavy and hard, rings fairly distinct and remote; pores numerous; small rays obscure. Used in house building.

Ridl. 106; K. & V. 9:216–220.

Dittelasma rarak Hook. f. (*Sapindus rarak* DC.) Lerek (Jav.).
Malacca, Cochin China, Philippines.

Hard and heavy, durable. Used for house building.

Van Eed. 77; K. & V. 9:150–152.

Dodonaea viscosa L. Plate XXV, fig. 48. Banderu.
In all tropical lands.

Sapwood white; heartwood dark brown, extremely hard and very heavy, called "lignum-vitæ" in Australia. Used for turnery, wood carving, walking sticks.

Ridl. 106; Gamb. 202; K. & V. 9:227–230; Van Eed. 78.

Ellatostachys verrucosa Radlk.
Java, Timor, Celebes, Philippines.

Moderately hard and moderately heavy.

K. & V. 9:212–215.

Erioglossum rubiginosum Bl. (*E. edule* Bl.). Mertajam; kelat layu (M.).
Malay Peninsula and Archipelago to Australia.

Wood reddish-white to chocolate-brown, grain fine, hard, does not split in drying.

E.-Pr. 3[5]:300; Ridl. 104; Van Eed. 78; Gamb. 192; K. & V. 9:154–157.

Euphoria cinerea Radlk. Plate XXVI, fig. 49.
Philippines.

Dark-red, hard and heavy, durable. A very choice structural wood, much like some of the wood of species of *Nephelium*.

Phil. Woods 371.

Ganophyllum falcatum Bl.
Philippines, Java, New Guinea, Australia.

Excellent wood for matches and match boxes.

Van Eed. 78; K. & V. 9:231–234.

Guioa pubescens Radlk. Sugi-sugi; Nilan (M.).
Malay Peninsula.

Wood heavy and hard, light-brown, pores small, not numerous, rays fairly fine, concentric lines rather distant and broad, undulating. Brittle, used in building.

Ridl. 106; K. & V. 9:210.

Harpullia cupanioides Roxb. Kajoe-kaleh (M.).
Burma, Andaman Islands, Malacca, Sumatra, Java, Borneo, New Guinea.

Wood white, soft. Pores moderate-sized, seanty, in whitish patehes. Pith-rays fine, numerous.

Gamb. 199; Van Eed. 78; K. & V. **9**:239–242.

Harpullia imbricata Thw.
Java.
K. & V. **9**:236–239.

Litchi chinensis Sonn. (*Nephelium litchi* Cambess.) Litchi.
China, India; widely cultivated.

Wood nearly indestruetible; used in carriage building and for eabinet work.

Wiesner **2**:104; Gamb. 198; Nörd. V (*Euphorbia litchi*); Van Eed. 79.

Litchi philippinensis Radlk.
Philippines.

A rather rare wood much like the last.

Nephelium. Wood red, hard; prominent wavy eoncentrie bands.

Nephelium lappaceum L. Rambutan (M.).
Malay Peninsula and Archipelago.

Wood hard and heavy, red when fresh cut, beeoming dirty-reddish-white or whitish-brown; pores large, seattered, surrounded by patehes of lighter-eolored softer tissue; pith-rays very fine and obseure, concentric rings broken up into short wavy pieees. Apt to split in drying, but eonsidered good for planks, beams, and other hard work, for water wheels, riee mills, stampers, ete.

Van Eed. 79; Ridl. 104; K. & V. **9**:186–188; Pierre 319.

Nephelium longana Cambess. (*Euphoria longana* Lam.). Longan.
British India, Ceylon, Malay Peninsula and Archipelago.

A very hard and heavy red wood, much used for struetural work and furniture.

Watt Dict. **5**:348; Gamb. 197; Nörd. IX (*Euphoria longana*); Van Eed. 80; Pierre 318.

Nephelium mutabile Bl. Pulasan (M.).
Malay Peninsula, Sumatra, Java, Philippines.

Wood harder and heavier than that of *N. lappaceum*.

Ridl. 105; Van Eed. 80; K. & V. **9**:192.

Other speeies of *Nephelium* are also used. The wood of *Euphoria, Nephelium, Litchi,* and possibly some other genera, is so closely related that I ean not distinguish it by the structure.

Pometia pinnata Forst. Plate XXVI, fig. 50. Dawa; lengsar; malugay (Phil.).

New Guinea, Sunda and South Sea Islands, Philippines, Ceylon, Andamans.

A moderately hard and moderately heavy wood, reddish. Used in structural work.

Phil. Woods 388; Gard. 66; Van Eed. 80; K. & V. 9:196.

Sapindus trifoliatus L. "Soap-nut tree;" ritha.

Southern Asia.

A yellow, hard, structural wood.

Watt Dict. 6^2:471.

Schleichera trijuga W. "Lac tree;" "Ceylon oak;" kosum (Hind.).

Tropical Asia.

Hard, durable, readily polished wood, with white sapwood and red-brown heartwood. Used for oil and sugar mills, rice-pounders (the best wood for the purpose in southern India), agricultural implements and carts; firewood and charcoal.

Gamb. 194, *tab. IV, fig. 6;* Nörd. VII (*Melicocca trijuga* Juss.); Watt Dict. 6^2:488; Van Eed. 81; K. & V. 9:177–180.

Xerospermum muricatum Bl. Rambutan pachat.

Malay Peninsula.

Wood brown, light, durable and good; used for building.

Ridl. 105.

Xerospermum noronhianum Bl. Ramboetan-oetan.

Sumatra and Java.

Wood much like the preceding.

Van Eed. 82; K. & V. 9:182–184.

STAPHYLEACEÆ.

Turpinia pomifera DC. Geritta.

Malay Peninsula and Archipelago, British India, Ceylon, and China.

Light and soft, not a durable wood. Used for household utensils.

Van Eed. 81; Ridl. 106.

SABIACEÆ.

Meliosma dilleniaefolia Bl.

Himalaya.

White, moderately hard, even-grained. Seasonal rings marked by a continuous line of pores and darker color. Pores small, single or subdivided or in rounded groups, except along the seasonal rings. Pith-rays wavy, moderately broad or fine, distinctly marked in silver grain, which has a satiny luster.

Gamb. 205, *tab. V, fig. 3;* Nörd. VIII.

Several other species occur with wood as described, but they are usually scattered and of small size.

RHAMNACEÆ.

Hovena dulcis Thunb. Kemponashi.
China, Japan, Himalaya.

Furniture and musical instruments.

Gamb. 187; Nörd. VII.

Zizyphus. Wood reddish, moderately hard or hard; no heartwood. Pores small to moderate-sized, often subdivided and fringed with wood parenchyma between numerous fine or very fine pith-rays.

Zizyphus jujuba Lam. "Indian jujube;" "Chinese date."
China, India, Australia, tropical Africa; much cultivated.

Durable structural and furniture wood.

Gamb. 181, *tab. IV, fig. 3;* Nörd. IX; Watt Dict. 6⁴:370; Van Eed. 75.

Zizyphus vulgaris Lam. "Acajou d'Afrique."
Orient to Bengal, China, and Japan; cultivated in southern Europe.

Similar to the preceding; cabinet work.

Gamb. 182; Nörd. II; Watt Dict. 6⁴:373.

Zizyphus xylopyrus Willd.
India and Ceylon.

Carriage building, agricultural implements, charcoal.

Gamb. 183; Watt Dict. 6⁴:374.

Zizyphus zonulatus Blanco (*Z. arborea* Merr.). Plate XXVI, fig. 51. Balacat.
Philippines.

Wood very pale-reddish or whitish; sapwood quickly eaten by beetles; heartwood very durable.

Phil. Woods 374; Gard. 60.

ELAEOCARPACEÆ.

Elaeocarpus lancaefolius Roxb.
Tropical Asia.

Bright-brown, soft wood, for tea chests.

Watt Dict. 3:206.

Muntingia calabura L. "Calabure;" "bois ramier;" "bois de soie."
Mexico to the Amazon River; widely cultivated.

Wood very soft and light, not durable.

Wiesner 2:107.

Echinocarpus dasycarpus Benth.
British India.

Wood grayish-brown, soft. Used for planks and beams where not exposed to changes of weather.

Gamb. 113; Nörd. X.

GONYSTYLACEÆ.

(Plate XXVI, fig. 52.)

Wood hard and heavy, sometimes with a distinct odor when cut. Sapwood white or yellowish; heartwood dark-brownish-yellow to almost black. Seasonal rings not present. Pores small or medium-sized, scattered, often with apparently crystalline contents. Pith-rays small, numerous, bending out around the vessels. Wood parenchyma present in irregular, broken, concentric lines.

Gonystylus bancanus (Miq.) Gilg (*G. miquelianus* T. & B.). Kayu garu (M.).

Java, Sumatra, Banca, Philippines.

The dark heartwood seems not to be of constant occurrence. Wherever the dark heart does occur, it is said to furnish a useful incense wood and to be useful for small chests. The other species of the genus are credited with having the same qualities. Other species of the genus are found in the Malay Peninsula, in Sumatra, Borneo and other portions of the Malay region.

E. Gilg in Engl. & Prantl Nachtr. 232; Teysm. & Binn. in Bot. Zeit. (1862) 265; K. & V. 9:48–51; Boorsma in Bull. Dept. Agr. Ned. Ind. 7 (1907) 6–13; Bargagli-Petrucci 45, *tab. IX;* Becc. 582.

(See p. 428.)

TILIACEÆ.

Berrya ammonilla Roxb. Plate XXVI, fig. 53. Halmalille; trincomali.

British India, Ceylon, Malay Archipelago.

Smooth yellow wood with dark-red heart. Heavy, very hard and durable. Distinct parallel transverse lines in longitudinal section. On account of its toughness and elasticity, much prized for house and boat building, agricultural implements, etc. A possible substitute for satinwood.

Watt Dict. 1:448; Semler 674; Gamb. 107; K. & V. 5:406–409; Van Eed. 46; Bargagli-Petrucci 46, *tab. IX;* Stone 16–18; Becc. 573; Janssonius 1:491.

Brownlowia elata Roxb.

India and Borneo.

Soft, reddish-gray. Fine irregular bars between pith-rays, not joining into concentric rings.

Gamb. 106.

Brownlowia tabularis Pierre.

Cochin China.

"One of the best redwoods known." Structural work, shipbuilding, furniture.

Pierre 132.

Grewia tiliaefolia Vahl.
British India and Ceylon, tropical Africa.

White wood, with small brown heart. Hard, easy to work, very durable. Used wherever firmness and elasticity must be combined, as in masts, rudders, etc.

Watt Dict. 4:184; Gamb. 109.

Grewia microcos L.
British India, Burma, Ceylon, Cochin China.

Gray, soft. Pores moderate-sized, scanty, joined by wavy belts of soft tissue, broken but concentrically arranged.

Gamb. 112; Nörd. IV; Pierre 152; K. & V. 1:226–228; Janssonius 1:502.

Numerous other species of *Grewia* occur and some of them are also used like those above described.

Pentace burmanica (L.) Kurz.
British India, Malacca, Java.

White, on exposure to the air reddish, light, soft wood, used principally for boats and tea-chests.

Watt Dict. 4^1:131; E.-Pr. 3^6:17; Gamb. 106; Pierre 151.

Schoutenia ovata Korth. Oostindisch paarden vleesch (Dutch).
Java.

Beautiful reddish-brown, long- and smooth-fibered, very elastic and durable structural wood, surpassing all others for bows.

Van Eed. 51; K. & V. 1:211–215; Janssonius 1:525.

MALVACEÆ.

Wood soft to moderately hard; light to heavy. Pores of medium size, scattered. Pith-rays of medium size. Sapwood and heartwood usually quite distinct. Heartwood often with distinct rose-like odor.

Bombycidendron campylosiphon (Turcz.) Warb. Plate XXVI, figs. 54, 55.
Probably not to be distinguished in the wood from *B. vidalianum* (Naves) Merr. & Rolfe.
Philippines.

Wood with much the same appearance as that of *Hibiscus tiliaceus* but distinctly harder and heavier; and with distinct ripple marks on the tangential surface (Plate XXVI, fig. 55). Used for cabinet making, carriage building, shafts, flooring, ordinary construction, furniture, planks, boat building, telegraph poles, sides and backs of guitars and mandolins.

Phil. Woods 385.

Hibiscus tiliaceus L. "Corkwood" of the Antilles.
Tropics of the world.

The nut-brown, very light and easily worked wood is used as floats for fish nets, light boats, etc. Also for some purposes as a kind of "rosewood."

K. & V. 2:106; Watt Dict. 4:247; Gamb. 88; Nörd. IX; Van Eed. 36; Ridl. 49; Janssonius 1:380.

Several other species of *Hibiscus* which closely resemble this are used in the same fashion.

Kydia calycina Roxb.
Himalaya, western Ghats, Burma.

The white, very tough and elastic wood without heartwood is used for house building, rudders, and turnery.

Watt Dict. 4:569; Gamb. 89.

Thespesia populnea (L.) Corr. Plate XXVI, fig. 56. "Tulip tree;" "faux bois de rose;" "bois de rose de l'Oceanie;" "Portia tree;" "umbrella tree;" baru laut (M.); banalo (Phil.).

Tropical Africa, Asia, Malaya, and Polynesia, to Australia; introduced and escaped in the West Indies.

Soft sapwood, light red; hard, dark-red heartwood. Moderately heavy and durable. Smells like roses when rubbed. Carriage building, furniture, and cabinet work. (See p. 432.)

K. & V. 2:118; Watt Dict. 6[1]:47; Ridl. 49; Gamb. 88; Pierre 173; Van Eed. 37; Stone 10.

BOMBACACEÆ.

Bombax. Wood usually white, soft and light. Pores large, scanty. Pith-rays broad.

Bombax malabaricum DC. "Cork wood;" "fromage de Hollande."
British India to North Australia.

Durable under water; used for floats for fishing nets, boats, boxes and tea-chests. (See p. 427.)

Gamb. 90; Nörd. XI; Watt Dict. 1:491; Wiesner 2:1022; K. & V. 2:122–125; Van Eed. 33; Lewis 308; Janssonius 1:398.

Boschia griffithii Mast. Daun durian; dendurien (M.).
Malacca.

Brown, darker-marked, very useful wood.

Ridl. 49.

Ceiba pentandra (L.) Gaertn. (*Eriodendron anfractuosum* DC.). "Silk cotton tree."
Mexico, Antilles, Africa, India, Malaya.

Soft, white, weak wood. Used for chests, boats, etc.

Ridl. 48; Gamb. 91; Wiesner 2:1022; Janssonius 1:399; Van Eed. 34.

Coelostegia griffithii Benth. Pungai (M.).
Malacca.

Wood orange when freshly cut, becoming darker and of a reddish color. Hard, flexible, and durable. Used in house building.

Ridl. 49.

Cumingia philippinensis Vid.
Philippines.

Wood soft and light, white and coarse-grained. Used for planks and temporary construction.

Cullenia excelsa Wight.
British India, Andaman Islands, Ceylon.

Tea-chests.

Gamb. 92; Lewis 308.

Durio zibethinus DC. Durian.
Southern and eastern Asia, Malay Archipelago.

Wood pale-reddish-brown, soft. Pores large, scanty, often subdivided. Pith-rays moderately broad, numerous, giving a well-marked silver grain. Temporary construction work.

K. & V. 2:132–134; Gamb. 92; Becc. 572; Van Eed. 34; Ridl. 48; Janssonius 1:404; Bargagli-Petrucci 49, *tab. X.*

Several other species of this genus in Borneo and Sumatra are also used to some extent.

Neesia altissima Bl.
Java.

Brown, beautifully marked, very soft wood, used for small cabinet work. Termite-proof.

K. & V. 2:129–131; Van Eed. 37; Janssonius 1:408.

STERCULIACEÆ.

Wood very soft to very hard; very light to very heavy. Pores rather scanty, often large. Pith-rays rather numerous, usually of medium size. Concentric bands of wood parenchyma in some species.

Eriolaena candollei Wall.
Western India.

Brick-red, orange-yellow and brown striped; moderately hard, shining. Cart building, gunstocks, paddles, etc.

Gamb. 103; Nörd. IX; Watt Dict. 3:265.
Other species are used locally in India and Cochin China.

Heritiera. Wood very heavy and very hard; dark-reddish-brown heart- and white sapwood. Pith-rays of medium size. Wood parenchyma in very fine, irregular, concentric lines.

Heritiera littoralis Dry. Totonai; dungon-late (Phil.); dungon (M.); sundri (Beng.).
East Africa, Indo-Malayan region, Australia; a very widely distributed species.

Boat building, posts, piles, house building, palisades, etc.

Watt Dict. 4:224; Gamb. 98; Phil. Woods 383; Ridl. 51; Van Eed. 39; K. & V. 2:170–174; Pierre 203; Janssonius 449; Bargagli-Petrucci 52, *tab. XI;* Becc. 573.

Heritiera minor Lam. (*H. fomes* Ham.). "Plank tree" (on account of the plank-like prop roots); sundri (Beng.).
Ganges Delta, southern India, Burma, Borneo.

Brown durable wood, considered to be the toughest in India. Boat, house, and bridge building; also used as firewood, and furnishes the best charcoal for gunpowder.

E.-Pr. 3[6]:99; Watt Dict. 4:223; Gamb. 97; Nörd. XI.

Kleinhofia hospita L.
India, East Africa, through Malaya to New Guinea and Polynesia.

Whitish, brown-spotted wood, valued for walking sticks, weapon handles, etc.

Pierre 177; Gamb. 99; Van Eed. 39; K. & V. 2:178–181; Janssonius 461.

Pterocymbium javanicum Bl.
Java.

Wood very much the same as that of *P. tinctorium*.

Janssonius 439; K. & V. 2:162–165.

Pterocymbium tinctorium (Blanco) Merr. Plate XXVI, fig. 57. Teluto.
Philippines.

Wood very soft and light, whitish, no heartwood. Pith-rays large. Pores large and scattered; ripple marks very evident on tangential section.

Phil. Woods 395.

Pterocymbium viridiflorum T. & B. Taloetoe.
Celebes.

Like the preceding.

Van Eed. 41.

Pterospermum. Wood reddish, moderately hard. Pores small and moderate-sized, often in short radial lines. Pith-rays fine, closely packed.

Pterospermum suberifolium Lam.
British India and Ceylon.

Structural wood.

Gamb. 101; Nörd. X (pith-rays very short, arranged on the transverse section in watermark pattern); Watt Dict. 4:184; Van Eed. 42; K. & V. 2:186–191.

Several other species of the genus are also used.

Sterculia. Wood usually light and soft, not durable. Pith-rays of medium size. Pores of medium size, scattered.

Sterculia foetida L. Telambu (Cingh.).
British India to New South Wales; cultivated in America.

Gray soft wood, for masts and boxes.

Watt Dict. 6[3]:363; Gamb. 93; Van Eed. 43; Janssonius 422; K. & V. 2: 139–142.

A number of other species are used, but none are of much importance.

Tarrietia. Wood with dark red or reddish-brown heart. Moderately hard to very hard and heavy. Pores medium-size to large, often with colored deposits. Pith-rays moderately large. Wood parenchyma scattered, occasionally in irregular, broken, concentric lines.

Tarrietia cochinchinensis Pierre.
Cochin China.

A useful structural wood in Cochin China.

Pierre 205.

Tarrietia javanica Bl. Plate XXVI, fig. 58. Lumbayao (Phil.).
Java, Cochin China, Philippines.

Light- or dark-red; light and easy to work. Good furniture wood.

Phil. Woods 387; Gard. 68; This Journ. 3 (1908) Bot. 171; Van Eed. 44; K. & V. 2:166–168.

Tarrietia simplicifolia Mast. Teraling; merbaju; siku keluang (M.).
Malay Peninsula.

Wood very pale-red, becoming darker toward the center; grain medium; fairly hard, splits in drying. Largely used in cart wheels.

Ridl. 50.

Tarrietia sylvatica (Vid.) Merr. Plate XXVI, fig. 59. Dungon.
Philippines.

Wood very hard and heavy. Dark-reddish-brown. Very durable; much valued for piling.

Phil. Woods 382; Gard. 59.

DILLENIACEÆ.

Dillenia. Wood light-red or reddish-brown, moderately hard. Pores medium-sized, uniformly distributed, often filled with a white substance. Pith-rays of two classes, numerous, broad or moderately broad with a few very fine ones between them.

Dillenia aurea Smith.
Upper India, Malay Archipelago.

Gray to reddish, beautifully marked, hard, difficult to work. Construction.

Watt Dict. 3:112; Gamb. 5; Nörd. V; Ridl. 5; K. & V. 1:165–167; Pierre 11–13; Janssonius 76.

Dillenia indica L. (*D. speciosa* Thunb.). Simpor (M.).
India, Burma, Ceylon, the Malay Peninsula and Archipelago; much cultivated.

Red, bright-spotted, moderately hard wood. Structural purposes.

Watt Dict. 3:113; Gamb. 4, *tab. I, fig. 1;* Nörd. XI and IX (*D. speciosa*); Ridl. 5; Van Eed. 1; K. & V. 1:161; Janssonius 71.

Dillenia philippinensis Rolfe. Plate XXVI, fig. 60. Catmon.
Philippines.

Hard and heavy; excellent furniture wood.

Phil. Woods 381.

Several other species of *Dillenia* are used. They seem to show the qualities of those already mentioned.

OCHNACEÆ.

Wood reddish-brown, even-grained. Pores small, uniformly distributed. Pith-rays not prominent, moderately broad, short, giving a pretty silver grain.

Ochna squarrosa L.
British India and Burma.

Wood suitable for inlaying and carving.

Gamb. 136.

THEACEÆ.

Eurya acuminata DC. Malukut jantan.
India to Malaya.

Wood pale-red, grain fine, splits slightly in drying. Used for beams in house building; also for charcoal.

Ridl. 48; Janssonius 302.

Eurya japonica Thunb. Hisakaki.
India to China, Japan, and Malaya.

Carriage building and turnery.

Pierre 126; Janssonius 306.

