THE FORESTS OF THE PHILIPPINES

PART I & II

FOREST TYPES AND PRODUCTS
THE PRINCIPAL FOREST TREES.

BY

H. N. WHITFORD, PH. D.
FORESTER, CHIEF OF DIVISION OF INVESTIGATION

DEPARTMENT OF THE INTERIOR
BUREAU OF FORESTRY

BULLETIN No. 10

MAJOR GEORGE P. AHERN
DIRECTOR OF FORESTRY

MANILA
BUREAU OF PRINTING
1911

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LETTER OF TRANSMITTAL.

MANILA, *November 11, 1910.*

SIR: I have the honor to transmit herewith the report entitled "The Forests of the Philippines," by H. N. Whitford, Ph. D., forester, chief division of investigation, and to recommend its publication as Bulletin No. 10 of this Bureau. It consists of two parts for separate publication, Part I, "Forest Types and Products," and Part II, "The Principal Forest Trees." It has been prepared in response to a strong and increasing demand for information concerning the forest resources of the Philippines.

Very respectfully,

GEORGE P. AHERN,
Director of Forestry.

The honorable,
The ACTING SECRETARY OF THE INTERIOR, *Manila.*

EQUIVALENTS OF THE METRIC AND ENGLISH SYSTEMS OF MEASUREMENTS USED IN THIS BULLETIN.

1 inch equals 25.4+ millimeters (approximately 25).
1 foot equals 0.3048+ meter (approximately 0.3).
1 mile equals 1.609+ kilometers (approximately 1.6).
1 centimeter equals 0.3937+ inch (approximately 0.4).
1 meter equals 3.28+ feet (approximately 3.3).
1 kilometer equals 0.62+ mile (approximately 0.6).

1 acre equals 0.404+ hectare (approximately 0.4).
1 hectare equals 2.47+ acres (approximately 2.5).
1 square mile equals 259 hectares (approximately 260).

1 cubic foot equals 0.028+ cubic meter.
1 cubic meter equals 35.314+ cubic feet.

THE FORESTS OF THE PHILIPPINES: PART I.

THE FOREST TYPES AND PRODUCTS.

INTRODUCTION.

The object of this bulletin is to bring together the most important facts concerning the forests of the Philippines and the exploitation of their products. Nontechnical terms have been used whenever possible. The estimates of areas of the different types of vegetation are based upon rough reconnoissance work on a large scale. The estimates of standing timber are based upon the results of rough cruising over large areas, supplemented by intensive valuation surveys over certain small selected stands. The figures given for the total area covered by virgin forests are known to be conservative; and the division of this area into the different types or groups of types is a rough estimate which will be subject to revision when more data have been collected.

Throughout the work emphasis has been laid on the importance of the dipterocarp family; for in spite of the richness of the Philippines in fine furniture woods, the real wealth of their forests consists of construction timbers, such as are represented by the lauans, apitongs, and yacals—all belonging to the dipterocarp family. It is estimated that the dipterocarps include about 144 out of a total of the 200 billion board feet of standing timber in the Islands. Not only is the total amount great, but the members of this family occur in stands sufficiently heavy to be exploited by the use of machinery. The predominance of this family needs emphasis because it is the general belief that the Philippines and the Tropics in general produce only woods of the mahogany and teak grades.

In Part II of this bulletin popular descriptions are given of 106 trees, or all the principal timber trees whose lumber finds a place of some prominence in the markets. Brief mention is made of some 277 other trees that are found commonly in the forests or are cultivated for ornament or for fruit. While this is a very small proportion of the estimated 2,500 or more trees in the Islands, yet it includes practically all the large trees except those of a few families like the Sapotaceæ, Meliaceæ, and Myrtaceæ, whose wood, if it reaches the markets, will probably be classed with some which are already known. All the species, even of the dipterocarps, have not been described because of insufficient data. The unexplored portions of Mindanao will undoubtedly furnish some species that are not as yet known on the markets. It must be remembered that a large number of the estimated 2,500 trees are small; many even in the mature state will not reach a size of 5 meters in height; others are not over 10 meters; and a large number of greater height have either ill-formed short trunks, or produce wood so soft that it will never occupy more than an inferior place in the markets.

Most of the descriptions of the species given in Part II were made in the woods from living trees; and the work was later supplemented and checked by wood and herbarium specimens. The description of the reproductive parts has been omitted altogether, and the form of the leaf can be found in the illustrations. A ranger, forester, or lumberman is called upon to pass judgment upon the trees of the forest that are not in flower and fruit, and if he is to have a working knowledge of the forest he must get it from bark, leaf, or wood characters. Many Filipino woodsmen are keen in distinguishing the forest trees, and to one who first enters the forest their aid is well-nigh indispensable. But it is nevertheless true that their determinations should be constantly subject to check. It should be borne in mind by those who wish to obtain some notion of the varieties and amount of each kind of timber on a given tract that while the forest as a whole is exceedingly complex, yet if the merchantable timber alone is considered, it is comparatively simple. The author has collected 80 different tree species on 1 acre which contained representatives of only two species that reach merchantable size when mature. This of course is an extreme case. The chances are great that for any given tract of forest there will not be more than 15 or 20 species of merchantable kinds. Thus, while the tract may contain 150 to 200 tree species, yet from the lumberman's point of view about nine-tenths of them may be discarded from further consideration by size alone.

In the descriptions, and throughout the text, a number of relative terms are used. For example, as regards size: "Very large" trees are those above 40 meters (134 feet) in height; "large," from 31 to 40 meters (100 to 134 feet); "medium," from 21 to 30 meters (68 to 98 feet); "small," from 11 to 20 meters (36 to 66 feet); "very small," 10 meters (32 feet) and under. While it is probable that there are trees in the Philippines that will reach a height of over 70 meters (230 feet), yet the largest tree measured to date shows 61 meters (200 feet). Very few species will reach a diameter of more than 180 centimeters (6 feet), measured above the root buttresses. The use of the relative terms "hardness" and "weight" is explained in another connection. (See p. 41, Part I.)

The terms "abundant" and "scattered," with qualifying adverbs, are used throughout the text to express the amounts of each kind of timber in the forests. The impression is apt to prevail that because a timber is abundant in the market it is abundant in the woods. Thus, during the fiscal year 1909–10, there were manifested 13,717 cubic meters of ipil, and 20,764 cubic meters of apitong, yet the relative proportion of the amounts cut does not give anything like a true idea of the proportionate amounts of standing timber of the two kinds; for there is probably more than one hundred times as much standing timber of apitong in the Islands as of ipil. The word "abundant" in reference to a species indicates that there are at least four trees to the acre, and that the stand extends over large areas. This restricts its use only to certain members of the dipterocarp family. Thus, one large tract of approximately 40,000 acres, shows the following number of trees 16 inches and over in diameter, per acre, all belonging to the Dipterocarpaceæ:

Apitong	7.77
Almon-lauan	6.55
Tanguile	4.59
Red lauan	8.45

It is very doubtful that there is a single tract of timber in the Islands of 1,000 acres that will contain an average stand of even two trees of ipil to the acre. A yacal forest in Mindanao, covering an area of approximately 4,000 acres, shows a stand per acre of 2.9 trees of lumbayao (belonging to the Sterculiaceæ or dungon family) 16 inches and over in diameter; and a lauan-hagachac forest in Mindoro, comprising about 3,500 acres, contains an average per acre of 1.93 trees of narra. On certain small definite areas, however, these and similar species often are found in relative abundance.

Durability, another relative term, is the most important quality of timber for use in the Tropics. In a general way it is associated with hardness and weight, yet there are important exceptions. For instance, calantas is classified as a soft wood, yet it is durable; on the other hand, many woods classified as hard and heavy, decay rapidly when exposed to soil or weather. It has been found impossible to arrange a table showing the relative durability of the principal timbers, because of the lack of sufficient data. Available data are referred to in the discussion of the woods in Part II and on page 37 in Part I.

In Part II there is given all the available information on the silvicultural characteristics of each species, especially concerning the relation to light and to soil moisture. More or less ill-defined rings of growth are associated with those species which are wholly or partly deciduous and which are intolerant of shade. The two most important tree families in the Philippines, the narra and dipterocarp families, show remarkable contrasts as regards their light relations. The members of the former family are light loving, those of the latter are tolerant of shade. The quality of the dipterocarps, which permits them to bear shade, is thought to be the main cause of their success in occupying large areas in the better soils.

In the United States the contents of round logs are generally measured in board feet. This does not show the entire contents of the logs, but an estimate of the amount of manufactured lumber that can be obtained from them. The logs are measured in the round, and from log rules the number of board feet a log of given dimensions will yield is estimated. Depending on the size of the log, these log rules show that for every cubic foot of timber in the round, approximately 4 to 8 board feet can be obtained. The average is usually taken as 6 board feet. In the Philippines the measurements and forest charges are based on the solid contents of the round logs in cubic meters. This can be expressed in board feet by using the following transposing factors: 1 cubic meter of round timber is taken as equivalent to 250 board feet, or 4 cubic meters as equivalent to 1,000 board feet. This is practically equivalent to stating that 1 cubic foot will yield 7 board feet, or 7.08, to be exact.

In this bulletin the stands of timber are expressed in cubic meters per hectare. To transpose this figure to an equivalent in board feet per acre, it is only necessary to multiply by 100. This factor is obtained by taking 250 board feet as equivalent to 1 cubic meter, and 2.5 acres as equal to 1 hectare. There are really 2.471 acres in 1 hectare, and if this exact figure were used, the transposing factor would be 101.17.

Special credit is due Mr. H. M. Curran, of this Bureau, for assistance in collecting data for the maps and wood specimens for the working museum; to Mr. E. E. Schneider, also of this Bureau, for aid in classifying the uses of the woods, determining their gross characteristics, and for revising the spelling of the common names; and to Mr. Elmer D. Merrill and other botanists of the Bureau of Science for aid in referring the tree species to their scientific names.

CLASSES OF VEGETATION.

1. General.

There is little question that practically the entire land area of the Philippines, from sea level to the highest mountains, was originally covered with unbroken forest growth of some kind. The following represents the present classes of vegetation, with the estimated area of each:

TABLE 1.

Classes of vegetation.	Area (square miles).	Percentage.
Virgin forests	40,000	33⅓
Second-growth forests	20,000	16⅔
Grass lands	48,000	40
Cultivated lands[a]	12,000	10
Total	120,000	100

[a] It is difficult to estimate, even roughly, the area under cultivation. The above is probably not far from the total amount that has been cultivated some time within the last twenty years. Probably less than half of this is actually under cultivation at any one time.

Put in another way, the land area of the Philippines is about equal to that of the State of New Mexico, while the virgin forest area is approximately equal to the entire area of the State of Kentucky.

2. Grass Lands.

The large grass areas, called *cogonales,* are covered principally with two species—cogon grass (*Imperata exaltata*) and talahib (*Saccharum spontaneum*). Such areas are known as *cogonales.* They are mainly the result of a shifting system of agriculture, which is prevalent throughout the Tropics and known in the Philippines as caingin making.[1]

Cogonales originate in the following manner, and remain as such so long as fires prevail. Usually a small portion of original or second-growth forest is cut during the dry season, the timber and brush are allowed to dry, and are then partially burned. The area thus prepared is planted with rice, sweet potatoes, corn, or other crops. Cultivation then practically ceases, and the jungle growth, consisting of grass, weeds, and tree species, quickly gains ascendancy over the planted crops, and at the end of the first, second, or third year the caingin maker abandons his clearing for a new one in another patch of forest. If the jungle growth is set on fire, as is frequently done, nearly all plants except the grasses are killed. In this way through many years vast areas of forest lands have been converted into *cogonales,* and repeated firings have prevented any change in their vegetation. Abandoned areas, formerly more intensively cultivated, have also become changed to grass lands in the same way. It is surprising how quickly this grass will become dry enough to burn. Three or four rainless days will permit it to burn with sufficient heat to kill nearly all the seedlings of woody species. Grass lands are prevalent on land of nearly all types of topography, from sea level to the tops of the mountains. In the pine region of central and northern Luzon other species of grasses frequently take the place of the cogon, although these grass lands originated in the same way.

The grass lands are a detriment rather than a help to agricultural development. They seem to be the favorite breeding places of grasshoppers which frequently destroy growing crops. It is very expensive to bring them under successful cultivation, for they form dense masses of roots and underground stems which several plowings will not entirely kill. Many Filipino farmers prefer to prepare for cultivation the land covered by virgin or second-growth forests. Indeed, in some instances they will first plant a grass area with seeds of some small rapid-growing trees, allow them to grow and shade out the grass, then cut and burn the wood, and plant their crops. The cogon grass is so coarse that it can not be considered a good forage crop unless it is kept closely cropped, in which case other grasses better for forage gain a foothold.

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[1] Known in India as taungyas.

3. Second-Growth Forests.

The 20,000 square miles of second-growth forests in the Islands, like the grass lands, are due in the main to the caiñgin system of agriculture. If fires are not started when the caiñgin is abandoned, the woody species quickly gain the ascendancy and shade out the little grass that has obtained a foothold. Here, as in temperate regions, certain species of little value enter the freshly deforested regions, giving rise to subtypes of forest known under the Tagalog name of "calaanan," the Visayan name of "late," and the Moro name of "boog." On freshly exposed soil, the first stages of this reforestation process are remarkably similar throughout the Islands. At first, the composition is very simple, being made up principally of the following species: Hamindang (*Macaranga bicolor*), binunga (*Macaranga tanarius*), hinlaumo (*Mallotus ricinoides*), alim (*Mallotus moluccanus*), and balanti (*Homalanthus populneus*), all belonging to the Euphorbiaceæ; anabion (*Trema amboinensis*), belonging to the Ulmaceæ; and anilao (*Columbia serratifolia*), belonging to the Tiliaceæ. For small areas, sometimes one—sometimes another—of these trees are found in almost pure stands. This is particularly true of hamindang, binunga, anabion, and balanti. All these trees are capable of producing seeds within a year or two after germination. Some are edible, and are thus quickly scattered by birds and animals; others have fruits adapted to wind distribution. Most of them mature early, are light loving, and are replaced by a more complex stand, composed of shade-enduring species. Ultimately, these second-growth forests may redevelop into forests whose composition is much like that originally destroyed.

In the natural reforestation of the grass lands, another set of species first gains entrance. In the high regions of central and northern Luzon, the Benguet pine (*Pinus insularis*) is the pioneer species. In the lowlands among those that first gain entrance are binayuyu (*Antidesma ghaesembilla*), alibangbang (*Bauhinia malabarica*), duhat (*Eugenia jambolana*), acleng-parang (*Albizzia procera*), and others. The first two of these are especially able to resist the effect of fires, and thus can occur as scattered trees through the grass lands. When fires are checked for several years, these trees often form the centers for closed stands, and eventually cover large areas. These subtypes become gradually more and more complex, the rapidity of the process depending on their distance from seed-bearing trees, and of course the composition varies according to the character of the species of the seed-bearing centers. Thus so many subtypes exist that it is difficult to make generalizations. Advance stages in the development of second-growth forests are so mixed with tangles of climbing bamboo and other vines that they are difficult to penetrate. Such forests often cover large areas, and are the so-called jungle growths of the Philippines. They often alternate with patches of grass, with which they make the vegetation known as *parang*. Forest fires such as exist in drier portions of the Tropics and in temperate regions do not exist in the Philippines. Surface fires run through the pine forests, destroying young trees and injuring somewhat the older ones. Outside the pine regions there are practically no forest fires, only "prairie" fires and burnings of timber that has been felled previously. These may injure the edge of the original forests, but do not penetrate them and produce conflagrations such as are known in the coniferous forests of the temperate regions. The *parang* districts often show kaleidoscopic changes, due to the rapid development of jungle growth where the fires are checked and the entrance of grass or second-growth forests in newly abandoned caingins. In the more thickly settled portions of the Islands, and along well-traveled trails, practically all the original forests have disappeared, giving place to grass or second-growth forests. The second-growth forests are seen by the average traveler, and have conveyed the wholly wrong impression that the forests of the Philippines, and, it is believed, of the Tropics in general, are a densely overgrown mass of inpenetrable jungle. Little is seen of the original forests of the interior, for the jungle growth on its borders tends to discourage efforts to penetrate within. Over one-half (approximately 68,000 square miles) of the area of the Islands is covered with grass or with second-growth forests. The prevention of further destruction of the virgin forest, and the reforestation of the grassy regions on nonagricultural lands, both by the prevention of fires and by planting, are the greatest forestry problems of the Philippine Islands.

4. Virgin Forests.

Virgin forests are those which either have been undisturbed by man, or have been so little exploited that their original character has not been materially changed. They form the source from which the inhabitants of the Islands may draw and are drawing their main supplies of timber, and also include the protective forests of the high mountain regions. They cover approximately one-third of the total area of the Islands.

I.—CLIMATE.

The average annual rainfall of the Philippines shows pronounced variations in different parts of the Archipelago, ranging from 900 millimeters (36 inches) to 4,000 millimeters (160 inches). The heaviest rains occur during the summer and autumn months (June to October), which is properly called the rainy season. The entire Islands are well watered during these months. During the winter months (November, December, January, and February) the northeast monsoon rains continue to water abundantly the eastern and northern coasts, thus giving the Pacific coasts and the islands bordering the large inland seas a prolonged or second rainy season. The western half of central and northern Luzon, the western coasts of Mindoro and Panay, the Calamianes group, and small areas in other portions of the Islands receive little rainfall from this monsoon, because of intervening mountain masses. Thus a prolonged, comparatively dry season with only occasional showers prevails in these regions for the six months from November to May. In the other portions of the Islands, this dry season varies from two to four months and is more frequently interspersed with showers. In some places the showers are so frequent that there is an entire absence of a dry season. Thus, it will be seen that there are two distinct climates, one in which the dry season is long and pronounced and another in which the dry season is shorter and less pronounced and sometimes wanting. In the former region, the forests during this season shed a portion of their leaves, and some trees are even entirely defoliated for a short time; in the latter, the forests are generally evergreen. Though grass areas are found in both, they more quickly establish themselves in the drier belt. It is a general rule that throughout the Islands during the long or short dry seasons the amount of rainfall in local showers, and the relative humidity, is less in the lowlands than in the high altitudes; consequently, the forests of the low altitudes may show a much less evergreen appearance than the forests of higher altitudes of the adjacent interior mountain passes.

The monthly distribution of the rainfall should be considered, because some localities in the regions of a long dry season receive a greater annual rainfall than others in the region of a short dry season. Thus Balanga (Bataan), in the region of the long dry season, has an annual rainfall of 2,394 millimeters, of which 83.5 per cent falls from June to October; 5.3 per cent from November to February; and 11.2 per cent from March to May. On the other hand, Jolo, in the Sulu Archipelago, with no dry season at all, has an annual rainfall of only 1,666.8 millimeters, of which 49.2 per cent falls from June to October; 28.3 per cent from November to February; and 22.5 per cent from March to May.

Although the Philippines have a range of latitude from 4.5° to 22° north, the variation in the temperature is believed not to be great enough to have any pronounced direct effect on the vegetation below 500 to 600 meters in altitude.

II. TOPOGRAPY AND SOIL.

As a general rule, the topography of the islands of the Archipelago consists of interior mountain ranges, with coastal plains of greater or less width. In some cases these ranges are nearer one side of the Islands than the other; in others, large river valleys separate two parallel mountain

PLATE I.—GENERAL VIEW OF SECOND-GROWTH FOREST.

In the foreground is a remnant of the original forest after being logged.

PLATE II.—VIEW IN SECOND-GROWTH FOREST.

Palosapis (1, 2, and 3) and cupang (4) are remnants of the original forest.

PLATE III.—YOUNG SECOND-GROWTH FOREST.

Hamindang and anabion.

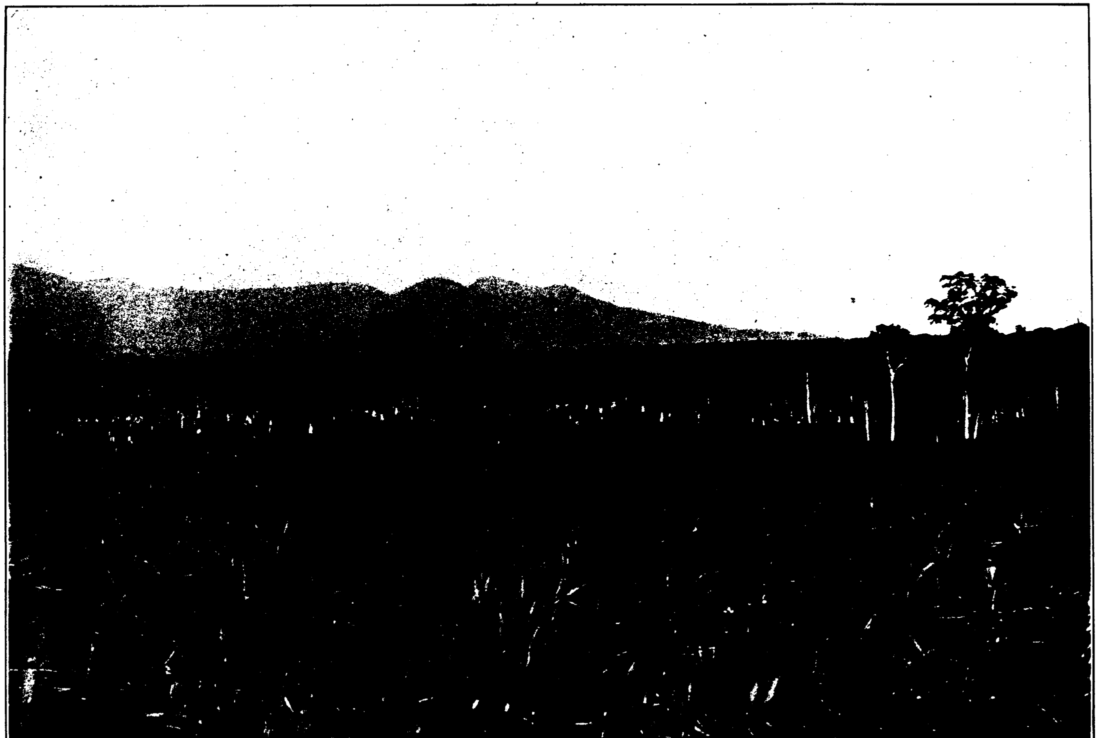

PLATE IV.—OUTSIDE VIEW OF A DIPTEROCARP FOREST OF THE LAUAN TYPE.

This forest will yield 30,000 feet per acre, board measure, clear lumber, and consists of an almost pure stand of the lauans and apitongs.

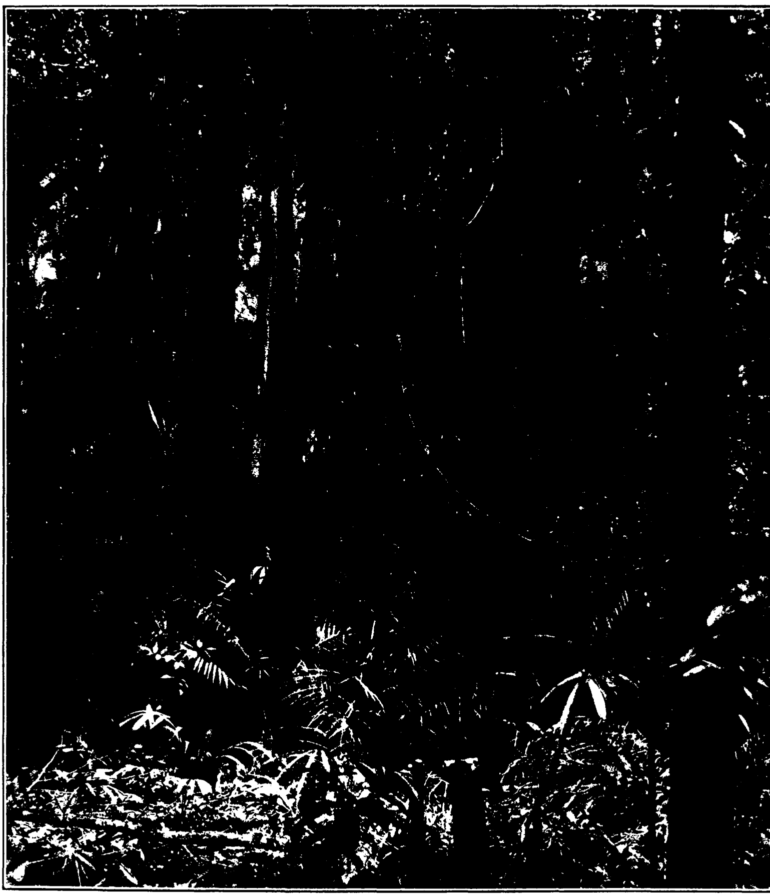

PLATE V.—INTERIOR VIEW OF THE LAUAN FOREST SHOWN IN PLATE IV.

The trees are almon-lauan and red lauan.

Plate VI.—INTERIOR VIEW OF LAUAN TYPE.

The trees are almon-lauan, red lauan, and tanguile.

PLATE VII.—INTERIOR VIEW OF THE LAUAN-HAGACHAC TYPE.

ranges. The mountains are volcanic in origin. Some isolated volcanic peaks rise abruptly from the surrounding lowlands. Limestone deposits, often crystallized by volcanic action, occur scattered throughout the Islands, especially along the coast. In some portions, large areas of stratified volcanic tuffs exist. These variations in the character of the rock and soils in a measure affect the character of the vegetation. Under a discussion of the forest types, attention will be called to certain pronounced variations due to this cause.

III.—TYPES OF FOREST.

The forest area of the Philippines may be divided into the following types:

1. Lauan type .... } Dipterocarp types.
2. Lauan-hagachac type .... }
3. Yacal-lauan type .... }
4. Lauan-apitong type .... }
5. Tanguile-oak type .... }
6. Molave type.
7. Pine type.
8. Mangrove type.
9. Beach type.
10. Mossy type.

It is convenient to use the term "dipterocarp" to distinguish the first five of the above types, as the characteristic trees belong to the Dipterocarpaceæ, the principal tree family of the Philippines. It is impossible, without more careful study and with the aid of topographical and geological surveys, to delineate the types on the map; and therefore the exact area covered by each type can not be ascertained at present. But the following is a very rough estimate of the area occupied by certain types or groups of types, with an estimate of their volume in cubic meters and board feet:

TABLE 2.

Kinds.	Area.				Volume of standing timber—		Total volume.	
	Per cent.	Square miles.	Acres.	Hectares.	Per acre (board feet).	Per hectare (cubic meters).[a]	Million board feet.	Million cubic meters.
Dipterocarp	75	30,000	19,200,000	7,770,000	10,000	100	192,000	777.000
Molave	10	4,000	2,560,000	1,036,000	3,000	30	7,680	31.080
Pine	5	2,000	1,280,000	518,000	2,000	20	2,560	10.360
Mangrove	2	800	512,000	207,200	2,000	20	1,024	4.144
Mountain	8	3,200	2,048,000	828,800		Purely	protective.	
Total	100	40,000	25,600,000	10,360,000			203,264	822.584

[a] See page 12 for explanation of factor used in changing cubic meters to board feet.

A.—DIPTEROCARP TYPES.

(*a*) *General character.*—Covering 75 per cent of the virgin forest area, or 30,000 square miles, and containing approximately 95 per cent of the total amount of standing timber in the Islands, the dipterocarp types are preëminently the most important. They are found on nearly all types of topography, from immediately behind the frontal zone of the beach to an altitude of approximately 800 meters on the slopes of largest mountain masses. From the standpoint of the botanist, the composition of these forests is complex; but from the standpoint of lumbermen it is comparatively simple. As the name implies, the members of the dipterocarp family constitute the prevailing class of timber. Taking it as a whole, it is estimated that 75 per cent of the 192 billion board feet, or 144 billion board feet, are dipterocarps. The remaining 48 billion board feet in the dipterocarp forests are divided among a large number of species, representing many families.

Practically all the species of the dipterocarps are large trees, reaching heights of 40 to 50 meters and diameters of 100 to 150 centimeters or more, and it is not rare to find even these dimensions exceeded. They have straight, regular boles, resembling in size and shape the *Liriodendron tulipiferum* (yellow poplar or tulip tree) of the United States. Some species of other families have a size and form similar to and codominant with the dipterocarps, but by far a greater majority are subdominant species, many of which have ill-formed boles, much smaller in diameter and length. Underneath the dominant and subdominant species are a large number of undergrowth tree species which do not attain more than 10 centimeters in diameter when mature, and a height of 10 meters or less. From a botanical point of view, these add greatly to the complexity of the forests, but for commercial considerations they should be called undergrowth trees. Within the forests there are comparatively few shrubs, or bushes, and herbs.

All the types of dipterocarp forests contain climbing palms (rattans), but the number and size of other large vines (lianas) seem to diminish with the prominence of the dipterocarps. Artificial and natural openings in the forests are often covered with a jungle of climbing bamboos and other large lianas, and the edges of the forests, especially along the streams, present breastworks of twisted vines which are very difficult to penetrate; but as soon as the interior is reached it is easy to pass through the forest with only the occasional use of a bolo (machete).

Practically all the dipterocarps are evergreens, for the new leaves are formed before the old ones drop. In some of the types discussed below, a few of the dipterocarps and many of the other tree species are partially deciduous, dropping a portion of their leaves during the dry season; some species, including one dipterocarp, may become entirely defoliated for a period varying from one day to two months.

As stated above, the dipterocarp forests show more or less distinct types (formations), which are here given the common names of the most numerous species found within them. These may be divided into subtypes (associations); but, except in limited regions where intensive work has been done, little or no attempt has been made to distinguish them. Many of them are only stages in successful movements of the forests. Such movements are either due to the recovery from artificial disturbances or to changes in the character of the topography.

As many of the regions of the Philippines have not yet been fully investigated, the following division of the dipterocarp forests into types is only provisional. It is believed, however, that these types, generally speaking, will hold good, and that if changes are made they will be in the nature of a division into subtypes.

(*b*) *Lauan type.*—To this type is given the name "lauan" because several species (see p. 20) producing similar woods having the name of lauan predominate. It represents the most successful commercial forest in the Philippines, and is confined to regions with a short or no dry season. It reaches its best development on the more gentle slopes near the base of the mountain masses, usually extending to altitudes of 300 to 400 meters, at which height it merges gradually into the tanguile-oak type. In regions of rougher topography it does not produce such heavy stands. In favorable soils it may occupy the low coastal hills, although usually near the sea it merges into the yacal-lauan type or the molave forest. The relative proportion of the dipterocarps is usually heavier in this than in any other type, and the total volume of timber is greater. An indication of the composition and stand of the forest can be best illustrated by the following table, which is based on the results of valuation surveys.

TABLE 3.—*Volume of trees 40 centimeters and over in diameter in northern Negros (average of 54.65 hectares).*

Scientific name.	Common name.	Volume per hectare (cubic meters).	Stand per acre (board feet).
Shorea sp.	Red lauan	185.18	18,518
Shorea furfuracea	Almon-lauan	92.02	9,202
Dipterocarpus grandiflorus	Apitong	66.63	6,663
Shorea polysperma	Tanguile	59.98	5,998
Pentacme contorta Parashorea plicata	White lauan Bagtican-lauan	25.23	2,523
Total Dipterocarpaceæ		428.99	42,899
All others (estimated)		22.58	2,258
Total		451.57	45,157

These figures are fairly representative of a portion of the lauan type, but, depending on the local conditions, the volume and other qualities will vary, and so give rise to the subtypes. Much closer study must be given to these subtypes before they can be accurately described. In parts of Luzon, especially in the Provinces of Tayabas and Camarines, the principal species of the family Dipterocarpaceæ occurring in the largest stands are as follows: Mayapis-lauan (*Shorea squamata*), almon-lauan (*Shorea furfuracea*), bagtican-lauan (*Parashorea plicata*), white lauan (*Pentacme contorta*), tanguile (*Shorea polysperma*), tiaong-lauan (*Shorea* sp.), the apitongs (*Dipterocarpus* spp.). The lauan types of Mindanao, especially in the Zamboanga district, contain mayapis-lauan, almon-lauan, bagtican-lauan, white lauan, kalunti-lauan (*Vatica* sp.), and *Dipterocarpus* spp.

Many other families are represented in this type, but the species which reach codominance with the dipterocarps are much less abundant than in other types in which the Dipterocarpaceæ predominate.

The lauan type is comparatively free from jungle undergrowth. It contains a very complex small-tree flora and a great many climbing palms. Erect palms, some of them reaching the height of subdominant trees, are everywhere present. Contrasted with other types, it presents a more closed canopy and consequently a regular profile. On its borders, and in natural or artificial openings, lianas grow in great profusion, but while lianas occur within the forest itself, yet they are reduced to a minimum in numbers, and especially in size, because of the dense prevalent shade. The forest floor contains a very scanty growth of herbaceous vegetation. The undergrowth of the forest is not an impenetrable jungle. One can pass through it in all directions, encountering difficulties in the way of obstructive vegetation only in artificial or natural openings where light permits the jungle growth. In short, the dominant trees, nearly all dipterocarps, form and maintain a successful forest of trees, which produce a shade so dense as to crowd out many light-demanding species. These are either forced to the edge of the forest, or else exist in the interior in a sickly condition, awaiting as it were the chance entrance of light to permit them luxuriously to fill up the opened space. Stripped of its ornaments of palms, lianas, epiphytic orchids, and ferns, whose importance is exaggerated in the eyes of the inhabitants of the temperate regions, the lauan type bears striking resemblance to the commercial forests of the temperate zone. In simplicity of composition of the dominant trees, and in volume of wood produced, it approaches in value the famous coniferous forests of the more northern latitudes.

It is not possible to estimate the area that this type of forest occupies. It covers a very large part of the entire forests, and probably formerly occupied extensive areas which are now in cogon or second-growth forests, or under cultivation.

(*c*) *Lauan-hagachac type.*—The lauan-hagachac, like the lauan type, is confined to the regions where the dry season is short or wanting. It is restricted to areas where the water level is near the surface of the ground. It reaches its most extensive development in river bottoms, especially on slightly raised river deltas. It extends in narrow strips along the smaller streams through the lauan type, where it resembles this in character, and often they can scarcely be distinguished.

In composition it differs mainly from the previous type in the presence of hagachac (*Dipterocarpus affinis*), and a much larger number of co-dominant species of other families. Where this forest has been analyzed carefully, it shows a large number of subtypes, which are often stages in succession, due to the unstable character of the habitat. Thus, in flood times, slight changes in the level of the soil due to deposits or the formation of new water channels alters the relative height of the ground-water level, which may be great enough to effect a decided change in the character of succeeding generations of trees. Thus, the type as a whole is a complex of many subtypes in various stages of development. Consequently the average hectare will show a greater number of species and fewer individual trees that have obtained maturity. Also, during the rainy season, the soil in large areas is too wet for the best development of many species. These factors reduce the volume of lumber per hectare as compared with forests growing in more stable areas.

In spite of the unstable and moist character of the soil, there is a constant tendency to produce a forest in which the dipterocarps predominate. The following is an estimation of the volume of such a forest:

TABLE 4.—*Volume of trees 40 centimeters and over in diameter, on a delta plain in eastern Mindoro (average of 42.4 hectares).*

Scientific name.	Common name.	Volume per hectare (cubic meters).	Stand per acre (board feet).
Dipterocarpaceæ:			
Pentacme contorta	White lauan	55.83	5,583
Shorea guiso	Guijo	14.5	1,450
Dipterocarpus sp.	Apitong	7.42	742
Dipterocarpus affinis	Hagachac	16.03	1,603
Total Dipterocarpaceæ		93.78	9,378
Leguminosæ:			
Pterocarpus indicus	Narra	8.76	876
Anacardiaceæ:			
Koordersiodendron pinnatum	Amuguis	10.69	1,069
Combretaceæ:			
Terminalia pellucida	Dalinsi	} 3.13	} 313
Terminalia nitens	Sacat		
Terminalia edulis	Calumpit		
All others (estimated)		46.67	4,667
Total		163.03	16,303

The principal other trees occurring in this type of forest that are dominant or subdominant with the dipterocarps are dao (*Dracontomelum dao*); malaikmo (*Celtis* sp.); *Canarium* spp.; ilang-ilang (*Canangium odoratum*); various species of the mahogany family (*Meliaceæ*), including very scattered specimens of calantas (*Toona calantas*); species of laurel family (*Lauraceæ*); dapdap (*Erythrina indica*); cupang (*Parkia timoriana*); several soft-wooded species of the dungon family (*Sterculiaceæ*); many species of the binunga family (*Euphorbiaceæ*), especially *Macaranga* and *Mallotus;* biluang (*Octomeles sumatrana*), a tree belonging to Datiscaceæ which reaches very large dimensions.

The portions of this type found along streams in the lauan type are somewhat more stable in character. Temporary flood plains may show pure stands of hagachac. Narra, dao, amuguis, acle (*Albizzia acle*), guisocguisoc (*Hopea philippinensis*), malugay (*Pometia pinnata*), catmon (*Dillenia philippinensis*), and others are found scattered along the streams mixed with various species of lauan, which reach their best development on the adjacent higher and drier soils.

As one would naturally suppose, this forest is more open than the lauan type, consequently the jungle growth consists of tangles of rattan and other large vines. However, mature subtypes are comparatively free from jungle growth.

Erect palms are constantly present. The Mindoro portion of it, above described, shows 66.5 palms to the hectare (not including young ones without stems), composed of six different species. The lowlands near the mouths of rivers at the head of Davao Gulf (Mindanao) will show even a larger stand.

As the lauan-hagachac type occurs on land sought for agricultural purposes, especially the cultivation of rice, the area occupied by it is very limited in extent. In thickly settled agricultural regions it has been entirely destroyed.

(*d*) *Yacal-lauan type.*—This type finds its best development in regions where the dry season is short, on low coastal hills whose basal rock is volcanic in structure. It occurs on headlands projecting into the sea, especially those at the heads of embayments. These headlands usually have drier soils, lower relative humidity, and less rainfall than the region back of them. It also occurs on the hills bordering large river valleys that have approximately the same physical conditions.

This type, in contrast to the two dipterocarp types above mentioned, has a slight deciduous appearance during the driest portion of the year. As it has a large number of codominant species, it more nearly resembles the lauan-hagachac than the lauan type. Erect palms are scattered throughout the forest, although they are not nearly so numerous as in the previous mentioned dipterocarp type. Climbing palms and other lianas are present, but are not especially abundant except in open places. The type can be divided into two subtypes—the ridge subtype which occurs on the tops and exposed slopes of the ridges, where yacal is most abundant, and a subtype found on protected slopes of ravines and along small streams. It is difficult to draw a sharp line between these subtypes, inasmuch as they merge into each other, and from the standpoint of the lumberman they are a unit. Hence they are treated as one. The following is an illustration of the volume of a fair sample of this type of forest in Mindanao.

TABLE 5.—*Volume of trees 40 centimeters and over in diameter, in the Port Banga region, Mindanao (average of 51.17 hectares).*

Scientific name.	Common name.	Volume per hectare (cubic meters).	Stand per acre (board feet).
Dipterocarpaceæ:			
Hopea plagata	Yacal	50.37	5,037
Pentacme contorta	White lauan	26.02	2,602
Parashorea plicata	Bagtican-lauan		
Dipterocarpus sp.	Apitong	12.05	1,205
Shorea guiso	Guijo	16.80	1,680
Vatica sp.	Kalunti-lauan	12.34	1,234
Shorea squamata	Mayapis-lauan	9.46	947
Shorea furfuracea	Almon-lauan		
Vatica sp.	Narig	6.14	614
Hopea sp.	Malayacal	2.83	283
Total dipterocarpaceæ		136.01	13,601
Sterculiaceæ:			
Tarrietia javanica	Lumbayao	21.35	2,135
Leguminosæ:			
Kingiodendron alternifolium	Batete	7.29	729
All others		124.35	12,435
Total		289.00	28,900

Other codominant species and the larger subdominant ones are as follows: Malaikmo; antipolo (*Artocarpus communis*); ilang-ilang; liusin (*Parinarium griffithianum*); *Canarium* spp.; kamatog (*Erythrophloeum densiflorum*); banawi (*Cylostemon grandifolius*); amuguis; malugay; alupag (*Euphoria cinerea*); balacat (*Zizyphus zonulatus*); taluto (*Pterocymbium tinctorium*); *Calophyllum* sp.; *Garcinia* spp.; *Anisoptera* sp. and *Hopea* sp. (*Dipterocarpaceæ*); batitinan (*Lagerstroemia piriformis*); sacat; *Eugenia* spp.; *Palaquium* spp.; lanete (*Wrightia calycina*); molave (*Vitex parviflora*); sasalit (*Vitex aherniana*); bancal (*Sarcocephalus cordatus*); calamansanay (*Nauclea* sp.). This list gives some idea of the complexity of the type.

Forests of the same type in Leyte and in various part of Luzon, especially the Provinces of Tayabas and Ambos Camarines, show so similar a composition that they may fairly be classed under this type. The actual area that this type occupies is not known at present, but it is not large, as it occurs in narrow belts along the coast, and in many cases has been cleared by caingin makers.

(*e*) *Lauan-apitong type.*—So far as altitude and topography are concerned, this corresponds to the lauan type, but differs from it in having a longer dry season, the effect of which is sufficient to justify its separation into a distinct type. During the dry season, this type shows a decided deciduous element. Except in places of favorable soil conditions, the forest cover is quite open, allowing the entrance of jungle undergrowth, lianas, erect bamboos, and the like. The composition of the dominant species is more complex than the lauan type, and resembles markedly in this respect the lauan-hagachac and yacal-lauan types. Here also the dipterocarps furnish the greatest bulk of timber. Many of the species found in the previous mentioned types are here not present, although all the species occurring in the lauan-apitong type are also found in the other dipterocarp types. This indicates that the distinction is a climatic one. While the dipterocarps show a decidedly less leaf surface during the dry season, only one of them, palosapis (*Anisoptera thurifera*), is wholly deciduous, but only for a day or two. This is true of a great majority of the trees belonging to other families, which contain only a few that become bare, even for a short time. On the clearing edge of this forest, there are good stands of almost pure erect bamboo; these extend into the virgin forests where the dipterocarps are mixed with cupang (*Parkia timoriana*) and other species. The bamboo undergrowth in such places, with the rather scattered trees, gives the forest the appearance of a park.

A typical stand of this forest is as follows:

TABLE 6.—*Volume of trees 40 centimeters and over in diameter in Bataan Province, Luzon (average of 50 hectares).*

Scientific name.	Common name.	Volume per hectare (cubic meters).	Stand per acre (board feet).
Dipterocarpaceæ:			
Dipterocarpus grandiflorus	Apitong	81.6	8,160
Dipterocarpus vernicifluus	Panao		
Pentacme contorta	White lauan	66.5	6,650
Anisoptera thurifera	Palosapis	28	2,800
Shorea polysperma	Tanguile	16	1,600
Shorea guiso	Guijo	4.1	410
Total Dipterocarpaceæ		196.2	19,620
All others		89	8,900
Total		285.2	28,520

Under "all others" are included the following species codominant with, or prominently subdominent to, the dipterocarps: Malaikmo; antipolo; tangisang-bayawak (*Ficus variegata*); tamayuan (*Strombosia philippinensis*); *Xylopia dehiscens;* dalinas (*Cyathocalyx globobus*); duguan (*Myristica philippensis*); lago (*Pygeum glandulosum*); liusin; acle; tanglin (*Adenanthera intermedia*); cupang; tindalo (*Pahudia *rhomboidea*); pili and pagsahingin (*Canarium* spp.); kamingi (*Santiria nitida*); *Dysoxylum* spp.; malakamingi (*Reinwardtiodendron merrillii*); *Amoora* spp.; *Aglaia* spp.; tuai (*Bischofia javanica*); hamindang (*Macaranga bicolor*); binunga (*Macaranga tanarius*); gubas (*Endospermum peltatum*); pahutan (*Mangifera altissima*); lamio (*Dracontomelum cumingianum*); dao; amuguis; alupag; balacat; taluto; bitanhol (*Calophyllum blancoi*); mangachapuy (*Hopea acuminata*); biluang; banaba (*Lagerstroemia speciosa*); sacat, calumpit, and binggas (*Terminalia* spp.); nato (*Palaquium luzoniense*); manicnic (*Palaquium tenuipetiolatum*); bolongeta (*Diospyros pilosanthera*); dita (*Alstonia scholaris*).

(*f*) *Tanguile-oak type.*—The forests of this type cover the area extending from the upper limits of the lauan and lauan-apitong types to the lower limits of the mossy-forest type in the higher portion of the mountains. These forests have not been studied in great detail, and more extended investigations are necessary to determine whether more than one type exists or not. When such studies have been made in many parts of the Islands, it may be found that there are a number of distinct types instead of the one here considered. In the meantime, the provisional name of tanguile-oak type has been adopted. Its lower limits are from 400 to 500 meters above sea level, and it extends upward to a height of between 800 and 900 meters. The topography is such as is usually found on mountain sides, gentle to steep ridges and slopes alternating with deep ravines and gorges. The evergreen character of the forests and actual measurements show that rainfall is more evenly distributed throughout the year, and the relative humidity is constantly higher than in the adjacent forests of the lower altitudes.

As its name implies, the principal species represented in this type are tanguile and oak; of these, the former also occurs frequently in dipterocarp types of the lower altitudes. It is found nearer sea level in regions where the dry season is short than in those where the dry season is longer, but in both its numbers increase with the altitude until the mossy-forest type is reached. In the higher portions of the tanguile-oak type, it is the only dipterocarp of numerical importance. In the lower limits of the type occur, of course, scattered specimens of the dipterocarps of the bordering types below. This is especially true of the lauans and the apitongs, although the latter are not nearly so abundant as the former. Some species that usually are found along streams in the types of lower altitudes occur in deeper soils of the tanguile-oak type away from the streams. Thus, tuai, catmon, and pahutan (*Mangifera altissima*) are among those so distributed. Certain species of oak, which occur as scattered trees in the lower types, here become much more abundant, and in some places give a decided tone to the vegetation. Among other species that are numerically prominent in this type are mangachapuy

(*Hopea acuminata*), almaciga (*Agathis alba*), kalingag (*Cinnamomum mercadoi*), and other species of the laurel family, malabayabas (*Tristania decorticata*), *Gordonia luzonica,* and many species of *Eugenia.* Many of the species occurring in this type also occur much dwarfed in the mossy forests higher up. Indeed, the type is the meeting ground of a number of the species which are found in the types both above and below. So far as is known, there are no species of trees that reach large size that are peculiar to this zone, with the exception, perhaps, of certain species of oaks. A number of species, however, reach more successful development, both as regards numbers and size, than in the other types in which they are found. Open places occur in this as in other types, giving rise to many subtypes. The undergrowth trees are numerous, but the composition is not so complex as the types below. The closed portions of the type are comparatively free from large lianas other than rattans, so that the only difficulty in penetrating the forest in any direction is encountered in the tangled growth of the open places.

In high plateau regions, between 500 and 800 meters of altitude, this type attains heavy stands, but usually the topography is so rough that tall forests, covering large areas without a break, are wanting. Large epiphytic plants, like birds'-nest ferns, are more abundant here than lower down. In the upper limits, the trees gradually become more dwarfed, and the trunks are covered with mosses and liverworts, until the type gradually merges into the mossy forests above.

B.—MOLAVE TYPE.

Throughout this type, molave (*Vitex parviflora*) is fairly well distributed. The type occupies a topography similar to that on which the yacal-lauan type is found, except that in a great majority of cases the underlying rock is usually limestone rather than volcanic in nature. The low limestone hills, either coastal or bordering large uplifted river valleys, are usually composed of crystalline coral limestone with a honeycombed structure. These rocks are generally covered by shallow or very scanty soil, and this, together with their honeycombed nature, makes the habitat a very dry one. It is roughly estimated that the area covered by this type comprises some 4,000 square miles (1,036,000 hectares). The trees are the most valuable in the Philippines, and are easily accessible for exploitation. This has brought about the more or less complete destruction of the original forest, and so it is very difficult to analyze the true nature of the vegetation. From the study of virgin and nearly virgin areas, however, the following characteristics seem to be most general. The forest is open. Its large trees are few and far apart, with the intervening spaces filled with small trees, or by a jungle growth usually of sprawling, climbing, or small erect bamboos. With a few exceptions, the dominant trees are short boled, irregular to very irregular in form, and with wide-spreading crowns. The forest has a decidedly deciduous foliage, almost entirely so on rough topography in regions where the dry season is pronounced. The composition of the type varies in different parts of the Islands.

In some expressions of the type, the following dominant trees are present: molave, dungon (*Tarrietia sylvatica*), tindalo, supa (*Sindora supa*), batete, ipil (*Intsia bijuga*), acle (*Albizzia acle*), banuyo (*Wallaceodendron celebicum*), balacat, alupag, bansalaguin (*Mimusops* sp.), calantas (*Toona calantas*), lanete (*Wrightia laniti*), mancono (*Xanthostemon verdugonianus*), batitinan (*Lagerstroemia piriformis*), spiny narra (*Pterocarpus echinatus*), narra, taluto, tucang-calao (*Aglaia clarkii*), and liusin. Of the smaller species, the following may occur: ebony (*Maba buxifolia*), camagon (*Diospyros discolor*), kuyus-kuyus (*Taxotrophis ilicifolia*), caña-fistula (*Cassia javanica*), bayok (*Pterospermum* spp.), and tulu-tulu (*Mallotus floribundus*). It must not be supposed, however, that all these species occur in any one locality. Indeed, the reverse is the case. Mancono, for instance, in merchantable quantities, is restricted to northeastern Mindanao and adjacent islands. Supa, likewise, is found in Tayabas and Ambos Camarines; narra, calantas, and acle are usually scattered along the hill streams. Distinct forms of the type are sometimes present on dry hills of hard volcanic rock—hills too dry to support any forest but members of this type. Often, such species as molave, batete, ebony, liusin, batitinan, and others, are found scattered throughout the open places of the yacal-lauan type. This is especially true of batete. Even in some limestone regions, the slopes of valleys often contain clearly defined expressions of the dipterocarp types, and in the very humid atmosphere of the Davao Gulf, the Island of Samal (mainly of a crystalline coral limestone formation) contains a dipterocarp forest of guijo, white lauan, bagtican-lauan, and other species that causes it more nearly to approach a dipterocarp type than any other, with trees of the molave type scattered among the thinner portions of the forest. North of this is a small coral island which contains an almost pure stand of ipil. Indeed, so far as observations go, with the single exception of supa, all the trees mentioned above are found growing scattered in the various types of dipterocarps, and occupy positions either along the streams or in drier portions. Some of them reach better individual development in such situations than when growing on limestone hills. It will thus be seen that many of these species occupy limestone soils, not because they prefer them to any other, but because they are shaded out of the moister soils by the more successful development of the shade-enduring dipterocarps. The dipterocarps, on the other hand, have soil-moisture requirements that will not permit them to exist in the drier soils of the limestone regions. In a word, the limestone habitat is one that contains a mixture of certain species of the various types of dipterocarp forest.

As one would suppose, the volume of the molave type is much lower than that of any of the dipterocarp types. This is due both to the thin stand and to the short boles of the trees. It is estimated that the type will average not more than 30 cubic meters per hectare of timber of merchantable size (3,000 board feet to the acre). However, the type is a valuable one, because it contains hard, durable timbers, many of which are very valuable cabinet and furniture woods.

C.—MANGROVE TYPE.

The mangrove type is in many respects the most peculiar one in existence. It is literally a forest of the sea. Where conditions are favorable, it occupies the beach washed by the tides. It is especially well developed on the mud flats at the mouths of rivers entering the sea at the heads of protected bays. Wherever wave action allows a fairly stable shore line, trees of the type are present. They occur on the quieter portions of the coral reefs, and are thinly scattered on many wave-made terraces that are exposed at low tide. A majority of the stand is composed of the members of one family, the Rhizophoraceæ, or bacauan family, comprising the following principal species: Bacauan (*Rhizophora mucronata*), bacauan-lalaki (*Rhizophora conjugata*), busain (*Bruguiera gymnorrhiza*), pototan (*Bruguiera eriopetala*), pototan-lalaki (*Bruguiera caryophylloidcs*), langarai (*Bruguiera parviflora*), and tangal (*Ceriops tagal*). The following principal species of other familes are pagatpat (*Sonneratia pagatpat*), pedada (*Sonneratia* sp.), api-api (*Avicennia officinalis*), tabao (*Lumnitzera littorea*), tabigi (*Xylocarpus obovatus*), piagao (*Xylocarpus granatum*), *Excoecaria agallocha,* and dungon-late (*Heritiera littoralis*).

On the muddy flats at the mouths of large rivers in protected bays, the pioneer plant is bacauan. Back of this come the bacauans mixed with pototan and other species of *Bruguiera,* and then, usually covering large areas, is langarai, mixed in varying proportions with bacauan, pototan, busain, tangal, and pedada. In more open bays, where the soil is mixed with considerable sand or coral limestone, occurs a distinct frontal zone of pagatpat, with more or less api-api. Wave-cut coral terraces often contain nearly pure stands of pagatpat. The inner margins of the swamps usually have scattered specimens of dungon-late, tangal, piagao, tabigi, and tabao. In many instances, a distinct zone of the nipa palm (*Nipa fruticans*) is present near the upper limits of this type. This palm also forms thickets along the streams where the water is less brackish. Where the type is less distinct, all sorts of mixtures of the above species are present.

The capacity of this type to produce firewood and timber varies according to the degree in which it has been exploited. In thickly populated districts, the forest has been reduced to such an extent as to render it valueless for anything except firewood. Virgin areas show surprisingly large stands of poles and trees, some of which are sufficiently large to produce lumber. In Mindanao, valuation surveys made on a very good stand show 149 trees per hectare of more than 25 centimeters in diameter, yielding 130 cubic meters of timber per hectare, or 13,000 board feet per acre. Pagatpat has been measured with a height of 31 meters, a diameter, breast-high, of 137 centimeters, and a merchantable length of 17.5 meters; bacauan, a height of 28 meters, a diameter above the stilt roots of 70 centimeters, and a merchantable length of 16.5 meters; pototan, a height of 28.8 meters, a diameter, breast-high, of 80 centimeters, and a merchantable length of 18.3 meters. It is estimated that the swamps of the Islands will show an average volume of 20 cubic meters per hectare of trees over 20 centimeters in diameter, and if, as is usually the case, the branches and large twigs are used, this amount will be exceeded.

The forest itself has rather an even top profile. The canopy is fairly well closed, and the forest is practically clear of undergrowth, except at its inner edge. The presence of a complex system of stilt roots, as high as 3 meters and wide spreading, of the two species of *Rhizophora* presents a tangle through which one can make his way with difficulty. A number of the species, such as pagatpat and api-api, show characteristic aërial roots. The leaves of all are hard and leathery in texture. The seeds of the Rhizophoraceæ begin to germinate on the trees, finally drop, and are distributed by the tides until they find a favorable lodging place, where they continue their development.

D.—BEACH TYPE.

Sandy beaches above high-tide limits are found throughout the Philippines. They are favorite places for settlements and so the original vegetation has been greatly modified. In those places where it has kept its original form, it presents a distinct type. Usually the frontal zone has a tangle of vegetation in which pandans (species of *Pandanus*) form a conspicuous part. The principal trees are as follows: Talisay (*Terminalia catappa*), dapdap, (*Erythrina indica*), botong (*Barringtonia speciosa*), malubago (*Hibiscus tiliaceus*), bani (*Pongamia glabra*), banalo (*Thespesia populnea*), dungon-late, palo maria (*Calophyllum inophyllum*), agoho (*Casuarina equisetifolia*), tawalis (*Osbornia octodonta*), and bantigi (*Pemphis acidula*). In some places ipil, narra, bansalaguin, and other valuable trees are encountered. Talisay often occurs in patches of pure stands in rich river bottoms. On sandy flood plains of large rivers, in various parts of the Islands, agoho often forms small pure forests.

Behind the frontal line, the vegetation partakes more of the nature of other types. Series of old beaches sometimes cover quite extensive areas, on which the lauan-hagachac type usually is found. This type is especially well developed on old beaches where the dry season is wanting. In the Davao Gulf, for instance, are encountered heavy stands of very large trees of hagachac, guijo, and bagtican lauan that will scale as high as 100,000 board feet to the acre. It must be remembered that in such places the ground water level is not far below the surface, and the atmospheric moisture conditions are constantly humid. The humus accumulations of previous generations of vegetation enriches the well-drained soil. Altogether, these conditions make the habitat an exceedingly favorable one.

E.—PINE TYPE.

This type reaches its best development in the high plateau region of northern and central Luzon. The greater part of it, although at an altitude ranging from 900 to 1,500 meters, is in a region with a distinct dry season. The rain-bearing winds of the dry season deposit most of their moisture before they reach this rough plateau region. The pines are scattered as single individuals, or in open to nearly closed patches throughout a large grass area. In many ravines and along water courses are stands of broad-leaved trees. There is much evidence to show that formerly this area was covered with forest growth consisting principally of broad-leaved trees, and although pines were undoubtedly present, they were of little relative importance, being confined to the steeper and drier situations where the broad-leaved trees could not grow. Through the activities of man, however, in the centuries of occupation, the broad-leaved trees have been cleared off, and repeated fires have prevented their reproduction. The pine, however, is less sensitive to fires, and consequently at present there are broad areas of grass lands with many groves of pines. There is little doubt that if fires were kept off, the pine, in the absence of broad-leaved competition, would quickly seed up the entire area, for its reproduction is abundant and rapid; and gradually the pines themselves would be replaced by the original broad-leaved vegetation. This struggle between the pines and the broad-leaved trees is often shown in caiñgins bordering situations where both types occur. The pines, because of their numerous winged seeds, will make their appearance first; the other vegetation comes more slowly, but will gradually prevent the starting of a new generation of the light-demanding pines. This last movement of vegetation is a much slower one. Not only are the pines found in regions where the dry season is pronounced, but at higher altitudes in the mossy-forest belt, where the humidity is greater and more evenly distributed throughout the year. Thus, pines occur in abandoned caiñgins at an altitude above 1,500 meters, and even as high as 2,500 meters. Here they alternate with patches of grass or mossy forest. The rainfall of this region, as in many other portions of the Islands, is exceedingly heavy from June to October. Especially in the deforested regions, landslides occur frequently on the mountain slopes, making the natural reforestation of such places difficult. In the more level places, where fire lines have been established, grass patches become quickly covered with pine seedlings.

Benguet pine (*Pinus insularis*) is the only species in the highlands of central and northern Luzon. In some places, scattered pines are found in the grass lands, as low as 500 meters altitude, bordering on the upper limits of the lauan-apitong type. Pines are also found in Zambales and Mindoro. In Zambales, two species occur: *Pinus insularis* and *Pinus merkusii*. Their altitudinal range is usually from 500 to 1,500 meters, although scattered trees of *Pinus merkusii* are found at as low an altitude as 60 meters. In Mindoro, *Pinus merkusii* occurs in pure stands and in open groves scattered throughout the grass lands, southwest of a high mountain mass. It is found as low as 60 meters above sea level in one situation, although usually it is not found below 900 meters.

Measured groves of Benguet pine show a volume of 74 cubic meters per hectare (7,400 board feet per acre) of trees 25 centimeters and over in diameter. The trees will reach a height of 40 meters and a diameter of from 90 to 100 centimeters.

F.—THE MOSSY-FOREST TYPE.

Some 3,200 square miles (828,800 hectares), or 8 per cent of the land area of the Philippines, is the estimated amount of the high and very rough mountain region covered by virgin forests. They are essentially protective forests. Many such mountainous regions have already been cleared of their forests by caiñgin makers and are now covered with grass. These regions show such a complex set of conditions, both as regards habitat and vegetation that as yet our knowledge is too incomplete to carefully distinguish the types. Perhaps, in a broad sense only, one type exists, with certain variations or subtypes. Because of the presence of moss and liverworts in great abundance, it has been designated as the mossy-forest type.

The topography is rough and constantly changing. It consists of steep main ridges, rising to exposed peaks, and whose sides are in turn cut into smaller ridges by the deep cañons. Land slips are frequent, and these in all stages of being reclothed with vegetation add to the difficulty of analysis. The soil is shallow or nearly absent. Rock exposures occur, often covering large areas; but except on very steep slopes or on fresh slides they are covered with vegetation. Some mountains have more rounded dome-shaped tops, and on these the topography is much more stable.

As a rule, the climatic conditions are exceedingly moist, both as regards rainfall and relative humidity. Opposed to this favorable climate is the very great exposure to winds. The former is the cause of the mossy condition; the latter, of the dwarfed habit of the trees. The temperature conditions are much lower than those of the coastal region.

The tree vegetation is complex, yet not so much so as the forests lower down. Especially on the highest mountains, owing to these very unstable conditions, or where volcanic action has not been long extinct, trees are absent or nearly so. On mountains above 1,200 meters, the mossy forest appears at its best. *Dacrydium* and *Podocarpus* spp., *Eugenia* spp., *Tristania decorticata, Leptospermum amboinense, Decaspermum* spp., *Quercus* spp., *Myrica* spp., *Englehardtia spicata, Acronychia laurifolia, Symplocos* sp., *Ternstroemia toquian,* are some of the principal trees, only a few of which are found lower down. All of these trees are usually dwarfed in appearance, seldom reaching a height of more than 20 meters, and usually not over 5 meters. The trunks and branches are generally covered with mosses, liverworts, filmy ferns, and epiphytic orchids. The open places are usually occupied with ferns, and sometimes with grass. Tree ferns occur on the slopes within the forests, and on some steep slopes give a decided character to the vegetation. Rattans and other climbers, especially Pandanaceæ, are common, as are also small erect palms. Few mountains in the Philippine Islands attain a height of more than 2,000 meters. In general, the vegetation at such altitudes is much more dwarfed; in some cases, good-sized trees are found, even at high elevations; on others, no tree vegetation occurs at all.

G.—SUMMARY.

The following is a tabular summary of the types of vegetation found in the Philippines. [See pp. 34, 35.]

WOOD USES.

It is estimated that the Philippines contain more than 2,500 tree species, of which probably 300 find their way into the Manila and provincial markets in the form of timber. Of this number, less than 100 are commonly encountered.

1. Dipterocarps.

As stated previously, the dipterocarp family furnishes the main bulk of standing timber. These woods can be roughly divided into three groups, viz, the lauans, the apitongs, and the yacals.

LAUANS.

Among the lauan group are white lauan, kalunti-lauan, almon-lauan, bagtican-lauan, malaanonang-lauan, mangasinoro-lauan, tiaong-lauan, mayapis-lauan, red lauan, and tanguile. Many shades of brown and red are comprised in the different species. White lauan and mangasinoro-lauan are of a light creamy brown color; bagtican-lauan and almon-lauan show shades of pink, which becomes a clear red in the case of mayapis-lauan, tiaong-lauan, and some grades of tanguile, and even a dark red color in the case of red lauan. In hardness they grade from soft to moderately hard in the approximate order outlined above. Their weight is light to moderately heavy. They are all coarse but straight-

Plate VIII.—EXTERIOR VIEW OF YACAL-LAUAN TYPE.

Also shows the method of logging with carabao.

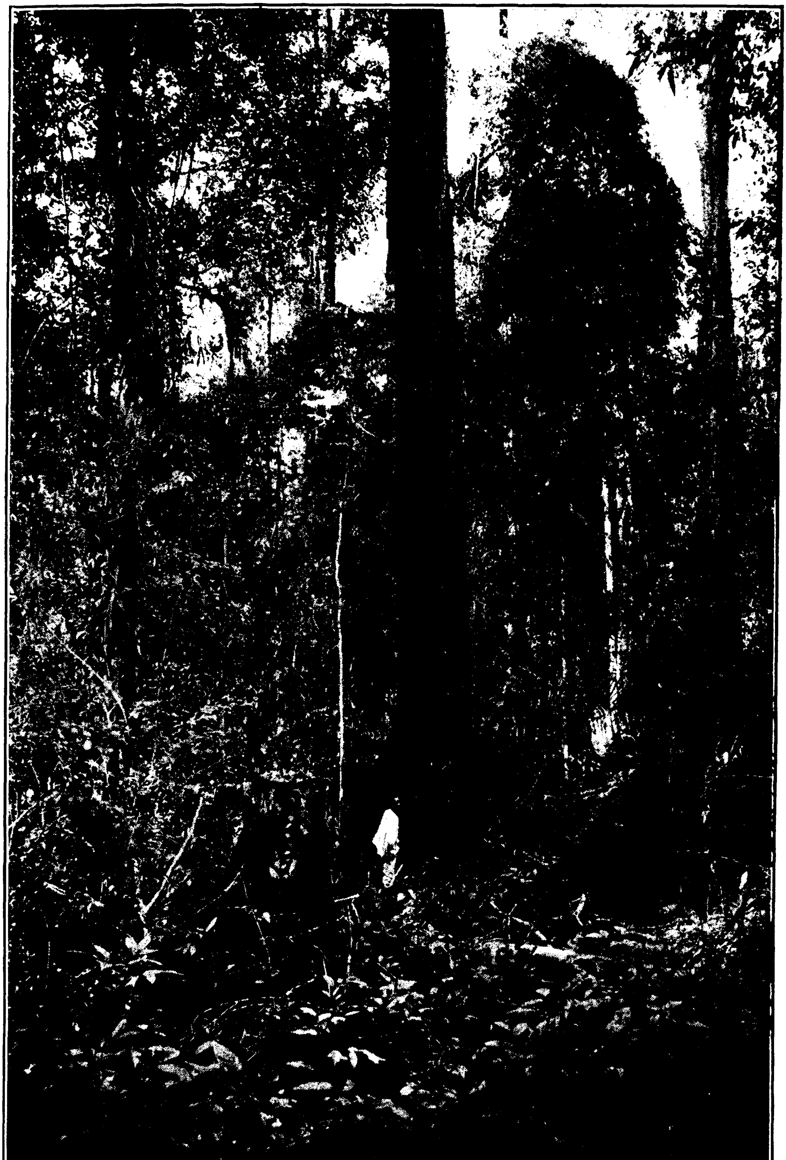

PLATE IX.—INTERIOR VIEW OF YACAL-LAUAN FOREST AFTER BEING PARTIALLY LOGGED.

Black yacal in the center.

Plate X.—GENERAL VIEW OF A LAUAN-APITONG TYPE ON THE EDGE OF A CLEARING.

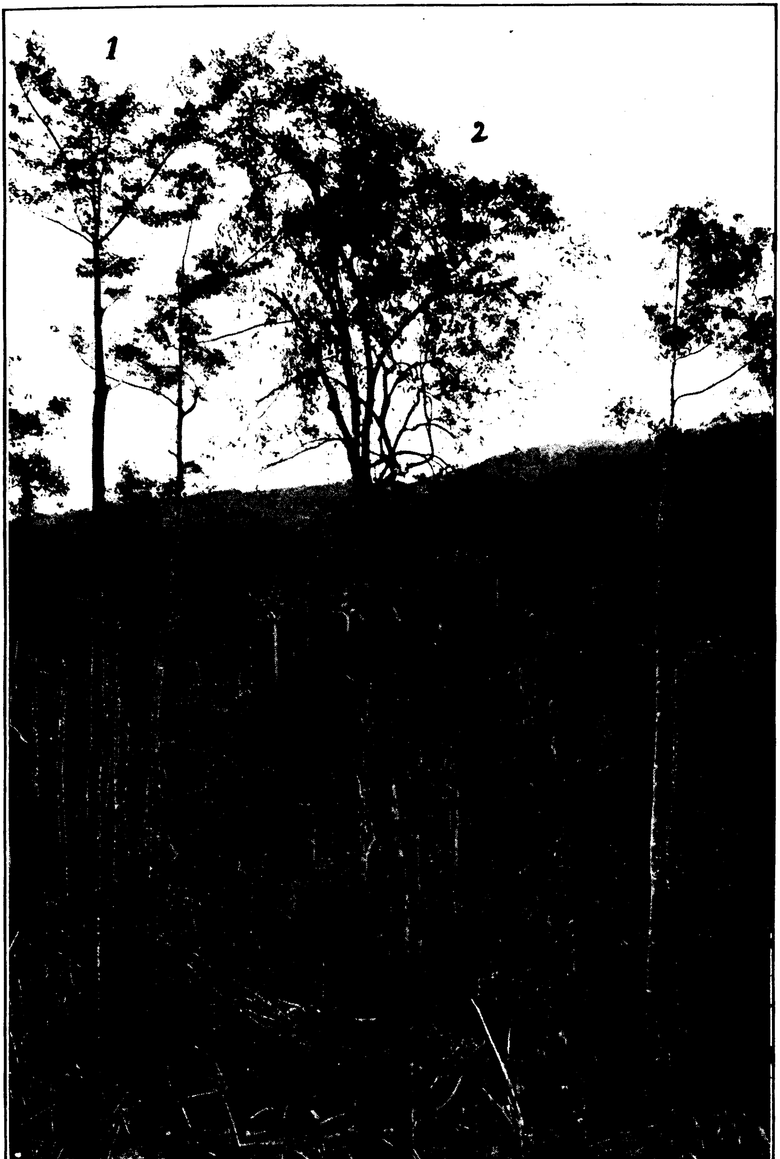

PLATE XI.—GENERAL VIEW OF LAUAN-APITONG FOREST.

Original forest in the background; cut-over forest in the foreground.

PLATE XII.—INTERIOR VIEW OF LAUAN-APITONG FOREST.

Apitong ridge.

PLATE XIII.—VIEW IN LAUAN-APITONG FOREST.

Tree of panao showing form of bole and crown.

PLATE XIV.—INTERIOR VIEW OF TANGUILE-OAK FOREST.

The trees are tanguile and lauan.

grained, free from knots, easily worked, and in general mechanical properties are not greatly dissimilar to the pines. When quarter-sawn or slash-sawn with a figure, they show a beautiful grain. The lauans, without exception, come from tall trees, 100 to 150 or more feet in height, 6 feet or less in diameter, and with straight, regular trunk up to 100 feet to the first limb.

The lauans are readily attacked by fungi and white ants, but not more so than is Oregon pine, their chief competitor. They can be divided into three groups, the white lauans, the red lauans and tanguile, which are the usual trade names.

Locally, they are used for a great variety of purposes. They are especially adapted for light and medium construction work, in which they will find their greatest usefulness. In this respect they are to the Tropics what the lighter grades of pines and their allies are to the temperate regions. Nevertheless, for many classes of construction, because of their color and beautiful grain, they are superior to the pines. This is especially true for interior finish of all classes. The better grades of lauan and tanguile are now being shipped to the United States under the trade name of "Philippine mahogany."

APITONGS.

The trees that furnish timbers of this group are apitong, hagachac, panao, and guijo. They grade in color from a dirty brownish red to red. In hardness they are moderately hard to hard; in weight they are moderately heavy. The first three appear in the market under the trade name of apitong, the last as guijo. The former are coarse but generally straight-grained; the latter has a somewhat finer grain.

They are used for many purposes, but are especially adapted for heavier construction where contact with the ground is not necessary. Guijo is considered more valuable than apitong. They are not durable timbers, being susceptible to the attacks of white ants and fungi. Of the two, guijo is somewhat the more resistant. The apitongs have general construction qualities comparable to the hard pines of the temperate regions. In abundance, they are next in importance to the lauans.

YACALS.

The trees that produce timber of this group are yacal, guisoc, guisoc-guisoc, malayacal, narig, karig, mangachapuy, and dalingdingan-isac. The woods as a whole are yellowish brown, becoming darker with old age. They are all considered very durable timbers. This is especially true of yacal, guisoc, and malayacal, which invariably appear under the market name of yacal. Narig is often mixed with and sold as yacal. Mangachapuy and dalingdingan-isak are sold as mangachapuy.[1]

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[1] Other trees, closely related botanically to these, yielding woods somewhat softer and less durable, are also found under the name of mangachapuy.

TABLE 7.—*Comparative characteristics*

CHARACTER OF

Types.	Lauan.	Lauan-hagachac.	Yacal-lauan.	Lauan-apitong.
Rainfall	Fairly well distributed throughout year; short or no dry season.	Fairly well distributed throughout year; short or no dry season.	Fairly well distributed throughout year; short or no dry season.	Pronounced dry season.
Relative humidity.	High and fairly well distributed throughout the year.	Medium during short dry season; high during rainy season.	Fairly low for short dry season; high during rainy season.	Fairly low throughout long dry season.
Altitudinal range.	From near sea level to 300 or 400 meters.	Near sea level	Near sea level	From near sea level to 300 or 400 meters.
Soil and underlying rock.	Medium shallow to fairly deep; rock volcanic; moist; sometimes fairly dry.	Usually alluvial; deep; alternatingly very moist and quite dry; underground water level near surface.	Shallow and fairly dry or very dry; volcanic rock.	Shallow to fairly deep; part of year very dry; volcanic rock.
Topography	Slight to steep slopes.	Level or nearly level.	Slight to steep slopes.	Slight to steep slopes.

CHARACTER OF

Merchantable timber per hectare.	50 to 450 cubic meters.	25 to 200 cubic meters.	50 to 300 cubic meters.	50 to 300 cubic meters.
Composition of dominant species.	Nearly pure stands of dipterocarps to complex.	Complex	Complex	Complex
Canopy of dominant species.	Closed or nearly closed; evergreen.	Open to closed; nearly evergreen.	Medium open: slightly deciduous.	Medium open; decidedly deciduous.
Profile of forest	Fairly regular to regular.	Very irregular	Irregular	Irregular
Erect palms	Abundant	Abundant	Fairly abundant	Almost absent
Erect bamboo	None or very few	None or very few	None or very few	Usually abundant.
Large lianas	Not abundant	Abundant	Fairly abundant	Fairly abundant
Composition of small trees.	Very complex	Very complex	Very complex	Very complex

of the different forest types.

THE HABITAT.

Tanguile-oak.	Molave.	Pine.	Mangrove.	Beach.	Mossy forest.
Fairly well distributed throughout the year; short or no dry season.	Fairly well distributed throughout the year to a distinct dry season.	Usually a distinct dry season.	Long, short, or no dry season.	Long, short, or no dry season.	Usually well distributed throughout the year.
High to very high, except in dry season.	Fairly low during dry season; high during rainy season.	Low to high	Fairly high, or low during dry season.	Usually low during dry season.	Daily range great, but high at night.
From 400 to 900 meters.	Usually near sea level to 150 meters.	Usually above 900 meters.	Between low and high tide.	Near sea level.	Above 900 meters.
Very shallow to fairly deep; sometimes fairly dry; volcanic rock.	Usually on limestone rock; shallow soil; dry.	On shallow soil above limestone, or in deep soils not limestone; dry to moist	Usually a muddy, deep, delta soil; also coral limestone and sandy soil; wet.	Sandy or pebbly soil; very dry during dry season.	Rock exposure near surface; soil shallow; volcanic rock.
Usually rough; some gentle slopes.	Usually steep slopes; some gentle.	Steep slope to level ground.	Gently shelving.	Gently shelving.	Very rough.

THE VEGETATION.

20 to 150 cubic meters.	50 cubic meters and under.	100 cubic meters and under.	130 cubic meters and under.	Under 25 cubic meters.	No estimate.
Medium complex.	Fairly complex.	1 or 2 species of pines.	About 10 species.	Simple	Simple to medium complex.
Open to closed; evergreen.	Open; decidedly deciduous.	Open; evergreen.	Open to closed; evergreen.	Open; decidedly deciduous.	Open to closed; evergreen.
Very irregular.	Very irregular.	Regular to irregular.	Fairly regular.	Irregular	Irregular.
Fairly abundant but small.	None	None	Almost stemless nipa palm.	Very few	Many small ones.
None	Abundant or none.	do	None	Very few, if any.	Practically none.
Fairly abundant.	Abundant climbing bamboo.	do	do	Very few	Fairly abundant.
Complex	Complex	Very few	Very few	Complex	Complex.

The yacals are usually hard and heavy. They are as free from the attacks of white ants and fungi as any so-called durable wood used for construction purpose. Yacal is a general all-round construction timber where contact with the ground is necessary, and because of this is much sought for railroad ties, paving blocks, and house posts. It is also used as bridge timber, in various parts of ships, and for construction of houses. It is estimated that there is more standing timber of the yacals in the Islands than all the other so-called standard durable timbers put together.

2. Substitutes for Mahogany.

The term "mahogany" is here used in its broadest sense. The true mahogany, the product of *Swietenia mahagoni,* does not occur in the Philippines. However, the narra family contains a group of woods of more or less brilliant color and beautiful grain which are capable of taking a high polish, and which can not be excelled as substitutes for mahogany. These are narra, tindalo, ipil, acle, and banuyo. Narra varies in color from a light yellow to a brilliant red. It is moderately heavy, moderately hard to hard, has a rather coarse more or less twisted grain, and is very durable. It is practically the same as the padouk of India. and is sometimes sold as Philippine mahogany. It is used principally for fine furniture, interior finish, doors, flooring, and windows. Large one-piece table tops come from the buttressed roots. Tindalo has a saffron red color, which becomes darker with age. It has a fine, more or less straight grain, and is heavy, hard, and durable. It is used in fine furniture and cabinetmaking, and is one of the best timbers for hardwood floors, stairways, and interior finishings, where beautiful expensive woods are required. Ipil, while used principally in the Philippines for construction work in contact with the ground, is nevertheless a wood of the mahogany grade. It is very durable, heavy, and very hard, has a fine, sometimes twisted, grain, and is one of the most satisfactory woods for fine furniture and cabinetmaking. Banuyo is moderately heavy and moderately hard, is golden brown in color, with a fine grain. It is used for fine furniture, cabinetmaking, carriage bodies, and carving. While none of the above are found in very large quantities, there is a sufficient supply to meet a small steady demand. All could probably be worked into veneers.

Besides the above, there are a number of other woods that are good substitutes for mahogany. Palo maria, sometimes called Borneo mahogany, is a hard and moderately heavy, reddish brown wood, with a fine twisted grain, that is capable of taking a good polish. Calantas is the only one of the true mahogany family that is sometimes sold under the name of Philippine mahogany. It is light and soft, reddish in color, and has a distinct odor resembling that of cedar. It is closely related to the West Indian cedar, and while making admirable furniture, piano cases, etc., it is much sought after for cigar boxes. It, however, like the other fine woods, is not plentiful.

Because of their abundance, and therefore their ability to supply the demands for a steady product, the finer grades of red lauan and tanguile will no doubt be known to the outside world as Philippine mahogany. These woods have a beautiful grain and color, and are susceptible of a good polish. They have already found a place in the United States as a substitute for mahogany. Such a market can be steadily supplied with large quantities of these woods.

3. Durable Timbers.

Next to fine furniture and cabinetmaking woods, the Tropics are noted for their hard durable timbers. Because of the warm climate and continuous moisture conditions, fungous growths and white ants rapidly destroy those timbers that are not able to withstand their attacks. No timber is able to do so indefinitely, but some are much more durable than others. Teak is perhaps the best known of this class of woods. This timber, while not indigenous to the Philippines, occurs in plantations in Mindanao and the Sulu Islands, and it has been demonstrated that the tree can be grown here successfully. It will no doubt become one of the planted tree crops of the Philippines, and the Islands will thus be enabled to furnish their share of the world's supply of this timber.

Because of their excellent qualities and comparative abundance, three Philippine timbers may be classed with teak, or at least may be regarded as substitutes for it. These are molave, ipil, and yacal.

Molave is perhaps the best known hardwood in the Philippines, and more of it is extracted than of any other one kind of wood in proportion to the amount of standing timber. It is a member of the teak family. The wood is hard and heavy, pale yellow in color, and has a fine but usually twisted grain. It is especially valuable for house posts, hardwood floors, window sills, railway ties, bridge timbers, paving blocks, salt-water piling, carvings, and many parts of shipbuilding. Trees of molave occur scattered usually on the limestone coastal hills throughout the Philippines. They generally have short, irregular boles, and this renders the timber less valuable than it would otherwise be. It is in such demand locally that little is now exported.

Attention has already been called to ipil as a valuable wood of the mahogany grade. Nevertheless, the demand for hard durable timbers is so great that it is usually considered as one of the best construction timbers, exposed to soil and weather. Like molave, its principal uses are for house posts, hardwood flooring, railway ties, paving blocks, and telegraph poles.

Yacal has also been discussed elsewhere. Because of its abundance, it is probably the only one of the hard durable timbers that will find much of a place in the markets outside of the Philippines. Prominence is given to the above-mentioned woods, not because they are the only hard durable timbers the Islands contain, but for the reason that they are the only ones in anything like sufficient quantity to supply the demands of the trade. Other principal timbers that resist well the attacks of fungi and white ants are narra, tindalo, acle, banuyo, calantas, palo maria, mancono, dungon, aranga, banaba, anubing, bansalaguin, batitinan, betis, the macaasims, pagatpat, supa, and agoho.

4. Salt-water Piling.

There is a strong demand for woods that will resist even fairly well the attacks of the shipworm (teredo), and few species are able to meet the necessary requirements. The woods most commonly sought for such purposes are molave, dungon, aranga, betis, liusin, and piagao.

Molave is one of the best woods for this purpose. The chief objection to it, however, is its irregular form, and the fact that it is difficult to find piles of sufficient length to meet the demands. Dungon has long been considered a valuable pile for salt water. The wood is very hard and heavy, tough, chocolate-brown in color, fine and cross grained, and difficult to saw. Besides piling, it is used for a large number of purposes, the principal ones being various kinds of naval construction, railway ties, and paving blocks. The amount that can be obtained in very limited. Aranga, formerly more plentiful but now very scarce, has long had the reputation of being one of the best woods for salt-water piling. It is very hard and heavy, ranging in color from yellow to chocolate brown. Betis, like the others, is a very hard and heavy wood, dark reddish brown in color. Liusin is one of the woods which has only recently come into use for this purpose. It is very hard and heavy, and pale red to red in color. Liusin piles, placed beside dungon, seem to last better than the latter. The part above water is more readily subject to fungous attacks. Piagao is said to resist the teredo well, but there is as yet no direct evidence to confirm this statement. None of the above woods are plentiful, especially in sizes suitable for piling.

5. Shipbuilding.

Teak, of course, is the standard shipbuilding wood. In the Philippines, the following are considered adapted to this purpose: Molave, dungon, yacal, mangachapuy, betis, ipil, guijo, narra, batitinan, palo maria, banaba, aranga, liusin. The following seem to be those in most common use for the different parts of the ship: Keels—Dungon, ipil, aranga, banaba, bansalaguin, betis, guijo, liusin, molave, narra, palo maria, yacal. Ribs—Molave, dungon, apitong, malugay. Sides—Yacal, guijo, banaba, apitong, batitinan, mangachapuy. Rudders—Molave, yacal, dungon, guijo. Spokes and handles of ships' wheels—Bansalaguin. Keelson—Batitinan. Masts—Palo maria, guijo, mangachapuy, and lauan. Decks—Mangachapuy, batitinan, palo maria. Rails—Yacal, guijo. Booms—Guijo, palo maria, mangachapuy.

6. A Substitute for Lignum-Vitæ.

True lignum-vitæ does not occur in the Philippines. Mancono has been tried, and seems likely to find a place as one of the lignum-vitæs in the world's markets.[1]

7. Bridges.

The following woods are most commonly sought for bridge building: Ipil, yacal, guijo, dungon, macaasim, and apitong.

8. Railroad Ties and Mining Timbers.

The railroads are accepting the following woods for ties: Ipil, molave, yacal, tindalo, betis, acle, anubing. To these can be added narig, mangachapuy, sasalit, banaba, malaruhat, macaasim, palo maria, batete, supa, and perhaps guijo and pagatpat. If creosoted, it is believed that the apitongs and the lauans would make very desirable ties.

The above woods could also be used as mining timbers. The scarcity of durable woods in the vicinity of mines, however, compels the use of any wood near at hand. In the Benguet mines, pine is practically the only timber used. Arrangements are being made for the use of preservatives on this wood. Where near at hand, the bacauans are also commonly used.

9. House Construction.

The choice of woods in building houses depends very much on the taste and means of the owner. The list given below is arranged approximately in the order of the quality, regardless of cost. It is well to explain that houses in the Philippines are usually built on posts known as *harigues* (from the Tagalog word *haligi*). This method doubtless comes from the original custom of building houses on posts to raise them above water or swampy ground, especially along the seashore, or as a protection against enemies. The custom still prevails, because the health conditions are better when the houses are some distance from the ground, and besides, they resist better the effects of earthquakes. As a usual thing the base or stump of the *harigue* is made of a durable wood, on which are spliced woods of a less durable quality.

Stumps: Ipil, molave, sasalit, bansalaguin, betis, dungon, yacal, banaba, and anubing.

Posts above stumps: Ipil, yacal, tindalo, dungon, aranga, anubing, macaasim, guijo, palomaria, supa, apitong, palosapis.

Trusses, girders, joists, framing, etc.: Yacal, dungon, ipil, tindalo, aranga, guijo, macaasim, supa, apitong, palosapis, amuguis, tanguile, lumbayao, red and white lauans.

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[1] See Hutchinson, W. F.: A Philippine Substitute for Lignum-vitæ. Bulletin No. 9, Bureau of Forestry, Manila, P. I.

Floors and stairs: Molave, ipil, tindalo, aranga, calamansanay, narra, pagatpat, palo maria, yacal, malacadios, supa, amuguis, mangachapuy, apitong, tanguile, palosapis, red and white lauans.

Interior trimming: Acle, narra, tindalo, molave, palo maria, malacadios, banuyo, calantas, malugay, supa, guijo, amuguis, tanguile, lumbayao, palosapis, red and white lauans.

Interior sheathing, doors, sash, etc.: Narra, molave, ipil, palo maria, malacadios, malugay, supa, guijo, tanguile, palosapis, lumbayao, red and white lauans.

Many houses are built cheaply now by using guijo and apitong for the trusses, girders, etc., guijo, amuguis, or tanguile for the flooring, and tanguile and red or white lauans for interior trim. These latter make a beautiful finish. Of course, all sorts of combinations of timbers are possible, depending upon the taste and means of the owner, and upon the local supply.

10. Paving Blocks.

Molave is the favorite paving block. Ipil and yacal are also used extensively. Tests are being made of treated blocks of the cheaper and less durable kinds. Creosoted paving blocks of lauan and other nondurable timbers have been in use over two years and as yet show no signs of decay or wear. Pagatpat blocks have been laid recently and are expected to give good results.

11. Furniture and Cabinetmaking.

The list of woods used for cabinetmaking and furniture is a long one. Of the durable woods, narra seems to be the favorite. Of the less durable ones, red lauan and tanguile are extensively used. Nearly all the woods of the narra family are used more or less for this purpose, especially tindalo, banuyo, ipil, acle, and supa. Other woods are ebony, camagon, bolongeta, palo maria, batitinan, baticulin, catmon, lanete, calamansanay, lumbayao, banaba, calantas, bancal, anubing, molave. (See under substitutes for mahogany, p. 36.)

12. Carving and Engraving.

Lanete is the favorite wood for carving. Others principally used are ebony, molave, camagon, banuyo, narra, acle, acleng-parang, tindalo, bansalaguin, and baticulin.

13. Canes.

The favorite woods for canes are ebony, camagon, and bolongeta; others are kuyus-kuyus, camuning, mancono; woods of various palms are also used for canes.

14. Boxes and Dry Measures.

The lauans and the natos are the favorite woods for these purposes. Narra is often used for the larger sizes of measures.

15. Tool Handles.

The following are the woods most suitable for tool handles: Dungon, dungon-late, kulis, bansalaguin, banaba, alupag, liusin, camagon, tindalo, narra.

16. Carriage Building.

For this purpose the common woods are: Shafts—Guijo, lanutan. Hubs—Palomaria, guijo, dungon, ipil. Spokes and felloes—Guijo, yacal, molave. Covering of the body—Banuyo, amuguis, white and red lauans, and the natos. Floor and back—Red lauan, guijo, apitong, narra, natos. Axles—Guijo.

17. Wooden Shoes.

The following are used for the soles of wooden shoes and slippers: Tui, dita, anabion, bayabas, cupang, balacat, ligaa, lumbang, pinkapinkahan, white natos, daluru (air roots of pagatpat and api-api).

18. Telegraph and Telephone Poles.

Here, as in many other instances, almost any available wood is used. Ipil seems to be the favorite, although pagatpat is now coming into use. Green poles of kapok (cotton tree) are placed in the ground, take root, and become trees. As such, they are extensively used in some parts of the Philippines.

19. Matchmaking.

The woods most commonly used for matchmaking are malapapaya and taluto. The following are also used: Pinkapinkahan, cupang, biluang, hamindang, binunga, lumbang, and gubas.

20. Musical Instruments.

The following is a list of woods used for making musical instruments: Sides of guitars and mandolins—Lanutan, nangka, banuyo, acle. Bottoms—Banuyo, camagon, nangka. Necks—Lanete, kayutana, camagon. Tops of necks—Camagon. Sounding board—Imported and native pines. Pins—Dungon and camagon. Calantas is used for piano cases, and ebony for keys.

In Part II of this bulletin there is arranged, for the various species discussed, a list of the uses to which each wood is put.

WEIGHT AND HARDNESS.

Weight and hardness are relative terms. In the United States the woods of all broad-leaved trees are considered hard. In this sense, all the woods of the Philippines, except the pines, are classified as hard. Using the term "hard" in a more rational way, a number of Philippine woods could be classified as soft.

Weight in woods is a variable quality. It depends, for woods of the same species, on the age of the tree; on the conditions in which it is grown; on the portion of the tree from which the sample weighed is taken; and on the amount of moisture contained. The latter variability is eliminated by basing the specific gravity on the dry wood, as is done in the following table. Taking everything into consideration, it would be misleading to apply a fixed specific gravity to each wood; therefore it is thought best to group the woods in such a way as to allow for a range in weight and hardness by using relative adjectives to designate these qualities.

The following tables are based mainly on the work of Gardner[1] and Foxworthy,[2] with some modifications and additions:

TABLE 8.—*Table of weights of the principal Philippine woods.*

Very heavy. Sp. gr. 0.90 or more; 900 kilos or more per cubic meter; 56 pounds or more per cubic foot.	Heavy. Sp. gr. 0.70–0.90; 700 to 900 kilos per cubic meter; 44 to 56 pounds per cubic foot.	Moderately heavy. Sp. gr. 0.50 to 0.70; 500 to 700 kilos per cubic meter; 31 to 44 pounds per cubic foot.	Light. Sp. gr. 0.50 or less; 500 kilos or less per cubic meter; 31 pounds or less per cubic foot.
Bacauans.	Agoho (*a*).[a]	Acle.	Almon-lauan.
Billian.	Alupag (*a*).	Acleng-parang.	Antipolo.
Bolongeta.	Aranga (*a*).	Amuguis (*a*).	Bagtican-lauan.
Camagon.	Bansalaguin (*a*)	Anubing.	Baticulins.
Camuning.	Batete.	Apitong (*a*).	Biluang.
Ebony.	Betis (*a*).	Banaba (*a*).	Calantas.
Mancono.	Batitinan.	Balacat.	Cupang.
Pototans.	Binggas.	Balinghasay.	Dita.
Sasalit.	Calamansanay.	Bancal.	Duguan (*a*).
Tangal.	Catmon.	Banuyo.	Gubas.
	Dalindingan-isak.	Batino.	Kalunti-lauan.
	Dungon (*a*).	Benguet pine.	Lauan, red (*a*).
	Dungon-late (*a*).	Calumpit.	Lauan, white.
	Guisoc (*a*).	Dalinsi.	Malapapaya.
	Guisoc-guisoc.	Dao.	Mayapis-lauan.
	Ipil (*a*).	Guijo (*a*).	Mangasinoro-lauan.
	Lanutan.	Hagachac (*a*).	Palosapis (*a*).
	Liusin (*a*).	Lanete.	Pinkapinkahan.
	Malayacal (*a*).	Lumbayao.	Taluto.
	Macaasim.	Malasantol.	Tiaong-lauan.
	Mangachapuy.	Malacadios (*a*).	
	Molave.	Malacmalac.	
	Narig (*a*).	Manicnic.	
	Pagatpat.	Malugay.	
	Tindalo.	Nangka.	
	Tucang-calao.	Narra.	
	Yacal (*a*).	Nato.	
		Palo maria.	
		Piagao.	
		Panao (*a*).	
		Salinkugi.	
		Santol.	
		Sacat.	
		Supa (*a*).	
		Tabigi.	
		Talisay.	
		Talisay-gubat.	
		Tamayuan (*a*).	
		Tanguile.	
		Teak.	
		Toog.	
		Tuai.	

[a] The woods followed by (*a*) also have representatives in the class immediately higher than the one in which they are placed.

[1] Gardner, R.: Mechanical Tests, Properties, and Uses of Thirty-four Philippine Woods. Bulletin No. 4 (2d ed.), Bureau of Forestry, Manila, 1907.

[2] Foxworthy, F. W.: Philippine Woods, Phil. Jour. Sci., Sec. C, Vol. II (1907), pp. 351–404, and Indo-Malayan Woods, same Journal, Vol. IV (1909), pp. 412–415.

TABLE 9.—*Table of hardness of the principal Philippine woods.*

Very hard.	Hard.	Moderately hard.	Soft.
Agoho.	Acle.	Anubing.	Almon-lauan.
Alupag.	Acleng-parang.	Apitong (*a*).[a]	Antipolo (*a*).
Aranga.	Amuguis.	Banuyo.	Bagtican-lauan.
Bacauans.	Batino.	Banaba (*a*).	Balacat (*a*).
Bansalaguin.	Batitinan.	Batete.	Bancal (*a*).
Betis.	Binggas.	Balinghasay.	Baticulins (*a*).
Billian.	Calamansanay.	Calumpit.	Binunga.
Bolongeta.	Catmon.	Dalinsi.	Calantas.
Camagon.	Guijo.	Dao.	Cupang.
Camuning.	Guisoc.	Hagachac (*a*).	Dita.
Dungon.	Guisoc-guisoc.	Malasantol.	Duguan.
Dungon-late.	Ipil.	Malacadios (*a*).	Gubas.
Ebony.	Macaasims.	Malacmalac.	Hamindang.
Liusin.	Mangachapuy.	Manicnic.	Kalunti-lauan.
Mancono.	Malayacal.	Nangka.	Lanete (*a*).
Narig.	Malugay.	Narra (*a*).	Lauan, red (*a*).
Pototans.	Molave.	Nato.	Lauan, white.
Sasalit.	Pagatpat.	Panao (*a*).	Lumbayao (*a*).
Tangal.	Palo maria.	Salinkugi.	Malapapaya.
	Piagao.	Talisay.	Mangasinoro-lauan.
	Supa.	Talisay-gubat.	Mayapis.
	Tabigi.	Tanguile.	Palosapis (*a*).
	Talisay.	Teak.	Benguet pine (*a*).
	Tamayuan.	Toog.	Santol (*a*).
	Tindalo.	Tuai.	Taluto.
	Tucang-calao.		Tiaong-lauan.
	Yacal.		

[a] The woods followed by (*a*) also have representatives in the class immediately higher than the one in which they are placed.

LUMBERING IN THE PHILIPPINES.

1. MARKETS.

The demand for lumber in the Philippines is greater at the present time that the local lumbering operations can supply. The volume of native timbers that passed through the official channels for the fiscal year 1909–10 amounted to 176,758 cubic meters (44 million board feet). During the same time there were imported into the Islands approximately 20 million board feet, 12 millions of which was for the United States Army. Besides this, 798 gratuitous licenses were issued for both public and private use, and a large amount of timber was obtained without license under the free-use privilege. The quantity used without charge is estimated to be at least 25 million board feet. This makes the total consumption of timber in the Islands as follows:

	Million board feet.
Regular licenses	44
Free use	25
Imported	20
Total	89

This amount does not include 246,776 cubic meters of firewood upon which forest charges were paid but which can not be expressed in board feet; nor an unknown, but large, amount of firewood extracted and used free of charge.

The lumber markets in the principal centers of the Islands are unstable, although they are more satisfactory to-day than ever before. Previously a large number of the dealers handled a mixture of many kinds of timbers which were often unassorted even as to classes, to say nothing of grading within the classes. The lumber was often poorly sawed, and not trimmed or edged. This condition still exists among many dealers. The larger firms are putting on the market more perfectly sawed timber, edged and trimmed, and in many instances graded. They confine their efforts to handling a few kinds, and keep a supply on hand to satisfy demands up to a million or more board feet. As a rule, however, a great deal of the lumber reaches the market green, and is sawed, sold, and put to use at once, shortly after it is cut. As a result, it is poorly seasoned, and can not but give the timber a bad name. It is hoped that some time in the near future concerted action can be taken by dealers to establish a uniform system of grading.

The market with regard to prices of the principal kinds is becoming more and more stable. Previously, small cutters with little capital, who brought timber to market, were at the mercy of the commission merchants, and often had to sell at a sacrifice in order to continue operations. This is not so true to-day as it was three or four years ago.

The average Manila retail price of the cheaper grades of the lauans is ₱50 to ₱60 per thousand feet board measure; better grades of red lauan and tanguile sell for ₱60 to ₱80; apitong sells for ₱70 to ₱80; guijo, ₱80 to ₱90; yacal for ₱120 to ₱150; molave, ₱150 to ₱200; ipil, ₱150 to ₱200. Oregon pine, the chief foreign competitor of the cheaper construction timbers, retails for ₱50 to ₱70. With the present strong demands for timber, there is little inducement to handle native timbers to undersell the Oregon pine. When well seasoned, the lauans are as good as Oregon pine for certain classes of construction, and are much better for other purposes for which they are used.

The increased activity in all lines of business during the past year has created great demands for all classes of construction timber, especially dipterocarps (lauan, apitong, and yacal), ipil, and molave. At the present time, this demand is too great to warrant large shipments to America or foreign countries. Should the local market become overstocked—and with greatly increased exploitation it can easily become so—the China market alone could consume the surplus. Philippine timbers have an excellent reputation in China, where the better grades from Borneo and Singapore are often sold under the name of Philippine hardwoods. This being the case, it is all the more imperative that a good system of grading should be established, with Government inspection for exported lumber. During the fiscal year 1909–10, 1,300,000 feet of lumber were exported, which is twice the amount exported during any previous year since the American occupation.

2. Logging Operations.

During the fiscal year 1909–10, there were issued 969 ordinary and exclusive licenses. Deducting 20 per cent for licenses which were not used, there are left 775 licensees, who extracted 44 million board feet of timber, an average of about 57,000 board feet for each licensee. During the fiscal year 1909–10 the largest licensee cut about 8 million board feet; the next largest cut and manufactured about 3 million board feet. A number reached over 250,000 board feet, but by far the majority of the licensees placed on the market much less than this amount.

From the above it will be seen that the majority of the licensees are small operators. They use human and animal motor power to get their timber to tide water. In a very few instances, hand labor is employed, but only when the timber is within a few hundred feet of the coast; in fact, in most instances, this method is utilized only on the slopes of hills fronting tide water. The animals used in hauling the logs are, almost without exception, carabaos (water buffaloes).

The method used in extracting timber by carabao is crude and wasteful at its best. This crudeness, coupled with the usual methods of financing the operation and getting the timber to market, is the main cause of the high price of lumber. As a general rule, the Filipino licensee is of the upper class, known as "ilustrados." He often controls a following of workmen who are practically under his power. He seldom, if ever, visits the woods. He furnishes a follower, or friend, with the carabao and other equipment, in consideration for which he receives a certain percentage of the value of the logs that are cut and hauled to the beach. This man in turn selects the woodsmen from his following, who are paid so much per cubic foot for the timber delivered on the beach. These men may or may not be advanced provisions and held responsible for the equipment and the health of the carabao. In some instances, the men who really do the work get no pay, except provisions, and usually are kept so deeply in debt that they become almost the slaves of their landlords and creditors. This is especially the case, as often occurs, when the licensee stakes the workmen with provisions direct, and holds them responsible for the condition of the carabao. Sometimes the licensee is the friend or relative of local native officials, who use their influence to help him get or control the labor. In return, political help is expected.

In the Moro country, the retainers of leading datos are used in the following way: A merchant in a coastal town, usually a Chinaman or American, who may or may not be a lumberman, gets on friendly terms with a leading dato who has a large following throughout a wooded district. The merchant obtains the license, and makes a bargain with the dato to furnish him with timber at so much per cubic foot. The dato issues orders to each of his henchmen, who are under his control, to cut and remove a certain amount each month, for which they are paid so much a cubic foot, usually in provisions. In this way, the dato and the merchant both get their timber cheap at the expense of the man actually doing the work. In defense of such methods, it is only fair to state that they are usually in operation in the outlying districts, and the forest wealth can not at present be utilized in any other way. With the development of the lumber industry, such methods will go and are going out of use.

In many instances, the licensee is a lumberman himself, pays his workman a direct wage, and treats them fairly. The policy of the Bureau of Forestry is to favor such licensees. Too often, however, the licensee pays little attention to the actual cutting in the woods, leaving this to the ignorant workmen without adequate attention, confining his own efforts to the milling operations and to the disposal of the product. The result is that his men are not utilized to the best advantage. This makes the cost of extracting the timber abnormally high, and places the licensee at a disadvantage, as compared with those who use the system of logging by contract. This handicap, however, may be overcome by the better milling he secures.

In many instances, the trees are cut with rude, narrow-blade axes, although American axes and crosscut saws are coming more into use. The logs are cut into proper lengths; one, two, three—sometimes as many as fifteen—carabaos are hitched tandem fashion to each one; and with one man to control each carabao the log is drawn to its destination. Sometimes the logs are squared, and sometimes they are removed in the round. Frequently a rude sled is used, one end of the log resting on the ground; but two-wheeled carts are sometimes substituted. The harness is often a rude affair, consisting of a yoke, with ropes made of rattan. Occasionally good logging trails are constructed, over which the logs are dragged. The length of haul varies from a few meters up to 5 and 8 kilometers (3 to 5 miles).

The above description of the financing system usually in vogue, and of the rude methods of logging, is sufficient to show that both the system and methods are capable of improvement, and until they are improved the actual cost of logging will be proportionately higher than it ought to be. What is needed more than anything else is competent supervision of the logging operations. It is believed that with such supervision the cost of cutting and removing timber to tide water can, in many instances, be reduced at least one-half. The removing of logs by man force, in use to some extent in Borneo and other neighboring countries, can not be adopted to any extent in the Philippines, principally on account of the scarcity of labor.

Certain portions of our forests are adapted to logging by animal labor and no other. This is true of the molave type, that contains scattered valuable trees too far apart to warrant the establishment of expensive steam logging. It is also true of isolated remnant patches of the dipterocarp types, where the amount of timber is limited.

Steam logging, with a railroad from the cuttings to the mills at tide water, is in successful operation by three companies. These companies have installed a logging system, patterned after the methods in use in the United States. The trees are cut by crosscut saws, bucked up into the proper lengths with saws, hitched to cables, pulled to landings by donkey engines, loaded on cars, and carried on a logging railway to the mill, 5 to 8 miles distant. These companies are exploiting forests covering large areas, that contain from 20,000 to 40,000 feet per acre of merchantable timber, composed principally of the lauans and the apitongs. With American foremen, they have been successful in accustoming their labor to the use of the crosscut saws and to the handling of the timber by machinery in all stages of the operations.

There are a number of locations in the Islands where equally good forests are found, but in some instances engineering obstacles will have to be overcome to obtain access to them. These difficulties, however, are no greater than those encountered in many parts of the United States where steam logging is in successful operation.

3. Milling Operations.

I.—STEAM SAWING.

The number of saw mills in the Islands has grown from 31 in 1907 to 60 in 1910. This increase has been mostly in the installation of small mills in the provincial towns, or in or near the cutting areas. Manila contains 11 steam mills, and the provinces the remainder. Outside of Manila, there are three band-saw mills. These contain modern appliances to handle the logs, the finished product, and the waste.

A majority of the provincial sawmills do not cut more than 3,000 board feet daily when running at their full capacity. Nearly all the small sawmills are greatly handicapped by the lack of sufficient power. Some of them can not handle many of the large logs, except by first cutting them up by handsaws.

II.—HAND SAWING.

Hand sawing, known also as whipsawing, is still extensively used throughout the Islands, principally by Chinese lumbermen. There are several firms, located in Manila, Cebu, Iloilo, and other large towns, who can manufacture from 3,000 to 10,000 board feet per day. Nearly every town of any importance has its whip sawyers. In most towns, no other kind of sawed lumber is used at all, so that the merchants find no competition from steam-sawed material. The firms in places where there is competition are able to hold their own because they utilize almost the full contents of the log. In the first place, the saw kerf is as low as 0.08 of an inch, as contrasted with 0.16 to 0.30 of the band and circular saws. As a rule, the lumber is neither edged nor trimmed, being sold in the full length and width of the portion of the log from which it is taken. Great care is taken to utilize all the waste; as much of the log as possible is converted into lumber, and the remainder is sold for firewood and other purposes. The hand sawyer is often able to manufacture from 9 to 10 board feet from each cubic foot of lumber, as against the steam mills' cut of 5, 6, or 7 board feet per cubic foot of the raw product. The Chinese and Filipino contractors demand a great deal of lumber ½ inch or less in thickness, which they use mostly for partitions and boxes. Hand sawyers often buy 1-inch steam-sawed material, and whipsaw it into two boards that sell for ½-inch lumber. Chinese merchants often contract with steam mills to have their logs sawed. They are usually on the ground watching the process, and save every scrap of the so-called waste.

Sawmills that are located in the large cities, or in heavily populated centers, find a ready marked for at least a portion of the waste. The merchants operating the smaller mills often carefully sort their timber into many grades, and find a ready sale for the slabs and edgings that are not used as fuel in the mill. In mills some distance from the centers of the population, the waste is usually burned, except that utilized for fuel or sold by the small boatload to any buyer who cares to come for it. The whipsawed material would become a more severe competitor of that from the steam sawmills if enough of it could be placed on the market to supply the demand, and were it not that large contractors will not handle it because it is not sized, edged, or trimmed. The lack of labor as cheap as that found in China will always limit the output of whipsawed lumber in the Philippines.

4. Transportation.

The high cost of getting timber to market in the form of logs or manufactured lumber is at present the bugbear of the lumbering business. Few companies have as yet succeeded in successfully solving this problem. The product of no single company is sufficiently large to warrant its maintaining a steamer built especially to carry lumber. Until such time as a single company or a combination can manufacture enough lumber to warrant its shipment direct from the mill to the markets they can not hope to compete sucessfully with Oregon pine in the Chinese or other markets. At present all the lumber for foreign markets is transshipped at Manila or Singapore. This, with the necessary handling in transshipping, approximately doubles the cost of a direct shipment, as the local freight rates are excessively high. From remote districts, out of the regular lines of steamers, it often costs as high as ₱60 a thou-

PLATE XV.—INTERIOR VIEW OF TANGUILE-OAK TYPE.

Tanguile and *Eugenia* sp.

Plate XVI.—INTERIOR VIEW OF MANGROVE SWAMP.

PLATE XVII.—INTERIOR VIEW OF MANGROVE SWAMP.

Plate XVIII.—View of the Beach Type.

Plate XIX.—PINE FOREST OF BENGUET.

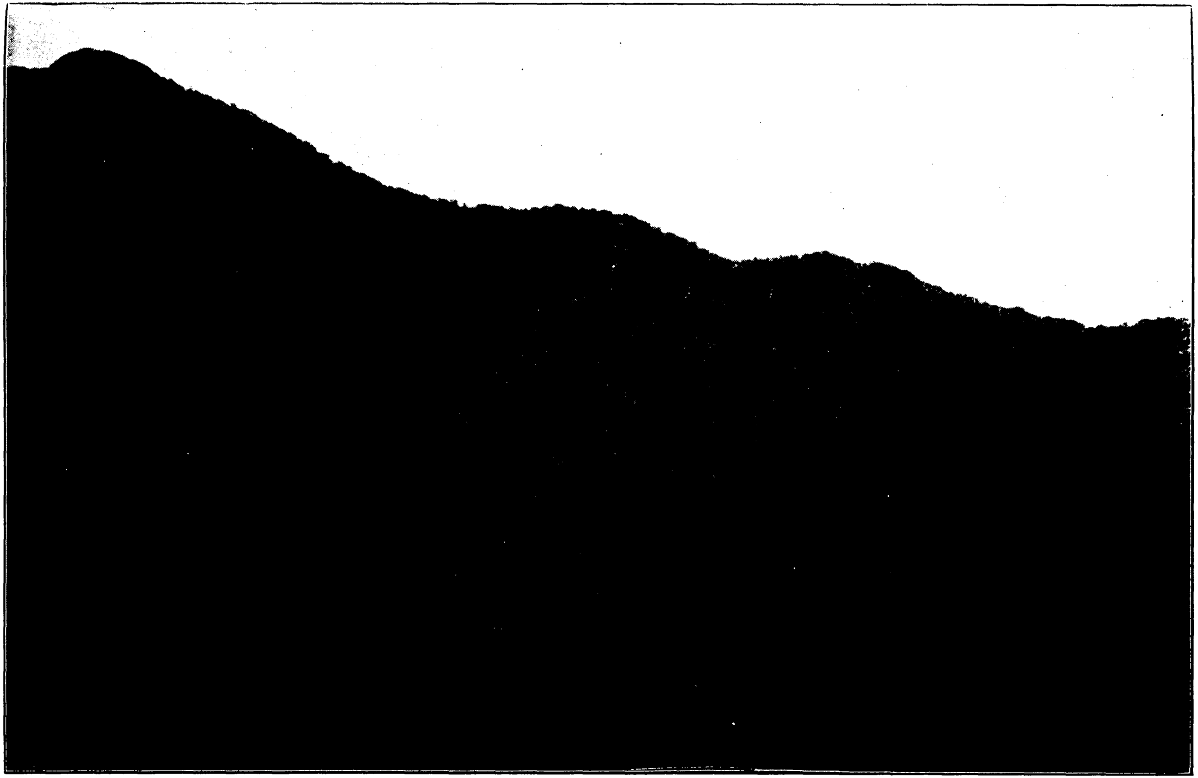

Plate XX.—EXTERIOR VIEW OF MOSSY-FOREST TYPE AND UPPER PORTION OF TANGUILE-OAK TYPE.

PLATE XXI.—INTERIOR VIEW OF THE MOSSY-FOREST TYPE.

sand board feet to transport timber in the form of logs. From distances equally remote from Manila in the line of travel of the interisland steamers, the cost is ₱11 to ₱29 per thousand board feet of the manufactured product. These boats are ill adapted to carrying lumber or logs.

Logs are occasionally transported short distances by rafts. These rafts are usually rudely constructed affairs, with the logs tied together with rattan. Light logs are used for buoys, and heavy timbers can thus be transported. However, the principal forest regions are remote from the lumber centers, and no attempt has been made to raft timber from them to the markets. Some of the larger companies use barges to transport the finished product. The smaller concerns are dependent upon small sailing vessels.

To sum up, the high cost of placing the timber of the Philippines on the market is due to the following causes: (1) The high cost of logging, due principally to the crude methods employed and to lack of proper supervision; (2) the excessive cost of milling, due to (*a*) insufficient equipment and poor arrangement of the mill, (*b*) to the difficulty of getting competent men to manage the operations, and (*c*) to a consequent loss in sawing due to excessive waste and poorly manufactured material; (3) as yet no company has a capacity sufficient to warrant their owning or hiring vessels especially adapted to carrying lumber to the home or foreign markets. The conditions above described are distinctly pioneer in nature. A few companies have sucessfully met some of them, but none have as yet succeeded in meeting the entire situation. When they do, they will be able to compete with all other timbers of like grades in the foreign and home markets.

The scarcity of the high-grade timbers needed in construction work in contact with the ground can and will be overcome by artificially preserving timbers of the cheaper construction kinds. This is the solution of the problem, especially so far as concerns the timber used in railroad construction and mines.

5. Labor.

Much has been written concerning the labor problem of the Philippines. That it is a serious one with many industries in the Philippines can not be denied; that it can be successfully solved is an established fact, so far as lumbering and logging are concerned. With good American foremen, crews of native laborers have been trained to conduct successfully the operations both in the woods and in the mill. Where the best results have been obtained, they are at least equal to and sometimes better than American labor, considering dollar for dollar of outlay. The wages vary from ₱0.50 to ₱1.50 per day. When properly treated, Filipinos make fairly steady workmen. In thinly settled forest regions, it is necessary to import labor from the more thickly settled districts. Many difficulties naturally stand in the way of doing this, but with some patience it can be and has been successfully accomplished. Colonies must be established, schools and churches built, and amusements provided. Once the lumberman gains the confidence of the men working for him, he will find laborers coming of their own accord. Failures in getting labor in the Philippines are less frequent in the lumbering business than in other pursuits. The Filipino has a natural aptitude for running machinery, and it is the kind of labor that he likes. He must, however, be constantly supervised by Americans or other foreigners who understand their business and the men working under them.

6. Opportunities for Lumbering.

A reference to the description of types will show that certain of our forests produce heavy stands of timber of a few kinds, and are therefore adapted to lumbering on a large scale. This is especially true of the lauan and the lauan-apitong types; less so of the lauan-hagachac and yacal-lauan types only because these do not cover so large a territory. With sufficient capital and modern methods of logging and milling, these forests can be successfully exploited.

There are a number of desirable tracts suitable for large operations in the dipterocarp types that await capital for the utilization of the timber upon them.

As already stated, the entire area of some of the forest types, and isolated patches of others, are not adapted to large operations simply because the supply of timber is not great enough to warrant great expenditure in extracting it. Opportunities for the small investor in these are not lacking. Indeed, a large proportion of the most valuable timber placed on the market to-day comes from the tracts granted to small licensees.

7. Conclusion.

As shown above, the lumber business in the Philippines is at present a small one. The handling of 89,000,000 board feet annually can not be considered, comparatively speaking, a large business. Yet the possibilities are great. A number of large tracts of virgin timber are ready for the ax. To exploit them successfully capital is necessary.

It is estimated that the forests properly managed can be made to yield two billion board feet annually, without being damaged. This will allow a rotation of one hundred years. While there is no prospect of the full utilization of the forest wealth in the immediate future, with sufficient investment of capital there is little reason to doubt that within the next ten or fifteen years the annual output of timber in the Philippines will reach the 500-million mark.

MINOR FOREST PRODUCTS.

Minor forest products include everything derived from the forest with the exception of timber. Most of the forest plants are put to some practical use—either the entire plant or some portion of it, as the bark, leaves, fruit, etc.—and in general the dependence of the neighboring peoples upon the forest for the means of existence is in inverse proportion to their stage of civilization. As they become more and more civilized, commerce offers them a wider range of choice and they become less dependent upon the local supply. Thus it happens that savage or semisavage tribes have shown great ingenuity in discovering uses for the forest products within easy reach, and as they are gradually thrown in contact with neighboring tribes the uses are extended, until eventually many of the forest products find a permanent place for themselves in the markets of the world. At the present time, therefore, minor forest products may be divided into two classes: Those whose uses are widely recognized, and which have a market value sufficiently definite to permit them to be assessed for the forest charges; and, second, those whose use is so purely local, or the demand for which is so unsteady, that they are not sold in the market, or which for some other reason it is impracticable at present to bring under the Internal Revenue Law.

1. Woods Used for Fuel.

FIREWOOD.

More wood is annually used for fuel in the Islands than for lumber. Records for the fiscal year 1909–10 show that 246,776 cubic meters of firewood were cut, and it is probable that an even greater amount was cut and used without record.

While all kinds of woods are used for firewood, the favorite source is the mangrove swamps, producing a group of woods which may be classed under the names of bacauans, pototans, and tangal. These woods have calorific power higher than that of oak,[1] and are among the best firewoods in the world. They constitute the principal value of the mangrove swamps which are found scattered along the seacoasts throughout the Islands, varying in width from a few feet to several miles. They probably cover about 2 per cent of the forest area of the Islands, or about 800 square miles.

There are other woods in the Philippines that have perhaps an even higher heating power than the mangroves. Among these is agoho (*Casuarina equisetifolia*), but because of its scarcity it can never take the place of the bacauans. Many species of trees found in the second-

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[1] **According to tests made by the Bureau of Science, Manila, the gram calories of bacauan is 8,161, of tangal 8,055, and of oak 7,965.**

growth forests yield excellent firewood. Among these are bayabas (*Psidium guajava*), ipil-ipil (*Leucaena glauca*), and madre-cacao (*Gliricidia sepium*).

Firewood is sold under the name of *rajas* and *leñas*. The former are from 60 to 150 centimeters in length and from 7 to 15 centimeters in diameter. *Leñas* are of smaller dimensions. It is impossible to estimate the value of the firewood used annually in the Philippines. The average retail price of bacauan in the Manila market is about ₱25 a cord.

CHARCOAL.

The principal woods employed in the manufacture of charcoal, like those used for fuel, come from the mangrove swamps. They include the bacauans, the pototans, tangal, tabigi, and dungon-late. In places where mangrove woods are not available, agoho, binayuyu, bayabas, madre-cacao, and other species of the second-growth forest furnish the supply. Kilns for burning charcoal, as a rule, are rudely constructed. A number of Japanese licensees have introduced the methods employed in their own country; and if their kilns would find general acceptance the usual methods of burning charcoal would be improved.[1] The charcoal industry of the Philippines is not a large one and does not supply the full demand, for small quantities are annually imported. Official records for the fiscal year 1909–10 show that 4,315 cubic meters[2] were used. During the same time 50,538 kilos were imported.

2. Barks.

Under the local name of cascalote, the barks of many trees are utilized for various purposes, principally for tanning and dyeing.

TAN BARKS.

The tanning industry in the Islands is not highly developed, and as there is no export trade in the barks or their products the amount utilized for this purpose is small. The principal source of tan bark is the bacauan family of the mangrove swamps. The crude product derived from the bark is known as mangrove cutch, which has to be put through certain processes of refinement before it is ready for tanning. There are no cutch factories in the Philippines, but some are in successful operation in Borneo, where the mangrove swamps are more extensive. However, the swamps in Mindanao, Palawan, and other islands in the southern portion of the Archipelago cover a sufficient area to justify the establishment of cutch factories, and there seem to be

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[1] For a description of the two types of kilns see Maule, Wm. M.: The charcoal industry of the Philippine Islands. Bull. 2, Bureau of Forestry, Manila, P. I., 1906.

[2] Approximately 1,000,000 kilos; 230 kilos equal 1 cubic meter.

excellent prospects for introducing the industry and for thus utilizing the bark from a large proportion of the swamp timber felled for firewood. Through certain chemical changes coloring matters begin to appear in the bark soon after felling, and for this reason it is considered necessary to work up the bark within forty-eight hours. This requires the factories to be located in or near compact mangrove areas. Four to 6 tons of bark are necessary to produce 2 or 2½ tons of cutch.

The barks of the following species of the mangrove trees contain tannin: Bacauan (*Rhizophora conjugata*), bacauan-lalaki (*Rhizophora mucronata*), pototan (*Bruguiera eriopetala*), busain (*Bruguiera gymnorrhiza*), langarai (*Bruguiera parviflora*), pototan-lalaki (*Bruguiera caryophylloides*), tangal (*Ceriops tagal*).

Recent analyses of barks from Mindanao made in the laboratories of the Bureau of Plant Industry, Washington, D. C., show the following results:

Kind.	Total solids.	Soluble solids.	Reds.	Nontannins.	Tannins.
Tangal	58.58	49.02	9.56	13.19	35.83
Bacauan	53.91	51.03	2.88	11.64	39.39
Pototan	37.36	36.81	.55	10.15	26.66
Langarai	24.43	19.82	4.61	7.27	12.55

The proportion of tannin according to these analyses compares favorably with that of barks of the same species from Borneo. It is estimated that the swamp area of one bay in Mindanao contains 25,000 hectares and that it will yield approximately 25 tons of bark to the hectare, making a total of 625,000 tons of bark. With a rotation of twenty years this is a sufficient quantity to supply a large factory indefinitely.

While there are probably many other trees in the Philippines besides the mangroves whose bark produces tannin, camanchile (*Pithecolobium dulce*) and agoho (*Casuarina equisetifolia*) are the only ones utilized to any extent.

OTHER BARKS.

The bark in the Philippines used most extensively for dyeing purposes comes from tabigi or nigi (*Xylocarpus obovatus*), also a tree of the mangrove swamps.

The extract from the bark of tangal is employed for flavoring and coloring the sap of coconut and other palms used as alcoholic beverages. By far the largest proportion of the bark of this tree now gathered in the Philippines is used for this purpose.

A number of small trees contain barks used for tying purposes. In some instances they are used direct; in others they are first made into ropes. Among these may be mentioned the following: Malubago (*Hi-*

biscus tiliaceus), anilao (*Columbia serratifolia*), tanag or taloktok (*Kleinhofia hospita*), danling-aso (*Helicteres hirsuta*).

The barks of a number of vines and trees produce materials suitable for soap. Gogo (*Entada scandens*), the principal one of these, is a large vine. Sections of the vine are pounded to a pulp, bound into small bales, and are used extensively for washing hair. Salinkugi or gogong-toko (*Albizzia saponaria*) is a tree containing a bark that is used for the same purposes as the gogo vine. While other vines and trees yield soapy barks, none are used to the same extent.

The total amount of tan bark officially manifested during the fiscal year 1909–10 was 3,302,939 kilos, two-thirds of which came from Mindanao. The amount of dye bark manifested amounted to 98,482 kilos.

3. Dyewood.

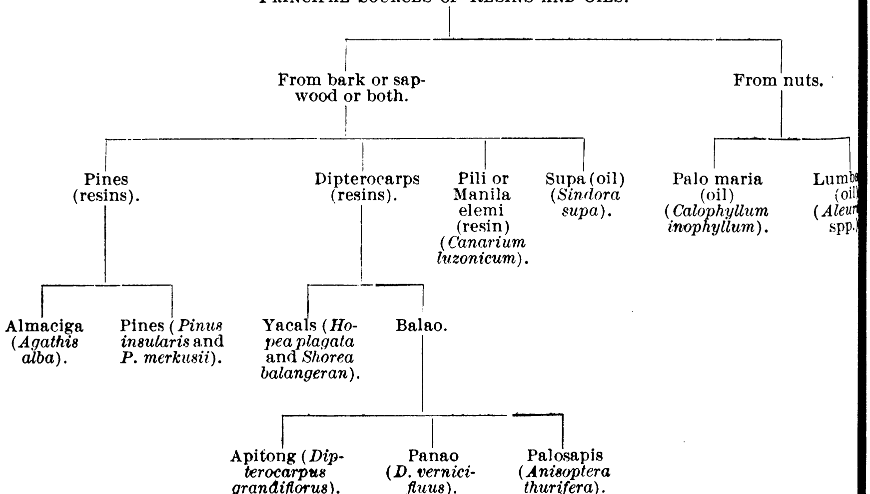
While a number of woods of the Philippines can be used for dyes, only one, sibucao (*Cæsalpinia sappan*), is so used to any extent. This is practically the equivalent of the Brazil wood (*Cæsalpinia echinata*). It is a small bushy tree and is semicultivated, especially in the Island of Guimaras, from which most of it comes. During the fiscal year 1909–10, 1,154,614 kilos of dyewood passed through official channels, practically all of which was sibucao.

4. Resins and Oils.

The following diagram shows the sources of the principal oil and resinous products of the Philippines:

Table 10.

Principal Sources of Resins and Oils.



ALMACIGA.

The local commercial name of the resin produced by *Agathis alba* is almaciga. This is a tree of the pine family, closely related to the species yielding the kauri resin of New Zealand. It grows in the mountainous regions of the Philippines usually between altitudes of 400 and 1,000 meters. The resin is gathered by the hill people. It accumulates as a hardened product on the trunk after incisions are made in the bark, or at the base of the trunk where it is deposited in the ground through ruptures made usually near the junction of the roots and the trunk. The latter deposits remain in the ground after the tree dies and decays and are discovered by the collector, who thrust a sharp pointed stick in the ground to determine their location. Almaciga to the amount of 1,092,398 kilos passed through official channels during the fiscal year 1909–10. Approximately four-fifths of this amount came from the Moro Province of Mindanao.

DIPTEROCARP RESINS.

While all the dipterocarps are resinous, only a few of them yield products that have reached the markets. Locally they are used extensively as torches, for calking small boats, etc. As explained in Part II, under a discussion of the dipterocarp family, these deposits are wood oils which quickly or slowly transform into a resin on exposure to the air. Some of these are encountered in a solid form, others are plastic, and still others harden so slowly that they are removed as fluids. The latter are known as wood oils and bear the local name of the tree from which they are collected. To the former class belongs the resin of yacal (*Hopea plagata*) and guisoc (*Shorea balangeran*). This is collected by making incisions through the bark. The oil hardens to a brittle brownish-black resin and is collected in this form. It is used locally for torches and is often mixed with softer resin for calking.

Apitong, panao, and palosapis are the principal dipterocarps that yield fluid resins, or wood oils. The resins of these trees are usually known as balao. The oil is allowed to collect in cup-shaped incisions made in the wood. As the flow ceases the surfaces are recut and fired, which greatly increases the deposit. It is used locally for lighting, and, when mixed with powdered charcoal, for calking boats. Other dipterocarps produce resins, but the amount that can be collected is much less than from those mentioned above.[1]

The amount of wood oils that passed through official channels during the fiscal year 1909–10 was 131,377 liters, mainly from the Provinces of Leyte and Occidental Negros.

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[1] For a discussion of the chemical nature of the oils of supa, balao, panao, and palosapis see Clover, A. M.: Philippine wood oils, Phil. Jour. Sci., 1 (1906), 191–202.

MANILA ELEMI.[1]

The resin produced by pili (*Canarium luzonicum*), a tree growing wild or as a planted crop in the Philippines, is known commercially as Manila elemi and locally as brea or pili resin. Incisions are made in the bark usually at the beginning of the rainy season. About once a month the resin is collected and the bark recut. This keeps up till December, when the resin practically ceases to flow for that year. The resin is graded into two classes, viz, "brea blanca" and "brea negra," the principal difference being one of cleanliness. It is soft, sticky, and opaque, slightly yellow in color, has a very agreeable resinous odor, and burns with a smoky flame. It is used extensively for torches and with other resins is mixed with powdered charcoal, brick, and ashes for calking boats. During the fiscal year 1909–10, 57,629 kilos of Manila elemi were officially manifested. The resin came principally from the Province of Tayabas, where the tree is quite extensively cultivated.[2]

OTHER RESINS AND OILS.

The two pines (*Pinus insularis* and *P. merkusii*) of the Philippines are rich in turpentine. As yet however the resinous products of these trees are used only locally. Lumbang oil is the product of the nuts of two species of *Aleurites*. *A. moluccana* (lumbang) is an introduced, semicultivated tree confined principally to the provinces near Manila and to the Davao district of Mindanao. *Aleurites trisperma* (balukanad), is a closely related species that is found wild or semicultivated. The nut is about the size and shape of a hickory nut. The hard shell is removed, and the oil is extracted from the kernel. It is used in the Philippines for illuminating purposes, in the manufacture of soap (usually known as Chinese soap), for painting small boats, and for treating timbers intended for use in water. It seems to be closely related to the Chinese wood oil or tung (tung yu or Ningpo varnish), which is extracted from a nut coming from another species of the genus *Aleurites*.[3] During the fiscal year 1907–8 some ₱22,000 worth of lumbang nuts were gathered in the Moro Province alone.

From the fruits of palo maria (*Calophyllum inophyllum*) an oil known as the "oil of palo maria" is extracted (known in India as domba

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[1] For a full discussion of this see Clover, A. M.: The terpene oils of Manila elemi, Phil. Jour. Sci. 2 (1907), Gen. Sci., 1–40.

[2] Forms of *Canarium luzonicum* produce a much-prized edible nut that is rich in oil and has a flavor not unlike that of the almond. There seem to be three varieties of the nuts known locally in Tayabas as basiad, tugdugin, and pilauai. Basiad is said to have the best flavor, though pilauai attains the largest size.

[3] For a discussion of the chemical properties of this and other oil-bearing seeds see Richmond and Vivencio del Rosario: Commercial utilization of some Philippine oil-bearing seeds: preliminary paper, Phil. Jour. Sci. 2 (1907), Gen. Sci. 439–449.

oil). This oil is used in small quantities in the Philippines chiefly for illuminating purposes.

5. Gutta-percha and Rubber.

The following diagram shows the wild and cultivated sources of gutta-percha and rubber in the Philippines.

Table 11.

Sources of Wild and Cultivated Gutta-percha and Rubber.

- Gutta-percha.
  - Native trees from *Palaquium* spp. (*Kalipaya*) Betis family.
  - Cultivated vine (*Calotropis gigantea.*)
- Rubber.
  - Native.
    - Trees.
      - *Ficus* spp. of balete group (fig family).
      - *Alstonia* spp. and others of dogbane family.
    - Vines.
      - Tabango (*Chonemorpha elastica*) (dogbane family).
      - *Parameria philippinensis* and other species (dogbane family).
  - Cultivated (trees).
    - Fig family.
      - India rubber (*Ficus elastica*).
      - Castilloa (*Castilloa elastica*).
    - Para rubber family.
      - Para rubber (*Hevea brasiliensis*).
      - Ceara rubber (*Manihot glaziovii*).

Gutta-percha is the product of certain species of *Palaquium* found in Mindanao and adjacent islands. The gutta-percha (kalipaya) trees are found scattered over a large area. The crude product is collected after felling the tree by ringing the bark at regular intervals. It is gathered by the wild tribes principally from the Cotabato Valley of Mindanao. No attempt has yet been made to cultivate trees producing gutta-percha. Official reports show that 96,169 kilos were collected during the fiscal year 1909–10. In Jolo and certain other ports it is rudely refined and eventually reaches the Singapore market. *Calotropis gigantea,* a vine belonging to the Asclepiadaceæ, yields a kind of gutta-percha. It is found in a few provinces in and about towns, and is undoubtedly an introduced plant in the Philippines. Only scattered specimens are to be found, and we have no information that it is utilized for any purpose locally.

Rubber is often confused with gutta-percha and for that reason the Philippines have gained the reputation of containing considerable quantities of wild rubber. It is probable that a small quantity of the product known officially as gutta-percha is really wild rubber, but it is impossible to state the exact amount. Investigations to determine the source and amount of wild rubber in the Philippines indicate that certain vines and trees produce it, but not in large quantities. The diagram (Table 9) shows the native trees and vines that are known to yield rubber. Certain species of *Ficus* belonging to the balete group of the *Moraceæ* produce rubber, but little is known about the quality or amount. Species of *Alstonia* (dita, etc.) and other trees of the dogbane family yield rubber of a poor grade in small quantities. A large vine, known under the Moro name of tabango (*Chonemorpha elastica*), is probably the principal source of the wild rubber of the southern islands. It has been found in the Cotabato region of Mindanao and on the Islands of Jolo and Tawi Tawi of the Sulu Archipelago. Dugtung-ahas (*Parameria philippinensis* and other closely related species) is a large vine that contains rubber in small quantities. Both of these vines belong to the dogbane family (*Apocynaceæ*). It is not known whether they occur in sufficient quantities to warrant a systematic attempt to exploit them on a large scale.

It has been demonstrated beyond doubt that the soil and climate of the Philippines are favorable to the growth of the standard cultivated rubber trees. One small plantation on the Island of Basilan is already successfully producing rubber, others have been started, and it is only a question of time when the Philippines will become one of the rubber-producing regions of the Tropics. At present Para rubber (*Hevea brasiliensis*) and Castilloa (*C. elastica*) seem to be the favorites, but Ceara (*Manihot glaziovii*) and India rubber (*Ficus elastica*) are also cultivated.

6. Vines.

The following diagram shows the principal minor products produced by vines:

TABLE 12.

PRINCIPAL MINOR PRODUCTS FROM VINES OR LIANAS.

- Climbing palms (rattans).
  - Rattans of commerce, known locally as bejucos.
  - Principal rough tying product of the Philippines.
  - Hat making.
  - Some forms have edible shoots and fruits.
- Climbing ferns.
  - Nito (*Lygodium* spp.).
  - Diliman or Hagnaya (*Stenoclaena* spp.).
- Other vines.
  - Many used locally for tying purposes.
  - (See under Gutta-percha and rubber).
  - Soap (gogo). (See under Barks).

RATTAN.

This is the product of a large number of species of climbing palms (the genus *Calamus*), and is known locally as bejuco. The best qualities are found in the lauan, the lauan-apitong, the tanguile-oak, and the mossy-forest types. The hill people are the principal rattan collectors. Rattan palm starts as a rosette of leaves from the center of which a stem develops. At first this is covered with prickly leaf sheaths, but as it develops, the old leaves with their sheaths drop off leaving a smooth jointed stem usually about 4 centimeters or less in diameter and of great length. One has been measured with a length of 122 meters (about 400 feet), and others are said to be much longer. In many species the stout midrib of the leaf extends into a long whip-like projection armed with stiff recurved spines.

Rattan is brought to the market either in the round or split. It finds its greatest use in the Philippines for tying bales of hemp, sugar, tobacco, and other agricultural products. The better grades are used in furniture making and one kind is used for making hats. The best qualities of rattan come from the Island of Palawan, and go to the Singapore market. According to the specifications of a Singapore firm a good grade of split rattan should be mature, strong, not ribbed, 3.7 to 5 meters (12 to 16 feet) long, with a diameter of 4.5 to 9 millimeters (three-sixteenths to three-eighths inch). Bright color is desirable but not absolutely necessary except in the best quality.

During the fiscal year 1909–10 there passed through official channels a total of 3,069,212 kilos of rattan. The Province of Ambos Camarines produced 759,278 kilos, and Sorsogon 607,951; Occidental Negros stands third with 347,138 kilos, mostly used in baling sugar. The other provinces producing more than 100,000 kilos are as follows: Mindoro, Tayabas, Oriental Negros, and Cagayan. This is not the arrangement of provinces according to the actual amount they contain. It merely means that the exploitation is greater because these provinces lie nearer the centers of demand. Probably the Moro Province and Palawan contain a larger supply than any of those mentioned above.

OTHER VINES.

Diliman or hagnaya (*Stenoclaena* spp.) are climbing ferns used principally as a string to bind the parts of fish traps. Black and white nitos (*Lygodium* spp.) are also climbing ferns and are employed in making wickerwork and for the borders of hats. The forest abounds in many kinds of other vines used for tying purposes, generally without being made into ropes.

7. Bamboo.

While wild bamboo of some kind is found scattered everywhere throughout the Islands, yet wild structural bamboo in commercial quantities is confined to regions with a pronounced dry season. Introduced bamboos are planted in all parts of the Philippines and with the wild forms play an important part in the domestic and economic life of the Islands.

The following is a list of the uses of bamboo: House construction (posts, beams, rafters, floors, siding, stairways, doors, windows, roofs); fencing; rafts, rude piling and decking for wharves; fish traps; bridges; parts of carts; parts of small boats; handles for tools and weapons; bows and arrows; musical instruments; hats; baskets; mats; sawali (a coarse kind of mat used principally for partitions and the siding of houses); picture frames; decorative arches and many kinds of ornaments; and temporary construction of all kinds.

8. Erect Palms.

In many places where bamboo is wanting or scarce the trunks of erect palms are extensively used as a substitute for many classes of construction. They are used in the round or split into narrow pieces and the pith removed. The following palms are most commonly used for structural purposes: *Livistona* spp. (anahao and palma brava), *Oncosperma* spp. (anibong), *Caryota* spp. (pugahan or fish-tail palm), *Heterospatha* sp. (sagasi), *Pinanga insignis* (sarawag), and many species of *Pinanga* under various local names.

The sap of the inflorescence of nipa palm (*Nipa fruticans*), a wild and semicultivated palm of the tide-water swamps, is the source of a large part of the alcohol and vinegar of the Philippines and its leaf is the principal roofing and thatching material of the Islands. The leaves of anahao and other palms are also used for this purpose, especially in places remote from nipa swamps. Next in importance to the nipa palm is the buri palm (*Corypha elata*). This grows wild and semicultivated. The sap of the inflorescence is fermented and used as an alcoholic drink (tuba).[1] The leaves are used for roofing, for making mats, sails, bags, hats, and ropes.

Many less important minor forest products are treated briefly in Part II of this bulletin.

RELATION OF THE GOVERNMENT TO THE FORESTS AND THEIR PRODUCTS.

1. Legal Status of the Public Forests and Forest Reserves.

The public forests of the Philippines include all unreserved public lands covered with trees of any age. By the action of the Governor-

[1] Tuba is the general term for the fermented sap of a number of palms. The principal source of this drink is the coconut palm.

General of the Philippines any portion of the public domain may be set aside as a forest reserve. Both the public forests and the forest reserves are administered by the Bureau of Forestry "for the protection of the public interests, the utility and safety of the forests, and the perpetuation thereof in productive condition by wise use." No land containing public forests can pass out of the control of the Bureau of Forestry until the Director certifies that it is more valuable for agricultural than for forest purposes.

2. Disposal of Forest Products.

The following diagram illustrates the various ways of disposing of forest products:

TABLE 13.

HOW THE GOVERNMENT DISPOSES OF ITS FOREST PRODUCTS.

- Free of charge.
  - Without license. (Second and lower group timbers and minor products for domestic purposes.)
  - Gratuitous license.
    - To miners from claims, for development of mines.
    - To home builders. (First-group timbers.)
    - For public works. (Second and lower group timbers and minor products.)
- With charge.
  - Miners' license. (From public forest for development of claims. Half charge.)
  - Ordinary license. (Full charge.)
  - Exclusive license. (Full charge.)
  - Exclusive license agreement. (Full charge.)

I.—FOREST PRODUCTS OBTAINED FREE OF CHARGE.

Certain forest products can be obtained without charge with or without license. The Free-use Act provides that until Oct. 25, 1915, inhabitants of the Philippine Islands can gather without license and free of charge all products to be used for domestic purposes except first-group timbers. Special areas of public forests, known as communal forests, are established for the use of certain settlements, from which the inhabitants are required to obtain all of their free-use products. Where such areas have not yet been set aside, the free-use products can be gathered in any portion of the public forests within the provinces in which the collector resides.

Gratuitous licenses may be issued (1) under certain conditions to inhabitants of the Philippines for first-group timbers to be used for the construction of homes; (2) to miners for all forest products from their claims used in the development of the mines; and (3) for minor products and second and other lower group timbers to be used in the construction of public works of all kinds.

II.—FOREST PRODUCTS GATHERED WITH CHARGE.

The following classes of licenses are issued for the cutting, collecting, and removal of products upon which forest charges are imposed: miners' licenses, ordinary licenses, exclusive licenses, and exclusive license agreements.

Miners' licenses provide for the gathering of products from areas outside of the claims, and that the products so collected be paid for at one-half the regular rates, and are to be used for the development of mines mentioned in the license. Ordinary licenses provide for the collecting of product upon which the full charges are made. The territory granted is restricted to definite areas, for which one or more licenses may be issued. Ordinary licenses are usually granted for terms of from one to three years and may be renewed at their expiration. Exclusive licenses grant to a single licensee the right to gather forest products in a particular area. Exclusive license agreements are granted for periods up to twenty years in large areas which can be extensively lumbered without permanent injury to the forest. Applications for such for an area of more than 1,000 hectares (approximately 2,500 acres) must secure the approval of the Secretary of the Interior. Thereupon proposal for competitive bids are published in the Official Gazette and other periodicals, and the license will be granted to the bidder who makes the most satisfactory offer, including a guaranty to install the most complete and efficient plant most promptly, and to do a sufficient amount of annual development work. A bond is required for the proper performance of all obligations.

The right to reject any and all bids is expressly reserved, and in general no proposal for an exclusive license agreement will be approved except upon a reasonable showing that the licensee will be able within the period fixed in his license actually to exploit the resources of the forest tract. The man who means business must show that he really intends to develop the tract for which he wishes to secure an exclusive license, and that he will protect the interests of the public in the concession.

3. Charges for Forest Products.

I.—LUMBER.

For the purpose of forest charges the present grouping of the timber is as follows:

TABLE 14.

Group I.	Group II.	Group III.
Acle.	Alupag.	Agoho.
Baticulin.	Aranga.	Amuguis.
Betis.	Banaba.	Anubing.
Camagon.	Bansalaguin.	Apitong.
Ebony.	Banuyo.	Batino.
Ipil.	Batitinan.	Bitanhol.
Lanete.	Bolongeta.	Catmon.
Mancono.	Calamansanay.	Calumpit.
Molave.	Calantas.	Cupang.
Narra.	Dungon.	Dalinsi.
Tindalo.	Guijo.	Dita.
Yacal.	Macaasim.	Dungon-late.
	Malacadios.	Malacmalac.
	Mangachapuy.	Malapapaya.
	Palo maria.	Malasantol.
	Supa.	Mayapis.
	Teak.	Palosapis.
	Tucang-calao.	Panao.
		Sacat.
		Santol.
		Tamayuan.
		Tanguile.

All other timbers are placed in Group IV.

The metric system of measurement has been officially adopted by the Philippine Government, and the charges are based on the volume of round timber. The forest charges of the different groups are as follows:

TABLE 15.

Group.	Charge per cubic meter.		Charge per 1,000 board foot.	
	Philippine currency.	United States currency.	Philippine currency.[a]	United States currency.
1	₱2.50	$1.25	₱10.00	$5.00
2	1.50	.75	6.00	3.00
3	1.00	.50	4.00	2.00
4	.50	.25	2.00	1.00

[a] Assuming that 4 cubic meters will cut 1,000 feet board measure. (See p. 12.)

II.—MINOR PRODUCTS.

The charges on minor products is 10 per cent of the market value. This may change from time to time. The following is a list of the principal minor products, except firewood, with their respective forest charges:

Almaciga	per 100 kilos	₱1.50
Manila elemi	do	1.50
Gutta-percha	do	7.00
Rubber	do	7.00
Rattan	do	1.00
Charcoal	per cubic meter	.40
Dyewood	per 100 kilos	1.50
Dyebark	do	.50
Tanbark	do	.30
Wood oils	per liter	.01

The forest charges on all firewood is ₱1 for 1,000 pieces, each from 60 centimeters to 1½ meters in length and from 7 to 15 centimeters in diameter; for all firewood of lesser dimensions the charge is 10 centavos per cubic meter.

No other charges are collected from the licensees. The land from which the timber is taken is free from all taxation, as it remains Government property. There are no export duties on forest products; all enter the United States free from duty, and logging and milling machinery and supplies can be imported from the United States without import charges.

4. Cutting Regulations.

The cutting regulations are simple and are devised merely to insure the wise use and perpetuity of the forest. On land that is more valuable for agriculture than for forest growth, clear cutting may be allowed. On trees cut from land suitable for forests and for no other more valuable purpose a minimum diameter limit is established. For the lower group timbers this is usually 40 centimeters (16 inches), measured breast-high outside of the bark. In some cases it is lower, depending upon the mature size of the species and on the silvicultural condition of the forest. For the higher group timbers the minimum diameter limit is usually 60 centimeters (24 inches). Where there is danger of the extinction of valuable species, the Government reserves the right to select the trees to be cut. The licensees are expected to utilize all merchantable timber that they cut; the stumps must not be unnecessarily high, and no timber must be abandoned in the forest. These rules are simple and no lumberman who has good control of his logging crew will find that he is hampered by carrying them out. On the other hand, he will generally be the principal gainer by doing so.

5. How the Bureau of Forestry Assists the Lumbermen.

The Bureau of Forestry will furnish advice in all classes of forest work. Nearly all the Islands of the Archipelago have been explored, and while much yet remains to be done, the results already obtained enable the Bureau to suggest profitable areas to lumbermen who are considering applying for a concession. Foresters are available to investigate and report upon special timbered areas.

The museum of the Bureau of Forestry contains more than 1,000 species of Philippine woods. These have been carefully studied by the experts of the Bureau, who are now in a position to identify samples of most of the native timbers.