Gordonia excelsa Bl. Pagar anak jantan.

British India and Malaya.

Wood pale-red, heavy and hard. Used for houses, beams, and posts.

Ridl. 48; Janssonius 334.

Gordonia obtusa Wall.
British India.

Wood pinkish-white to reddish-brown. Pores small, very numerous, uniformly arranged between the fine, short, very numerous pith-rays, the distance between which is equal to the transverse diameter of the pores. Seasonal rings faintly marked by a line. Construction work.

Gamb. 67.

Schima noronhae Reinw. (*S. crenata* Korth.). Medang bekwoi.
British India, Malay Peninsula, Sumatra, Borneo, Philippines.

Timber very close-grained, dark-red; rays very fine and obscure, not close, pores exceedingly numerous, very small, containing a resinous substance. The wood is heavy and hard, shining, apt to split but useful. Used for house posts and rice mortars.

Ridl. 47; Watt Dict. 6²:485; Pierre 121; Janssonius 327.

Schima wallichii Choisy.
Himalaya, Tenasserim, Farther India.

Red, moderately hard in drying, durable. Construction work.

Gamb. 66, *tab. I, fig. 5;* Nörd. X; Watt Dict. 6²:486.

Ternstroemia japonica Thunb. Makakoku.
Ceylon, India, China, Japan, Sumatra

Red, hard wood, sometimes used for furniture.

Janssonius 296.

GUTTIFERÆ.

Wood usually reddish, generally with a distinct heartwood, and marked by characteristic, faint, concentric lines, which are often interrupted. Pores variable in size, usually rather large, single or more or less oblique wavy lines. Pith-rays fine or very fine, clearly marked.

Calophyllum. Wood soft or moderately hard, reddish, with a darker-colored heartwood; seasons well; weight moderate. Cellular tissue regular, cells roughly rectangular. Pores medium-sized or large, prominent on a vertical section, arranged in wavy strings or groups. Pith-rays fine or very fine, indistinct on a cross-section, but prominent as straight narrow lines on a radial section. Interrupted concentric lines of darker color and larger cells, also prominent on vertical section.

Calophyllum inophyllum L. Plate XXVII, fig. 61. "Alexandrian laurel;" palo maria de la playa or bitaog (Phil.); pennagah (M.).

Africa to India, Malaya, Australia, and Polynesia; often cultivated.

Extremely difficult to split. Used for fine furniture, bowling balls, knees of boats, turnery, etc. (See p. 431.)

Gamb. 67, *tab. I, fig. 4;* Nörd. IX; Phil. Woods 390; Gard. 64; Becc. 569; Ridl. 45; Watt Dict. 2:32; Van Eed. 16; Wiesner 2:974; Janssonius 272–276.

Calophyllum spectabile Willd.

British India, Burma, and the Malay Peninsula.

Mast and spar wood.

Van Eed. 17; Watt Dict. 1:460, 2:32; Ridl. 46; Pierre 107; Janssonius 276–278.

Calophyllum tomentosum Wight. Poon.

Ceylon.

Spar wood.

Watt Dict. 2:32; Gamb. 57; Nörd. X; Lewis 308.

Many other species of *Calophyllum* are used, usually under the name of *entangor* or *bintangor*. They are generally used as spars or masts for small boats. Plate XXVII, fig. 62.

Newt. 4.

Cratoxylon. Plate XXVII, fig. 63. Wood usually with more pronounced concentric lines than in *Calophyllum*.

Cratoxylon neriifolium Kurz.

India and Burma.

Structural wood.

Gamb. 49; Watt Dict. 2:588; Pierre 49.

Cratoxylon glaucum Korth. Gerunggang.

Borneo.

Very soft, light, red wood, for interior finish.

Several other species of *Cratoxylon* occur in Borneo and are often used under the name of *gerunggang*.

Becc. 586.

Garcinia. Hard or moderately hard, close-grained, yellowish-white, red or gray, with numerous characteristic wavy bands of loose texture. Pores scanty, small to large. Pith-rays usually fine.

Garcinia cowa Roxb.
Eastern Bengal, Assam, Chittagong, Burma, and the Andaman Islands.
Gamb. 54; Nörd. IV; Pierre, page XXVIII, 119.

Garcinia speciosa Wall.
Coast of Martaban and Tenasserim.

The beautiful uniformly reddish-brown wood is used principally for house and bridge building.

Watt Diet. 3:477; Pierre, page XIV, 59.
Numerous other Garcinias are used in much the same ways.

Mesua ferrea L. (*M. speciosa* Choisy). Plate XXVII, fig. 64. "Indian rose chestnut;" naga-kesara; pennagah; "the Ceylon or East Indian ironwood or nagasholz."
Wild in India, cultivated in the whole of the East Indies because of the white fragrant flowers and the wood.

Wood somewhat resembling that of *Calophyllum,* but much harder and heavier. Heartwood dark-red, extremely hard. Pores moderate-sized, scanty, often filled with yellow resin, single or grouped or in oblique strings of varying lengths. Pith-rays extremely fine, uniform, equidistant, very numerous. Numerous fine, wavy, concentric lines of dark-colored tissue, regular and prominent, but of very different lengths.

Structural work and furniture. According to Grisard and v. d. Berghe, the wood has an aromatic odor and also bears the name of "Bois d'Anis."

E.-Pr. 3[e]:219; Watt Diet. 5:238; Semler 634; Gamb. 59–61; Nörd. XI; Ridl. 46; Van Eed. 19; Pierre 97.

Ochrocarpus longifolius Benth. & Hook. f.
Western India.

Wood red, hard, close- and even-grained. Pores moderate-sized. Pith-rays moderately broad, very numerous, the distance between them equal to, or less than the diameter of the pores. Seasonal rings marked by a dark line. Lines of soft texture numerous, but indistinct. Numerous resin-ducts in radial long cells, which appear as shining lines on a horizontal, and black spots on a vertical section.

Gamb. 55.

Ochrocarpus siamensis T. And.
Cochin China; cultivated in the whole of Indo-China.

Wood almost as hard as that of *Mesua ferrea* and substituted for it.

Gamb. 56; Pierre 94–96.

Poeciloneuron indicum Bedd.
Western India.

Wood dark-red, heartwood darker, very hard. Pores moderate-sized, ringed, single or in short slanting, irregular lines. Pith-rays fine,

numerous, the distance between them less than the diameter of the pores. Occasionally very short, fine, white, concentrically running lines, especially in the sapwood. Structural work, rice-pounders and firewood.

Gamb. 61.

Kayea stylosa Thw.
Ceylon.

Wood red, moderately hard and very heavy. Pores moderate-sized, in radial strings, which are more or less in echelon and rather scanty. Pith-rays very fine, indistinct. Very fine concentric bands of soft texture across the rays.

Gamb. 59.

DIPTEROCARPACEÆ.

This is, by far, the most important family of the Orient. It is probable that this one group produces more commercial wood than all others of the region together. The trees here are often of large size and they constitute a larger percentage of merchantable stand than is the way with most other groups, outside of the mangrove swamps. In places, as some of the dipterocarp forests in India, certain species form almost pure stands (*sál* and *eng* forests in Burma).

"The most striking peculiarity of this order is, that numerous species are gregarious, forming nearly pure forests of large extent, in which one species has obtained the upper hand, to the exclusion of almost all others. In the tropical forests of eastern Asia, these species play the part which in Europe belongs to trees of Coniferæ and Cupuliferæ—the Scotch pine, the mountain pine, the spruce, and the beech. The most remarkable of these gregarious species is the sál tree, *Shorea robusta*, which forms pure or nearly pure forests of vast extent at the foot of the Himalaya, from Assam to the Punjab, and in the hills of eastern central India extending south to near the Godavery River. In a climate and on soil which suits it, this tree reigns supreme." (Brandis Enumeration of the *Dipterocarpaceae*. Journ. Linn. Soc. Bot. **31**: (1895).)

Very often a number of dipterocarp species are found making up a very large percentage of a given stand.

Many leguminous species have very ornamental wood which is in great demand for furniture and cabinet work, but they do not supply anything like the quantity of wood furnished by the dipterocarps. It is this plentiful supply of usable timber which puts the dipterocarps far in the lead among the oriental timber-producing families.

In many sections the dipterocarps predominate to such an extent that the market conditions would not be seriously changed if all other kinds of wood were taken from the market. It is not to be understood, from what has just been said, that the dipterocarps are unsuited for furniture and cabinet work. There are some members of the family which can be

made up in a decidedly ornamental fashion; but it is as general construction timber, where large quantities of good woods are required, that the dipterocarps are most useful. There are a number of very durable woods in the family and quite a number of fair durability, which are very easily worked.

The family is restricted to the Orient, being found in tropical Asia from the Seychelles to New Guinea.

The wood of the family is characterized by the presence of resin-ducts. These are usually arranged in incomplete concentric lines, and sometimes appear at first sight to represent seasonal rings. However, this irregular occurrence and the incompleteness of the rings is sufficient to show very conclusively that they do not represent such periods of growth. Seasonal rings are never present, so far as known. There is a wide range of color and hardness. Pith-rays fine to moderately broad. Pores small to large. Wood parenchyma irregularly arranged, usually scattered, sometimes in discontinuous tangential lines. Two kinds of pith-rays are sometimes present, as in *Vatica* and some species of *Dipterocarpus*.

The number of species in the family is large and many of them are but incompletely known. When Brandis wrote his Enumeration (1895) there were 325 species known. Since that time, there have been 25 or 30 species described and there are probably quite a number of undescribed species in Sumatra, Borneo and other portions of Malaya.

It seems that nearly all species in the family produce wood which is utilized, most of it commercially; consequently the classification of dipterocarp woods is an undertaking of some magnitude. There are groups of species which correspond in structure and which are marketed under the same name. An effort has been made to group the dipterocarps according to the structural groups and to apply the most used trade names to these groups.

The following seem fairly distinct: *rassak, chengal, yacal, peniow, mangachapuy, mangasinoro, kapor, sál* or *guijo, apitong, tanguile, red lauan, almon, white lauan, mayapis.*

RASSAK. Plate XXVII, fig. 65.

This is variously known as *rassak, resak, resak batu, empadu,* and *narig,* and comes principally from species of *Vatica* and *Cotylelobium.* It is found in Borneo, Sumatra, the Philippines, Ceylon and southern India. Trees of this group are very widely distributed. Singapore seems to be the principal market for the wood. It is probable that some of the wood in the Singapore market under this name is supplied by species of *Shorea.* The supply of *rassak* in Borneo seems to be rather limited. It is increasingly difficult to find large trees. The tree seems less gregarious than is the habit of many other members of the family.

Wood very hard and heavy, close-grained, yellowish-brown. Like *yacal* and *mangachapuy,* it darkens characteristically on exposure to the air. Pith-rays of two sorts, moderately broad and very fine. Pores small or very small, clear and unbordered. Resin very scanty, often difficult to see at all. Wood durable; used for construction work.

Newton 6.

CHENGAL (Penak). Plate XXVII, fig. 66.

This is the best member of this group in the Federated Malay States and Straits Settlements. It is very much the same as *yacal,* but may be distinguished from that wood by the fact that the tangential section always shows distinct parallel transverse lines (ripple marks). The wood is used for railroad ties, telephone and telegraph poles, bridges and construction work. It is very durable and a very satisfactory wood to work. It is produced by different species of the genus *Balanocarpus.*

YACAL. Plate XXVII, fig. 67.

Yacal (Phil.); *selangan batu* (M.); *ballow.* In the Singapore market, this wood is known as *ballow* and has supplanted the "Johore teak" (*Parinarium oblongifolium* Hook. f.), which was the original wood sold under that name. In Burma, the wood which seems to be the commercial equivalent of this is known as *thingan. Yacal* seems to be supplied by *Shorea balangeran* Burck and other species of *Shorea.* Some of it is also supplied by *Hopea odorata* Roxb. and other species of *Hopea.* The name *yacal* seems to be the most used name for this wood. Large quantities of this wood are used in the Philippines for railroad ties. Perhaps the largest place of export for the wood is British North Borneo, where it is locally known as *selangan batu* and *Borneo yacal.*

Wood very hard and heavy to very heavy, brownish when first cut but rapidly darkening on exposure to the air. Always giving a very glistening surface in transverse section. Pores more or less distinctly fringed and with occasional indistinct bands of wood parenchyma. Resin distinctly present. Resin-ducts occasionally forming incomplete concentric lines of lighter color than the surrounding wood. Pith-rays uniform, fine. A very excellent and durable wood, which is said to be free from insect attacks.

Gard. 56; Phil. Woods 396.

MANGACHAPUY. Plate XXVII, fig. 68.

Much like preceding but lighter in color and weight.

This wood is also known by the following names: *gagil* and *selangan batu* No. 2 (British North Borneo); *chengal* No. 2 (Federated Malay States); *kaniongan* (Dutch East Borneo).

The source of this wood seems to be a group of small leaved Hopeas, of which *Hopea acuminata* Merr. is one.

PENIOW.

This is produced by *Shorea grandiflora* Brandis and is found only in Sarawak. It is probably the best member of the family in the region where it occurs. In durability, it is considered as second only to *billian* (*Eusideroxylon zwageri*). Wood very hard, very heavy and very resinous. More uniformly yellowish-brown than any of the preceding. Used for piling, corner posts, wherever great strength and durability are required.

KAPOR. Plate XXVII, fig. 69.

Found in Borneo, Sumatra and the Malay Peninsula and some of the islands of the Malay Archipelago. The Dutch call it "kampferhout," and the English, "Borneo camphorwood." Wood reddish, very straight-grained. Resin-ducts not abundant. Pores medium-sized, not fringed, and wood parenchyma scanty. Occasionally a faint odor of camphor in the wood. Ripple marks occasionally present on longitudinal sections. Used for piling, planking, etc. Easily worked and much in demand. Produced by the species of the genus *Dryobalanops*.

GUIJO (Phil.); SÁL (Burma); TEKAM (Sarawak); SELANGAN BATU MIREH (British North Borneo). Plate XXVII, fig. 70.

In the Philippines, where it is known as a shipbuilding wood, it is produced by *Shorea guiso* Bl. In Burma it is known as *sál* and occurs in solid stands. It is here the product of *Shorea robusta* Gaertn. Wood hard and moderately heavy to heavy. Wood parenchyma present in some quantity, sometimes faintly fringing the vessels and often forming indistinct concentric lines. Resin-ducts not infrequent. Grain crooked. This is an exceedingly good wood, but it is very likely to warp badly unless carefully seasoned. Used for house and shipbuilding, planks, carriage building, etc.

Gard. 55; Phil. Woods 384.

APITONG (Phil.); KRUEN (M.); ENG (Burma). Plate XXVII, fig. 71.

Quite a number of species of *Dipterocarpus* produce wood of this grade. The most widely distributed seems to be *Dipterocarpus grandiflorus* Blanco, which is found in the Philippine Islands, in northern and western Borneo and on the Malay Peninsula. In the Philippines the name *apitong* is used. In northern and western Borneo and on the Malay Peninsula the name *kruen* is used for the same and related species. In east Borneo the name *tampoerouw* or *tampoedow* is found for wood which is probably mainly the product of *Dipterocarpus tampurau* Korth. In Burma, the *eng*, which is the product of *Dipterocarpus tuberculatus* Roxb., is a wood of this quality, as is also the wood of *Dipterocarpus turbinatus* Gaertn. f., the *gurjun* of India, and *Dipterocarpus*

zeylanicus Thw., the *horá* of Ceylon. The quality of the wood varies to some extent in the same species under different conditions, and in different species; but, as a genus, *Dipterocarpus* has rather uniform wood. A number of different grades of *apitong* are recognized in the Philippine Islands.

Wood moderately hard to hard and moderately heavy. Pale-grayish-red, sometimes with a faint purplish tinge. Pores large and more or less distinctly fringed. Wood parenchyma often rather copious. Resin-ducts numerous and evident. Wood sometimes rather close-grained, resembling *guijo* or *sál,* and sometimes rather coarse and open-grained. Rather easily worked. Used for heavy structural work, planks, etc. Very suitable for railroad ties, wherever the termites are not bad. Other grades of this wood are known in the Philippines as *panao* or *hagachac.*

TANGUILE (Phil.); KLAPAK (Dutch Borneo); OBAR SULUK. Plate XXVII, fig. 72.

In the Philippines, this wood is supplied by *Shorea polysperma* (Blanco) Merr. It seems to be identical with the wood known as *klapak* in Dutch East Borneo and *obar suluk* in British North Borneo. Wood soft to moderately hard; light. Red, close- and straight-grained. Pores of medium size. Resin white and hard, frequently forming conspicuous hard lines. This wood works very well and is exceedingly well suited for interior finish. It is being sold as "Philippine mahogany." It is of course not a mahogany at all; but, for interior finish, it makes a pretty substitute.

Gard. 58; Phil. Woods 394.

RED LAUAN (Phil.); MERANTI (M.); SERIAH MERAH (M.). Plate XXVII, fig. 73.

The product of several species of *Shorea* (possibly also of *Hopea*) and seemingly identical with the *meranti* of Borneo and Malaya and the *seriah merah* of British North Borneo and the Malay Archipelago. Wood soft or very soft and light. Pale-reddish. Pores large, sometimes showing dark glistening deposits. Resin-ducts rather numerous, filled with whitish deposits. Used for light furniture and light or temporary construction. The softer pieces are well suited for pattern work.

Newton 2; Gard. 53; Phil. Woods 386.

MANGASINORO (Phil.); SERIAH PUTEH (British North Borneo). Plate XXVII, fig. 78.

This seems to be the product of some species of *Shorea* in the Philippines and it is identical in structure and appearance with the *seriah puteh* of British North Borneo and the *bangkirai* of Dutch East Borneo. Wood

yellowish-white, soft and light. Pores arranged in a fairly regular reticulate pattern, and resin-ducts almost entirely absent. . Easily worked; used for planks, etc.

PALOSAPIS OR MAYAPIS. Plate XXVIII, fig. 74.

This is produced by species of *Anisoptera* in the Philippines. It seems to be the same as the *mersawa* of the Federated Malay States and the *mirauan* of Sarawak. Wood yellowish-white; pith-rays of two sorts, moderately broad and fine. Pores of medium size. Resin-ducts rather distinct. Wood of young trees coarse-grained and brittle, rather difficult to work. Wood from well-grown trees is of very good quality and seems to be fairly durable. Used for planks, crossbeams, etc.

Gard. 66; Phil. Woods 389.

WHITE LAUAN. Plate XXVIII, fig. 75.

This is produced in the Philippines by *Parashorea plicata* Brandis and *Pentacme contorta* (Vid.) Merr. & Rolfe. It occurs in British North Borneo under the name of *gagil* and *urat mata* and in the Straits Settlements as a poor grade of *seriah*. It is possible that some species of *Shorea* and *Hopea* also produce wood which is sold under this name. Wood grayish-white or brownish-gray; soft and light, not durable. Pith-rays of two kinds, moderately broad and fine. Resin-ducts numerous, often forming incomplete concentric lines, falsely resembling seasonal rings. Wood used for various forms of light or temporary construction.

Phil. Woods 386; Gard. 52.

ALMON.

This is a good grade of *lauan,* with a pinkish or reddish color. It is often exactly the equivalent of some grades of *meranti* and *seriah*. It is probably produced by different species of *Shorea* and possibly also *Hopea*. It is a very good wood for light construction and interior finish. The structure of this wood is very much the same as that of *tanguile,* but it is usually much softer and lighter in color than that wood. In some parts of Luzon this wood is known as *mayapis*.

The soft red-wooded dipterocarps are very common, but they are not yet very clearly understood. *Tanguile, red lauan* and *almon* are frequently confused. The best qualities of *tanguile* are conspicuously darker in color and harder than the other two woods, and *red lauan* is usually distinctly coarser grained than either *almon* or *tanguile,* but there are numerous intermediate grades of these woods which may belong to any one of the three.

In spite of our present fragmentary knowledge of the group, it has seemed entirely feasible to prepare the following key to the commercial dipterocarps.

KEY TO DIPTEROCARP WOODS.

a. Wood hard and moderately heavy to very heavy.
b. Yellowish-brown or whitish when first cut.
c. Resin very scanty; pith-rays evidently of two kinds; pores small.... *Resak*
cc. Resin distinctly present in whitish concentric lines.
d. Distinct parallel transverse lines on tangential section..... *Chengal*
dd. Lines not present as above.
c. With glistening fracture.
f. Straw-color or almost white when fresh..... *Mangachapuy*
ff. Light- to dark-brown..... *Yacal*
ee. Without glistening fracture..... *Peniow*
bb. With distinct reddish color.
c. Resin not abundant; very straight-grained..... *Kapor*
cc. Resin abundant, not so straight-grained.
d. Pores medium size..... *Guijo*
dd. Pores large ..... *Apitong*
aa. Wood moderately hard or soft; light to moderately heavy.
b. Distinctly reddish.
c. Vessels of medium size or small; wood fine-grained..... *Tanguile*
cc. Vessels large ..... *Red lauan*
bb. Usually white or yellowish, reddish tinge faint, if present.
c. Yellowish-white.
d. Pores in definite patterns..... *Mangasinoro*
dd. Pores scattered ..... *Palosapis*
cc. Grayish-white or with faint pinkish tinge.
d. Faint pinkish tinge present..... *Almon*
dd. Grayish-white or with slight brownish tinge..... *White lauan*

SPECIES NOTES.

The following notes are intended to serve as a list of the better known commercial species and to indicate the distribution and give the more important literature on the wood of each.

Anisoptera glabra Kurz. Thinkadu (Burma).
British India, Burma, Malay Peninsula.

Used in boat building.

Ridl. 60; Gamb. 73.

Anisoptera palembanica Miq. Basoeng (Sumatra).
Van Eed. 26.

Anisoptera thurifera Blanco. Plate XXVIII, fig. 74. Mayapis or Palosapis.
Philippines.
Phil. Woods 389.

Balanocarpus maximus King. Chenghei; penak (M.).
Malay Peninsula.
Ridl. 62.

Balanocarpus penangianus King. Damar hitam (M.).
Malay Peninsula.
Ridl. 62.

Cotylelobium flavum Pierre. Rassak durian.
Sarawak.

Used in boat building.

Becc. 570.

Cotylelobium melanoxylon Pierre (*Anisoptera melanoxylon* Hook.). Resak (M.).
Borneo.

The shining brown heartwood is much prized. Next to *Dryobalanops*, perhaps the most valuable tree in Labuan.

E.-Pr. 3[e]:268; Brandis Enum. 115.

Dipterocarpus alatus Roxb. Kanyinbyu (Burma).
British India and Burma.

House building and canoes.

Gamb. 72; Nörd. VIII; Pierre 212.

Dipterocarpus eurhynchus Miq. Kroewing (M.).
Sumatra, Riouw.
Van Eed. 26.

Dipterocarpus gracilis Bl. Palaglar.
Java.
K. & V. 5:117; Janssonius 1:358.

Dipterocarpus grandiflorus Blanco. Plate XXVII, fig. 71. Apitong (Phil.); kruen (M.).
Philippines, British North Borneo, Malay Peninsula, Banka.
Phil. Woods 372; Ridl. 55.

Dipterocarpus hasseltii Bl. Hagachac (Phil.).
Java, Philippines.
Phil. Woods 373; K. & V. 5:109–111; Janssonius 1:359.

Dipterocarpus insularis Hance.
Cochin China.
Pierre 214; Janssonius 1:348.

Dipterocarpus littoralis Bl. Lalar.
Java.
K. &. V. 5:114; Janssonius 1:348.

Dipterocarpus lowii Hook. f. Kruyn (M.).
Sarawak.
Bargagli-Petrucci 60–62; Becc. 569.

Dipterocarpus retusus Bl. Palaglar-mienjak (M.).
Java.
K. & V. 5:112–114.

Dipterocarpus tampurau Korth. Tampoerouw or tampoedau.
South and east Borneo.

Dipterocarpus trinervis Bl. Boembang; palalaglar; palaglar-mienjak; klalar; mesegar.
Java, Sumatra.
Van Eed. 26; K. & V. 5:105–109; Janssonius 1:354.

Dipterocarpus tuberculatus Roxb. Eng, in (Burm.).
British India and Burma, Cochin China.

Reddish-brown, heavy, but readily worked wood. Used for structural work.

Pierre 218; Watt Dict. 3:160; Gamb. 72, *tab. II, fig. 1;* Nörd. V (*D. grandiflorus* Wall.), XI.

Dipterocarpus turbinatus Gaertn. f. (*D. laevis* Ham.). Kanyin (Burm.); gurjun (Beng.).
British India and the Andaman Islands.

Red, moderately hard wood; used for house and boat building.

Watt Dict. 3:170; Gamb. 70.

Dipterocarpus vernicifluus Blanco. Panao.
Philippines.
Phil. Woods 373.

Dipterocarpus zeylanicus Thw. Hora.
Ceylon.
Gamb. 72.

Doona congestiflora Thw. Tinya.
Ceylon.
Used for tea-boxes.
Lewis 308.

Doona gardneri Thw.
Ceylon.

Wood hard, even-grained, durable, reddish-brown; called "red doon" by sawyers in the hill country, and used for sleepers in the Haputale railway.

Doona zeylanica Thw. Dun, doon.
Ceylon.

Wood light, moderately hard, pale-grayish-brown, durable and greatly in request for shingles, whence the tree is often called "shingle tree."

Gamb. 74.

Dryobalanops aromatica Gaertn. f. Kapor; kampferhout; Borneo camphor wood.
Borneo, Sumatra, Malacca.
Van Eed. 27; Ridl. 61; Newton 6.

Dryobalanops beccarii Dyer. Kapor gunong and kapor paya (M.).
Sarawak.
Becc. 572; Bargagli-Petrucci 73.

Dryobalanops kayanensis Becc. Kapor bennar.
Sarawak.
Becc. 572; Bargagli-Petrucci 74.

Other species of *Dryobalanops* furnish wood which is not to be distinguished from that of the species mentioned.

Hopea acuminata Merr. Plate XXVII, fig. 68. Mangachapuy or dalindingan.
Philippines.
Phil. Woods 389; Gard. 68.

Hopea beccariana Burck. Mahan besi; mangbesi.
Sarawak.
Bargagli-Petrucci 70; Becc. 572.

Hopea dryobalanoides Miq. Dammar-mata-koetjing; dammar-poetih.
Sumatra.

Hopea fagifolia Miq. Kawang; djempina; tjengal.
Banka, Java.
Van Eed. 27; K. & V. 5:124–126; Janssonius 1:369–374.

Hopea ferrea Pierre.
Cochin China.
Pierre 249.

Hopea grisea Brandis. Lon putte; loon putih.
Sarawak.
Becc. 571; Bargagli-Petrucci 71.

Hopea intermedia King. Jankang; merawan kunyit; mengarawan.
Malay Peninsula.
Ridl. 59.

Hopea mengarawan Miq. Ngarawan; mengrawan; tjinkang; maranti.
Sumatra, Banka.
Van Eed. 28.

Hopea myrtifolia Miq. Mengarawan.
Sumatra.
Van Eed. 28.

Hopea odorata Roxb. Thingan (Burma); sao (Anam).
British India and Burma, Andaman Islands, Cochin China, Borneo.

Yellowish-brown, moderately hard and heavy; easy to work; not subject to insect attack. Said to combine many of the good points of oak with the durability of teak. Much the same wood as *yacal*. In demand for all kinds of building.

Pierre 224; Gamb. 75, *tab. II, fig. 2;* Nörd. IX.

Hopea pierrei Hance.
Cochin China.
Pierre 248.

Hopea philippinensis Dyer.
Philippines.

Hopea plagata Vidal.
Philippines.
Phil. Woods 396.

Hopea treubii Heim. Mar akka.
Sarawak.
Becc. 571; Bargagli-Petrucci 72.

Hopea wightiana Wall.
British India.
Gamb. 74.

Isoptera borneensis Scheff.
Borneo, Banka, Malay Peninsula.
Becc. 571.

Monoporanda cordifolia Thw.
Ceylon.

Pachinocarpus umbonatus Hook. f.
Borneo.

Soft white wood.

E.-Pr. 3⁶:270.

Parashorea plicata Brandis. White lauan.
Philippines.
Phil. Woods 386.

Parashorea stellata Kurz. (*Shorea stellata* Dyer.) Chengal (M.); thingadu (Burm.); kaunghmu (Burm.).
Burma, Malacca, Cochin China.

Brownish-white, moderately hard. Used for boat building.

Gamb. 83; Watt Dict. 6²:678; Ridl. in Agric. Bull. F. M. S. & S. S. 6 (1907) 170.

Pentacme contorta (Vid.) Merr. & Rolfe. White lauan.
Philippines.
Phil. Woods 386.

Pentacme suavis A. DC. (*P. siamensis* Kurz). Ingyin (Burm.).
Burma, Cochin China.

Wood very hard, very heavy, cross-grained, in this respect similar to *sál* which it also resembles in color. Very durable, indestructible in water. Wood fibers diaphragmed with delicate cross-walls; the vessels form short radial rows; the pith-rays are usually two cells wide and have crystal-bearing border cells.

Gamb. 77; Nörd. IV (*Hopea suavis* Wall.); E.-Pr. 3⁶:263; Watt Dict. 6²:678; Pierre 225–227.

Shorea acuminata Dyer. Rambeh daun; maranti payah.
Malay Peninsula.
Ridl. 58.

Shorea aptera Burck. (*Hopea balangeran* de Vr., not Korth.) Minjak tengkawang.
Borneo.
Burck in Ann. Jard. Bot. Buitenz. 6 (1887) 210.

Shorea assamica Dyer. Makai.
Assam.
Gamb. 83.

Shorea balangeran Burck. (*Hopea balangeran* Korth.; *Parahopea balangeran* Heim.) Yacal (Phil.); njating-mahambong; tengjawang-blongseng; tengkawang-seloengsoeng; balangeran (M.).
Banka, Borneo, Philippines.

This furnishes a part of the *yacal* of the Philippines, and probably, also, a part of the *selangan batu* of British North Borneo.

Phil. Woods 396; Burck l. c. 214.

Shorea barbata Brandis. Resak.
Malay Peninsula.
Ridl. 59.

Shorea brachyptera Heim. Mangkabang assu.
Sarawak.
Becc. 571; Bargagli-Petrucci 67.

Shorea compressa Burck.
Borneo.
Van Eed. 28.

Shorea curtisii King. Meranti; tahi.
Malay Peninsula.
Ridl. 58.

Shorea elliptica Burck. Merawan mera.
Sarawak.
Becc. 571; Bargagli-Petrucci 66.

Shorea eximia Scheff. Koejoeng.
Banka, Sumatra.
Van Eed. 28.

Shorea falcifera Dyer. Mengkabang pinang.
Sarawak.
Bargagli-Petrucci 65; Becc. 571.

Shorea ferruginea Dyer. Sassak suppok.
Sarawak.
Becc. 571; Bargagli-Petrucci 64.

Shorea furfuracea Miq. Maranti.
Sumatra.
Burck l. c. 219.

Shorea ghysbertsiana Burck. Mengkabang pinang.
Borneo.

A fine-grained, hard, red wood, resembling *guijo*.

Becc. 571.

Shorea glauca King. Balau.
Malay Peninsula.

Wood dark-brown in color and heavy, with numerous small pores, and close fine rays. Much resembles *damar laut* (*Shorea utilis*).

Ridl. in Agric. Bull. F. M. S. & S. S. 6 (1907) 171.

Shorea gratissima Dyer.
Singapore.
Ridl. 59.

Shorea guiso (Blanco) Blume. Plate XXVII, fig. 70. Guijo.
Philippines.
Phil. Woods 384; Gard. 55.

Shorea hypochra Hance. Vin-vin.
Cochin China.

The hard, yellow heartwood is much prized.

Pierre 228.

Shorea javanica K. & V. Plalar.
Java.
K. & V. 5:121.

Shorea leprosula Miq. Seraya batu; laro (M.).
Malay Peninsula, Borneo.
Ridl. 55; Beec. 571; Bargagli-Petrucci 64.

Shorea macroptera Dyer. Kepong; kepong hantu; sassak (M.).
Malay Peninsula, Borneo.
Ridl. 57; Bargagli-Petrucci 63; Beec. 571.

Shorea maranti Burek. (*Hopea ? maranti* Miq.) Meranti.
Malacca, Sumatra, Banka.
Ridl. 55–57; Van Eed. 27.

Shorea martiniana Scheff. (*Hopea macrophylla* de Vr.) Tengkawang-lajar.
Borneo.
Burek l. c. 208.

Shorea nitens Miq. Maranti bras; sengkawang.
Sumatra.
Van Eed. 28.

Shorea obtusa Wall. Thitya (Burm.).
Burma.
Gamb. 82.

Shorea palembanica Miq. Melebekan.
Sumatra.
Van Eed. 28.

Shorea parvifolia Dyer. Serayah samak; meranti daun keehil; meranti kerap.
Malay Peninsula.
Ridl. 57.

Shorea platycarpa Heim. Mranti boaya.
Sarawak.
Bargagli-Petrucci 67; Beec. 570.

Shorea polysperma Merr. Plate XXVIII, fig. 73. Tanguile.
Philippines.
Phil. Woods 394; Gard. 58.

Shorea robusta Gaertn. Sâl (Hind.).
British India, Burma, Coehin China.

Sapwood small, whitish, not durable; heartwood brown, pale when first eut, but darkening on exposure, eoarse-grained, hard, with a remarkable fibrous and eross-grained strueture; the fibers of alternate belts in the wood on a vertieal section running in opposite directions, so that when the wood is dressed, a very sharp plane is necessary or it will not get smooth; does not season well. Seasonal rings only visible in young trees or on freshly cut wood. Pores moderate-sized to large, often filled with resin; eaeh pore or group of pores in a pateh of pale, loose tissue. Pith-rays uniform, moderately broad, straight, very prominent, joined

by short white transverse lines, the distance between the pith-rays equal to the transverse diameter of the pores. Pith-rays mostly four cells wide with cubical border cells. The most important structural wood of northern India. Used also for joinery and railroad ties.

Janssonius 1:364–369; E.-Pr. 3[a]:266; Gamb. 77–81, *tab. II, fig. 3;* Nörd. V; Watt Dict. 6[2]:677.

Shorea selanica Bl. (*Hopea selanica* Roxb.) Dammar-sila; dammar-malaijoe; bahoet; kajoe-bapa; bapa-mereh; bapa-puti.
Borneo, Moluccas.
Van Eed. 28.

Shorea sericea Dyer.
Malay Peninsula.
Ridl. 58.

Shorea squamata Benth. & Hook. f.
Borneo, Philippines.
Becc. 570.

Shorea talura Roxb. Talura (Tam.)
British India.
Gamb. 82.

Shorea tumbaggaia Roxb. Tambugai (Tam.); cangu.
British India.

The wood, which is harder than that of *sál,* though otherwise similar, is used in structural work.

Watt Dict. 6[2]:679; Gamb. 81.

Shorea utilis King. Damar laut numero satu.
Malay Peninsula.

A very useful and durable wood. Used for structural work, piling, etc.

Ridl. 58; Newton 6.

Stemonoporus wightii Thw. Halmendora.
Ceylon.
Gamb. 85.

Vateria acuminata Hayne.
Ceylon; frequently planted.

Light but hard and durable wood, with thin-walled wood cells. Vessels single or in small groups. Used for tea-chests and structural work.

Lewis 308.

Vateria indica L. Piney maram; "the piney varnish tree."
British India.

Rough, coarse-grained, moderately hard wood with reddish-white sap and gray heart. Used for boats, masts, coffins, tea-chests, packing cases, etc.

Gamb. 85, *tab. II, fig. 4;* Nörd. V; Watt Dict. 6[2]:225.

Vateria seychellarum Dyer.
Seychelles.

Wood of this rare tree much valued because of the large amount of oil which it contains.

E.-Pr. 3^6:273.

Vatica (Synaptea) astrotricha Pierre.
Cochin China.

Yellow-brown to reddish or greenish, black-streaked, very durable. Used for structural work and furniture.

Pierre 240.

Vatica bancana Scheff.
Banka, Java.
K. & V. 5:127–129; Janssonius 1:360–364.

Vatica bantamensis Burck.
Java, Sumatra.
K. & V. 5:129.

Vatica cinerea King. Pinang baik.
Malay Peninsula.
Ridl. 60.

Vatica chinensis L.
British India and Ceylon.

Reddish-brown, hard, close-grained.

Gamb. 84.

Vatica (Synaptea) faginea Pierre.
Cochin China.
Pierre 242.

Vatica mangachapoi Blanco. Narig (Phil.).
Philippines.

Vatica rassak Korth. Rassak; njating; dammara.
Dutch Borneo.

It seems probable that quite a number of species produce timber which is known as *rassak*. In some places the wood of *Vatica* is known as *tjengal*.

TAMARICACEÆ.

Tamarix articulata Vahl.
Africa, Arabia, Java, British India.

White, moderately hard wood, used for cart wheels, agricultural implements, etc.

Watt Dict. 6^3:409; Gamb. 46; Nörd. VI.

Tamarix gallica L.
India, Burma, Ceylon.

Wood white or reddish, sometimes darker in the center, but no heartwood. Pores small to moderate-sized, often in groups, more numerous

and large in the earlier-formed wood if the seasonable rings are distinct. Pith-rays generally broad, short, distant, giving a marked silver grain.

Gamb. 46; Nörd. I.

FLACOURTIACEÆ.

Wood usually reddish-brown, moderately hard or hard. Pores small, in short radial lines. Pith-rays fine, numerous, closely packed. The structure closely resembles that of the red-wooded section of *Euphorbiaceæ*.

Casearia glomerata Roxb.
British India to Hongkong and Java.

Yellowish-white, moderately hard, coarse wood.

Watt Dict. 2:209; Gamb. 378, *tab. VIII, fig. 5;* Nörd. X.

Casearia tomentosa Roxb.
British India to Java and north Australia.

Wood similar to the preceding and used for making combs.

Gamb. 379; Watt Dict. 2:209; K. & V. 1:176–178.

Flacourtia cataphracta Roxb.
British India and Burma.

K. & V. 5:26–28; Gamb. 39, *tab. I, fig. 3;* Nörd. IX; Van Eed. 11; Janssonius 1:209; Ridl. 11.

Flacourtia ramontchi L'Herit. "Madagascar-plum."
India, Burma, Ceylon; cultivated in Egypt and throughout southern Asia.

Red, hard, close- and even-grained, splits but does not warp, and is durable. Pores small, in radial lines. Pith-rays fine, uniform, closely packed and somewhat wavy. Agrieultural implements and turnery.

Watt Dict. 3:399; Gamb. 40; Van Eed. 12; K. & V. 5:19–22; Janssonius 1:208.

Gynocardia odorata R. Br.
British India.

Yellow or yellowish-brown wood; used for rough structural work.

Watt Dict. 4:194; Gamb. 41.

Homalium frutescens King. Petaling ayer.
Malay Peninsula.

A fine-grained wood, suitable for building.

Ridl. 180.

Homalium tomentosum Benth. Dalingsem.
Java to Burma.

A hard and heavy structural wood.

K. & V. 1:182–185; Van Eed. 149.

Homalium luzoniense F.-Vill. (Plate XXVIII, fig. 79), and other species. Aranga.

Philippines.

A very hard and durable wood. Reddish, close-grained. Pith-rays very fine and very numerous, turning out to pass vessels. Vessels medium-size, scattered. Used for piling and structural work. Considered by many as the best wood for piling in the Philippines.

Phil. Woods 373; Gard. 63.

Hydnocarpus alpina Wight.

India and Ceylon.

Light-brown, hard, with streaks of darker color and clearly containing tannin. Seasonal rings faint. Pores moderate-sized, often subdivided radially into 2 or 3, scanty. Pith-rays fine, very numerous and closely packed, the distances between them much less that the transverse diameter of the pores. Used for beams and rafters and a good fuel.

Gamb. 42.

Pangium edule Reinw. Putjung; pangi.

Malay Archipelago.

A hard wood; used for house building.

Van Eed. 12; Janssonius 1:211; K. & V. 5:6–8.

Trichadenia zeylanica Thw. Tolol (Cingh.).

Ceylon.

Wood yellowish-white, hard. Pores moderate-sized, often subdivided, rather scanty, in radial patches. Pith-rays fine, very close, regular, bent round the pores.

Gamb. 41.

DATISCACEÆ.

Tetrameles nudiflora R. Br.

India and Ceylon.

White and soft. Seasonal rings marked by a belt of close pores. Wood cells large. Pores large, often subdivided and in short zigzag transverse lines. Pith-rays fine to moderately broad, clearly marked, the distance between the rays equal to the diameter of the pores. Tea-chests.

Gamb. 381; K. & V. 9:37–40; Van Eed. 150; Lewis 309.

Octomeles sumatrana Miq. Plate XXVIII, fig. 80. Binuang (Phil.); minuang (M.); kajoe-palaka (M.).

Sumatra, Borneo, Philippines.

Wood soft, yellowish, not durable.

Van Eed. 150; Becc. 579.

THYMELAEACEÆ.

Aquilaria agallocha Roxb. Kayu-garu (M.).
British India and Malaya.

Wood white, soft and light, even-grained, scented when fresh cut. In the interior of old trees are sometimes found irregular masses of harder and darker-colored wood, with a honey-like scent, which constitute the "eaglewood" of commerce. Pores small and moderate-sized, in short radial lines. Pith-rays fine, numerous; the distance between two consecutive rays less than the transverse diameter of the pores. Numerous short transverse bands of pores and intercellular ducts filled with a brownish substance. A valuable incense wood. (See p. 427.)

Gamb. 579.
Aquilaria malaccensis Lam., and other species also furnish *eaglewood*.

LYTHRACEÆ.

Wood grayish or reddish-brown, moderately hard. Pores of various sizes, joined by narrow bands of wood parenchyma. Pith-rays fine, numerous, uniform, usually bent around the pores.

Lagerstroemia floribunda Jack.
Tropical Asia.

Wood light-fawn-colored with the rings usually very distinct and large, sometimes rather close, rays fine and close, rather obscure, pores of medium size in lines along the rings, the rings being marked out by lines of large pores.

Ridl. 179.

Lagerstroemia hexaptera Miq. Bungah malukut.
Malay Peninsula.
Ridl. 179.

Lagerstroemia parviflora Roxb.
Tropical Asia.

Wood very hard, gray or grayish-brown, often almost red, darker-colored near the center, hard. No seasonal rings. Pores moderate-sized and large, often subdivided, surrounded singly or in patches by pale rings, which are joined by fine narrow, irregular, wavy, interrupted and anastomosing bands of wood parenchyma. Pith-rays fine, very numerous, inconspicuous. Used for house posts, beams and rafters, frames for doors and windows, pieces for agricultural implements, carts and boats.

Gamb. 371; Nörd. X; Watt Dict. 4:584.

Lagerstroemia piriformis Koehne (*L. batitinan* Vid.). Batitinan.
Philippines.

Wood hard and moderately heavy. Sapwood light; heartwood dark-brown. Fine straight grain. Seasonal rings distinct. Ring porous. Black glistening deposits in the vessels. Used for general construction; posts, sleepers, flooring, joists, planks, rafters; shipbuilding, keelsons, masts; piles; telegraph poles.

Phil. Woods 377; Gard. 65.

Lagerstroemia speciosa (L.) Pers. (*L. flos-regine* Retz.). Plate XXVIII, fig. 81. Jarul (Beng.); banaba (Phil.); bongoh, boengoer (M.).
Throughout the eastern tropics.

Moderately heavy and hard. Sapwood light to pinkish; heartwood dark-reddish-brown or light-red. Seasonal rings distinct. Ring-porous. Straight-grained. Dark-colored, glistening deposits in the vessels. Used for high-grade construction, boat building, interior partitions and furnishings; planks, rafters, sills, wharves; piling; furniture; carabao yokes; barrels; railroad ties. Considered as almost the equal of teak.