Coöperative work with companies to ascertain the ability and methods of preserving the different timbers have been taken up; and there is little doubt that cheap timbers, which are abundant but decay quickly in their natural state, can be made to take the place of the scarcer, high-priced timbers for many structural purposes where contact with the ground is necessary.

Plate XXII.—LOGGING SLED.

[illegible]

PLATE XXIII.—STEAM LOGGING; DONKEY ENGINES.

PLATE XXIV.—LOGGING RAILROAD.

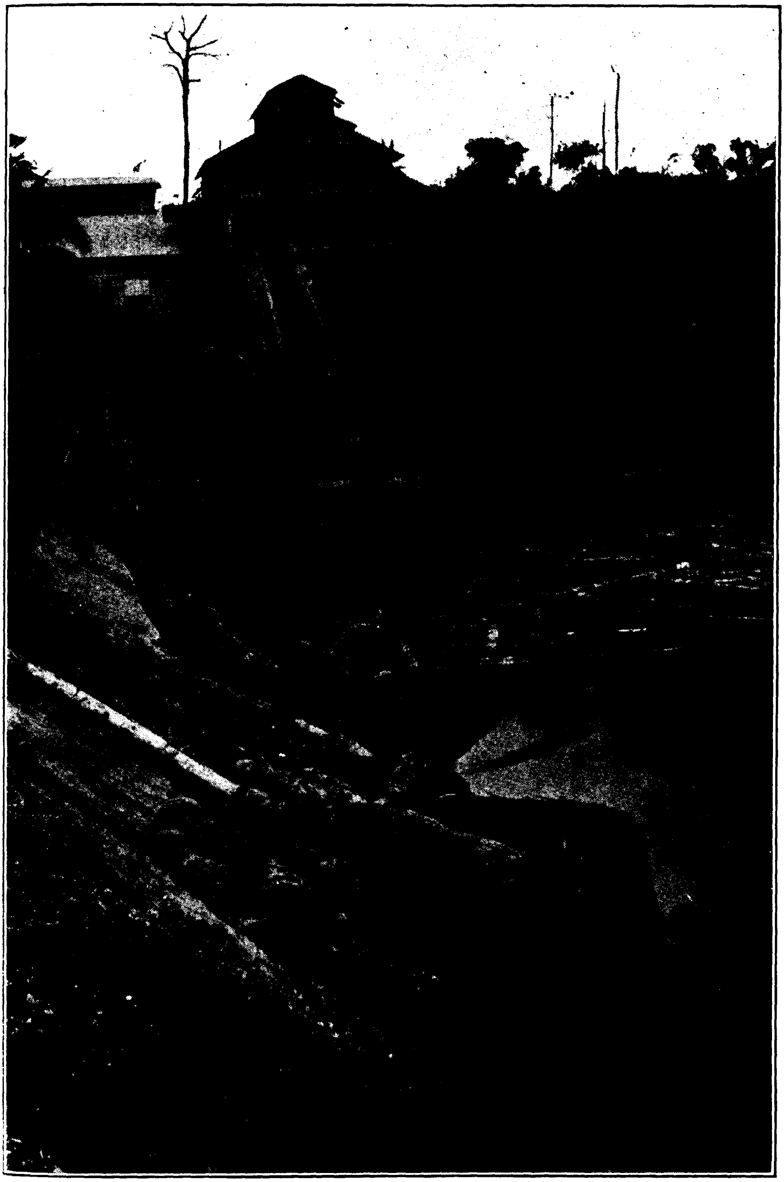

PLATE XXV.—STEAM SAWMILL.

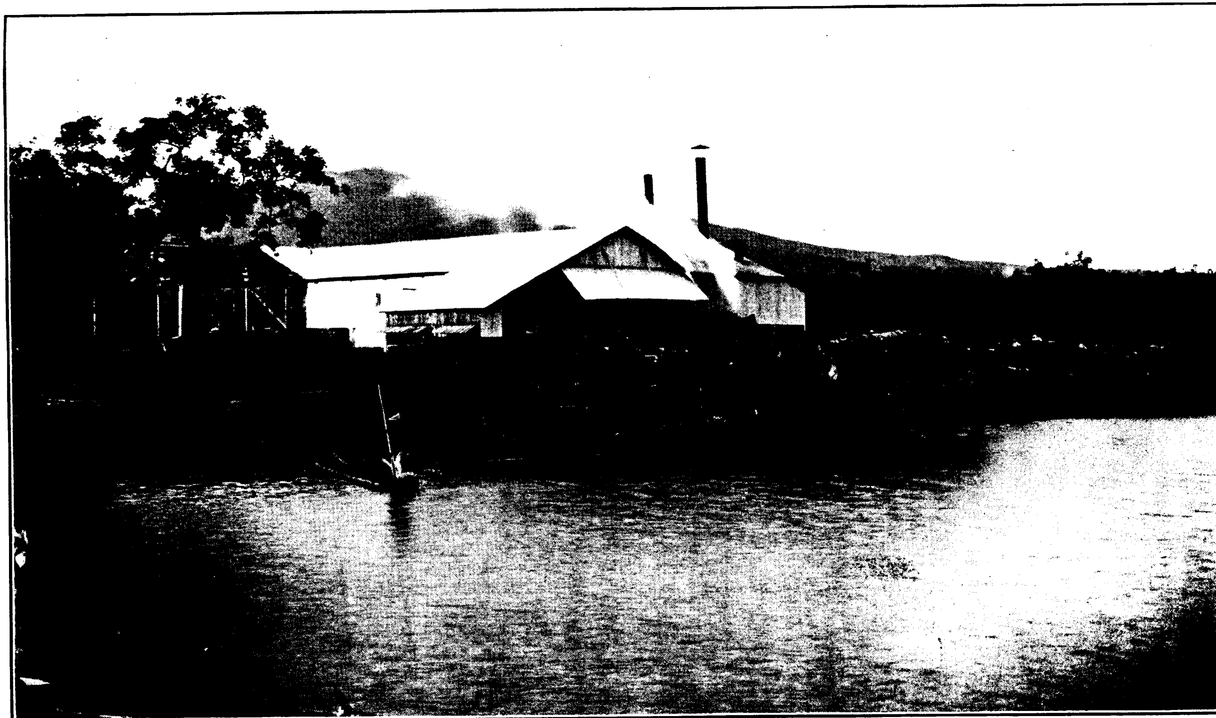

Plate XXVI.—STEAM SAWMILL.

PLATE XXVII.—GUTTA-PERCHA AS IT REACHES THE MARKET.

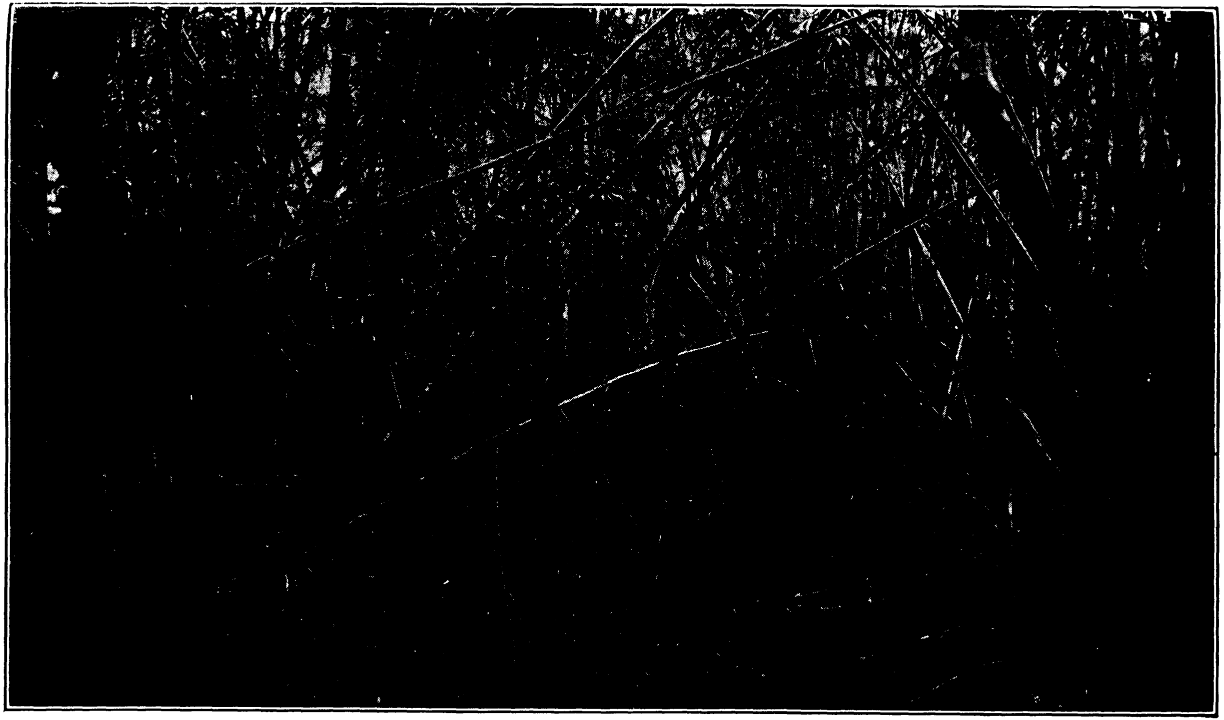

PLATE XXVIII.—A BAMBOO FOREST.

APPENDIXES.

APPENDIX I.

MECHANICAL PROPERTIES OF THIRTY-FOUR PHILIPPINE WOODS.

Gardner[1] has published the mechanical tests of thirty-four Philippine woods. The results of this work are given in the following tables:

[1] Gardner R.: I. Mechanical tests, properties, and uses of thirty-four Philippine woods. II. Philippine sawmills, lumber market, and prices. Bull. 4 (1907). Second edition revised.

TABLE I.—*Cross-bending*

Name.	Locality.		Moisture over 35 per cent.						
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).[a]	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch.)
Lauan	Mindanao	Average	38	51.8	0.444	2,630	4,570	6,870	1,464
		Maximum		75	.485	5,340	5,840	7,950	1,820
		Minimum		35.5	.405	1,410	3,160	5,340	975
Do	Zambales	Average	36	63	.478	5,260	6,410	8,040	1,438
		Maximum		86.4	.529	7,450	7,880	9,770	1,740
		Minimum		41.6	.412	2,810	4,510	4,510	1,050
Almon	Occidental Negros.	Average	18	59.2	.464	5,400	6,380	8,260	1,377
		Maximum		70	.52	6,750	7,310	9,430	1,500
		Minimum		49	.378	3,800	4,360	5,980	1,120
Apitong	Mindanao	Average	52	53.9	.62	3,750	5,550	7,350	1,754
		Maximum		81	.715	6,330	8,720	10,550	2,580
		Minimum		36	.56	1,970	3,730	5,540	1,320
Do	Zambales	Average	30	55.8	.679	5,220	6,790	8,910	1,428
		Maximum		84.6	.721	7,030	8,430	10,470	1,740
		Minimum		48.8	.588	2,530	3,230	3,910	900
Do	Negros	Average	11	95.5	.564	5,960	7,060	9,470	1,565
		Maximum		107	.581	7,040	8,300	10,960	1,740
		Minimum		76.8	.55	4,920	6,050	8,040	1,370
Guijo	Ambos Camarines.	Average	27	43.7	.677	6,330	8,660	12,050	1,915
		Maximum		56	.735	8,150	10,200	13,820	2,240
		Minimum		37.2	.629	4,920	7,180	10,380	1,635
Do	Mindoro	Average	49	57.8	.696	6,420	8,780	11,350	1,825
		Maximum		89.8	.806	9,140	11,450	14,200	2,210
		Minimum		41	.596	2,110	4,570	6,210	1,190
Molave	Near Laguna de Bay.	Average	47	45.5	.772	4,870	8,380	10,610	1,503
		Maximum		62	.858	9,150	13,600	14,600	2,000
		Minimum		36.4	.69	1,410	4,360	5,200	895
Do	Ambos Camarines.	Average	29	54.4	.782	6,840	8,640	10,380	1,381
		Maximum		72.5	.825	9,850	11,950	14,380	3,090
		Minimum		43.8	.712	2,100	2,460	3,820	1,050
Yacal	do	Average	21	43.3	.823	7,270	10,160	13,070	2,079
		Maximum		54.2	.906	9,850	11,600	15,350	2,650
		Minimum		35.3	.76	4,920	7,750	10,260	1,680
Narra	Near Laguna de Bay.	Average	11	79	.563	3,000	6,300	8,390	1,509
		Maximum		93	.59	4,500	8,100	11,300	1,850
		Minimum		65	.535	2,110	4,500	5,300	1,130
Do	Cagayan	Average	11	51.8	.63	6,020	7,960	10,220	1,352
		Maximum		81.7	.77	7,730	10,830	13,500	1,630
		Minimum		35.5	.475	4,360	6,050	7,190	1,050
Tanguile	Unknown	Average	8	39.9	.536	5,180	6,780	9,160	1,576
		Maximum		45.4	.565	5,900	7,600	10,210	1,685
		Minimum		35.5	.51	4,640	5,760	7,030	1,380
Do	Zambales	Average	27	47.7	.457	4,010	4,980	6,380	1,241
		Maximum		80	.54	5,620	7,170	9,450	1,660
		Minimum		38.9	.405	2,110	2,110	3,040	950
Tanguile-balacbacan	Occidental Negros.	Average	15	58.1	.509	5,030	6,280	8,670	1,348
		Maximum		62.5	.53	5,900	6,900	9,330	1,530
		Minimum		53	.479	2,950	5,350	7,920	1,180
Sacat	Lamao Forest Reserve, Bataan.	Average	8	48.5	.561	3,340	5,030	6,960	1,584
		Maximum		54.4	.585	4,220	5,380	7,670	1,710
		Minimum		45.2	.54	2,110	4,120	4,840	1,340

[a] The apparent elastic limit was used in order to compare tests of native woods with similar tests of American woods. See table of tests, pp. 83, 84.

strength of Philippine timber.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
	29.8	0.442	3,350	5,300	7,200	1,462		10.4	0.457	5,730	8,240	9,760	1,653		0.446
21	35	.47	6,190	7,740	8,920	1,790	14	17.5	.488	10,550	12,640	14,250	1,840	73	.488
	20	.40	1,550	3,520	4,220	1,050		3	.404	3,390	5,480	7,020	1,395		.40
															.478
----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	36	.529
															.412
															.464
----	-----	-----	-----	-----	-----	-----	----	-----	-----	-----	-----	-----	-----	18	.52
															.378
	26.8	.699	6,190	8,220	10,230	2,033		14	.706	7,340	9,760	11,620	2,144		.645
10	33.6	.74	9,150	9,850	11,640	2,550	13	19.8	.825	10,550	12,480	15,600	2,425	75	.825
	22	.658	4,220	6,320	8,600	1,710		9	.618	4,920	6,050	6,050	1,900		.56
	20.8	.93	2,950	4,150	5,100	1,000									.687
1	20.8	.93	2,950	4,150	5,100	1,000	----	-----	-----	-----	-----	-----	-----	31	.93
	20.8	.93	2,950	4,150	5,100	1,000									.588
															.564
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															.55
	26.6	.72	7,820	9,940	12,860	2,077		13.7	.759	10,080	12,850	15,150	2,158		.708
15	35	.776	9,850	12,380	14,600	2,370	13	18.6	.82	12,650	19,700	21,500	2,480	55	.82
	20.3	.673	4,920	7,800	10,540	1,660		7	.718	7,730	8,940	11,900	1,740		.629
	23.3	.724	7,740	9,150	12,650	2,110									.697
1	23.3	.724	7,740	9,150	12,650	2,110	----	-----	-----	-----	-----	-----	-----	50	.806
	23.3	.724	7,740	9,150	12,650	2,110									.596
	31.8	.803	5,010	9,000	10,190	1,602		10.4	.824	8,240	8,580	8,580	1,614		.785
11	35	.848	7,030	10,700	12,150	1,950	9	19.5	.88	10,550	13,600	13,600	1,980	67	.88
	24.8	.725	3,520	7,740	9,530	1,400		3.5	.79	4,920	4,920	4,920	1,240		.69
															.782
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															.712
	29.6	.846	8,180	10,700	14,090	2,368		15.6	.848	9,650	12,130	15,690	2,583		.848
42	34.3	.94	11,250	13,600	17,650	2,870	17	19.8	.90	12,230	17,480	21,800	3,000	80	.94
	21.5	.77	4,220	5,480	7,700	1,680		11.4	.81	6,680	9,140	13,580	1,844		.76
															.563
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															.535
	26.9	.508	5,650	6,570	7,380	1,462		9.6	.487	6,440	7,070	7,560	1,510		.54
7	32.7	.56	8,430	9,850	11,020	1,710	13	13.8	.531	10,550	10,680	11,730	1,670	31	.77
	22.9	.438	2,110	3,090	3,460	870		4.6	.384	2,810	2,810	2,960	1,050		.384
	30.6	.487	5,310	6,960	9,110	1,456		13.7	.422	6,440	7,380	8,360	1,232		.469
12	34.6	.524	6,740	7,600	10,230	1,685	16	18.7	.58	9,150	11,400	12,560	1,610	36	.58
	21.8	.38	4,220	6,190	7,030	1,050		5	.355	4,500	4,920	4,920	976		.355
	34.5	.54	6,050	6,330	7,700	1,320		9.7	.535	6,430	7,470	8,570	1,594		.491
1	34.5	.54	6,050	6,330	7,700	1,320	19	18.4	.606	10,550	11,520	13,220	1,950	47	.606
	34.5	.54	6,050	6,330	7,700	1,320		1.6	.478	2,110	2,110	2,300	1,120		.405
															.509
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															.479
															.561
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															.54

TABLE I.—*Cross-bending strength*

Name.	Locality.		Moisture over 35 per cent.						
			Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).[a]	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Sacat	Tarlac	Average	42	55.2	0.60	5,800	7,050	9,300	1,569
		Maximum		82.6	.657	7,740	9,000	12,450	1,920
		Minimum		35.3	.478	2,250	2,810	3,120	920
Ipil	Ambos Camarines.	Average	19	52.7	.79	4,360	6,690	7,960	1,295
		Maximum		76.1	.872	5,620	9,420	11,680	1,680
		Minimum		36.1	.68	2,670	5,620	5,620	1,000
Do	Mindoro	Average	44	63.1	.67	5,450	7,430	9,410	1,226
		Maximum		106	.77	9,150	10,820	13,640	1,840
		Minimum		35.6	.56	1,480	2,050	2,050	550
Do	Palawan	Average	41	52.2	.807	9,170	11,210	13,520	1,953
		Maximum		60.1	.867	12,220	13,750	17,000	2,210
		Minimum		46.6	.75	2,110	2,810	6,330	1,420
Dungon	Ambos Camarines.	Average	6	42.2	.824	5,660	7,400	11,770	1,680
		Maximum		66.4	.895	7,880	9,570	14,980	2,080
		Minimum		35.2	.723	1,410	2,540	4,370	1,050
Do	Masbate	Average	3	36.3	.827	4,730	6,420	10,250	1,598
		Maximum		37.2	.845	4,920	7,030	11,400	1,790
		Minimum		35.5	.816	4,360	5,620	8,640	1,470
Do.[b]	Mindanao	Average	21	49.4	.668	4,520	5,740	7,870	1,317
		Maximum		81.6	.707	5,900	6,890	9,520	1,690
		Minimum		35.5	.636	2,810	4,150	5,510	920
Malasantol	Unknown	Average	21	66.2	.633	4,500	6,480	8,690	1,518
		Maximum		84.5	.689	6,330	7,380	10,040	1,670
		Minimum		35.4	.608	2,810	5,280	5,870	1,420
Supa	do	Average	5	37.3	.673	6,410	8,180	10,050	1,435
		Maximum		40.8	.692	8,440	8,870	11,150	1,530
		Minimum		35.6	.61	4,920	7,180	8,630	1,370
Do	Tayabas	Average	12	38.7	.755	4,890	7,170	8,700	1,415
		Maximum		46.7	.843	6,720	8,920	10,500	1,650
		Minimum		35.1	.70	2,810	4,920	6,490	1,160
Balacat	Lamao Forest Reserve, Bataan.	Average	9	56.1	.517	5,120	6,280	8,540	1,293
		Maximum		86	.57	6,190	6,750	9,200	1,450
		Minimum		45.7	.478	4,220	5,780	7,730	1,105
Do	Tarlac	Average	21	45.4	.56	5,210	6,200	7,780	1,221
		Maximum		59.8	.62	6,330	7,390	9,370	1,420
		Minimum		36.5	.515	3,520	3,940	4,790	870
Macaasim	Unknown	Average	35	68.4	.695	4,370	6,120	8,660	1,416
		Maximum		87.9	.734	8,440	8,790	10,880	1,750
		Minimum		36.3	.667	1,546	3,550	5,180	1,070
Calantas	Albay	Average	15	75.4	.357	3,000	4,240	5,650	961
		Maximum		94	.379	3,949	4,920	6,600	1,185
		Minimum		61	.336	1,970	3,100	4,400	738
Do	Mindoro	Average	10	57.3	.511	3,560	4,900	6,250	940
		Maximum		67	.54	5,620	6,180	7,950	1,160
		Minimum		38	.492	2,110	3,020	3,060	580
Tindalo	Unknown	Average	6	40.4	.747	8,090	10,770	15,000	2,226
		Maximum		44.6	.77	9,140	11,940	16,980	2,340
		Minimum		35.8	.734	6,330	8,430	12,300	2,050
Do	Ambos Camarines.	Average	12	44.7	.808	7,070	9,005	11,330	1,588
		Maximum		55	.86	10,400	12,400	14,200	1,750
		Minimum		37.7	.757	5,350	5,350	8,600	1,130

[a] The apparent elastic limit was used in order to compare tests of native woods with similar tests of American woods. See table of tests, pp. 83, 84.

[b] This is not the wood commonly known as dungon, but is often sold under that name.

of Philippine timber—Continued.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
10	24.2	0.606	5,930	7,290	9,050	1,637	16	12.8	0.664	8,350	9,610	11,440	1,886	68	0.616
	35	.677	7,600	9,140	12,470	1,900		19.3	.70	10,540	12,230	15,600	2,080		.70
	20.2	.485	2,110	2,390	4,220	1,160		4.2	.622	4,220	4,500	4,920	1,710		.478
14	25.8	.783	5,580	6,640	7,900	1,470	8	18.1	.816	6,000	6,440	6,980	1,383	41	.792
	34.6	.83	7,730	9,420	12,600	1,730		19.6	.99	7,580	7,740	9,040	1,630		.99
	21	.685	3,520	5,070	5,620	1,260		16	.713	4,780	4,780	4,780	1,180		.68
2	34.5	.743	7,530	9,520	13,040	1,750	---	---	---	---	---	---	---	46	.673
	34.5	.77	7,740	9,700	13,520	1,840									.77
	34.4	.717	7,320	9,350	12,560	1,660									.56
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															.867
															.75
40	26.4	.878	6,870	8,940	13,510	1,947	26	11.6	.845	10,160	13,460	17,110	2,209	72	.857
	33.9	.924	9,850	11,400	16,900	2,260		17.6	.985	14,760	18,300	22,700	2,500		.985
	20	.788	3,800	5,910	7,900	1,240		6.5	.796	5,770	7,180	9,770	1,500		.723
21	30.1	.854	4,960	6,910	10,600	1,442	---	---	---	---	---	---	---	24	.85
	34.5	.89	6,330	8,440	13,150	1,900									.89
	26.3	.822	3,520	4,220	7,260	1,050									.816
2	30.7	.685	5,060	6,540	9,070	1,525	---	---	---	---	---	---	---	23	.669
	31.9	.69	5,200	7,040	9,200	1,530									.707
	29.5	.68	4,920	6,050	8,940	1,520									.636
2	26.3	.663	5,840	7,180	10,310	1,595	5	12.1	.694	5,760	7,630	10,880	1,754	28	.646
	27.1	.68	6,330	7,600	10,550	1,610		18.2	.712	7,730	9,000	13,540	2,290		.712
	25.6	.646	5,350	6,760	10,080	1,580		5.3	.66	3,520	4,220	4,800	1,320		.608
23	29.3	.711	7,360	10,070	12,390	1,907	18	14.5	.722	10,060	11,670	13,100	1,863	46	.711
	34.4	.835	11,250	12,660	16,450	2,870		19.7	.808	15,500	15,800	16,850	2,280		.835
	20	.644	4,220	7,450	9,140	1,370		10.2	.625	7,040	7,730	7,810	1,475		.61
49	30.1	.827	5,280	7,520	9,050	1,510	---	---	---	---	---	---	---	61	.813
	34	.955	9,250	11,010	13,220	1,930									.955
	26.6	.712	1,680	2,410	3,230	750									.70
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															.57
															.478
7	26.6	.579	5,710	6,060	7,010	1,204	32	10.4	.589	6,050	7,600	8,270	1,271	60	.578
	30	.602	6,330	8,090	10,000	1,310		18.7	.66	8,440	11,250	11,720	1,520		.66
	24.1	.561	3,800	4,220	4,690	1,110		2.6	.54	4,220	4,670	4,670	1,080		.515
8	26.7	.77	5,200	8,130	10,560	1,778	4	15.7	.79	6,260	9,650	11,010	1,825	47	.717
	30.4	.81	5,910	10,400	13,130	1,950		19.1	.82	8,450	11,980	13,240	2,030		.82
	23	.734	3,870	6,380	8,940	1,630		12.3	.76	3,240	6,690	7,750	1,530		.667
---	---	---	---	---	---	---	4	11.1	.363	5,300	7,260	8,980	1,255	19	.358
								14.6	.37	6,320	8,160	9,300	1,340		.379
								8.6	.355	4,220	6,320	8,670	1,160		.336
8	28.9	.547	3,460	4,500	5,210	801	---	---	---	---	---	---	---	18	.527
	34.5	.583	4,920	6,330	7,200	1,050									.583
	28.7	.505	1,410	1,410	1,610	580									.492
4	28.9	.787	9,490	12,750	16,570	2,182	---	---	---	---	---	---	---	10	.768
	35.5	.864	11,250	14,340	17,650	2,230									.864
	23.3	.756	8,440	11,380	15,100	2,160									.734
16	26.6	.802	5,800	7,470	8,680	1,445	1	19.5	.808	7,180	9,140	11,200	1,570	29	.805
	33.4	.866	9,710	11,250	12,830	1,580		19.5	.808	7,180	9,140	11,200	1,570		.866
	20.6	.72	2,890	2,890	3,030	1,180		19.5	.808	7,180	9,140	11,200	1,570		.72

TABLE I.—*Cross-bending strength*

Name.	Locality.		Number of tests.	Moisture over 35 per cent. Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).[a]	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Tindalo	Masbate	Average	10	59	0.77	5,290	7,690	11,200	1,536
		Maximum		71.8	.813	7,460	9,480	13,240	1,710
		Minimum		50.7	.70	2,950	4,500	8,420	1,160
Amuguis	Mindoro	Average	31	46.1	.692	4,490	6,800	9,780	1,697
		Maximum		61.1	.76	9,110	9,300	12,670	2,160
		Minimum		35.7	.621	1,548	3,520	5,630	1,160
Do	Palawan	Average	8	53.9	.675	6,730	8,020	11,040	1,735
		Maximum		64.1	.753	8,000	8,850	11,680	1,840
		Minimum		49.5	.613	6,320	6,880	9,620	1,530
Acle	Tarlac	Average	41	92.5	.632	3,920	6,000	7,270	1,069
		Maximum		103	.707	5,280	7,730	8,920	1,395
		Minimum		77	.598	2,460	4,780	5,250	895
Do	Zambales	Average	6	96.8	.579	5,900	7,010	9,080	1,213
		Maximum		111	.604	7,030	8,720	11,560	1,360
		Minimum		83.6	.553	4,080	4,570	5,810	1,080
Betis	Tayabas	Average	7	38.1	.849	5,780	8,460	11,910	1,768
		Maximum		42.5	.882	7,380	10,130	13,680	2,055
		Minimum		35.1	.82	3,160	6,330	10,010	1,293
Do	Ambos Camarines.	Average	30	61.6	.725	3,670	5,620	7,450	2,035
		Maximum		100	.798	5,240	7,750	9,340	2,400
		Minimum		45	.615	2,090	2,830	3,660	1,050
Bansalaguin	Unknown	Average	18	46.2	.841	6,820	9,420	11,740	1,702
		Maximum		57.8	.883	8,440	10,550	14,150	2,050
		Minimum		40	.784	3,800	7,310	9,510	1,480
Palo Maria	Zambales	Average	24	56	.623	5,840	7,040	8,930	1,461
		Maximum		105	.708	8,790	9,500	12,450	1,680
		Minimum		36.6	.488	2,950	4,080	5,500	810
Batitinan	Unknown	Average	10	54.4	.777	4,540	6,350	9,320	1,427
		Maximum		61.2	.795	5,620	7,600	10,600	1,630
		Minimum		49.1	.76	2,540	4,080	5,900	1,200
Aranga	Ambos Camarines.	Average	--						
		Maximum							
		Minimum		------	------	------	------	------	------
Banuyo	Masbate	Average	16	82	.522	2,900	4,170	5,140	881
		Maximum		115	.572	5,070	6,880	7,390	1,120
		Minimum		47.7	.455	1,400	2,860	4,080	575
Red Lauan	Occidental Negros.	Average	15	75.8	.406	4,040	4,690	7,100	1,201
		Maximum		84	.43	4,920	5,620	7,900	1,370
		Minimum		65	.371	2,110	2,250	2,610	870
Mayapis	Laguna	Average	20	67.7	.399	4,070	5,320	6,760	1,133
		Maximum		91	.456	4,920	6,330	8,300	1,420
		Minimum		48	.343	3,510	3,510	3,510	870
Malugay	Mindoro	Average	18	57.2	.635	4,780	6,930	10,280	1,627
		Maximum		72	.713	6,680	8,570	12,700	1,920
		Minimum		48.2	.553	2,810	5,200	6,900	1,290
Sasalit	Zambales	Average	--						
		Maximum		------	------	------	------	------	------
		Minimum							
Liusin	Bataan	Average	14	60.9	.71	5,430	8,120	11,360	1,896
		Maximum		63	.73	7,720	10,200	14,150	2,180
		Minimum		57.6	.70	2,390	5,900	7,160	1,340

[a] The apparent elastic limit was used in order to compare tests of native woods with similar tests of American woods. See table of tests, pp. 83, 84.

of Philippine timber—Continued.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
3	22.5	0.785	6,370	8,160	9,050	1,273	5	18.9	0.766	5,990	8,220	8,920	1,180	18	0.772
	24.6	.788	7,020	8,300	10,000	1,320		19.9	.808	7,450	9,770	11,020	1,370		.813
	20.3	.784	5,340	8,080	8,080	1,180		17.7	.68	4,920	7,170	7,680	950		.68
1	33.6	.75	5,620	8,590	12,050	1,760								32	.694
	33.6	.75	5,620	8,590	12,050	1,760	-	-	-	-	-	-	-		.76
	33.6	.75	5,620	8,590	12,050	1,760									.621
														8	.675
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.753
															.613
5	27.9	.635	5,630	6,830	7,550	1,138	1	15.7	.684	3,660	4,920	5,400	880	20	.635
	34.5	.67	6,330	8,870	9,750	1,210		15.7	.684	3,660	4,920	5,400	880		.707
	21	.607	4,640	5,340	5,980	1,060		15.7	.684	3,660	4,920	5,400	880		.598
														6	.579
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.604
															.553
13	31.8	.86	4,930	8,090	10,850	1,593								20	.856
	34.4	.886	7,380	10,550	14,060	1,950	-	-	-	-	-	-	-		.886
	27.1	.82	2,110	5,380	7,030	1,080									.82
1	34	.806	4,190	5,660	7,580	2,020								31	.728
	34	.806	4,190	5,660	7,580	2,020	-	-	-	-	-	-	-		.806
	34	.806	4,190	5,660	7,580	2,020									.615
1	33.3	.88	6,750	7,030	7,740	1,740	6	15.5	.87	8,670	11,870	14,480	2,311	25	.85
	33.3	.88	6,750	7,030	7,740	1,740		17	.905	10,250	13,350	18,200	2,530		.905
	33.3	.88	6,750	7,030	7,740	1,740		14.3	.85	6,330	8,780	12,400	2,100		.784
														24	.623
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.708
															.488
							4	5	.836	6,850	8,400	9,630	1,655	14	.795
-	-	-	-	-	-	-		6.2	.85	8,860	11,100	12,300	1,910		.85
								4.1	.821	4,920	5,770	7,030	1,450		.76
19	31.4	.826	7,970	11,070	13,440	2,061	26	5.6	.882	12,530	16,230	17,920	2,419	45	.859
	34.8	.86	10,200	12,660	16,900	2,350		7.5	.942	16,880	21,350	24,450	2,800		.942
	29.3	.796	4,790	8,860	10,300	1,740		2.9	.832	7,740	9,850	11,630	2,000		.796
1	29.3	.52	4,220	5,340	5,940	1,105	3	17	.538	4,030	5,530	6,000	1,070	20	.525
	29.3	.52	4,220	5,340	5,940	1,105		18.9	.546	5,200	6,040	6,270	1,105		.572
	29.3	.52	4,220	5,340	5,940	1,105		13.4	.523	2,810	5,200	5,800	1,000		.455
														15	.406
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.43
															.371
														20	.399
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.456
															.343
7	22.4	.656	5,790	7,530	10,530	1,732	15	12	.686	7,730	11,220	13,980	1,788	40	.658
	26.4	.693	6,900	8,080	11,740	2,150		19.8	.75	9,850	14,900	19,830	2,180		.75
	21	.625	3,800	6,900	8,850	1,530		7.5	.62	4,090	6,810	10,040	1,480		.553
21	26.4	.901	9,990	11,420	14,050	2,120	18	12.4	.839	8,010	10,260	11,310	1,837	39	.872
	30.2	.995	13,350	15,480	18,720	2,480		19.2	.87	12,650	13,980	15,820	2,270		.995
	22	.742	7,030	7,460	8,770	1,240		9	.807	4,080	4,220	5,310	1,120		.742
														14	.71
-	-	-	-	-	-	-	-	-	-	-	-	-	-		.78
															.70

TABLE I.—*Cross-bending strength*

Name.	Locality.		Moisture over 35 per cent. Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).[a]	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).
Lumbayao	Basilan Island, Moro Province.	Average	2	37.1	0.545	5,620	6,460	7,790	1,160
		Maximum		38.7	.56	6,740	6,890	8,060	1,210
		Minimum		35.5	.53	4,500	6,040	7,520	1,110
Agoho	Tarlac	Average	28	45.9	.704	8,400	9,730	11,920	1,696
		Maximum		57.4	.762	11,820	13,220	15,950	2,050
		Minimum		35.4	.62	1,970	2,670	3,160	870
Do	do	Average							
		Maximum							
		Minimum							
Do	do	Average							
		Maximum							
		Minimum							
Mangachapuy	Albay	Average	5	51.3	.59	6,070	7,430	8,600	1,528
		Maximum		69	.622	7,880	8,290	10,320	1,710
		Minimum		36.2	.55	3,240	5,620	7,020	1,260
Do	do	Average							
		Maximum							
		Minimum							
Dao	Mindoro	Average							
		Maximum							
		Minimum							
Cupang	Palawan	Average	14	96.2	.285	2,460	3,090	3,580	779
		Maximum		129	.368	3,380	3,940	4,530	1,100
		Minimum		69	.259	1,410	2,250	2,550	160

[a] The apparent elastic limit was used in order to compare tests of native woods with similar tests of American woods. See table of tests, pp. 83, 84.

of Philippine timber—Continued.

Moisture 20 to 35 per cent.							Moisture under 20 per cent.								
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Fiber stress at true elastic limit (pounds per square inch).	Fiber stress at apparent elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Total number of tests.	Specific gravity of dry wood, all tests.
	26.1	0.552	6,550	7,620	10,090	1,416		12.7	0.584	7,800	9,110	11,390	1,570		0.565
30	33.9	.603	8,870	10,000	12,180	1,630	22	19.5	.671	10,140	12,380	14,920	1,870	54	.671
	20.5	.483	3,510	4,150	4,430	950		5.3	.53	4,220	4,220	7,810	1,340		.483
															.704
---	------	------	------	------	------	------	------	------	------	------	------	------	------	28	.762
															.62
	26	.854	6,620	8,240	11,730	1,775									.854
15	34.2	.905	9,000	10,980	16,100	2,130	---	------	------	------	------	------	------	15	.905
	20	.80	4,080	5,630	8,370	1,420									.80
								17.6	.942	8,620	11,290	14,660	1,970		.942
------	------	------	------	------	------	------	4	19.7	.954	9,150	12,670	15,420	2,160	4	.954
								16	.93	7,740	10,280	14,250	1,630		.93
															.59
---	------	------	------	------	------	------	------	------	------	------	------	------	------	5	.622
															.55
	30.8	.725	9,030	10,780	14,190	1,715									.725
14	34.8	.75	10,400	11,960	16,450	2,030	---	------	------	------	------	------	------	14	.75
	23.5	.708	3,240	4,220	5,830	920									.708
	32.5	.631	6,390	7,230	8,550	1,740									.631
2	34	.633	6,600	8,150	9,440	1,740	---	------	------	------	------	------	------	2	.633
	31	.63	6,190	6,320	7,660	1,740									.63
															.285
---	------	------	------	------	------	------	------	------	------	------	------	------	------	14	.368
															.259

TABLE II.—*Compressive strength along*

Name.	Locality.		Moisture over 35 per cent. Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Lauan	Mindanao	Average	67	52.4	0.444	3,840
		Maximum		73	.485	5,490
		Minimum		38.4	.408	3,262
Do	Zambales	Average	70	59.5	.478	4,180
		Maximum		76	.529	4,980
		Minimum		35.2	.412	3,220
Almon	Occidental Negros	Average	34	57.6	.464	4,500
		Maximum		71.6	.52	5,170
		Minimum		46.1	.378	3,140
Apitong	Mindanao	Average	98	53	.617	4,350
		Maximum		71.8	.715	5,740
		Minimum		36	.56	3,350
Do	Zambales	Average	60	53.4	.679	5,010
		Maximum		93	.721	5,710
		Minimum		46.4	.588	2,810
Do	Occidental Negros	Average	20	93.2	.564	4,750
		Maximum		102	.581	5,400
		Minimum		83	.55	3,550
Guijo	Ambos Camarines	Average	50	41.8	.675	6,070
		Maximum		59.6	.73	6,610
		Minimum		36	.629	5,180
Do	Mindoro	Average	98	55.7	.697	6,070
		Maximum		79.6	.806	7,300
		Minimum		40.9	.596	3,660
Molave	Near Laguna de Bay	Average	78	46.4	.772	6,680
		Maximum		66	.85	8,470
		Minimum		37	.69	4,770
Do	Ambos Camarines	Average	50	50.5	.784	6,530
		Maximum		61.5	.822	8,300
		Minimum		40.3	.712	3,900
Yacal	do	Average	34	46.7	.828	7,490
		Maximum		75	.85	8,400
		Minimum		38.6	.77	6,200
Narra	Near Laguna de Bay	Average	20	77.7	.563	5,780
		Maximum		93	.69	6,900
		Minimum		66.5	.535	4,180
Do	Cagayan	Average	18	55.9	.619	5,300
		Maximum		75.5	.68	6,530
		Minimum		35.5	.482	3,770
Tanguile	Unknown	Average	18	40.5	.53	4,750
		Maximum		47.4	.565	5,270
		Minimum		35.2	.47	3,650
Do	Zambales	Average	54	44.1	.46	3,980
		Maximum		58.6	.54	4,780
		Minimum		35.6	.405	3,050
Tanguile-balacbacan	Occidental Negros	Average	28	56.4	.509	4,620
		Maximum		59.5	.53	4,960
		Minimum		49.3	.479	3,910
Sacat	Bataan	Average	14	49.8	.561	4,530
		Maximum		53.8	.585	4,740
		Minimum		46.2	.54	4,280
Do	Tarlac	Average	74	53.1	.60	5,260
		Maximum		89.7	.657	9,150
		Minimum		35.2	.478	3,140
Ipil	Ambos Camarines	Average	36	52.9	.796	5,650
		Maximum		78.7	.872	6,390
		Minimum		43.5	.714	4,980

the grain of Philippine timber.

Moisture 20 to 35 per cent.				Moisture under 20 per cent.				Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).		
40	30.5 35 25	0.44 .47 .40	4,040 4,550 3,470	32	12.4 19.4 3.3	0.458 .488 .404	6,180 9,270 4,730	139	0.448 .488 .40
--------	--------	--------	--------	--------	--------	--------	--------	70	.470 .529 .412
--------	--------	--------	--------	--------	--------	--------	--------	34	.464 .52 .378
24	27.2 34 20	.711 .825 .664	5,740 6,770 4,740	28	14.4 19.4 7.8	.688 .735 .618	7,250 9,400 5,270	150	.645 .825 .56
--------	--------	--------	--------	2	15.2 15.2 15.2	.93 .93 .93	4,190 4,220 4,160	62	.687 .93 .588
--------	--------	--------	--------	--------	--------	--------	--------	20	.564 .581 .55
24	28.8 35 23.2	.719 .76 .673	6,160 7,220 4,900	36	14.6 19.8 7.5	.748 .82 .68	7,940 11,400 3,980	110	.708 .82 .629
--------	--------	--------	--------	--------	--------	--------	--------	98	.697 .806 .596
20	29.7 34.6 20.2	.794 .858 .725	7,080 8,800 6,100	17	12.7 18.8 5.2	.818 .88 .728	8,330 10,300 6,800	115	.783 .88 .69
--------	--------	--------	--------	--------	--------	--------	--------	50	.784 .822 .712
94	29.5 35 21.8	.832 .94 .76	8,340 9,510 6,250	29	13.4 18.1 10.7	.849 .90 .814	9,220 11,280 7,580	157	.843 .94 .76
--------	--------	--------	--------	--------	--------	--------	--------	20	.563 .59 .535
18	28.5 34.2 21.1	.534 .77 .438	5,290 7,060 4,160	24	7.5 9.7 4.8	.484 .531 .384	6,740 8,600 4,540	60	.54 .77 .384
22	30.6 35 27.2	.485 .52 .355	5,030 5,450 3,752	32	13.7 19.9 8.8	.424 .58 .376	5,230 6,521 3,825	72	.469 .58 .355
--------	--------	--------	--------	38	9.6 19.2 1.7	.535 .606 .478	6,900 8,670 4,150	92	.491 .606 .405
--------	--------	--------	--------	--------	--------	--------	--------	28	.509 .53 .479
--------	--------	--------	--------	--------	--------	--------	--------	14	.561 .585 .54
22	26.6 34.8 20	.592 .677 .485	5,500 5,910 3,990	38	12.4 19.7 4.2	.661 .70 .601	7,140 9,020 4,970	134	.616 .70 .478
30	25.9 31.7 21.6	.779 .855 .68	6,250 7,600 4,280	16	17.7 19.9 14.8	.807 .99 .713	6,570 8,020 3,650	82	.792 .99 .68

TABLE II.—*Compressive strength along the*

Name.	Locality.		Moisture over 35 per cent. Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Ipil	Mindoro	Average	84	60.4	0.666	5,450
		Maximum		89	.75	7,150
		Minimum		37.5	.56	2,390
Do	Palawan	Average	79	51.4	.807	8,090
		Maximum		61.2	.867	9,470
		Minimum		44.8	.75	5,350
Dungon	Ambos Camarines	Average	6	44.1	.803	6,160
		Maximum		58	.846	6,520
		Minimum		37.1	.723	5,900
Do	Masbate	Average	6	36.9	.825	4,540
		Maximum		37.5	.84	5,030
		Minimum		36.2	.816	3,830
Do[a]	Mindanao	Average	38	50.7	.669	4,000
		Maximum		82	.707	4,740
		Minimum		35.5	.636	3,080
Malasantol	Unknown	Average	40	64.4	.631	4,660
		Maximum		86	.68	5,410
		Minimum		37.4	.608	3,390
Supa	do	Average	8	36.1	.677	6,480
		Maximum		36.3	.692	7,030
		Minimum		36	.644	5,750
Do	Tayabas	Average	10	37.2	.746	5,090
		Maximum		41.6	.855	6,090
		Minimum		35.1	.70	3,770
Balacat	Lamao Forest Reserve, Bataan.	Average	16	52.6	.517	4,020
		Maximum		61.6	.57	4,510
		Minimum		39.5	.478	3,540
Do	Tarlac	Average	40	44.7	.56	4,150
		Maximum		63	.62	4,710
		Minimum		36.8	.515	2,920
Macaasim	Unknown	Average	76	63.9	.703	4,350
		Maximum		81.5	.81	6,260
		Minimum		35.2	.667	2,610
Calantas	Albay	Average	28	77.3	.357	2,960
		Maximum		89.6	.379	3,450
		Minimum		62.9	.336	2,330
Do	Mindoro	Average	18	57.3	.51	3,810
		Maximum		64.7	.54	4,960
		Minimum		46	.492	3,230
Tindalo	Unknown	Average	12	41.9	.747	7,400
		Maximum		44.8	.77	9,150
		Minimum		38.3	.734	5,620
Do	Ambos Camarines	Average	23	43.9	.80	7,140
		Maximum		58.1	.86	8,960
		Minimum		37	.72	5,850
Do	Masbate	Average	20	56.7	.77	5,930
		Maximum		70.1	.813	7,030
		Minimum		50.7	.70	4,270
Amuguis	Mindoro	Average	54	45.2	.692	5,210
		Maximum		57.8	.76	6,490
		Minimum		36	.621	2,660
Do	Palawan	Average	14	54.1	.675	5,640
		Maximum		61.6	.753	6,150
		Minimum		48.1	.613	4,660
Acle	Tarlac	Average	27	84.5	.631	4,550
		Maximum		101	.707	5,440
		Minimum		39.2	.598	3,970

[a] This is not the wood commonly known as dungon, but is often sold under that name.

grain of Philippine timber—Continued.

Moisture 20 to 35 per cent.				Moisture under 20 per cent.				Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).		
4	32.5 33.4 31.5	0.77 .77 .77	6,030 6,470 5,530	2	19.8 19.8 19.8	0.77 .77 .77	6,540 6,570 6,510	90	0.673 .77 .56
----	----	----	----	----	----	----	----	79	.807 .867 .75
54	25.2 34 20	.88 .985 .788	6,440 7,970 4,050	48	10.7 16.4 8	.839 .882 .796	9,420 11,970 6,410	108	.858 .985 .723
40	29.5 34.8 25.1	.854 .89 .822	4,690 6,670 3,460	----	----	----	----	46	.85 .89 .816
6	32.6 35 29	.67 .69 .657	4,600 5,200 4,090	----	----	----	----	44	.669 .707 .636
4	30.7 34.3 27.2	.684 .689 .679	4,840 5,040 4,660	10	13.5 17.1 10	.694 .712 .66	6,580 8,040 5,140	54	.646 .712 .608
42	30.2 33.4 26	.711 .835 .61	7,100 8,510 5,790	42	14.5 19.5 8.3	.713 .808 .625	8,700 10,340 7,046	92	.711 .835 .61
112	28.3 34.7 22.5	.819 .955 .712	5,980 7,700 4,000	----	----	----	----	122	.818 .955 .70
----	----	----	----	----	----	----	----	16	.517 .57 .478
12	24.9 30.7 20	.588 .66 .561	4,650 5,320 3,770	66	9.8 19.2 2.2	.587 .638 .54	5,530 7,590 4,020	118	.578 .66 .515
10	26.2 30.5 20	.776 .78 .774	5,880 6,600 4,960	6	17.1 18 15.7	.793 .82 .76	6,860 7,650 5,980	92	.717 .82 .667
----	----	----	----	8	9.7 12.8 7.1	.363 .37 .355	4,420 4,830 3,230	36	.358 .379 .336
12	26.3 32.2 23.8	.537 .583 .505	3,820 4,320 3,360	6	12.5 19.1 9.1	.557 .573 .531	3,520 4,360 2,890	36	.527 .583 .492
8	28.8 32.4 23.6	.787 .864 .756	8,770 9,680 6,890	----	----	----	----	20	.763 .864 .734
26	27.4 32.7 22.5	.806 .866 .742	7,310 9,040 3,530	6	16.9 17.6 15.7	.819 .83 .802	7,710 8,650 7,040	55	.805 .866 .72
8	22 23 20.1	.753 .788 .68	6,340 7,350 5,150	8	18.6 19.4 16.9	.794 .808 .784	6,780 7,660 5,950	36	.772 .813 .68
6	32.9 34.8 30	.707 .75 .641	4,920 6,140 3,980	----	----	----	----	60	.693 .76 .621
----	----	----	----	----	----	----	----	14	.675 .753 .613
10	30.2 34 25	.647 .684 .607	5,050 5,820 4,400	----	----	----	----	87	.635 .707 .598

TABLE II.—*Compressive strength along the*

Name.	Locality.		Moisture over 35 per cent. Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Acle	Zambales	Average Maximum Minimum	12	94.9 106 81	0.579 .604 .553	5,330 5,880 4,900
Betis	Tayabas	Average Maximum Minimum	14	38.2 42.7 31.6	.854 .882 .82	6,540 7,540 5,640
Do	Ambos Camarines	Average Maximum Minimum	60	59.5 79.3 42.8	.725 .798 .615	4,330 4,930 3,380
Bansalaguin	Unknown	Average Maximum Minimum	34	43 53.6 35.1	.841 .88 .784	6,960 8,140 5,410
Palo maria	Zambales	Average Maximum Minimum	40	50.2 103 35.1	.618 .704 .488	4,770 6,220 3,150
Batitinan	Unknown	Average Maximum Minimum	18	54.9 61.6 48.5	.777 .795 .76	4,650 5,180 3,950
Aranga	Ambos Camarines	Average Maximum Minimum				
Banuyo	Masbate	Average Maximum Minimum	30	77.9 110 35.3	.527 .572 .46	3,290 4,470 2,550
Red lauan	Occidental Negros	Average Maximum Minimum	28	76.9 92.3 63	.406 .43 .371	3,850 4,270 3,040
Mayapis	Laguna	Average Maximum Minimum	40	63.5 85.4 44.1	.399 .456 .343	3,530 4,080 2,780
Malugay	Mindoro	Average Maximum Minimum	34	55.8 70.8 46.6	.635 .713 .553	5,120 6,040 3,960
Sasalit	Zambales	Average Maximum Minimum				
Liusin	Bataan	Average Maximum Minimum	8	60.9 63 57.6	.71 .73 .70	5,220 5,640 4,860
Lumbayao	Basilan Island, Moro Province.	Average Maximum Minimum				
Agoho	Tarlac	Average Maximum Minimum	56	44.2 56.4 35.3	.725 .762 .62	7,220 8,760 4,390
Do	do	Average Maximum Minimum				
Do	do	Average Maximum Minimum				
Mangachapuy	Albay	Average Maximum Minimum				
Dao	Mindoro	Average Maximum Minimum	14	46.2 62.7 35.4	.602 .633 .55	5,070 5,710 3,770
Cupang	Palawan	Average Maximum Minimum	26	93 128 59.8	.285 .368 .259	2,070 2,330 1,630

grain of Philippine timber—Continued.

Moisture 20 to 35 per cent.				Moisture under 20 per cent.				Total number of tests.	Specific gravity of dry wood, all tests.
Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).	Number of tests.	Moisture (per cent).	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).		
								12	0.579 .604 .553
24	31.5 34.8 28.3	0.857 .886 .82	6,410 7,330 5,000					38	.856 .886 .82
2	34 34 34	.806 .806 .806	4,410 4,540 4,290					62	.728 .806 .615
2	32.8 32.8 32.8	.883 .883 .883	7,140 7,310 6,980	12	14.5 16.5 12.1	0.87 .905 .85	8,630 9,560 7,800	48	.85 .905 .784
2	34.2 35 33.4	.674 .708 .64	5,720 6,240 5,340					42	.623 .708 .488
				8	5 5.6 4.4	.836 .85 .821	9,290 10,640 7,190	26	.795 .85 .76
36	31.2 34.5 27.7	.826 .86 .796	8,020 8,730 6,840	52	4.9 6.4 3.4	.882 .942 .832	12,420 14,920 9,290	88	.859 .942 .796
4	24.2 28 20.5	.50 .546 .455	3,990 4,470 3,400	4	15.5 17.8 13.3	.534 .545 .523	4,150 4,470 3,530	38	.525 .572 .455
								28	.406 .43 .371
								40	.399 .456 .343
18	22.1 35.9 20	.666 .71 .625	5,740 7,270 5,160	26	11.2 18.8 7.4	.683 .75 .62	8,080 10,930 4,830	8	.658 .75 .553
42	25.7 31.1 21.5	.89 .984 .742	9,290 11,890 6,600	34	11.3 15.8 8.7	.849 .995 .815	9,100 11,180 6,400	76	.872 .995 .742
								8	.71 .73 .70
54	25.2 31.5 20.1	.551 .603 .483	5,480 6,390 4,520	52	12.5 19.7 5.3	.58 .671 .53	6,410 8,100 3,550	106	.565 .671 .483
								56	.725 .762 .62
36	27 34.8 20.4	.858 .94 .78	5,770 7,770 4,330					36	.858 .94 .78
				8	18.3 19.6 17.6	.909 .954 .93	7,370 8,580 5,010	8	.909 .954 .93
26	29.6 33.1 24.9	.726 .75 .51	7,730 8,280 6,950					26	.726 .75 .51
								14	.602 .633 .55
								26	.285 .368 .259

TABLE III.—*Shearing strength along the grain of Philippine timber.*

[Results averaged regardless of moisture content.]

Name.	Locality.		Number of tests.	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Lauan	Mindanao	Average	142	0.446	557
		Maximum		.488	934
		Minimum		.40	326
Do	Zambales	Average	69	.478	525
		Maximum		.529	873
		Minimum		.412	292
Almon	Occidental Negros	Average	34	.464	506
		Maximum		.52	737
		Minimum		.378	324
Apitong	Mindanao	Average	150	.645	669
		Maximum		.825	1,203
		Minimum		.56	240
Do	Zambales	Average	62	.687	757
		Maximum		.93	1,212
		Minimum		.588	298
Do	Occidental Negros	Average	20	.564	753
		Maximum		.581	997
		Minimum		.55	528
Guijo	Ambos Camarines	Average	110	.708	915
		Maximum		.82	1,324
		Minimum		.629	366
Do	Mindoro	Average	98	.697	824
		Maximum		.806	1,500
		Minimum		.596	561
Molave	Near Laguna de Bay	Average	129	.784	914
		Maximum		.88	1,362
		Minimum		.69	357
Do	Ambos Camarines	Average	51	.784	839
		Maximum		.825	1,323
		Minimum		.716	403
Yacal	do	Average	150	.843	849
		Maximum		.94	1,665
		Minimum		.76	427
Narra	Near Laguna de Bay	Average	20	.563	678
		Maximum		.59	844
		Minimum		.535	456
Do	Cagayan	Average	59	.54	660
		Maximum		.77	1,225
		Minimum		.384	291
Tanguile	Unknown	Average	70	0.471	647
		Maximum		.58	928
		Minimum		.355	326
Do	Zambales	Average	86	.491	555
		Maximum		.606	1,068
		Minimum		.405	288
Tanguile-balacbacan	Occidental Negros	Average	26	.509	602
		Maximum		.53	878
		Minimum		.479	380
Sacat	Lamao Forest Reserve, Bataan.	Average	14	.561	776
		Maximum		.585	1,055
		Minimum		.54	550
Do	Tarlac	Average	132	.616	850
		Maximum		.70	1,584
		Minimum		.478	466
Ipil	Ambos Camarines	Average	79	.793	904
		Maximum		.99	1,810
		Minimum		.68	458

TABLE III.—*Shearing strength along the grain of Philippine timber*—Continued.

[Results averaged regardless of moisture content.]

Name.	Locality.		Number of tests.	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Ipil	Mindoro	Average	90	.673	948
		Maximum		.77	1,445
		Minimum		.56	410
Do	Palawan	Average	80	.807	753
		Maximum		.867	1,226
		Minimum		.75	525
Dungon	Ambos Camarines	Average	98	.852	1,253
		Maximum		.985	1,854
		Minimum		.723	672
Do	Masbate	Average	46	.85	1,298
		Maximum		.89	1,560
		Minimum		.816	925
Do.[a]	Mindanao	Average	44	.669	855
		Maximum		.707	1,102
		Minimum		.636	563
Malasantol	Unknown	Average	54	.646	720
		Maximum		.712	1,110
		Minimum		.608	409
Supa	do	Average	86	.71	898
		Maximum		.835	1,480
		Minimum		.61	520
Do	Tayabas	Average	118	.813	852
		Maximum		.955	1,380
		Minimum		.70	293
Balacat	Lamao Forest Reserve, Bataan.	Average	16	.517	486
		Maximum		.57	638
		Minimum		.478	300
Do	Tarlac	Average	117	.578	692
		Maximum		.66	1,281
		Minimum		.515	253
Macaasim	Unknown	Average	92	.717	916
		Maximum		.82	1,390
		Minimum		.667	376
Calantas	Albay	Average	34	.358	526
		Maximum		.379	870
		Minimum		.336	289
Do	Mindoro	Average	35	.527	778
		Maximum		.583	1,049
		Minimum		.492	455
Tindalo	Unknown	Average	20	.763	1,004
		Maximum		.864	1,460
		Minimum		.734	685
Do	Ambos Camarines	Average	56	0.805	911
		Maximum		.866	1,507
		Minimum		.72	299
Do	Masbate	Average	36	.772	905
		Maximum		.813	1,226
		Minimum		.68	496
Amuguis	Mindoro	Average	60	.692	824
		Maximum		.75	1,762
		Minimum		.621	396
Do	Palawan	Average	14	.675	851
		Maximum		.753	1,107
		Minimum		.613	641

[a] This is not the wood commonly known as dungon but is often sold under that name.

TABLE III.—*Shearing strength along the grain of Philippine timber*—Continued.

[Results averaged regardless of moisture content.]

Name.	Locality.		Number of tests.	Specific gravity of dry wood.	Stress at rupture (pounds per square inch).
Acle	Tarlac	Average	36	.63	686
		Maximum		.707	1,270
		Minimum		.598	420
Do	Zambales	Average	11	.579	778
		Maximum		.604	1,190
		Minimum		.553	443
Betis	Tayabas	Average	38	.856	1,168
		Maximum		.886	1,555
		Minimum		.82	598
Do	Ambos Camarines	Average	61	.728	819
		Maximum		.806	1,243
		Minimum		.615	474
Bansalaguin	Unknown	Average	48	.85	1,098
		Maximum		.905	1,865
		Minimum		.784	695
Palo maria	Zambales	Average	46	.623	856
		Maximum		.708	1,581
		Minimum		.488	528
Batitinan	Unknown	Average	26	.795	859
		Maximum		.85	2,195
		Minimum		.76	535
Aranga	Ambos Camarines	Average	82	.863	1,038
		Maximum		.942	2,324
		Minimum		.796	355
Banuyo	Masbate	Average	38	.525	596
		Maximum		.572	1,065
		Minimum		.455	287
Red lauan	Occidental Negros	Average	28	.406	502
		Maximum		.43	761
		Minimum		.371	332
Mayapis	Laguna	Average	40	.399	472
		Maximum		.456	790
		Minimum		.343	288
Malugay	Mindoro	Average	78	.658	980
		Maximum		.75	1,885
		Minimum		.553	464
Sasalit	Zambales	Average	75	.872	1,176
		Maximum		.995	1,938
		Minimum		.742	708
Liusin	Bataan	Average	8	.71	886
		Maximum		.73	1,388
		Minimum		.70	543
Lumbayao	Basilan Island, Moro Province.	Average	104	.565	827
		Maximum		.671	1,306
		Minimum		.483	353

TABLE IV.—*Summary of mechanical tests on thirty-two species of American woods.*

[From Tables, I, II, IV, V, and VI, Circular No. 15, Division of Forestry, United States Department of Agriculture.]

Kind of wood.	Specific gravity of dry wood.	Fiber stress at relative (apparent) elastic limit (pounds per square inch).	Modulus of rupture (pounds per square inch).	Modulus of elasticity (1,000 pounds per square inch).	Stress at rupture compression along the grain (pounds per square inch).	Stress at rupture shearing along the grain; not reduced for moisture (pounds per square inch).
Reduced to 15 per cent moisture.						
Longleaf pine	0.61	8,500	10,900	1,890	6,900	700
Cuban pine	.63	9,500	11,900	2,300	7,900	700
Shortleaf pine	.51	7,200	9,200	1,600	5,900	700
Loblolly pine	.53	8,200	10,100	1,950	6,500	700
Reduced to 12 per cent moisture.						
White pine	.38	6,400	7,900	1,390	5,400	400
Red pine	.50	7,700	9,100	1,620	6,700	500
Spruce pine	.44	8,400	10,000	1,640	7,300	800
Bald cypress	.46	6,600	7,900	1,290	6,000	500
White cedar	.37	5,800	6,300	910	5,200	400
Douglas spruce[a] (Oregon pine)	.51	6,400	7,900	1,680	5,700	500
White oak	.80	9,600	13,100	2,090	8,500	1,000
Overcup oak	.74	7,500	11,300	1,620	7,300	1,000
Post oak	.80	8,400	12,300	2,030	7,100	1,100
Cow oak	.74	7,600	11,500	1,610	7,400	900
Red oak	.73	9,200	11,400	1,970	7,200	1,100
Texan oak	.73	9,400	13,100	1,860	8,100	900
Yellow oak	.72	8,100	10,800	1,740	7,300	1,100
Water oak	.73	8,800	12,400	2,000	7,800	1,100
Willow oak	.72	7,400	10,400	1,750	7,200	900
Spanish oak	.73	8,600	12,000	1,930	7,700	900
Shagbark hickory	.81	11,200	16,000	2,390	9,500	1,100
Mockernut hickory	.85	11,700	15,200	2,320	10,100	1,100
Water hickory	.73	9,800	12,500	2,080	8,400	1,000
Bitternut hickory	.77	11,100	15,000	2,280	9,600	1,000
Nutmeg hickory	.78	9,300	12,500	1,940	8,800	1,100
Pecan hickory	.78	11,500	15,300	2,530	9,100	1,200
Pignut hickory	.89	12,600	18,700	2,730	10,900	1,200
White elm	.54	7,300	10,300	1,540	6,500	800
Cedar elm	.74	8,000	13,500	1,700	8,000	1,300
White ash	.62	7,900	10,800	1,640	7,200	1,100
Green ash	.62	8,900	11,600	2,050	8,000	1,000
Sweet gum	.59	7,800	9,500	1,700	7,100	800

[a] Actual tests on "dry" material not reduced for moisture.

TABLE V.[a]—*Comparison of selected Philippine, Borneo, and American woods.*

Name.	Locality	Compression along the grain.		Cross-bending.			
		Average per cent moisture.	Average stress at rupture (pounds per square inch).	Average per cent moisture.	Average modulus of rupture (pounds per square inch).	Average modulus of elasticity (1,000 pounds per square inch).	Average specific gravity of dry wood.
Aranga	Philippine Islands	4.9	12,420	5.6	17,920	2,419	0.859
Billian (Borneo ironwood).	Borneo	22.5	11,290	22.5	19,660	2,384	.96
Pignut hickory	United States	12	10,900	12	18,700	2,730	.78
Dungon	Philippine Islands	10.7	9,420	11.6	17,110	2,209	.857
Yacal	do	13.4	9,220	15.6	15,690	2,583	.843
Merabau (Borneo ipil)	Borneo	21	9,035	21	18,830	2,505	.965
White oak	United States	12	8,500	12	13,100	2,090	.80
Molave	Philippine Islands	12.7	8,330	10.4	8,580	1,614	.785
Guijo	do	14.6	7,940	13.7	15,150	2,158	.708
Selangan batu (Borneo yacal).	Borneo	27.6	7,420	27.6	12,325	2,027	.689
Apitong	Philippine Islands	14.4	7,250	14	11,620	2,144	.645
Longleaf pine	United States	15	6,900	15	10,900	1,890	.61
Ipil	Philippine Islands	17.7	6,570	18.1	6,980	1,383	.792
Lauan	do	12.4	6,180	10.4	9,760	1,653	.446
Oregon pine	United States	12	5,700	12	7,900	1,680	.51
California redwood	do	13.3	5,560	12.3	9,110	1,320	.445

[a] Table VI of the original report.

APPENDIX II.

BIBLIOGRAPHY OF THE FORESTS AND FOREST PRODUCTS OF THE PHILIPPINES.

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Appendix K. K. Report of the Military Governor in the Philippines. (1900.) (This appendix contains the first annual report of Capt. Geo. P. Ahern, who on April 14, 1900, was assigned the task of organizing a forest service for the Philippines.)

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GENERAL INDEX.

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THE FORESTS OF THE PHILIPPINES

PART II

THE PRINCIPAL FOREST TREES

BY

H. N. WHITFORD, PH. D.

FORESTER, CHIEF OF DIVISION OF INVESTIGATION

BUREAU OF FORESTRY MANILA P.I.

DEPARTMENT OF THE INTERIOR
BUREAU OF FORESTRY

BULLETIN NO. 10

MAJOR GEORGE P. AHERN
DIRECTOR OF FORESTRY

MANILA
BUREAU OF PRINTING
1911

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
BUREAU OF FORESTRY,
Manila, November 29, 1910.

SIR: I have the honor to submit herewith a report entitled, "The Forests of the Philippines: Part II. The Principal Forest Trees," by H. N. Whitford, Ph. D., forester, chief division of investigation, and to recommend its publication as Part II of Bulletin No. 10.

Part I of this bulletin, dealing with The Forest Types and Products, was submitted for publication on November 11.

Very respectfully,

GEORGE P. AHERN,
Director of Forestry.

The honorable,
The ACTING SECRETARY OF THE INTERIOR, *Manila.*

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THE FORESTS OF THE PHILIPPINES: PART II.

THE PRINCIPAL FOREST TREES.

FAMILIES, SPECIES, OFFICIAL COMMON NAMES, AND USUAL TRADE NAMES OF THE PRINCIPAL TREES.

Family.	Species.	Official name.	Usual trade name.
Pinaceæ	Agathis alba (Lam.) F. W. Foxw. (*Agathis philippinensis* Warb.).	Almáciga	Almaciga.
	Pinus insularis Endl.	Benguét pine	Benguet pine, saleng.
	Pinus merkusii J. & de V.	Tapúlao	
Casuarinaceæ	Casuarina equisetifolia Forst.	Agohó	Agoho.
Fagaceæ	Quercus spp.	Oaks	
Ulmaceæ	Celtis philippensis Blanco	Malaíkmo	
	Trema amboinensis Bl.	Anabión	
Moraceæ	Allæanthus glaber Warb.	Malambíngan	
	Artocarpus communis Forst.	Antipólo	Antipolo.
	Artocarpus cumingiana Trec.	Anubíng	Anubing,cubi.
	Artocarpus integrifolia L. f.	Nángka	Nangka.
	Castilloa elastica Cerv.	Castilloa	Castilloa.
	Ficus elastica L.		India rubber.
	Ficus minahassae Miq.	Hagímit	
	Ficus variegata Bl.	Tangísang-bayáwak.	
	Streblus asper Lour.	Kaliós	
	Taxotrophis ilicifolia Vid.	Kúyus-kúyus	Kuyus-kuyus.
Olacaceæ	Strombosia philippinensis (Baill.) Rolfe	Tamayúan	Tamayuan.
Magnoliaceæ	Michelia champaca L.	Champáca	
	Talauma villariana Rolfe	Patángis	
Anonaceæ	Anona muricata L.	Guanábano	
	Anona reticulata L.	Anónas	
	Anona squamosa L.	Atis	
	Canangium odoratum Baill.	Ilang-ilang	Ilang-ilang.
	Cyathocalyx globosus Merr.	Dalínas	
Myristicaceæ	Knema heterophylla Warb.	Tambaláo	Duguan.
	Myristica philippensis Lam.	Dugúan	Duguan.
Lauraceæ	Beilschmiedia cairocan Vid.	Malacadiós	Macaladios, cubi.
	Cinnamomun mercadoi Vid.	Kalíngag	
	Cinnamomum mindanaense Elm.	Cinnamon	
	Cryptocarya bicolor Merr.	Dugkátan	Malacadios?
	Dehaasia triandra Merr.	Basláyan	Baticulin.
	Eusideroxylon zwageri T. & B.	Tambúlian	Billian or Borneo ironwood.
	Litsea perrottetii (Bl.) F.-Vill.	Maráng	Baticulin.
	Litsea spp.		Do.
	Neolitsea vidalii Merr.	Puso-púso	Do.
	Phoebe sterculioides (Elm.) Merr.	Maláya	Do.
Pittosporaceæ	Pittosporum pentandrum (Blanco) Merr.	Mamalis	
Rosaceæ	Parinarium griffithianum Benth.	Liúsin	Liusin.
	Pygeum preslii Merr.	Lágo	

Families, species, official common names, etc.—Continued.

Family.	Species.	Official name.	Usual trade name.
Leguminosæ	Acacia farnesiana (L.) Willd.	Aróma	
	Adenanthera intermedia Merr.	Tanglin	Ipil.
	Albizzia acle (Blanco) Merr.	Ácle	Acle.
	(*Pithecolobium acle Vid.*)		
	Albizzia procera (Roxb.) Benth.	Acleng-párang	Acleng-parang.
	Albizzia retusa Benth.	Kásai	
	Albizzia saponaria (Lour.) Blume	Salinkúgi	Salinkugi.
	Bauhinia malabarica Roxb.	Alibangbáng	
	Caesalpinia sappan L.	Sibucáo	Sibucao.
	Cassia javanica L.	Caña-fistula	
	Cassia siamea Lam.		
	Delonix regia Raf. (*Poinciana regia* Boj.)	Fire tree	
	Enterolobium saman (Jacq.) Prain	Rain tree	Acacia.
	(*Pithecolobium saman* Benth.)		
	Erythrina indica Lam.	Dapdáp	
	Erythrophloeum densiflorum (Elm.) Merr.	Kamátog	
	Gliricidia sepium (Jacq.) Steud.	Madre cacáo	
	Intsia acuminata Merr.	Merrill's ipil	Ipil.
	Intsia bijuga (Colebr.) O. Ktze. (*Afzelia bijuga* A. Gray).	Ipil	Do.
	Kingiodendron alternifolium (Elm.) M. & R.	Batéte	Batete.
	Leucaena glauca (L.) Benth.	Ipil-ípil	Santa elena.
	Ormosia calavensis Azaola	Báhai	
	Pahudia rhomboidea (Blanco) Prain	Tíndalo	Tindalo.
	Parkia timoriana (DC.) Merr.	Cúpang	Cupang.
	(*Parkia roxburghii* G. Don)		
	Peltophorum inerme (Roxb.) Naves		
	Pithecolobium dulce (Roxb.) Benth.	Camanchíle	Camanchile.
	Pithecolobium scutiferum (Blanco) Benth.	Anagáp	
	Pongamia mitis (L.) Merr.	Bani	
	Prosopis vidaliana Naves	Philippine mesquite.	Aroma.
	Pterocarpus blancoi Merr.	Blanco's narra	Narra.
	Pterocarpus echinatus Pers.	Prickly narra	Do.
	Pterocarpus indicus Willd.	Nárra	Do.
	Sesbania grandiflora (L.) Pers.	Katúrai	
	Sindora supa Merr. (*Sindora wallichii* F.-Vill, *non* Benth.)	Supá	Supa.
	Tamarindus indica L.	Sampálok	
	Wallaceodendron celebicum Koord.	Banúyo	Banuyo.
Rutaceæ	Citrus hystrix DC.	Kabúyao	
	Fagara integrifoliola Merr.	Kayutána	
	Murraya exotica L.	Camúning	Camuning.
Burseraceæ	Canarium luzonicum A. Gray	Píli	
	Canarium villosum F.-Vill.	Pagsahíngin	
	Garuga abilo (Blanco) Merr.	Bogó	
	Santiria nitida Merr.	Kamíngi	
Meliaceæ	Aglaia clarkii Merr.	Tucang-cálao	Tucang-calao.
	Aglaia harmsiana Perk.	Malaságing	
	Dysoxylum sp.?	Agarú	
	Lansium domesticum Jack	Lansones	
	Sandoricum indicum Cav.	Santól	Santol.
	Sandoricum vidalii Merr.	Malasantól	Malasantol.
	Toona calantas M. & R.	Calántas	Calantas.
	Xylocarpus granatum Koen.	Piagáo	
	Xylocarpus obovatus A. Juss.	Tabígi	
Euphorbiaceæ	Aleurites moluccana Willd.	Lumbáng	Lumbang.
	Aleurites trisperma Blanco	Balukánad	Do.
	Antidesma bunius Spr.	Bignái	
	Antidesma edule Merr.	Taníg	
	Antidesma ghaesembilla Gaertn.	Binayúyu	
	Aporosa sphaeridophora Merr.	Bignái laláki	
	Aporosa symplocosifolia Merr.	Malabignái	
	Baccaurea tetrandra Muell.-Arg.	Dílak	
	Bischofia javanica Bl.	Túai	
	Cyclostemon bordenii Merr.	Tináan-pantái	Tinaan-pantai.
	Cyclostemon grandifolius C. B. Rob.	Banáwi	
	Cyclostemon microphyllus Merr.	Butong-manúk	
	Endospermum peltatum Merr.	Gúbas	Gubas.
	Hevea brasiliensis Muell.-Arg.	Para rubber	Para rubber.
	Homalanthus populneus Pax	Balantí	
	Jatropha curcas L.	Túba	

Families, species, official common names, etc.—Continued.