Phil. Woods 374; Becc. 579; Gamb. 373, *tab. VIII, fig. 4;* Nörd. X; Watt Dict. 4:582; K. & V. 1:190–193; Van Eed. 146; Watt in Agric. Ledger (1907) No. 9, 1–7.

Several other species also produce wood of very good quality.

SONNERATIACEÆ.

Crypteronia paniculata Bl. Krakas; tjelemgan; kajoe-ramo (M.).
British India, Malay Peninsula and Malay Archipelago.

Wood light-reddish-brown, moderately hard. Pores moderate-sized, scanty, usually subdivided radially. Pith-rays very numerous, fine, red, inconspicuous. Used for cabinet work. Other species used in the same manner.

Gamb. 370; Van Eed. 145; Ridl. 180; K. & V. 1:203–205.

Duabanga grandiflora (Roxb.) Ham. (*Duabanga sonneratioides* Ham.; *Lagerstroemia grandiflora* Roxb.).
British India and Burma.

Wood gray, often streaked with yellow, soft, seasons well, neither warps nor splits. Pores large and moderate-sized, often oval and subdivided, in roughly oblique lines. Pith-rays fine, very numerous, wavy. Used for canoes, tea-boxes, etc.

Gamb. 376; Watt Dict. 3:196; Ridl. 179.

Duabanga moluccana Bl. Loctob (Phil.); takir, kedjimas (Java).
Philippines, Celebes, Java, Amboina, Bali.

Wood soft, light-colored, not durable. Used for planks and small boats.

K. & V. 1:195–197; Van Eed. 145.

Sonneratia acida L. f. Pedada, p'dada (M.).
British India, Ceylon, Burma, Malay Archipelago.

Wood gray, soft, even-grained. Pores small, oval and subdivided, very

numerous, uniformly distributed. Pith-rays very fine, very numerous, bent around the pores. Used for models and fuel.

Gamb. 377; Nörd. X; Watt Dict. 6³:275; Becc. 579; Van Eed. 147; K. & V. 1:198–200; Bargagli-Petrucci 76, *tab. XIV*.

Sonneratia apetala Ham.
British India, Burma, Ceylon.

Moderately hard; sapwood gray; heartwood reddish-brown. Used for house building, packing boxes, planks, fuel.

Gamb. 376; Watt Dict. 6³:196.

Sonneratia pagatpat Blanco. Plate XXVIII, fig. 82. Pagatpat (Phil.).

Sonneratia alba Smith. Prapat (M.).
These two species are very much alike and may be identical. The outer part of the mangrove swamp. Throughout the Malay region.

Wood hard and heavy, fine-grained, with slightly disagreeable odor. Sapwood white or grayish, heartwood dark-brown and taking up most of the log, sapwood in a rather narrow layer. Pores small and scattered. Works readily, but contains quite a large amount of salt and, consequently, is said to cause nails or spikes to rust quickly. Shavings salty to the taste. Air-dry wood sometimes contains as much as 1 per cent of its weight of salt. In some parts of Borneo the natives secure salt from the ashes of the wood. Used for house building, planking for boats, wall plates, bridges and all parts of structures which come in contact with metal work; used also for telegraph and telephone poles. It should be tried for railroad ties. The air-roots of this tree are very corky and light. They are commonly known in the Philippines by the name of *daluru* and are used as razor hones. (See p. 427.)

Van Eed. 148; K. & V. 1:200; Becc. 579.

LECYTHIDACEÆ.

Barringtonia acutangula Gaertn. Indian oak.
From the Seychelles to north Australia and Queensland.

White, shining, soft, even-grained. Pores small, often subdivided or in radial groups between the broad and very broad, rarely fine and moderately broad, long pith-rays, which form the greater part of the wood, and show a handsome silver grain on radial section. Boat building and joinery.

Gamb. 363, *tab. VIII, fig. 3;* Nörd. X; Watt Dict. 1:402.

Barringtonia racemosa Bl. Nivar.
British India, Ceylon, Malay Archipelago.

Wood white, very soft, porous. Pores small and moderate-sized, numerous, uniformly distributed. Pith-rays moderately broad, long, equidistant. Used principally for fuel.

Gamb. 363; Van Eed.-131; K. & V. 6:6–8.

Barringtonia speciosa Forst. Putat.
Malay Archipelago.

Wood like the preceding. A number of species of this genus furnish wood of this grade. They are usually known by the name of *putat* and are not of much commercial importance.

K. & V. 6:4–6; Van Eed. 131; Ridl. 178.

Careya arborea Roxb.
India.

Wood moderately hard; sapwood whitish, large; heartwood dull-red, sometimes claret-colored, very dark in old trees, even-grained. Pores oval, moderate-sized to large, subdivided, wavy on vertical section. Pith-rays numerous, fine, equidistant and uniform; the space between two consecutive rays less than the diameter of the pores, around which they bend. Across the pith-rays are numerous very fine transverse bars, not easily seen except on a thin section. Durable. Agricultural implements, gun-stocks, house-posts, planking, carts, furniture and cabinet work.

Gamb. 364; Nörd. X; Watt Dict. 2:157.

Planchonia valida Bl. (*P. littoralis* Van Houtte).
Andaman Islands and the Malay Archipelago.

Wood reddish-brown, with yellow streaks, very hard and very heavy, close-grained. Pores moderate-sized and large, often subdivided, in rounded and elongated patches, which are sometimes joined by narrow, undulating bands of softer tissue. Pith-rays very fine, numerous, bending. The pores are frequently filled up by a yellow substance, and are prominent on a vertical section. Seasons well and takes a fine polish.

Gamb. 365; Watt Dict. 6[1]:284; Van Eed. 139; K. & V. 6:24–26.

RHIZOPHORACEÆ.

Hard and usually heavy-wooded trees. *Rhizophora, Ceriops,* and *Bruguiera* have small pores and equidistant, fine or moderately broad rays. The pores are sometimes joined by interrupted concentric bands. The structure of *Kandelia* is different. *Carallia* and *Anisophyllea* differ by having two classes of medullary rays; short very fine rays between the regular broad ones.

Pith-rays broad, of two classes.
- Wood heavy or very heavy ..... *Carallia*
- Wood only moderately heavy ..... *Gynotroches*, *Anisophyllea*

Pith-rays fine or moderately broad.
- Pith-rays yellow, contrasting with the rest of the wood ..... *Kandelia*
- Pith-rays not very different in color from the rest of the wood.
  - Wood orange-colored and giving a fluorescent orange-colored aqueous solution. *Ceriops*
  - Wood not orange ..... *Rhizophora*, *Bruguiera*

Anisophyllea zeylanica Benth.
Ceylon.

Moderately hard and heavy. Grayish-brown. Tea-boxes.

Gamb. 336; Lewis 307.

Bruguiera caryophylloides Blume. Kakandan (Tam.); Bosung (M.).
Tidal forests of India and Burma, rare in Ceylon; Philippines, New Guinea.

Wood reddish, hard and heavy, close-grained. Pores small, scanty, often subdivided. Pith-rays fine, numerous, wavy, with a pretty silver grain.

Gamb. 334; K. & V. 4:298–300; Ridl. 172.

Bruguiera eriopetala W. & A.
Madagascar to Australia.

Wood very hard and heavy; dark-reddish. Used for piling and for fuel.

K. & V. 4:295–297; Van Eed. 126.

Bruguiera gymnorrhiza Lam. Plate XXVIII, fig. 84. Tumu (M.); pototan (Phil.).
East Africa to Australia.

The most stately tree of the mangroves. Wood very hard and very heavy, dark-reddish-brown. Construction and furniture in India; piling; fuel.

Ridl. 172; Watt Dict. 1:54; Gamb. 334; K. & V. 4:292–295; Van Eed. 127; Bargagli-Petrucci 75.

Bruguiera parviflora W. & A. Burrus; b'rus; b'eus (M.); lenggadi (Phil.).
India to Malaya and the Philippines; very abundant in the interior of mangrove swamps.

Hard and heavy. Growing usually to only a small size, but with a beautifully clear straight trunk. Wood less desirable than that of *Rhizophora* spp., or of *B: gymnorrhiza,* but still a good wood. Chief use, piling.

K. & V. 4:297; Van Eed. 127; Ridl. 172; Becc. 578.

Carallia integerrima DC. Plate XXVIII, fig. 83.
India and Ceylon to Malaya; fairly common in the Philippines, but usually not of large size.

Pretty, red-marked heartwood, used for construction, furniture, and fine cabinet work.

Watt Dict. 1:541; Gamb. 335, *tab. VII, fig. 3;* Nörd. X; K. & V. 4:301–304.

Ceriops roxburghiana Arn. Tengah; tengah puti (M.); tangal (Phil.).
Tropical tidal forests of the Old World.

Wood very hard and very heavy, orange-red in color and giving a fluorescent orange color to water in which it is placed. Very durable in water. Pith-rays distinct. The two species of this genus are distinctly the best of the mangroves, although they are of comparatively small

size. Used for piling, roof supports, etc., specially prized as a high-grade firewood.

K. & V. 4:287–289; Van Eed. 127.

Ceriops tagal (Perr.) C. B. Rob. (*C. candolleana* Arn.). Tangal (Phil.); tengah (M.).

Same distribution as the last.

Same kind of wood and same uses. Shipbuilding.

Watt Dict. 2:261; K. & V. 4:284–287; Van Eed. 127; Ridl. 172.

Gynotroches axillaris Bl. Mata keli; koekoeran (M.).

Malay Peninsula and Archipelago.

Wood soft, moderately heavy, not durable, light-brownish. Used for house work, rafters, blades of oars, etc.

K. & V. 4:306–213; Ridl. 173.

Kandelia rheedii W. & A. Tumu (M.).

British India to Formosa and Malaya.

Much less common than the preceding and but little used. Pith-rays said to be distinct from the rest of the wood because of a distinct yellow color.

K. & V. 4: 290.

Rhizophora conjugata L. Bakko, Akit (M.); Bacauan (Phil.).

Tidal forests of eastern Africa, Asia, and Australia.

Very hard and very heavy; like the next.

Ridl. 172; K. & V. 4:282; Van Eed. 128.

Rhizophora mucronata Lam. Plate XXIX, fig. 86. Belukap, b'lukap (M.); bacauan (Phil.).

Principal constituent of the mangrove on the Zanzibar coast (there called *mkonko*), then in the Seychelles, Madagascar, the whole of tropical Asia, through Malaya to Australia.

Much valued for construction work in regions of east Africa where timber is scarce. Piling, firewood.

Ridl. 172; Gamb. 335; Wiesner 2:123; K. & V. 4:278–282; Boulger 241; Van Eed. 128; Newton 6; Holtzapffel 93.

I can not distinguish the wood of *Rhizophora* spp. from that of *Bruguiera* spp.

COMBRETACEÆ.

KEY TO THE GENERA OF COMBRETACEÆ.

Pores more or less connected and surrounded by wood parenchyma.
- Pores medium-sized to small ..... *Anogeissus*
- Pores medium-sized to large ..... *Terminalia*

Pores not surrounded nor connected by wood parenchyma, small and in short radial lines ..... *Lumnitzera*

Anogeissus. Wood gray usually with a small purple-brown heartwood, hard, close-grained. Pores small, in light-colored patches sometimes arranged more or less concentrically (*A. latifolia* and *A. acuminata*), sometimes radially (*A. pendula*). Pith-rays fine, uniform, equidistant.

Anogeissus latifolia Wall.
British India.

Very hard and very heavy. Seasonal rings marked by lines without pores. Pores small, very numerous, often subdivided, surrounded either singly or in loose patches by wood parenchyma, the patches arranged obliquely or transversely in a roughly concentric fashion. Pith-rays very fine, extremely numerous, uniform, equidistant. Transverse diameter of the pores about equal to the distance between the pith-rays. Very strong and tough, but splits in seasoning and unless kept dry is not very durable. Ax handles, poles for carrying loads, axles of carts, furniture, agricultural implements, shipbuilding. Good fuel and excellent charcoal.

Gamb. 346, *tab. VII, fig. 4;* Nörd. X, also IX (*Conocarpus*); Watt Dict. 1:257.

Lumnitzera littorea (Jack) Voigt (*L. coccinea* W. & A.). Plate XXIX, fig. 87. "Red-flowered mangrove;" ñaña (Guam); culasi, ságasa, tabao (Phil.); taruntum, griting (M.); doekoek, doekoek-ageng (Jav.); taroengtoeng (Sumatra); api-api (Java and Sumatra).

British India and Ceylon to Australia and Polynesia; a mangrove swamp tree.

Wood hard and heavy, grayish- or yellowish-brown, occasionally with a certain reddish tinge. Fine-grained, with faint rose-like odor when first cut. Irregular seasonal rings said to be sometimes present. Pores small, in short radial lines. Pith-rays fine, numerous, the distance between them about equal to the diameter of the pores. Wood strong and durable. Used for piling, with the bark on. In Borneo, this wood is considered as second only to *billian* for piling, and much of it is exported for that purpose. On the Malay Peninsula it is used for the axles of carts. Used for boat building by the natives of Kaiser Wilhelmsland. Not much used in the Philippines, although it is very widely distributed.

Ridl. 173; Van Eed. 129; Safford 385; Becc. 578; Bargagli-Petrucci 77, *tab. XIV;* K. & V. 9:31–33.

Lumnitzera racemosa Willd. Kripa (Beng.); yinye (Burm.).

Tropical east Africa, Madagascar, Ceylon, British India, Burma, Java, New Guinea, Australia, Polynesia, Philippines, and Formosa.

This is a much smaller and less important tree than the last, but it is said to be very important as a firewood in some sections. The wood is strong and durable and is sometimes used for house posts.

Gamb. 348; K. & V. 9:33; Watt Dict. 5:97.

Terminalia. The woods of the *Pentaptera* and *Chuncoa* sections are dark-colored, rather like, but darker and rougher than walnut; those of the *Catappa* section are lighter in color, but have occasionally an irregular dark heartwood. In the former class the pores are larger and the texture rather more open, but in this respect *T. belerica* comes between the two. In all, the pores are in patches or single, and these patches are more or less concentrically confluent, and in all the pith-rays are fine, numerous, and uniform. The wood of *T. oliveri* resembles that of *T. chebula* in the *Catappa* section, but has smaller pores.

SUBGENUS 1, CATAPPA.

Terminalia catappa L. "The Indian almond;" "Malabar almond;" talisai (Guam); talisay, dalisai (Phil.); talie (Samoa); kaorika, kauarika (Rarotonga); tavola (Fiji); kamani (Hawaii); almendro (Spanish America); badamier (French); saori (Solomon Islands); tipop, tipapop (Ponape, Caroline Islands); badam (Beng.); kottamba (Cing.); katapang (Malay).

Madagascar, British India and Ceylon, Malay Peninsula and Archipelago to New Guinea and Polynesia; cultivated in all the tropics.

Wood red, with lighter-colored sapwood, hard. Pores moderate-sized, scanty, joined by wavy, short, concentric bands of wood parenchyma. Pith-rays fine. Troughs, carts, posts, planks, etc.

Gamb. 337; Safford 385; Watt Dict. 6:22; Phil. Woods 393; Ridl. 173; K. & V. 9:27; Van Eed. 129.

Terminalia belerica Roxb. Behara (Hind.); bohera (Beng.); tani (Tam.); búlú (Cing.); thitsein (Burm.).

British India, Ceylon, Burma, Malacca.

Wood yellowish-gray, hard, no heartwood, not durable, readily attacked by insects; seasonal rings indistinct. Pores very scanty, large, frequently divided, joined by irregular, wavy, concentric bands of wood parenchyma. Fine, uniform and equidistant pith-rays distinctly visible in the darker and harder portions between the bands, and on radial section, where, too, the pores are prominent. Planking, packing-cases, canoes, and in northwest India for house building after it has been steeped in water, which renders it more durable.

Gamb. 337, *tab. VIII, fig. 5;* Nörd. VIII; Watt Dict. 6:22; Van Eed. 129; K. & V. 9:17–20.

Terminalia chebula Retz. Harra (Hind.).

British India and Ceylon to Malaya.

Wood very hard, brownish-gray with a greenish or yellowish tinge, with an irregular small dark-purple heartwood, close-grained, fairly durable. Seasonal rings indistinct. Pores small and moderate-sized, often subdivided, singly or in groups surrounded by small patches of wood parenchyma which are slightly confluent into more or less concentrically arranged bands. Pith-rays very fine, uniform, equidistant,

numerous, stopping at or bent round the pores or groups of pores. The wood takes a good polish and is fairly durable; it is used for furniture, carts, agricultural implements, and house building. Beddome says it is cross-grained and difficult to work.

Gamb. 338–340, *tab. VII, fig. 6;* Nörd. VIII; Watt Dict. 6[4]:24.

Terminalia citrina Roxb., and *T. angustifolia* Roxb., of this section are two Indian species of local importance.

SUBGENUS 2, PENTAPTERA.

Terminalia arunja Bedd. Arjún (Beng.).
Western India and Ceylon.

Sapwood reddish-white; heartwood with darker-colored streaks, very hard and heavy. Seasonal rings doubtful. Pores moderate-sized and large, sometimes very large, uniformly distributed, more numerous and larger than in *T. tomentosa,* often subdivided into 2 to 4 compartments, each pore surrounded by a ring of wood parenchyma. Numerous, thin, wavy, concentric lines, which frequently anastomose. Pith-rays very fine and numerous. Wood apt to split in seasoning and not easy to work. Used for carts, agricultural implements, boats, and for building purposes.

Gamb. 341; Van Eed. 126; Nörd. IX (*T. macrocarpa* Steud.).

Terminalia oliveri Brandis. Than (Burm.).
Burma.

Wood hard, close- and even-grained, resembling that of *T. chebula;* sapwood yellow to gray; heartwood purplish-brown, streaked and clouded, very irregular. Pores small or very small, numerous, often subdivided, singly or in groups surrounded by patches of loose tissue which run into more or less concentrically arranged bands. Pith-rays fine and very fine, numerous, regular.

Gamb. 340.

Terminalia tomentosa W. & A.
India, Ceylon.

Sapwood reddish-white; heartwood dark-brown, hard, beautifully variegated with streaks of darker color, showing on a radial section as dark streaks which are generally undulating. Pores moderate-sized and large, uniformly distributed, each pore inclosed in an irregularly shaped and generally elongated patch of wood parenchyma; these patches are often arranged in concentric lines and frequently joined by thin, wavy, concentric bands. Pith-rays not distinct, very fine, numerous, uniform, equidistant, often wavy, the transverse diameter of the pores many times larger than the distance between the rays. House building, carts, rice-pounders, ship and boat building, railroad ties.

Gamb. 341–344; Nörd. VIII; Watt Dict. 6[4]:37–41.

SUBGENUS 3, CHUNCOA.

Terminalia paniculata W. & A.
Western British India.

Wood gray, with darker heartwood, very hard. Pores large and moderate-sized, oval, often subdivided, numerous, surrounded by faintly marked patches of wood parenchyma, arranged in oblique and wavy lines and connected into somewhat concentric bands. Pith-rays fine, uniform, wavy, numerous; the distance between them usually less than the diameter of the pores. Structural work.

Gamb. 344.

SUBGENUS 4, BIALATA.

Terminalia bialata Wall.
Burma and the Andaman Islands.

Wood gray and beautifully mottled, moderately hard and heavy. Structure and uses the same as in *T. belerica.*

Gamb. 345; K. & V. 9:28–30.

PHILIPPINE SPECIES OF TERMINALIA.

Thus far the Philippine species of *Terminalia* have not been sufficiently understood to make it possible to work out their structure with anything like completeness. Most of our Philippine species belong to the section *Catappa.* Our species in this section are *T. catappa* L., *T. pellucida* Presl, *T. nitens* Presl, *T. edulis* Blanco, *T. ellipsoidea* Merr., and *T. mollis* Rolfe; in the section *Diptera* we have *T. calamansanay* Rolfe.

Some of these woods are known under the names of *Talisay* (Phil. Woods 393), *calumpit* (Phil. Woods 380), *dalinsi* (Phil. Woods 381), and *sacat,* Plate XXIX, fig. 88, (Gard. 58; Phil. Woods 392). Until the specific limits are better known, it will be difficult to do anything with the structure of these woods.

Besides these, there is a *Terminalia* furnishing a very good wood known as *bingas, dinglas,* or *lasila* (*Terminalia comintana* (Blco.) Merr.). This wood is dark-gray with purple markings. It is hard and moderately heavy, durable, works readily and is used for structural work and for furniture. It is sometimes sold under the name of *batitinan,* and it is so fine grained that it is sometimes used as a substitute for *molave* (*Vitex littoralis* Dene.).

MYRTACEÆ.

Pores small to moderate-sized, often arranged in more or less conspicuous concentric belts, or else in short strings. Pith-rays fine and numerous.

Eucalyptus. This very large genus is mainly confined to Australia, but it produces such quantities of wood and it is so extensively handled that it is a prominent factor in all eastern markets. Certain species have

been rather extensively planted in India and elsewhere. A few of the best known species are here considered.

Wiesner 2:976–982 includes the following characterization.

Wood in cross section with numerous, prominent, light-colored spots, which contain small vessels and which frequently or always are arranged in obliquely placed stripes of changeable direction, arranged in concentric zones and so forming an appearance more or less suggesting annual rings. Sometimes there are seen on the cross-section cavities in which there is a dark-reddish-brown mass. Wood hard, heavy, usually splitting easily but roughly, checking and warping badly, but tough, elastic, strong and durable. The *Eucalyptus* woods are divided into two groups on the ground of color. The one light-brown, having about the appearance of ordinary oak wood, from which, however, it differs very markedly by the irregular appearance of the cross-section and the absence of broad pith-rays; the others appear dull-red to fleshy-red, about the tint of red *Casuarina* wood or of horseflesh wood, with which woods, however, they are not to be confused. Both sorts of *Eucalyptus* woods have the same structure.

LIGHT-BROWN EUCALYPTUS WOODS.

Distinct from the reddish-colored species by the scanty development of wood parenchyma and by the contents of the wood parenchyma and pith-ray cells. Both of these elements contain in many cells light-brown or yellowish-brown coloring material which is quickly or slowly blackened by iron chloride, partially soluble in water, which it colors, blackened by quicklime.

Eucalyptus globulus Labill. The blue gum.
Victoria and Tasmania; naturalized in British India and Ceylon.

Wood gray with darker streaks and moderately hard. Very heavy. Pores small to moderate-sized, round, in groups or in radial or oblique lines; closely packed in concentric belts in the annual rings. Pith-rays fine, very numerous, the intervals between the rays smaller than the diameter of the pores. Pores marked on a longitudinal section. House beams, railway sleepers, bridge-work, charcoal.

Stone 125; Gamb. 353. *tab. VIII, fig. 1;* Nörd. Vl; Hough's American Woods, 8:183; Van Eed. 133.

Eucalyptus maculata Hook. "Spotted gum," in Queensland and New South Wales.

Eucalyptus microcorys F. v. Muell. "Tallowwood," same range.

Eucalyptus obliqua L'Her. "Stringybark," in Tasmania, New South Wales and southern Australia. In Australia, the shaggy-barked species are usually called "stringy bark trees," while the smooth-barked species are called "iron bark trees."

Eucalyptus pilularis Smith. "Blackbutt," in Tasmania, New South Wales and Queensland.
Stone 124.

RED EUCALYPTUS WOODS.

In addition to the points already mentioned, the red *Eucalyptus* woods frequently have two- or three-layered pith-rays. The yellowish crystalline substance in the cells seems to be sometimes only sparingly present. Calcium oxalate seems to be wanting. Chips coloring alcohol or water, the latter more darkly red, without the content of the cells being noticeably dissolved; it remains unchanged in boiling water and is only dissolved when quicklime is added. The unchanged contents of the cells deeply blackened by iron chloride.

Of *Eucalyptus* species with red wood, the following are to be placed here:

Eucalyptus crebra F. v. Mueller. Ironbark in New South Wales, Queensland and north Australia.

Eucalyptus marginata Sm. The jarrah or bastard mahogany. West Australia; cultivated in British India.

Wood hard, sapwood white, heartwood red. Pores small, scanty, scattered unevenly, but chiefly in pale concentric bands. Pith-rays very fine, very numerous. Heavy construction work, piling.

Gamb. 353; Van Eed. 133; Stone 114; Stevenson 250–254.

Eucalyptus rostrata Schl. Red gum, West Australia.

Eucalyptus resinifera Smith. Forest-mahogany, West Australia. Stone 115.

Very many other species are used, but those mentioned are said to be the ones most commonly exported. Many of these woods seem to have proved quite durable for street paving in temperate regions.

Eugenia. Plate XXIX, fig. 89. Wood rough, moderately hard to very hard, seasons well, usually reddish- or grayish-brown. Pores small to moderate-sized, more or less arranged in concentric bands, sometimes joined by pale tissue of large wood cells. Pith-rays fine, numerous. A very large number of species, which are very difficult to distinguish. The timbers are usually good, and some are exceptionally so, and can be used for house or ship building. In the Philippines, woods of this genus are known as *macaasin* or *malaruhat*. In the Federated Malay States, they are known as *kayu klat*. Some very fine and some rather indifferent woods belong to the genus; but, as yet, I have not been able to properly classify them. Many of the species of *Eugenia* are of very scattered occurrence and do not grow to unusual size, consequently they are not a very considerable factor in the market.

Ridl. 175–178; Phil. Woods 387; Newton 5; Gard. 61.

Eugenia caryophyllaea Wight.

Van Eed. 134; Gamb. 359; Nörd. VII (*Myrtus caryophyllata* L.); K. & V. 6:101–104.

Eugenia jambolana Lam. Jaman (Hind.).

Van Eed. 135; Gamb. 361, *tab. VIII, fig. 2;* Nörd. VII; K. & V. 6:132–136.

Eugenia jambos L.
Van Eed. 135; Gamb. 357; Nörd. V (*Myrtus jambosa*); K. & V. 6:53–55.

Eugenia operculata Roxb.
Van Eed. 137; Gamb. 360; Nörd. IX; K. & V. 6:148–152.

Eugenia wallichii Wight.
Gamb. 357; Nörd. IX.

Sudjung.—There is found in the Island of Mindanao a very hard wood of this name which is probably produced by some species of *Eugenia*. The wood is dark-brown in color, contains a considerable amount of oil and is very durable. It is often used for corner posts of houses.

Leptospermum flavescens Sm. (*Leptospermum amboinense* Reinw.)
Sunda and Molueca Islands, Australia, Malay Peninsula.

Very hard wood used for tool handles.

Van Eed. 138; E.-Pr. 3[7]:94.

Melaleuca leucadendron L. "Cajeput tree."
British India, Malay Peninsula and Archipelago, and Australia.

Reddish-brown, hard. Pores moderate-sized, scanty, producing wavy lines on a vertical section. Pith-rays fine, extremely numerous. Piling.

Van Eed. 138; Gamb. 351; Ridl. 174; K. & V. 6:180–183; Stone 132–134.

Metrosideros (*Nania*). Very hard and very heavy wood. Pores and pith-rays very small, hard to distinguish with a lens. Dark-purplish-brown.

Metrosideros vera Lindl. (*Nania vera* Miq.) Eijserhout; kajoe besi; nani (M.).
Java, Amboina, Ternate, the Molueeas.

Very hard and very heavy; dark-reddish-brown; durable; very difficult to work. Resists the teredo. House and bridge building.

Van Eed. 139; K. & V. 6:168–171.
Other speeies of the genus in Australia and New Zealand are also noted for fine grain, hardness and durability.

Psidium guajava L.
Cultivated throughout the tropics.

Wood grayish-brown, moderately hard, even-grained. Pores small, numerous, in short radial groups. Pith-rays fine, short, numerous, indistinct. Engraving, spear handles, charcoal, firewood.

Van Eed. 139; Gamb. 355; Ridl. 175; Nörd. V (*Psidium pyriferum*); K. & V. 6:35.

Rhodamnia trinervia Blume. (*Rhodamnia cinerea* Jack.) Mempayan (M.).
British India, through Malaya, to Australia.

Wood brown, moderately hard, with faint irregular but more or less concentric very narrow lines of loose texture. Pores small to moderate-sized, irregularly distributed, occasionally in somewhat concentric lines.

Pith-rays few, moderately broad to broad, with many very fine between them. Beams for house building and plow handles.

Van Eed. 139; Gamb. 355; Nörd. IV (*Myrtus trinervia* Sm.), VII (*Myrtus melastomoides* F. M.); Ridl. 174.

Tristania. Wood hard to very hard and heavy to very heavy; durable. Reddish or dark-reddish; close-grained. Pores small; pith-rays small. Wood parenchyma scanty.

Tristania burmannica Griff.
British India and Malaya.
Gamb. 354.

Tristania decorticata Merr. Malabayabas.
Philippines, Sarawak.

Wood hard and heavy, fine-grained; dark-reddish-brown; used for tool handles.

Tristania merguensis Griff.
Straits Settlements.
Ridl. 175.

Tristania obovata Benn. Palawan, prawan.
Banka, Sumatra, Borneo.

Very fine firewood. Used for the tin and gold mines.

Van Eed. 140; Bargagli-Petrucci 78, *tab. XV.*

Tristania whitiana Griff.
Singapore.
Ridl. 175.

Various species of *Tristania* are known in Borneo by the name of *Plawan* and the wood is used for firewood; Becc. 578, 585.

Xanthostemon verdugonianus Naves. Plate XXIX, fig. 90. Mancono (Phil.)
Philippines; Surigao, Leyte, Palawan, Camarines.

Very hard and very heavy. Probably the hardest and heaviest of Philippine woods. Exceedingly durable. A possible substitute for *lignum-vitæ.*

Phil. Woods 388; Hutchinson, For. Bur. (Philip.) Bull. 9 (1908).

MELASTOMATACEÆ.

Wood heavy, hard, fine-grained. Usually light-colored. Pores and pith-rays fine to very fine.

Astronia papetaria Blume.
Malay Archipelago.

Good structural wood.

Van Eed. 144.

Melastoma malabathricum L. Sendukduk.
British India, Burma, and Ceylon.
Gamb. 366; Ridl. 178.

Memecylon. Wood very hard, close-grained, brown or whitish. Pores small, in irregular groups. Pith-rays many, extremely fine to fine.

Memecylon edule Roxb. Nipis kulit; "ironwood tree."
India, Ceylon, Malaya.

Valuable hard durable wood, which is one of the best substitutes for boxwood. (See p. 426.)

Gamb. 368; Watt Dict. 5:226; Ridl. 178; K. & V. 5:210; Beec. 579.

Pternandra caerulescens Jack.
British India, Burma, Straits Settlements.

Wood light and soft.

Gamb. 368; Ridl. 178.

ARALIACEÆ.

Wood white, usually soft. Pores small, usually rather scanty; a line of larger pores often indicating the seasonal rings. Pith-rays moderately broad, not numerous, giving a silver-grain.

Aralidium pinnatifidum Miq. Alus surat.
Straits Settlements.

Wood faint-dull-red, hard, splits deeply in drying. Upright supports of bridges and heavy work of a similar description.

Ridl. 180; Gamb. 384.

Polyscias nodosa Seem. Plate XXIX, fig. 91. Malapapaya.
Philippines and Malay Archipelago.

Matchwood; the best wood for this purpose in the Philippines.

Phil. Woods 387; K. & V. 7:11–13; Van Eed. 151.

CORNACEÆ.

Pores usually small and in short radial lines, and the pith-rays fine and numerous.

Alangium lamarckii Thw.
East Indies.

Hard, close-, and even-grained, sapwood light-yellow, heartwood olive-brown, with a pleasant scent. Pores small, scanty, in short radial lines of 2 to 5. Pith-rays fine, closely packed, wavy, bent round the pores, the diameter of which is slightly greater than the distance between the rays.

Watt Dict. 1:155; Gamb. 389.

Marlea begoniaefolia Roxb.
British India, Java, Philippines.

Wood white, soft, even-grained. Seasonal rings marked by a belt of numerous pores. Pores moderate-sized and large, small in the outer portion of each ring. Pith-rays short, wavy, fine and moderately broad. Structural work.

Gamb. 389; K. & V. 5:82–84.

Marlea ebenacea C. B. Clarke. Lidah kerbau putih.
Straits Settlements.

Wood hard, strong, and durable, yellow with a red heart.

Ridl. 180.

Marlea nobilis C. B. Clarke. Sutubal.
Straits Settlements.

Hard and durable; structural work.

Ridl. 180.

Mastixia arborea C. B. Clarke.
British India and Ceylon.

Wood greenish-gray, soft. Pores small, numerous, evenly distributed. Pith-rays fine and very fine, numerous and short. Seasonal rings indistinct.

Gamb. 391.

MYRSINACEÆ.

Wood compact, close-grained. Pores very small or extremely small, often in groups or in radial or oblique lines. Pith-rays distant, fine to broad, more often broad. Resin-ducts frequent, sometimes among the wood cells, sometimes in the rays.

Aegiceras corniculatum (L.) Blanco (*Aegiceras majus* Gaertn.). Tinduc-tinducan (Phil.); truntum (M.).

A constituent of the mangrove swamp, Ceylon to the Philippines and Australia.

Wood reddish or dark-brown, often streaked with yellow, moderately hard, even-grained. Pores very small, scanty, uniformly distributed. Pith-rays moderately broad to broad, short, scanty, dark, yellow in spots. Very oily; used in structural work and for firewood.

Gamb. 442; Ridl. 212; Van Eed. 161; K. & V. 5:276–278.

Aegiceras floridum Roem. & Schult. Plate XXIX, fig. 92.
Philippines, Amboina, New Guinea.

Very much like the preceding.

Ardisia. Wood moderately hard. Pores small, usually in radial lines. Pith-rays broad.

Ardisia paniculata Roxb.
British India.

Wood pinkish-white, moderately hard. Pores small, in radial lines. Pith-rays short, broad, wavy.

Gamb. 441.

Maesa. Wood light-brown, soft. Pores small, scanty, sometimes in short radial lines, often filled with resin. Pith-rays usually fine, numerous.

Maesa indica (Roxb.) Wall.
British India and Ceylon.

Brownish-white wood, used for posts.

Gamb. 438; K. & V. 5:222–224.

Maesa rugosa Clarke.
British India and Java.
Gamb. 437.

Myrsine africana L.
British India and South Africa.

Wood light-brown, moderately hard. Pores extremely small, scattered or in short radial lines, between the distant, moderately broad pith-rays, which contain many resin-cells.

Gamb. 438; Nörd. V (*M. retusa* Ait.).

SAPOTACEÆ.

The wood of the *Sapotaceæ* has a well-marked character, somewhat difficult to describe accurately, but easily recognized when understood, as it resembles that of no other family except *Ebenaceæ*, where the woods are usually black or gray, while those of *Sapotaceæ* are usually red. Wood hard, smooth, durable; heartwood dark-colored, generally red. Pores small and moderate-sized, in wavy, radial lines, which are frequently oblique, the lines being more or less in echelon. Pith-rays numerous, fine, equidistant, joined by fine, transverse bars or concentric lines of loose texture.

Bassia. Wood hard, smooth, durable, usually with red heartwood. Pores small and moderate-sized, in short radial or oblique lines, more or less in echelon. Pith-rays numerous, fine, equidistant, joined by fine transverse bars.

Bassia latifolia Roxb.
British India and Burma.

Wood hard to very hard; sapwood large; heartwood reddish-brown. Seasonal rings indistinct. House building, furniture and country vessels, naves of wheels.

Gamb. 447, *tab. IX, fig. 4;* Nörd. X.

Chrysophyllum roxburghii G. Don. "Star apple."
British India, Java, Sumatra and Philippines.

Wood white, close-grained, moderately hard. Pores in small radial lines bending into oblique strings. Pith-rays numerous, very fine. Shingles.

Gamb. 443; Ridl. 212; K. & V. 1:130; Lewis 309.

Illipe. Wood soft to very hard and light to very heavy. Wood of some species very durable. Reddish. At any rate the harder woods with a considerable amount of saponin in the wood, lathering when wet.

Illipe latifolia (Roxb.) Engler. (*Bassia latifolia* Roxb.) "Butter tree;" "mahua tree."
British India.

Wood hard with red heart.

Watt Dict. 1:445.

Illipe malabrorum König. (*Bassia longifolia* L.) Mowa tree; mahua tree.
Ceylon, Malabar.

Reddish, moderately hard. Structural work and shipbuilding.

Watt Dict. 1:416; E.-Pr. 4[1]:134.

Illipe betis (Blco.) Merr. Plate XXIX, fig. 93. Betis.
Philippines.

Piling and heavy construction, very durable.

Phil. Woods 377; Gard. 63.

Isonandra perrottetiana Wight.

Wood light-reddish-brown, hard, close-grained. Pores small to moderate-sized, in narrow groups which are somewhat radially but obliquely arranged, and often fork. Pith-rays fine, regular. Transverse lines clear and conspicuous, regular and wavy. Structural and finishing work.

Gamb. 445.

Mimusops. Wood red, very hard. Pores small, in short radial or oblique lines. Pith-rays very fine, very numerous, uniform and equidistant. Numerous wavy, concentric lines.

Mimusops elengi L. Poko Tanjong; tandjoeng; ki-tandjoeng; boengo-tandjoeng (M.); bansalaguin (Phil.).
British India and Ceylon and throughout the Malayan region.

Widely cultivated in the tropics. Wood very hard and very heavy; close- and even-grained; sapwood reddish-brown; heartwood dark-red. Strong, durable. Piling and heavy construction work, tool handles.

Gamb. 449; Ridl. 213; Van Eed. 164; Watt Dict. 5:251; Phil. Woods 375; Gard. 64.

Mimusops kauki L. San, saoe (M.); "ironwood."
Malay Peninsula, Java, Celebes.

Much like the preceding and used for the same things.

K. & V. 1:156–158; Van Eed. 164; Ridl. 214.

Mimusops littoralis Kurz. "Andaman bullet wood."
Andaman and Nicobar Islands.

Very hard and very heavy; reddish-brown to pinkish-brown; durable. Structural work.

Gamb. 451; Watt Dict. 5:253; E.-Pr. 4[1]:152.

Palaquium. Plate XXIX, fig. 94. Reddish, moderately hard and heavy to very hard and heavy. Pores moderate-sized, in radial echeloned strings. Pith-rays fine, numerous. Transverse concentric lines numerous, wavy. Wood with or without saponin.

Palaquium barnesii Merr. Nato.
Philippines.

Soft or moderately hard and moderately heavy. Light planking and temporary construction work.

Phil. Woods 391.

Palaquium borneense Burck. Njatoe-doerian.
Borneo.
Van Eed. 164.

Palaquium javense Burck. Njatoh; njatoe; kawang; djempina; grawang.
Java.

Furniture and structural work.

Van Eed. 165; K. & V. 1:143–145.

Palaquium sp. Nyatto pisang.
Sarawak.

Very hard and durable. Boats.

Palaquium obovatum Engl. Belian wangi. Betis.

Timber very dull-reddish, grain medium, very hard and very heavy; splits slightly in drying; affords beams of excellent quality, which remain undecayed a long time under water and are not badly eaten by termites. Pith-rays fine, rings distinct and irregular with very fine concentric rings numerous and wavy. Pores moderate in short rows parallel with the rays, often subdivided, not very numerous.

Ridl. 213; also in Agric. Bull. F. M. S. & S. S. (1906) 39; (1907) 171.

Palaquium polyanthum Engl.
British India.

Wood red, hard. Pores moderate-sized, in wavy radial lines, sometimes slightly oblique. Pith-rays fine, not prominent. Fine wavy, parallel and equidistant concentric lines. Planks, tool handles, etc.

Gamb. 446; Nörd. X.

Palaquium bancanum Burck.
Malay Peninsula.

Wood reddish-brown, rays fine and close, pores moderate, in radial rows; rings fairly distinct, fiber wavy. A light wood with a good gloss.

Ridl. 213.

Numerous other species of *Palaquium* are used, most of them of not very good quality.

The name *nato,* with its variants, is applied to this genus and its close relatives, gutta-percha bearing plants, all the way from Madagascar to the Pacific. In the Malay Peninsula the equivalent term is *taban* and in Sumatra *balam.*

Becc. 579.

Payena leerii Kurz. Gutah-sundik; njatoe-balam-bringin; balam-tandjong; poeting; getah-seundik (M.).
Malay Peninsula, Borneo, Sumatra, Banka, Riouw.

Wood used for house building.

Van Eed. 165; Ridl. 213.

Payena lucida A. DC. Niato balam.
British India and Malay Peninsula.

Wood red, hard. Pores moderate-sized, in short radial lines. Pith-rays very fine, very numerous, uniform, equidistant. Numerous parallel, wavy, concentric lines, not very prominent. Planking.

Gamb. 449; Ridl. 213.

Sarcosperma arboreum Benth.
British India.

Wood pink, moderately hard. Pores moderate-sized, in long, wavy, radial lines. Pith-rays numerous, fine, equidistant, the distance between two rays much less than the diameter of the pores. Indistinct concentric lines. Used in making canoes.

Gamb. 443.

Sideroxylon ferrugineum Hook. Tuak-tuak.
Malay Peninsula.

Wood hard and heavy, pinkish-brown in color, with very fine rays, and wavy concentric lines, the pores arranged in wavy lines radiating from the center, whiter than the ground color and giving the wood a pleasing mottled appearance.

Ridl. 212; Van Eed. 165.

Sideroxylon tomentosum Roxb.
British India, Burma, and Ceylon.

Wood light-yellowish-brown, moderately hard (plains specimens) to hard (hills specimens). Pores fine (hills) to moderate-sized (plains), in groups in short lines, usually oblique, the groups somewhat far apart and in echelon. Pith-rays very fine, very numerous, equidistant. Very numerous, very faint lines across the rays, irregular. Structural work.

Gamb. 444.

Many other species of *Sideroxylon* are used locally, but they do not commonly occur in much quantity and so are not of much importance commercially.

Bedaru, Daru, or *Daroo-daroo.* This wood has been credited to this family at various times. Ridley (214) says that it is evidently sapotaceous. King and Gamble in their materials for a Flora of the Malay Peninsula,[2] under the description of *Sideroxylon malaccense* Clarke, make the following statement: "Mr. Cantley (the collector) says that this tree gives the true 'daru-daru' wood of the Malay Peninsula."

The wood now known as *bedaru* or *daru* in Sarawak and Singapore is distinctly not sapotaceous in structure. (See p. 492.) I have collected herbarium material and wood from the same tree in Sarawak and have compared the wood with the material sold under that name by the timber dealers at Singapore and have found the two to be identical. It is a species of *Urandra* (*Icacinaceae*).

[2] Journ. As. Soc. Beng. 74[2]:162.

EBENACEÆ.

This family is important because it produces the ebony of commerce. The sap and heartwood are often very distinct; sapwood white, yellow, pink or reddish or gray; heartwood black or black-streaked, sometimes with a greenish tinge. Wood hard to very hard and heavy to very heavy. Pores small to moderate-sized, scanty, often in short radial lines which are distant and somewhat in echelon, each pore surrounded by a collar of wood parenchyma one cell thick. Wood parenchyma in fine, more or less regular, sometimes indistinct, parallel concentric lines. The *Sapotaceæ* are distinguished from the *Ebenaceæ* by having usually red or yellow wood, longer radial lines of pores which have a more conspicuously oblique arrangement. Also the *Sapotaceæ* do not have the collar of wood parenchyma about the pores.

The different members of the family have such uniform structure that it seems impossible to distinguish the different genera and species structurally.

Any member of the family may furnish ebony, if the heartwood is sufficiently developed. Many species do furnish ebony, but most of them are of small size and so relatively unimportant. The true black heartwood seems to be somewhat irregular in occurrence. Occasionally a tree of good size seems to lack it entirely. In many cases, old injuries are found to be bordered by a small amount of the black heartwood. The following statements by Hiern [3] show which are the best known commercial species and their region of occurrence.