Family.	Species.	Official name.	Usual trade name.
Euphorbiaceæ	Macaranga bicolor Muell.-Arg.	Hamindáng	
	Macaranga tanarius Muell.-Arg.	Binúnga	
	Mallotus moluccanus Muell.-Arg.	Alim	
	Mallotus philippinensis Muell.-Arg.	Banáto	
	Mallotus ricinoides Muell.-Arg.	Hinlaúmo	
	Manihot glaziovii Muell.-Arg.	Ceara rubber	Ceara rubber.
Anacardiaceæ	Anacardium occidentale L.	Kasói	
	Buchanania arborescens Blume	Balinghásay	Balinghasay.
	Dracontomelum cumingianum Baill.	Lamió	Dao.
	Dracontomelum dao M. & R.	Daó	Do.
	Koordersiodendron pinnatum (Blanco) Merr.	Amúguis	Amuguis.
	Mangifera altissima Blanco	Pahútan	
	Mangifera indica L.	Mango	Mango.
	Semecarpus perrottetii March.	Ligás	
	Spondias lutea L.	Ciruélas	
	Spondias pinnata Kurz	Libás	
Rhamnaceæ	Zizyphus trinervia Poir.	Ligáa	
	Zizyphus zonulatus Blanco	Balácat	Balacat or ligaa.
Sapindaceæ	Arytera littoralis Bl.	Alásin	
	Euphoria cinerea Radlk.	Alúpag	Alupag.
	Harpullia arborea (Blanco) Radlk.	Uás	
	Litchi philippinensis Radlk.		Do.
	Pometia pinnata Forst.	Malúgay	Malugay.
Staphyleaceæ	Turpinia pomifera DC.	Anongo	
Tiliaceæ	Columbia serratifolia (Cav.) DC.	Aniláo	
	Diplodiscus paniculatus Turcz.	Balobó	
	Grewia stylocarpa Warb.	Susumbík	
Malvaceæ	Bombycidendron vidalianum (Naves) M. & R.	Lanútan	Lanutan.
	Hibiscus tiliaceus L.	Malubágo	
	Thespesia populnea Corr.	Banálo	Lanutan or banalo.
Bombacaceæ	Bombax malabaricum DC.	Malabúlak	
	Ceiba pentandra (L.) Gaertn.	Kápok	
Sterculiaceæ	Heritiera littoralis Dry.	Dúngon-láte	Dungon-late or dungon.
	Kleinhofia hospita L.	Tanág	
	Pterocymbium tinctorium (Blanco) Merr.	Talúto	Taluto.
	Pterospermum spp.	Bayók	
	Sterculia blancoi Rolfe	Magalípak	
	Tarrietia javanica Bl.	Lumbayáo	Lumbayao.
	Tarrietia sylvatica (Vid.) Merr.	Dúngon	Dungon.
Dilleniaceæ	Dillenia luzoniensis (Vid.) Merr.	Malacatmón	Catmon.
	Dillenia philippinensis Rolfe	Catmón	Do.
	Dillenia speciosa Gilg	Catmón-carabáo	Do.
Theaceæ	Adinandra luzonica Merr.		
	Eurya spp.		
	Gordonia luzonica Vid.		
	Ternstroemia toquian (Blanco) F.-Vill.	Bikag	
	Thea montana (Blanco) Merr.		
Guttiferæ	Calophyllum blancoi Pl. & Tr.	Bitánhol	Palomaria.
	Calophyllum inophyllum L.	Palo maria	Do.
	Cratoxylon celebicum Blume	Gúyong-gúyong	
	Garcinia benthami Pierre	Bunóg	
	Garcinia binucao Choisy	Binúkao	
	Garcinia mangostana L.	Mangosteen	Mangosteen.
	Kayea paniculata (Blanco) Merr.	Kalíwas	
Dipterocarpaceæ	Anisoptera curtisii Dyer	Malapáho	Palosapis, mayapis.
	Anisoptera thurifera Blanco	Palosápis	Do.
	Anisoptera sp.	Afu	Do.
	Dipterocarpus affinis Brandis	Hagachác	Apitong.
	Dipterocarpus grandiflorus Blanco	Apítong	Do.
	Dipterocarpus vernicifluus Blanco	Pánao	Do.
	Hopea acuminata Merr.	Mangachapúy	Mangachapuy, dalingdingan.

Families, species, official common names, etc.—Continued.

Family.	Species.	Official name.	Usual trade name.
Dipterocarpaceæ	Hopea philippinensis Dyer	Guísoc-guísoc	
	Hopea pierrei Hance	Dalingdíngan-isák.	Dalingdingan, mangchapuy.
	Hopea plagata Vid.	Yacál	Yacal.
	Hopea sp.	Black yacál	Do.
	do	Malayacál	Do.
	Parashorea plicata Brandis	Bagtícan-lauan	Almon, white lauan.
	Pentacme contorta (Vid.) M. & R. (*Shorea contorta* Vid.)	White lauán	Lauan, white lauan.
	Shorea balangeran Burck	Guísoc	Yacal.
	Shorea furfuracea Miq.	Almón-lauán	Almon, white lauan.
	Shorea guiso (Blanco) Blume	Guíjo	Guijo.
	Shorea malaanonan (Blanco) Blume	Malaanónang-lauan.	Lauan, malaanonang.
	Shorea polysperma (Blanco) Merr.	Tanguíle	Tanguile, mayapis, balakbakan.
	Shorea sp.	Mangasinóro-lauan.	Lauan, mangasinoro.
	do	Red lauán	Red lauan, red almon, tanguile, balakbakan.
	do	Tiáong-lauan	Tiaong-lauan, red lauan.
	Shorea squamata (Tcz.) Dyer	Mayápis-lauán	Mayapis, red lauan.
	Vatica sp.	Kalúnti-lauán	
	do	Nárig	Yacal.
	do	Yacal blanco	Yacal blanco.
Flacourtiaceæ	Flacourtia inermis Roxb.		
	Homalium luzoniense F.-Vill.	Aránga	Aranga.
Datiscaceæ	Octomeles sumatrana Miq.	Biluáng	Biluang.
Lythraceæ	Lagerstroemia piriformis Koehne (*Lagerstroemia batitinan* Vid.).	Batitínan	Batitinan, Philippine teak.
	Lagerstroemia speciosa (L.) Pers.	Banabá	Banaba.
Sonneratiaceæ	Sonneratia pagatpat Blanco	Pagatpát	Pagatpat, montol.
	Sonneratia sp.	Pedadá	Pagatpat.
Lecythidaceæ	Barringtonia racemosa Roxb.	Pútat	
	Barringtonia speciosa Forst.	Bótong	
	Planchonia spectabilis Merr.	Lamóg	
Rhizophoraceæ	Bruguiera caryophylloides Bl.	Potótan-laláki	Bacauan.
	Bruguiera eriopetala W. & A.	Potótan	Do.
	Bruguiera gymnorrhiza Lam.	Busáin	Do.
	Bruguiera parviflora W. & A.	Langárai	Do.
	Carallia integerrima DC.	Bacáuan-gubat	
	Ceriops tagal (Perr.) C. B. Rob.	Tangál	Tangal, bacauan.
	Rhizophora conjugata L.	Bacáuan	Bacauan.
	Rhizophora mucronata Lam.	Bacáuan-laláki	Do.
Combretaceæ	Lumnitzera littorea (Jack) Voigt	Tabáo	Tabao.
	Lumnitzera racemosa Willd.		
	Terminalia calamansanai (Blanco) Rolfe	Malacalumpít	
	Terminalia catappa L.	Talísay	Talisay.
	Terminalia comintana (Blanco) Merr.	Binggás	Bunglas, binggas, molave, batitinan.
	Terminalia edulis Blanco	Calumpít	Calumpit.
	Terminalia nitens Presl	Sácat	Sacat.
	Terminalia oöcarpa Merr.	Talísay-gúbat	Talisay.
	Terminalia pellucida Presl	Dalínsi	Dalinsi.

PLATE I.—ALMACIGA (*Agathis alba*).

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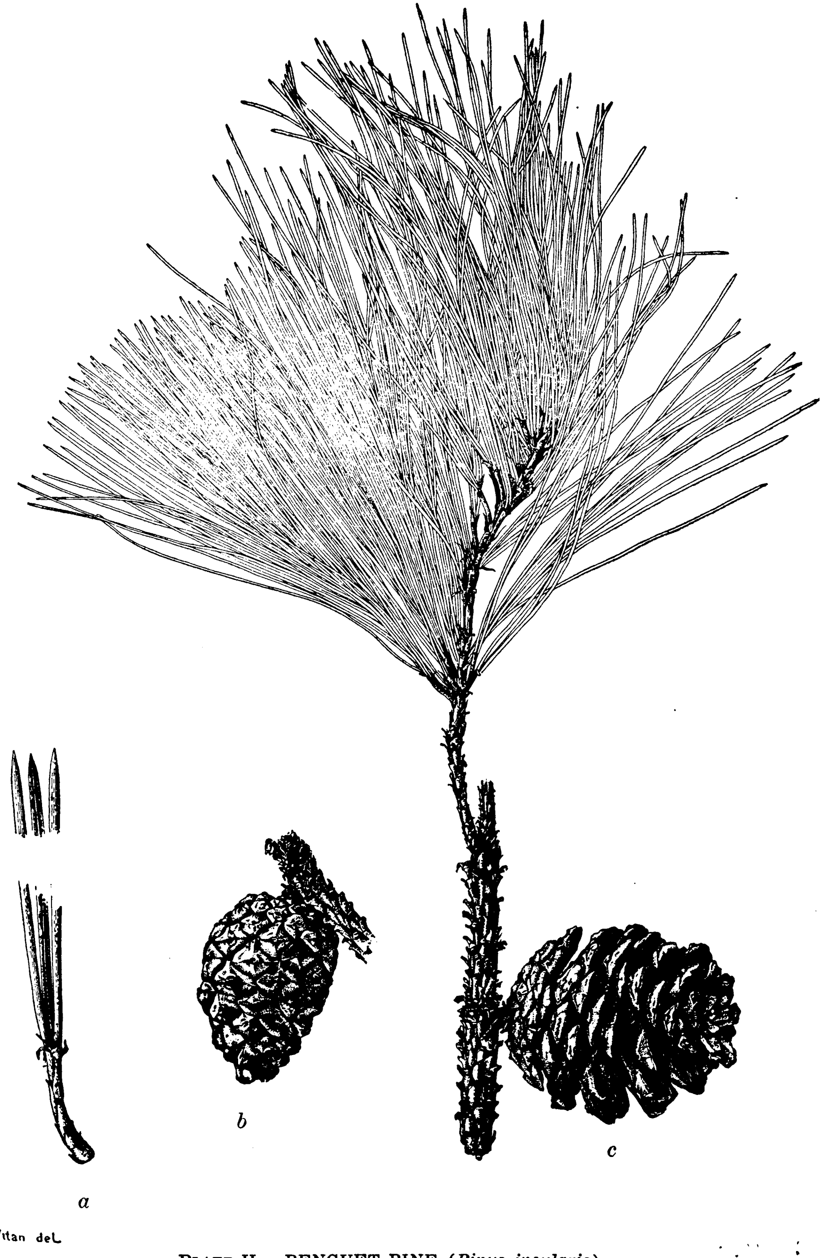

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PLATE II.—BENGUET PINE (*Pinus insularis*).

a, Cluster of leaves; *b*, unopened cone; *c*, opened cone.

PLATE III.—BENGUET PINE (*Pinus insularis*).

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PLATE IV.—AGOHO (*Casuarina equisetifolia*).

a, Branchlet showing reduced leaves.

PLATE V.—GROVE OF AGOHO TREES.

PLATE VI.—ANUBING (*Artocarpus cumingiana*).

a, Young fruit; *b*, mature fruit.

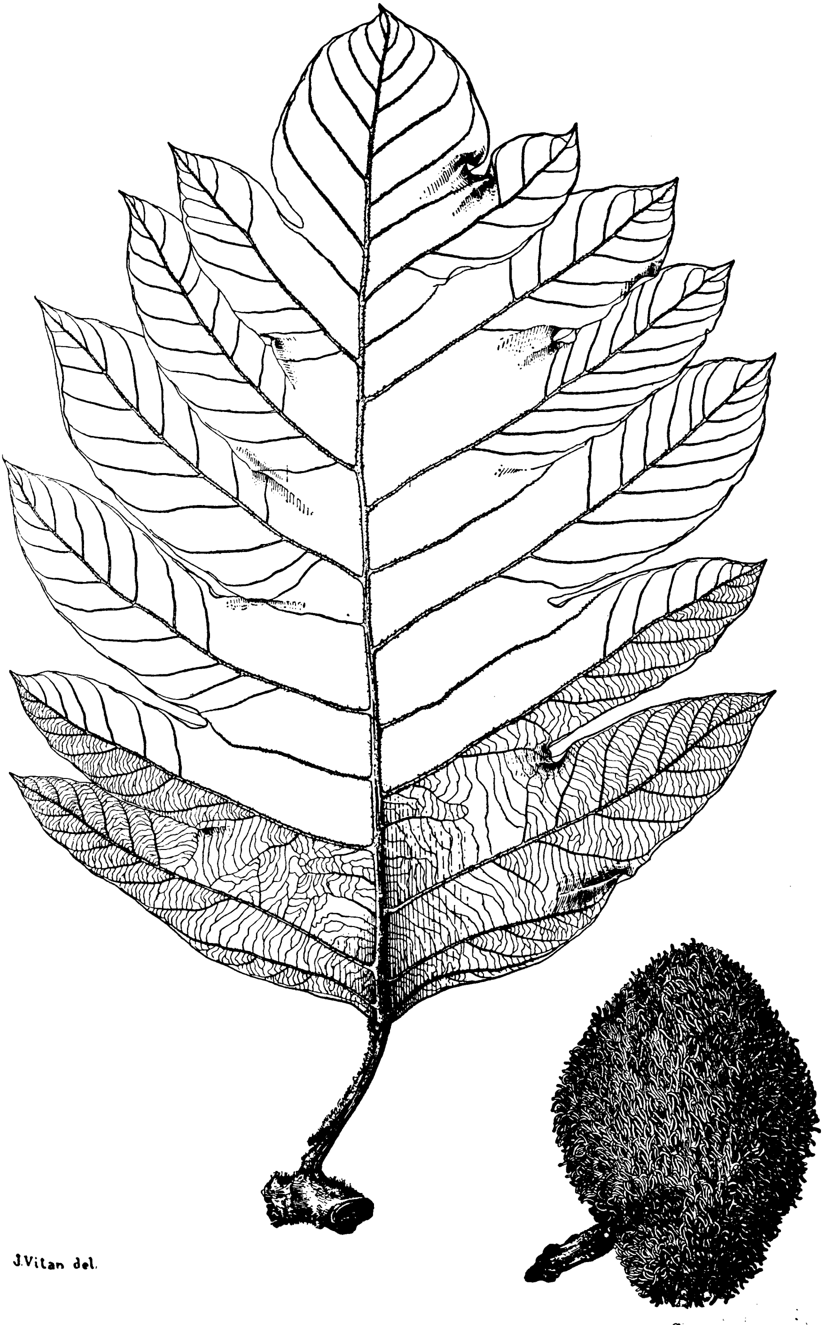

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PLATE VII.—CULTIVATED FORM OF ANTIPOLO (*Artocarpus communis*).

a, Fruit.

PLATE VIII.—BALETE (*Ficus* sp.).

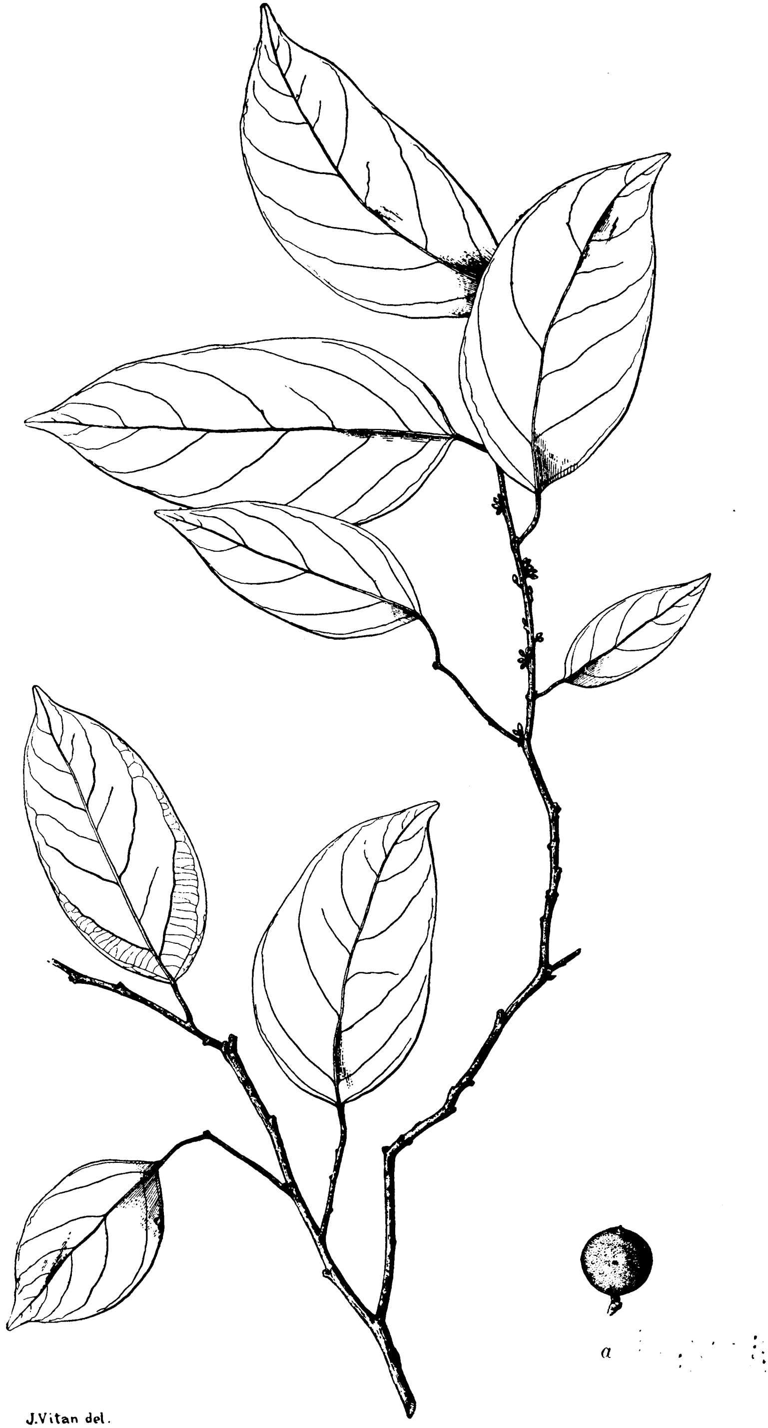

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PLATE IX.—TAMAYUAN (*Strombosia philippinensis*).

a, Fruit.

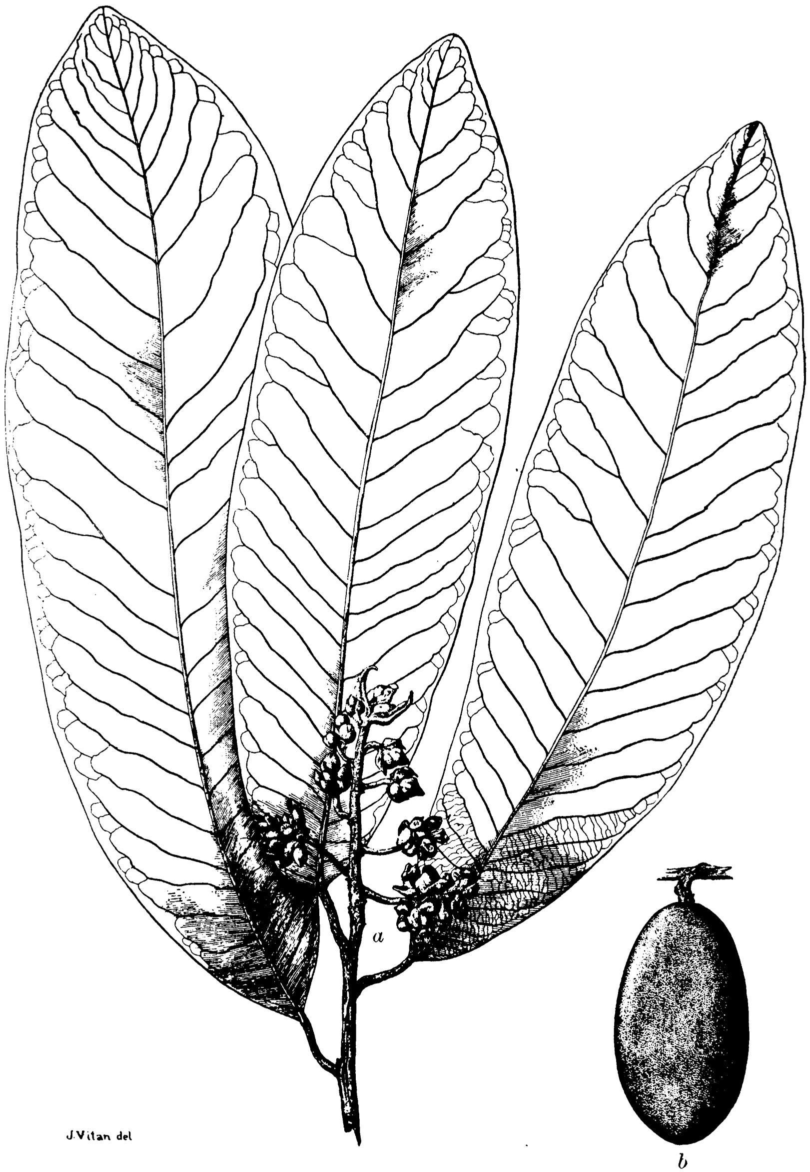

PLATE X.—DUGUAN (*Myristica philippensis*).

a, Flowers ; *b*, fruit.

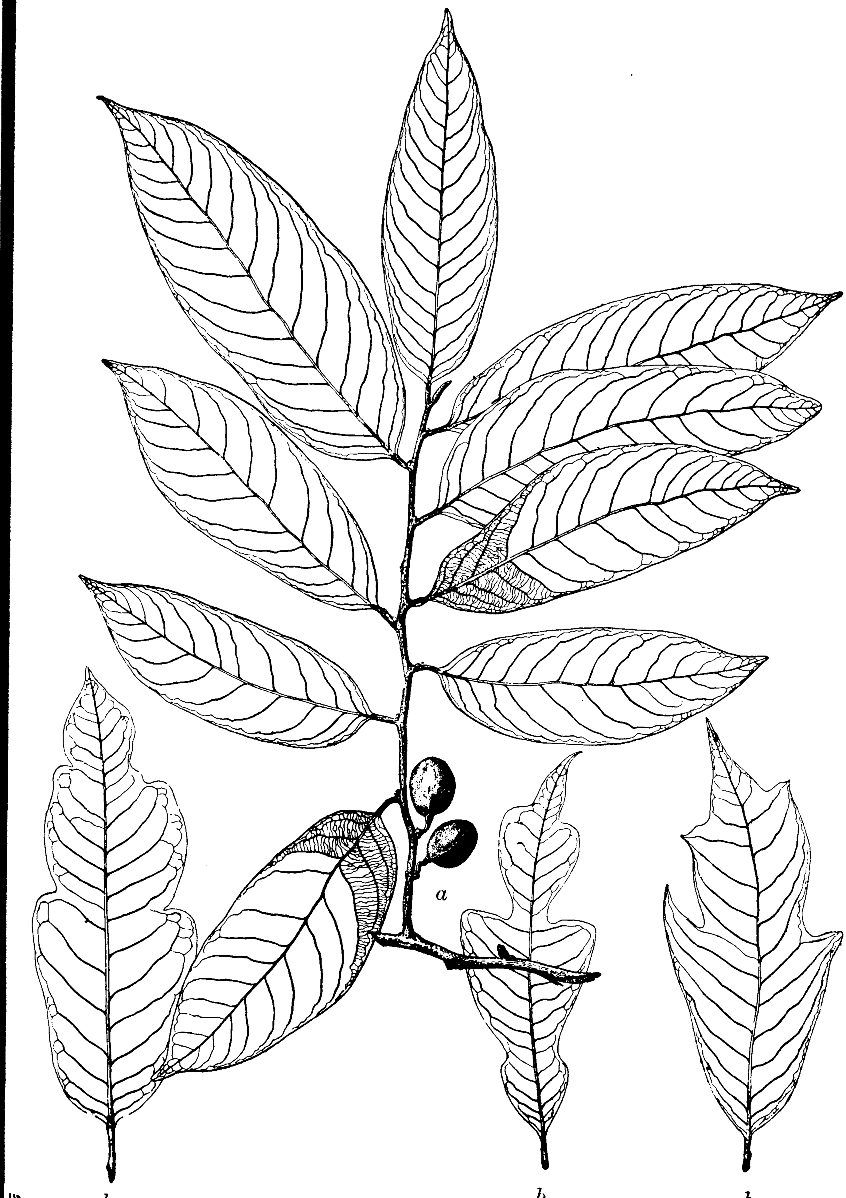

PLATE XI.—TAMBALAO (*Knema heterophylla*).

a, Fruit; *b*, different forms of leaves.

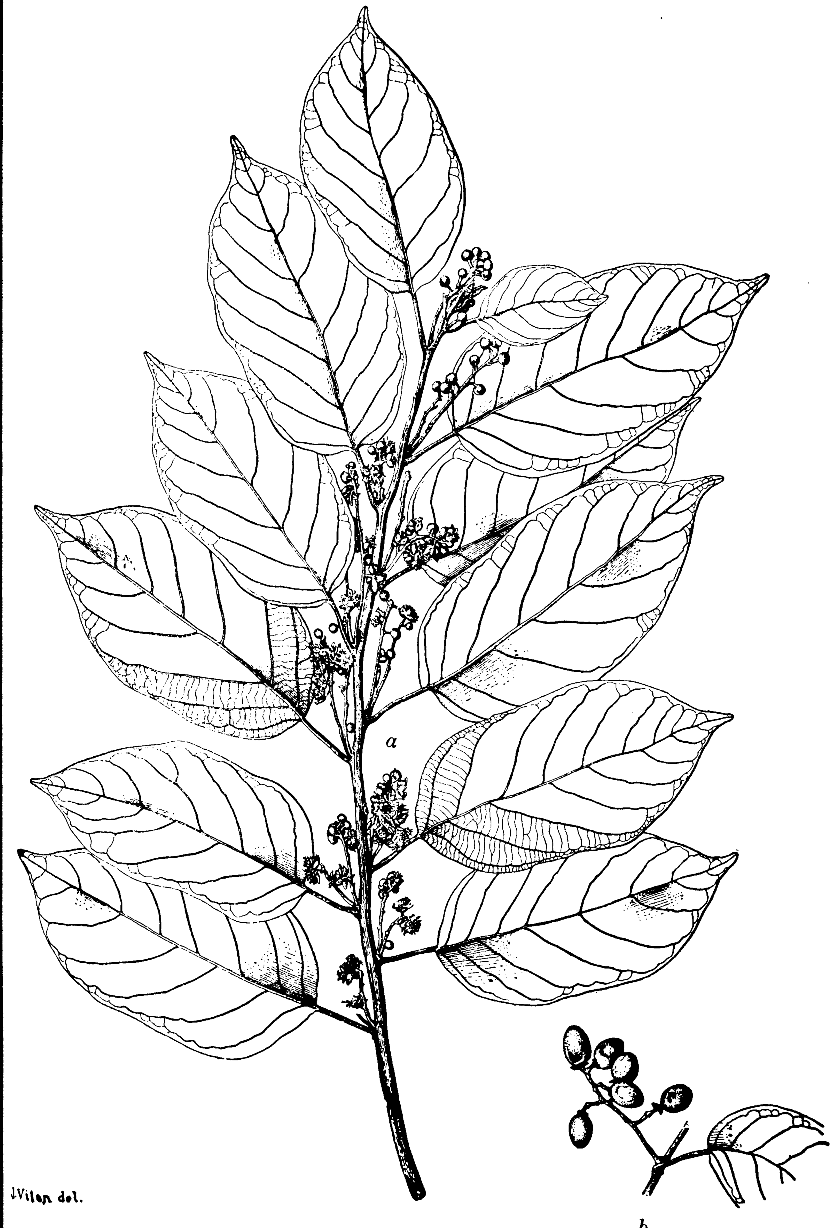

PLATE XII.—MARANG (*Litsea perrottetii*).

a, Cluster of flowers and young fruits; *b*, mature fruits.

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PLATE XIII.—MALACADIOS (*Beilschmiedia cairocan*).

a, Fruit; *b*, flower cluster.

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PLATE XIV.—LIUSIN (*Parinarium griffithianum*).

a, Flower cluster; *b*, fruits.

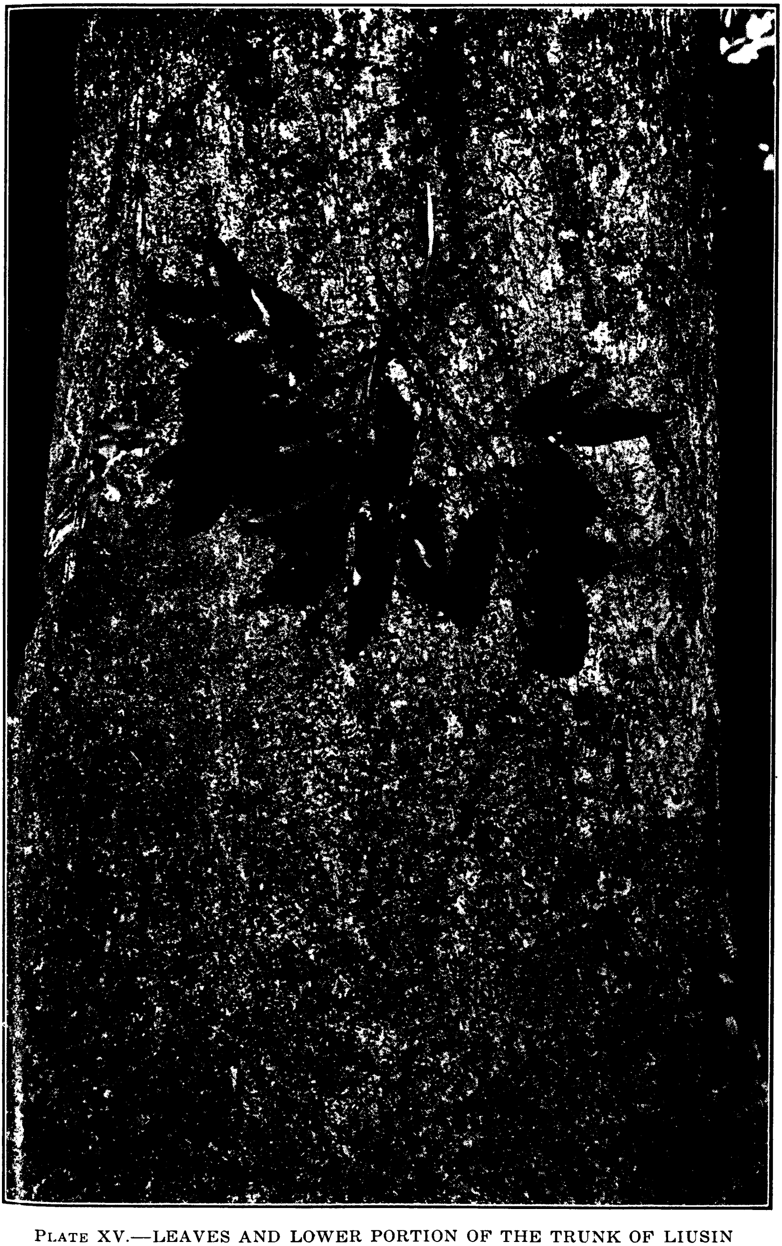

PLATE XV.—LEAVES AND LOWER PORTION OF THE TRUNK OF LIUSIN
(*Parinarium griffithianum*).

PLATE XVI.—THE NARRAS.

a, Spiny narra (*Pterocarpus echinatus*); *b*, fruit of Blanco's narra (*Pterocarpus blancoi*); *c*, fruit of narra (*Pterocarpus indicus*).

PLATE XVII.—LOWER PORTION OF THE TRUNK OF A LARGE NARRA (*Pterocarpus indicus*).

Showing root buttress.

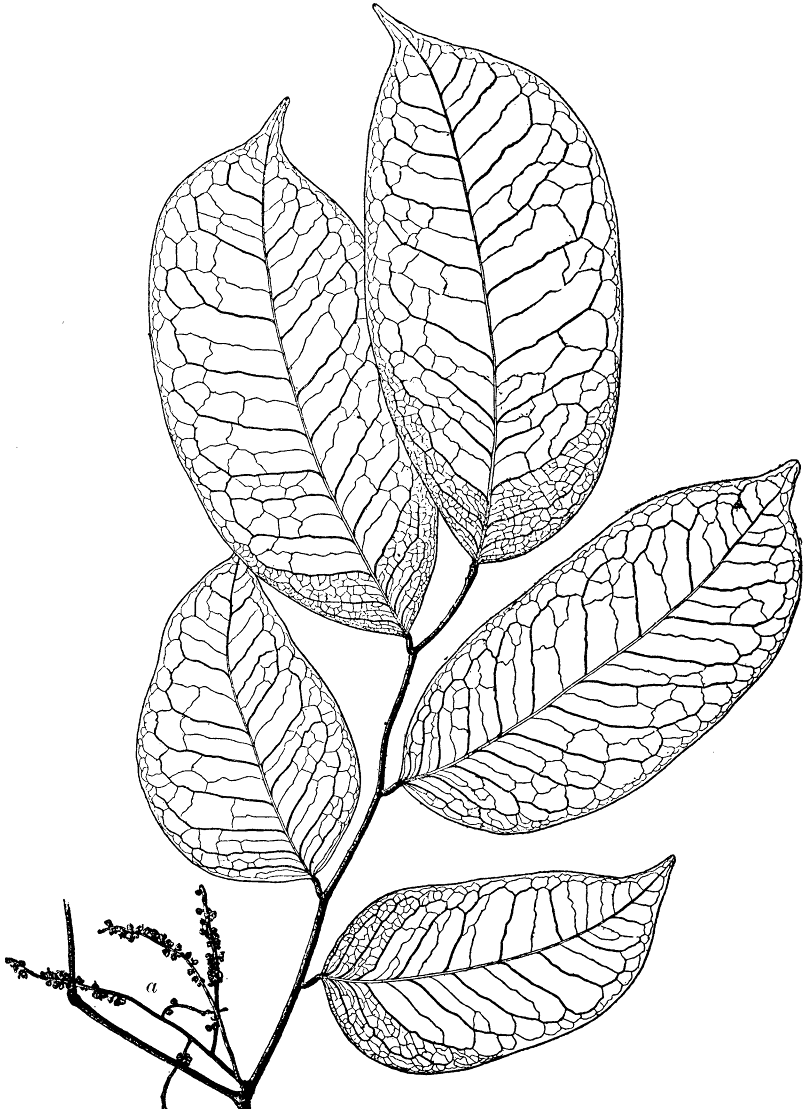

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PLATE XVIII.—BATETE (*Kingiodendron alternifolium*).

a, Flower cluster; *b*, fruit.

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Families, species, official common names, etc.—Continued.

Family.	Species.	Official name.	Usual trade name.
Myrtaceæ	Decaspermum blancoi Vid.		
	Decaspermum paniculatum Kurz		Macaasim, malaruhat, binolo.
	Eucalyptus naudiniana F. Muell.		
	Eugenia bordenii Merr.	Malarúhat na pulá.	Malaruhat, macaasim.
	Eugenia calubcob C. B. Rob.	Kalubkób	
	Eugenia jambolana Lam.	Dúhat	
	Eugenia jambos L.	Tampói	
	Eugenia javanica Lam.	Makópa	
	Eugenia luzoniensis Merr.	Malarúhat na pulá.	Malaruhat, macaasim.
	Eugenia spp.	Macaásim, malarúhat.	Do.
	Leptospermum flavescens Smith	Malasulási	
	Osbornia octodonta F. Muell.	Tawális	
	Psidium guajava L.	Bayábas	Bayabas.
	Tristania decorticata Merr.	Malabayábas	
	Xanthostemon verdugonianus Naves	Manconó	Mancono, palo de hierro.
Melastomataceæ	Memecylon edule Roxb.	Kúlis	
Araliaceæ	Polyscias nodosa Seem.	Malapapáya	Malapapaya, malasapsap.
Cornaceæ	Alangium longiflorum Merr.	Malatápai	Malatapai, guntapai.
Sapotaceæ	Achras sapota L.	Chico	
	Illipe betis (Blanco) Merr.	Bétis	Betis.
	Illipe ramiflora Merr.	Banití	Manicnic, mayapis.
	Mimusops sp.	Bansaláguin	Bansalaguin.
	Palaquium luzoniense (F.-Vill.) Vid.	Náto	Malac-malac.
	Palaquium philippense (Perr.) C. B. Rob.	Malacmálac	Manicnic, nato.
	Palaquium tenuipetiolatum Merr.	Manicníc	Manicnic, mayapis, amuguis.
	Sideroxylon spp.	White nátos	
Ebenaceæ	Diospyros discolor Willd.	Camagón	Camagon, ebony.
	Diospyros mindanaensis Merr.	Ata-áta	Bolongeta, camagon.
	Diospyros pilosanthera Blanco	Bolongéta	Bolongeta, camagon.
	Maba buxifolia Pers.	Ebony	Ebony, ébano.
Lagoniaceæ	Fagraea fragrans Roxb.	Urung	Dolo, teca.
Apocynaceæ	Alstonia macrophylla Wall.	Batino	Batino.
	Alstonia scholaris (L.) R. Br.	Ditá	Dita.
	Wrightia calycina R. Br.		Lanete.
	Wrightia laniti (Blanco) Merr.	Lanéte	Do.
Borraginaceæ	Cordia blancoi Vid.	Anonang	
Verbenaceæ	Premna nauseosa Blanco	Alagao	Mulawin-aso.
	Tectona grandis L. f.	Teak	Teak.
	Vitex aherniana Merr.	Sasalít	Sasalit, molave.
	Vitex parviflora Juss. (*Vitex littoralis* Decne.).	Molave	Molave.
	Vitex pentaphylla Merr.	Kalipápa aso	Mulawin-aso.
	Vitex pubescens Vahl.	Hairy-leaf molave.	Molave.
	Vitex turczaninowii Merr.	Lingo-lingo	Mulawin-aso.
Bignoniaceæ	Dolichandrone spathacea (L. f.) K. Sch.	Túi	
	Oroxylum indicum Benth	Pinkapinkáhan	
	Radermachera pinnata (Blanco) Seem.	Bánaibánai	
Rubiaceæ	Nauclea spp.		Calamansanay.
	Sarcocephalus cordatus Miq.	Bancál	Bancal.
	Sarcocephalus junghuhnii Miq.	Mambóg	Do.

KEY TO THE PRINCIPAL TIMBER TREES OF THE PHILIPPINES.

1. Wook or bark, or both, resinous.

2. Leaves needle-like .... **Benguet pine** (p. 26)

2. Leaves not needle-like.

3. Leaves simple, opposite or nearly so........ **Almaciga** (p. 25)

3. Leaves simple, alternate (Dipterocarpaceæ).

4. Bark ridged.

5. Bark black, less than 5 millimeters in thickness; axils of basal veins of leaves with glands........ **Black yacal** (p. 73)

5. Bark brown to black, more than 10 millimeters in thickness; axils of veins with or without glands.

6. Glands only in axils of basal veins or wanting; leaves 4.5 to 8 centimeters long, 2 to 2.5 centimeters wide.. **Mangachapuy** (p. 75)

6. Glands in axils of all secondary veins; leaves 3 to 8.5 centimeters long 1 to 3.5 centimeters wide........ **Dalingdingan-isak** (p. 76)

5. Bark brown, cinnamon brown to nearly black; more than 10 millimeters thick; leaves without glands.

6. Leaves hairy beneath.

7. Hairs coarse, star shaped; stipules large; leaves 10 to 30 centimeters long; wood light red........ **Mayapis-lauan** (p. 65)

7. Hairs not so coarse, star shaped; stipules smaller than preceding; leaves 9 to 17 centimeters long, wood with a very light red color .... **Almon-lauan** (p. 62)

7. Hairs fine; bark with reddish tinge; wood dark red. **Red lauan** (p. 66)

7. Hairs fine and scattered, giving leaves a slightly rusty brown appearance; wood light brown with a reddish to yellowish tinge .... **Malaanonang-lauan** (p. 64)

6. Leaves without hairs.

7. Leaves with a white glaucous bloom beneath. **Bagtican-lauan** (p. 63)

7. Leaves without glaucous bloom.

8. Leaves 7.5 to 23 centimeters long; 3.5 to 10 centimeters wide; widely distributed .... **White lauan** (p. 61)

8. Leaves 7 to 12 centimeters long, 3 to 6 centimeters wide, reported only from Mindanao........ **Kalunti-lauan** (p. 64)

4. Bark not ridged.

5. Bark brown, cinnamon red, to nearly black; inner bark stringy.

6. Bark brown to cinnamon red, inner bark tan red; less than 10 millimeters thick; leaves without glands.

7. Leaves 5 to 14 centimeters long, 3 to 6 centimeters wide, bluntly wedge shaped at the base........ **Tanguile** (p. 67)

7. Leaves 8 to 19 centimeters long, 3 to 8 centimeters wide, rounded at base .... **Guijo** (p. 70)

6. Bark brown to black, less than 6 millimeters thick; inner bark brown with pinkish tinge; leaves with prominent glands in axils; sharp-pointed stipules .... **Guisoc-guisoc** (p. 74)

6. Bark gray-brown, cinnamon brown to nearly black; inner bark yellow; 10 millimeters or more in thickness.

7. Bark gray-brown to cinnamon brown; some leaves with glands in axils of veins .... **Yacal** (p. 72)

7. Bark darker than preceding; no glands; leaves slightly rusty brown beneath .... **Guisoc** (p. 73)

7. Bark like yacal; tree shorter and stockier; no glands; leaves like guijo and larger than guisoc and yacal.... **Malayacal** (p. 74)

5. Bark light gray, 8 millimeters or less in thickness; inner bark very brittle and red.

6. Leaf blade smooth; petiole 5.5 to 7 centimeters long. **Apitong** (p. 68)

6. Leaf blade finely hairy beneath; petiole 2.5 to 3 centimeters long. **Panao** (p. 69)

6. Petiole and midrib of underside of leaf coarsely hairy; leaves larger than apitong and panao (18 to 53 centimeters long, 7 to 22 centimeters wide) .... **Hagachac** (p. 70)

6. Tree smaller than preceding; resin scanty; leaves smooth, smaller than apitong, panao, hagachac (4.5 to 10 centimeters long, 3 to 5.5 centimeters wide)......................... **Narig** and **Karig** (p. 76)

5. Bark yellowish gray, 15 to 25 millimeters thick; inner bark granular yellow .... **Palosapis** (p. 77)

3. Leaves compound, alternate; bark resinous. The **pilis, kamingi,** and **bogo** (p. 44)

1. Wood and bark not resinous or at least not prominently so.

2. Bark with white sap.

3. Leaves opposite or whorled. (Apocynaceæ.)

4. Leaves in whorls of 4 to 7; each 5 to 20 centimeters long, 1 to 6.5 centimeters wide; wood soft... **Dita** (p. 95)

4. Leaves in whorls of 3 to 4; 10 to 20 centimeters long, 3 to 7.5 centimeters wide; wood moderately hard .... **Batino** (p. 95)

4. Leaves opposite .... The **lanetes** (p. 96)

3. Leaves simple, alternate; sap flows sparingly when bark is cut from layer next the sapwood; woods lather readily when rubbed with saliva or water. (Sapotaceæ.)

4. Wood light brown or creamy white .... The **white natos** (p. 92)

4. Woods reddish.

5. Leaves with dense mat of golden-brown hairs beneath.

6. Bark 10 millimeters or less in thickness; brown to reddish brown in color; wood very hard and heavy .... **Betis** (p. 89)

6. Bark more than 10 millimeters in thickness, grayish brown in color; wood moderately hard and moderately heavy. **Malacmalac** (p. 91)

5. Leaves smooth or nearly so.

6. Bark nearly black, ridged; leaves 4 to 12 centimeters long, 2 to 4 centimeters wide; wood very hard and heavy. **Bansalaguin** (p. 90)

6. Bark gray to brown; leaves 9 to 17 centimeters long, 4 to 7 centimeters wide; wood moderately hard and moderately heavy. **Nato** (p. 91)

6. Bark dark gray to dark brown; leaves 6 to 12 centimeters long, 2.5 to 4.5 centimeters wide; wood moderately hard and moderately heavy .... **Manicnic** (p. 92)

3. Leaves simple, alternate; sap flows freely when bark is cut. (Moraceæ.)

4. Fruit a fig.

5. Trees entrapping other trees .... The **baletes** (p. 30)

5. The trees not entrapping other trees; trees usually small; fruit often growing on the trunk or limbs .... Many species of **Ficus** (p. 30)

5. Tree not entrapping other trees; tree large, with smooth yellow bark.
Tangisang-bayawak (p. 30)
4. Fruit very large, not a fig.
5. Leaves very large (up to 90 centimeters in length), usually deeply lobed, hairy beneath and on veins above .... **Antipolo** (p. 29)
5. Leaves 18 to 35 centimeters long, hairy beneath and on veins above.
Anubing (p. 28)
5. Leaves small, entire, less than 18 centimeters long, smooth.
Nangka (p. 29)
2. Bark with yellow sap; leaves opposite. (Guttiferæ.)
3. Leaves yellowish green in color; bark yellow, ridged.
4. Leaves 9 to 16 centimeters long, 5.5 to 10 centimeters wide; wood with twisted grain; tree of seacoast .... **Palo maria** (p. 59)
4. Leaves longer and narrower than the preceding; wood straighter in grain; tree of the forests .... **Bitanhol** (p. 60)
2. Bark with red sap.
3. Sap very thin; bark dark colored; leaves simple.
4. Leaves 13 to 36 centimeters long, 6 to 13 centimeters wide, rusty hairy beneath; tree larger than the following .... **Duguan** (p. 31)
4. Leaves 14 to 24 centimeters long, 5 to 8 centimeters wide, white beneath.
Tambalao (p. 32)
3. Sap rather sticky, flows freely from tubes and hardens quickly; bark gray; leaves compound, 6 to 11 leaflets................................. The **narras** (p. 35)
3. Sap flows sparingly; leaves compound.
4. Leaves trifoliate .... **Tuai** (p. 49)
4. Leaves pinnately compound .... **Malugay** (p. 54)
2. Bark with black sap which flows sparingly; leaves simple, alternate.
Ligas (p. 52)
2. Bark without resin or black, white or colored sap.
3. Leaves reduced to bracts .... **Agoho** (p. 27)
3. Leaves simple.
4. Leaves opposite; bark without purplish layer next to sapwood.
5. Trees of the mangrove swamps.
6. Trees with prominent stilt roots .... The **bacauans** (p. 82)
6. Trees without stilt roots.
7. Bark black .... The **pototans** (p. 82)
7. Bark dark red .... **Tangal** (p. 82)
6. Trees with aërial roots.
7. Leaves white beneath .... **Api-api** (p. 98)
7. Leaves orbicular, not white beneath .... **Pagatpat** (p. 81)
5. Trees not of the mangrove swamps.
6. Leaves with interpetiolar stipules .... **Rubiaceae** (p. 99)
7. Wood yellow with greasy feeling .... The **bancals** (p. 99)
7. Wood deep red when fresh cut, changing to rose color.
Calamansanay (p. 100)
6. Leaves very large (19 to 33 centimeters long, 13.5 to 22 centimeters wide), hairy beneath, without interpetiolar stipules.. **Teak** (p. 98)
6. Leaves smaller than the preceding, smooth, without interpetiolar stipules .... The **macaasims** (p. 87)
4. Leaves opposite, sometimes alternate; inner bark with purplish layer next to the sapwood. (Lythraceæ.)
5. Leaves 6 to 12 centimeters long, 2 to 5 centimeters wide.
Batitinan (p. 79)

5. Leaves 7.5 to 24 centimeters long, 3.5 to 11 centimeters wide. **Banaba** (p. 80)
4. Leaves alternate; bark without purplish layer next to the sapwood.
 5. Leaves with serrate margin .... **Catmon** (p. 58)
 5. Leaves with wavy margin .... The **arangas** (p. 78)
 5. Leaves with entire margin.
  6. Leaves silvery white beneath.
   7. Tree of the beach and mangrove swamp .... **Dungon-late** (p. 56)
   7. Tree not of the beach .... **Dungon** (p. 55)
  6. Leaves white beneath.
   7. Leaves heart shaped .... **Hamindang** and **binunga** (p. 48)
   7. Leaves not heart shaped .... **Malacadios** (p. 33)
  6. Leaves not white nor silvery white beneath.
   7. Leaves large, usually more than 18 centimeters long.
    8. Trees with branches in horizontal planes .... **Talisay** (p. 85)
    8. Trees with branches not in horizontal planes.
     9. Bark inclined to be ridged .... **Talisay-gubat** (p. 84)
     9. Bark not ridged .... **Toog** (p. 86)
   7. Leaves less than 18 centimeters long.
    8. Bark 5 millimeters or less in thickness .... **Binggas** (p. 86)
    8. Bark more than 5 millimeters thick.
     9. Leaves with two prominent glands at base of blade. **Liusin** (p. 34)
     9. Leaves without glands.
      10. Leaves obovate.
       11. Heartwood reddish brown .... **Dalinsi** (p. 84)
       11. Heartwood gray to brownish yellow .... **Sacat** (p. 85)
      10. Leaves not obovate. Inner bark yellow with white concentric rings .... **Tamayuan** (p. 30)
      10. Inner bark yellow without white concentric rings. **Calumpit** (p. 83)

3. Leaves compound.
4. Leaves opposite, palmately compound.
 5. Leaflets smooth.
  6. Leaflets usually 3; wood very hard .... **Molave** (p. 97)
  6. Leaflets 3 to 7 (usually 5); wood very hard .... **Sasalit** (p. 98)
  6. Leaflets 5, wood soft or moderately hard .... **Mulawin-aso** (p. 98)
 5. Leaflets hairy, usually 3 .... **Hairy molave** (p. 98)
4. Leaves alternate.
 5. Leaves palmately compound.
  6. Leaves trifoliate.
   7. Fine velvety hairs beneath .... **Santol** (p. 46)
   7. Smooth or nearly so .... **Malasantol** (p. 46)
  6. Leaflets 3 to 5 .... **Lumbayao** (p. 57)
 5. Leaves simply compound, pinnate.
  6. Leaves more than 1 meter in length .... **Malapapaya** (p. 89)
  6. Leaves less than 1 meter in length.
   7. Leaflets with white hairs beneath; more than 10 pairs. **Tucang-calao** (p. 46)
   7. Leaflets with white bloom beneath; less than 10 pairs.
    8. Bark more than 8 millimeters thick .... **Tindalo** (p. 39)
    8. Bark less than 8 millimeters thick .... **Alupag** (p. 53)
   7. Leaflets neither hairy nor white beneath.

8. Leaflets 5 pairs or more.
    9. Bark without cedary odor.
        10. Bark black, ridged .... **Amuguis** (p. 50)
        10. Bark steel gray, not ridged .... **Dao** (p. 50)
    9. Bark with a distinct cedary odor................ **Calantas** (p. 45)
8. Leaflets less than 5 pairs.
    9. Bark gray with a yellowish tinge; sapwood contains a greenish black oily sap .... **Batete** (p. 36)
    9. Bark brown to nearly black; fruit with oily spines. **Supa** (p. 37)
    9. Bark light or steel gray with an orange tinge .... **Ipil** (p. 38)

5. Leaves doubly compound.
    6. Leaflets white beneath.
        7. Leaflets less than 1 centimeter long; leaves large and fern-like. **Cupang** (p. 39)
        7. Leaflets 2 centimeters or more long; leaves not fern-like. **Acleng-parang** (p. 40)
    6. Leaflets hairy beneath .... **Salinkugi** (p. 41)
    6. Leaflets neither white nor hairy beneath.
        7. Usually 3 pairs pinnæ .... **Banuyo** (p. 41)
        7. Usually 1 pair pinnae .... **Acle** (p. 42)

ABREVIATIONS USED FOR PROVINCES, SUBPROVINCES, ISLANDS, AND DIALECTS.

Ab.	Abra (subprovince).
Ag.	Agusan (subprovince).
Al.	Albay Province.
B.	Bicol dialect.
Bal.	Baler (subprovince).
Bas.	Basilan Island.
Batn.	Bataan Province.
Bat.	Batangas Province.
Ben.	Benguet Province.
Bul.	Bulacan Province.
Bur.	Burias Island.
But.	Butuan (subprovince).
Cag.	Cagayan Province.
Cam.	Ambos Camarines Province.
Cav.	Cavite Province.
Cot.	Cotabato district.
Dav.	Davao district.
Guim.	Guimaras Island.
Il.	Ilocano dialect.
I. N.	Ilocos Norte.
I. S.	Ilocos Sur.
Ib.	Ibanag dialect.
Ig.	Igorot dialect.
In.	Infanta (subprovince).
L.-B.	Lepanto-Bontoc Province.
Lag.	Laguna Province.
Lan.	Lanao district.
Ley.	Leyte Island.
Mar.	Marinduque Island.
Mas.	Masbate Island.
M.	Mindoro Province.
Mind.	Mindanao Island.
Mis.	Misamis Province.
N.	Negrito dialect.
N. E.	Nueva Ecija Province.
N. Luz.	Northern Luzon.
N. V.	Nueva Vizcaya Province.
Neg.	Negros Island.
Pal.	Palawan Island.
Pam.	Pampanga Province.
Pan.	Panay Island.
Pang.	Pangasinan Province.
Riz.	Rizal Province.
Rom.	Romblon Island.
S. Luz.	Southern Luzon.
Sam.	Samar Island.
Sor.	Sorsogon Province.
Sp.	Spanish.
Sur.	Surigao Province.
T.	Tagalog dialect.
Tar.	Tarlac Province.
Tay.	Tayabas Province.
Tic.	Ticao Island.
U.	Union Province.
V.	Visayan dialect.
Z.	Zambales Province.
Zam.	Zamboanga district.

NOTES ON THE COMMON NAMES OF TREES.

The matter of establishing a uniform common name for a given species is a difficult one even in the United States where there is one universal language. It may be easily imagined how much more complicated this becomes where there are, as in the Philippines, languages and dialects numbering, according to various authorities, from thirty to eighty. The confusion arising from this source leaves the average man helpless, in so far as recognizing a given tree by its local name is concerned.

The variations in local names fall principally into three classes: First, the case where various forms of a single name are applied to one species, or often to two or more species within one genus. The most familiar instance occurs in the case of *molave,* such widely varying forms as *muláwin, amugáuan, hamuráuon,* etc., being found in different regions for the two or three species of *Vitex* that produce a hard, durable wood. Second, where radically different names are applied to one and the same species. A familiar instance of this is furnished by *tindalo* (*Pahudia rhomboidea*) ; the official name is Tagalog, but in northern Luzon it is known as *magaláyao,* in southern Luzon and the Visayas as *baráyong* or *baláyung.* Third, where one name, instead of being confined to one species or even genus, is transferred to a different genus or even to plants of different families. Besides these, there are a number of cases where several names are applied to all or several of the species within one or two genera of a given family, but are rarely found outside that family. Two of the most striking instances of this are in the Gutta-percha and Talisay families. The names *sácat, calumpít, dalínsi,* and *talísay* are applied almost indifferently to half a dozen species of the genus *Terminalia,* of the latter family, but very rarely to other trees, unless with some distinguishing prefix or suffix. Similarly, the names *palacpálac, malacmálac, alacáac, dulítan, tagátoi,* and *manicníc* are found associated with a number of species of *Palaquium,* and certain species of *Illipe* and *Sideroxylon,* of the Gutta-percha family.

When we consider, in addition to this, that most of the names (obscure even to the Filipino as soon as he leaves his own province) are meaningless to the foreigner, and that there is as yet no uniform system of orthography for the Philippine languages, it is easy to see that any attempt to bring uniformity out of this chaos will be as difficult as it is desirable.

Nevertheless, the attempt has been made in the following pages. The following principles have been used as guides: To select, from the various names used for a given species, one either already well established in literature or in commerce, or if none such exists, the most widely known name as recorded in botanical collections, etc.; to select in cases where the meaning is known, such a name as would apply well to the species in question; and, finally, to adopt as nearly as possible, a uniform, phonetic system of spelling. In regard to the last rule, it has been necessary to make one considerable exception; it has not been considered advisable to change radically the spelling of those names that are included in the classification of the four groups as given in the Forest Manual.

A matter that would be of interest and even an appreciable aid to the botanist or forester is that of the meanings of common names, but, valuable as it might be, the average collector has little time to devote to this point. Aside from the fact that our knowledge on this side of the subject is still far from extensive, there is no place in a work of this kind for detailed linguistic studies. However, a few notes on some of the words commonly occurring in plant names would not be out of place.

The words recurring most frequently are color adjectives, among which the following are common: *putí, púlau* or *púrau, mitlá* (white); *pulá* (red); *diláu* or *duláu* (yellow); an obscure and very variable, but frequently occurring word *ngísit, ngítit, ngitngít, innítit* (black); *itím* or *itóm* (black); *ágta, áta, éta* or *íta* (all related to *Aéta,* "Negrito," and meaning "black"). *Laláki* (male) and *babáe* (female) are frequently used to indicate great or less size, or, in other cases, greater or less hardness and durability. *Malakí* and *maliít* mean "large" and "small," respectively. *Dágat* and *láut* (sea), *pantái* (beach), *baibái* and *buhángin* (sand) are often used in names of plants growing on the beach or even on low coastal hills. *Búnduk, búkid,* and *gúbat* (forest or mountain) are used either to indicate that a plant grows only in the mountains or, sometimes, to distinguish a wild species from a cultivated one. *Túbig sálog, ílog,* etc., mean "water" or "river." *Sáhing, sáleng,* etc., mean "resin," "pitch," "gum." *Dugú* is "blood." *Párang,* found in various compounds, means land covered with the open second growth on abandoned clearings. The very common element *bolóng, balíng,* etc., found in many compounds, equals "leaf" and has, in Bicol at least, the derived meaning "medicine." The name *taluto* is derived from *lutu,* "red," "clotted blood." Various names come from the root *tína,* "to dye." *Macaásim* is from Tag. *ásim,* "acid," "sourness." Many names of animals are used, such as *áso* and *áyam* (dog); *usá* (deer); *bayáwak* and *butikí* (lizard); *núang, kalabáu,* and *damúlag* (carabao); *kambíng* (goat); *púsa, ikús, kutíng* (cat); *kabáyo* (from Sp. caballo, "horse"); *alibangbáng* (butterfly); *manúk* (chicken). *Bató* ("stone, rock") is generally used for trees producing very hard woods; *tigás, tugás, tigá, tras* mean "hard." Many prefixes are used, of which the commonest and the one of most constant signification is *mala,* which means "resembling" and is used as are the English words "false" or "bastard;" names compounded with this prefix generally signify that the plant so named resembles another either in general habit or in some particular feature, as leaves, flowers, fruit or bark, color, taste or odor, etc. In the case of timber trees, it sometimes refers to similarity of the wood.

In the matter of spelling, the most important changes made are the substitution of *k* for *c* or *qu*, *c* being retained as a rule only in the combination *ch* and at the beginning of certain names, like *camuning*, that are already well known; and the substitution of *i* for *y*, unless the latter is consonantal as in *yacal*. Also the Spanish orthographic *u* has been omitted between *g* and *i*, except, as above stated, in names found in the classified list of the Forest Manual.

PINE OR SALENG FAMILY.

(Pinaceæ.)

This family, while the most important in temperate regions, where it furnishes the greatest bulk of lumber, is comparatively unimportant in the Philippines. Generally speaking, few representatives are found below 400 meters elevation. The members of the family can be readily distinguished by the resinous woods, combined with the character of the fruits, which are of the familiar type of the pine cone.

ALMACIGA. (Pl. I.)

Almaciga reaches a height of 40 to 45 meters and a diameter of 180 to 200 centimeters. It has a straight, regularly cylindrical bole without buttresses, which reaches a length of one-half to two-thirds the height of the tree. It is found scattered throughout the mountain regions from Cagayan to Davao. While usually above an altitude of 400 meters, scattered specimens sometimes occur as low as 200 meters. It requires fairly deep soil and somewhat protected situations. It seldom, if ever, occurs on exposed peaks or ridges, and is found associated with tanguile and the oaks. It is fairly tolerant of shade.

The bark is 10 to 15 millimeters in thickness, brittle in texture, light greenish to brownish gray in color, sheds in scroll-shaped patterns, and is thickly set with corky pustules; the inner bark is brown streaked with red, grading into a creamy color near the sapwood. The leaves are simple, opposite or nearly so, of a leathery texture, from 3 to 9.5 centimeters long and from 1 to 2.5 centimeters wide.

The sapwood has a light brownish creamy color; the heartwood is light brown, straight grained, soft in texture and light in weight. The wood, probably because of the comparative inaccessibility of the trees, is not found in the markets. The tree is valuable because it yields a resin known locally as almaciga and commercially as dammar. A closely related species yields the kauri resin and lumber of New Zealand. Almaciga resin is either gathered from the trunk, where it hardens after the bark of the tree has been cut, or from the ground at the base of the tree where it has accumulated, or more commonly is mined where trees have stood previously and have long since died and decayed, leaving only large masses of resin in the ground.

The following regions are credited with having almaciga: Luzon (Cagayan, Abra, Benguet, Zambales, Bataan, Tayabas, Camarines, Albay, Sorsogon); Mindoro; Negros; Palawan; Mindanao (Davao and Zamboanga).

Almaciga has the scientific name of *Agathis alba.* Besides almaciga, this tree has the following common names: Adiangao (T., B.); baltik (Pal.); bidiangao (Neg.); bunsog (Ben.); dadiangao (T., B.); galagala (Pal.); litao (Ab.); makao (Mis.); saleng (Il., Tay.); titao (Ab.).

BENGUET PINE. (Pls. II and III.)

Benguet pine reaches a height of 30 meters and diameter of 140 centimeters. The bole is straight and clear; the crown is narrow with the lateral branches weakly developed. It is found in the high mountain region of central and northern Luzon. It reaches an altitude of 3,000 meters. It does best in deep rich soils, is intolerant of shade, and is found in patches sometimes of considerable size scattered throughout extensive grass areas.

The bark is 10 to 25 millimeters in thickness, yellowish or reddish brown in color, and broken into sections by vertical and horizontal fissures. The needle-like leaves, grouped in bunches of three or sometimes two, are 8 to 30 centimeters in length. The sapwood is yellowish white; the heartwood is light reddish brown with alternate light and dark rings, and very resinous. The wood is moderately hard and moderately heavy, resembling the yellow pines of the United States. It is used locally for house construction, mine props, and coffins.

Benguet pine has been reported from the following regions of Luzon: Ilocos Sur; Abra; Lepanto-Bontoc; Benguet; Pangasinan; Zambales.

The scientific name is *Pinus insularis.* It has the general Ilocano common name of saleng. Other names prevailing are bel-bel (Ig.); boo-boo (Ig.); ol-ol (Ig.); palanpino (Cag.); parna (Il.); talanpino (L.-B.); tapulao (Z.).

Under the name of tapulao or salit another species of pine (*Pinus merkusii*) is found in the mountain regions of Zambales and western Mindoro. This differs mainly from Benguet pine in having two needles instead of three.

YEW FAMILY.

(Taxaceæ.)

Species of *Podocarpus, Dacrydium,* and *Taxus* are found on the mountain tops throughout the Philippines. On some mountains the former two genera form almost pure stands on exposed ridges and peaks. The trees are usually low with short stocky trunks. The woods, though hard, are little if at all used in the Philippines.

PALM FAMILY.

(Palmæ.)

The members of this family reach their best development in the dipterocarp forests where the dry season is not pronounced. The trees are more valuable for their by-products than for their wood. The leaves of nipa (*Nipa fruticans*), a mangrove swamp product, is a universal thatching material, and the fermented sap of the inflorescence is the chief source of vinegar and alcohol. In regions where bamboo is scare, split trunks of the anahao palm and palma brava (*Livistona* spp.), anibong (*Oncosperma* spp.), and others replace that product for general house construction, and other domestic uses. Climbing palms (*Calamus* spp.) also furnishes the rattans of commerce which are known locally as "bejuco." (See Part I, p. 59.)

AGOHO OR CASUARINA FAMILY.

(Casuarinaceæ.)

While this family produces several species, agoho is the only one of commercial importance.

AGOHO. (Pls. IV and V.)

Agoho is a tree reaching a height of 20 to 25 meters, and 50 to 60 centimeters in diameter, though it is usually much smaller. The bole is variable, being sometimes cylindrical and sometimes irregular. The crown is conical in shape and open. It is found scattered throughout the Philippines, where it usually occurs in groups on newly formed sand beaches or sand bars of the large rivers. It is distinctly an intolerant species.

The bark is 5 to 10 millimeters in thickness, brown to dark brown in color, smooth when young, roughening in old trees into fine ridges of greater or less length; the inner bark is bright rose in color and has a bitter taste. The leaves are reduced to small scales; in their place are thickly set jointed branchlets, which give the tree the general appearance of a pine.

The wood of agoho is very hard, very heavy, difficult to work and is considered durable. The sapwood is slightly lighter in color than the reddish brown to dark brown heartwood. It has large pith rays resembling those of oak. It has the following uses: Posts; railway ties; firewood.

Agoho has been collected from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Benguet, Pangasinan, Nueva Ecija, Tarlac, Pampanga, Zambales, Laguna, Baler, Infanta, Tayabas, Camarines, Sorsogon, Albay); Palani Island; Camiguin Island; Polillo Island; Ticao Island; Masbate; Mindoro; Palawan.

The scientific name of agoho is *Casuarina equisetifolia*. It has the general Tagalog name of agoho. Various forms of this name are agoso, agoo, and aroo. Karamutan (Moro) and malabohok (V.) are other local names.

Other species of *Casuarina* are present in the Philippines, principally in the mountains. These can be readily distinguished from agoho by their finer pith rays.

OAK OR KATABANG FAMILY.

(Fagaceæ.)

About twenty-five species of oak have been described as belonging to the Philippines. Trees of this genus occur at low altitudes, but are more abundant at 500 meters or more above sea level, where they often form a quite prominent feature of the forest. The wood is little used and can be readily distinguished by the prominent pith rays. The following common names are recorded for the various species of oak: Bangai (Ley.); basakan (Cam.); bultiok (Cag.); diraan (Pan.); kataban (Batn.); kotilik (Ben.); makabingao (N. V.); manaring (N. V.); olayan (Al.); pangnan (Batn.); palaien (Ab.); palonapoy (Z.); tiklik (Cag.); ulian (Cag.).

ELM OR MALAIKMO FAMILY.

(Ulmaceæ.)

The wood of malaikmo or malagibuyo (*Celtis philippinensis*) comes from a medium-sized tree scattered throughout the dipterocarp forests. This tree can be readily distinguished by its prominently three-veined leaves and by the black flecks of the inner bark. The wood is soft and light in weight and is used locally for various classes of light constructions. To this family belongs anabion or hanagdon (*Trema amboinensis*), a very small rapidly growing tree that sometimes forms almost pure stands in places where caiñgins have been abandoned. The wood is used only locally.

FIG OR ANTIPOLO FAMILY.

(Moraceæ.)

While the number of species and individuals of this family is large, only a few produce wood of any great value. The members can be readily recognized by the fact that the bark when cut exudes freely a thin milky sap. This character combined with alternate leaves distinguishes the family from all others. (See Betis family, p. 89.)

ANUBING. (Pl. VI.)

Anubing is a tree of medium height with a straight regular unbuttressed bole. It is found scattered on the edges of the dipterocarp type and on the moister slopes of the molave type.

The bark is 5 to 8 millimeters in thickness, light orange to dark orange red in color, in young trees papery in texture, in older ones harder and shedding in small patches. The inner bark is pink in color. On being cut, it exudes freely a milky sap which thickens rapidly on coming in contact with the air. The leaves are from 18 to 35 centimeters long and from 9 to 16 centimeters wide, hairy beneath and on the veins above.

The sapwood is a creamy white; the heartwood bright yellow when fresh cut, turning on ageing to a chocolate brown or greenish black. It is straight grained, moderately hard, moderately heavy, very durable, and the pores generally contain white deposits. It has a disagreeable odor and taste, especially when fresh. It has the following uses: House construction (especially posts and rafters); railroad ties; canoes; naval construction.

Anubing has been found in the following regions: Luzon (Ilocos Sur, Abra, Bontoc, Rizal, Zambales, Bataan, Laguna, Tayabas, Camarines, Albay, and Sorsogon); Ticao Island; Masbate Island; Mindoro; Marinduque Island; Negros Occidental; and Surigao.

The scientific name of anubing is *Artocarpus cumingiana,* though some other species of *Artocarpus* produce the wood which passes for anubing. This tree has the general Tagalog name of anubing and the Visayan name of cubi. This latter name must not be confused with the cubi of Zamboanga, which is malacadios. (See p. 33.) Other names for anubing are bayuko (V.); kalulot (M.); nerek (N. Luz.); panganamaen (Il.); ubien (Il.).

ANTIPOLO. (Pl. VII.)

Antipolo is a tree reaching a height of 20 to 30 meters and a diameter of 60 to 100 centimeters. The bole is regular and gives lengths up to 15 meters. It has a dense crown, $\frac{1}{3}$ to $\frac{2}{3}$ the height of the tree. The tree is found scattered throughout the dipterocarp forests, growing best in deep soils. It is slightly tolerant of shade.

The bark is 10 to 15 millimeters in thickness, very dark in color tinged with red, and with obscure irregularly broken ridges; the inner bark is salmon red, yielding when cut a milky sap. The leaves are alternate, usually deeply lobed and very large, sometimes reaching 90 centimeters in length.

The sapwood is light creamy and the heartwood is bright yellow in color. The wood is softer than anubing and less durable. It has the following uses: Bancas; flooring; keels and planks of ships; ordinary furniture.