The following species supply ebony:

Diospyros ebenum König. India, etc.
D. melanoxylon Roxb. India.
D. dendo Welw. Angola, west tropical Africa.
D. sylvatica Roxb. India, etc.
D. gardneri Thw. Ceylon.
D. hirsuta L. f. Ceylon.
D. discolor Willd. Malaya, etc.
D. embryopteris Pers. India, etc.
D. ebenaster Retz. Malaya, etc.
D. montana Roxb. India, etc.
D. insignis Thw. Ceylon and southern India.
D. tupru Ham. India.
D. mespiliformis Hochst. Tropical Africa.
D. truneata Zoll. & Mor. Java.
D. tessellaria Poir. Mauritius.
D. haplostylis Boiv. Madagascar.
D. microrhombus. Madagascar.
D. ramiflora Wall. Northeast India.
Maba buxifolia Pers. India, Madagascar, etc.
M. mulala Welw. Angola, west tropical Africa.
Euclea pseudebenus E. Mey. South Africa.

[3] Hiern, Ebenaceae 29.

The following species also produce good wood:

Diospyros malacapai A. DC. Wood yellow with black spots. Philippines.
D. pilosanthera Blanco. Ornamental wood.
D. pilosa A. DC. Timber fit for building purposes. Cochin China.
D. chloroxylon Roxb. Wood pale. Circars, India.
D. foliosa Wall. Valuable light-colored wood. Southern India.
D. lanceaefolia Roxb. Hard and handsome wood. East Indies.

Calamander or Coromandel wood, a finely variegated and scarce wood, is produced by *D. quaesita* Thw. and by *D. oppositifolia* Thw.

Anchors for large boats are made, in the Province of Tavoy in Burmah, of the wood of *Maba buxifolia* Pers.

Those species which produce a mottled or streaked wood are really much more beautiful than the dead black ebony, but this latter is usually more in demand.

Artificial ebony.—Local dealers often use various artificial means to produce an even black color. European dealers sometimes dye pieces of box or pear wood and sell them for ebony. The fine, even grain of these woods makes them well suited for this purpose. They are usually lighter in weight than the true ebony and the color given them is usually only superficial.

In the Philippines, it is said that *camagon, bolongeta* and other native ebonies, which are only streaked with the black heartwood may be colored uniformly black by being buried for some months in the salt mud of the mangrove swamp. I can not vouch for the correctness of this statement, but it sounds reasonable. I think that the method indicated or the application of certain chemicals may be successfully used to produce a good even black heartwood. This would, in reality, be merely a hastening of the normal process of heartwood formation and it should produce a very good ebony. Experiments are in progress to determine the feasibility of this scheme.

Uses of ebony.—Ebony is employed to make pianoforte keys, the stringholder in violins, spear-points, fine furniture and cabinet work, canes, inlaying; and the best kind of ebony is very valuable on account of its maintaining a permanent shape and not warping, and is therefore used for rules and measures. This freedom from shrinking and warping is probably due to the fact that the wood is very fine-grained and all the elements of the wood are filled up with a homogeneous substance which is probably some combination of an iron salt with a tannic acid.

CLASSIFICATION OF PHILIPPINE EBONIES.

Philippine ebonies are black, streaked or dull-grayish in color.

Black ebonies.—These have heartwood of a uniform dead black. They are known as *ebano* or *ata-ata*. *Ebano* is usually produced by *Maba buxifolia* Pers. The sapwood is white and the heartwood very sharply marked off from it. This is a very satisfactory ebony, but it is of

rather local occurrence and is usually of small size. It seems to furnish the best of the ebony canes sold in Manila.

Ata-ata.—This is the name given to *Diospyros* spp. which have a white or streaked sapwood and a dead black heart. The sapwood and heartwood are not here so sharply separated as in *Maba buxifolia* and the relative amount of heartwood is less; *ata-ata* seems to be of fairly common occurrence from southern Luzon southward. It usually forms considerably larger trees than does *Maba buxifolia.*

Streaked ebonies.—These are the most beautiful woods of the group. They are known as *bolongeta* and *camagon.*

Bolongeta.—This is produced by *Diospyros pilosanthera* Blanco, and, probably, other species. The sapwood is pink or reddish and the heartwood black with brownish or reddish streaks. This is a large tree of frequent occurrence and wide distribution in the Archipelago. It is used for various articles of furniture and for structural work. It is sometimes used for piling, but is said to be very subject to teredo attack. If an artificial seasoning method can be devised, this will be a very prominent source of commercial ebony.

Camagon.—This seems to be mainly the product of *Diospyros discolor* Willd. Next to *bolongeta,* it is the most commonly seen of our ebonies. It is cultivated for its fruit, which is known as *mabolo.* The sapwood is gray-mottled to purplish-gray with black spots; the heartwood is black with brownish streaks. It is not to be distinguished in appearance from the Calamander wood of Ceylon. It is commonly used for fancy furniture and for canes.

Of the other ebonies, *Diospyros nitida* Merr. may be mentioned for its uniform dull bluish-gray wood, much like the sapwood of *camagon.* Apparently this species does not form a distinct heartwood. It is of small size and relatively infrequent occurrence.

Other forms of ebony may occur in the Islands, but they are certainly not of commercial importance. The so-called "white ebony," *Diospyros malacapai* A. DC., is not well known. It may be nothing but sapwood of *ata-ata* or other ebonies.

I believe that any of the above-described ebonies may, at times, produce the dense black form.

Ebonies in Malaya.—*Kayu arang* is the name applied to those ebonies of the Malay region which produce a distinct black heartwood.

In Borneo, various species of *Diospyros* which do not have distinct black heartwood are known as *kayu malam* or *mar pinang.*

Some very fine large ebony logs are produced in the Moluccas and in Sumatra. Borneo does not seem to produce very much.

Indian ebonies.—Gamble classifies the Indian ebonies as follows:

(1) Heartwood wholly black or only slightly streaked: *ebenum, tomentosa, melanoxylon, assimilis.*

(2) Heartwood regularly streaked black and brown or gray: *kurzii, quaesita, oocarpa, thwaitesii, gardneri, insignis, oppositifolia, undulata.*

(3) Heartwood very small, merely black streaks in the brownish-gray or gray wood: *embryopteris, foliolosa, sylvatica, ehretioides, microphylla, humilis, ovalifolia, kaki, tupru.*

(4) Heartwood none, wood red, white, gray, or yellowish: *martabanica, montana, toposia, foliolosa, lotus, chloroxylon, oppositifolia, candolleana, nilagirica, crumenata, pyrrhocarpa.*

Ceylon ebonies.—The ebonies, perhaps, reach their highest development on the Island of Ceylon. They have been carefully studied and H. Wright's "The Genus Diospyros in Ceylon; its Morphology, Anatomy and Taxonomy" [4] is much the most complete work of its sort.

Diospyros ebenum König. Itam (M.); ebbenhout; ebony.
Ceylon, south India, Sumatra, Malacca, the Moluccas, Celebes.

This is the best-known ebony tree. There is very little of it cut in India, the trees not being very common, and being found only here and there and of small size; but in Ceylon it is one of the chief woods, the average sales being 300 tons yearly. When the wood of this species is evenly black, it is sold as ebony; when it is at all streaked, it is sold as "bastard" ebony. Used for turning, cabinet work, piano keys, rulers, walking sticks, brushes and general furniture, in Europe; and in China, for chopsticks, pipes and carved stands.

Wright 146–151; Van Eed. 168.

The following are a few of the best-known commercial ebonies.

Diospyros melanoxylon Roxb.
British India and Ceylon.

This produces most of the ebony that comes from British India. It is rare in Ceylon.

Gamb. 461, *tab. IX, fig. 6;* Nörd. IX; Stone 154, *pl. X, fig. 85;* Wright 174–178.

Diospyros quaesita Thw. Calamander or Coromandel wood.
Ceylon.

Red, hazel-brown or chocolate-brown, with handsome black stripes. This very beautiful wood is found only in Ceylon and seems not to be plentiful there, but it has set a widely recognized standard of beauty. It is used for a great many different kinds of ornaments.

Wright 166–171; Boulger 178.

D. kurzii of the Andaman Islands, is said to furnish wood very much like calamander in ornamental value. *D. oocarpa* and *D. affinis* of Ceylon are also said to approach calamander in ornamental value, but they have a much larger proportion of the useless sapwood. The *camagon, Diospyros discolor* Willd., of the Philippines (Phil. Woods 380), is not to be distinguished in appearance from calamander. It is more plentiful and is at least as good a wood.

[4] Ann Roy. Bot. Gard. Peradeniya 2 (1904–05) 1–204.

Diospyros pilosanthera Blanco. Bolongeta.
Philippines.

This is a very good example of those ebonies which have a streaked heart and reddish sapwood. It is of equal beauty with *camagon*.

Phil. Woods 378.

Diospyros chloroxylon Roxb. The so-called "green ebony" of central and southern India.

Wood yellowish-gray, moderately hard. The greenish tinge seems not to be pronounced. Used principally for firewood.

Wiesner 2:1005; Gamb. 458; Nörd. VII (*D. tomentosa Poir.*).

Maba buxifolia Pers. Plate XXIX, fig. 95. Ebano; ironwood.
British India, Ceylon, tropical Africa, Madagascar, Burma, Malay Peninsula, Malay Archipelago to Australia.

Sapwood white; heartwood even dead black. Small pieces of ebony of good quality. Used for small ornaments, anchors for boats, etc.

Gamb. 452; Watt Dict. 5:102; K. & V. 1:23–25; Phil. Woods 383.
Wiesner 2:986–991 gives a discussion of ebonywood. Other discussions of ebony are found in Stevenson 258–261, Holtzapffel 83, and Boulger 169.

SYMPLOCACEÆ.

Wood white, close-grained, soft to hard. Pores small, numerous, usually evenly distributed. Pith-rays fine and moderately broad, the latter short.

Symplocos crataegoides Ham.
British India and Burma.

Turnery and carving.

Gamb. 464, *tab. X, fig. 1;* Nörd. VIII.
Many other species are found, but they are ordinarily rather small or of scanty occurrence.

STYRACACEÆ.

Wood white to light-brown, moderately hard, close-grained. Pores small, scanty, usually subdivided. Pith-rays short, fine, very numerous. Faint, white, regular, concentric, transverse bands.

Styrax benzoin Dryand. Menjan; kemajan; kamian; kajoe-limoeta.
Siam, Malacca, Sumatra, Java.

Wood of but little value, though it is occasionally used in house building and for bridges.

Van Eed. 171; Pierre 260; Ridl. 215.

Styrax serrulata Roxb.
British India and Burma.
Gamb. 467.

OLEACEÆ.

Wood white or yellowish-white or light-brown, sometimes with a dark irregular heartwood, usually close- and even-grained. Pores sometimes in white patches. Pith-rays usually fine, sharply defined. In *Osmanthus* the pores are in reticulate anastomosing patches. In *Osmanthus* and *Linociera* there are narrow concentric lines, the relationship of which to seasonal rings is very doubtful.

Linociera. Wood yellowish-white or light-brown, hard, close-grained. Pores small, usually in short radial groups. Pith-rays fine or very fine, distinct, numerous. Fine, fairly regular concentric lines prominent.

Linociera intermedia Wight.
British India.

Wood fine, like boxwood.

Gamb. 473.

Several other species of this region, which are usually either small or very much scattered, are found to produce the same kind of wood.

Osmanthus fragrans Lour.
British India to China and Japan.

Wood white, hard, close- and even-grained. Pores in irregular light-colored patches, radially elongated, arranged obliquely and branching; the patches somewhat distant and forming a net-work, and the pores small and numerous in them. White, very narrow parallel concentric lines, which look like seasonal rings, but are not. Pith-rays fine, uniform.

Gamb. 472; Nörd. IX.

Schrebera swietenioides Roxb. (*Nathusia swietenioides* (Roxb.) O. Ktze.) Moka (Hind.).
British India and Burma.

Wood brownish-gray, hard, close-grained; no definite heartwood, but irregular masses of purple or claret-colored wood in the center, and scattered throughout the tree. Seasonal rings indistinct. Pores small, often in small groups in radial arrangement. Pith-rays fine, numerous, uniform and at equal distances. Beams of weavers' looms, combs, turnery.

Gamb. 469, *tab. X, fig. 2;* Nörd. X; Watt Dict. 6^2:488.

SALVADORACEÆ.

Salvadora persica L.
India, Persia, Syria, Arabia, central Africa.

Wood white, soft. Pores small, in short radial lines, inclosed in oval patches of soft tissue, very scantily distributed, but prominent on a vertical section. Numerous fine, interrupted, concentric bands of wood

parenchyma, separating broader bands of firm texture, in which the fine and numerous pith-rays are distinctly visible.

Gamb. 476; Nörd. XI.

Salvadora oleoides Dene.
British India, Afghanistan.

Wood light-red, moderately hard, with a small, irregular, purple heartwood. Pores large and small, oval, often subdivided, surrounded by irregular patches of wood parenchyma, which are joined into wavy, irregular, zigzag, concentric bands; scanty, but much more numerous and prominent than in *S. persica*, prominent on a vertical section. Pith-rays fine, numerous, distinct, at unequal distances. Structural work, agricultural implements, Persian wheels and the knee timbers of boats.

Gamb. 477, *tab. X, fig. 4;* Nörd. X; Watt Dict. 6²:448.

LOGANIACEÆ.

Fagraea. Plate XXIX, fig. 96. Wood hard, close-grained, gray or light-brown. Pores large, scanty, often subdivided. Pith-rays fine, very numerous. Concentric pale bands numerous: in these there may be (extremely fine) pores.

Fagraea fastigiata Bl. Malebera; malbira.
Malay Peninsula, Java.

Wood of a dirty yellowish color with very close narrow rays, and scattered pores partitioned. It has a great reputation for resisting water, and if the trunks are used with the bark on, resist the teredo, so that it is a very valuable timber for wharfs and piles.

Ridl. 217; K. & V. 9:80.

Fagraea fragrans Roxb. Anan (Burm.); tembusu (M.); "kings-wood;" kajoe-radjah; urung (Phil.).
British India, Burma, Malay Peninsula and Archipelago.

Wood light-brown, hard, close-grained. Pores (or intercellular ducts) large, very scanty, often subdivided and filled with a white substance. Numerous pale concentric bands alternating with bands of firmer tissue in which the fine numerous pith-rays are distinctly visible. Numerous very fine, parallel transverse lines in longitudinal section. One of the most important woods of the Malay Peninsula. One of the best woods for piling. House building, boat anchors, etc. Very durable, untouched by white ants and fungus and lasts a long time in the ground.

Gamb. 496; Wiesner 2:1015; Ridl. 216; Watt Dict. 3:312; Van Eed. 179; K. & V. 9:86.

Fagraea speciosa Bl. Tembusu tembaga; tembusu talang; tembusu paya.
Malay Peninsula.

Wood like that of *F. fragrans* but more compact and resinous, with a strong odor and showing no concentric lines. Very durable. House beams, bridges and planks.

Ridl. 216.

Fagraea wallichiana Benth.
Malay Peninsula.

Very heavy and darker in color than that of other species. A very fine compact wood.

Ridl. 217.

Strychnos nux-vomica L. Kajoe-oelar; "snakewood;" "strychnine tree;" bidara-pahit.
Ceylon, British India, Burma, Java.

Wood white, close-grained, durable. No heartwood, no seasonal rings. Pores of two classes; large pores very scanty; very small pores numerous, in irregular ramified patches, which are joined by concentric and oblique white lines. Pith-rays white, fine and moderately broad, numerous, sharply defined in the darker tissue. The large pores, which are prominent as white streaks on a vertical section are filled with a white pith-tissue, and sometimes ramify; they may be not vessels, but large intercellular ducts. The wood is bitter and is not eaten by white ants. Used for plow-shares, car-wheels, cots and fancy cabinet work.

Gamb. 497; Watt Dict. 6[3]:382; Van Eed. 190; K. & V. 9:65–68; Boulger 274.

Other species of *Strychnos* are also used, but their wood has a structure like that just described.

APOCYNACEÆ.

Wood white, soft to hard, even-grained, rarely with heartwood. Pores small or very small, scanty, in short or long radial groups. Pith-rays very fine, very numerous. Occasional light concentric lines as in *Alstonia*.

Alstonia macrophylla Wall. Plate XXX, fig. 97. Batino.
Philippines.

Much harder than *A. scholaris*. Without the white concentric lines. Pores distinctly in radial rows. Structural work.

Phil. Woods 377.

Alstonia scholaris (L.) R. Br. Plate XXX, fig. 98. Dita; chatwan; Plai; "corkwood."
British India and Ceylon to New Guinea and Australia, Philippines.

Wood white, soft, even-grained, seasons badly, and soon gets moldy and discolored if allowed to season in the log. Pores moderate-sized, oval, subdivided, ringed, scanty. Pith-rays fine, wavy, irregularly distributed, with numerous intermediate extremely fine rays. Numerous

fine, wavy, concentric lines at unequal distances. Used for floats, blackboards, tool handles, scabbards, coffins, etc.

Gamb. 483, *tab. X, fig. 5;* Becc. 580; Nörd. X; Ridl. 216; Phil. Woods 382; Watt Dict. 1:199; Van Eed. 174; K. & V. 1:117–120; Wiesner 2:1022; Lewis 309.

Dyera. Wood white, very soft and very light, with large pores, which are rather few in number. Pith-rays close; numerous, fine, irregular transverse lines of wood parenchyma.

Dyera costulata Hook. f. Jelutong.
Malay Peninsula.

Used for making clogs, and also for planking, boxes, models, the cheaper grade of Chinese coffins, etc.

Ridl. 215.

Dyera lowii Hook. f. Plate XXX, fig. 99. Jelutong, djeloetoeng, djiuluton.
Borneo.

Much the same uses as the preceding. Both of these species furnish wood which closely resembles that of *Alstonia scholaris.*

Van Eed. 176; Bargagli-Petrucci 84; Becc. 580.

Holarrhena antidysenterica Wall. Kurchi bark; conessi bark.
British India and Burma.

Wood white, soft, even-grained. Seasonal rings marked by a faint line. Pores small, numerous, grouped in radial lines. Pith-rays fine, very numerous. Cellular tissue loose. Wood carving.

Gamb. 484; Nörd. VII; Watt Dict. 4:258.

Wrightia. Wood white, moderately hard. Pores small, scanty, in short radial lines. Pith-rays very fine, numerous.

Wrightia javanica DC. Bintaos; mentaos, djalitri.
Java, British India.

Used for wood carving and ornament.

Van Eed. 177; K. & V. 1:112–114.

Wrightia laniti (Blanco) Merr. Plate XXX, fig. 100. Lanete.
Philippines.

This wood is not to be distinguished from the last. It is the best Philippine wood for carving; and it is used in the carving of sacred images, light construction, bolo scabbards, canes, cooking utensils, chairs, musical instruments, shoes, trunks, turning, wardrobes, window-sills.

Phil. Woods 385.

Wrightia tinctoria R. Br.
British India and Burma.

Wood ivory-white, moderately hard, even-grained. Pores scanty, very small, in short radial lines. Pith-rays extremely fine, numerous. Wood carving.

Gamb. 486; Watt Dict. 6[1]:317.

Wrightia tomentosa Roem. & Schult.
British India, Ceylon, Burma.

Wood white or yellowish, moderately hard, even-grained. Seasonal rings marked by a pale line and occasionally more pores; pores in the rest of the wood very small, in short radial groups, scanty. Pith-rays very fine and extremely fine, very numerous, closely packed. Turnery and wood carving.

Gamb. 487; Watt Dict. 6[4]:317.

Other genera of *Apocynaceae* which occasionally furnish pieces of fine-grained wood are *Cerbera, Kickxia, Ochrosia* and *Tabernaemontana*. These usually are of but scattered occurrence and small size.

BORRAGINACEÆ.

No well-marked character for the family.

Cordia. Pores of variable size, more or less joined by concentric, often broken, belts of loose tissue, separated by darker belts in which the pith-rays are prominent. *C. myxa* and *C. octandra* have soft woods, the others have hard woods much resembling good teak; durable and suitable for carpentry.

Cordia fragrantissima Kurz.
Burma.

Wood moderately hard, reddish-brown with darker streaks, beautifully mottled, has a fragrant scent. Pores moderate-sized to large, in roundish patches, which are joined by occasional, broken, concentric lines. Pith-rays rather distant, moderately broad. Small quantities have been exported to London.

Gamb. 501, *tab. XI, fig. 2;* Nörd. X.

Cordia myxa L.
Egypt to tropical Australia; also frequently planted.

Wood grayish-brown, moderately hard. Pores moderate-sized or large, scanty, scattered and frequently double, or partitioned, joined by angled wood cells; the alternate bands denser and closer in texture. Pith-rays short, moderately broad, shallow. Boat building, well-curbs, agricultural implements, gunstocks, canoes.

Gamb. 500, *tab. XI, fig. 1;* Nörd. X; K. & V. 7:64–66.

Ehretia. Wood very light-brownish or yellowish-white, moderately hard, even-grained, usually rough. Pores small, in radial lines or scattered, in some species larger in the earlier-formed wood where they mark the seasonal rings. Pith-rays fine to moderately broad, regular.

Ehretia acuminata Br.
British India, Burma, Java to Australia.

Wood very light-brown, rough, moderately hard, resembling that of the ash. Pores of two kinds: those in the earlier-formed wood, large and closely packed in a line, making conspicuous seasonal rings; those in the rest of the wood small, scattered. Pith-rays short, moderately

broad, not numerous. Scabbards, sword-hilts, gun-stocks, and used for building and agricultural implements.

Gamb. 503, *tab. XI, fig. 3;* Nörd. III; K. & V. 7:74–76.

Ehretia laevis Roxb.
British India, Persia, China.

Wood grayish or brownish-white, moderately hard, even-grained. Seasonal rings indistinctly marked. Pores small, grouped in small clusters or radial lines. Pith-rays fine, short, numerous. Tough and durable; agricultural implements and building.

Gamb. 503; Watt Dict. 3:203.

Ehretia javanica Bl. (*E. wallichiana* Hook. f. & Th.) Kendal; Ki-bako.
British India, Burma and Java.

Wood yellowish-white, moderately hard, rough. Seasonal rings marked by light-colored belts. Pores small and moderate-sized, in scattered groups and short radial lines. Pith-rays short, numerous, uniform. Building, charcoal, tea-boxes.

Gamb. 504; Nörd. X; K. & V. 7:76–78; Van Eed. 182.

VERBENACEÆ.

Wood usually of good quality, not liable to warp or split, of various colors. Pores usually moderate-sized, scanty, those in the earlier formed wood larger and marking the seasonal rings. Pith-rays generally fine and moderately broad, regular. The wood of *Avicennia* is quite anomalous.

Avicennia officinalis L. Plate XXX, fig. 101. Api-api (M.).
Mangrove swamps, tropical East Africa to Australia.

Wood brown or gray, hard and heavy, in alternate layers of pore-bearing tissue and loose large-celled tissue without pores; the former layer shows the large, moderate-sized or small pores in radial strings of 1 to 5 between the fine short pith-rays; the latter is much narrower and darker, forming belts which occasionally join each other, so that the layers are clearly not seasonal growths. Wood very brittle. Firewood, mills for husking paddy, rice-pounders, and oil-mills.

Gamb. 546, *tab. XI, fig. 6;* Nörd. III; Watt Dict. 1:360; K. & V. 7:217–221; Van Eed. 187; Ridl. 219.

Callicarpa. Wood white or brownish-white, even-grained. Pores small to large, usually in radial lines. Pith-rays moderately broad to broad. Usually small shrubs.

Callicarpa arborea Roxb. Ambon (M.).
British India and Burma, Malay Peninsula.

Wood light-brownish-white, moderately hard, even-grained. Seasonal rings marked by a line of harder wood. Pores rather scanty, small to large, oval and often elongated, subdivided into numerous compartments, often in radial lines. Pith-rays broad, with numerous fine rays between

them, well marked on a radial section; the distance between the rays greater than the transverse diameter of the pores. Charcoal.

Gamb. 525; Ridl. 218.

Gmelina arborea Roxb. Goomar teak; peddah gomra; gumaldi.
British India, Burma, Ceylon.

Wood yellowish, grayish, or reddish-white, with a glossy luster, even-grained, soft, light and strong, durable, does not warp or crack. Seasonal rings marked either by a white line or by more numerous pores in the spring wood. Pores large and moderate-sized, often subdivided, rather prominent on a vertical section; sometimes arranged in rough, more or less concentric lines. Pith-rays short, moderately broad, prominent. Wood easily worked and readily takes paint or varnish; it is very durable under water. Highly esteemed for planking, furniture, door-panels, carriages and palanquins, and for well-work, boats, toys, packing-cases and all ornamental work; it is used in Burma for carving images and canoes. Roxburgh says it is very like teak.

Gamb. 537–539; Nörd. IV; Watt Dict. 3:515; E.-Pr. 4^{3a}:173.

Peronema canescens Jack. Soengkei-melajoe (Sumatra); loewis-madang (Borneo).
Malay Peninsula, Sumatra, Java, Borneo.

Wood white, light but fairly hard; rings distinct, marked with a close continuous line of pores. Pores large, few, often partitioned. Used for house posts and bridge building.

Van Eed. 188; Ridl. 219; K. & V. 7:214.

Premna. Wood light-brown or gray, often streaked, moderately hard. Pores small or moderate-sized, rather scanty, often subdivided. Pith-rays fine or moderately broad, with a silver grain of very small plates.

Premna integrifolia L.
Ceylon, British India, Burma, Philippines.

Wood light-creamy-brown, moderately hard, even-grained. Pores moderate-sized, sometimes subdivided, numerous. Pith-rays fine, close, fairly numerous. Wood with pleasant scent, fresh and fragrant, not so aromatic as sandal.

Gamb. 535.

Premna pyramidata Wall.
Burma.

Wood very light-brown or yellowish-white, often streaked, hard, close-grained, smooth. Pores small or moderate-sized, sometimes subdivided, fairly numerous. Pith-rays fine to moderately broad, numerous, close. Wood seasons and polishes well and is used for weaving-shuttles.

Gamb. 536, *tab. XI, fig. 5;* Nörd. IV.

Premna tomentosa Willd. Boengboelan; boelang; bolang; gadoengan; gadoeng.

Ceylon, British India, Java.

Wood said to be almost as durable as teak. Used for house building.

Van Eed. 188; K. & V. 7:179–182.

Tectona grandis L. f. Plate XXX, fig. 102. Teak; jati.

British India, Burma, Java, Siam, and much planted.

"The best teak is from Malabar, then the Java teak; the Burmese and also the Siamese teak is usually lighter in weight and of brighter color; the greater part of this comes by way of Bangkok, Moulmein, or Rangoon.

"Wood moderately hard, strongly and characteristically scented and containing an oil which is easily perceptible to the touch and is preservative; sapwood white, usually small; heartwood dark, golden-yellow, turning brown, dark-brown and finally almost black with age. Annual rings marked by one or more lines of regularly arranged pores, often set in a belt of loose tissue; in the rest of the wood the pores are scattered, scanty, sometimes subdivided, variable in size from small to moderate-sized, a few large. Pith-rays moderately broad to broad, fairly numerous, giving a conspicuous handsome silver-grain of elongated plates. Pith large quadrangular.

"The small pieces left in working up big logs are worked up into shingles. There is one difficulty in the utilization of teak wood, viz., that it is so often unsound at the center, necessitating scantlings being cut so as to leave the center out. The unsoundness is due partly to the large soft pith which is easily bored by insects, allowing damp and rot to enter afterwards, and partly, perhaps, to so much of the teak still brought out coming from old overmature trees. Teak is the chief export timber of India and Burma, also the chief building timber of the country. The wood is exported chiefly for shipbuilding, especially for the backing of armor plates in battle ships and for the decks of most vessels, also for the construction of railway carriages and for the best class of house carpentry, being admirably suited for staircases, balustrades, door and window frames and furniture. In India it is used for all purposes of house and ship building, for bridges, railway sleepers, furniture, shingles, etc. It is used for carving, the Burmese carved teakwood being especially noted, in Burma itself carved 'Kyaungs,' or monasteries, being prominent in almost every village of any importance. The wood is very durable, as is shown by the specimens obtained by Brandis from the old city of Vijiyanagar (Hampi) in the South Deccan, which are still sound and good though probably five hundred years old. There are also in the Dehra collection pieces, now quite black and very hard, from the ancient city of Ujjain in Ajmere, whose age must be very

great. The durability is probably due to the large amount of oil contained in the wood. This oil is used medicinally, as a substitute for linseed oil and as a varnish." (Gamb. 526–534.)

Nörd. IV (sapwood only); Watt Dict. 6⁴:1–14; Ridl. 220; Winton 229; Wiesner 2:1003–1005; K. & V. 7:165–172; Van Eed. 189–194; Blits 48–50; Phil. Woods 394; Stone 170; Stevenson 269–274; Holtzapffel 107.

The teak is probably the best known of all tropical woods. It has a wider range of usefulness than any other and has become the standard for estimating the value of other woods from the rest of the world. Other woods surpass it for special purposes, but for general utility there is none to equal it. Moreover, the way in which it adapts itself to cultivation on comparatively poor soil makes it certain that it can maintain a place in the world's markets indefinitely.

Tectona hamiltoniana Wall.
Burma.

A hard and very heavy wood, which is light-brown, close-grained, with an irregular dark-brown heartwood. Pores small, often subdivided, rather scanty. Pith-rays fine, the distance between them equal to the transverse diameter of the pores. Seasonal rings marked by a continuous white line with somewhat larger pores. Harder and heavier than teak.

Gamb. 534.

Vitex. Wood gray, brown or olive-brown, moderately hard to very hard. Pores small or moderate-sized. Pith-rays fine to moderately broad.

Vitex aherniana Merr. Plate XXX, fig. 103. Sasalit.
Philippines.

Very hard and heavy to very heavy. Dark-brownish-yellow. Very durable; house posts, etc.

Phil. Woods 392; Gard. 67.

Vitex altissima L. f. Myrole; mibella.
British India and Ceylon.

Wood gray with a tinge of olive-brown, hard, close-grained, polishes well. Seasonal rings distinctly marked by a belt of firmer wood on the outer edge. Pores small, scanty. Pith-rays fine, numerous, wavy, very heavy. Structural work and carts.

Gamb. 540; Watt Dict. 6⁴:247.

Vitex littoralis Dene. (*Vitex timoriensis* Walp.) Plate XXX, fig. 104. Molave.
Philippines, Timor.

Wood hard and heavy; pale-yellow; fine and usually straight-grained. Seasonal rings present, diffuse-porous. Slightly acid odor. Bitter taste. Turning greenish-yellow when treated with an alkaline solution. Staining water a greenish-yellow color. Often said to be the finest Philippine wood. Much valued for house and ship building. Classed in the third line of Lloyd's Register. Some of its uses in the Philippines are:

Axles, beams, bridges, cabinet making, carabao yokes, cogwheels, general high-grade construction, docks, doors, finishing of houses, firewood, flooring, footings in the ground, futtocks, palo (wooden club to pound rice), posts, joists, knees, piles, pillars, pinions, planks, plows, rafters, rice mortars, shipbuilding, cutwater, ships' knees, ribs, frames, siding of houses, sleepers, sternposts, sugar presses, wedges, wheel rims, undersills, paving blocks, railroad ties. For many purposes, it seems to be fully the equal of teak.

Phil. Woods 389; Gardner 55; Van Eed. 194; Boulger 217; Semler 685.

Vitex pubescens Vahl. Halban; calipapa; leban; kuzoe-arak; molave.
British India, Burma, Andaman Islands, Borneo, Philippine Islands, Malay Archipelago and Peninsula.

Wood smooth, reddish-brown or olive-brown, very hard, close-grained, seasonal rings marked by a more or less sharp line and by a broad belt of firmer wood on the outer edge. Pores small to moderate-sized, scanty, uniformly distributed. Pith-rays fine and very fine, numerous, equidistant. Difficult to distinguish from the preceding. Durable, used for structural work, mine-props, etc.

Gamb. 541; Ridl. 218; Van Eed. 195; K. & V. 7:202–204.
Other species of *Vitex* are also used, furnishing wood of excellent quality.

BIGNONIACEÆ.

Pores usually moderate-sized, ringed or in patches of loose texture which are often oblique or confluent into more or less broken concentric belts; they are often filled with resin. Pith-rays fine, regular.

Dolichandrone. Pores rather scanty, small to moderate-sized, in oblique lines and sometimes in concentric bands. Pith-rays fine, numerous. Texture, color and hardness variable.

Dolichandrone spathacea (L. f.) K. Sch. (*D longissima* (Lour.) K. Sch., D. rheedii Seem.) Tui (Phil.).
Malabar to New Guinea.

Wood white, soft. Pores small, often subdivided, in wavy, narrow, concentric bands. Pith-rays very fine, very numerous. Not durable. Used for temporary construction.

Gamb. 512; Van Eed. 183; K. & V. 1:69–71; Becc. 581.

Heterophragma. Pores moderate-sized, ringed. Pith-rays fine, the distance between the rays being equal to or greater than the transverse diameter of the pores. No regular distinct concentric bands.

Heterophragma adenophyllum Seem.
British India.

Sapwood light-yellow; heartwood orange-yellow, with occasional darker streaks, moderately hard to hard. Pores moderate-sized, ringed, filled with yellow resinous matter, uniformly distributed, but occasionally running into more or less concentric lines. Pith-rays fine to moderately

broad, the distance between them equal to or greater than the diameter of the pores.

Gamb. 514, *tab. XI, fig. 4;* Nörd. IX (sapwood).

Millingtonia hortensis L. Sekar-poetih; potean.
British India, Burma and Malay Archipelago.

Wood soft, yellowish-white. Seasonal rings marked by the younger wood with few pores and the older wood with rather more numerous ones. Pores small, numerous, arranged in light-colored patches which run together to form a more or less concentric zigzag pattern. Pith-rays fine, the distance between the rays somewhat larger than the transverse diameter of the pores. Very soft and corky; used for boxes and other temporary uses.

Gamb. 509; Watt Dict. 5:247; Van Eed. 183.

Oroxylum indicum Benth. Pincapincahan (Phil.); pohon-pedang, kajoe-sabel (M.).
British India, Burma, Andamans, Ceylon, Malaya.

Wood yellowish-white, soft; no heartwood. Pores scanty, moderate-sized, uniformly distributed. Seasonal rings marked by more numerous pores. Pith-rays fine to moderately broad. Matchwood.

Gamb. 510; Ridl. 218; Van Eed. 184.

Pajanelia rheedii DC.
British India, Burma, Andaman Islands.

Wood orange-brown, very hard, close-grained. Pores large, occasionally filled with yellow resin; each pore surrounded by a narrow ring of wood parenchyma, uniformly distributed. Pith-rays fine, very numerous, uniform and nearly equidistant, prominent. Wood very similar to that of *Planchonia littoralis,* but differs by more prominent pith-rays and larger pores, which are not arranged in bands, but isolated.

Gamb. 517.

Various species of *Radermachera* and, possibly, other genera occasionally furnish trees of sufficient size to give soft and easily worked woods.

Stereospermum. Wood grayish-brown, heartwood (if present) yellowish-brown. Pores small to large, variable in size, scanty, surrounded by wood parenchyma, the patches joined into more or less concentric belts. Pith-rays fine to moderately large, rather scanty.

Stereospermum chelonioides DC.
British India, Burma, Ceylon, Malay Peninsula.

Wood hard, gray, no heartwood. Pores moderate-sized and large, joined by narrow, irregular, wavy, interrupted belts and lines of soft tissue. Pores frequently filled with a white substance of a resinous nature, which is prominent on a vertical section. Pith-rays short, wavy, moderately broad, numerous. House building, furniture, canoes, tea-boxes.

Gamb. 514; Ridl. 217; Watt Dict. 6^3:466; Van Eed. 184.

Stereospermum suaveolens DC.
British India and Ceylon.

Wood hard; sapwood gray; heartwood small, yellowish-brown, beautifully mottled with darker streaks, very hard, seasons and polishes well. Pores moderate-sized, inclosed in patches of wood parenchyma which are more or less concentrically arranged and sometimes run together into concentric belts. Pores frequently filled with a white shining substance, which becomes yellow in the heartwood. Pith-rays fine, sharply defined, numerous, wavy, equidistant. Durable, easy to work and good for building, but the amount of heartwood is small. An excellent firewood and makes good charcoal.

Gamb. 515; Watt Dict. 6[a]:367.

RUBIACEÆ.

Wood white, yellow, or rarely red, close- and even-grained, generally hard or moderately hard; usually no heartwood. Pores small or very small; in *Anthocephalus cadamba* and a few other species, moderate-sized. Pith-rays uniform, equidistant, fine or very fine, often closely packed. In *Morinda* the pores collect in patches, but otherwise the structure is very uniform. Many of the species have woods resembling boxwood, and worthy of practical test to see if they could not be used as substitutes for it.

Adina. Wood yellowish, moderately hard to hard, even-grained. Pores small, numerous. Pith-rays fine and very fine, numerous.

Adina cordifolia Hook. f.
British India, Burma, Ceylon.

No heartwood. Seasonal rings faint. Pores small, numerous, evenly distributed. Pith-rays very fine, short, numerous. Combs, turnery, house posts. Durable.

Gamb. 401, *tab. IX, fig. 2;* Nörd. VII, IX; Watt Dict. 1:114.

Adina rubescens Hemsl. Berombong (M.).
Malay Peninsula.

Heartwood yellow, with distinct rings. Hard and heavy wood suitable for building.

Ridl. 209.

Anthocephalus cadamba (Roxb.) Miq. Henhja, kajoe-koening (M.).
Southeastern Asia, Malay Archipelago, New Guinea.

Wood white, with a yellowish tinge, soft, even-grained. Pores large, oval, elongated, subdivided, sometimes in short radial lines, scanty. Pith-rays fine, numerous, close together, bent outward where they touch the pores. Structure very similar to that of *Sarcocephalus cordatus* Miq. Structural work, joinery, tea-chests.

Gamb. 400; Nörd. IX; Watt Dict. 1:266; Van Eed. 154; K. & V. 8:8–11.

Canthium. Wood hard, close-grained. Pores very small, numerous. Pith-rays fine and very fine, numerous, regular.

Canthium didymum Roxb. Butulang.
British India, Ceylon, Burma, Malay Peninsula.

White or light-brown. Seasonal rings marked by a dark line with few or no pores. A fine wood used for agricultural purposes. In Ceylon, its resemblance to boxwood has caused it to be called "Ceylon boxwood."

Gamb. 419; Ridl. 211.

Gardenia. Wood creamy-white, smooth, close-grained, hard, but cuts easily. Pores small to extremely small, evenly distributed, often scanty. Pith-rays short, very fine to fine, numerous. Like the species of *Randia,* those of *Gardenia* have the characters of boxwood, and deserve attention as possible substitutes for the cheaper rougher work of engraving, tool-handles, etc.

Gardenia barnesii Merr. Plate XXX, fig. 105.
Philippines.

Wood very hard and very heavy, white, much resembling boxwood, for which it could possibly be substituted. An excellent wood for small ornaments.

Gardenia coronaria Ham.
British India and Burma.

Combs and turnery, liable to crack.

Gamb. 416; Nörd. IV (*G. costata*).

Gardenia gummifera L. f.
British India.
Gamb. 415; Watt Dict. 3:481.

Gardenia tubifera Wall. Delima hutan (M.).
Malay Peninsula, Sumatra, Borneo.

Wood white, grain fine, medium hard and heavy, splits in drying. Used for house building and is fairly durable.

Ridl. 210; Van Eed. 115; K. & V. 8:90.

Guettarda speciosa L. Seacoast teak; Ketapang-ketek (M.).
Seacoasts throughout the Indo-Malayan region.

Wood yellow, with a tinge of red. Pores small, often in radial lines. Pith-rays moderately broad and very fine.

Gamb. 418; K. & V. 8:129–131.

Hymenodictyon excelsum Wall.
British India, Burma, Philippines.

Wood white, when cut up fresh; if cut up dry, brownish-gray; soft. Seasonal rings indistinctly marked. Pores moderate-sized, scanty, single or subdivided. Pith-rays few, moderately broad, alternating with others, fine, bent around the pores. Wood cells large. Tea-boxes, scabbards, grain-measures, palanquins, toys.

Gamb. 406; Nörd. IX; Watt Dict. 6[4]:349; K. & V. 8:50–52.

Ixora. Wood brownish, hard, close-grained. Pores small. Pith-rays very fine, numerous, regular. Very numerous species but usually of relatively small size.

Gamb. 420; Ridl. 211; K. & V. 8:146–169.
Pavetta and *Coffea* are much like the last.

Mitragyne. Wood reddish- or yellowish-brown. Pores small to moderate-sized, not very numerous. Pith-rays fine, numerous, uniform. Wood cells usually rather large.

Mitragyne parvifolia Korth. (*Stephegyne parvifolia* Korth.) Kajoe mas, kajoe-koening (M.).
British India, Burma, Ceylon.

Wood light-pinkish-brown, moderately hard, even-grained, much resembling that of *Adina cordifolia,* but rather harder, and at once recognized by its different color. Pores small, numerous, uniformly distributed. Pith-rays very fine, numerous, short. The wood is easily worked and polishes well; it is durable, if not exposed to wet. It is used in building, furniture, agricultural implements, combs, cups, spoons and platters, and for turned and carved articles.

Gamb. 403; Nörd. VII and X; Van Eed. 155; K. & V. 8:38–40.

Morinda tinctoria Roxb. Mengkudu.
British India, Burma, Ceylon, Malay Peninsula and Archipelago.

Wood red, often yellow with red streaks, moderately hard, close-grained. Seasonal rings fairly marked. Pores small, scanty, in radial or oblique groups, rather distant from each other. Pith-rays fine and moderately broad, rather distant. Durable; plates and dishes.

K. & V. 8:192–194; Gamb. 422; Ridl. 211.

Nauclea sp. Plate XXX, fig. 106. Calamansanay.
Philippines.

Wood hard and heavy, yellow with a beautiful rose tint; close- and straight-grained. No seasonal rings. Pith-rays very fine, pores small and scattered. Used for flooring, masts of boats, beams in interior construction, posts for houses or in contact with the ground, shipbuilding, telegraph poles, window sills.

Phil. Woods 378.

Randia. Wood creamy-white, light-brown or grayish-brown, smooth, close-grained, hard. Pores small or very small, evenly distributed. Pith-rays fine and very fine, numerous.

Randia dumetorum Lam.
British India, Burma, Ceylon, Abyssinia, China, Sunda Islands.

Seasonal rings marked by a belt without pores. Agricultural implements, fences, fuel.

Gamb. 413; Watt Dict. 6:391; K. & V. 8:96.

Sarcocephalus cordatus Miq. Plate XXX, fig. 107. Bancal (Phil.); kajoemas (M.); bakmi (Ceylon); "yellow wood."

Ceylon, Burma, Malacca, Philippines, Malay Archipelago, New Guinea, North Australia.

Wood soft, sapwood light-yellow, heartwood bright-yellow. Pores moderate-sized, rather scanty, usually subdivided, in rough radial lines between the numerous fine pith-rays which bend round them. Furniture, door frames, panels, sandals, tea-chests.

Gamb. 400; Nörd. VI; Phil. Woods 375; Lewis 309; Van Eed. 157; K. & V. 8:13–15.

Sarcocephalus junghuhnii Miq. Mangel; chermin ayer (M.); mambog (Phil.).

Malay Peninsula, Philippine Islands.

Wood fairly heavy, bright-yellow when fresh, turning brown; not very hard. Sapwood not very distinct. Pores large and small mixed, rays very close and fine, rings fairly distinct and regular, narrow and almost poreless. A good ordinary building wood, durable.