The tree is widely distributed throughout the Philippines from Cagayan to Mindanao. The scientific name of antipolo is *Artocarpus communis.* A cultivated form of it produces the bread fruit. Besides antipolo it has the following names: Pakak (Il.); tipolo (B.). Cultivated forms are known under the names of bread fruit, kamangsi (T.); rima (T.); ugob (B.).

NANGKA.

Nangka (*Artocarpus integrifolia*) is a small to medium-sized tree cultivated for the jack fruit. It has roundish leaves from 6.5 to 10 centimeters long and from 4 to 9 centimeters wide. The wood is softer and more even in texture than anubing; golden yellow in color, turning dark brown with age. It is used principally for the back and sides of stringed instruments and for furniture.

Besides the above named the forests contain many species of the genus *Ficus*. A number of these under the common name of "balete" start upon other trees and finally entrap them entirely. Some of the baletes produce an inferior quality of rubber. Some of the species like tangisang-bayawak (*Ficus variegata*) are large and can probably be utilized for match woods. Hagimit (*Ficus minahassæ*), with its long pendulous fruit stalks, is a conspicuous tree of the river bottoms, especially in second-growth forests. The woods of species of *Ficus* are soft, light, and of inferior quality, and the trees usually have ill-formed, short boles. The India rubber tree (*Ficus elastica*) and castilloa (*Castilloa elastica*) are cultivated to some extent for rubber.

Kuyus-kuyus (*Taxotrophis ilicifolia*) is a small tree with prickly leaves, whose wood is used extensively in making walking sticks. It is hard and heavy; the heartwood is streaked or mottled with green or dark brown and is sometimes almost black. Malambingan (*Allæanthus glaber*) is a medium-sized tree with a nearly white sapwood subject to the attacks of beetles; the outside heartwood is brilliant red, which grades into a light grayish brown; light in weight to moderately heavy and soft to moderately hard. Closely related species have the common names of himbabau (T.) and aplit (Pam.). Kalios (*Streblus asper*) is a small tree common in second-growth forests.

TAMAYUAN FAMILY.

(Olacaceæ.)

This family is represented in the Philippines by one commercial species.

TAMAYUAN. (Pl. IX.)

Tamayuan is a small to medium-size tree reaching a height of 20 to 25 meters and a diameter of 50 centimeters. The bole is short and usually somewhat irregular in shape. The crown is dense and rather elongated. It has a prominent place as a second-story tree in some dipterocarp forests. It does best on slopes with a fairly deep soil and is distinctly tolerant of shade.

The bark is 5 to 12 millimeters in thickness, smooth, dark brown to nearly black in color, and is thickly set with corky pustules. It is shed in large irregular patterns, the freshly exposed portions being cinnamon brown in color. The inner bark is yellowish with whitish rings. The leaves are simple, alternate, smooth, from 5 to 16 centimeters long and from 2 to 8 centimeters wide.

The sapwood has a light gray color and is sharply distinguished from the reddish brown heartwood. The wood is moderately heavy to heavy, hard, very fine and straight grained, and durable. It has the following uses: House building (especially posts, joists and rafters); ax handles; mining props; railway ties.

The tree has been found in the following regions: Luzon (Cagayan, Ilocos Norte, Isabela, Bulacan, Bataan, Laguna, Tayabas, Camarines, Sorsogon); Catanduanes Islands; Masbate; Mindoro; Leyte; Mindanao (Lanao and Zamboanga). The scientific name of tamayuan is *Strombosia philippinensis*. It has the general common names of tamayuan and kamayuan or some forms of these.

MAGNOLIA OR CHAMPACA FAMILY.

(Magnoliaceæ.)

Among others this family is represented by the champaca (*Michelia champaca*), cultivated for ornament, and patangis (*Talauma villariana*), a small tree occurring occasionally in the dipterocarp forests.

PAWPAW OR ILANG-ILANG FAMILY.

(Anonaceæ.)

With some practise the species of this family can be distinguished by the prominent pith rays in the bark and woods. They have alternate, simple leaves. The trees are usually small to very small and occur as undergrowth in the dipterocarp forests. A number of the species have the common name of lanutan. Among the more prominent is ilang-ilang (*Canangium odoratum*) whose blossoms are the source of the famous ilang-ilang perfume. It occurs in the dipterocarp forests and is cultivated to some extent. Dalinas or latuan (*Cyathocalyx globosus*) is a medium-sized tree whose small heartwood is purplish brown in color, hard, and heavy. So far as is known it is used only locally.

This family also contains the following introduced species cultivated for their fruits: Anonas or custard apple (*Anona reticulata*); atis or sweetsop (*Anona squamosa*); guanabano or soursop (*Anona muricata*).

NUTMEG OR DUGUAN FAMILY.

(Myristicaceæ.)

The trees of this family can be readily distinguished from all others by the abundant flow of a thin red sap when the bark is slashed. The leaves are simple and alternate. Two species seem to furnish timber that reaches the markets in small quantities at least and is used rather more extensively locally. A number of species of this family have the common name of duguan, but this name is most commonly applied to *Myristica philippensis*.

DUGUAN. (Pl. X.)

Duguan is a small to medium-sized tree reaching a height of 15 to 25 meters and a diameter of 60 or more centimeters. The bole is usually somewhat irregular, slightly buttressed and yields lengths up to 12 meters. The crown is irregular and somewhat dense, about one-third the height of the tree. This species is found scattered throughout the dipterocarp forests. It requires good soil and is fairly tolerant of shade.

The bark is 4 to 6 millimeters in thickness, nearly black in color with light brown patches where freshly shed; the inner bark is brown to reddish brown in color, and when cut exudes a thin red sap. The leaves are alternate, simple, rusty hairy beneath, from 13 to 36 centimeters long and from 6 to 13 centimeters wide. The sapwood is very light creamy pink in color; the heartwood is slightly darker in color, soft, moderately heavy, not durable, and somewhat spongy in texture. It is used locally for light and temporary construction, boxes, and dry measures.

Duguan has been reported from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Benguet, Pangasinan, Baler, Rizal, Bataan, Laguna, Batangas, Tayabas, Camarines); Camiguin Island; Mindoro; Leyte; Palawan; Culion; Mindanao (Zamboanga, Lanao); Basilan Island.

The scientific name of duguan is *Myristica philippensis.* Tambalao (*Knema heterophylla*) also furnishes some of the wood known as duguan. This tree is somewhat smaller than *Myristica philippensis,* with small leaves (from 14 to 24 centimeters long and from 5 to 8 centimeters wide) white underneath. Besides duguan (T.) and tambalao (Z. and Batn.) species of this family have the following common names: Anapias (Pang.); anis-kahoi (T.); anis-moscada (T.); balintua (Z.); dumadara (Cag.); durugo (Lag.); hindang-atian (Ley.); lanot (Cag.); malamabolo (Pang.); palong (Il.); pao (Il.); saging-kahoi (T.); talang-talang (T.); talihagan (Cag.). (Pl. XI.)

CINNAMON OR BATICULIN FAMILY.

(Lauraceæ.)

This family, while it contains a large number of tree species, yet yields only a few of little value, principally because the species are small or are so scattered that quantities can not be obtained in any one place. The members of the family (at least the species mentioned here) have simple alternate leaves. The principal woods are known as baticulin and malacadios. Except in a few cases it is impossible with our present knowledge to refer a number of similar woods to definite species. There seem to be three grades with transition forms between them.

Marang or white baticulin: This is a medium sized-tree with a straight cylindrical bole. Though scattered, it is widely distributed. The wood is very pale yellow fading to a dirty white. It is soft, light in weight, coarse grained, and not as resistant to the attacks of insects as the yellow baticulins. The species that produces this wood is *Litsea perrottetii.* While formerly thought to be the tree that produces baticulin of commerce it is now known that little if any of the baticulin of the sculptors comes from this species. (Pl. XII.)

Yellow baticulin: The woods known as baticulin to the cabinetmakers, carvers, sculptors, etc., are soft to moderately hard, light in weight to moderately heavy; pale straw color to deep yellow with reddish or greenish tints; generally with a distinct odor similar to camphor, and rarely attacked by insects. Certain species referred to the genera *Litsea, Phoebe, Dehaasia,* and perhaps *Neolitsea* and others produce yellow baticulin. Baslayan (*Dehaasia triandra*) is a medium-sized tree producing a wood

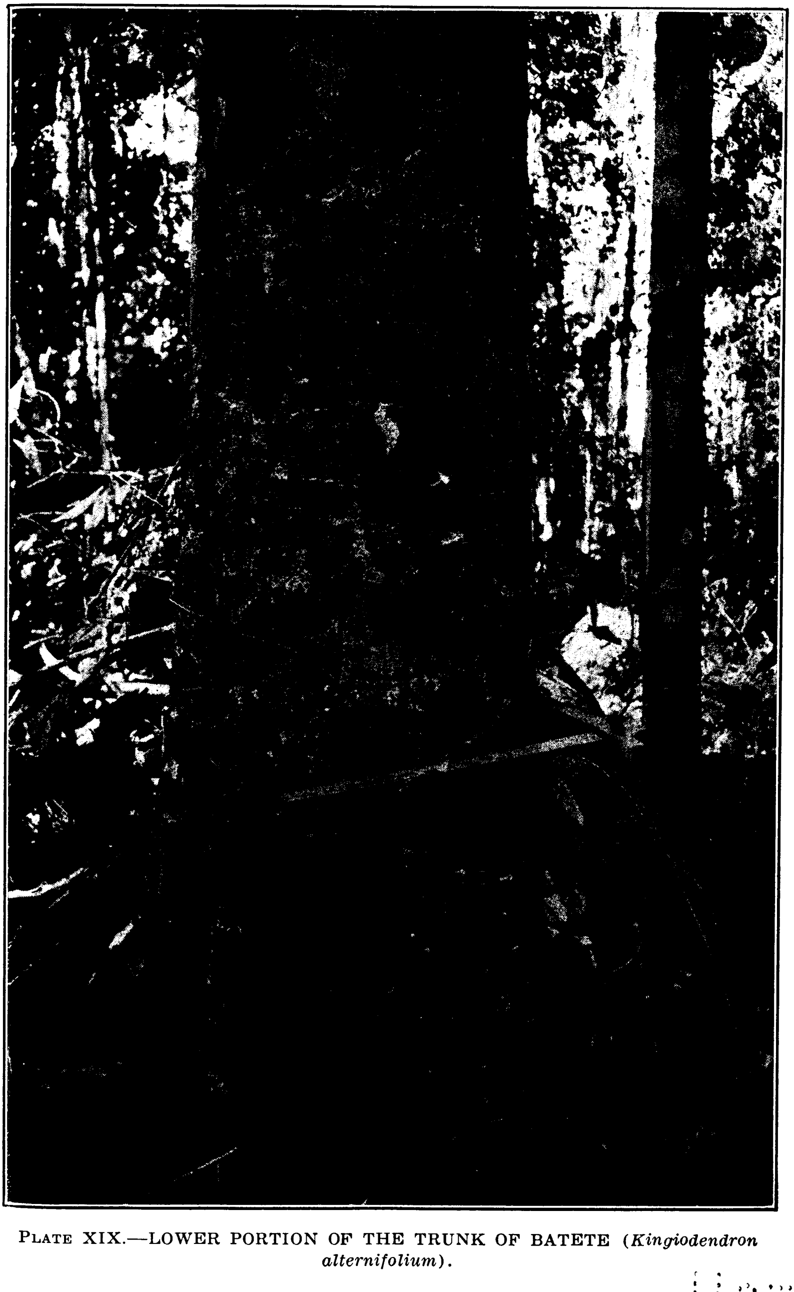

PLATE XIX.—LOWER PORTION OF THE TRUNK OF BATETE (*Kingiodendron alternifolium*).

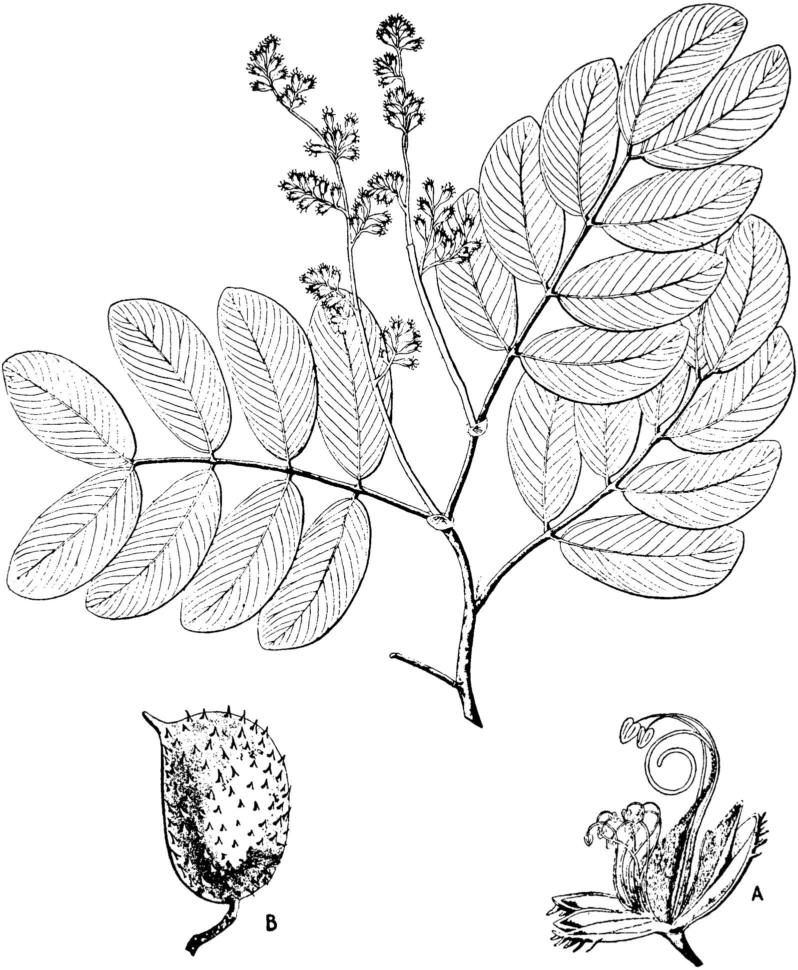

PLATE XX.—SUPA (*Sindora supa*).

a, Flower; *b,* fruit.

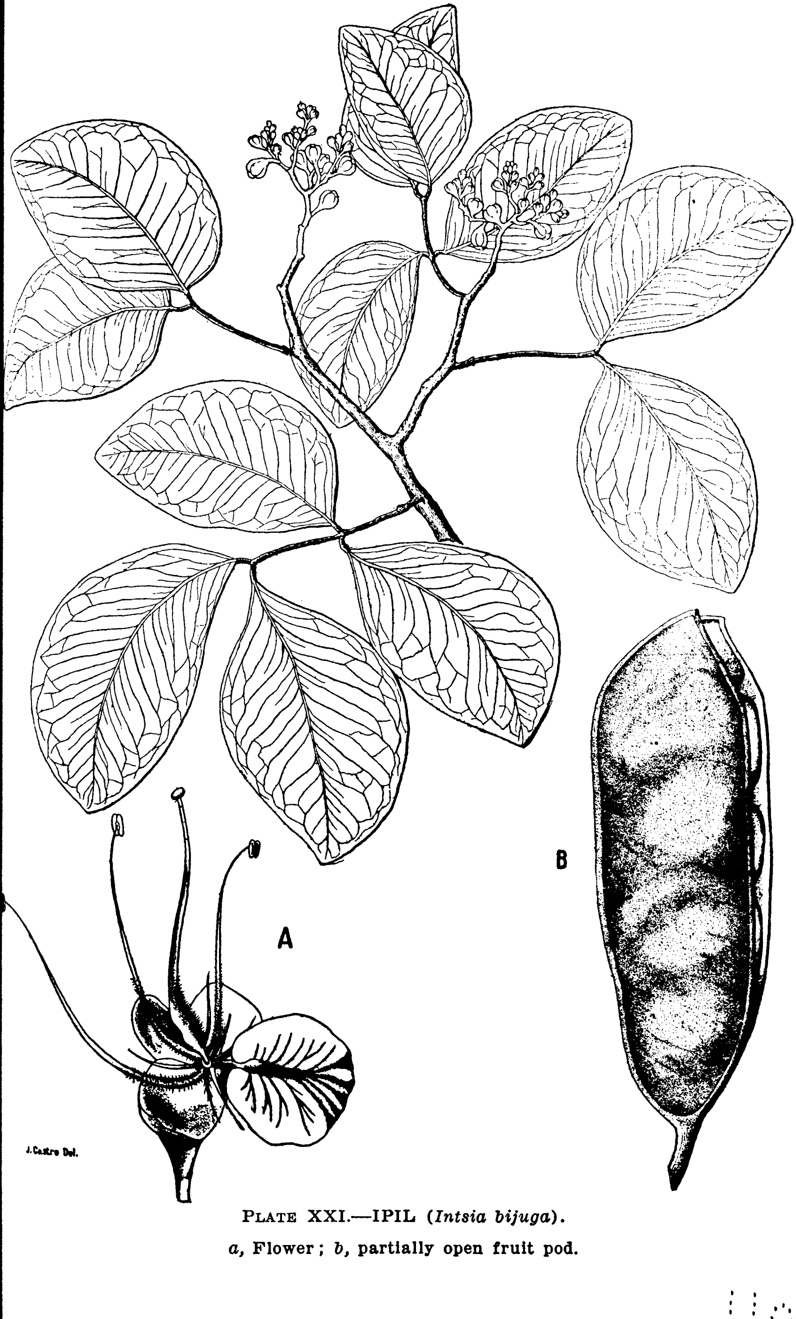

PLATE XXI.—IPIL (*Intsia bijuga*).

a, Flower; *b*, partially open fruit pod.

PLATE XXII.—LOWER PORTION OF THE TRUNK OF MERRILL'S IPIL (*Intsia acuminata*).

J. Vitan del.

PLATE XXIII.—TINDALO (*Pahudia rhomboidea*).

a, Seed; *b*, fruit.

J.Vitan

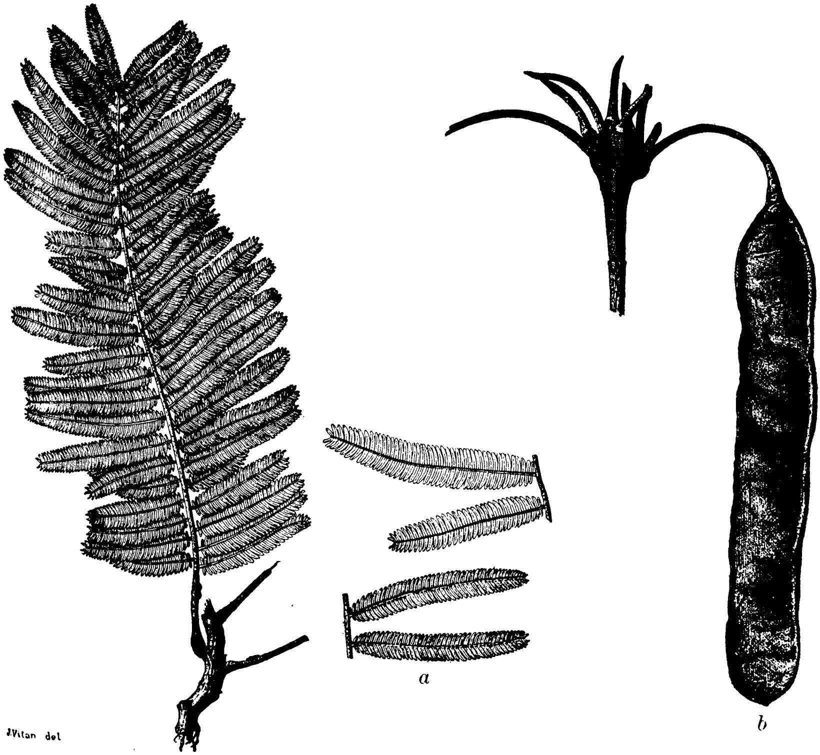

PLATE XXIV.—CUPANG (*Parkia timoriana*).

a, Pinnæ; *b*, fruit pod.

PLATE XXV.—LOWER PORTION OF THE TRUNK OF CUPANG (*Parkia timoriana*).

Showing character of bark; leaves attached to the trunk.

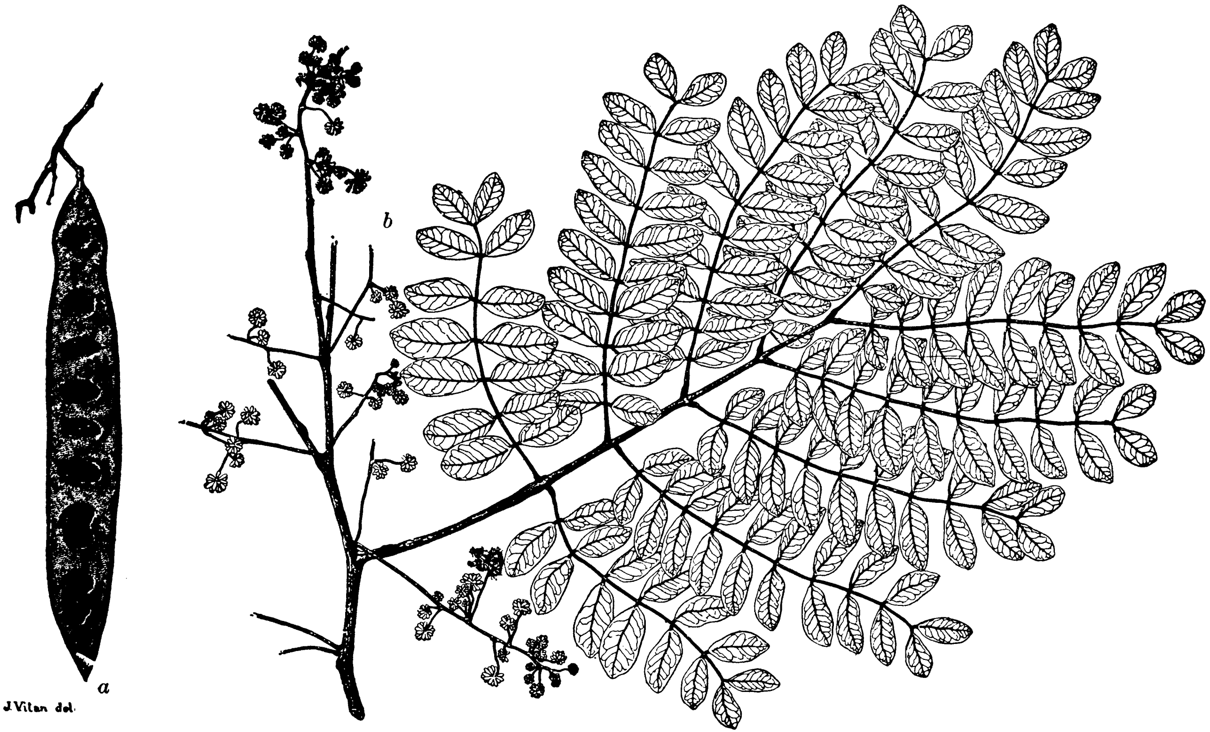

PLATE XXVI.—ACLENG-PARANG (*Albizzia procera*).

a, Fruit pod; *b*, cluster of young flowers.

PLATE XXVII.—PORTION OF THE BARK OF ACLENG-PARANG (*Albizzia procera*).

Leaves attached.

PLATE XXVIII.—SALINKUGI (*Albizzia saponaria*).

a, Fruit pod; *b*, cluster of flowers.

J. Vilan del.

PLATE XXIX.—BANUYO (*Wallaceodendron celebicum*).

a, Fruit pod; *b*, flower cluster.

dVilan

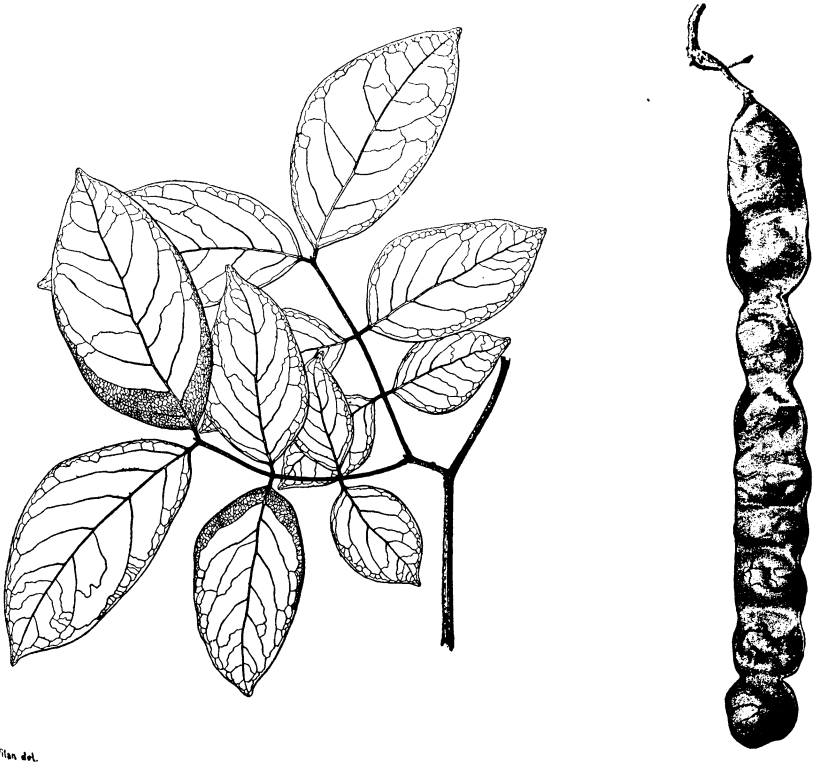

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PLATE XXX.—ACLE (*Albizzia acle*).

a, Fruit pod.

PLATE XXXI.—PORTION OF TRUNK OF ACLE (*Albizzia acle*).

Cluster of leaves and fruit attached.

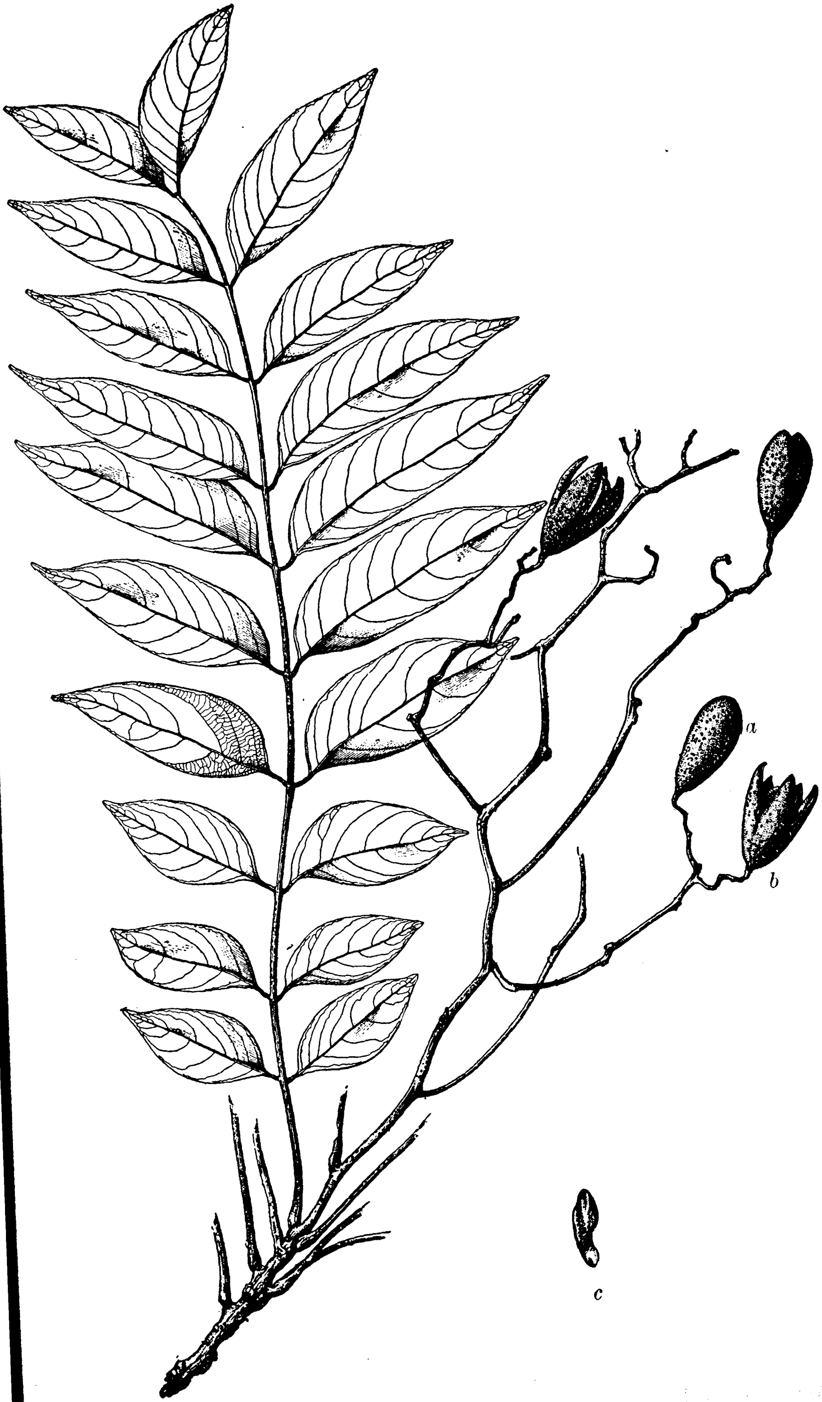

PLATE XXXII.—CALANTAS (*Toona calantas*).

a, Closed fruit; *b*, opened fruit; *c*, seed.

PLATE XXXIII.—YOUNG TREES OF CALANTAS (*Toona calantas*).

J. Vilan del.

PLATE XXXIV.—SANTOL (*Sandoricum indicum*).

a, Fruit; *b,* cross section of fruit.

PLATE XXXV.—MALASANTOL (*Sandoricum vidalii.*)

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deep yellow in color, soft, light to moderately heavy that is undoubtedly accepted by sculptors as baticulin. Malaya (*Phoebe sterculioides*) has a somewhat heavier and slightly darker wood than the average baticulin. Pusopuso (*Neolitsea vidalii*) produces a wood that is greenish yellow, streaked and mottled with brown, moderately heavy and moderately hard. It would perhaps be accepted as baticulin. Some species of *Litsea* produce wood so similar to the description given above that they will undoubtedly pass for baticulin.

Dugkatan (*Cryptocarya bicolor*) has a dark brown heartwood sharply marked off from the dull yellowish sapwood; it is hard, moderately heavy, rather fine and straight grained and has a good reputation for durability. It is known only from Mindanao. It is used for house posts. In mechanical properties and durability this wood might be classed with malacadios.

Malacadios (*Beilschmiedia cairocan*) is a tree that reaches a height of 30 meters and a diameter of 70 or more centimeters, with a bole 16 to 20 meters long. The bark is 15 to 20 millimeters in thickness, is gray to a dirty brown in color and distinctly ridged. Beneath the cork is a white spongy layer, very thin and pitted; this grades into a brown or dark brown color near the sapwood. The leaves are simple, alternate, whitish beneath, from 9 to 20 centimeters long and 3 to 8 centimeters wide. The wood is yellow, moderately heavy to heavy, moderately hard to hard, rather fine grained, when fresh has an odor much like aromatic vinegar and is said to be difficult to burn. The wood has the following uses: House construction (flooring, posts); furniture; shipbuilding. This tree has the following known distribution: Luzon (Ilocos Norte, Ilocos Sur, Tayabas, Camarines); Ticao Island; Masbate; Panay; Zamboanga. Besides malacadios, a name that is used in the northern islands, it has the local name of cubi in the Zamboanga region. (Pl. XIII.)

Tambulian (*Eusideroxylon zwageri*) is the Tawi Tawi name for the ironwood or billian of Borneo. The wood is yellow, on exposure turning to a glossy brown; very hard and very heavy and generally straight grained. It is difficult to saw, but is not hard to finish. It is said to be the best wood in the world for piling and is used for heavy construction, bridges, telegraph and telephone poles, and railway ties. In the Philippines it is known only from the Island of Tawi Tawi.

Kalingag (*Cinnamomum mercadoi*) is a medium-sized tree usually found in the tanguile-oak type. The wood is dull reddish brown, with dark mottlings and streaks; soft to moderately hard; moderately heavy; both bark and wood have a strong taste and odor of sassafras. The camphor wood (*Cinnamomum camphora*) is not native to the Philippines and has only recently been introduced. Cinnamon is gathered and used locally in Mindanao from *Cinnamomum mindanaense*.

MAMALIS FAMILY.

(Pittosporaceæ.)

Mamalis (*Pittosporum pentandrum*) is a small tree growing in open places with the common names of basuit (Il.); darayao (Pal.); dili (N. V.); mamalis (T.). It yields a light colored wood, moderately hard, that is used only locally.

ROSE OR LIUSIN FAMILY.

(Rosaceæ.)

This family yields only one timber tree of commercial importance.

LIUSIN. (Pls. XIV and XV.)

Liusin is a medium-sized tree reaching a height of 25 to 30 meters and a diameter of 70 to 100 centimeters or larger. The bole is usually regular and straight, slightly buttressed. The crown is irregularly conical and dense. It is very scattered throughout the dipterocarp forests, found both on moist and dry soils and is intolerant of shade.

The bark is 5 to 8 millimeters in thickness, light brown or slightly gray in color; smooth and, where freshly shed, often very light gray with a tinge of green. In Mindanao, at least, the bark is shed in large elongated plates turned out below. This gives the tree a striking appearance. The inner bark is tan red in color, very brittle, and when cut exudes a sweetish watery sap. The leaves are simple, alternate, free from hairs, with two more or less prominent glands at the base of the leaf blade. They are somewhat leathery in texture, from 9 to 15 centimeters long and from 3 to 7 centimeters wide.

The sapwood is creamy brown in color; the heartwood is light reddish brown, heavy, very hard, extremely difficult to saw, fine and usually straight grained. It is very durable in contact with salt water. Liusin is especially valuable for piling, and also used for shipbuilding and house posts.

The following regions contain liusin: Luzon (Cagayan, Ilocos Sur, Abra, Nueva Ecija, Pangasinan, Rizal, Zambales, Bataan, Tayabas, Camarines); Mindoro; Samar; Leyte; Guimaras Island; Mindanao (Zamboanga, Lanao and Davao).

The scientific name of liusin is *Parinarium griffithianum*. Other species of the genus produce wood indistinguishable from liusin. Until recently the tree seemed to be little used and was first known under the name of liusin from Bataan and Zambales. The following local names are known: Aningat (Cag.); bakayo (Pang.); bingao (Il.); binggas (Pang.); dungon-dungonan (Tay.); kankangan (Dav.); kapgangan (M.); kulatingan (Tar.); malafuga (Tay.); maluktuk (Moro); mantalingan (Zam.); matamata (Ley.); olayan (Sam.); pasak; sabongkaag (Il.); sampinit (Guim.); sarangan (Sam.); tabun-tabun (Al.); tadian-manuk (Riz., Ab.); tiga (Sam.).

Lago or liusin-gubat (*Pygeum preslii*) and other species of *Pygeum* are sometimes used as lumber. An extract from the bark of lago is employed locally to dye cloth.

LOCUST OR NARRA FAMILY.

(Leguminosæ.)

The Narra family is, next to the dipterocarp family, the most important one from a lumber standpoint in the Philippine Islands. With the exception of cupang, it is preëminently the family of fine and durable furniture woods. A group of six of these, viz: narra, tindalo, banuyo, supa, acle, and ipil, have a beautiful grain and color, and for furniture and cabinetmaking will compare with any six other woods in the markets of the world. Nowhere appearing in any considerable quantity, the members of this family are encountered isolated here and there in situations with dry or sandy soils (tindalo, supa, ipil, and banuyo) or occupy places on moist flats or along streams (acle, ipil, and narra). Cupang, salinkugi, and acleng-parang are usually confined to the open parang country. All of the species mentioned are intolerant of shade, and associated with this they are found destitute or nearly destitute of leaves during a portion of the dry season. All of them also show seasonal rings of growth. The members of the Narra family mentioned here have simply or doubly compound leaves. The fruit is a one-seeded pod (batete), a winged pod with or without spines (various kinds of narra); a pod with oily spines (supa), or the usually long pod so characteristic of the family. The trees are usually medium size with short thick trunks, often large buttresses (narra and cupang) and broad spreading, open, vase-shaped crowns. They often give character to the vegetation, because they overtop the surrounding low growth and during the dry season their bare, or nearly bare, branches stand out in sharp contrast.

NARRA. (Pls. XVI and XVII.)

Narra is a medium-sized tree, 20 to 30 meters in height with an average diameter of 70 to 80 centimeters, though exceptional trees will reach a diameter of 150 to 200 centimeters. The bole has a merchantable length up to 15 meters, is usually angular and irregular and has flat buttresses, from which one-piece table tops 1.5 to 2 meters in diameter are made. It has a low-branching, wide-spreading, vase-shaped crown which is about one-half the total height of the tree.

Narra is found throughout the Philippines, principally in the forest regions where the dry season is not pronounced, nearly always occupying places on flat coastal plains behind mangrove swamps, or very scattered along streams in the low hills near the coast. In the former situation, for small areas, as high as four or five trees to the hectare may be found. While it prefers low, damp soils, occasional trees may be found on drier slopes. It is decidedly a light-loving tree and is nearly deciduous for a short time during the dry season.

The bark is 3 to 5 millimeters in thickness, soft to the touch, grayish yellow to brownish yellow in color, with fine longitudinal lines about a centimeter apart. It is often shed in small thin flakes. The inner bark is light red, streaked with darker red short tubes united in vertical rows. These, when cut, exude a crimson liquid which on solidification becomes a very dark reddish brown. This liquid is said to have medicinal and dyeing properties. The leaves are simply compound, alternate, with 6 to 11 leaflets, which are smooth, from 5 to 13 centimeters long and from 2 to 8 centimeters wide.

The sapwood is nearly creamy white. The heartwood is yellow, red, or nearly white. It has a faint, sweet cedary odor, and chips soaked in water turn it fluorescent blue. The wood is moderately heavy, moderately hard to hard, with coarse and sometimes twisted grain, and durable, the heart being rarely attacked by insects. It has fine parallel cross lines ("ripple marks") in longitudinal sections.

Narra has the following uses: Bancas; bridge construction; cabinet-making; carabao yokes; carriage making; carving; doors; door panels; finishing of houses; floors; furniture; posts; railway ties; store fronts; table tops; walls; window sills.

The scientific name of narra is *Pterocarpus indicus*. Closely related species are prickly narra (*Pterocarpus echinatus*) and Blanco's narra (*Pterocarpus blancoi*) which are much like narra in all particulars except character of the fruits.

The distribution of the narras is as follows: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Union, Benguet, Pangasinan, Nueva Ecija, Tarlac, Zambales, Bulacan, Bataan, Rizal, Laguna, Baler, Tayabas, Camarines, Sorsogon, Albay); Palani Island; Marinduque; Mindoro; Masbate; Samar; Leyte; Negros Occidental; Palawan; Balabac Island; Camiguin Island; Mindanao (Surigao, Misamis, Lanao, Zamboanga, Davao).

Narra is the most common commercial name for the wood in the Philippines. It is also known as Philippine mahogany, and is practically the same as the *padouk* of India and Andaman rosewood. The following local names are also known: Agana (T.); antagan (Ib.); apalit (Tar.); asana (T., Il.); daitanag (Pam.); dungon (Kalinga Ig.); magalayao (Il., Ib.); naga (B., V.); nala (Moro); naya (Z.); odiao (Pam.); sagat (Cag.); sangki (Il., V.); tagga (Ib.); urian (Pam.).

BATETE. (Pls. XVIII and XIX.)

Batete is a tree which reaches a height of 30 to 35 meters and a diameter of 80 to 100 centimeters. It has a regularly cylindrical unbuttressed bole which has a clear length of 18 to 20 meters. The crown is globular and quite dense and is about one-third the height of the tree.

Batete is confined to the drier soils of the regions where the dry season is not pronounced. It is usually associated with molave or supa on limestone ridges, or with yacal on volcanic hills near the sea. It is slightly tolerant of shade, more so than any other member of this family, and occupies shallow soils usually on the top of ridges.

The bark is 7 to 10 millimeters in thickness; gray to gray-brown in color, with a yellowish tinge; sheds in large scroll-shaped patches. The inner bark is red. The leaves are alternate, simply-compound with from 3 to 7 usually alternate leaflets, which are smooth from 8 to 19 centimeters long and 4 to 9 centimeters wide.

The sapwood is light red, exuding a dirty, dark green, oily sap. The heartwood is reddish brown in color, streaked with black which is due to a dark colored oil. The wood soaked in water produces a brown color, tinged with purple. It is moderately hard and moderately heavy, easy to work and fairly durable. Batete is used for furniture, flooring, interior finish, and siding.

It is known from the following regions: Luzon (Cagayan, Tayabas, Camarines, Albay); Ticao Island; Masbate; Samar; Leyte; Mindanao (Zamboanga, Davao):

Batete has the scientific name of *Kingiodendron alternifolium*. The following local names are known: Danggai (B., V.); duka (Ley.); magbalago (Sam.); palo maria (Zam.); palina (Dav.); salalangin (Al.); talabangon (Sor.).

SUPA. (Pl. XX.)

Supa is a tree reaching a height of 20 to 30 meters, and in exceptional cases a diameter of 150 to 180 centimeters. The bole is regular, straight, and unbuttressed. The crown is very large, usually flattened vase-shaped, open, and with heavy limbs having a diameter of 25 to 40 centimeters. Supa seems to be confined to a limited part of regions without a distinct dry season. Here it occurs on the low limestone ridges near the seashore. It is intolerant of shade.

The bark is 7 to 10 millimeters in thickness, brown to nearly black in color, and sheds in large scales. Where freshly shed, pink colored patches are exposed. The leaves are alternate and simply compound, with usually three pair of leaflets, each smooth, leathery in texture, from 3.5 to 9 centimeters long and from 2.5 to 5 centimeters wide. The fruit is a pod, covered with straight, stiff spines, on the ends of which sticky drops of oil accumulate.

The sapwood is cream colored or pinkish; the heartwood is yellow when fresh, changing on exposure to a yellowish brown, often having a reddish tinge. It colors water a dark-reddish brown, and has a faint peppery odor. The wood is heavy, hard, fairly durable, slightly cross-grained, and rather difficult to work. It has the following uses: House construction (flooring, interior trim, door frames, posts); baseball bats;

bridge construction; naval construction; railroad ties; furniture; cabinet-making. (For a discussion of supa oil see Part I, p. 54.)

Supa has been found in the following regions: Luzon (Baler, Tayabas, Camarines, Sorsogon, Albay); and Mindoro.

The scientific name of supa is *Sindora supa*. Besides supa, the following names for this tree are known: Malapaho (T., V.); manapo (Bal.); parina (B.); yacal dilao (Tay.).

IPIL. (Pls. XXI and XXII.)

Ipil is a tree reaching a height of 30 to 45 meters and a diameter of 150 to 180 centimeters, though usually it is between 60 and 120 centimeters. The usually unbuttressed bole is sometimes straight and regular, though more often crooked and deformed. The tree often forks a short distance above the ground. Exceptionally large trees will have a clear length of 15 to 18 meters. The crown is large, and irregularly vase shaped. Ipil is found scattered throughout the Philippines along the coast, on flood plains near the mouths of large rivers, and occasionally on low hills. It seems to prefer a sandy soil with the ground water level not far below the surface. It is intolerant of shade.

The bark is 5 to 8 millimeters in thickness, gray with an orange tinge in color. The shallow saucer-like depressions made where bark is shed show a tan gray color until exposed for some time. The inner bark is light brown, mottled with pinkish brown specks. The leaves are alternate, simply-compound, composed usually of two pairs of leaflets; these are smooth, from 8 to 12 centimeters long and from 5.5 to 8.5 centimeters wide.

The sapwood is creamy in color, the heartwood is yellow when freshly cut, but turns reddish brown on exposure, and in old well-seasoned pieces it is chocolate colored. The pores frequently contain sulphur-colored deposits. The wood is heavy, hard, stiff, and not difficult to work.

It is one of the most desirable of the common hardwoods because of its great durability. It is used principally for house construction (doors, posts, flooring); railroad ties; paving blocks; telegraph poles; bridge construction; shipbuilding; high class furniture and cabinet work.

The following is the distribution of ipil: Luzon (Cagayan, Baler, Zambales, Bataan, Tayabas, Camarines, Albay, Sorsogon); Camiguin Island; Ticao Island; Masbate; Mindoro; Leyte; Guimaras Island; Dinagat Island; Panay; Negros; Palawan, Mindanao (Zamboanga, Davao, Cotabato, Surigao); Basilan Island; Tawi Tawi.

The scientific name of ipil is *Intsia bijuga*. Another closely related species, with usually three pairs of leaflets instead of two, is Merrill's ipil (*Intsia acuminata*). Ipil is the widespread common name for this wood in the Philippines; others recorded are: Labing (Tay.); sangai (Il.); tanglangao (Cam.). Equivalents of this wood are known in

Samoa as ifi-lele, in Guam as ifil, in Borneo as mirabow, and in the Federated Malay States, as merbou.

TINDALO. (Pl. XXIII.)

Tindalo is a tree reaching a height of 25 to 30 meters and a diameter of 60 to 80 centimeters, occasionally up to 120 centimeters. It is usually without buttresses and has a somewhat regular bole 12 to 15 meters in length. The crown, one-half the height of the tree, is broad spreading, vase shaped, semiopen, and partly deciduous during the dry season. Tindalo has a wide distribution throughout the Islands, but is not abundant. It is found scattered usually on dry, shallow, or rocky soils on the low ridges and hills along the coast. Less frequently it is scattered in the edges of the dipterocarp forests.

The bark is about 10 millimeters in thickness, creamy yellow in color, and has an uneven surface due to the saucerlike depressions made by the shedding of the outer layers. It is covered with numerous corky pustules, and sheds in scroll-shaped patterns. The inner bark is brownish yellow in color. The leaves are alternate, simply compound, with 3 (sometimes 4) pairs of leaflets. These are smooth with a white bloom beneath, from 3.5 to 10 centimeters long and from 3 to 5 centimeters wide.

The sapwood is white to creamy brown; the heartwood is yellowish red, becoming very dark with age. It is heavy, hard, durable, not difficult to work, has a fine, usually straight grain, takes a beautiful finish, and is almost free of the defect of warping.

Tindalo has the following uses: Fine furniture; cabinetmaking; fine interior finish (doors, floors, stairways, panels, etc.); railway ties; shipbuilding; general construction purposes.

The following regions are known to contain tindalo: Luzon (Cagayan, Isabela, Ilocos Norte, Pangasinan, Zambales, Rizal, Bataan, Tayabas, Camarines, Sorsogon); Palani Island; Polillo Island; Ticao; Masbate; Marinduque; Mindoro; Culion; Leyte; Cebu; Mindanao (Zamboanga, Cotabato, Surigao).

The scientific name of tindalo is *Pahudia rhomboidea.* Besides tindalo the most common names are as follows: Apalit (Pang.); Balayong or some form of it (V.); barayong (B.); magalayao (N. Luz.); pintok (Z.); uris (Il.).

CUPANG. (Pls. XXIV and XXV.)

Cupang reaches a height of 35 to 40 meters, and a diameter of 150 to 180 centimeters. The bole is 15 to 20 meters in length, strongly buttressed, but otherwise fairly regular. The crown, about one-half the height of the tree, is large, vase shaped, widespreading, and open. Cupang is preeminently a tree of the rather open and second-growth forests where the dry season is pronounced, and is very scarce or entirely absent in those parts where a pronounced dry season is wanting. It prefers good soils, requires a great deal of light, and therefore is found in the parang or on edges of untouched forests, or in open places of dipterocarp forests.

The bark is 6 to 12 millimeters in thickness, brown to russet-brown in color, often gray where exposed to sunlight. It has a roughened appearance due to shallow vertical broken lines, and is covered with small brown corky pustules. The inner bark is dark brownish red in color. The leaves are alternate, doubly compound, large and fern-like in appearance; the leaflets about 0.5 centimeter in length, and whitish beneath. The tree is bare of leaves from one to six weeks during the dry season.

The large sapwood is creamy white when fresh and then has a very disagreeable odor. On exposure it discolors rapidly. The heartwood is light brown, but is found only in trees 60 centimeters or more in diameter. The wood is light and soft, and decays rapidly.

Cupang has the following uses: Light and temporary construction; packing boxes; wooden soles of shoes; matches. It is known to be good for paper pulp.

The scientific name of cupang is *Parkia timoriana.* Besides cupang and some forms of it, the only known other name in use is butarik (N. Luz.).

Cupang is known to occur in the following regions, though no collections have been made in some of them: Luzon (Cagayan, Isabela, Ilocos Sur, Abra, Benguet, Pangasinan, Tarlac, Nueva Ecija, Pampanga, Bulacan, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines); Mindoro, Marinduque; Palawan.

ACLENG-PARANG. (Pls. XXVI and XXVII.)

Acleng-parang is a medium-sized tree reaching a height of 20 to 22 meters and a diameter of 60 to 90 centimeters. It has a straight, unbuttressed, regular bole about one-half the height of the tree. The crown is vase shaped, rather broad spreading and open. The tree is usually confined to the regions where the dry season is pronounced. Here it is found on the edge of the forest or in the more or less open parang type of forest. It resists fire well, and is intolerant of shade. It will grow in shallow or deep soil, but is seldom found in the latter. It is usually destitute of leaves from two to six weeks during the dry season.

The bark is 5 to 10 millimeters in thickness, smooth, and light gray when young, but on ageing it becomes slightly roughened and brownish gray to yellowish in color. The inner bark is pink, streaked with radiating lighter colored lines. The leaves are alternate and doubly compound with about 3 to 5 pairs of pinnæ, each with 6 to 10 pairs of leaflets; these are whitish beneath, from 2 to 6 centimeters long and from 1 to 2.5 centimeter wide.

The sapwood is large, creamy white; the heartwood is chocolate colored, shining, with alternate belts of darker and lighter color. The wood is hard, moderately heavy, fairly durable, and sometimes substituted for acle. It is used for sugar-cane crushers, rice pounders, wheels, agricultural implements, carving, railroad ties, and house construction.

The tree is known from the following regions: Luzon (Ilocos Norte, Ilocos Sur, Abra, Benguet, Union, Pangasinan, Tarlac, Pampanga, Rizal, Zambales, Bataan, Camarines); Mindoro.

The scientific name of acleng-parang is *Albizzia procera.* The following local names are known: Adaan (Il.); alalangad (T.); aninapla (T.); kalai (Ig.); karial (Z.); palatangan (Il.).

SALINKUGI. (Pl. XXVIII.)

This is a small to medium sized tree attaining a diameter of 80 centimeters and a height of 25 meters, especially in the southern islands. The bole is one-half the height of the tree, usually somewhat irregular, but without buttresses. The crown is broadly vase shaped to globular and is open. It is found throughout the Philippine Islands generally in the parang or open forest.

The bark is about 5 millimeters in thickness, light gray to dark gray in color and densely covered with corky pustules; the inner bark is slightly pink in color and somewhat spongy in texture. The leaves are alternate, doubly compound, consisting usually of 2 pairs of pinnæ, each with 2 to 4 pairs of leaflets; these are from 5 to 14 centimeters long, and from 2.5 to 8 centimeters wide, and are covered beneath with fine velvety hairs.

The sapwood is creamy white; the heartwood is dark brown to nearly black streaked with lighter and darker belts and resembles that of aclengparang. It is moderately hard and moderately heavy. The wood is used locally for general house construction, and, especially in the southern islands, for furniture and fine interior finish.

Salinkugi has the following distribution: Luzon (Ilocos Norte, Ilocos Sur, Benguet, Pangasinan, Pampanga, Bataan, Rizal, Laguna, Tayabas, Camarines, Albay); Mindoro; Ticao Island; Masbate; Guimaras Island; Samar; Negros; Mindanao (Zamboanga, Surigao); Basilan.

The scientific name of salinkugi is *Albizzia saponaria.* Besides the Visayan name of salinkugi, or some form of it, and the Tagalog one of gogong-toko, the following local names are known: Gogo (T.); gogokasai (Tay.); malatoko (Riz.); maratika (Il.); pipi (Neg.); tigian (V.).

BANUYO. (Pl. XXIX.)

Banuyo is a medium to large sized tree with a short, often irregular bole and an open crown. It is scattered throughout the molave type of forest on the dry coastal hills. It is intolerant of shade and seems to thrive best in dry places.

The bark is 5 to 8 millimeters in thickness, gray to brownish-gray in color, not ridged but roughened somewhat by irregularly shaped shallow pits, due to the depressions left where it is shed; the inner bark is dark reddish brown. The leaves are doubly compound with 3 pairs of pinnæ each having about 5 pair of leaflets; these are smooth, from 3.5 to 8 centimeters long and from 1.5 to 4 centimeters wide.

The wood is golden brown in color and resembles acle, but is coarser grained, lighter in color and somewhat softer. It is moderately heavy, moderately hard, durable and is easily worked. Banuyo is used for furniture, cabinetmaking, carving, carriage bodies, picture frames, and fine interior finish. It is also employed for various classes of house construction work, especially flooring and siding.

The tree has been reported from the following regions: Luzon (Cagayan, Isabela, Benguet, Tayabas, Camarines); Camiguin Island; Masbate; Burias Island; Ticao Island; Samar; Negros.

The scientific name of banuyo is *Wallaceodendron celebicum.* Besides the Tagalog name of banuyo the following names are used: Balayong (V.); dauer (Cag.); lupigi (N. Luz.) molina (Cag.).

ACLE. (Pls. XXX and XXXI.)

Acle is a tree of medium height with usually a somewhat irregular bole, 70 to 100 centimeters in diameter and one-half or less than one-half the height of the tree. The trunk has root swells, but no buttresses. The crown is broad spreading, open, and is decidedly thinner during the dry than the wet season. It is a very scattered tree, and is usually found along streams where its roots can easily reach the ground-water level. It is intolerant of shade.

The bark is 8 to 12 millimeters in thickness; is dark brown to almost black, and is covered with thick small scales giving it a very characteristic appearance. When rubbed with saliva or water the bark produces a lather. The inner bark is reddish brown in color, and brittle in texture. The leaves are doubly compound, usually with one pair of pinnæ, each with 3 to 6 pair of leaflets, the terminal pair being much larger than the others. The leaflets are from 4.5 to 18 centimeters long and from 2 to 7 centimeters wide.

The sapwood is creamy white and perishable; the heartwood is a rich dark brown color, fine and curly grained, moderately heavy and hard, and gives water a dark brown color. It has a decided peppery odor. Acle is highly valued for fine furniture and cabinet making, and also has the following uses: House construction (posts, flooring, siding, interior finish); naval construction; ties; sides of guitars; carving.

Acle has been collected from the following regions: Luzon (Ilocos Sur, Union, Pangasinan, Nueva Ecija, Rizal, Zambales, Bataan, Tayabas, Camarines, Sorsogon); Masbate; Mindoro; Negros; Palawan.

The scientific name of acle is *Albizzia acle.* The wood resembles somewhat the pyingadu of India (*Xylia dolabriformis* Benth.). Besides the Tagalog name of acle, the wood is known under the following names: Kita-kita or quita-quita (Il., Pam., Pang.); langip (V.); tabalangi (V.).

Besides the above the following members of this family need mention:

The raintree (*Enterolobium saman*) is extensively cultivated for ornament and shade throughout the Philippines. It is also known as acacia or monkey pod. Camanchile (*Pithecolobium dulce*) is a small to medium sized tree introduced from tropical America, whose bark is used for tanning leather, and the fleshy aril around the seeds is eaten. Anagap or bansilak (*Pithecolobium scutiferum*) is a small to medium sized tree, with large red, deeply lobed and curved pods, whose wood is used to some extent. Kasai (*Albizzia retusa*) is a small tree usually found in the beach type. Aroma (*Acacia farnesiana*) is a small bushy introduced tree found in the second-growth forests or scattered in the grass lands. Ipil-ipil or santa elena (*Leucaena glauca*), introduced from tropical America, is widely distributed in the second-growth forests and is sometimes planted to kill out the cogon grass. It is a small shrubby tree used extensively for firewood. Philippine mesquite or aroma (*Prosopis vidaliana*) is a small prickly tree, introduced from Mexico, that often forms thickets in the beach type. Tanglin (*Adenanthera intermedia*) is a medium-sized tree found scattered in the forests. Its wood is much like ipil and is often sold for it. Kamatog (*Erythrophloeum densiflorum*) is a medium-sized to large tree very scattered in the dipterocarp forests. The wood is not well known. Alibangbang (*Bauhinia malabarica*) is a small-sized tree very common in the parang. The common name signifies butterfly, from the shape of the leaves. Caña-fistula (*Cassia javanica*) is a small to medium sized tree usually found in the molave type. Its wood resembles banuyo in color, but has a structure similar to tindalo. The foreign name, caña-fistula is applied to the introduced *Cassia fistula* L. but most of the wood that reaches the market probably comes from *Cassia javanica.* The following native names also occur: Anahuhan (Tay.); bagiroro (Bur., Sor.); balayong (V.); dulaueng (Is.); tualing (Z). *Cassia siamea* and *Peltophorum inerme* are introduced trees extensively cultivated for ornament and shade. Both have brilliant yellow flowers. Fire tree (*Delonix regia*) is a small to medium sized cultivated tree introduced from Madagascar. Sibucao or sappan (*Cæsalpinia sappan*) is a small shrubby tree semicultivated as a dyewood. (See Part I, p. 54.) Bahai (*Ormosia calavensis*) is a medium-sized tree found very scattered in the dipterocarp forests. The wood is red, but is little known on the markets. Madre-cacao or kakawati (*Gliricidia sepium*) is a small bushy tree introduced from tropical America. It occurs in the parang and is one of the principal woods used for fuel. Katurai or katudai (*Sesbania grandiflora*) is a small tree with large white flowers used as salad or vegetable. It has probably been introduced into the Philippines. Sampalok or tamarind (*Tamarindus indica*) is a medium-sized tree growing in or near towns, probably introduced from Africa. The fruit is eaten raw or cooked with meat to flavor it. Bani (*Pongamia mitis*) is a small tree usually growing on the sandy beaches. The wood is used locally. Dapdap (*Erythrina indica*) is a medium-sized tree with a white, very soft wood, growing along the seashore. The tree is cultivated for its large red flowers and as a shade tree in hemp plantations. It is sometimes erroneously called the fire tree.

LEMON OR CAMUNING FAMILY.

(Rutaceæ.)

This is a family of small trees, representatives of which are found throughout the Philippines. The species usually have compound leaves which are full of oily droplets (pellucid dots). Camuning (*Murraya exotica* L.), the principal one worthy of mention, is a small tree, furnishing a very hard, very heavy, yellowish wood, used for canes, kris handles, and carvings. It is said to be a good substitute for boxwood. It is also known as banasi or banati. Species of the genus *Citrus* furnish the native cultivated orange (dalandan or cajel), the native cultivated grape fruit (suha or lukban) and two varieties of lime (dayap and kalamansi.) *Citrus hystrix* (kabuyao) is a wild species whose fruit is used for washing hair and bleaching clothes. Kayutana (*Fagara* sp.) is a small to medium sized tree whose wood is pale yellow, hard, and heavy.

CANARY OR PILI FAMILY.

(Burseraceæ.)

The trees of this family have alternate compound leaves and resinous barks. Pili (*Canarium luzonicum*) is the tree that produces the resin that is known as the Manila elemi of commerce (known locally as pili resin, brea, or brea blanca). A form of this tree (perhaps a different species) produces the pili nut, an edible nut with a rich oily flavor resembling the almond. (See Part I, p. 56.) Pagsahingin (*Canarium villosum*) produces a resin similar to that of pili. The wood of both these Canariums and that of twenty or more other species is usually moderately hard, light to moderately heavy, and light grayish brown, sometimes pinkish, in color, fairly fine and straight grained; not very durable, but said to make good house posts if the portion in the ground is charred. The wood of kamingi (*Santiria nitida*) is pale brown, heavy, hard, rather tough, does not check much, but warps considerably, and is somewhat difficult to work. Bogo or bagulibas (*Garuga abilo*), another tree of this family, is usually found growing with molave. It has a short bole, large in diameter, and wide spreading branches. The sapwood has a pale dull brown color; the heartwood dark reddish brown with almost black streaks and mottlings, moderately heavy, moderately hard, rather coarse irregular grain, and not difficult to work.

MAHOGANY OR CALANTAS FAMILY.

(Meliaceæ.)

While this family has many representatives in the Philippines, the wood of only four species are commonly found in the lumber market. The woods of a large number of species are used, but the identifications are so obscure that it is impossible to discuss them at this time. Outside the Philippines this family furnishes to the lumber market the West Indian cedar (*Cedrela odorata* L.), the toon tree of India (*Toona* spp.), the true mahogany (*Swietenia mahagoni* L.), the satinwood of India (*Chloroxylon swietenia* DC.[1]) and the African mahogany (*Khaya senegalensis*).

With some practise the members of the Calantas family can be distinguished by the large compound alternate leaves, grouped at the ends

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[1] Placed in Rutaceæ by Engler.

of short, stout branchlets. The trees are small, medium sized, and sometimes large in diameter, though usually short boled. The wood of many species have a faint to distinct odor.

CALANTAS. (Pls. XXXII and XXXIII.)

Calantas is a tree that will reach a height of 40 to 50 meters and a diameter of over 150 centimeters, though the trees are usually much smaller. The bole is straight and cylindrical and about one-half the height of the tree in length. The crown is wide spreading and rather open. This tree is found scattered throughout the Philippines and can not be said to be abundant in any place. It occurs along small streams in the molave type, on flood plains in the lauan-hagachac type and sometimes in drier situations. It is not tolerant of shade.

The bark is 5 to 10 millimeters in thickness, brown to reddish brown in color and breaks into rough rectangular scales, the ends of which turn slightly outward. In small trees the bark often has longitudinal lines. The inner bark is reddish brown, slightly streaked with lighter bands, and has a distinct cedary odor. The leaves are compound, alternate, bunched at the ends of the twigs. There are 7 to 11 pairs of leaflets, each smooth or nearly so except when young, from 5 to 13 centimeters long and from 3.5 to 6 centimeters wide.

The sapwood of calantas is very light red; the heartwood is pale to dark red in color. The wood usually has a strong cedary odor. It is soft in texture and light in weight, and is coarse and straight grained. It is durable and resists the attacks of white ants and fungi very well. A form of calantas (probably a distinct botanical species) is found in Mindanao and Palawan. The wood of this, while in other respects like calantas, has no distinct odor except when fresh, and some of it has the bird's-eye grain, when it is known as bird's-eye or curly calantas.

Calantas is closely related to the West Indian cedar and like it is especially valuable for fine furniture, cabinetmaking, and cigar boxes. It is sometimes sold as Philippine mahogany. It is also used for pattern making, carvings, ceilings, doors, partitions, sides of guitars, and for bancas.

The present knowledge of the distribution of calantas is as follows: Luzon (Cagayan, Isabela, Bontoc, Pangasinan, Zambales, Bataan, Tayabas, Camarines, Sorsogon); Mindoro; Samar; Leyte; Negros; Palawan; Mindanao (Zamboanga and Basilan).

The scientific name of calantas is *Toona calantas*. Other species of *Toona* probably occur. Besides the general Tagalog name of calantas the following local names are known: Balongkauit (B.); bantinon (N. V.); danga (Is.); danigga (N. Luz.) danupra (Il.); kalantad (Pang.); Kantingen (Z., Il.); lanigda (V., B.); lanipga or some form of it (V., B.); porak (Il.); sagged (Pal.); sandana (V.); taratara (T.).

SANTOL. (Pl. XXXIV.)

Santol is a medium-sized tree reaching a height of 20 meters and a diameter of 70 centimeters. The tree has a straight, regular, but short bole. The crown is fairly dense and compact.

The bark is 4 to 7 millimeters in thickness, gray to grayish brown in color, rather smooth with fine longitudinal lines, and covered with corky pustules. Just beneath the surface the color is mottled green; the inner bark is pinkish red nearest the surface, but shades into a very light pink next to the sapwood. The leaves are compound and alternate. There are three leaflets, each from 13 to 16 centimeters long and from 6 to 9.5 centimeters wide, and covered below with fine velvety hairs.

The sapwood and heartwood are brownish pink in color. The wood is moderately heavy and moderately hard and has a very faint aromatic odor. When soaked in water it gives a reddish tinge. It is straight grained and easily worked. Santol is used for light construction purposes, especially house building, also for carving, sacred images, blocks for shaping hats, and furniture.

The scientific name of santol is *Sandoricum indicum*. It has the general common name of santol and besides growing wild is cultivated throughout the Philippines for its edible fruit.

MALASANTOL. (Pl. XXXV.)

Malasantol is a medium-sized tree reaching a height of at least 20 to 25 meters and a diameter of 80 centimeters. The bark is 4 to 7 millimeters in thickness and gray to grayish-brown in color; the inner bark is tan red in color. The leaves are alternate and trifoliate. The leaflets are from 6 to 18.5 centimeters long and from 4 to 9 centimeters wide and smooth or nearly smooth.

The sapwood is creamy white to salmon pink in color; the heartwood is reddish brown with a violet tinge. The wood is somewhat harder and heavier than santol and is straight and coarse grained. It has an odor similar to santol.

It has been recorded from the following provinces: Luzon (Nueva Vizcaya, Tarlac, Zambales, Bataan, Rizal, Laguna, Tayabas); Mindoro; Samar; Negros; Zamboanga.

The scientific name of malasantol is *Sandoricum vidalii*. It has the following local names: Biot (N. V.); bok-bok (Tay.); magsantol (Z.); malabobonao (Sam.); santol (Neg., Riz.).

TUCANG-CALAO. (Pl. XXXVI.)

Tucang-calao is a tree usually reaching a height of 20 to 25 meters and a diameter of 60 to 80 centimeters. The bole is regular and about one-half the height of the tree. The tree grows on the dry coastal hills, usually scattered through the forests in which bansalaguin and dungon occur.

The bark is 5 to 10 millimeters in thickness, light gray to gray in color, distinctly ridged. The inner bark is tan red in color. The leaves are alternately compound, composed of about 12 pairs of leaflets, each from 10 to 24 centimeters long and 2.5 to 8 centimeters wide, densely covered with whitish to rusty-brown hairs beneath.

The sapwood is grayish in color; the heartwood is brownish red with a fine and curly grain and a pungent cedary odor. The wood is heavy and hard. For beautiful color and grain this wood is of a mahogany grade. It is used for furniture, flooring, general house construction (especially interior finish), and shipbuilding.

This tree has been reported from the following regions: Luzon (Pangasinan, Batangas, Tayabas, Camarines, Albay); Masbate; Burias; and Cebu.

The scientific name of tucang-calao is *Aglaia clarkii.* The general commercial name is tucang-calao. Other local names are as follows: Alamog (Al.); balui (Pang.); kansuyod (Al., Bur.); makopa (Bat.); saldana (Cebu).

TABIGI.

This is a medium-sized tree with a short, thick, irregular bole and a spreading semiopen crown. It is found scattered throughout the mangrove swamps of the Philippines. The bark is 2 to 4 millimeters in thickness, smooth, cinnamon brown in color, sometimes with parallel curved lines of corky pustules. The inner bark is pink. The leaves are alternately compound; the leaflets are obovate, smooth, from 8 to 12 centimeters long and from 3.5 to 6 centimeters wide.

The sapwood is light brownish red. The heartwood is dark red in color, moderately hard, moderately heavy, and with fine ripple marks. It is very fine grained, durable, and shrinks but little in drying. It is used for furniture, sandals, and locally for construction of small houses and as firewood. The bark is used extensively for dyeing. (See Part I, p. 53.)

The scientific name of tabigi is *Xylocarpus obovatus.* It has the following local names: Lubanayong (Cag.); nigi (T.); tawigi (Mind.).

PIAGAO.

This is a medium-sized to tall tree with a fairly regular bole that will yield poles up to 18 meters in length and 60 to 80 centimeters in diameter. It is found throughout the mangrove swamps of the Philippines and seems to do best in the Davao region of Mindanao, where for very small areas it forms almost pure stands.

The bark is 3 to 7 millimeters in thickness, gray to dark brown with a reddish tinge, often with vertical bands of gray alternating with reddish brown, and inclined to be irregularly ridged or at least much roughened; the inner bark is red. The leaves are alternately compound;

the leaflets are smooth, leathery, from 9.5 to 12 centimeters long and from 3 to 7 centimeters wide.

The sapwood is brown, lightly tinged with red; the heartwood is dark red, with ripple marks. It is moderately hard, moderately heavy, durable, and said to last well as salt-water piling. It makes fine furniture and is of a mahogany grade.

The scientific name of piagao is *Xylocarpus granatum*. A third species of *Xylocarpus* is found in the Philippines.

A number of species of the genera of *Aglaia*, *Amoora*, *Chisocheton*, and *Dysoxylum* are scattered throughout the Islands, especially in the dipterocarp forests. It is impossible at the present time to describe these trees so that they be referred to definite species. Agaru (a species of *Dysoxylum?*) yields a light-colored, golden-yellow, fine-grained, hard, and moderately heavy wood, found in small quantities on the Manila market. It takes a beautiful finish like that of satinwood. Woods similar to this in hardness and other characteristics are known under the Tagalog name of kuling-manuk and the Visayan name of miao. Malatumbaga is the Bataan name usually applied to *Aglaia harmsiana*. A wood similar to this, known as malasaging, and possibly the same species, comes from Tayabas and Camarines. It is dark red in color (resembling somewhat tucang-calao) and very durable. While the harder species of the genera mentioned above are valuable woods, they will never find much of a place in the markets because they are scattered and usually have ill-formed short boles. Lansones (*Lansium domesticum*) is a tree cultivated for its fruit.

RUBBER OR BINUNGA FAMILY.

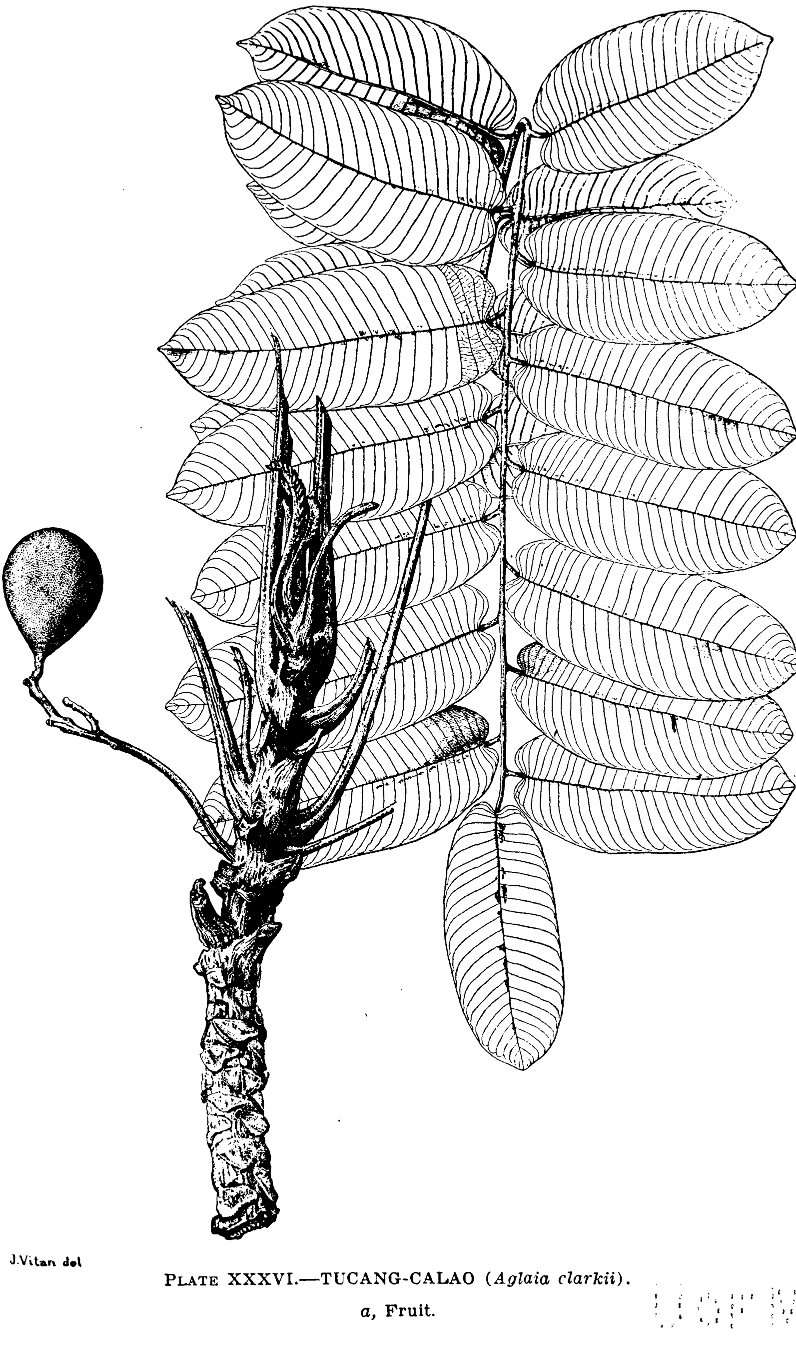
(Euphorbiaceæ.)