Ridl. 209.

Scyphiphora hydrophyllacea Gaertn. Cingum (M.).

In the mangrove swamps throughout this region.

Wood dark-brown, fine-grained, rings obscure, pores exceedingly small, and pith-rays very fine.

Ridl. 210; K. & V. 8:125–127.

Urophyllum glabrum Wall.

Malay Peninsula.

Maingay says *Urophyllum* is the *kayu gading;* the wood is very pale whitish-red or reddish-white, grain medium, very hard, splits very slightly in drying. Used for the manufacture of kris handles and probably valuable for carving or wood engraving. The name *kayu gading* is applied to several plants which have white (like ivory) hard wood, chiefly species of *Canthium, Petunga venulosa* and also *Hunteria corymbosa.*

Ridl. 210; K. & V. 8:66–68.

Wendlandia. Wood reddish-brown. Pores small, evenly distributed. Pith-rays of two kinds, very fine and fine or moderately broad, numerous.

Wendlandia exserta DC.

British India.

Hard. Seasonal rings marked by fewer pores in the later-formed wood. Building, agricultural implements, house posts.

Gamb. 408; Nörd. IX (*W. excelsa*); Watt Dict. 6[4]:402.

Other species of the genus in India and Malaya produce wood very much like that already described, but usually in small pieces.

COMPOSITÆ.

Wood soft and light. Pores moderate-sized, rather scanty. Pith-rays moderately broad to fine.

Vernonia arborea Ham. Plate XXX, fig. 108. Merambong (M.).
Malay Peninsula, Philippine Islands, Malay Archipelago.

Wood white or brownish; used for house building but is not durable.

Ridl. 211; K. & V. 5:50–54.

ILLUSTRATIONS.

Plate XXII.

Fig. 1. Agathis alba.
2. Pinus insularis.
3. Casuarina equisetifolia.
4. Engelhardtia serrata.
5. Quercus soleriana.
6. Artocarpus cumingiana.
7. Sloetia sideroxylon.
8. Taxotrophis ilicifolia.
9. Helicia philippinensis.
10. K'runtum.
11. Scorodocarpus borneensis.
12. Strombosia philippinensis.

Plate XXIII.

Fig. 13. Michelia champaca.
14. Canagium odoratum.
15. Myristica philippensis.
16. Beilschmiedia cairocan.
17. Cinnamomum camphora.
18. Eusideroxylon zwageri.
19. Litsea perrottetii.
20. Parinarium griffithianum.
21. Pygeum preslii.
22. Pithecolobium acle.
23. Acacia melanoxylon.
24. Sindora cochinchinensis.

Plate XXIV.

Fig. 25. Pericopsis mooniana.
26. Intsia bijuga.
27. Cassia nodosa.
28. Pterocarpus indicus.
29. Kingiodendron alternifolium.
30. Erythrina indica.
31. Caesalpinia sappan.
32. Parkia roxburghii.
33. Ixonanthes icosandra.
34. Chloroxylon swietenia.
35. Fagara integrifoliola.
36. Murraya exotica.

Plate XXV.

Fig. 37. Irvingia malayana.
38. Canarium commune.
39. Aglaia clarkii.
40. Amoora aherniana.
41. Toona calantas.
42. Sandoricum indicum.
43. Xylocarpus granatum.
44. Bischofia trifoliata.
45. Koordersiodendron pinnatum.
46. Melanorrhoea sp.
47. Urandra sp.
48. Dodonaea viscosa.

Plate XXVI.

Fig. 49. Euphoria cinerea.
50. Pometia pinnata.
51. Zizyphus zonulatus.
52. Gonystylus bancanus.
53. Berrya ammonilla.
54. Bombycidendron campylosiphon.
55. Bombycidendron campylosiphon (long. section).
56. Thespesia populnea.
57. Pterocymbium tinctorium.
58. Tarrietia javanica.
59. Tarrietia sylvatica.
60. Dillenia sp.

PLATE XXVII.

FIG. 61. Calophyllum inophyllum.
62. Calophyllum borneense.
63. Cratoxylon sp.
64. Mesua ferrea.
65. Vatica sp.
66. Balanocarpus sp.
FIG. 67. Shorea balangeran ?
68. Hopea acuminata.
69. Dryobalanops sp.
70. Shorea guiso.
71. Dipterocarpus grandiflorus.
72. Shorea polysperma.

PLATE XXVIII.

FIG. 73. Red Lauan.
74. Anisoptera sp.
75. White Lauan.
76. Cotylelobium sp.
77. Cotylelobium sp.
78. Seriah puteh.
FIG. 79. Homalium sp.
80. Octomeles sumatrana.
81. Lagerstroemia speciosa.
82. Sonneratia pagatpat.
83. Carallia integerrima.
84. Bruguiera gymnorrhiza.

PLATE XXIX.

FIG. 85. Ceriops tagal.
86. Rhizophora sp.
87. Lumnitzera littorea.
88. Terminalia nitens.
89. Eugenia sp.
90. Xanthostemon verdugonianus.
FIG. 91. Polyscias nodosa.
92. Aegiceras floridum.
93. Illipe betis.
94. Palaquium sp.
95. Maba buxifolia.
96. Fagraea sp.

PLATE XXX.

FIG. 97. Alstonia macrophylla.
98. Alstonia scholaris.
99. Dyera lowii.
100. Wrightia laniti.
101. Avicennia officinalis.
102. Tectona grandis.
FIG. 103. Vitex aherniana.
104. Vitex littoralis.
105. Gardenia barnesii.
106. Nauclea sp.
107. Sarcocephalus cordatus.
108. Vernonia sp.

(*All figures with a magnification of five diameters.*)

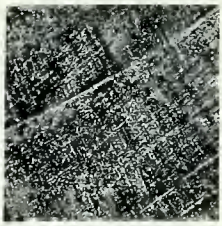

FIG. 1.—*Agathis alba.*

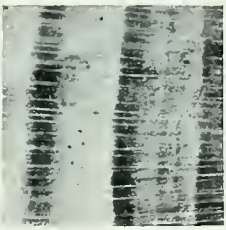

FIG. 2.—*Pinus insularis.*

FIG. 3.—*Casuarina equisetifolia.*

FIG. 4.—*Engelhardtia serrata.*

FIG. 5.—*Quercus soleriana.*

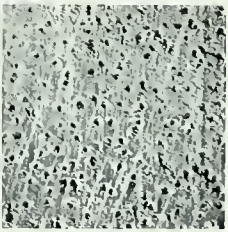

FIG. 6.—*Artocarpus cumingiana.*

FIG. 7.—*Sloetia sideroxylon.*

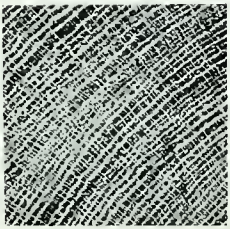

FIG. 8.—*Taxotrophis ilicifolia.*

FIG. 9.—*Helicia philippinensis.*

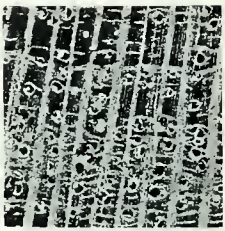

FIG. 10.—*K'ranutum.*

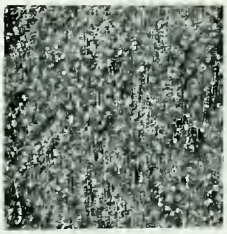

FIG. 11.—*Scaphocarpus borneensis.*

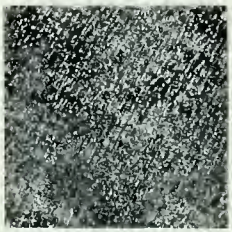

FIG. 12.—*Strombosia philippinensis.*

PLATE XXII.

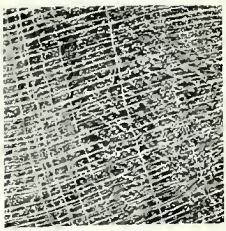

FIG. 13.—*Michelia champaca.*

FIG. 14.—*Canangium odoratum.*

FIG. 15.—*Myristica philippensis.*

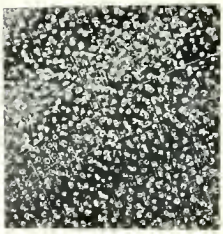

FIG. 16.—*Beilschmiedia cairocan.*

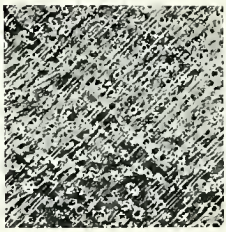

FIG. 17.—*Cinnamomum camphora.*

FIG. 18.—*Eusideroxylon zwageri.*

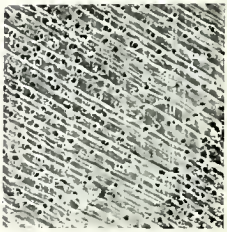

FIG. 19.—*Litsea perrottetii.*

FIG. 20.—*Parinarium griffithianum.*

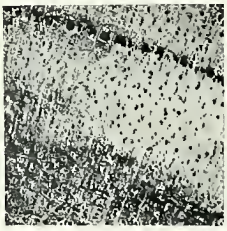

FIG. 21.—*Pygeum preslii.*

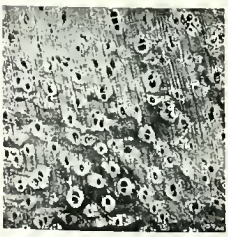

FIG. 22.—*Pithecolobium acle.*

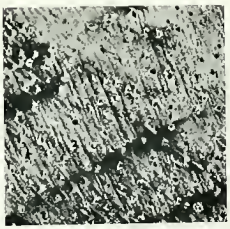

FIG. 23.—*Acacia melanoxylon.*

FIG. 24.—*Sindora cochinchinensis.*

PLATE XXIII.

FIG. 25.—*Pericopsis mooniana.*

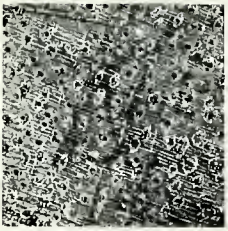

FIG. 26.—*Intsia bijuga.*

FIG. 27.—*Cassia nodosa.*

FIG. 28.—*Pterocarpus indicus.*

FIG. 29.—*Kingiodendron alternifolium.*

FIG. 30.—*Erythrina indica.*

FIG. 31.—*Caesalpinia sappan.*

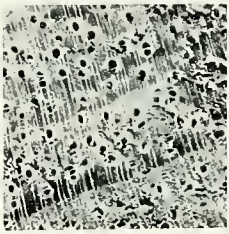

FIG. 32.—*Parkia roxburghii.*

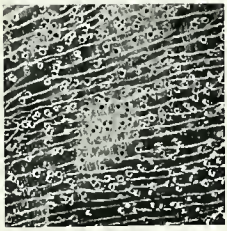

FIG. 33.—*Ixonanthes icosandra.*

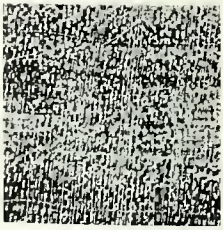

FIG. 34.—*Chloroxylon swietenia.*

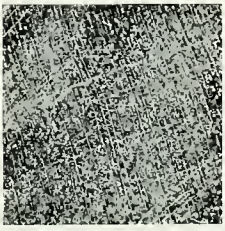

FIG. 35.—*Fagara integrifolia.*

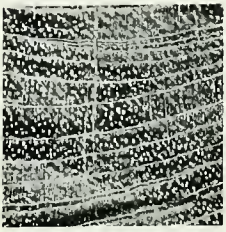

FIG. 36.—*Murraya exotica.*

PLATE XXIV.

FIG. 37.—*Irvingia malayana.*

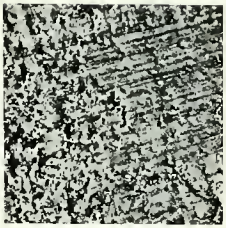

FIG. 38.—*Canarium commune.*

FIG. 39.—*Aglaia clarkii.*

FIG. 40.—*Amoora aherniana.*

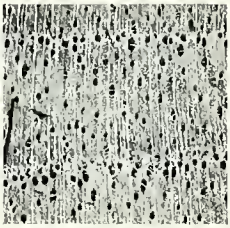

FIG. 41.—*Toona calantas.*

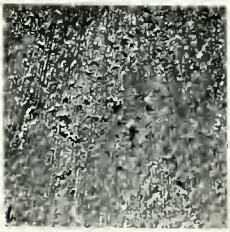

FIG. 42.—*Sandoricum indicum.*

FIG. 43.—*Xylocarpus granatum.*

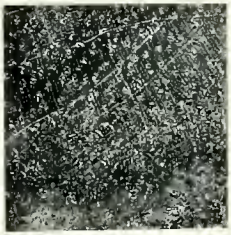

FIG. 44.—*Bischofia javanica.*

FIG. 45.—*Koordersiodendron pinnatum.*

FIG. 46.—*Melanorrhoea* sp.

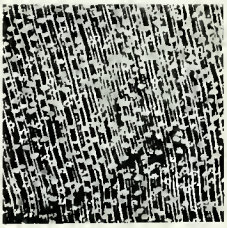

FIG. 47.—*Urandra* sp.

FIG. 48.—*Dodonaea viscosa.*

PLATE XXV.

FIG. 49.—*Euphoria cinerea.*

FIG. 50.—*Pometia pinnata.*

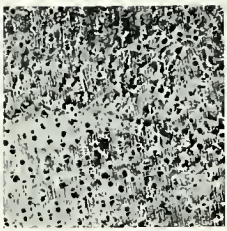

FIG. 51.—*Zizyphus zoaulatus.*

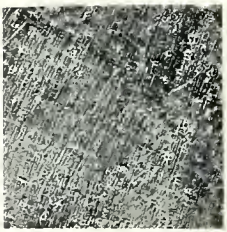

FIG. 52.—*Gonystylus bancanus.*

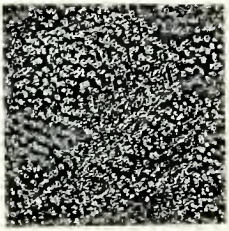

FIG. 53.—*Berrya ammonilla.*

FIG. 54.—*Bombycidendron campylosiphon.*

FIG. 55.—*Bombycidendron campylosiphon.*

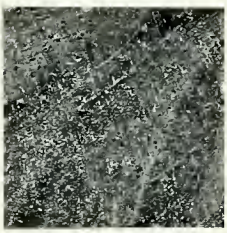

FIG. 56.—*Thespesia populnea.*

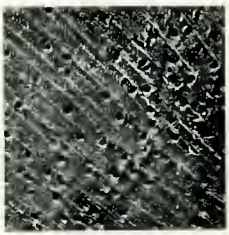

FIG. 57.—*Pterocymbium tinctorium.*

FIG. 58.—*Tarrietia javanica.*

FIG. 59.—*Tarrietia sylvatica.*

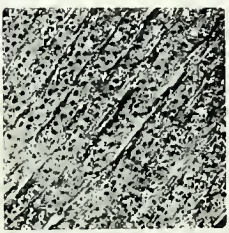

FIG. 60.—*Dillenia* sp.

PLATE XXVI.

FIG. 61.—*Calophyllum inophyllum.*

FIG. 62.—*Calophyllum braceense.*

FIG. 63.—*Cratoxylon* sp.

FIG. 64.—*Mesua ferrea.*

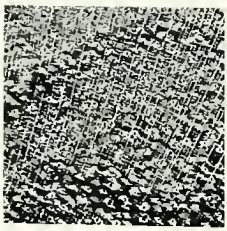

FIG. 65.—*Vatica* sp.

FIG. 66.—*Balanocarpus* sp.

FIG. 67.—*Shorea balangeran?*

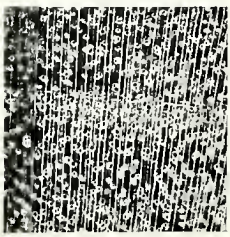

FIG. 68.—*Hopea acuminata.*

FIG. 69.—*Dryobalanops* sp.

FIG. 70.—*Shorea guiso.*

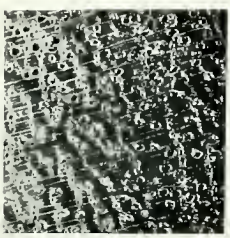

FIG. 71.—*Dipterocarpus grandiflorus.*

FIG. 72.—*Shorea polysperma.*

PLATE XXVII.

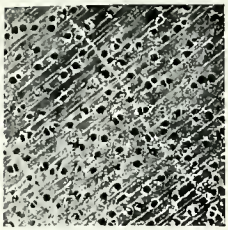

FIG. 73.—*Red lauan.*

FIG. 74.—*Anisoptera* sp.

FIG. 75.—*White lauan.*

FIG. 76.—*Cotylelobium* sp.

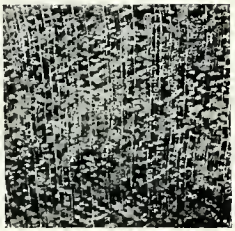

FIG. 77.—*Cotylelobium* sp.

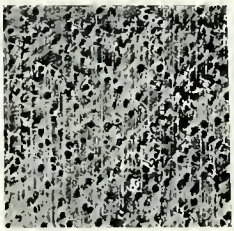

FIG. 78.—*Serial patch.*

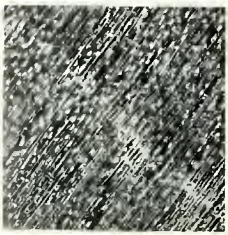

FIG. 79.—*Homalium* sp.

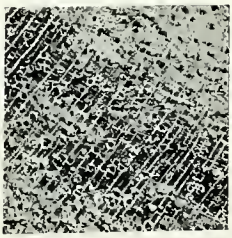

FIG. 80.—*Octomeles sumatrana.*

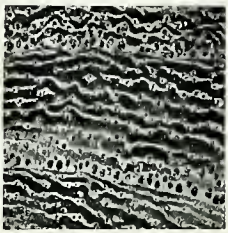

FIG. 81.—*Lagerstroemia speciosa.*

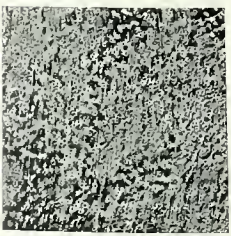

FIG. 82.—*Sonneratia pagatpat.*

FIG. 83.—*Carallia integerrima.*

FIG. 84.—*Bruguiera gymnorrhiza.*

PLATE XXVIII.

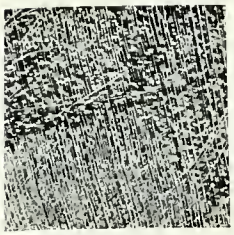

FIG. 85.—*Ceriops tagal.*

FIG. 86.—*Rhizophora* sp.

FIG. 87.—*Lumnitzera littorea.*

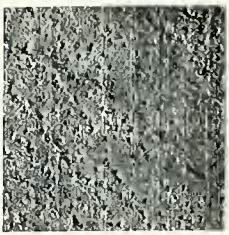

FIG. 88.—*Terminalia nitens.*

FIG. 89.—*Eugenia* sp.

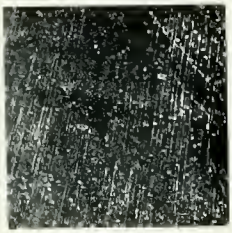

FIG. 90.—*Xanthostemon verdugonianus.*

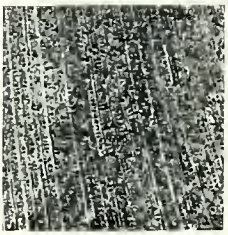

FIG. 91.—*Polyscias nodosa.*

FIG. 92.—*Aegiceras floridum.*

FIG. 93.—*Illipe betis.*

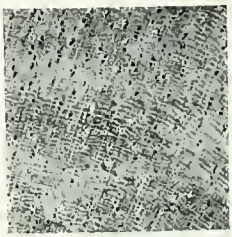

FIG. 94.—*Palaquium* sp.

FIG. 95.—*Maba buxifolia.*

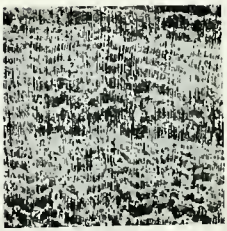

FIG. 96.—*Fagraea* sp.

PLATE XXIX.

FIG. 97.—*Alstonia macrophylla.*

FIG. 98.—*Alstonia scholaris.*

FIG. 99.—*Dyera lowii.*

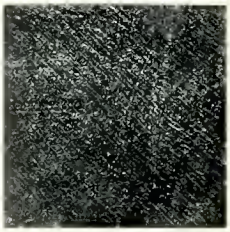

FIG. 100.—*Wrightia laniti.*

FIG. 101.—*Avicennia officinalis.*

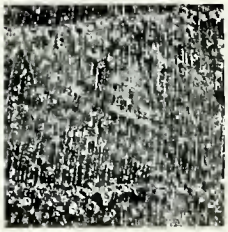

FIG. 102.—*Tectona grandis.*

FIG. 103.—*Vitex aherniana.*

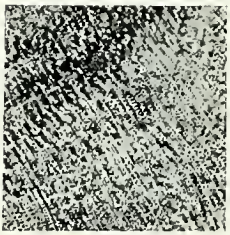

FIG. 104.—*Vitex littoralis.*

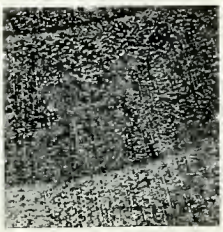

FIG. 105.—*Gardenia barnesii.*

FIG. 106.—*Nauclea* sp.

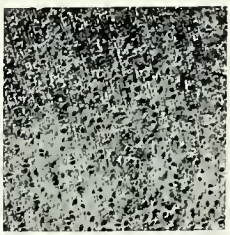

FIG. 107.—*Sarcocephalus cordatus.*

FIG. 108.—*Vernonia* sp.

PLATE XXX.

VIII. INDEX.

(Synonyms are in italics.)

J.

K.

P.

S.

U.

V.

W.

X.