While not of much importance from the standpoint of producing lumber, yet this family contains a large number of tree species, nearly all of which are small. These usually occupy a conspicuous place in the undergrowth of the dipterocarp forests, or are the "weed" trees of the second-growth forests.

The leaves are usually alternate and simple, but *Hevea brasiliensis* and *Bischofia javanica* are trifoliate and *Manihot glaziovii* has deeply three to seven palmately parted leaves.

Undergrowth species: A number of species occupy a conspicuous place in the undergrowth of some of the dipterocarp forests. Among the most important of these are bignai lalaki (*Aporosa sphœridophora*), malabignai or kaping-gubat (*Aporosa symplocosifolia*), butong-manuk or talimorung (*Cyclostemon microphyllum*), dilak (*Baccaurea tetrandra*). These are all strictly undergrowth trees, seldom reaching a diameter of over 15 centimeters and a height of 10 meters. They are all tolerant of shade.

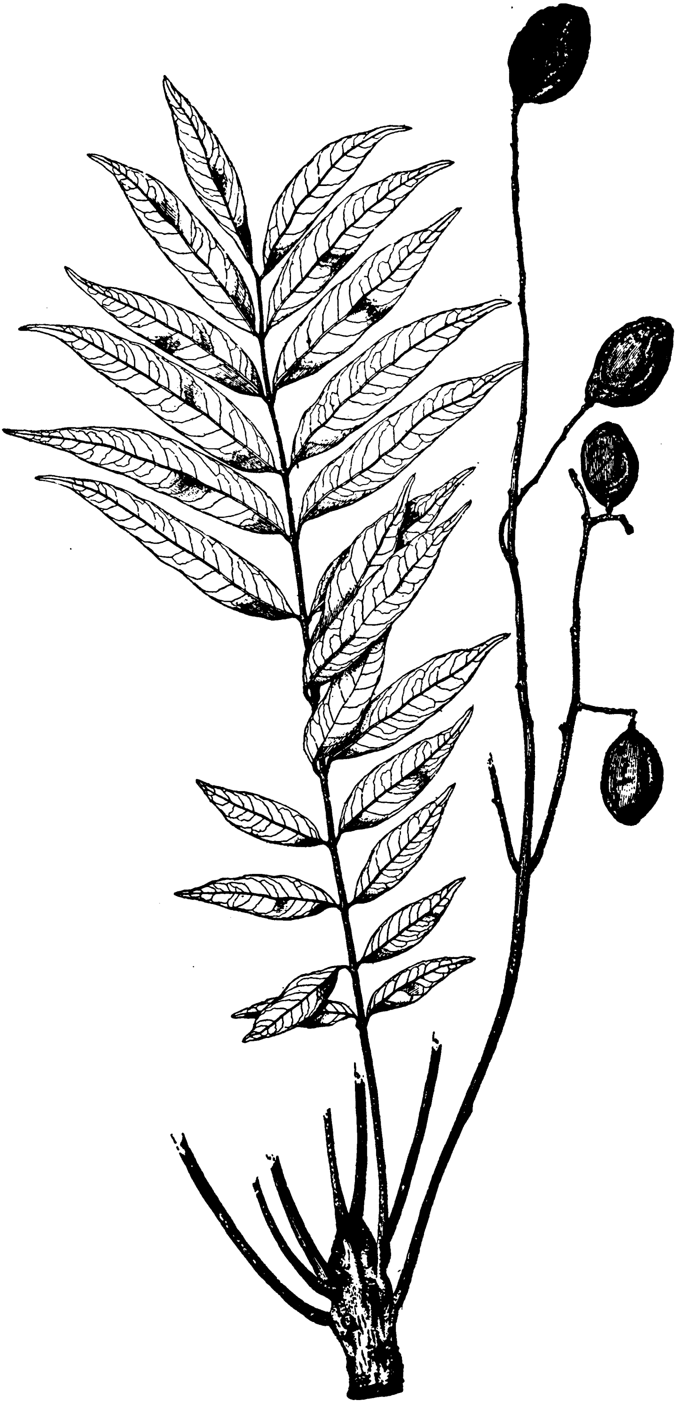
Caiñgin species: Hamindang (*Macaranga bicolor*) and binunga (*Macaranga tanarius*) are among the first trees to enter newly made clearings, forming with *Homalanthus* species (especially balanti, *H. populneus*) almost pure stands. The Macarangas reach as scattered trees in some dipterocarp forests the dimensions of dominant or subdominant trees. They have peltate leaves. Balanti, with heart-shaped leaves, is a small spindly tree. All of these, with hinlaumo, (*Mallotus ricinoides*) and alim (*M. moluccanus*) are rapid growing trees, producing seeds at a very early age. Binayuyu or inyam (*Antidesma ghaesembilla*), tanigi (*Antidesma edule*), and bignai (*Antidesma bunius*) and other species of *Antidesma* are small trees found in the open grass lands. A special characteristic



J. Vitan del.

PLATE XXXVI.—TUCANG-CALAO (*Aglaia clarkii*).

a, Fruit.



J. Vitan del

PLATE XXXVII.—AMUGUIS (*Koordersiodendron pinnatum*).

a, Fruit.

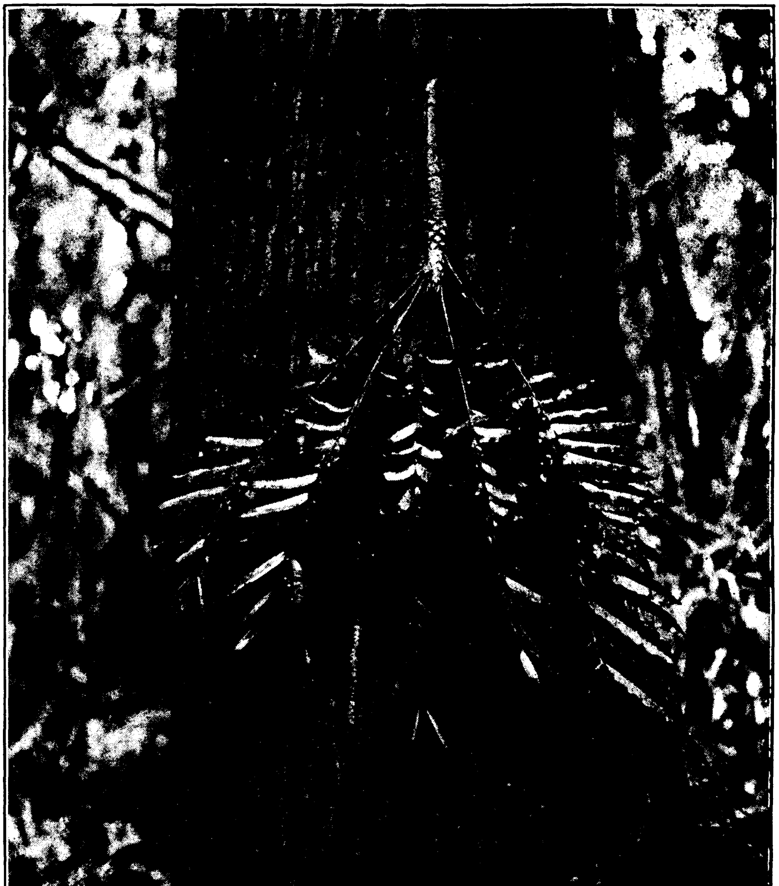


PLATE XXXVIII.—LOWER TRUNK OF AMUGUIS (*Koordersiodendron pinnatum*).

With leaves attached.

J.Vitan del.

PLATE XXXIX.—DAO (*Dracontomelum dao*).

a, Flower cluster; *b,* fruit cluster.

Plate XL.—LOWER PORTION OF THE TRUNK OF DAO (*Dracontomelum dao*).

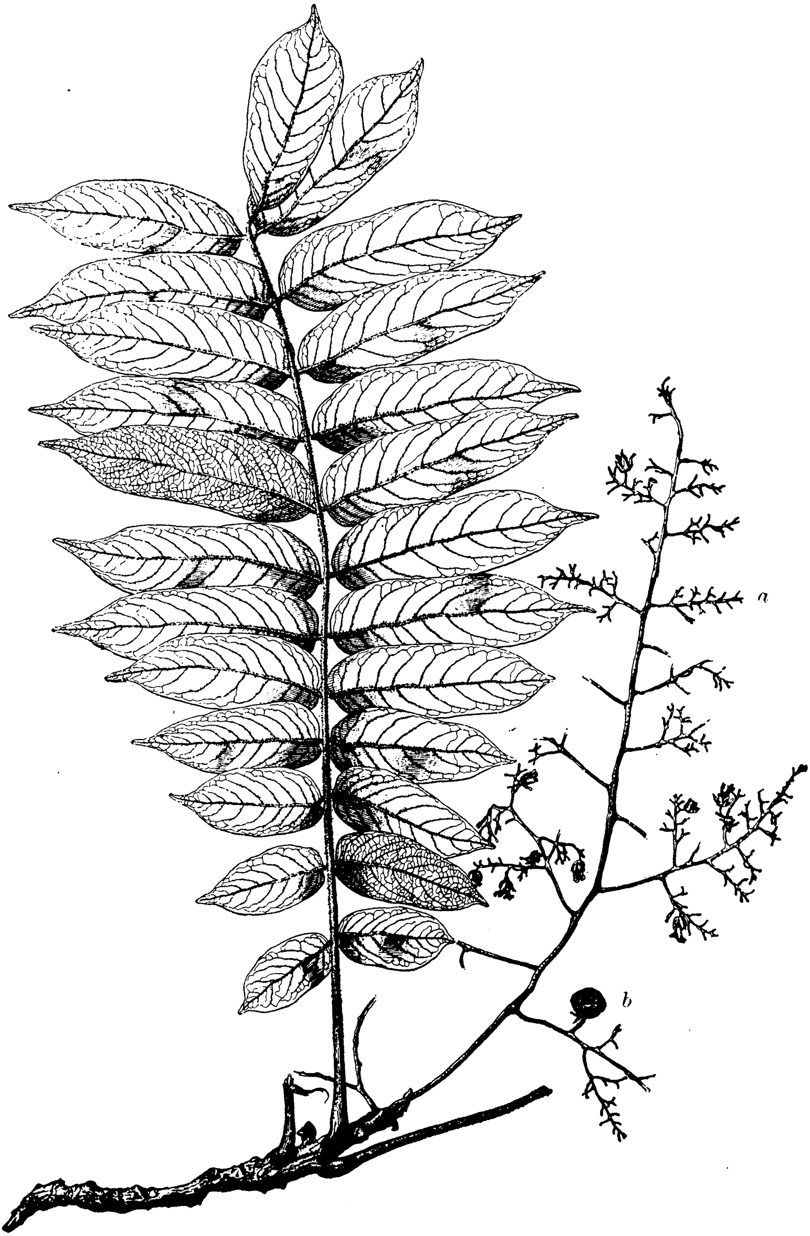


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PLATE XLI.—LAMIO (*Dracontomelum cumingianum*).

a, Flower cluster; *b*, fruit.

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PLATE XLII.—BALACAT (*Zizyphus zonulatus*).

a, Fruit cluster.

PLATE XLIII.—BALACAT (*Zizyphus zonulatus*).

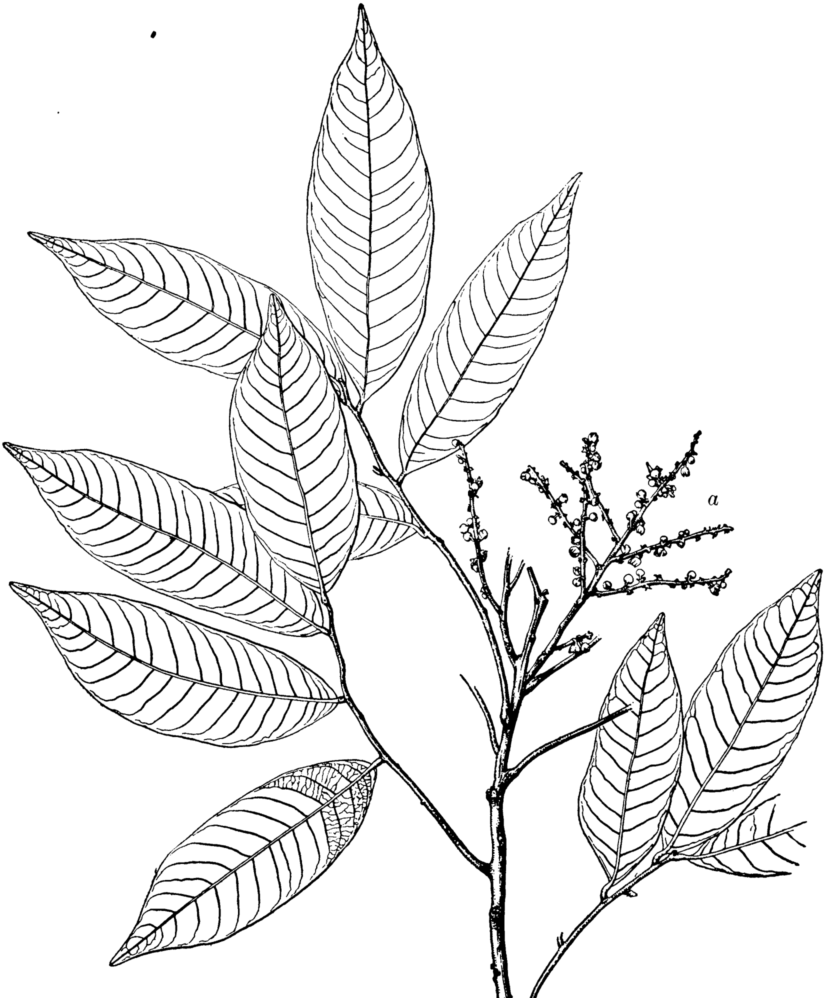

PLATE XLIV.—ALUPAG (*Euphoria cinerea*).

a, Flower cluster; *b*, fruit.

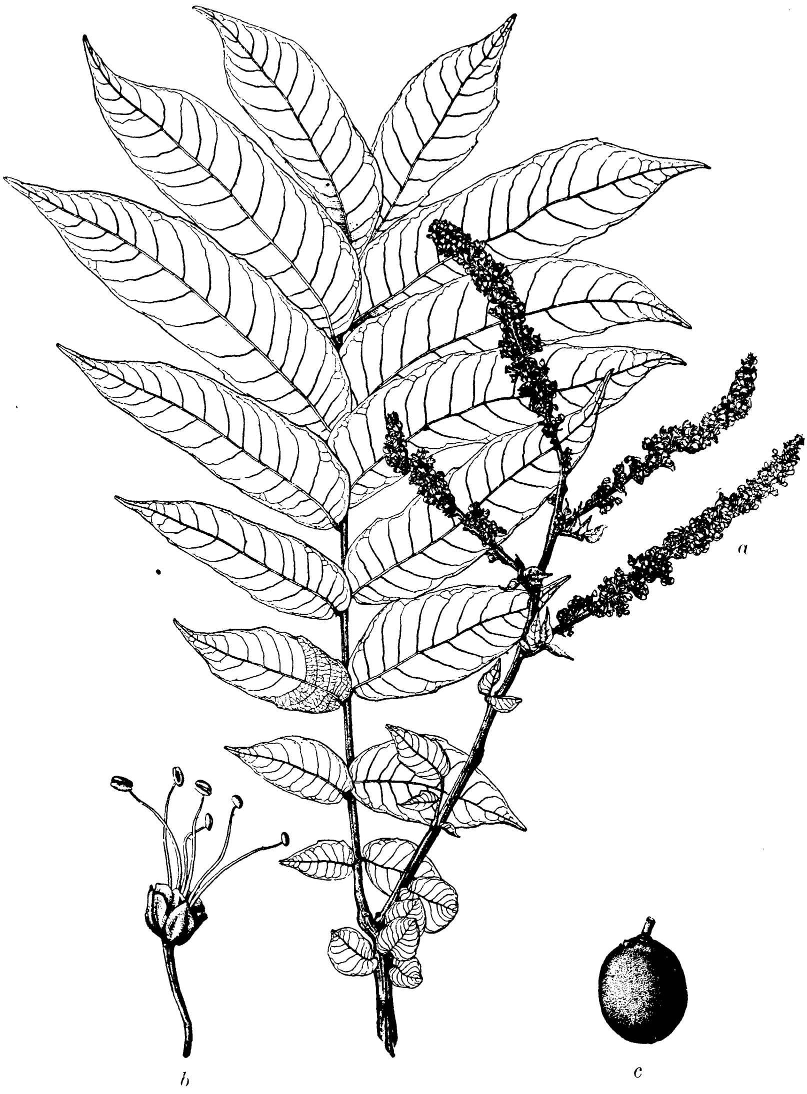

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PLATE XLV.—MALUGAY (*Pometia pinnata*).

a, Flower cluster; *b,* flower; *c,* fruit.

PLATE XLVI.—DUNGON (*Tarrietia sylvatica*).

a, Fruit.

PLATE XLVII.—BARK CHARACTERS OF DUNGON (*Tarrietia sylvatica*).

J. Vitan del.

PLATE XLVIII.—DUNGON-LATE (*Heritiera littoralis*).

a, Fruit.

PLATE XLIX.—DUNGON-LATE (*Heritiera littoralis*).

Bark and leaves.

PLATE L.—LUMBAYAO (*Tarrietia javanica*).

Bark characters.

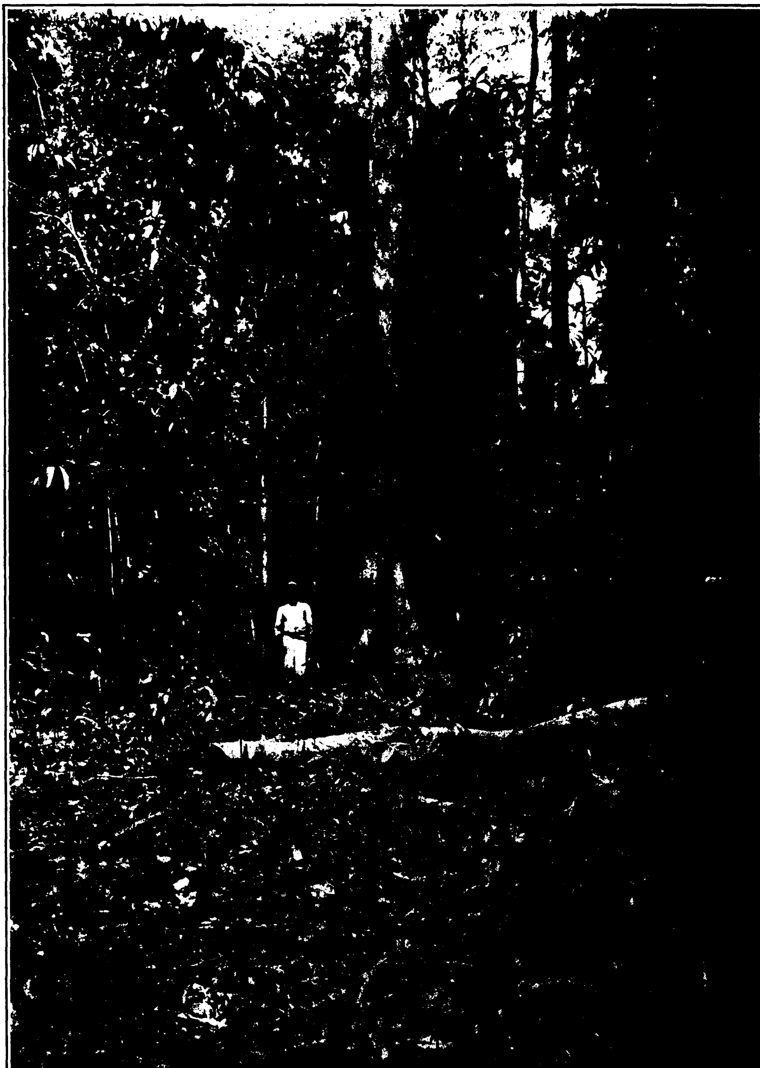


PLATE LI.—LUMBAYAO (*Tarrietia javanica*).

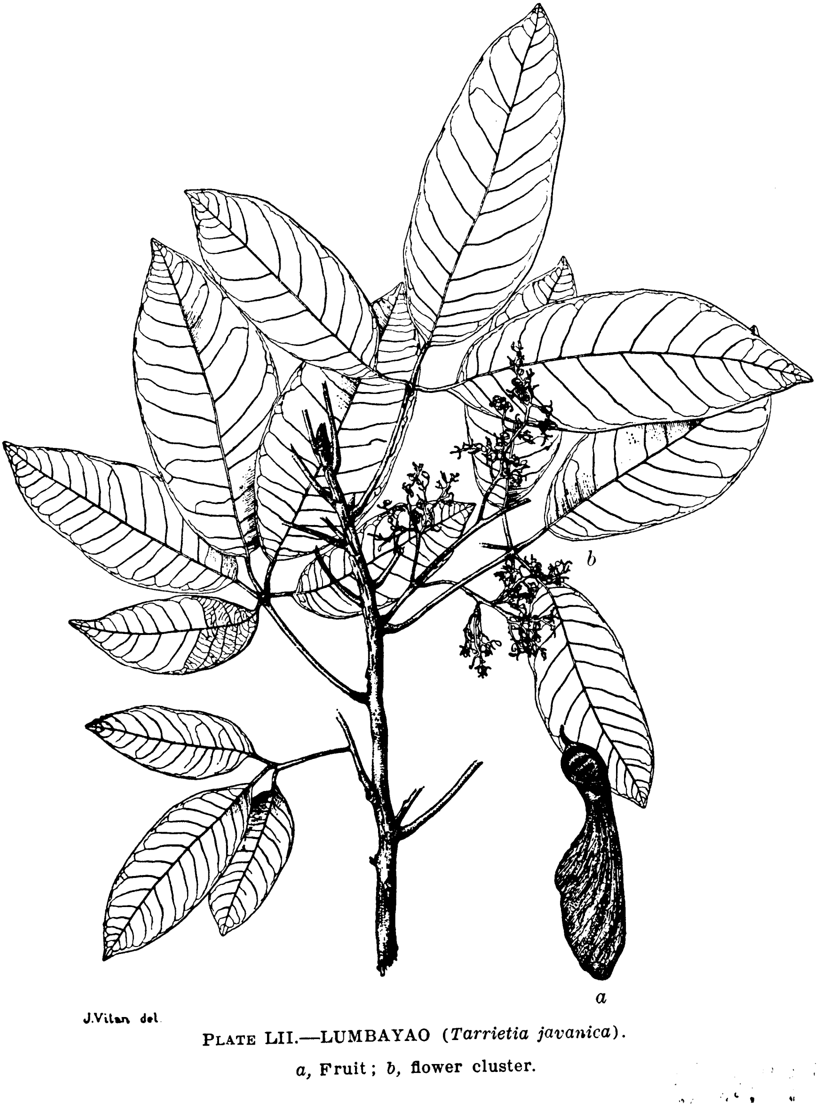


PLATE LII.—LUMBAYAO (*Tarrietia javanica*).

a, Fruit; *b*, flower cluster.

of binayuyu is its power to resist fires. Fire-swept cogonales often show scattered specimens of this tree nearly to the exclusion of all others.

Rubber-producing species: Para rubber (*Hevea brasiliensis*) and ceara rubber (*Manihot glaziovii*) of this family have recently been introduced into the Philippines. (See Part I, pp. 57, 58.)

Lumber species: Tuai or toog (*Bischofia javanica*) is a tall tree found scattered throughout the Philippines, usually isolated along streams. The tree has a fairly regular, unbuttressed, short bole with a wide-spreading crown. It is intolerant of shade. The bark is dark brown, soft to the touch, shedding in large thin scales. The inner bark is red with a thin, dark-red latex. The leaves are alternate, trifoliate and smooth, with the edges of the leaflets toothed. The sapwood is light creamy color; the heartwood is red, moderately hard, and moderately heavy.

Gubas or binuang (*Endospermum peltatum*) is found very scattered in some of the dipterocarp forests of Luzon and Mindoro especially. It is a tall tree, codominant with the dipterocarps and has a straight regular bole without prominent buttresses. The bark is 4 to 10 millimeters in thickness, light gray, with a tinge of orange. The inner bark has a golden yellow color with a disagreeable odor. The leaves are alternate, peltate, and hairy. The sap and heart woods are light yellow in color. The wood is soft and light in weight and used principally for making matches or for light boxing material.

Hamindang and binunga, usually small trees in second-growth forests, sometimes attain the size of subdominant trees in virgin forests. They both have smooth, alternate, peltate leaves, white beneath. The bark is brown to light brown in color. The wood is light colored, light in weight, and sometimes used in making matches.

Some species of *Cyclostemon*, especially tinaan-pantai or dila-dila (*C. bordenii*) of the northern provinces and banawi (*C. grandifolius*) of Mindanao, attain the size of subdominant species in the dipterocarp forests. Banawi has a straight regular bole, strongly buttressed. The bark is about 10 millimeters in thickness, brown or slightly yellowish brown in color; thickly set with corky pustules, otherwise smooth. The inner bark is mottled yellow, with concentric lines of white, and is very brittle. The sapwood is slightly lighter in color than the heartwood, which is a rich creamy yellow when fresh cut and changes on drying to a brown streaked with black. The wood is moderately heavy and moderately hard. It is used locally for general construction purposes. Tinaan-pantai is a somewhat smaller tree than banawi, but in other respects similar to it.

Other species: The seeds of lumbang or biao (*Aleurites moluccana*) and balukanad or lumbang (*Aleurites trisperma*) produce the candle-nut oil of commerce. (See Part I, pp. 54, 56.) Under the name of bignai several species of *Antidesma* (principally *A. bunius*) produce edible fruits. Tuba or physic nut tree (*Jatropha curcas*) is an introduced species, extensively planted for hedges, whose nut is used in medicine and for bleaching clothes. Banato (*Mallotus philippensis*), whose fruit yields a powder used for dyeing and medicine, is a small tree growing in the virgin and second-growth forests.

SUMAC OR MANGO FAMILY.

(Anacardiaceæ.)

This family contains a few prominent timber trees, and some cultivated for their edible fruits. The members of the family have simple or compound alternate leaves.

AMUGUIS. (Pls. XXXVII and XXXVIII.)

Amuguis is a medium to large sized tree reaching a height of 30 to 40 meters and a diameter of 120 centimeters. It has a merchantable length of 18 to 20 meters. The bole is usually quite straight and cylindrical, though sometimes slightly crooked and irregularly cylindrical. It is strongly buttressed, especially in old trees. The crown is about one-half the height of the tree and is quite dense. Amuguis reaches its best development in the lauan-hagachac type, though it is scattered through the lauan-apitong type, especially near the streams. It requires considerable ground moisture and can be classified as an intolerant species.

The bark is 8 to 15 millimeters in thickness, dark brown to nearly black in color, and rather strongly ridged. The inside bark is pink to red, with vertical bands of very light color beneath the furrows.

The leaves of amuguis are compound, closely alternate, and bunched at the ends of twigs. There are 13 to 16 pairs of leaflets, each from 7 to 16 centimeters long and from 2 to 5 centimeters wide. These are smooth and glossy green above, yellowish green below, with the veins usually light red in color. The main leaf stalk is hairy. The tree is evergreen, though during the dry season the canopy is considerably thinner.

The sapwood is pale red; the heartwood red, moderately heavy, hard, and durable where not in contact with ground or much exposed. This wood ranks among the first for general house construction. It is especially desired for flooring. Other uses are furniture, partitions, naval construction, carriage making.

Amuguis is found scattered everywhere throughout the Philippines. The scientific name is *Koordersiodendron pinnatum.* Besides the general Tagalog name of amuguis the following names occur: Ambogis (V.); ampopot (Cag.); bankahasi (Il.); bankalari (Il.); dangilo (T.); gagil (Moro); karogkog (B.); lako-lako (Vis.); magalibas (Moro); marsantog (Cag.); palosanto (T.); sambulauan (V., B.); urisan (Cag.).

DAO. (Pls. XXXIX and XL.)

Dao is a tree reaching a height of 35 to 40 meters and a diameter of 100 centimeters or more. It has a bole 18 to 20 meters in length and is strongly buttressed. The bole above the buttresses is usually regular, but often fluted near their attachment and that of the larger branches. The crown is about one-half the height of the tree. It is wide spreading, open, and with heavy branches. Dao is a widely distributed tree and is usually associated with amuguis, occupying a position in flats and along streams, though found on moist slopes. It thrives best in damp soils and is intolerant of shade.

The bark is 8 to 10 millimeters in thickness, nearly smooth, light steel gray in color on the older bark and light brown where freshly shed. It scales in scroll-shaped pieces either large or small. Just beneath the cork is a thin red layer, under this is a very light pink spongy layer, which becomes red in color next to the sapwood. The inner bark is stringy in texture.

The leaves are alternate and compound, closely bunched at ends of stout twigs. There are usually 5 to 7 pairs of leaflets, each from 5 to 15 centimeters long and from 3 to 4.5 centimeters wide, glossy, light green in color, and smooth.

The sapwood is very light in color and large. The heartwood is brownish gray, streaked with black. The wood is moderately heavy and moderately hard. It is used locally for light construction work, bancas, rafters, and flooring. The small heartwood takes a beautiful polish and is used to some extent for furniture.

Dao is found throughout the Philippines, probably occurring in every province. It has the scientific name of *Dracontomelum dao*. It is well known everywhere under the Tagalog name of dao. Other local names are as follows: Batuan (V.); kamarak (N. Luz.); lamio (T.); malaiyao (T.); mamakao (Davao).

BALINGHASAY.

Balinghasay is a tree of medium height, reaching in exceptional cases 25 to 30 meters. It has a straight, fairly regular bole 15 to 18 meters in length. It has a fairly open crown, which is partly deciduous in the dry season. It occurs usually with amuguis and dao and is intolerant of shade.

The bark is 8 to 10 millimeters in thickness, quite smooth, but sometimes roughened with many small knobs; it is brownish in color with grayish yellow tinge. The inner bark is red. The leaves are simple and alternately bunched at the ends of rather stout twigs. They are from 10 to 30 centimeters long and from 3 to 9 centimeters wide.

The sapwood is light in color and large. The heartwood is reddish brown in color, moderately heavy, soft to moderately hard, rather fine, straight grained, often with numerous very small knots, and very easy to work. It is used for boxes, light construction purposes, cheap furniture, cigar boxes, dry measures, and is sometimes subtituted for amuguis, but is lighter in weight and color, softer, and coarser grained.

Balinghasay is widely distributed throughout the Philippines in the lowlands. It has the scientific name of *Buchanania arborescens*. Besides the common name of balinghasay or some form of it the following names are known: Anam (V.); aranges (Cag.); bagulibas (M.); balanga (Guim.); balayohot (T.); baligohot (Cam.); bankalauan (T.); beobayano (Sur.); boroan (Pang.); dilaan (Z.); ganga (Cag.); hupong-hupong (Tay.); kaming (Z., Pang.); kanteng (Ab.); ligas (Cam.); lingabunu (Bas.); malabalunu (M.); malaligas (Tay.); paleng (Cag.); pusopuso (M.); tangantang (Tic., Mas., Tay.).

Besides the above, the family contains the following species worthy of mention: Lamio (*Dracontomelum cumingianum*) is a large tree very much resembling dao, but with much larger leaflets that are very hairy below on the midrib. Pahutan (*Mangifera altissima*) is a large tree, usually found in the river bottoms, with alternate, simple leaves and a wood much like that of balinghasay except for its small dark brown heartwood. Libas (*Spondias pinnata*) yields a soft wood used for making matches. Ligas (*Semecarpus perrottetii*) is a medium-sized tree with alternate, simple leaves and yields a wood much like amuguis. The leaves of this tree are poisonous to the touch and act much like those of the poison ivy. Kasoi, balubad, or cashew nut (*Anacardium occidentale*) is cultivated for its fruit. *Mangifera indica* yields the well-known mango or manga. Ciruelas (*Spondias lutea*) is cultivated for its fruits.

BUCKTHORN OR BALACAT FAMILY.

(Rhamnaceæ.)

This family contains trees with alternate (sometimes opposite) leaves, with (those mentioned here) three prominent veins.

BALACAT. (Pls. XLII and XLIII.)

Balacat reaches a height of 30 to 35 meters and a diameter up to 100 centimeters or over. It has a straight regular bole up to 20 meters in length, which is strongly buttressed. The crown is open, and for a short time during the dry season is sometimes destitute of leaves or nearly so. It is intolerant of shade. It is found scattered in the lauan-apitong, yacal-lauan, and sometimes the molave types; it occurs also in the moister soils of river valleys.

The bark is grayish brown in color, where freshly shed of a lighter color, and is ridged. In young trees it has sharp spines. In older trees, especially at the base between the buttresses, there are occasionally present large, thick and short spines. The inner bark is brownish red with white vertical lines beneath the furrows. The leaves are simple and alternate, usually smooth, sometimes hairy, especially when young, from 7 to 15 centimeters long and from 4 to 9 centimeters wide, prominently three veined.

The wood is creamy white to light brown in color, soft, light to moderately heavy in weight, and not durable. The heartwood is usually slightly darker than the sap, but in very large trees is red. It is coarse and straight grained. It is used for light and temporary construction, cheap furniture, and boxes.

The following are the regions from which this tree is reported. No doubt further explorations will extend its range. Luzon (Ilocos Norte, Ilocos Sur, Cagayan, Nueva Ecija, Pangasinan, Zambales, Bataan, Rizal, Tayabas, Camarines); Masbate; Mindoro; Leyte; Mindanao (Surigao, Zamboanga, Davao); Palawan.

It has the scientific name of *Zizyphus zonulatus,* though a hairy leaved form may be considered a distinct species. The commercial name is balacat. Other names collected are as follows: Agguk (Cag.); aligamen (Il.); bigaa (T., V.); dagaa (Pal.); danlik (Tay.); diraan (Il.); duplak (Pang.); ligaa (T., V.); lumangud (Ley.); maglanka (Pal.).

Ligaa (*Zizyphus trinervia*) is the name of a small tree common in certain subtypes of the parang. It has spines or spiny warts arranged in circular rows around the tree.

SOAPBERRY OR ALUPAG FAMILY.

(Sapindaceæ.)

This is a family of trees with alternate compound leaves; the boles are usually irregular in shape; the barks are smooth. While there are a number of small trees, only two are commonly known in the lumber markets.

ALUPAG. (Pl. XLIV.)

Alupag is a medium-sized tree reaching exceptionally a height of 25 meters, though usually much smaller, and a diameter of 80 contimeters. The bole is 10 to 12 meters in length and is usually irregular in cross section and crooked. The crown, about one-half the height of the tree, is broad spreading and semiopen. It is found scattered throughout the Philippines, especially in the molave type and in the drier portions of the dipterocarp types. It is intolerant of shade.

The bark is 3 to 5 millimeters in thickness, ashy gray in color, and sheds in scroll-shaped scales; the inner bark is brownish red with alternate rings of light and dark colors. The leaves are compound and alternate; the leaflets (3 to 4 pairs) are whitish beneath, from 7 to 16 centimeters long and from 2 to 6 centimeters wide.

The sapwood is very light red in color; the heartwood is darker red to dark brown, heavy, very hard, durable, fine and straight grained, and very difficult to work. It has the following uses: House construction (flooring, rafters, posts); tool handles; carriage making; parts of ship; piling; cogwheels; carabao yokes.

Alupag has the following distribution: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Benguet, Pangasinan, Baler, Pampanga, Zambales, Bataan, Rizal, Batangas, Tayabas and Camarines); Marinduque; Masbate; Mindoro; Samar; Leyte; Mindanao (Zamboanga, Cotabato, Davao).

The scientific name is *Euphoria cinerea*. Besides the Tagalog name of alupag, or some form of it, the following names have been recorded: Alupay (T., Z.); apalong (Cag.); bagiles (Pang.); bait (Tay.); bakalao (Il.); bolik (Zam.); buanubai (Cot.); bulala (B.); dagindigan (Sam.); halupag (T.); himlaloang (Pam.); kandongisal (Mas.); lasilasan (Il.); malaresa (Pam.); marutong (Cag.); moling (Pang.); pamito (Mas.); ulayan (Ley.); usao (Ley.).

MALUGAY. (Pl. XLV.)

Malugay is a tree reaching a height of 25 to 35 meters and a diameter of 90 to 100 centimeters. The bole is 18 to 22 meters in length, usually somewhat fluted and sometimes slightly crooked. The crown is about one-third the height of the tree and semiopen. The tree is slightly intolerant of shade. It is found scattered throughout the drier portions of the dipterocarp types and reaches its best development on the Island of Mindoro; also found in the lauan-hagachac type.

The bark is 6 to 8 millimeters in thickness, and sheds in circular patches; the old bark is reddish brown in color with a purplish tinge; the new is brown to khaki color. The inner bark is reddish brown with rings of lighter color alternating with the darker. At certain seasons of the year the bark and sapwood exude sparingly a red sap. The leaves are compound, closely alternate, bunched at the ends of twigs, with 5 to 10 pairs of leaflets, each slightly serrate, from 8 to 24 centimeters long and from 3.5 to 8.5 centimeters wide, the basal ones reduced to bracts.

The sapwood is creamy red; the heartwood is pale red, moderately heavy, moderately hard, fine and straight grained, and tough. It has the following uses: General construction; cabinetwork; interior finish; ribs and planking of small boats; tool handles.

The tree is lumbered principally from Mindoro. It is recorded from the following regions: Luzon (Cagayan, Ilocos Norte, Bataan, Laguna, Camarines, Albay); Camiguin Island; Masbate; Mindoro; Ticao Island; Samar; Leyte; Negros; Mindanao (Zamboanga, Agusan, and Lanao); Palawan, and probably occurs in many other provinces. The scientific name is *Pometia pinnata*. Besides the common Mindoro name of malugay, the following have been recorded: Agupanga (M.); alauihau (Sam.); balambanan (Il.); bantangali (Ag.); ibu (Neg.); kabakabat (Il.); karunyan (M.); kogik (Al.); madalo (Cag.); mansanab (Neg.); quia-quia or kia-kia (Ley., Sam.); sidao (Cam., Is.); takugan (Mas.); tigawi (Tic., Cam., Mas.); tugoran (Mas.).

Besides the above-mentioned species the family furnishes a number of smaller trees, among the most important of which are alasin (*Arytera littoralis*), alahan (*Guioa perrottetii*), uas (*Harpullia arborea*), and *Litchi philippinensis*. The wood of the latter resembles very closely that of alupag.

BLADDERNUT OR ANONGO FAMILY.

(Staphyleaceæ.)

This family furnishes but one tree, anongo (*Turpinia pomifera*). It is a medium-sized tree in the undergrowth of dipterocarp forests. It has opposite, compound leaves, a light and soft wood, and is said to be used for household utensils.

LINDEN OR ANILAO FAMILY.

(Tiliaceæ.)

This is a family of small or medium sized trees with simple, alternate leaves, whose woods are used locally for fuel and light construction work. Anilao (*Columbia serratifolia*) is a small quick-growing tree common in second-growth forests. Its bark is used for tying purposes. Susumbik or kamuling (*Grewia stylocarpa*) and other species of *Grewia* are small to medium sized trees found as undergrowth in the dipterocarp types. Balobo (*Diplodiscus paniculatus*) is a small to medium sized tree fairly abundant in some dipterocarp forests. The wood is grayish or pale reddish brown, moderately hard, moderately heavy, and is used locally.

MALLOW OR MALUBAGO FAMILY.

(Malvaceæ.)

This is a family containing few trees of commercial importance. The leaves are simple, alternate, usually palmately nerved, at least those mentioned here.

Lanutan (*Bombycidendron vidalianum*) furnishes a heavy wood that is purplish in color and is used for carriage shafts and backs and sides of guitars and mandolins. Malubago (*Hibiscus tiliaceus*) is a tree of the sandy beaches and has a brown wood with a purplish tinge, very light in weight, used for floats for fish nets. The bark is used for making rope and cloth. Banalo or Portia tree (*Thespesia populnea*) is a medium-sized tree of the sandy beaches and yields a hard, moderately heavy, dark red heartwood that is used for backs, sides, and necks of musical instruments. This is the rosewood of the Seychelles Islands.

COTTON-TREE OR MALABULAK FAMILY.

(Bombacaceæ.)

The species mentioned in this family have alternate, palmately compound leaves. Malabulak (*Bombax malabaricum*) is a very large tree with light-colored, very soft wood. It is found scattered principally in the dry regions, where it is entirely deciduous for a short time. Kapok, doldol, or the cotton tree (*Ceiba pentandra*) is cultivated throughout the Philippines for the cotton it produces. It is used extensively for telephone or telegraph poles. Fresh cut poles of it placed in the ground take root and become trees. The wood is very soft, light colored, and is little used.

CACAO OR DUNGON FAMILY.

(Sterculiaceæ.)

The species mentioned in this family have alternate and simple leaves (except lumbayao), and yield a variety of woods. While a large number of species are present, only a few produce lumber found in the general market.

DUNGON. (Pls. XLVI and XLVII.)

This tree reaches a height of 30 to 35 meters and a diameter of 100 or more centimeters. It has a regular to irregular, strongly buttressed bole, in exceptional cases reaching 18 meters in length, but usually much shorter. The crown is one-third to one-half the height of the tree and open. The tree is scattered throughout the molave type, sometimes in drier situations of the dipterocarp types. It is intolerant of shade.

The bark is 6 to 10 millimeters in thickness, ashy gray to cinnamon brown in color, sheds in irregular small flakes, and has small tan-colored pustules. The inner bark is pink in color with fine lighter concentric rings. The leaves are simple, alternate, from 7 to 20 centimeters long and from 3 to 9 centimeters wide, silvery white beneath.

The sapwood is pinkish; the heartwood is dark chocolate brown, very hard, heavy, tough, fine and cross grained, and very difficult to saw. It often contains white stony deposits in old knots and heart cracks. It is used for all sorts of construction purposes where great durability is desired. It is especially valuable for salt-water piling. Other uses are as follows: Naval construction (anchors, boat ribs, keels of ships, hoists); railroad ties; telegraph poles; wheels; cogwheels; bridge building; house construction (posts, beams, pillars); hemp presses.

The following regions are reported to contain dungon: Luzon (Ilocos Norte, Ilocos Sur, Pangasinan, Tarlac, Nueva Ecija, Bulacan, Zambales, Bataan, Rizal, Laguna, Batangas, Tayabas, Camarines, Albay); Masbate; Marinduque; Mindoro. The scientific name of dungon is *Tarrietia sylvatica.* The local names are as follows: Malarungon (T.); palmegapoy (Il.); palogapig (Il.); palonapin (Il.); palonapoy (Z.).

DUNGON-LATE. (Pls. XLVIII and XLIX.)

Dungon-late is a tree reaching a height of 20 meters and a diameter of 80 to 90 centimeters. It has an irregular bole, strongly buttressed. It has an open crown and is confined to the beach and the upper limits of the mangrove types. It is intolerant of shade.

The bark of dungon-late is 5 to 8 millimeters in thickness and is gray in color; in old trees it splits into rectangular patches, otherwise it is smooth; the inner bark is tan red in color and stringy in texture. The leaves are simple and alternate, from 9 to 25 centimeters in length and from 4 to 12 centimeters wide, silvery white beneath.

The wood in nearly all respects is like that of dungon, and it is difficult to tell them apart. Dungon has winged fruits, is found usually on the coastal hills some distance from tide water and is a larger tree. Dungon-late usually has a larger amount of sapwood, a large woody fruit strongly keeled and adapted for floating, and is found in or close to tide water. Dungon-late has much the same uses as dungon, and is no doubt substituted for it in many instances. The relative merits of the durability of the two woods is in doubt. Good specimens of both woods, free from sap, will probably withstand the attacks of teredo, white ants, and fungi equally well. Besides those given for dungon it has the following uses: Canoes (outrigger supports); firewood; charcoal.

Dungon-late is found in every province in the Philippines bordering on tide water. It has the scientific name of *Heritiera littoralis*. Besides dungon-late it has the common names of dungon, especially in regions where dungon is unknown, paronapin or some form of it, and magayao (Cag.).

LUMBAYAO. (Pls. L, LI, and LII.)

This is a tree that reaches a height of 40 to 50 meters and a diameter of 80 to 120 centimeters. The bole, 20 to 25 meters in length, is regular and straight, though strongly buttressed. The crown is open, evergreen (slightly thinner during the dry season). It is slightly tolerant of shade. The tree is reported only from the southern islands, where it forms an important element of the yacal-lauan type, occupying with yacal the ridges and drier slopes.

The bark is 5 to 7 millimeters in thickness; in young trees gray in color, mottled with different shades; in older trees light gray, with brown patches where freshly shed; sheds in more or less regular, square, oblong, and rhomboidal pieces. The inner bark is reddish brown in color. The leaves are alternate, palmately compound, with 3 to 5 leaflets, each smooth, from 6 to 16 centimeters long and from 3 to 7 centimeters wide. The fruit is winged.

The sapwood is very pale red merging gradually into the red to reddish brown heartwood. The wood is moderately heavy, soft to moderately hard, coarse and straight grained, fairly durable, and is easy to work. It has the following uses: House construction (partitions, siding, doors, interior finish); furniture; canoes; boxes. It is one of the woods now being sold for Philippine mahogany in the United States.

The tree is reported from Mindanao (Zamboanga, Cotabato) and Basilan. The scientific name is *Tarrietia javanica*. So far only the common Moro name of lumbayao has been reported. Another species (*Tarrietia riedeliana*) resembling this one in general respects is reported from the Lanao district of Mindanao.

TALUTO. (Pl. LIII.)

Taluto is a very tall tree reaching a height of 45 to 50 meters and a very large diameter. It has a straight, regular, unbuttressed bole up to 25 or 30 meters in length. It usually has surface roots extending as much as 8 or more meters from the base of the trunk. The crown is open and deciduous for a short period during the dry season. It usually occupies the drier soils, and is found in the apitong-lauan, yacal-lauan, and molave types.

The bark is 25 to 30 millimeters in thickness, brittle in texture, brown in color, fissured with short vertical lines, otherwise smooth; the inner bark is bright red, streaked with white vertical plates arranged radially. The leaves are simple, alternate, heart shaped, prominently 5-nerved, usually hairy beneath, from 10 to 14 centimeters long and from 9 to 13 centimeters wide.

Both the sapwood and heartwood are creamy white in color, light, soft, and with prominent pith rays. It is used principally as a match wood, also for boxes and as buoys for rafts.

While it probably occurs well scattered throughout the Philippines, it is recorded at present only in the following regions: Luzon (Cagayan, Pampanga, Nueva Ecija, Zambales, Rizal, Bataan, Laguna, Tayabas, and Camarines); Mindoro; Leyte; Mindanao (Surigao, Zamboanga); Palawan. It has the scientific name of *Pterocymbium tinctorium*. Besides the common Tagalog name of taluto or some form of it (taoto, teluto), the following names occur: Bangat (Z.); fanginhan (Riz.); huligano (N., E.); libtuk (Cag.); malasapsap (Pamp.); takung (Surigao).

Besides the above the following trees deserve mention. Tanag or taloktok (*Kleinhofia hospita*) occurs in open places, yields a light yellow wood little used and a bark used as rope. Kalumpang (*Sterculia fœtida*) has palmately compound leaves (7 to 9 leaflets), and a gray, soft wood little used. The tree is cultivated for its seeds, which yield a valuable oil. A number of species of *Pterospermum* under the general name of bayok are small to medium sized trees occurring throughout the dipterocarp and molave types. They yield woods light in weight and moderately hard that are used locally. Magalipak (*Sterculia blancoi*) is often quite prominent in the molave type and some portions of the dipterocarp type. It yields a soft wood that is easily attacked by insects and fungus.

CATMON FAMILY.

(Dilleniaceæ.)

The forest trees of this family are confined to one genus (*Dillenia*). The leaves are simple and alternate. The wood has prominently twisted pith rays.

CATMON.

This is a small to medium sized tree with a short bole and dense crown. It is found along streams or on moist slopes and ridges. The bark is 6 to 10 millimeters in thickness, irregularly blotched with gray to brown patches, the latter color occurring in the shallow depressions where freshly shed; the inner bark is light reddish brown. The leaves are simple, alternate, smooth, with edges coarsely toothed, from 13 to 18 centimeters long and from 5 to 8 centimeters wide. The leaf stalks of young leaves are winged. The sapwood is pale reddish; the heartwood dark red to dark brown, hard, heavy, brittle, with a coarse and twisted grain. The wood stains water a pale reddish color. The pith rays are broad and crooked. The vessels contain white deposits. The wood is used for furniture and general construction work.

The tree occurs throughout the Philippines. The scientific name of catmon is *Dillenia philippinensis*. Catmon carabao (*Dillenia speciosa*) has a larger leaf. Both the above have white flowers. Malacatmon

(*Dillenia luzoniensis*) is a large tree with yellow flowers. The following local names are known for the species of Dillenia: Alato (N. Luz.); anagao (Sur.); calocatmon (Tay.); magalapalali (N. Luz.); magatli (Cag.); palali (V., B., N. Luz.); pamalalian (Pang.).

TEA OR BIKAG FAMILY.

(Theaceæ.)

This a family of small to medium sized trees common in the tanguile-oak and mossy-forest types. None are important from the lumberman's standpoint. Bikag (*Ternstroemia toquian*) furnishes a bark commonly used for poisoning fish. *Adinandra luzonica, Gordonia luzonica, Thea montana* and *Eurya* spp. are common in the higher mountain regions.

MANGOSTEEN OR PALO-MARIA FAMILY.

(Guttiferæ.)

This family of trees contains a yellowish sap in the bark. It has opposite leaves, usually with fine, closely set veins. The family can be readily distinguished from others by these characters.

PALO-MARIA. (Pl. LIV.)

This is usually a medium-sized, scraggly tree with a very short bole and a wide-spreading rather dense crown. It is found on the sandy beaches throughout the Islands.

The bark is 12 to 20 millimeters thick, brown in color with a decided yellowish tinge, and has a tendency to divide into distinct ridges, which are often broken into irregularly rectangular plates by cross fissures; the inner bark is pink to yellowish with concentric lines of darker color. When cut the bark exudes a yellowish sticky sap. A valuable oil known as oil of palo-maria is extracted from the seed. (See Part I, p. 56.) The leaves are simple, opposite, yellowish green in color with a very yellow midrib, and vary from 9 to 16 centimeters long and from 6.5 to 10 centimeters wide.

The wood is reddish brown in color, hard, moderately heavy, easy to saw, but difficult to finish on account of the twisted grain. It has the following uses: Fine furniture; turnery; general construction; house construction (flooring, interior finish, posts); bridge building; naval construction (masts, spars, decks, futtock timbers, oars, ships' booms, bowsprits, spars, and keels); carriage making (hubs and wagon shafts).

While probably nearly all provinces, especially those bordering the coast, have palo-maria, the records show it from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Infanta, Pangasinan, Nueva Ecija, Zambales, Bataan, Rizal, Tayabas, Camarines, Albay); Palani Island; Batanes Island; Camiguin Island; Polillo Island; Masbate Island; Burias Island; Mindoro; Culion Island; Cebu; Bohol; Negros; Mindanao (Zamboanga, Davao); Basilan; Palawan; Balabac

Island. The scientific name is *Calophyllum inophyllum*. Besides the common Spanish name of palo-maria, the following are recorded: Bansangal (Il.); biroi (Il.); bitangol (V.); bitaog (Il., V., Pam., T.); bitaoi (Z., Pam., Il., V.); dankalan (T.); pamitlaten (Il.); pamitaogan or some form of it (V., Il.); Zarumayen (Il.). It is sometimes known on the markets from Borneo as Borneo mahogany.

The dipterocarp types contain a number of other species of *Calophyllum* with about the same common names, whose wood passes for palo-maria. As a rule, however, these trees are small to medium sized, though one, bitanhol or palo-maria del monte (*Calophyllum blancoi*), attains in some cases the size of a dominant tree. The tree can be told from palo-maria by the straight grain of the wood, the narrower leaves (2 to 6 centimeters wide), and by the fact that it does not grow on the beach. All Calophyllums can be easily recognized by their distinctly yellow bark. A number of species of *Garcinia* are small to medium sized trees scattered through the dipterocarp types and produce woods used locally. The wood of bunog (*Garcinia benthami*) is reddish brown and hard and durable. It is lumbered and used locally on the Island of Palawan. The fruits of binukao (*Garcinia binucao*) and other wild Garcinias are edible. The mangosteen (*Garcinia mangostana*) is cultivated in the southern islands for its edible fruit. Guyung-guyung (*Cratoxylon celebicum*) and other species of *Cratoxylon*, usually under the same common name, are small to medium sized trees that yield reddish woods used locally. Kaliwas (*Kayea paniculata*) is a small tree scattered along water courses.

DIPTEROCARP OR LAUAN FAMILY.

(Dipterocarpaceæ.)

This is by far the most prominent family of trees in the Philippines. It not only produces the largest trees containing the greatest bulk, but, counting all trees in the virgin forests from seedlings up, there are probably more dipterocarps than all other individual trees. Our knowledge concerning the number of species is still far from complete. So far there are recognized about 40 distinct species. This number will probably reach more than 50. About 12 species produce the bulk of the lumber found on the market, and are considered the most successful ones because they compose the largest stands.

The leaves are simple, alternate, and hairy or smooth. The wood is conspicuously oily (except *Vatica* spp. where it is obscurely so.) These oils, known as wood oils, harden into resin on exposure to the air. Deposits of resin often visible to the naked eye are arranged irregularly in incomplete concentric lines having the appearance of growth-rings, but they do not represent periods of growth. When the bark and sapwood are cut, the oil exudes more or less freely and usually hardens into forms having the appearance of candle drippings. While other families in the Philippines have resinous or oily woods, yet in none is this character so prominent as in the dipterocarps. The only other trees that approach the dipterocarps in this respect are members of the pili family (*Burseraceæ*), whose resin is usually in the inner portion of the bark (the bast). The members of the pili family can readily be distinguished from the dipterocarps by their compound leaves. The dipterocarp fruits are usually globose or ovoid in shape and have, attached above or below, two or more longitudinally veined wings.

As a rule the trees are tall, many of the species reaching a height of 50 meters or over, though generally mature trees are between 40 and 50 meters. The boles are straight and regular, and usually have a merchantable length of 20 to 30 meters. They are generally strongly buttressed, though this is not always the case, especially in species of the genus Dipterocarpus.

From the lumberman's standpoint the woods can be divided into four groups as follows: The lauans, the apitongs, the yacals and palosapis. (See Part I, p. 32, for the distinction of these groups.)

THE LAUAN GROUP.

The principal trees that furnish the woods belonging to the lauan group are as follows: Almon-lauan; bagtican-lauan; kalunti-lauan; malaanonang-lauan; mangasinoro-lauan; mayapis-lauan; red lauan; tanguile; tiaong-lauan; white lauan.

WHITE LAUAN. (Pls. LVI and LVII.)

White lauan is a tree usually reaching a height of 40 to 45 meters and a diameter of 150 centimeters. It has a regular bole which reaches a length of 25 to 30 meters. Old trees are strongly buttressed. The crown is fairly dense and irregularly dome shaped. It is tolerant of shade, but seedlings do best in semiopen situations. It is widely scattered throughout the Islands in flats and on hills up to 700 meters, but reaches its best and most abundant development in the lauan-apitong and lauan-hagachac types. In many places it forms the principal tree of the depterocarp forests.

The bark is 10 to 20 millimeters in thickness, brown to nearly black, or when exposed to sunlight is gray. There are distinct longitudinal ridges, especially in the upper part of the bole, which connect diagonally with each other. The ridges are 3 to 5 centimeters in width; the grooves are about 1 centimeter wide, lighter brown in color, and sometimes filled with corky pustules, especially in the young trees. In very old trees the bark at the base of the tree loses its ridged appearance and becomes more or less scaly. The inner bark is brown to slightly pinkish in color and stringy in texture. Beneath the grooves there are vertical cream-colored bands. The leaves are simple, alternate, and entirely free from hairs. They vary in size from 7.5 to 23 centimeters long and from 3.5 to 10 centimeters wide.

Both sapwood and heartwood are grayish white in color. The wood is light in weight, soft, with a straight and coarse grain, not durable, and easy to work. It is used for all purposes where cheapness and easy working are more important than strength and durability. It has the following uses: Cheap furniture; shipbuilding (canoes, lighters, masts, planks for ships); house construction (panels for doors, partitions, siding); boxes; concrete forms.

It is reported from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Bontoc, Benguet, Isabela, Nueva Vizcaya, Pangasinan, Bulacan, Rizal, Zambales, Bataan, Laguna, Tayabas, Camarines, Sorsogon, and Albay); Polillo Island; Marinduque Island; Mindoro; Masbate; Samar; Negros; Mindanao (Agusan, Zamboanga, Lanao, Davao); Basilan Island. It is probably present in all provinces.

The scientific name is *Pentacme contorta.* The most common name is lauan (white lauan, lauan blanco, lauan puti). The following local names are the most common: Apnit (Ib., B.); balabak (Cag.); bayukan (Lag., Z.); bugis (Davao); danlog or some form of it (V.); diraan (Ig.); hapnit (B.); lauaan (T., V.); malaanonang (Riz., Cam.); malakayan (Moro); mangasinoro (S. Luz., Mas.); sandana.

ALMON-LAUAN. (Pls. LVIII and LIX.)

This is a very large tree, reaching a height of 45 to 50 meters and a diameter of 150 centimeters. The bole is usually regular in shape and of even taper, in old trees is rather strongly buttressed, and has a maximum length of about 30 meters.

The crown is about one-third to one-half the length of the bole. It is wide spreading, flattened cone shaped to irregular and rather dense. The tree is found on gentle to medium steep slopes, usually requiring a good well-drained soil, and is confined to the regions where there is no pronounced dry season. It is tolerant of shade, and to this is attributed its success in holding its own in dense forests. It occurs associated with other lauans and the apitongs, with which it forms almost pure stands in some places.

The bark is 15 to 20 millimeters in thickness. In young and medium-sized trees it is cinnamon brown in color, in older trees it is darker, and when weathered in strong light it becomes lighter in color. In medium-sized trees it has long furrows between which are flat ridges 3 to 4 centimeters wide. These are checkered into irregular rectangular patches by cross lines connecting the furrows. The ridges are not usually prominent in the lower part of the tree, where the furrows are merely shallow fissures of the bark; in older trees, especially near the top, the furrows are deeper and then contain lines of corky pustules. The middle bark is very thin and has a pitted dark purple layer. The inner bark is light brown to slightly yellowish beneath the ridges, alternating with vertical creamy bands beneath the furrows, and is stringy in texture.

The leaves are simple, alternate, from 9 to 17 centimeters long and 4.5 to 9 centimeters wide, smooth above, with a dense mat of hairs beneath.

The petioles and young twigs are covered with hairs like those on the leaves.

The fresh sapwood is creamy in color, when exposed becoming light brown; the heartwood is light creamy brown to a pale red. The wood is light in weight and soft. It is used in all sorts of light and temporary construction and is especially valuable for interior finish. It has the same uses as white lauan.

It is reported from the following regions: Luzon (Laguna, Tayabas, Camarines, Sorsogon, Albay); Negros, Mindanao (Surigao, Zamboanga); Basilan Island.

The scientific name is *Shorea furfuracea.* The wood is sold in the Manila market under the names of almon and white lauan. The following are the most common local names: Danlig (Tay.); lauan (T.); malakayan (Moro); mangasinoro (Sor., Al., Cam.); mayapis (Tay.).

BAGTICAN-LAUAN. (Pls. LX and LXI.)

This is a very large tree reaching a height of 40 to 45 meters and a diameter of 150 to 180 centimeters. The bole is regular, usually strongly buttressed, and 20 to 30 meters in length. The crown is irregularly vase shaped, one-fourth to one-third the length of the bole, and somewhat dense.

This tree is found throughout the regions of the Philippines where the dry season is not pronounced and is probably more abundant than any other species. It extends from the subprovince of Baler to Davao, Mindanao. While doing best in deep soils on gentle slopes it occurs on fairly shallow soils from near sea level to 500 meters in altitude. It is found principally in the lauan type. It is a tree tolerant of shade, but will reproduce best in partially open places. Seedlings having become well established in such places during the wet season will be able to flourish in fully opened places during the short period of dry weather.

The bark is 10 to 20 millimeters in thickness. In young trees it has longitudinal cracks; in older trees it is distinctly divided into ridges which are long or short, finally connecting diagonally with each other, making a network. The grooves between the ridges usually contain rows of brown corky pustules. The bark is brown to nearly black in color, and in trees exposed to strong light is much lighter. The thin middle bark beneath the ridges is purplish red. The inner bark is tan colored with whitish vertical bands beneath the grooves, and is fibrous in texture. The leaves are simple and alternate and usually covered with a white glaucous bloom beneath. They are from 9 to 21 centimeters in length and from 4.5 to 11 centimeters in width.

The sapwood is grayish; the heartwood is dirty brown in color when fresh, but on exposure may change to a pale reddish brown. It is soft, light in weight, and not durable, but like the other lauans when quarter sawn shows a fine figure. It has the same uses as the other light-colored lauans.

Bagtican-lauan is reported from the following regions: Luzon (Baler, Bulacan, Rizal, Laguna, Tayabas, Camarines, Sorsogon, Albay); Catanduanes Islands; Polillo Island; Masbate; Leyte; Negros; Mindanao (Zamboanga, Davao).

The scientific name of this species is *Parashorea plicata.* Bagtican-lauan is marketed usually under the names of lauan or almon. The following local names are reported: Apnit (S. Luz.); bagtican-lauan (Neg.); bayukan (Lag.); danlig (Tay.); hapnit (S. Luz.); lauan (T., Ley., Mas., Sur.); lauan puti (Riz.); malaanonang (Riz.); mangasinoro (Mas.); mayapis (Bal.).

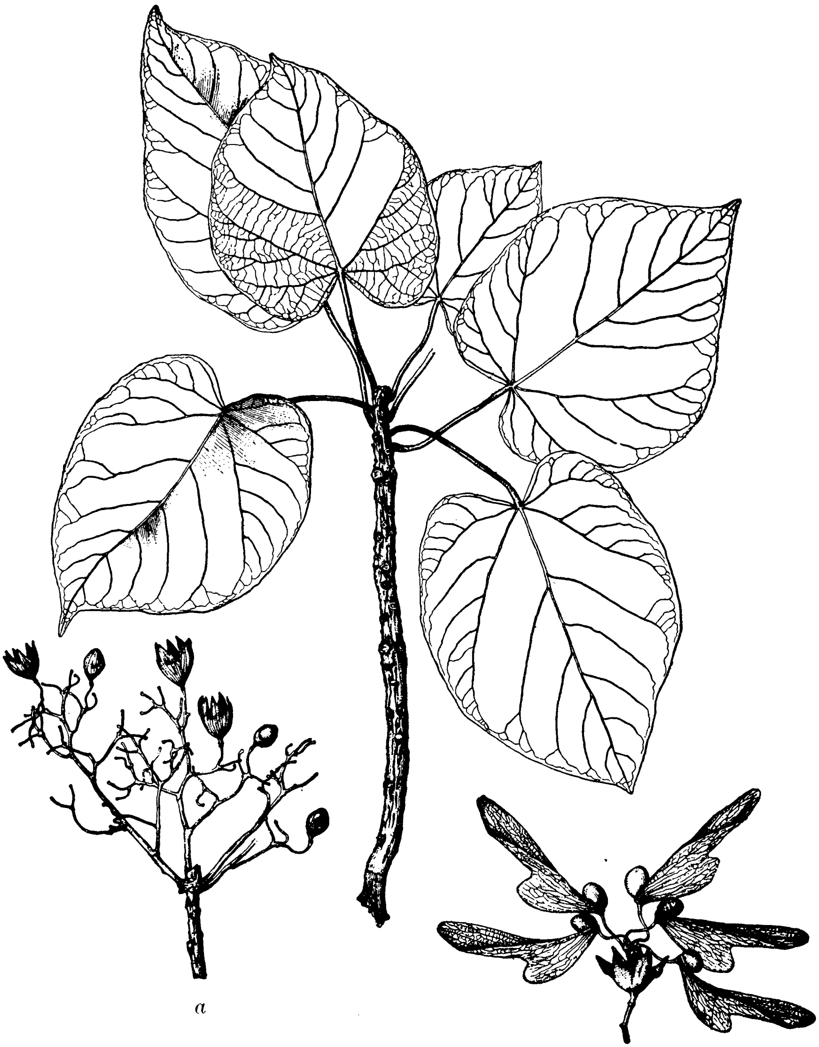
MALAANONANG-LAUAN.

This name is applied to a tree that strongly resembles white lauan in general appearance. Herbarium specimens show that the tree is confined to central and northern Luzon and extends as far south as Tayabas Province. The bark is 10 to 20 millimeters in thickness and is prominently ridged. The wood is light brown with a yellowish and sometimes reddish tinge. It is moderately hard and light to moderately heavy. It is used for all purposes to which lauan is put. The leaves are from 5 to 12 centimeters long and from 4 to 7.5 centimeters wide, and when dry are slightly rusty brown beneath, due to scattered fine hairs. Malaanonang-lauan is reported from the following provinces: Luzon (Pangasinan, Nueva Ecija, Rizal, and Tayabas).

This tree is referred to *Shorea malaanonan.* The usual market name is lauan. The following local names are most common: Danlig (Tay.); Lauan puti (N. E.); malaanonang (Riz.); lauan (Riz., Tay.); pamayawasen (Pang.).

KALUNTI-LAUAN. (Pl. LXII.)

Kalunti-lauan is a tree reaching a height of 50 to 55 meters and a diameter of 180 centimeters. It has been reported only from the Zamboanga district of Mindanao, where it grows associated with yacal on the ridges and upper slopes. In silvicultural habits it closely resembles yacal. The bole is fairly regular, 30 to 40 meters in length, and strongly buttressed in old trees. The crown is narrow to fairly wide spreading and semiopen. The bark is 10 to 25 millimeters in thickness. In young trees it has a fairly uniformly smooth, brown color with short gray vertical lines; this characteristic sometimes holds in trees up to 75 centimeters in diameter in places. Trees from 20 centimeters up in diameter usually have a bark breaking into ridges 3 to 8 centimeters broad; horizontal cracks divide these into fairly regular pieces six to eight times as long as wide. In young trees the middle bark is green;



J. Vitan, del.

PLATE LIII.—TALUTO (*Pterocymbium tinctorium*).

a, Flower cluster; *b*, fruit cluster.

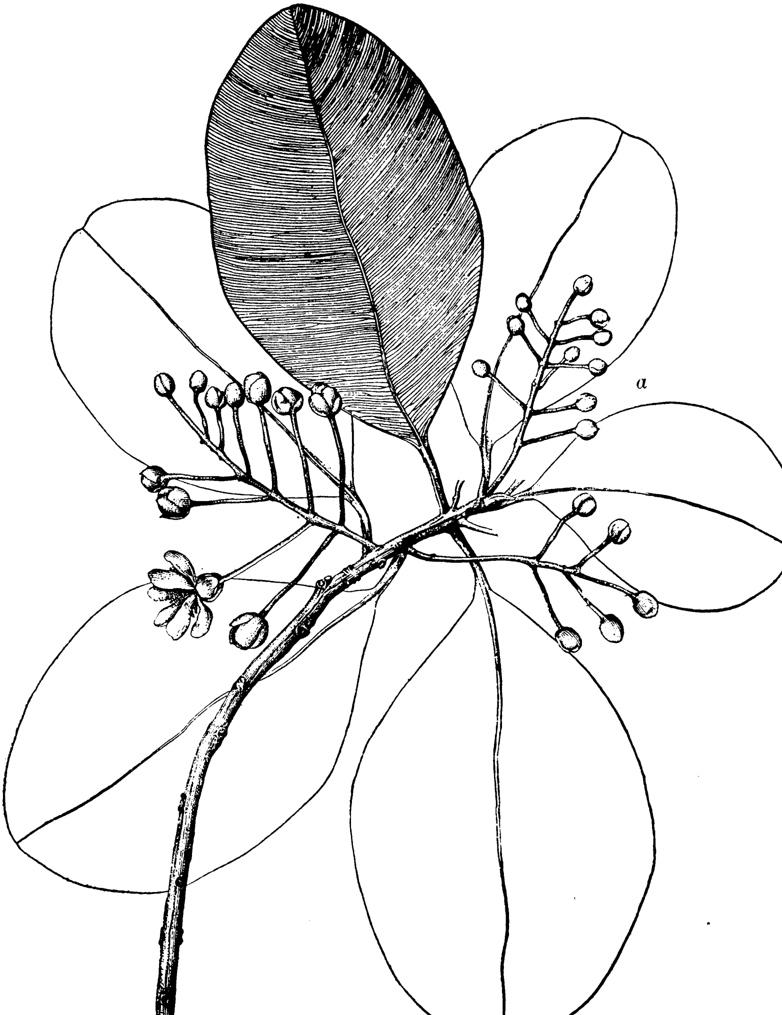


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PLATE LIV.—PALO-MARIA (*Calophyllum inophyllum*).

a, Flower cluster; *b*. fruit.

PLATE LV.—SMALL TREE OF BITANHOL (*Calophyllum blancoi*).

Leaves attached to the bark.

Plate LVI.—WHITE LAUAN (*Pentacme contorta*).

a, Fruit.

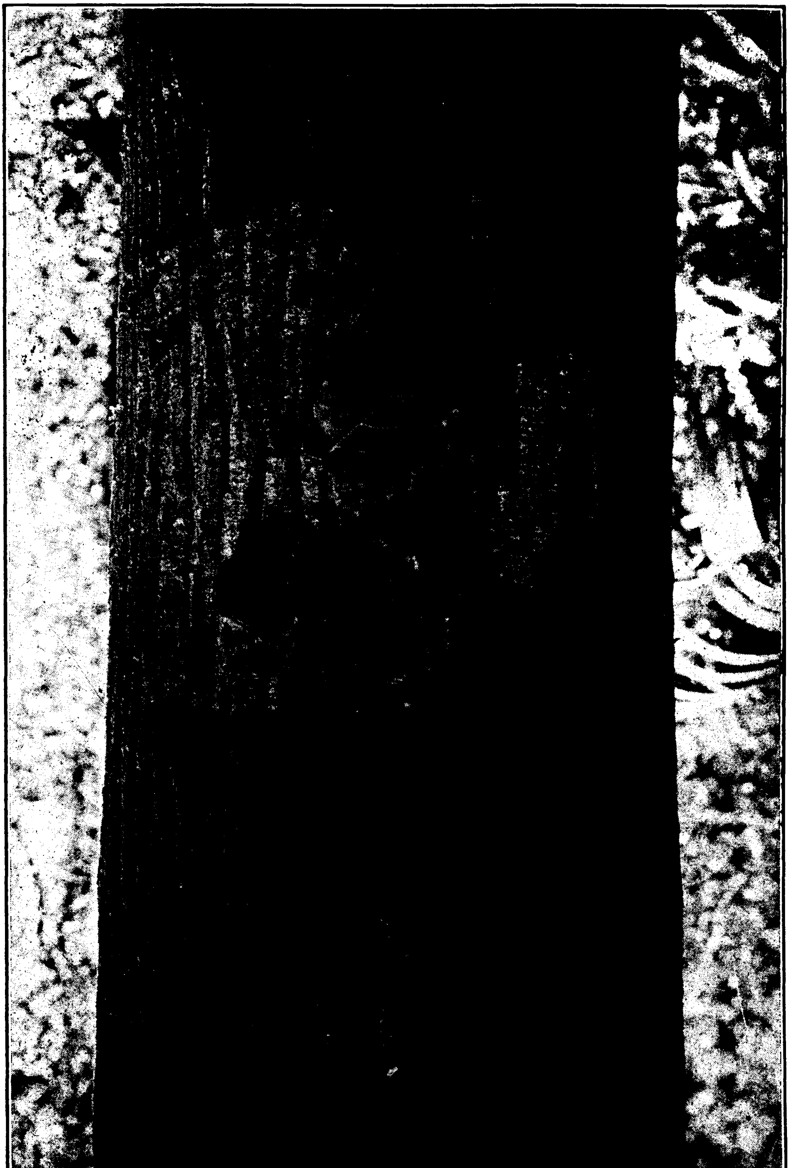

PLATE LVII.—BARK AND LEAVES OF WHITE LAUAN (*Pentacme contorta*).

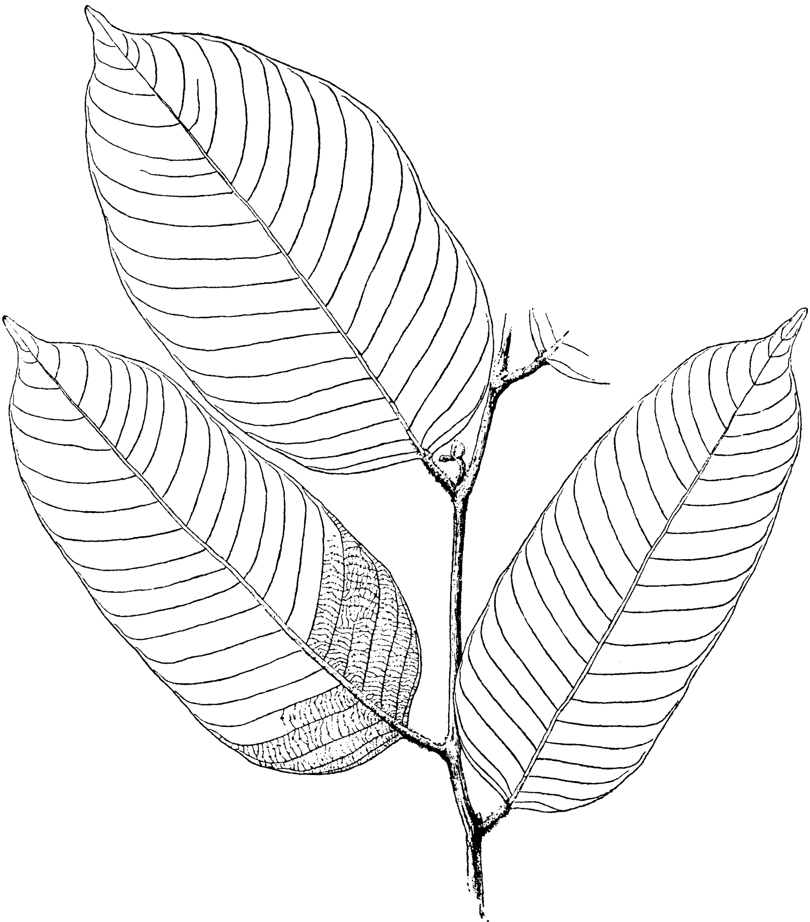

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PLATE LVIII.—ALMON-LAUAN (*Shorea furfuracea*).

PLATE LIX.—BARK AND LEAVES OF ALMON-LAUAN (*Shorea furfuracea*).

PLATE LX.—BAGTICAN-LAUAN (*Parashorea plicata*).

a, Fruit.

PLATE LXI.—BARK OF BAGTICAN-LAUAN (*Parashorea plicata*).

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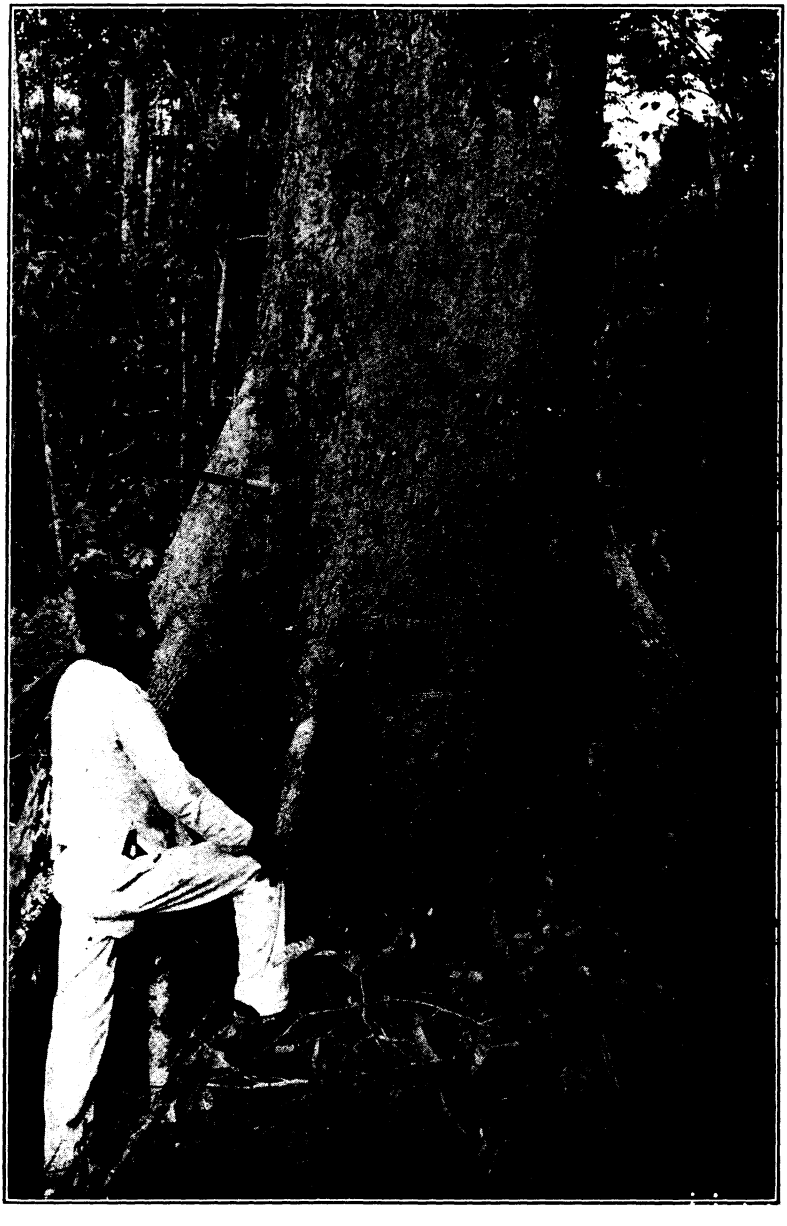

PLATE LXII.—KALUNTI-LAUAN (*Vatica* sp.).

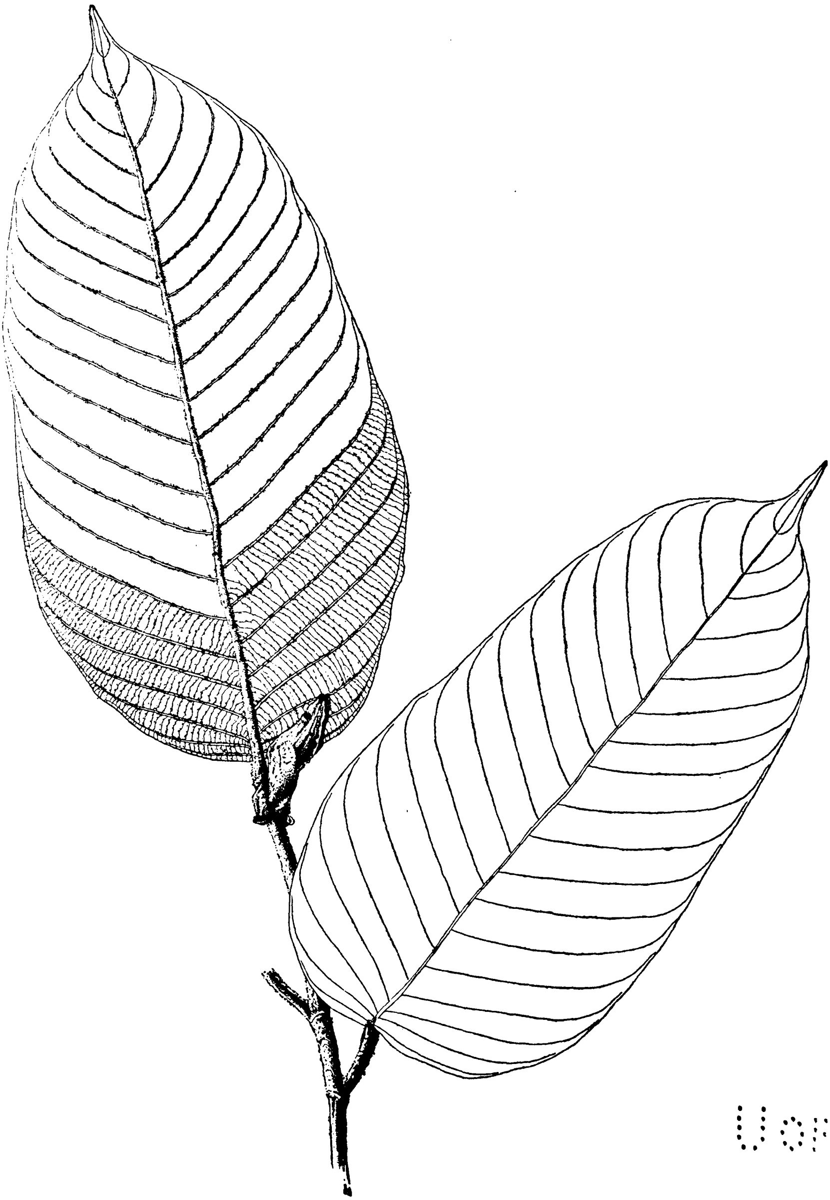

PLATE LXIII.—MAYAPIS-LAUAN (*Shorea squamata*).

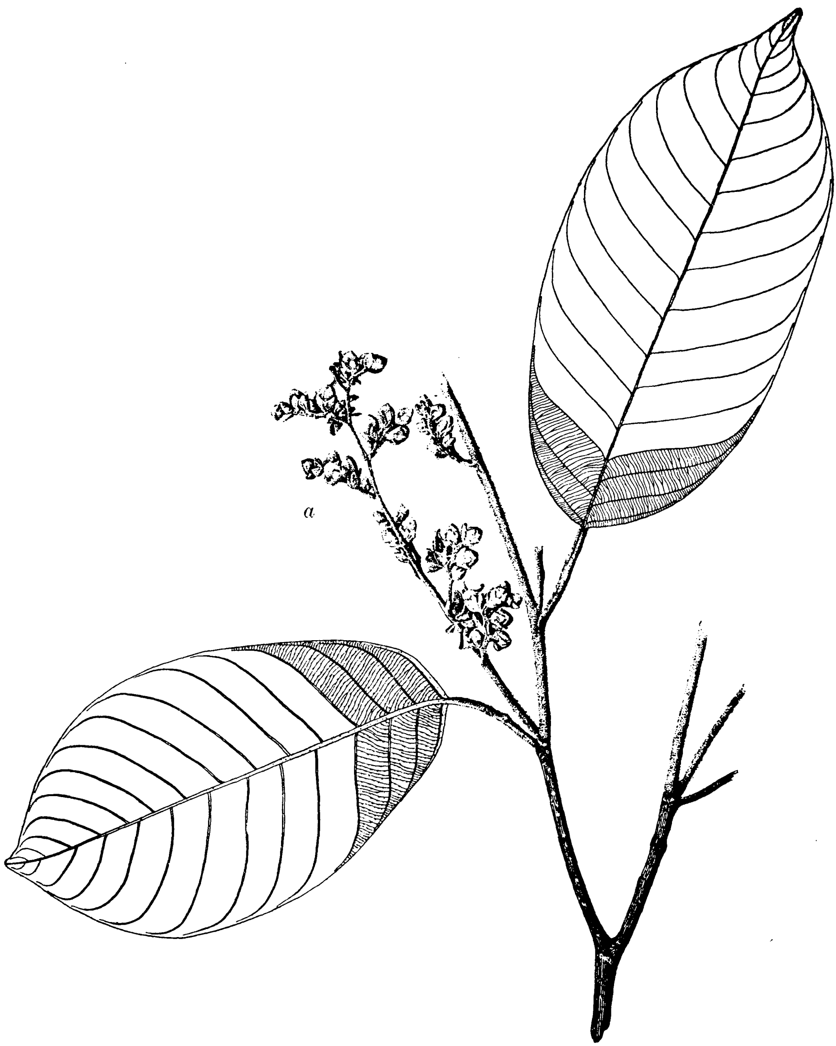

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PLATE LXIV.—RED LAUAN (*Shorea* sp.)

a, Flower cluster.

PLATE LXV.—BARK AND LEAVES OF RED LAUAN (*Shorea* sp.).

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PLATE LXVI.—TANGUILE (*Shorea polysperma*).

a, Flower cluster; *b*, fruit.

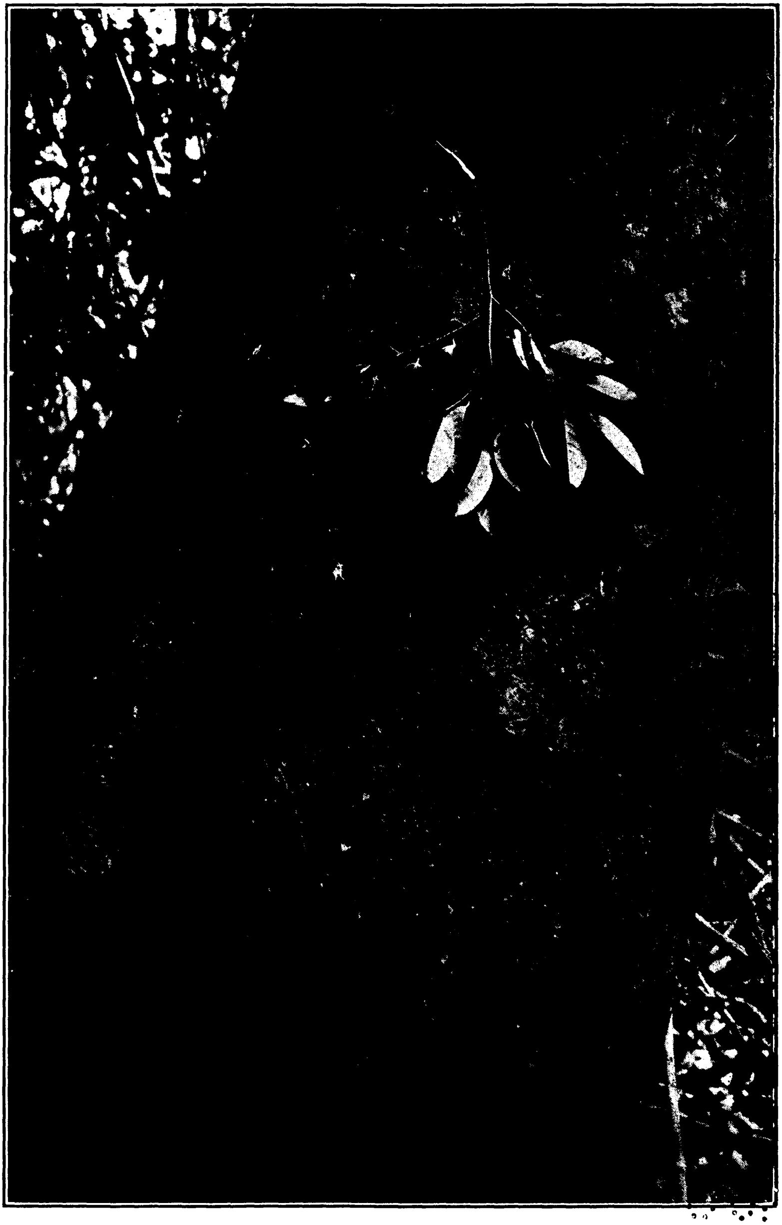
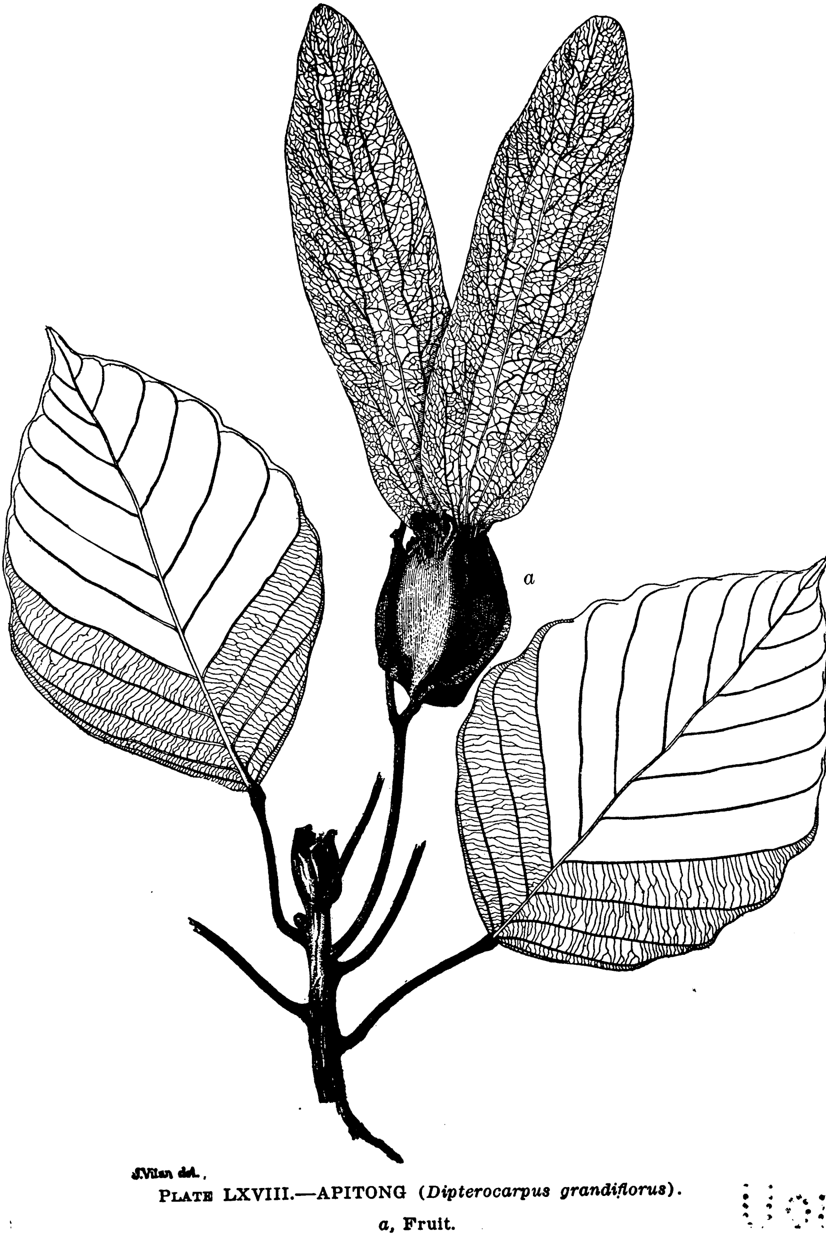


PLATE LXVII.—BARK AND LEAVES OF TANGUILE (*Shorea polysperma*).



J.Vilan del.

PLATE LXVIII.—APITONG (*Dipterocarpus grandiflorus*).

a, Fruit.

PLATE LXIX.—BARK AND LEAVES OF APITONG (*Dipterocarpus grandiflorus*).

in older ones it is a thickened brown layer. The inner bark is yellow to brownish yellow, diagonally fibrous, and very stringy.

The leaves are simple, alternate, and leathery in texture, from 7 to 12 centimeters long and from 3 to 6 centimeters wide, dark green above, lighter green below, smooth.

The sapwood is dirty creamy color when freshly cut, soon turning to a light brown; the heartwood is light yellow in color. The tree exudes a brown oil, which quickly hardens into jet black brittle resin.

The wood is light in weight, soft, coarse, and straight grained. At present it is little used, but will undoubtedly find its way into the market in some quantities and be sold for lauan.

It is reported only from the district of Zamboanga, Mindanao, but probably occurs in other parts of Mindanao and neighboring islands.

From the character of the leaves the tree is provisionally referred to *Vatica* sp. The only local name reported for this wood is kalunti (calunti).

MANGASINORO-LAUAN.

While the name mangasinoro is applied to several kinds of lauan, there is a species of *Shorea* found in southern Luzon that produces a yellowish white, soft, and light wood that has a structure different from the other lauans. From a lumberman's standpoint the timber would be classed as a white lauan. There are not sufficient data to describe the tree. It is probably not abundant nor widely distributed.

MAYAPIS-LAUAN. (Pl. LXIII.)

This is a tree which reaches a height of 40 to 45 meters or more and a diameter of 150 centimeters. The tree is strongly buttressed and has a regular bole with a length up to 25 or 30 meters. The crown is spreading, flatly conical in shape, and dense.

The tree is one of the constituents of the lauan and lauan-hagachac types. It is found more or less abundantly from the northern part of Luzon to the southern part of Mindanao. It does best on rich, deep, but fairly well-drained soils in the lowlands, and seldom reaches an altitude of over 300 meters. It is distinctly a tolerant tree. It grows with the other lauans, apitong, and sometimes hagachac. It is confined to regions where the dry season is not pronounced.

The bark is from 8 to 16 millimeters in thickness; it is brown to dark brown or cinnamon brown in color, gray when exposed to strong light and black when wet. It is rather prominently ridged, especially above. The inner bark is stringy in texture and brown to slightly pink in color, especially a distinct vertical band beneath the furrows.

The leaves are simple and alternate, from 12 to 30 centimeters in length and from 6 to 11 centimeters wide. They are coarsely hairy beneath, especially along the midrib and veins. These hairs are set in bunches and to the naked eye appear star shaped. The leaf is coarse in texture and has large prominent stipules which are for a time persistent.

This tree resembles closely almon-lauan, but can be distinguished from it by its darker colored bark and much coarser, larger leaves and more prominent hairs. The wood, also, is redder in color.

The sapwood is creamy brown to pinkish in color; the heartwood is light red to red. It is slightly resinous, has a straight regular grain, and is light to moderately hard and soft. It is used in all classes of light and temporary construction purposes, especially where contact with the ground is not necessary. It is valuable for interior finish and light furniture and shows a good figure. Locally it is used for bancas and all classes of house building.

It is reported from the following regions: Luzon (Cagayan, Isabela, Laguna, Tayabas, Camarines, and Sorsogon); Polillo Island; Marinduque Island; Mindoro; Samar; Mindanao (Misamis, Lanao, Agusan, Zamboanga); Basilan Island.

Mayapis-lauan has the scientific name of *Shorea squamata*. The wood is sold in the Manila market under the name of mayapis, lauan, red lauan, and tanguile.

The following local names are the most common: Alam (Mangyan name of M.); balabak (Ib.); danlig (Tay.); lauan (T.); malacacao (Tay.); malakayan (Moro); malasinoro (Sam.); mayapis (T.); oghayan (Sam.); tabak (Tay.); ubanan (Manobo name of Ag.).

RED LAUAN. (Pls. LXIV and LXV.)

Red lauan is a tree reaching a height of 40 to 50 meters and a maximum diameter of 200 centimeters. It has a straight cylindrical bole with a slight taper and is strongly buttressed. The bole reaches a maximum length of 33 meters. The crown is one-fourth to one-third the length of the bole, and is irregularly dome shaped.

The tree is much like almon-lauan in all its requirements and is associated with it, apitong, tanguile, and bagtican-lauan in forming the dipterocarp forest of Negros. It is found on very gentle to fairly steep slopes in good soil. It is tolerant of shade, but develops best in young stages in partially open places.

The bark is 10 to 20 millimeters in thickness, dark brown to nearly black with a reddish tinge, and has ridges with shallow furrows, more prominent in the upper portions of the trunk. The bark is shed in rectangular plates, 10 to 20 centimeters long; freshly exposed patches are purplish black, brownish tan, or even gray in color and covered with thickly set corky pustules. At the base of large trees between buttresses there are often large irregular, very thin flakes. The inner bark is dull tan or reddish in color with white fibers and stringy in texture. The leaves are simple and alternate, from 5 to 19 centimeters long and from 4 to 8 centimeters wide, and somewhat leathery in texture. The midrib above, the entire surface of the underside of the leaves, the petioles, and young twigs are covered with whitish velvety hairs.

The fresh sapwood is creamy in color near the bark, and gradually grades though a tan to the dark red color of the heartwood. The wood is light to moderately heavy and soft to moderately hard. It is used in all classes of temporary construction. Fine grades of it (with tanguile and other lauans) are used for interior finish and furniture and are shipped to the United States under the name of Philippine mahogany, where it is sold in competition with quarter-sawn oak. There it is finding great favor as a fine interior finish wood. Locally the wood of this tree is used for bancas and for all grades of house construction.

It is reported only from Occidental Negros and Agusan, but is probably present in other neighboring provinces. It is an undescribed species of *Shorea*. It has the local names of balakbakan, mangachapuy, and red lauan in Negros, and the wood is sold in the Manila market under the names of balakbakan, tanguile, red almon, and red lauan.

TANGUILE. (Pls. LXVI and LXVII.)

Tanguile is a tree that reaches a height of 45 to 50 meters and a diameter of 160 centimeters. The bole is regular, little to strongly buttressed, and reaches lengths of 25 to 30 meters. The crown is wide spreading, irregularly dome shaped and dense, and from one-third to one-half the length of the bole. This is one of the principal trees of the tanguile-oak and lauan types, but reaches its best development in the former type.

The bark is 5 to 6 millimeters in thickness, light red in color, and sheds in small to medium sized flakes. In old trees fresh bark for a time is nearly smooth or free from scales, when it is soft to the touch. The inner bark is red and stringy in texture.

The leaves are simple and alternate, from 5 to 14 centimeters long and from 3 to 6 centimeters wide, usually thin in texture, dark green above, a lighter green below, and smooth.

The sapwood is creamy in color, on exposure turning to a dirty brown. The heartwood is light red to reddish brown in color. The wood of trees grown in dry shallow soils is moderately hard and moderately heavy; that grown in the deeper soils is softer in texture and lighter in weight. The former is known as tanguile in Bataan and Zambales; the latter as balakbakan in Negros, and mayapis in Tayabas. The trees in dry exposed situations are shorter boled than those grown in moister places.

Tanguile resembles guijo in general character of the bark and leaves. Usually, however, they are not found growing together. The shape of the leaves is slightly different. The wood of tanguile is red in color, soft to moderately hard, and light to moderately heavy. The softer grades of tanguile resemble red lauan, and for most purposes there is little or no difference, but the harder grades are superior to it. It has the following uses: House construction (flooring, doors, interior finish); furniture; shipbuilding; canoes; boxes. With red lauan, it is the chief export material known as Philippine mahogany.

Tanguile is reported from the following regions: Luzon (Cagayan, Ilocos Norte, Pangasinan, Zambales, Bataan, Tayabas, Camarines, Albay); Polillo Island; Marinduque Island; Mindoro; Cebu; Negros. It is the equivalent of the wood known as klapak in Dutch East Borneo and obar suluk of British North Borneo.

It has the scientific name of *Shorea polysperma.* The following local names for tanguile are the most common: Abuhungan (Al.); adamui (B.); araka (Il.); balakbakan (Neg.); balagayan (Mangyan name of M.); damilang (Ib.); manaog (Cebu); mayapis (Tay.); pata (Pang.).

TIAONG-LAUAN.

This name is applied to a species of *Shorea* yielding a soft red wood which will pass on the market as red lauan or mayapis lauan. The tree resembles red lauan in general character, but has leaves something like tanguile. It is reported from the lauan forests of portions of the Tayabas and Laguna region, where it is very abundant. There is not sufficient information concerning it to warrant a detailed description. It has the same uses as red lauan.

THE APITONG GROUP.

The woods that belong to this group are as follows: Apitong, panao, hagachac and other species of Dipterocarpus, and guijo. (See Part I, p. 33.)

APITONG. (Pls. LXVIII and LXIX.)

Apitong is a tree that reaches a height of from 40 to 45 meters and a diameter of 180 centimeters. It has a straight regular bole with a length of from 25 to 30 meters. The crown is roughly flat-conical or irregular and semiopen. The tree is found throughout the Visayas and the northern islands and is especially abundant in the region where the dry season is pronounced. Here it occurs on ridges from near sea level to an altitude of 300 to 350 meters. It occupies somewhat drier situations than panao, and although tolerant of shade it does better in slightly open places.

The bark is 6 to 8 centimeters in thickness and brittle in texture. It varies from a brown-gray color in dense shade to a light gray color where exposed to strong light. It sheds in large scroll-shaped plates and has many corky pustules. The inner bark is reddish in color. The leaves vary in size from 19 to 30 centimeters in length and from 9.5 to 17 centimeters in width, are leathery in texture, and smooth. The petioles are from 5.5 to 7 centimeters in length. The tree resembles panao greatly in appearance, but can be readily distinguished from it by the character of the leaves, a somewhat shorter bole, longer bark scales, and longer leaf stalk. (See Panao.)

The heartwood is dark with a reddish tinge, the sapwood grayish brown. On cutting, the wood exudes abundant quantities of oil, which changes rapidly to a thick fluid resin on exposure to the air. This resin is known locally as balao, and is used principally in calking small boats. (See Part I, p. 55.) The wood is moderately heavy, moderately hard, with a straight but coarse grain. It is the most abundant heavy construction timber in the Islands, but can not be classed as a durable timber. It has the following uses: House building (interior finish, rafters, doors and windows, joists, sills, flooring, and sometimes parts of house posts spliced on top of more durable timbers); ship building (bancas, planks, bottoms, sides); piling; ordinary furniture; wagon beds; bridge timbers; charcoal.

Apitong is known to exist in the following regions: Luzon (Cagayan, Isabela, Ilocos Sur, Abra, Benguet, Pangasinan, Pampanga, Nueva Ecija, Bulacan, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines, Albay); Mindoro; Masbate; Leyte; Negros; Palawan. It probably occurs in a number of other provinces.

The scientific name of apitong is *Dipterocarpus grandiflorus*. The following local names have been recorded: Anahauon (B.); balao (T.); damalalian (Cag.); duko (N. Luz.); hagachac (Cam.); kamuyao (V., Il.); malapaho (T.); pagsahingin (Lag.); pamalalian (Cag.); pamantuling (Pang., Il.); panao (T.).

PANAO. (Pls. LXX and LXXI.)

Panao is a tree that reaches a height of 40 to 45 meters and a diameter of 160 to 180 centimeters. It has a straight regular bole attaining a length of 28 to 32 meters, usually with very prominent buttresses. Panao is especially abundant in the regions where the dry season is pronounced. Here it occurs in slightly more moist situations than apitong, usually occupying the slopes of the ridges up to an altitude of 600 meters. It is a medium tolerant species; seedlings, however, thrive best in fairly open situations.

The bark is 5 to 8 millimeters in thickness. It is light brown to gray in color, scaling off in large patches, and is covered with very numerous corky pustules; the inner bark is brown to reddish brown, stringy in texture. The leaves are from 10 to 23 centimeters long and from 6 to 13 centimeters wide with velvety hairs beneath. The petioles are 2.5 to 3 centimeters long and hairy. (For the difference between this tree and apitong see apitong.)

The sapwood is pale brown in color; the heartwood reddish brown, and the grain coarse. Both sapwood and heartwood are very resinous. (See Apitong for further description.)

Panao is reported from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Pangasinan, Pampanga, Bulacan, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines); Polillo Island; Marinduque; Mindoro; Leyte; Negros. It probably occurs in many other provinces.

It has the scientific name of *Dipterocarpus vernicifluus.* The following local names are recorded: Afu (Il.); apitong (T.); kamuyao (Cag.); malapaho (Polillo); pagsahingin (Lag.).

HAGACHAC. (Pls. LXXII and LXXIII.)

Hagachac is a tree of the apitong group that reaches a height of 45 to 50 meters and a diameter of 150 to 170 centimeters. It has a straight, regular bole upward of 30 meters in length, usually without buttresses. The crown is broadly conical, medium compact. This tree is uniformly distributed throughout the Philippines where the dry season is not pronounced, on flood plains of the large and small rivers, and occasionally occurs on the low hills bordering these.

The bark is 6 to 8 millimeters in thickness. It is light gray and smooth in young trees; in older trees it sheds in thin, irregular flakes about three times as long as wide. The inner bark is reddish brown, about the same color as the heartwood.

The leaves are variable in size and shape, running from 18 to 53 centimeters in length and from 7 to 22 centimeters in width. The petioles are covered with coarse hairs, which also occur on the midrib of the underside of the leaves.

The wood resembles closely that of apitong, for which it is sold on the market. It also has the same uses.

It is reported from the following regions: Luzon (Cagayan, Laguna, Tayabas, Camarines); Marinduque Island; Mindoro; Masbate; Samar; Leyte; Mindanao (Surigao, Zamboanga, Davao).

This tree is usually referred to *Dipterocarpus affinis,* though there may be more than one species. Besides the common name of hagachac, the following local names have been collected: Anahauon (B.); apitong (Mas., Ley., Sam.); bayu (Sur.); kamuyao (Cag.); liput (Sur.).

Other species of the apitong group, usually referred to *Dipterocarpus hasseltii* and *Dipterocarpus speciosus,* and unknown species occur in many regions throughout the lauan types. These have the general habits of apitong and panao and yield woods much like them. Our information concerning them is not sufficient to warrant detailed descriptions.

GUIJO. (Pls. LXXIV and LXXV.)

Guijo is a tree that will reach a height of 40 to 55 meters and a diameter up to 180 centimeters. It has a straight, regular bole, strongly buttressed, that is from three-fifths to two-thirds the height of the tree.

The crown is irregularly globular in shape, somewhat open, especially in the dry season. Guijo is found in all the dipterocarp types. While it is tolerant of shade it does better in slightly open places.

The bark of guijo is 5 to 6 millimeters in thickness. Long exposed bark is light brown in color with corky pustules and sheds in scroll-shaped or nearly rectangular patches. Freshly exposed bark is cinnamon brown in color. The inner bark is light reddish brown in color and stringy in texture.

The leaves are simple, alternate, from 8 to 19 centimeters long and from 3 to 8 centimeters wide, and usually smooth. They closely resemble those of tanguile, though they are more rounded at the base.

The sapwood is very light in color; the heartwood is ashy red to brownish red. It is fairly straight grained and inclined to warp when not well seasoned. Better grades of apitong closely resemble guijo and are often sold for it. It is moderately heavy and hard, and is one of the most useful timbers in the Islands. It is more durable than apitong, but considerably less so than yacal. It has the following uses: House construction (flooring, joists, rafters, posts joined above durable timbers, partitions, doors, sills, window frames, and interior finish of all kinds); shipbuilding (beams, booms, decking, keels, masts, outrigger supports, oars and paddles, side planking); carriage making (hubs, wheels, especially rims and spokes, and all other parts); furniture; docks; telegraph poles; piling; agricultural implements; vats; barrels.

Guijo is recorded from the following regions: Luzon (Cagayan, Isabela, Abra, Nueva Vizcaya, Bontoc, Pangasinan, Pampanga, Zambales, Bataan, Rizal, Laguna, Batangas, Tayabas, Camarines, Sorsogon, Albay); Marinduque Island; Mindoro; Masbate Island; Ticao Island; Samar; Leyte; Occidental Negros; Mindanao (Zamboanga, Cotabato, Davao); Basilan.

The scientific name of guijo is *Shorea guiso*. Besides the common name of guijo (or guiso) the following local names are recorded: Betik (Lag.); guisoc (V., Moro); katapang (N. V.); litan (Cag.); niquet or niket (Il.); sarai (Il.); yamban (Il.); zitan or some form of it (Il.).

THE YACAL GROUP.

A great deal of confusion yet exists concerning the correct determination of the species of trees that produce the woods of this group. Some of these are described here, in others there are not sufficient data to warrant description. As a rule the woods can be divided into two groups—the yacals proper and the mangachapuy group. Two grades of the mangachapuys are known on the market—the one hard and only slightly less durable than yacal, the other much less hard and durable. These latter are sometimes sold as mangachapuy, and have resulted in giving the harder varieties of the woods of the same name a bad reputation. As yet there is insufficient information to warrant a full description of the trees of the softer varieties. (See Part I, p. 33.)

YACAL. (Pls. LXXVI and LXXVII.)

Yacal is a large tree with a height of 45 to 55 meters, though often mature trees are less than 45 meters. They will measure from 80 to 180 centimeters in diameter. The bole of yacal is regular, free from knots, and mature trees are usually strongly buttressed. The crown is semi-open, broad, with a few heavy branches, and is one-fourth to one-third the height of the tree. It is evergreen, but during the dry season there is a period when there are fewer leaves than during the wet season. It is found growing on the low coastal hills, usually of volcanic rock, and is especially abundant on headlands projecting into the sea. In these situations it occurs almost exclusively on the ridges and upper slopes where the soil is well drained and fairly shallow. Occasional trees are found scattered in the deeper soils of the more gentle slopes, though they do not occur in moist soils. It is partially tolerant of shade. Young trees develop best in open places, provided they can survive exceptionally dry periods. The altitudinal range is from near sea level to about 200 meters.

The bark is 10 to 15 millimeters in thickness. It is gray brown, cinnamon brown, to brown in color and is shed in small or large plates; weathered bark is somewhat lighter in color. The fresh bark of old trees is sometimes seamed; in young trees the bark is darkbrown, smooth, and sometimes seamed. The inner bark is yellowish brown when freshly cut, but changes rapidly to brown on exposure.

The leaves of yacal are simple, alternate, from 6.5 to 12 centimeters long and from 3 to 6 centimeters wide. In some leaves the axils of the secondary veins contain glands, which are absent in mature leaves of old trees. The old leaves are leathery and smooth.

The sapwood is light yellowish brown, changing rapidly to a color slightly lighter than the yellowish brown to brown heartwood. Old wood becomes dark brown. The wood is rather coarse grained and crossed fibrous, and splits quite easily tangentially, but with difficulty radially. It is hard and heavy and is very durable. When cut the tree yields an oil which quickly hardens into a brittle dirty black resin. (See Part I, pp. 54 and 55.)

Yacal is the most abundant of the heavy, hard, and very durable timbers. It is especially valuable in all classes of construction work where contact with the ground is necessary, but it is readily destroyed by teredo. It is used for the following purposes: House construction (posts, joists, rafters, flooring, doors, walls, sills); shipbuilding (keels, decking, sides, masts, rudders); bridge construction; railway ties; cabinetmaking; furniture; carriage making (especially spokes and fellies).

This species (probably including others closely allied in leaf and wood character) is reported from the following regions: Luzon (Cagayan, Nueva Vizcaya, Pangasinan, Nueva Ecija, Zambales, Camarines, Tayabas, Sorsogon); Mindoro; Mindanao (Zamboanga, Cotabato).

The species described above is referred to *Hopea plagata.* Besides the name of yacal it has the following local names: Betik (Il.); guisoc (B., V., Moro); papolongan or some form of it (T.); sapolongan (T.); siggai (Il.); taggai (Il.).

GUISOC. (Pl. LXXVIII.)

Guisoc, with yacal, furnishes most of the lumber known on the market as yacal. The habits of the tree are very similar to yacal. It attains a height of 35 to 45 meters and reaches a diameter of 150 to 170 centimeters. The bole, compared with trees of the same diameter of yacal, is usually shorter, the tree being consequently more stocky in appearance. The bark is reddish brown to brown where freshly shed, changing on weathering to dark brown or nearly black. It sheds in usually much larger irregular patterns. The fresh bark and that of young trees becomes seamed. The leaves are simple and alternate, from 8.5 to 15 centimeters long and from 2 to 6 centimeters wide. They, with the twigs and petioles, are covered beneath with fine brown hairs, which become rusty brown as the leaves age, so that the crown of the tree looked at beneath has a rusty brown appearance. During the dry season the canopy is much thinner between the time of the beginning of the shedding of the leaves and before the new leaves begin to develop. The tree, however, is not wholly deciduous, probably not losing more than a third of its foliage at any one time.

The wood is much like yacal in general appearance, and furnishes a considerable part of the yacal of commerce. The specimens examined have a slightly finer texture than that of yacal, but are equally hard and heavy. It has the same uses as yacal.

The tree has been reported from Tayabas, Camarines, Albay, Masbate, Samar, and Leyte, though it doubtless occurs elsewhere. From incomplete botanical specimens this tree has been referred to *Shorea balangeran.* It has the common names of guisoc, guisoc-amarillo, guisoc-guisoc, and yacal. It may be that the species from Pangasinan and Zambales furnishing wood under the names of guisoc colorado and yamban that are classed as yacal belong to this species.

BLACK YACAL.

Black yacal is a tree reaching a height of 30 or more meters and a diameter of 60 to 90 centimeters. The bole is usually irregular and spirally twisted. The bark is thin (3 to 4 millimeters) and nearly black with a reddish tinge. It is distinctly ridged. The inner bark is light brown in color. The sapwood is one-fourth the radius in thickness, turning to the color of the heartwood on exposure. The heartwood is chocolate brown in color. The wood is similar to yacal, but harder. This tree is found scattered singly or in groups on low, dry coastal ridges in the Zamboanga district of Mindanao. So far it has not been reported from any other region. It belongs to the yacal group and is sold as yacal. As yet, no fruiting and flowering specimens have been collected from it, and it has provisionally been referred to the genus *Hopea.*

MALAYACAL.

Malayacal is a tree reaching an average height of 30 to 40 meters, and a diameter of 60 to 80 centimeters or more. This tree resembles yacal so closely in characters of bark that it at first sight is easily mistaken for it. It differs from yacal in being shorter boled, and less inclined to be buttressed. The crown is denser and more compact, in contrast with the open crown of yacal. The bark is usually thinner (6 to 10 millimeters). The leaves are larger, thinner, and of a different shape. While yacal is found on the upper slopes and ridges (on the lower slopes in rocky dry soils), malayacal is confined to the lower slopes, coves, and on flood plains along streams or arroyos of the low-hill region bordering on salt water. It is distinctly a tolerant species.

The wood of malayacal resembles closely that of yacal and is used for it. It is reported so far only from the Zamboanga district of Mindanao. From leaf specimens it has been referred provisionally to a species of *Shorea.*

GUISOC-GUISOC. (Pl. LXXIX.)

Guisoc-guisoc is a medium-sized tree reaching a height of 20 to 25 meters and a diameter of not more than 50 centimeters. The bole is fairly regular, usually slightly buttressed, and is apt to have persistant dead twigs near the base. The crown is semiopen and fairly wide spreading. It is distributed throughout the Philippines in the region where the dry season is not pronounced, usually very scattered on lower slopes and streams. It is a tolerant species and grows in dense dipterocarp forests. The weathered bark is dark brown to black, when fresh it is light brown. It is 3 to 5 millimeters in thickness, and sheds in large scaly patches; the inner bark is brown with pinkish tinge. The leaves are simple, alternate, from 10 to 26 centimeters long and from 4 to 7 centimeters wide, with very hairy glands in the axils of the secondary veins and with sharp-pointed stipules.

The sapwood is creamy when fresh cut, soon changing to brown. The heartwood is brown to chocolate brown and in places has dark brown streaks. Because of its small size and consequently large proportion of sap to heart the tree is infrequently cut because the sapwood is not durable. The heartwood is hard and probably as durable as yacal, and could be substituted for it. The tree has the following distribution: Luzon

(Tayabas, Camarines, Albay); Leyte; Occidental Negros; Mindanao (Agusan). The scientific name of guisoc-guisoc is *Hopea philippinensis.* Other common names reported are barakbakan (Ag.); makitarim or some form of it (B., V.); paina (B.).

An undescribed species of *Hopea,* under the common Moro name of mangasusu, occurs on the Zamboanga Peninsula of Mindanao. In habit, color, and character of the bark, in shape of leaves and presence of glands, and in fruit it is similar to guisoc-guisoc. The tree is uniformly larger, however, reaching a height of at least 35 meters and a diameter of 60 centimeters. The leaves vary in size from those of guisoc-guisoc to some two to three times their size. The wood shows irregularly concentric bands of nearly black, otherwise it is like guisoc-guisoc.

MANGACHAPUY. (Pl. LXXX.)

Mangachapuy is a tree that reaches a height of 30 meters and a diameter of 80 to 100 centimeters. It has a regular bole reaching 20 meters in length and a dense crown of small leaves. It is found on slopes associated with tanguile, more abundant above altitudes of 300 meters. It is a tolerant tree.

The bark is 10 to 15 millimeters in thickness. It is distinctly divided into ridges, but these are short and join diagonally, forming a more or less regular network. The furrows are usually filled with lines of corky pustules. The ridges are brown to nearly black in color, the furrows light brown and yellowish. The middle bark is brown; the inner bark is a light yellowish cream color, very stringy in texture and resinous. The leaves are simple and alternate, smooth above and below, thin in texture, usually with glands in the axils of the secondary veins; these are more prominent near the base of the leaf. The leaf blade is from 4.5 to 8 centimeters long and from 2 to 3.5 centimeters wide.

The sapwood is light creamy in color when fresh, changing to dirty brown on exposure. The heartwood is light yellowish brown when fresh, darkening on weathering. The wood is hard and heavy, and is considered nearly as durable as yacal. It has a straight and moderately fine grain.

It has the following uses: House construction (partitions, ceilings, moldings, rafters, posts, joists, flooring, sills, doors); shipbuilding (masts, decks, sides); piles; railway ties; wharves.

This tree is reported from the following regions: Luzon (Cagayan, Ilocos Norte, Bataan, Laguna, Tayabas, Camarines, Sorsogon, Albay); Mindoro; Leyte; Negros; Basilan.

Mangachapuy has the scientific name of *Hopea acuminata.* Besides the common name given above it also goes under the name of dalingdingan, under which it is very often sold.

DALINGDINGAN-ISAK.

This is a tree resembling mangachapuy in most particulars. It can be distinguished from it by the fine and closely set veins and the prominent hairy glands in the axils of the veins. The leaves are from 3 to 8.5 centimeters long and from 1 to 3.5 centimeters wide. The wood of this tree is much like that of mangachapuy. It is usually found scattered through certain subtypes of the lauan type and is reported from the following regions: Luzon (Cagayan, Pangasinan, Laguna, Infanta, Tayabas, Camarines, Sorsogon, and Albay); Polillo Island; Mindoro; Negros.

It is referred to *Hopea pierrei*. Besides the common name of dalingdingan-isak this species has the following local names: Dalingdingan (T.); lito (Sor.); makitarem (Sor.); mangachapuy (T., V.); pisak (Cag.).

NARIG.

Narig is a medium-sized tree between 20 and 30 meters in height. It reaches a diameter of 70 centimeters. The bole is quite regular, usually moderately or little buttressed, about two-thirds the height of the tree. The crown is semiopen. It is found on dry coastal ridges and is a constant associate of yacal in the yacal-lauan type of certain parts of Mindanao.

The bark is 5 to 7 millimeters in thickness. The outer bark is light gray in color when weathered; the fresh bark is brown to brownish-gray. It sheds in scroll-shaped patterns; the inner bark is very light pink with dark brown flecks, and is hard and brittle. The leaves are simple, alternate, and leathery in texture. They vary in size from 4.5 to 10 centimeters long and from 3 to 5.5 centimeters wide.

The sapwood is creamy to light brown in color and not durable. The fresh heartwood is pale yellow in color and when weathered becomes dark brown with a reddish tinge and often dark greenish streaks or mottlings. It is finer grained than yacal. The chief objection to narig is its small size and comparatively large proportion of sapwood.

The tree is reported only from the Zamboanga and Davao districts of Mindanao and from Basilan Island. Doubtless it occurs elsewhere in Mindanao and adjacent islands. A wood, probably narig, comes from Palawan under the name of atpai.

This tree is referred to a species of *Vatica* and may be the same as karig (*Vatica mangachapoi*), which it resembles in many respects.

KARIG. (Pl. LXXXI.)

This is a tree resembling narig in many respects. It seems to be confined to western Luzon where it is usually found at altitudes of from 350 to 700 meters. The tree differs mainly from narig in having smaller leaves and a pale-yellow wood without the greenish mottling. Like narig it turns to a dull reddish brown on exposure.

This species has been collected from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Benguet, Bataan, Rizal). It is referred to *Vatica mangachapoi* and seems to be the species that produces the wood that was formerly known as mangachapuy. It has not, however, been collected under that name. Besides karig the following common names are recorded for it: Aniga (Ben.); aningat (Pang.); dangi (Riz.); labang (Il.).

YACAL BLANCO.

Yacal blanco is the name applied to a tree that resembles closely narig and karig. It occupies a place usually in the yacal-lauan type of Luzon and Leyte, that is, on the low coastal hills in the regions where the dry season is wanting or not pronounced. It is reported from the following regions: Luzon (Cagayan, Baler, Tayabas, Camarines, Albay); Polillo Island; Leyte. Besides the common name of yacal blanco the following local names are recorded: Bani (Cag.); bibit (Bal.); durog (Ley.); siongsiongan (Ley.); tapurao (Al.); yacal (Polillo).

The heartwood of narig, karig, and yacal blanco are hard and heavy timbers probably equal to yacal and are often substituted for it. The general characters of the trees are so nearly alike that they can scarcely be distinguished from each other. They have a smoother and finer grain than yacal.

THE PALOSAPIS GROUP.

The genus *Anisoptera* produces woods quite distinct from any of the above.

PALOSAPIS. (Pls. LXXXII and LXXXIII.)

This tree reaches a height of 40 to 45 meters and a diameter of 120 to 180 centimeters. It has a straight, regular, unbuttressed bole that is three-fifths to two-thirds the height of the tree. The canopy is dense in the rainy season and open in the dry, when it changes leaves. Trees in very dry situations may become entirely destitute of leaves for a few days. It is slightly tolerant of shade. Palosapis reaches its best development in the lauan-apitong type of regions where the dry season is pronounced, though it is scattered in various types of the other dipterocarp forests.

The bark is 15 to 25 millimeters in thickness, in young trees smooth with a yellowish tinge; in older trees, especially at the base, it is broken into choppy pieces, dirty brown in color. The bark just beneath the surface is a reddish brown color; the inner bark is granular brownish yellow, the granular appearance being due to broken concentric rings of yellow. The leaves are from 7.5 to 16 centimeters long and from 3 to 7 centimeters wide, often yellowish in color and usually free from hairs.

The sapwood is light creamy in color, staining on exposure to dirty gray; the heartwood pale yellow, often with rose streaks, changing on exposure to uniform yellowish brown. It has a coarse and fairly straight grain and is moderately heavy and soft to moderately hard. When fresh cut it has an unpleasant odor and yields abundant resin. The following are the uses of the wood: General construction; house construction (joists, rafters, flooring, siding); bancas; boxes; rice mortars; furniture; dry measures.

Palosapis is recorded from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Nueva Vizcaya, Pangasinan, Tarlac, Nueva Ecija, Zambales, Bataan, Rizal, Laguna, Camarines, Sorsogon, Albay); Masbate Islands; Mindoro; Cebu.

The scientific name of this species is *Anisoptera thurifera.* Besides the common name of palosapis the local names recorded are as follows: Dagang or dagum (Lag., Riz., Al.); duyong (Il.); letis (Mas.); mayapis (T.); paihapi (Z.).

A number of other species of *Anisoptera* yield wood that will pass on the market as palosapis. Malapaho or dagang (*Anisoptera curtisii*), with leaves very yellow beneath, is reported from Tayabas, Camarines, and Laguna. An undescribed species of *Anisoptera* (afu) from Cagayan and Ilocos Norte is much like palosapis, but with larger fruits. Another species (probably undescribed) occurs in the Zamboanga district of Mindanao.

ARANGA FAMILY.

(Flacourtiaceæ.)

THE ARANGAS.

Several species of the genus *Homalium* produce the wood known as aranga. The following description applies to *Homalium luzoniense.*

This tree reaches a height of 30 to 40 meters and a diameter of 80 to 90 centimeters. It has a fairly straight and regular bole that is strongly buttressed. It is a very scattered tree which is found principally in the Provinces of Tayabas and Camarines. The bark is 8 to 12 millimeters in thickness, gray to brown in color, and has a slightly uneven surface, sometimes with vertical lines. The leaves are simple and alternate, smooth, with slightly wavy margins, varying from 7 to 20 centimeters long and from 3.5 to 12.5 centimeters wide.

The sapwood is yellow, merging gradually into a yellowish or reddish brown heartwood, which in large trees has often irregular streaks of chocolate color. It is very hard, heavy, and fine grained. It is one of the most durable timbers in salt water and in the ground and is consequently much valued for piling and naval construction. It is also used for house construction (flooring, interior finish, posts, rafters); cabinetwork; railway ties.

It is impossible at the present time to give the gross characteristics of the following species, which also produce the wood known as aranga: *Homalium bracteatum, barandæ, panayanum,* and *villarianum.* Besides the general name of aranga for the woods that come from these species the following local names are recorded: Ampupuyot (V.); arangan, kamagahai (Cam.); kamuyon (Ab.); laing (Riz.); matangbokal (Il.); puyot (V.). One or more of the species above mentioned are reported from the following provinces: Luzon (Ilocos Sur, Pampanga, Bulacan, Bataan, Tayabas, Camarines); Guimaras Islands.

Flacourtia inermis is known as calamansanay in Zambales Province, but it seems that the wood of this species is not found in the Manila market and that the market calamansanay comes from another species in a different family. (See p. 100.)

BINUANG FAMILY.

(Datiscaceæ.)

This family is credited with one very large timber tree, binuang or biluang (*Octomeles sumatrana*). This reaches its best development along streams, and where the main body of the virgin forest has been removed it often occurs in groups. The bark is 12 to 18 millimeters in thickness, and grayish brown to reddish brown in color. The wood is light in weight and soft. It is used as buoys for rafts and sometimes for making matches.

BANABA FAMILY.

(Lythraceæ.)

The species of this family have opposite or nearly opposite leaves. The inner bark when cut and thus exposed to the air turns rapidly to a purplish color. This enables one to distinguish the timber trees of the family from those of others.

BATITINAN. (Pl. LXXXIV.)

This is a large tree that reaches a height of 30 to 40 meters, with a diameter of 80 to 90 centimeters. The bole is crooked to fairly straight and usually angular in cross-section. It is very strongly buttressed. The crown is about two-fifths the height of the tree, irregular, wide spreading, often flattened in one plane, and open. It is intolerant of shade and occurs very scattered on dry hills, in the yacal-lauan and molave types, and on coastal plains in certain portions of the lauan-hagachac type.

The bark is 4 to 5 millimeters in thickness, ashy gray in color, splitting into long obscure ridges about 5 millimeters in width. The newly formed bark is brown, covered with curling papery flakes, either square, rhomboidal, or rectangular. The inner bark has concentric rings of yellow alternating with gray; next the sapwood it quickly turns to a very dark purple on exposure to the air. The leaves are opposite or nearly so, smooth, from 6 to 12 centimeters long and from 2 to 5 centimeters wide.

The sapwood is grayish, the heartwood greenish gray to dark brown. It is hard, heavy, very durable, and has a fine straight grain; seasonal rings are distinct. It has the following uses: House construction (posts, flooring, joists, rafters, interior finish); shipbuilding (keelson, masts, sides, decks); ties; piles; telegraph poles; furniture; tool handles.

Batitinan is reported from the following regions: Luzon (Rizal, Batangas, Tayabas, Camarines, Sorsogon, Albay); Samar; Leyte; Occidental Negros; Mindanao (Zamboanga, Davao); Basilan.

The scientific name is *Lagerstroemia piriformis.* Besides the name batitinan, the following local names are recorded: Bagunaum (Dav.); bugaron (Sam.); dinglas (Tay.); linan (Sor.); mantalinga (Zam.); tinaan (Cam.). The names binggas and lasila from northern Luzon, often credited to batitinan, apply to the wood of *Terminalia comintana,* which sometimes passes for batitinan. (See p. 86.) Batitinan is also known as Philippine teak.

BANABA. (Pl. LXXXV.)

This a medium-sized tree reaching a height of 25 to 28 meters and a diameter up to 80 centimeters. It has a short, usually irregular bole, with a wide-spreading, semiopen crown which is deciduous, or nearly so, during the dry season. It is intolerant of shade and is scattered along streams in open places in the forest, and often occurs in the second-growth forests.

The bark is 2 to 4 millimeters thick, gray to brown in color, with a yellowish tint, has fine vertical lines and is sometimes scaly. The bark next to the sapwood quickly turns to a purple color on exposure to the air. The leaves vary in size from 7.5 to 24 centimeters long and from 3.5 to 11 centimeters wide. They are smooth and opposite or nearly so.

The sapwood is light pink in color; the heartwood reddish brown. The wood is hard, moderately heavy, straight grained, and durable. It has the following uses: House building (posts, rafters, joists, flooring, sills, partitions, interior finish); boat construction; wharves; piling; furniture; carabao yokes; barrels; railroad ties; tool handles.

It has been reported from the following regions: Batanes Islands; Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Abra, Benguet, Pangasinan, Nueva Ecija, Baler, Zambales, Pampanga, Bulacan, Bataan, Rizal, Laguna, Batangas, Tayabas, Camarines); Mindoro; Samar; Leyte; Guimaras; Occidental Negros; Mindanao (Misamis); Palawan.

The scientific name is *Lagerstroemia speciosa.* Besides banaba, the following local names are recorded: Danioura (N. Luz.); kanilan (Guim.); makabalo (Pang.); mitla (Pam.); pamarauagon (Sam.); parasabuking (Mis.); tabangao (Il.); tanaganan (Cag.).

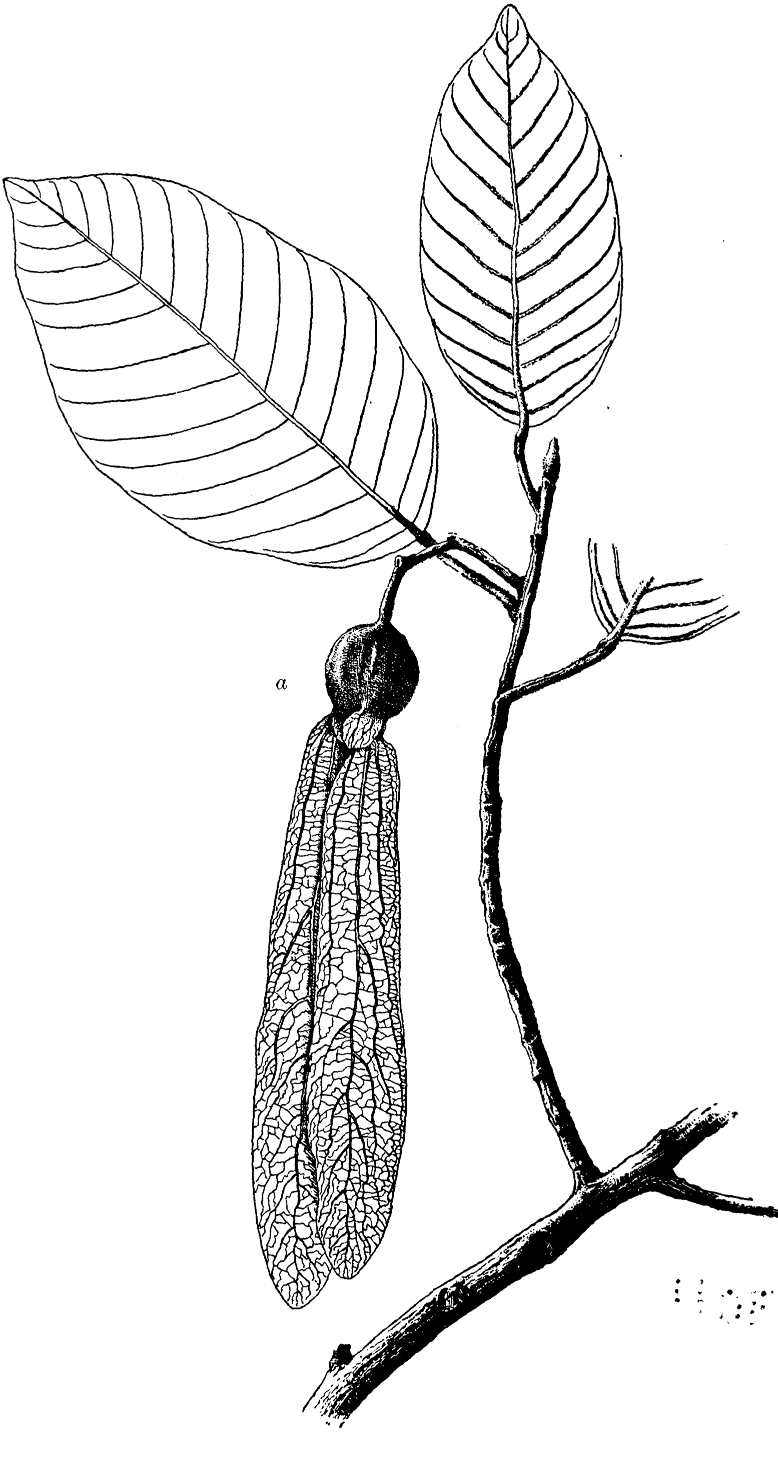


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PLATE LXX.—PANAO (*Dipterocarpus vernicifluus*).

a, Fruit.

PLATE LXXI.—BARK AND LEAVES OF PANAO (*Dipterocarpus vernicifluus*).

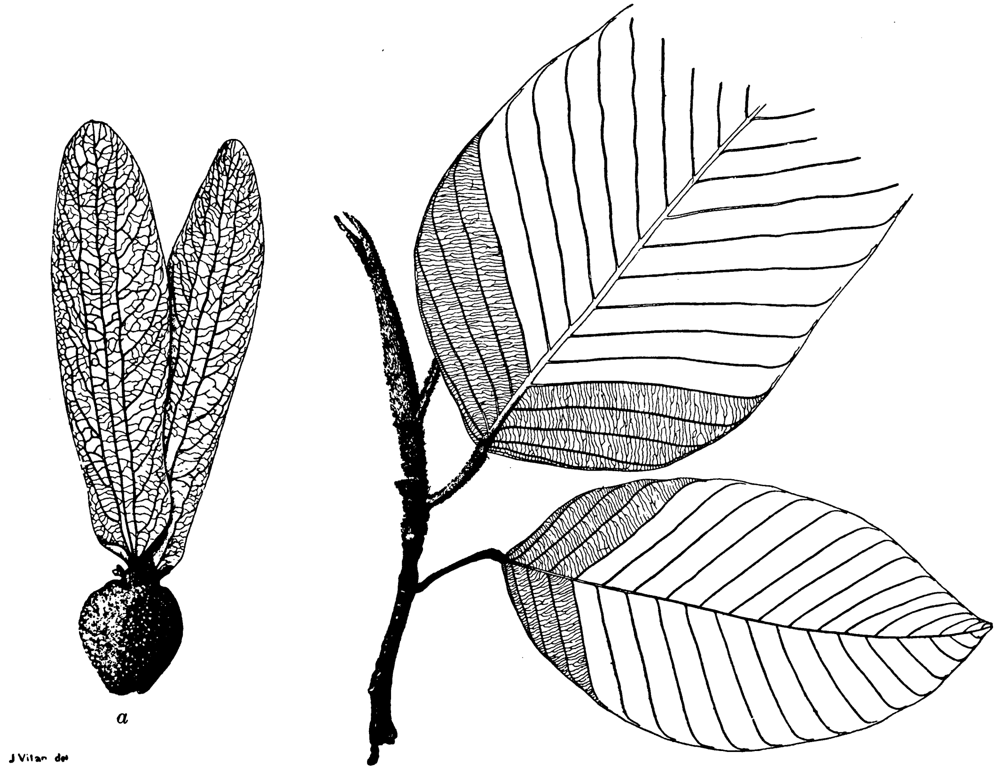

PLATE LXXII.—HAGACHAC (*Dipterocarpus affinis*).

a, Fruit.

PLATE LXXIII.—BARK OF HAGACHAC (*Dipterocarpus affinis*).

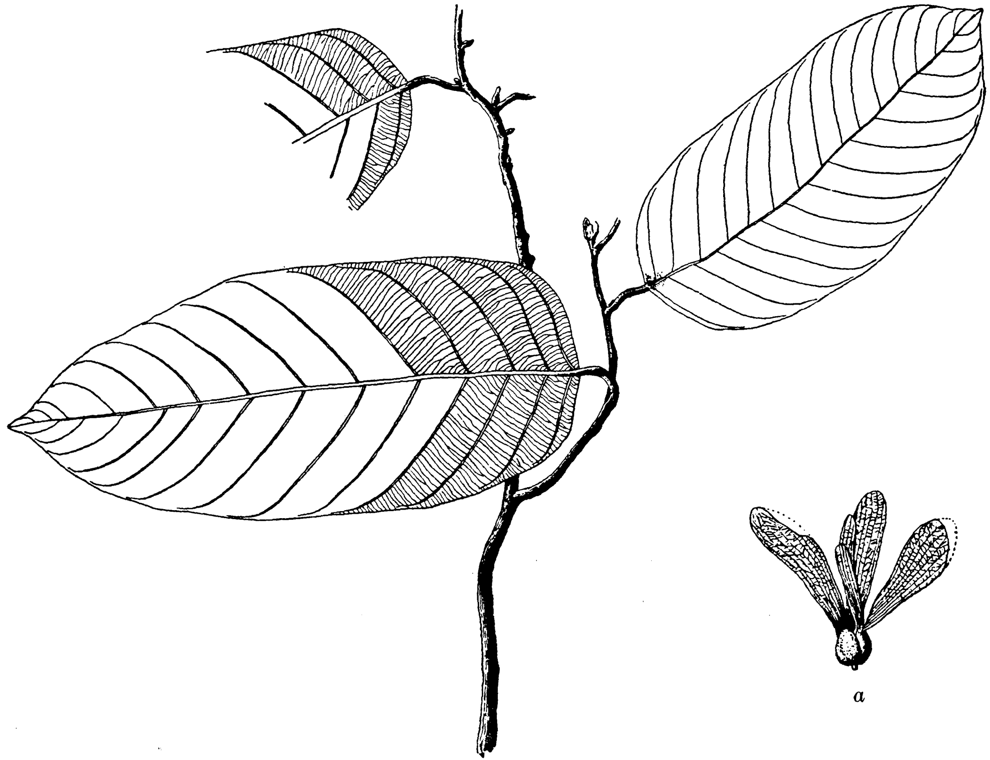

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PLATE LXXIV.—GUIJO (*Shorea guiso*).

a, Fruit.

PLATE LXXV.—BARK AND LEAVES OF GUIJO (*Shorea guiso*).

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PLATE LXXVI.—YACAL (*Hopea plagata*).

a, Fruit.

PLATE LXXVII.—BARK OF YACAL (*Hopea plagata*).

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PLATE LXXVIII.—GUISOC (*Shorea balangeran*).

a, Flower cluster.

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PLATE LXXIX.—GUISOC-GUISOC (*Hopea philippinensis*).

a, Fruit.

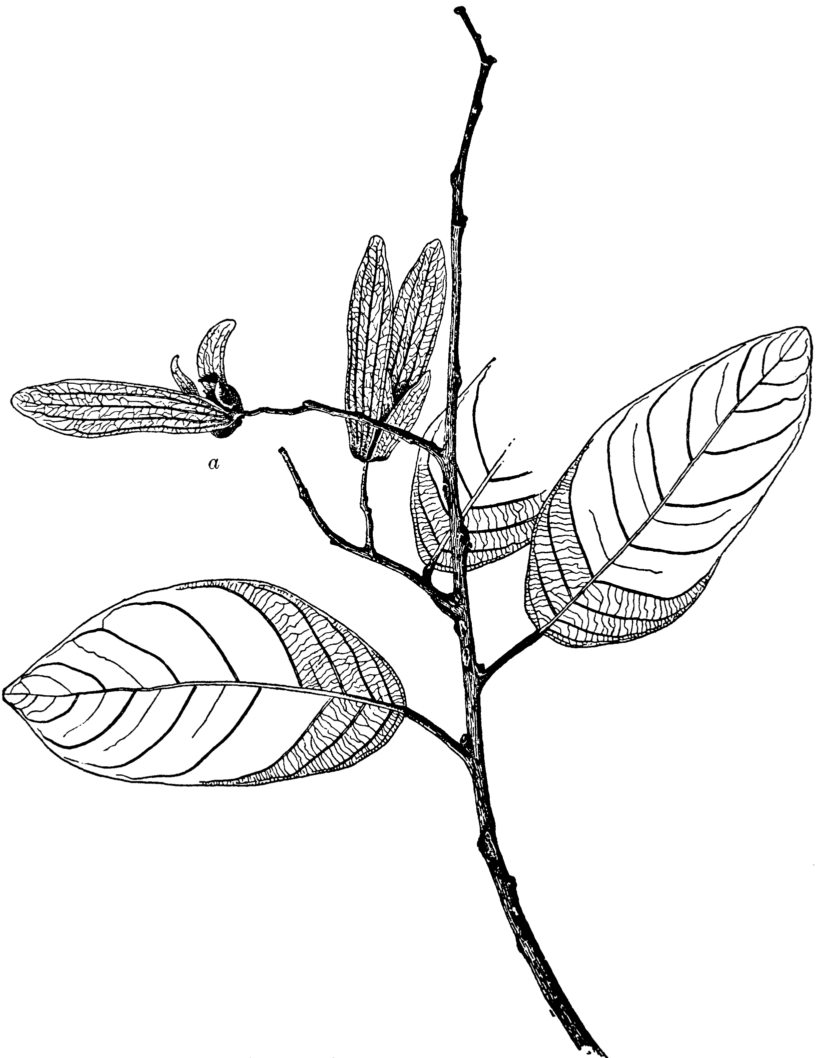

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PLATE LXXXI.—KARIG (*Vatica mangachapoi*).

a, Fruit.

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PLATE LXXXII.—PALOSAPIS (*Anisoptera thurifera*).

a, Fruit.

PLATE LXXXIII.—BARK AND LEAVES OF PALOSAPIS (*Anisoptera thurifera*).

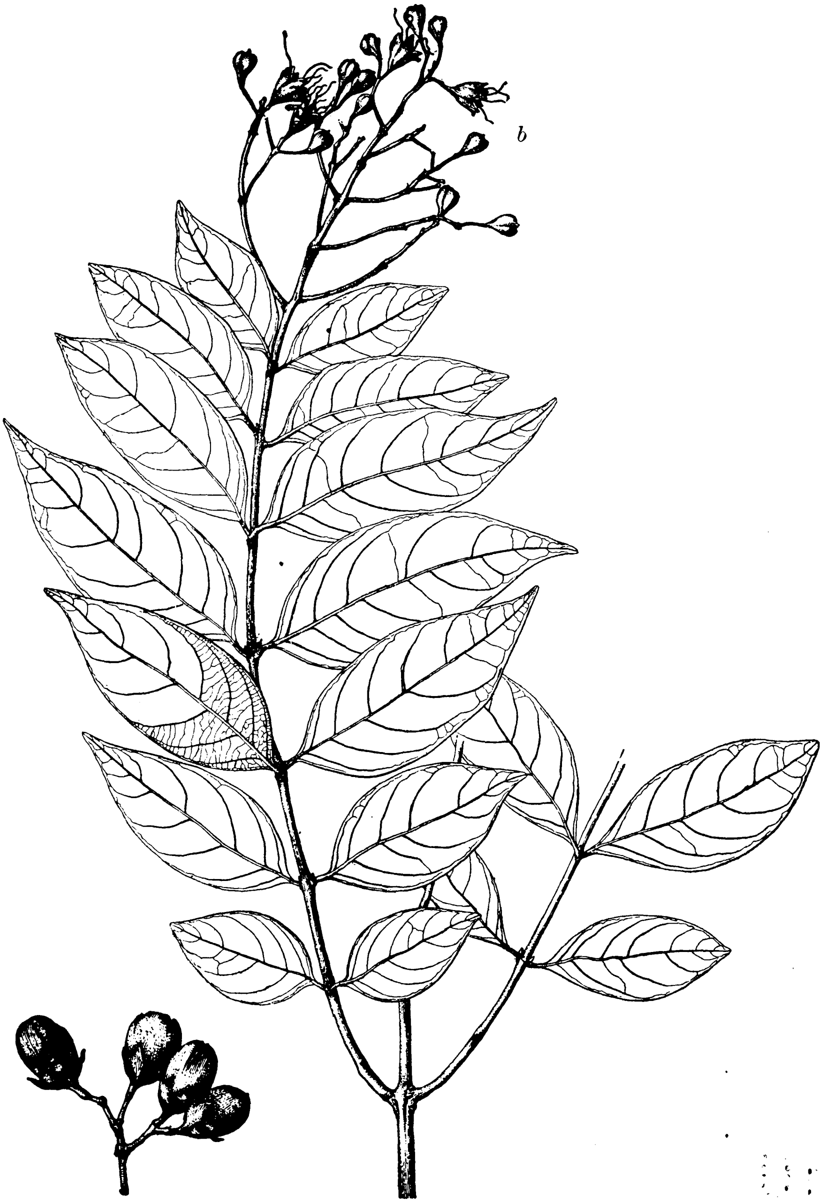

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PLATE LXXXIV.—BATITINAN (*Lagerstroemia piriformis*).

a, Fruit cluster; *b*, flower cluster.

PLATE LXXXV.—BARK, LEAVES, AND FLOWERS OF BANABA (*Lagerstroemia speciosa*).

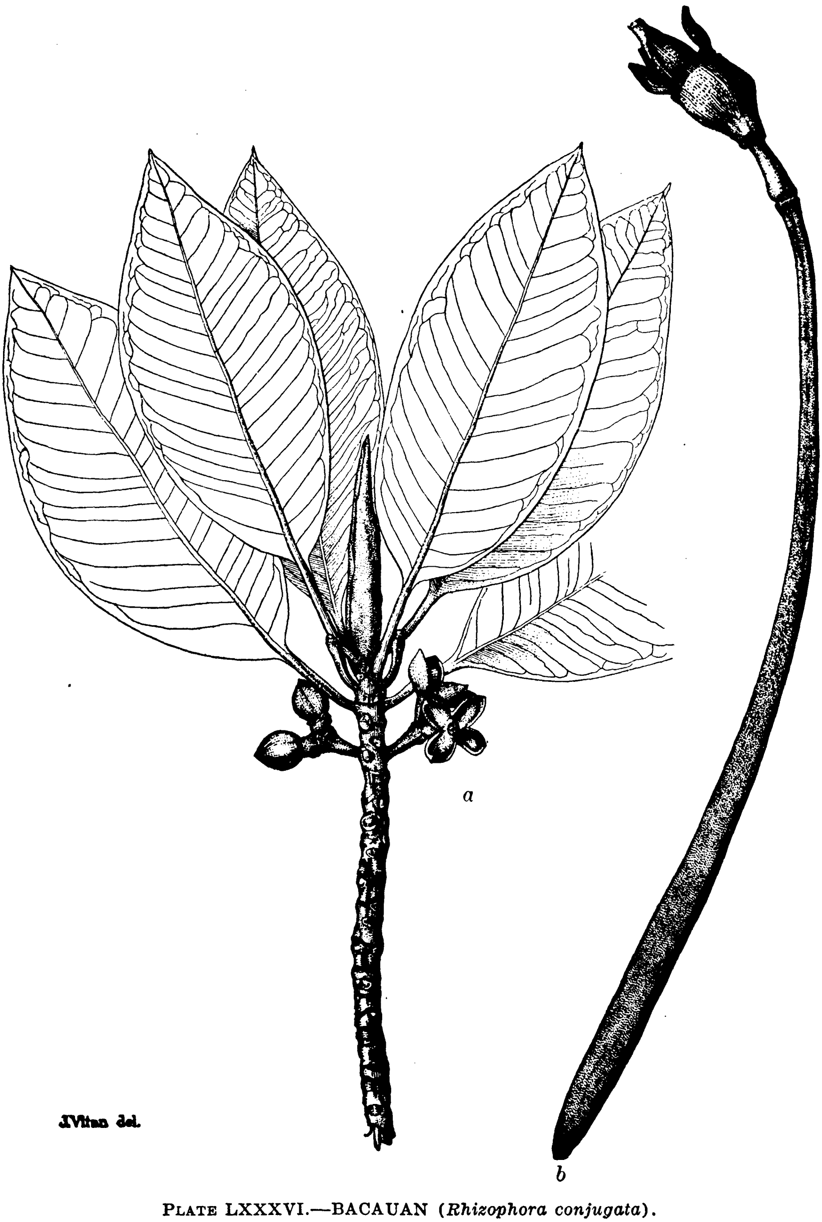

PLATE LXXXVI.—BACAUAN (*Rhizophora conjugata*).

a, Flower cluster; *b*, seedling, with fruit attached.

PAGATPAT FAMILY.

(Sonneratiaceæ.)

PAGATPAT.

Pagatpat is a medium-sized to tall tree, usually with a straight regular bole. It is found throughout the Islands in the mangrove swamps. It is the largest of the species growing in the mangrove swamps. It coppices well, yielding good-sized logs in this way. The bark is 8 to 12 centimeters in thickness, brown to gray in color, inclined to be ridged and scaly; the inner bark is reddish brown with lighter colored fibers. The leaves are opposite, varying in size from 6 to 12 centimeters long and from 4 to 8 centimeters wide, sometimes nearly circular, thick, and leathery in texture.

The sapwood is light brown; the heartwood dark brown, heavy, durable and fine grained. It contains a large amount of salt and will rust nails, discoloring the wood in contact with them. It has the following uses: House building (flooring, siding, interior finish); bridge building; telegraph poles; planking for boats; furniture; ties, musical instruments. The air roots, known as daluru, are used for razor hones.

Pagatpat is found in all tidal swamps in the Philippines, where it usually occupies the outer zone; it reaches its best development in size and numbers in the southern islands. The scientific name of pagatpat is *Sonneratia pagatpat*. It is sometimes sold under the copyrighted name of montol.

Another species (*Sonneratia* sp.), has the common name in the Mindanao region of pedada. This tree has narrower leaves than pagatpat and occurs usually in the interior of the swamps.

PUTAT FAMILY.

(Lecythidaceæ.)

This family, with alternate simple leaves, has a number of species of trees, but none of very great importance from a commercial standpoint.

Botong (*Barringtonia speciosa*) is a medium-sized tree with large leaves, flowers, and fruits (the latter adapted for floating) that occupies a conspicuous place on the sandy beaches throughout the Philippines. *Barringtonia racemosa* and other closely allied species have the common name of putat. They are usually found back of the mangrove swamps or along streams where the ground-water level is very near the surface. The woods are light colored, very soft, and porous and are used only locally. Lamog or apalang (*Planchonia spectabilis*) is a medium-sized to tall tree found very scattered in some portions of the dipterocarp forests. Its wood is dark reddish brown, fine grained, hard, and moderately heavy to heavy.

THE MANGROVE OR BACAUAN FAMILY.

(Rhizophoraceæ.)

This in many respects is the most remarkable tree family in the world. With a few exceptions it is confined to the tidal-swamp regions, where its members form the principal elements of the mangrove swamps. The trees all have simple, opposite, and leathery leaves; the seeds (those of the tidal-swamp species) germinate on the trees, developing seedlings without leaves, which drop, and are carried by the tides until they reach a lodging place, where they rapidly develop into trees. The woods of the trees are hard and heavy with prominent pith rays. The mangrove trees are the principal source of firewood and tan barks of the Philippines.

The principal trees of the swamps may be divided into three groups: The bacauans, the pototans, and tangal.

THE BACAUANS. (Pl. LXXXVI.)

These trees can be distinguished from the others by the prominent stilt roots. There are two species, bacauan (*Rhizophora conjugata*), and bacauan lalaki (*R. mucronata*).

Bacauan is a tree reaching a height of 20 to 22 meters and a diameter of 40 to 45 centimeters, though usually much smaller. The bark is 20 to 30 millimeters thick, nearly black, rough and usually scaly. The leaves vary in size from 11 to 14 centimeters long and from 3 to 7 centimeters wide. The flower stalk is 5 millimeters long or nearly sessile, and usually two-flowered.

Bacauan lalaki is a tree slightly larger than bacauan. It differs from it in having a flower stalk 2.5 centimeters long, usually three flowers, and larger leaves, varying in size from 11 to 18 centimeters long and from 5 to 12 centimeters wide.

THE POTOTANS. (Pl. LXXXVII.)

These reach a height of 20 to 25 meters and differ from the bacauans in having smaller leaves and no stilt roots. Their bark is dark colored, nearly black; the inner bark thick and yellowish brown in color.

The following are the species: Busain (*Bruguiera gymnorrhiza*); langarai (*Bruguiera parviflora*); pototan (*Bruguiera eriopetala*); pototan lalaki (*Bruguiera caryophylloides*).

TANGAL.

Tangal (*Ceriops tagal*) is a much smaller tree than the others and has a brown to nearly black smooth bark, except the large, scattering, nearly round pustules. The inner bark is reddish in color and thick. The leaves are from 4.5 to 9 centimeters long and from 2 to 4.5 centimeters wide.

Bacauan-gubat (*Carallia integerrima*) is found very scattered in the forests outside the swamps.

The following is a key to the principal trees of the mangrove swamps, including species of the other families.

KEY TO THE PRINCIPAL TREES OF THE MANGROVE SWAMPS.

I. Trees with prop roots.
  A. Leaves 11 to 14 centimeters long by 3 to 7 centimeters wide; flower stalk 5 millimeters or less in length, usually two-flowered................ 1. **Bacauan.**
  B. Leaves somewhat larger, 11 to 18 centimeters long, 5 to 12 centimeters wide; flower stalk 2.5 centimeters long, usually three-flowered.
  2. **Bacauan lalaki.**

II. Trees without prop roots.
  A. Leaves simple, opposite, not white beneath.
    1. Apex of leaf acute.
      Flowers 2.5 centimeters long or more.
        Leaves 7 to 14 centimeters long, 2.5 to 5.5 centimeters wide, flowers usually red .... 3. **Pototan.**
        Leaves 7 to 15 centimeters long, 3 to 6 centimeters wide, flowers usually yellow .... 4. **Busain.**
      Flowers less than 1.25 centimeters long.
        Leaves 5 to 9 centimeters long, 1.5 to 2.5 centimeters wide; flowers usually yellowish green to white .... 5. **Langarai.**
        Leaves 7 to 11 centimeters long, 3 to 5.5 centimeters wide; flowers usually yellow .... 6. **Pototan lalaki.**
    2. Apex of leaf obtuse or rounded.
        Leaves 7.5 to 10.5 centimeters long, 3 to 5.5 centimeters wide; small tree with red bark, with prominent corky pustules.
        7. **Tangal.**
        Leaves 6 to 12 centimeters long; 4 to 8 centimeters wide; medium sized to large tree with flaky bark and many short air roots springing from underground roots.
        8. **Pagatpat.** (See p. 81.)
  B. Leaves simple, opposite, white beneath................ 9. **Api-api.** (See p. 98.)
  C. Leaves simple, alternate.
      Leaves white beneath .... 10. **Dungon-late.** (See p. 36.)
      Leaves not white beneath .... 11. **Tabao.** (See p. 87.)
  D. Leaves compound, alternate.
      Leaflets ovate .... 12. **Tabigi.** (See p. 47.)
      Leaflets obovate .... 13. **Piagao.** (See p. 47.)

TALISAY FAMILY.

(Combretaceæ.)

This is a family of alternate simple leaves. The genus *Terminalia* has eight species that produce wood known in the markets. Five of these are so nearly alike that they are undoubtedly mixed and sold under the name that happens to be known by the dealers. The leaves of the Terminalias are usually obovate and more or less closely bunched at the ends of the twigs.

CALUMPIT. (Pl. LXXXVIII.)

This is a medium-sized to tall tree that reaches a height of 25 to 30 meters. The bole is usually regular, straight, and about one-half the height of the tree. It is very slightly if at all buttressed. The crown is widespreading and semiopen. The tree is tolerant of shade and is very scattered.

The bark is 10 to 12 millimeters in thickness, dirty brownish black in color, irregularly but obscurely ridged, and in old trees scaly. The inner bark is yellowish with a thin watery sap. The leaves are simple, alternate, smooth, loosely bunched at ends of twigs, varying in size from 5 to 15 centimeters long and from 2.5 to 6 centimeters wide.

The sapwood is pale yellowish brown to yellow; the heartwood is pale reddish brown. The wood is moderately heavy to moderately hard, with a fairly straight to twisted grain, and takes a glossy finish. It colors water a pale dirty straw color. It has the following uses: House construction (pillars, rafters, siding, interior finish); cabinetwork; ship knees.

It is reported from the following regions: Luzon (Cagayan, Ilocos Sur, Lepanto-Bontoc, Nueva Vizcaya, Zambales, Bataan, Rizal, Tayabas, Camarines); Polillo Island; Masbate; Mindoro; Guimaras Island; Palawan; Zamboanga.

It has the scientific name of *Terminalia edulis.* Besides calumpit or some form of it, the following local names are recorded: Barasus (Pal.); gayumayen (Z.); gisit (N. Y.); kalautit (N. V.); kalumanog (Mas.); magtalisay (Mas.); tayataya (Guim.).

DALINSI.

This is a tree reaching a height of 25 to 30 meters and a diameter of 80 to 100 centimeters. The bark is gray to brown, with an inclination to be ridged. It resembles closely talisay-gubat, with which it is often confused. It, however, has smaller fruit and leaves; the latter vary in size from 5 to 9 centimeters long and from 3 to 6 centimeters wide.

The sapwood is yellowish gray to yellow; the heartwood reddish brown. The wood is moderately hard, moderately heavy, coarse and straight grained. It colors water a pale yellow. It has the same uses as calumpit.

It is recorded from the following regions: Luzon (Pangasinan, Tarlac, Zambales, Tayabas); Palawan.

The scientific name of dalinsi is *Terminalia pellucida.* The following local names are recorded: Aritongtong (Il.); hakit (Z.); kalautit (Tar.); Manaong (Pang.); subosubo (Z.); and many of the names applied to talisay-gubat.

TALISAY-GUBAT. (Pl. LXXXIX.)

This is a medium-sized tree reaching a height of 25 to 30 meters, and a diameter of 80 to 90 centimeters. The bole is unbuttressed, fairly straight and regular. The crown is irregular in shape, somewhat compact and semiopen. It occurs very scattered in the dipterocarp forests, usually in river bottoms or on lower slopes. The bark is 8 to

10 millimeters in thickness, brown, inclined to be obscurely ridged, and in old trees sheds in long flakes; the inner bark is brown with wedge-shaped pink patches near the outer surface. The leaves are simple, alternate, obovate, smooth, varying in size from 10 to 20 centimeters long and 6 to 10 centimeters wide.

The wood is a dull reddish brown, moderately hard, moderately heavy, and fairly straight grained. It has the same uses as calumpit.

It has the following distribution: Luzon (Cagayan, Ilocos Norte, Rizal, Laguna, Tayabas, Infanta, Camarines); Mindoro; and probably many other provinces.

The scientific name is *Terminalia oöcarpa.* Besides talisay-gubat, the following local names are known: Balinsil (In.); calumpit (Tay.); dalinsi (Cam., Tay., Cag.); kalautit (Il.); malagabi (M.); malaputat (Riz.); sacat (Cag.); talisay del monte (Batn.).

SACAT.

This is a tree that reaches a height of 25 to 30 meters and a diameter of 70 to 90 centimeters. It is intolerant of shade, and is scattered through the lighter portions of the dipterocarp forests.

The bark is 5 to 8 millimeters in thickness, gray to brown in color, sometimes with a yellowish tinge, and has fine longitudinal lines, sometimes with scattered corky pustules. The inner bark is brown with red tinge and yellow next to the sapwood. The leaves are simple, smooth, bunched alternately at the ends of the twigs, varying in size from 7 to 15 centimeters long and from 3 to 8 centimeters wide. The sapwood is light brown; the heartwood gray to brownish yellow, moderately heavy, moderately hard, coarse and straight grained, and colors water a pale yellow. It is used for all classes of light construction.

The following is the recorded distribution: Luzon (Ilocos Norte, Ilocos Sur, Pangasinan, Tarlac, Zambales, Bataan, Rizal, Batangas, Tayabas); Masbate; Mindoro; Zamboanga.

The scientific name is *Terminalia nitens.* The following local names are recorded: Calumpit (Batn.); dalinsi (Tay.); kalautit, (Il.); magtalisay (Mas.); subosubo (Z.).

It will be seen from the common names given above that calumpit, dalinsi, talisay-gubat, and sacat are confused and often mistaken for each other. It is sometimes difficult to separate them even with botanical specimens.

TALISAY.

This tree has two forms, the beach form and the river-bottom form. The beach form is a medium-sized tree seldom over 20 meters in height and often much less. It has a knotty bole, dirty gray in color. The river-bottom form is a tall tree with a grayish brown bark, 10 millimeters in thickness, which splits in longitudinal ridges, the furrows filled with corky pustules. The inner bark is pink, streaked with green-colored longitudinal lines. Both forms have the branches whorled in horizontal planes, with a flat, very broad crown. The leaves are large and coarse, varying in size from 14 to 33 centimeters long and from 10 to 20 centimeters wide.

The sapwood is light brown, sometimes with yellowish tints; the heartwood is reddish brown, moderately heavy, moderately hard, with a glossy, usually somewhat crossed grain (straight in river-bottom form). It colors water a pale yellow.

The tree is found distributed along sandy beaches everywhere; in deforested flood plains it often forms groups characterized by the whorled branches.

The scientific name is *Terminalia catappa.* The coast form has the common name of talisay; the river-bottom form, talisay, and lumanog or lanipao.

BINGGAS. (Pls. XC and XCI.)

This is a tall tree reaching a height of 35 to 40 meters and a diameter of 80 to 100 centimeters or more. It is found very scattered through the drier portions of the dipterocarp types.

The bark is 3 to 5 millimeters in thickness, light gray, and smooth; beneath the outer bark there is a papery layer, ashy gray in color; the inner bark is brown. The leaves are simple, alternate, smooth (young leaves downy), varying in size from 6 to 15.5 centimeters and in width from 3 to 6.5 centimeters.

The sapwood is yellow to very pale brown; the heartwood brown to dark gray with purplish streaks. The wood is hard, heavy, fine, and straight grained, and probably durable. It often passes for molave and batitinan and has the same uses as these.

It has been recorded from the following regions: Luzon (Cagayan, Ilocos Sur, Pangasinan, Nueva Ecija, Zambales, Bataan, Rizal, Camarines); Ticao Island; Mindoro; Leyte, Zamboanga.

The scientific name is *Terminalia comintana.* Besides the name of binggas, the following are recorded: Batitinan babaye (Ticao); dinglas or some form of it (T., V.); hinabusi (M.); lasila (Il.); maglalopoi (Pang.); malatagum (Zam.); naghubo (Riz.); palang (Riz.); saplungan (Riz.); tiroron (Cam.).

TOOG. (Pl. XCII.)

This is a tall tree reaching a height of 35 to 40 meters and a diameter of 80 to 100 centimeters. It has a straight regular bole usually without buttresses. The crown is semiopen, the tree is semitolerant of shade. It occupies a conspicuous place in the dipterocarp forests of some regions.

The bark is 10 to 12 millimeters thick, dark red, nearly black when wet, with irregular lines of corky pustules. It is scalloped with irregular shallow depressions as large as saucers which mark the places of newly shed bark. The inner bark is tan red in color and very stringy. The leaves are simple, closely alternate at the ends of the twigs, smooth, varying in size from 15 to 25 centimeters long and from 4 to 10 centimeters wide.

The sapwood is grayish to very pale red in color; the heartwood bright reddish brown, moderately heavy, moderately hard, rough in texture, fairly straight grained, but warping badly when green.

The tree seems to be confined to a definite region, being reported only from Sorsogon, Masbate, Samar, and Leyte. The scientific name of it is *Terminalia quadrialata.* Only the local name of toog is recorded for it. It should not be confused with *Bischofia javanica* (tuai) which also has the name of toog and whose wood is very similar to it.

Malacalumpit or calamansanay (*Terminalia calamansanai*) was supposed to furnish some of the wood on the market known as calamansanay, but it is practically certain that the wood of this species is not the calamansanay of commerce. Tabao (*Lumnitzera littorea*) is a small to medium sized tree found in the mangrove swamps. The wood is yellowish or brownish gray, sometimes with a reddish tinge, hard, heavy, fine grained, strong and durable. It has the following uses: House construction; posts; piling; axles. In Borneo it is considered second only to billian for piling. This species has red flowers with inflorescence axillary. Another species, *L. racemosa* Willd., has white flowers with inflorescence terminal.

EUCALYPT OR MACAASIM FAMILY.

(Myrtaceæ.)

This is a family that produces a large number of small, medium-sized, and tall trees. The leaves are usually opposite and often contain more or less distinct oil glands (pellucid dots). Tree descriptions have not been collected and only a brief mention will be made of the species important to the lumber trade.

THE MACAASIMS.

From local names the following species are credited with producing the wood known as macaasim: *Eugenia benthamii; E. mimica; E. philippensis; E. bordenii; E. vidaliana;* and *Decaspermum paniculatum.* Of these, malaruhat (*E. bordenii*) seems to be the most abundant.

The wood of the macaasims is generally grayish brown, occasionally with yellowish, greenish or reddish tinge, and rather fine grained, hard, heavy and durable. The wood has the following uses: House construction (beams, posts, flooring, window sills); cabinetwork and furniture; boat building (rudders, decks, sides); telegraph poles; tool handles; washbowls; ties; piling.

The species of *Eugenia* are a constant element in all types of the dipterocarp forests, where they occur very scattered, occasionally as codominant trees, more usually as subdominant or undergrowth trees.

MANCONO. (Pl. XCIII.)

This is a medium-sized tree with an irregular bole reaching a diameter of 80 to 100 centimeters. The leaves vary in size from 5 to 8.5 centimeters long and from 3 to 6 centimeters wide, smooth and slightly whitish beneath. The sapwood is light reddish; the heartwood is yellowish brown turning to chocolate brown on exposure. The grain is fine and twisted. It is very hard and very heavy and exceedingly durable. It is undoubtedly the hardest and heaviest wood in the Philippines and is probably a good substitute for lignum-vitæ.[1] It has the following uses: Posts; piling; wooden tools; tool handles; pulleys; bearings.

Mancono reaches its most successful development in the northeastern part of Mindanao and the adjacent islands. It is recorded from the following regions: Ticao Island, Romblon; Leyte; Culion Islands; Palawan: Dinagat Island; Tinago Island. The scientific name is *Xanthostemon verdugonianus.* Besides the local name of mancono or magkono, it is called palo de hierro (Sp.), and tugas (V.).

Besides the above, the following deserve mention: Sudyang is a very hard, very heavy, and durable wood found in Surigao and islands adjacent which has provisionally been placed in this family. Malabayabas or tiga (*Tristania decorticata*) is a tree growing on dry coastal hills, and in the tanguile-oak type, where it sometimes occurs gregarious over small areas on very dry ridges or tops of low mountains. Its bark sheds frequently leaving a smooth gray surface like that of bayabas, whence the name malabayabas. It has a hard and heavy, dark reddish brown wood resembling mancono. Bayabas or guava (*Psidium guajava*) is introduced and escaped from cultivation. It produces an edible fruit and a good firewood. In many places it gives a decided tone to the second-growth forests. One species of eucalyptus (*E. naudiniana*) is reported from Zamboanga. It may have been introduced there. Malasulasi (*Leptospermum flavescens*) occurs gregarious on many mountain tops. Two species of *Decaspermum, D. blancoi* and *D. paniculatum*, are found, usually near the tops of the mountains, where the latter is nearly gregarious. Tawalis or sagasa (*Osbornia octodonta*) is a small tree with a hard durable wood, occurring on the edge of the mangrove swamps and on sandy beaches. The following species of *Eugenia* produce edible fruits: kalubkob (*E. calubcob*); duhat or lumboi (*E. jambolana*); makopa (*E. javanica*); tampoi (*E. jambos*) and others.

KULIS FAMILY.

(Melastomataceæ.)

This family contains a number of undergrowth trees and some small ones. Kulis (*Memecylon edule*) is a small or undergrowth tree occurring in certain regions of the dipterocarp types. It yields a hard durable wood that has been suggested as a substitute for boxwood.

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[1] Hutchinson, W. I. A substitute for Lignum-vitæ. Bull. 9, Bureau of Foresty, 1908.

GINSENG OR MALAPAPAYA FAMILY.

(Araliaceæ.)

MALAPAPAYA.

This is a tree that reaches a height of 25 to 30 meters and a diameter of 50 to 60 centimeters. It has a straight bole 15 to 18 meters in height. Young trees are usually crowned with one group of large compound leaves, older ones have several branches, each similarly crowned. The bark is 12 to 15 millimeters in thickness, light gray to brown in color, with vertical lines; the inner bark is white with yellow rays and very brittle. The leaves are closely alternate, compound, 1 meter or more in length, with many leaflets, each with margins serrate and varying in size from 12 to 25 centimeters long and from 5 to 10 centimeters wide. The wood is yellowish white in color, light and very soft, straight grained, and easy to work. It is considered one of the best match woods, and is also used for very light construction purposes, match boxes, packing cases, and rafts.

It is recorded from the following provinces: Luzon (Pampanga, Bataan, Rizal, Laguna, Tayabas); Surigao; Basilan Island. It doubtless occurs in almost every province. It is usually a tree of the second-growth type, but occurs scattered in dipterocarp forests, especially the apitong-lauan type.

The scientific name is *Polyscias nodosa*. Besides malapapaya it has the following local names: Bias-bias (T., V.); bongling or some form of it (T., V.); malasapsap (Pam. and neighboring provinces); mano-mano (Bas.); tukud-langit (Batn.).

DOGWOOD OR MALATAPAI FAMILY.

(Cornaceæ.)

Only one tree, malatapai or guntapai (*Alangium longiflorum*) is of any importance to the lumberman. The sapwood is clear light yellow, very sharply distinguished from the dark coffee-colored heartwood. The wood is moderately hard, moderately heavy, very fine grained, and easy to work. It is used locally for construction purposes and is occasionally made into furniture and canes.

GUTTA-PERCHA OR BETIS FAMILY.

(Sapotaceæ.)

This is a family of large trees with alternate leaves and inner barks that contain a sticky milky sap which exudes sparingly when the bark is cut. The woods make a lather when rubbed with water or saliva.

BETIS. (Pls. XCIV and XCV.)

This is a large tree reaching a height of 35 to 40 meters and a diameter of 80 to 100 centimeters. It seems to be confined to the Island of Luzon, where it occurs as very scattered trees.

The bark is 5 to 8 millimeters in thickness, brown to reddish brown in color and is nearly smooth with light-colored vertical lines in young trees, but in older trees ridged; the inner bark is brownish red in color. The leaves are simple, alternate, closely bunched at ends of twigs, covered with dense brown hairs beneath and usually on the veins above, varying in size from 10 to 33 centimeters long and from 5 to 10 centimeters wide.

The wood is dark red in color, very hard, heavy, has a bitter taste, and is clear and straight grained. It is very durable and is especially valuable for piling. It also has the following uses: Shipbuilding (keels, stern posts); house building (posts, flooring, doors, rafters); railroad ties; wooden tools; tool handles; wharf building.

It is reported from the following regions: Luzon (Cagayan, Rizal, Tayabas, and Camarines); Samar. The scientific name of betis is *Illipe betis.* Besides betis or some forms of it, the following common names have been recorded: Bakayao (Il., Pang., T.); duyog-duyog (V.); lamigien (N. Luz.); pappagai; pasak (T., Z.); pianga (Cag.); talipopo (V.); urien (Cag.). A wood under the name of manilig from Cotabato seems to be betis, but may be a closely related species.

BANSALAGUIN.

This is a medium-sized tree reaching a height of 25 to 30 meters and a diameter of 80 to 90 centimeters, and usually has a straight, unbuttressed, regular bole less than half the height of the tree in length. The tree is intolerant of shade and is found in the dry soils of the coastal hills, where it is usually a constituent of the molave type.

The bark is 8 to 10 millimeters in thickness, black or nearly so, with prominent ridges broken by cross fissures into rectangular or rhomboidal patterns; the inner bark is red with white vertical lines beneath the furrows, brittle in texture, and next the sapwood exudes sparingly a thick milky sap. The leaves are simple, alternate, smooth, usually varying in size from 4 to 12 centimeters long, and from 2 to 4 centimeters wide, bunched at ends of twigs. The fruit is yellowish red in color.

The sapwood is light red in color; the heartwood dark red. The wood is very hard, heavy to very heavy, has a very fine grain and a bitter taste, and produces lather when rubbed with water or saliva. It is very much like betis, but takes a glossier finish and is finer, darker, heavier, and harder than betis. It is a first-class construction timber, and is especially valuable for salt-water piling. It also has the following uses: Tool handles; house construction (posts, beams, flooring); turnery; shipbuilding (keels, treenails, marlin spikes, belaying pins; spokes and handles of ships' wheels).

It has the following distribution: Luzon (Cagayan, Ilocos Sur, Nueva Ecija, Zambales, Bataan, Batangas, Tayabas, Sorsogon); Polillo, Ticao Island; Masbate; Mindoro; Culion Island; Samar; Mindanao (Zamboanga, Cotabato,) Tawi Tawi Island; Palawan.

Bansalaguin is a species of *Mimusops.* It has the following common names: Anak-batu (Tawi Tawi); duyog-duyog (V.); gatasan (N. E., Il.); cabiqui or kabiki (T.); ligayan (Moro); pappagan (Cag.); patsaragon (Sam.); pisek (Il.); talipopo (V.).

NATO.

Nato is a large to very large tree reaching a height of 35 to 45 meters, with a diameter of 90 to 120 centimeters. It has a fairly straight, but usually rather strongly buttressed, bole that is one-fourth to one-half the height of the tree. The crown is irregular and semiopen. The tree is partially tolerant of shade. It is found scattered throughout certain portions of the dipterocarp types.

The bark is 15 to 25 millimeters thick, gray to brown in color, split by vertical fissures, usually filled with raised lines of corky pustules, giving it the appearance of being ridged. The inner bark is granular, salmon red in color, brittle in texture, and exudes a milky juice on being cut. The leaves are simple, alternate, smooth or nearly so, varying from 9 to 17 centimeters long and from 4 to 7 centimeters wide.

The wood is a pale dull red in color, moderately hard, moderately heavy and with fine, often wavy grain. It is used for about the same purposes as the red lauans and tanguile, which it resembles in color and general properties.

Nato is reported from the following regions: Luzon (Ilocos Sur, Abra, Pangasinan, Zambales, Rizal, Bataan, Laguna, Tayabas); Mindoro; Guimaras Island.

The scientific name of nato is *Palaquium luzoniense.* Besides nato the following local names are recorded: Bitanhol (Guim.); dulitan (Tay.); gatasan (Il.); palok-palok (Batn.); tagatoi (Batn.); takaran (Pang.); uakatan (M.).

MALACMALAC. (Pl. XCVI.)

This is a tree which in size and general characteristics is much like nato. The bark is 15 to 20 millimeters thick, grayish brown in color, with disconnected vertical lines, or furrows, and inclined to be ridged. The inner bark is red with lighter streaks beneath the furrows and next the sapwood exudes a thick milky sap. The leaves are simple, alternate, densely covered below with soft, golden brown hairs and vary in size from 14 to 28 centimeters long and 6 to 14 centimeters wide. The wood is much like that of nato and has the same uses.

Malacmalac is credited to the following regions: Luzon (Tarlac, Nueva Ecija, Zambales, Pampanga, Bulacan, Bataan, Rizal, Laguna, Batangas, Tayabas, Albay); Mindoro; Palawan.

It has the scientific name of *Palaquium philippense.* Besides malacmalac, it has the following local names: Alakaak (T.); baniti (Batn.); tayogong (Z.).

MANICNIC. (Pl. XCVII.)

Manicnic is a large-sized tree reaching a height of 33 to 35 meters and a diameter of 80 to 90 centimeters. It has a straight, regular, but medium buttressed, bole that reaches a length of 20 meters. The crown is flatly irregular. The bark is 18 to 25 millimeters thick, dark gray to dark brown, with longitudinal furrows about 3 centimeters or less apart; the inner bark is red, and when cut, exudes a milky sap. The leaves are simple, alternate, smooth, varying in size from 6 to 12 centimeters long and 2.5 to 4.5 centimeters wide. The wood is red in color, fine grained, moderately heavy, and moderately hard. It has the uses of the other *Palaquiums*.

The distribution of this tree is as follows: Luzon (Cagayan, Bataan, Laguna, Tayabas); Masbate; Mindoro. The scientific name is *Palaquium tenuipetiolatum*. Besides manicnic the following local names are known: Betis (Mas. and Tay.); mayusip (M.); pango (Cag.).

Besides the above, there are a large number of species of *Palaquium* about which there is not sufficient information to warrant description. Some species of this genus produce the gutta-percha of Mindanao. (See Part I, p. 57.)

Baniti (*Illipe ramiflora*), sometimes known as tanguile, is a medium-sized tree with wood much like the Palaquiums. Several species of *Sideroxylon* (*Nato puti*, or white nato) yield wood of much the same texture as the *Palaquiums* but not red in color. Information concerning these is too meager to permit their description.

PERSIMMON OR EBONY FAMILY.

(Ebenaceæ.)

This family is important because it produces the ebony of commerce. The leaves are simple and alternate, usually leathery in texture. The trees are small to medium-sized, with rough black bark. The sapwood is grayish white or red; the heartwood in many species sometimes of the same color, but more often the color of the sap streaked with black, or black streaked with red or grayish white, or jet black. Species with a jet-black heartwood are known as the true ebony in the Philippines, those with black streaked with another color are called camagon or bolongeta. Many species of *Diospyros* with or without black hearts are not described below because there are not sufficient data at present to do so. It is said that streaked black ebonies can be changed to wholly black by burying them in the salt mud of the mangrove swamps.

The ebonies are used in the Philippines principally for musical instruments, fine furniture, cabinetmaking, and canes. The supply is limited and so far as known little or none is exported. Locally the species with little or no black heart are used for all sorts of purposes.

EBONY.

This is a small tree occurring on dry coastal hills and sometimes on the edge of mangrove swamps. It seldom reaches a height of over 20 meters and a diameter of more than 40 centimeters. The bark is 4 to 10 millimeters thick, shiny black, with steel gray patches where recently shed. The inner bark is brownish red. The leaves are simple, alternate, smooth, leathery, varying in size from 2 to 6.5 centimeters long and 1 to 4 centimeters wide. The sapwood is grayish or creamy white, large, sharply distinguished from the small jet-black heartwood. It is used in the Philippines for canes, inlaying, frames, hilts, tool handles, fine furniture. It is not at all abundant.

The distribution is as follows: Luzon (Cagayan, Baler, Pangasinan, Zambales, Tayabas, Camarines); Batanes Islands; Mindoro; Masbate; Leyte; Panay; Mindanao (Surigao, Zamboanga, Davao); Tinago Island; Dinagat Island. The scientific name is *Maba buxifolia.* The Spanish name, "ebano," seems to be widespread. The principal Philippine name is bantulinao or some form of it; others are galarigal (T.); kaloyanan (Pam.); luyong (T.); malatalang (T.); tangintin (Sur.).

CAMAGON.

Camagon is usually a medium-sized to large tree reaching a height of 25 to 32 meters and a diameter of 60 to 80 centimeters. It is extensively cultivated for its fruit, which is usually known as mabolo. It occurs, however, scattered on coastal hills and sometimes in the deeper soils of the dipterocarp types.

The bark is 3 to 5 millimeters thick, brown to nearly black in color, with a rough surface; the middle bark is black, the inner light pink. The leaves are simple, alternate, leathery in texture, densely covered with fine white hairs beneath, and vary in size from 10 to 22 centimeters long and 4 to 9 centimeters wide.

The sapwood is large, grayish to pale red in color; the heartwood is black with brown, ashy gray, or red streaks. The wood is very hard, very heavy, and very fine grained. It is used for the same purposes as ebony and is much more abundant.

As previously stated, camagon is cultivated; probably almost every province in the Islands contains it. The scientific name is *Diospyros discolor.* Besides camagon and mabolo (the name of the fruit), the following local names occur: Amaga or some form of it (T., V.); bantulinao or some form of it (T.); ituman (Ley.); kalangtapai (T.); kaloyanan (Pam.); talang (Riz.).

BOLONGETA. (Pl. XCVIII.)

Bolongeta is a tree resembling camagon in many respects, except it is smaller in size and forms a conspicuous part of the undergrowth of some of the dipterocarp types. The bark is 3 to 5 millimeters thick, nearly black in color, with an uneven surface, having jagged, short spinous projections. The middle bark is black, the inner light red. The leaves are alternate, simple, nearly smooth, or with a few scattered white hairs beneath, hardly visible to the naked eye; they vary in size from 9 to 17 centimeters long and 2.5 to 8 centimeters wide.

The sapwood is light red in color, the heartwood often has the same color, but may be black with reddish streaks. When large it is practically indistinguishable from camagon. It is used for the same purposes as camagon, but both sapwood and heartwood are locally used as structural timber. It is very heavy, very hard, and fine-grained.

The tree is reported from the following regions: Luzon (Cagayan, Ilocos Norte, Ilocos Sur, Nueva Ecija, Pangasinan, Baler, Zambales, Bataan, Rizal, Laguna, Batangas, Tayabas, Camarines); Camiguin Islands; Masbate; Mindoro; Samar; Tinago Island.

The scientific name is *Diospyros pilosanthera.* Besides the common name of bolongeta, or some form of it, the following local names are recorded: Alintatao or some form of it (T.); anam (B.); ata-ata (V.); bantulinao or some form of it (T.); camagon (T.); dambuhala (Riz.); ebano (Sp.); galangan (Pang.); malatalang (T.).

ATA-ATA.

This is a tree that in size, form, and bark characters closely resembles bolongeta. It seems to be more abundant in the Visayan Islands and Mindanao, and there replaces bolongeta as a medium-sized tree in the dipterocarp types. The leaves are nearly smooth with a whitish bloom beneath and vary in size from 10 to 17 centimeters long and 2.5 to 5 centimeters wide. The sapwood is grayish white, the heartwood sometimes of the same color but often black with or without whitish streaks.

This tree is referred to *Diospyros mindanaensis.* Besides ata-ata, it has the local names of bolongeta; anang (Tay.); and tapilak (Moro). The heartwood of the above and many other species may be sold as ebony, camagon, or bolongeta, depending on the color; if black, ebony; if black, slightly streaked, camagon; if much streaked, as bolongeta.

STRYCHNINE OR URUNG FAMILY.

(Loganiaceæ.)

The only representative of this family is urung (*Fagraea fragrans*). The wood is yellow when fresh and on exposure turns to a light brown. It is heavy, hard, fine grained, and very durable. It has the following uses: Posts; shipbuilding; piling; house construction. It is found principally in Palawan and has the common names of dolo and teca.

DOGBANE OR DITA FAMILY.

(Apocynaceæ.)

This family can usually be distinguished by the abundant milky sap in the bark and the opposite or whorled leaves.

DITA.

This is a medium to large tree reaching a height of 25 to 35 meters and a diameter of 80 to 100 centimeters. It has a fluted bole, weakly if at all buttressed. It is found very scattered in the dipterocarp forests, especially in the regions where the dry season is pronounced. It frequently occurs in the parang type as a small tree. It is intolerant of shade.

The bark is 8 to 10 millimeters thick, grayish to brownish yellow in color and sometimes covered with fine corky pustules; the inner bark is granular yellow in color, brittle, and exudes when cut an abundant thin milky white latex which has the taste of quinine. The leaves are smooth with glaucous bloom beneath, are usually arranged in whorls of 4 to 7, and vary in size from 5 to 20 centimeters long and 1.5 to 6.5 centimeters wide.

The wood is creamy white, light, soft, has a very bitter taste and discolors easily. It is used for light construction work, furniture, wooden soles for shoes, musical instruments, scabbards, and floats for fish nets.

The following is the distribution: Luzon (Cagayan, Ilocos Norte, Isabela, Abra, Bontoc, Union, Bataan, Rizal, Laguna, Tayabas, Camarines, Sorsogon, Albay); Mindoro; Samar; Leyte; Zamboanga; Palawan; Balabac Island. The scientific name is *Alstonia scholaris*. Besides dita or ditaa, it has the following local names: Alipauin (N. Luz.); andarayan (N. Luz.); dilupaon or some form of it (N. Luz.); lanitan (V.); oplai (Cag.); polai (Pang.); tanitan (V.).

BATINO.

Batino is a medium-sized tree resembling dita in many respects, but somewhat smaller. It usually occurs on dry hills and is tolerant of shade. The bark is 6 to 8 millimeters thick, gray in color, with slightly yellowish lines of corky pustules; the inner bark is yellowish brown in color with a milky sap. The leaves are simple in whorls of 4 (sometimes 3), sparingly hairy below, and varying in size from 10 to 20 centimeters long and 3 to 7.5 centimeters wide.

The wood is creamy white, moderately heavy and moderately hard, with a fine grain, has a bitter taste and disagreeable odor. It is used for house building (posts, rafters, siding, etc.); ties.

The following is the recorded distribution: Luzon (Cagayan, Ilocos Sur, Pangasinan, Baler, Rizal, Laguna, Batangas, Tayabas, Camarines); Mindoro; Guimaras Island; Lanao.

The scientific name is *Alstonia macrophylla*. Besides batino the following names are recorded: Itang-itang (Guim.); kalatuchi (Pang.); Pangolakloen (N. Luz.); tangitan (V.); ughayan (V.).

THE LANETES.

A number of species with similar characteristics as regards bark, size, and form of the tree, but with differences in character of the leaves, flowers, and fruits have the general name of lanete.

LANETE.

This is a tree that will reach the height of 20 to 25 meters and a diameter of 60 centimeters or more. It has usually a fluted and sometimes crooked bole and a rather open and irregular crown. It is found very scattered in semiopen portions of the dipterocarp types.

The bark is 4 to 8 millimeters in thickness, light gray to yellowish brown in color, and rather smooth; the inner bark is granular yellow in color, and when cut exudes rather freely a milky sap. The leaves are simple, opposite, with a more or less distinctly toothed margin, with velvety hairs beneath and sometimes above, and vary in size from 7 to 12 centimeters long and 2.5 to 5.5 centimeters wide. The wood is a pale cream color to that of old ivory, with no distinction between heartwood and sapwood. It varies in hardness from soft to moderately hard, and is moderately heavy.

It is one of the favorite carving woods of the Philippines. Other uses are as follows: Light construction purposes; furniture; soles of wooden shoes; kitchen utensils; chairs; parts of musical instruments; chests; turnery; window sills; scabbards.

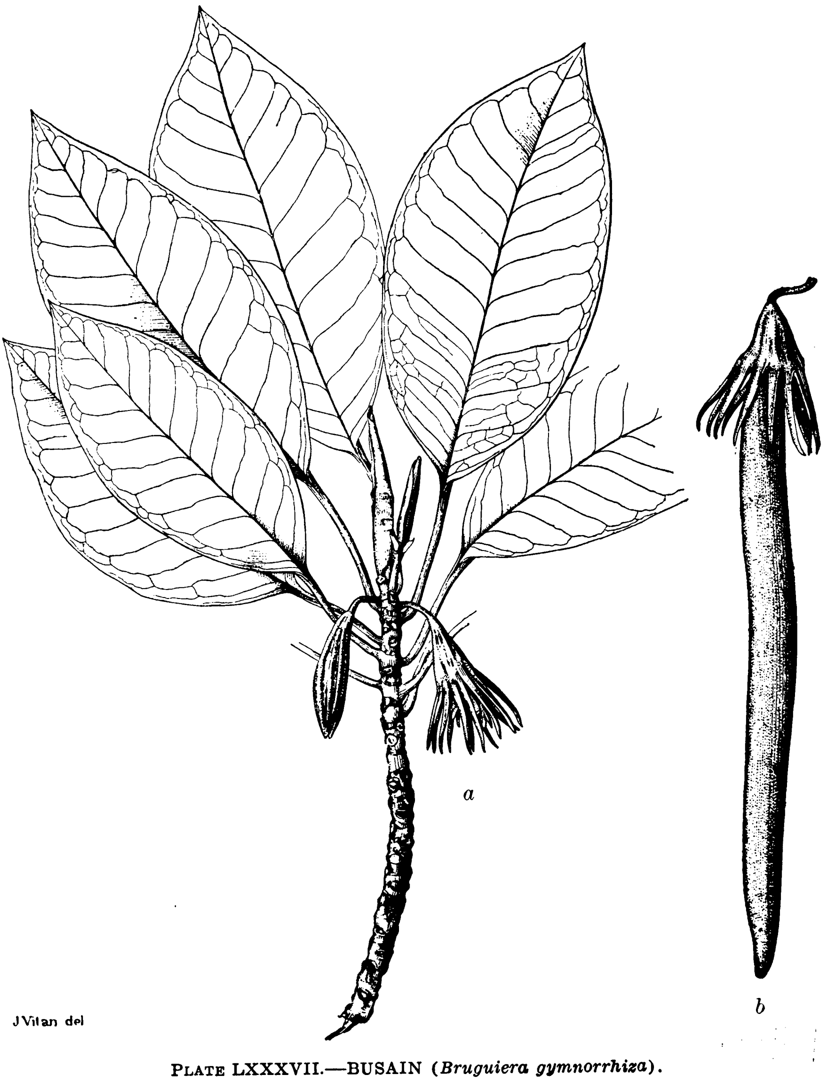
The following is the recorded distribution of lanete: Luzon (Cagayan, Abra, Ilocos Sur, Lepanto, Union, Benguet, Nueva Ecija, Pangasinan, Zambales, Bataan, Rizal, Laguna); Mindoro; Culion Island. The scientific name is *Wrightia laniti*. Besides the Tagalog name of lanete or laniti, the following are recorded: Anotong (Z.) balubat (N. Luz.); lamisi or lamusi (Il.); laniteng (Riz.); lanoti (Il.); tanghas (V.); tigig (V.).

Wrightia calycina differs from the above species in having leaves with few, if any, hairs, varying in size from 5 to 16.5 centimeters long and 1.5 to 6.5 centimeters wide. This tree in Mindanao attains a much larger size than *Wrightia laniti*. No common name except lanete is recorded for it. It seems to be confined to the regions where the dry season is not pronounced, and is recorded from Tayabas, Masbate, Leyte, Guimaras, Occidental Negros, Palawan, Zamboanga, Lanao.

ANONANG FAMILY.

(Borraginaceæ.)

No trees of this family are of any importance from the lumberman's standpoint. Anonang (*Cordia blancoi*) deserves mention because it occupies a prominent place in the second-growth type and often occurs as isolated trees in grass patches, which position is due to the fact that it resists fairly well the effects of fires.



J Vilan del

PLATE LXXXVII.—BUSAIN (*Bruguiera gymnorrhiza*).

a, Flower; *b*, young seedling with remains of the fruit attached.

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PLATE LXXXVIII.—CALUMPIT (*Terminalia edulis*).

a, Fruit.

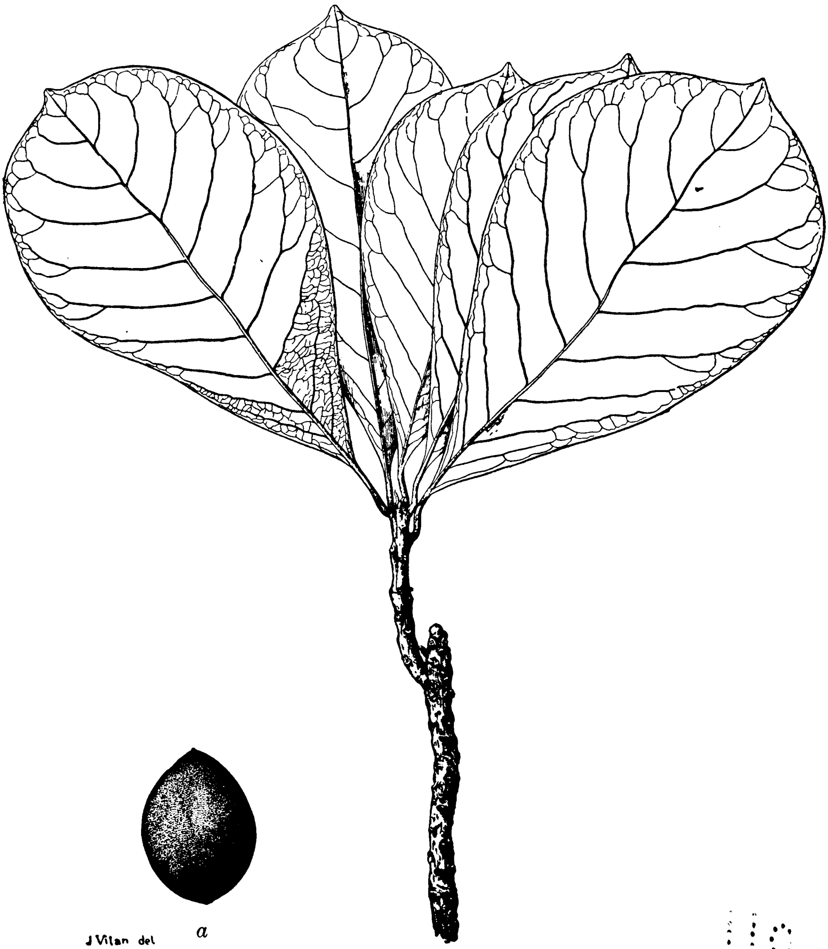

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PLATE LXXXIX.—TALISAY-GUBAT (*Terminalia oöcarpa*).

a, Fruit.

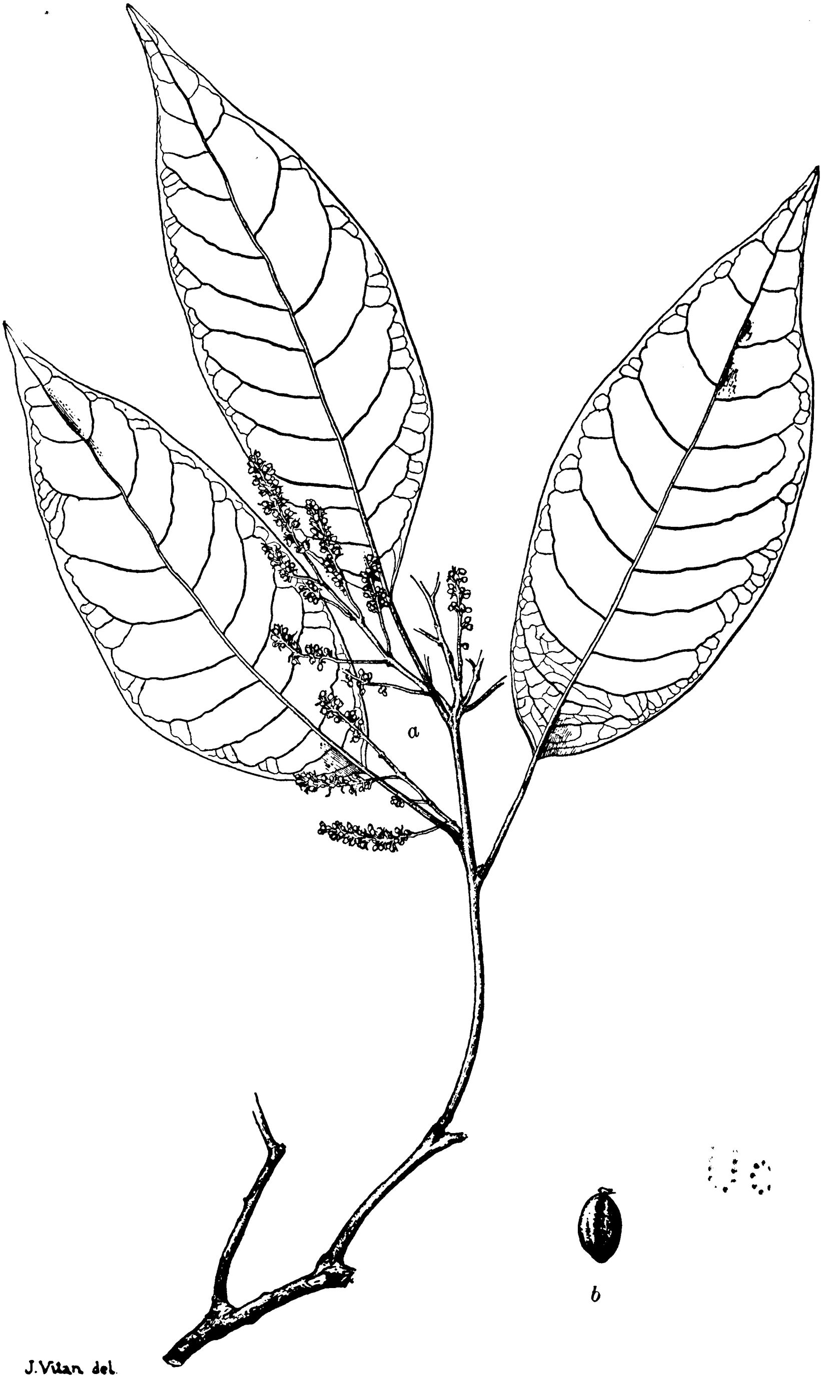

PLATE XC.—BINGGAS (*Terminalia comintana*).

a, Flower cluster; *b*, fruit.

PLATE XCI.—BARK OF BINGGAS (*Terminalia comintana*).

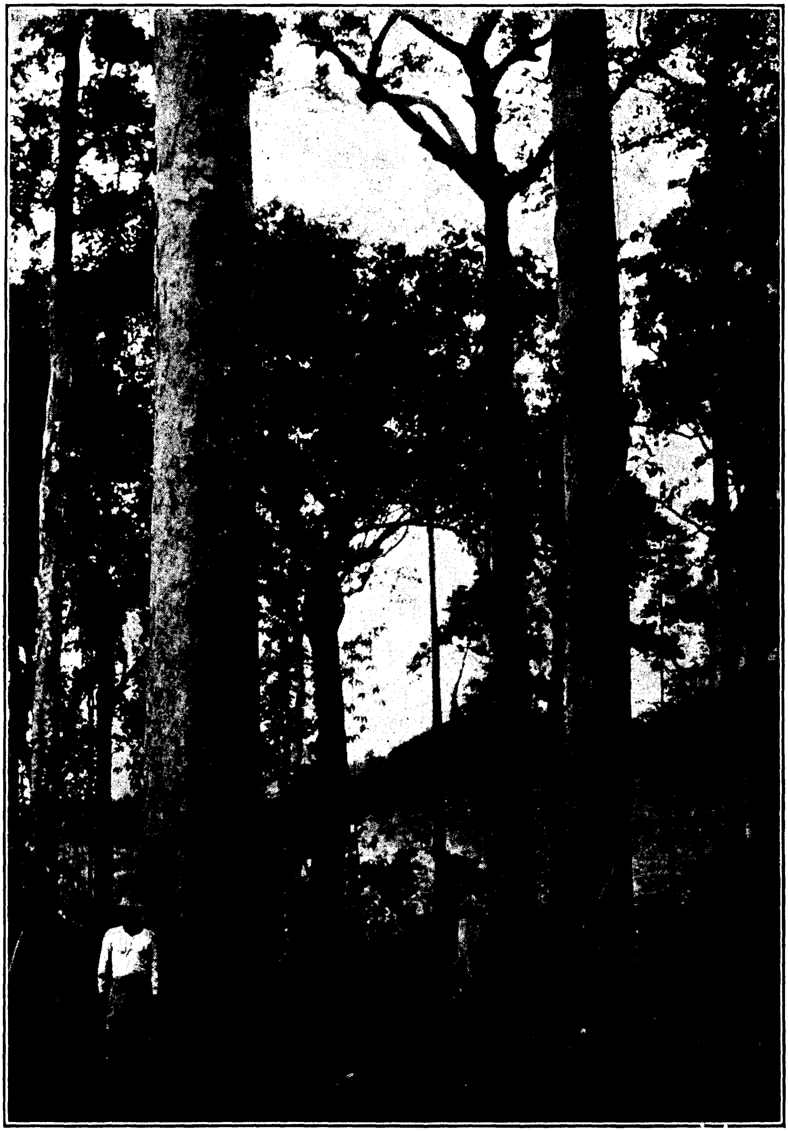

PLATE XCII.—TOOG (*Terminalia quadrialata*).

Large tree on the left.

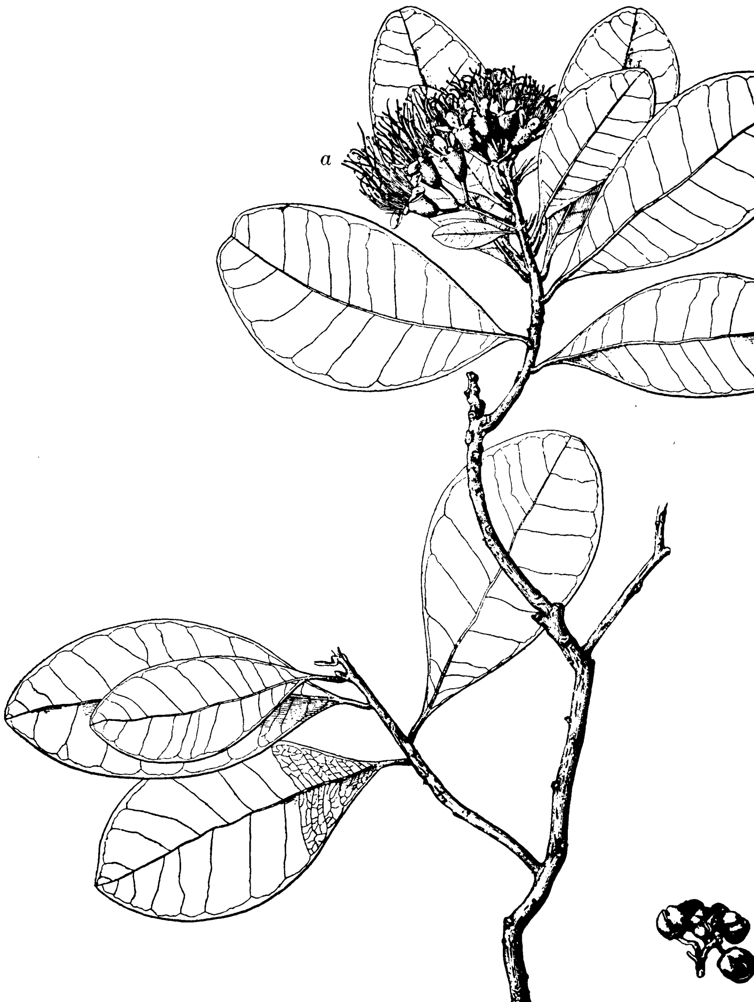

PLATE XCIII.—MANCONO (*Xanthostemon verdugonianus*).

a, Flower cluster; *b*, fruit cluster.

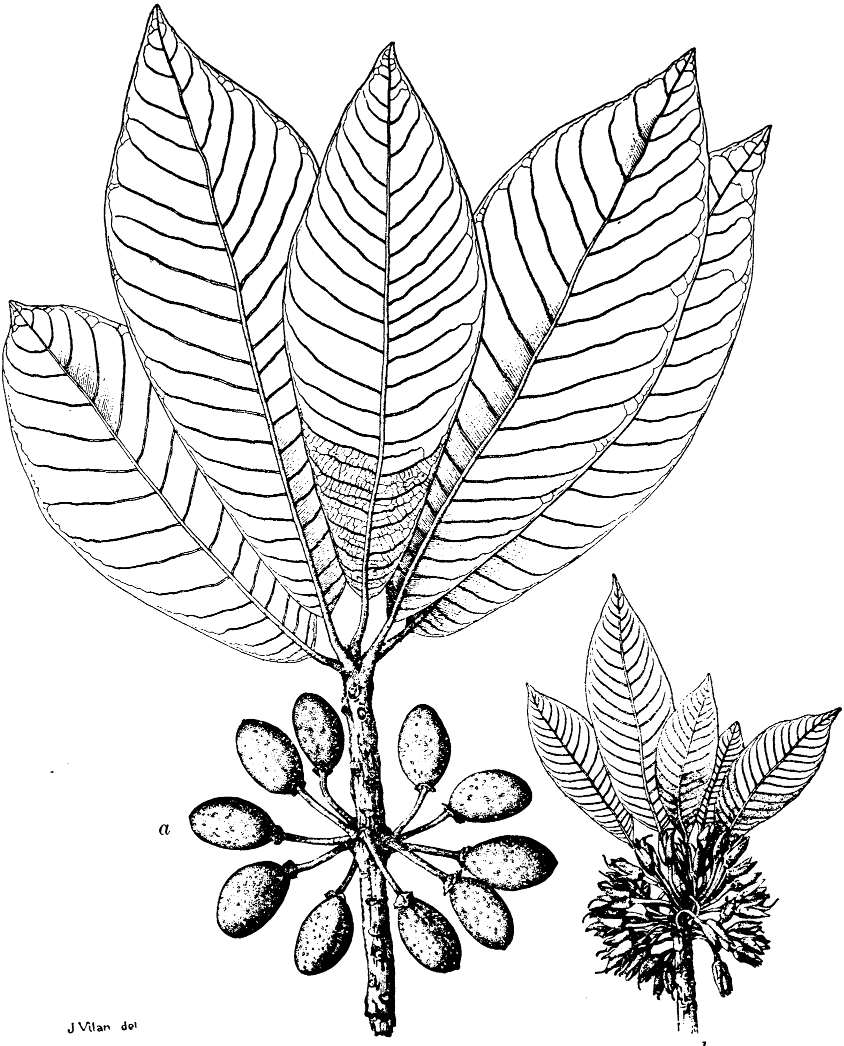

PLATE XCIV.—BETIS (*Illipe betis*).

a, Fruit cluster; *b*, flower cluster with young leaves.

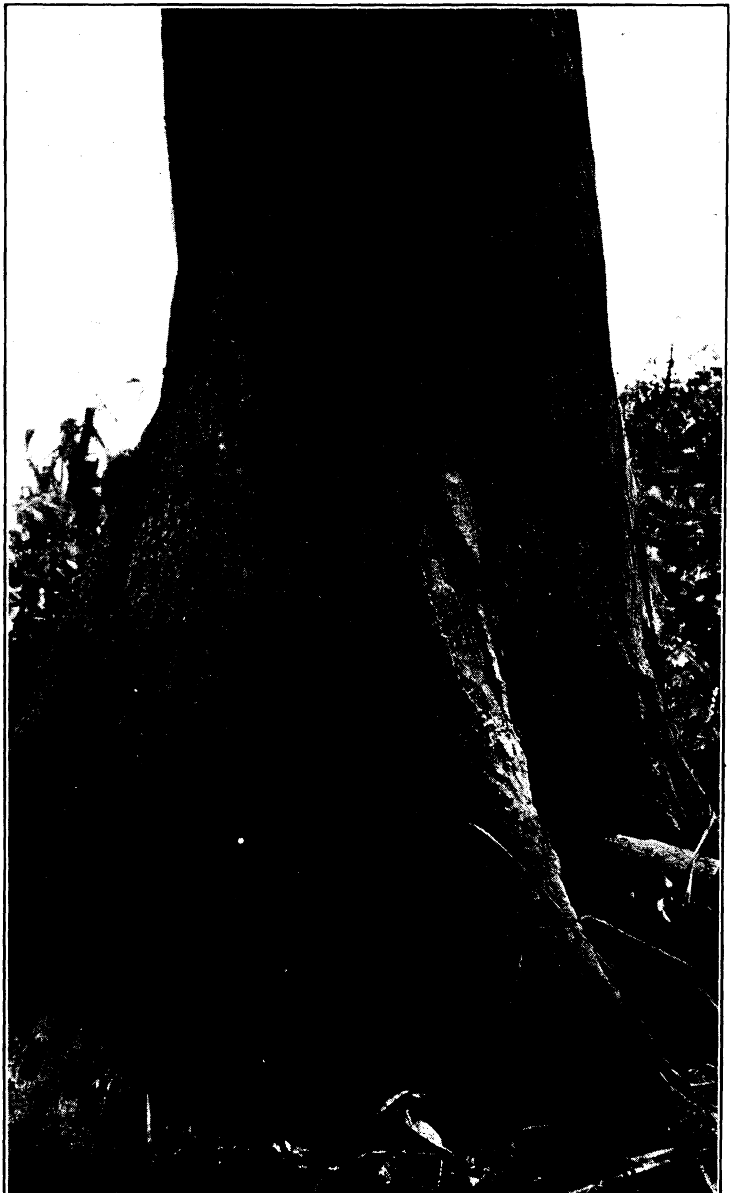

PLATE XCV.—BARK OF BETIS (*Illipe betis*).

PLATE XCVI.—BARK AND LEAVES OF MALACMALAC (*Palaquium philippense*).

PLATE XCVII.—BARK AND LEAVES OF MANICNIC (*Palaquium tenuipetiolatum*).

PLATE XCVIII.—BOLONGETA (*Diospyros pilosanthera*).

a, Flower cluster; *b*, fruit cluster.

PLATE XCIX.—MOLAVE (*Vitex parviflora*).

a, Flower cluster; *b*, flower; *c*, fruit cluster.

PLATE C.—BARK OF MOLAVE (*Vitex parviflora*).

J. Vilan del

PLATE CI.—SASALIT (*Vitex aherniana*).

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PLATE CII.—TEAK (*Tectona grandis*).

a, Flower cluster; *b*, fruit.

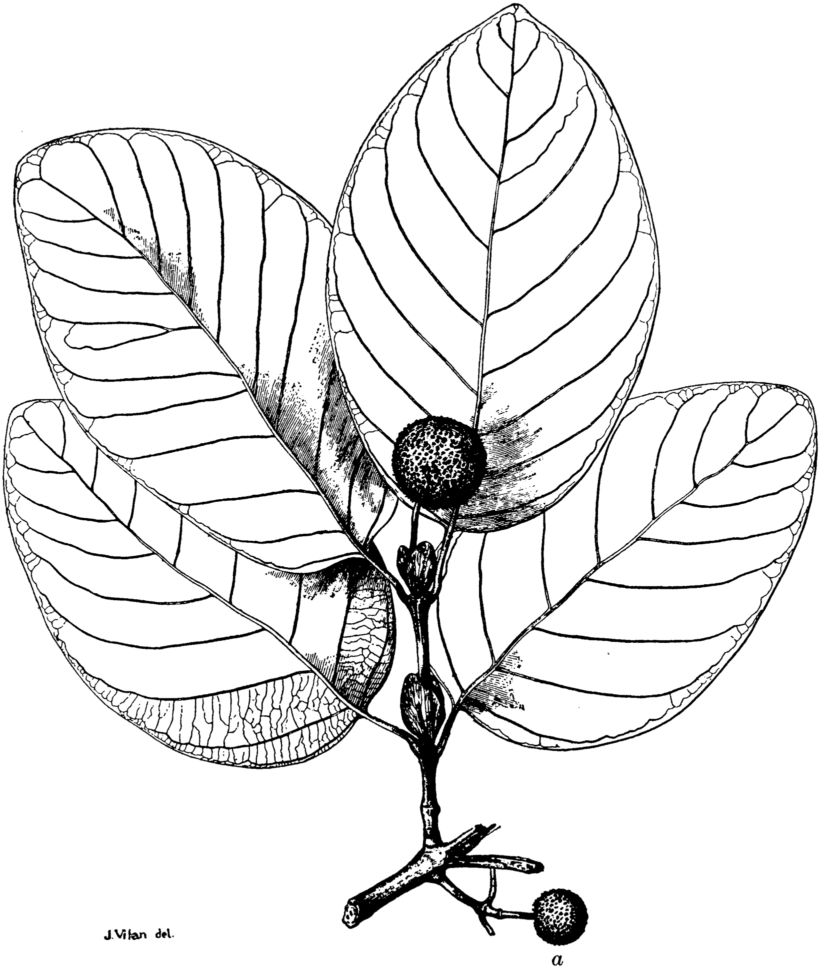

PLATE CIII.—BANCAL (*Sarcocephalus cordatus*).

a, Flower cluster.

TEAK OR MOLAVE FAMILY.

(Verbenaceæ.)

This is a family that has opposite, simple or palmately compound leaves.

MOLAVE. (Pls. XCIX and C.)

Molave is a tree that in exceptional cases will reach a height of 35 to 38 meters and a diameter up to 200 centimeters with a bole of 16 to 20 meters. Usually, however, it is below 30 meters high and may form in severe conditions a scraggly tree with a bole 2 meters or less in length. The bole is usually crooked, fluted, and buttressed. It has an open, wide-spreading crown. It is found throughout the Islands, especially on the low coastal hills, usually on limestone, but may occur on volcanic rocks. It is intolerant of shade, and partially or wholly deciduous during the dry season.

The bark is 8 to 10 millimeters in thickness, yellowish brown to gray in color, velvety to the touch, sometimes shedding in small thin flakes, otherwise smooth. The inner bark is light yellow, with darker yellow rings when freshly cut, but rapidly turns brown on exposure. The leaves are opposite, usually trifoliately compound; the leaflets are smooth, and vary in size from 4 to 15 centimeters long and 2.5 to 7 centimeters wide.

The sapwood is creamy white; the heartwood a pale yellow often turning to dull brown on exposure. It has a fine, usually crossed grain, with short and brittle fibers, making it easy to work. It is hard and heavy. It turns greenish yellow when treated with an alkali, and has a bitter taste and a slight odor. It stains water a greenish yellow color.

Molave is one of the best high-grade construction timbers in the Islands and is a good substitute for teak. It resists well the action of fungi, teredo, and white ants. The following is an enumeration of its uses: House construction (posts, doors, interior finish, flooring, joists, siding, sills); shipbuilding (knees, cutwater, sternposts); wagon making (axles, wheel rim, spokes); bridges; cabinetmaking; carabao yokes; cogwheels; docks; salt-water piles; pillars; plows; rice mortars; railroad ties; sugar mills; paving blocks; furniture; balusters and other turned work; hemp presses; sculpture; wooden tools; plane stocks; tool handles.

Practically all the provinces in the Philippines contain molave, though in many it is no longer in commercial quantities. The scientific name of molave is *Vitex parviflora*. The name molave is a corruption of the Tagalog name mulawin. The following local names are also recorded: Agubarao (V.); aguherao (V.); amurauon (B.); amugauan (Il., V., B.): bangongon (V.); bulaon (V., T., Pam.); bulauen (Pang.); bulauisan (Il.); bulaun (Z., Pam.); buyog tongon (Sur.); danigga (Il.); hamuraun (V.); hamulaon (T., B.); hamurauon (B.); hamursan (B.);

kalibayan (V.); kalipapa (Moro); kulipapa (Moro); lanahan (B.); maraun (V.); sagad (Il.); salingkapa (Guim.); tugas (V.).

The hairy leaf molave (*Vitex pubescens*) produces a wood so similar to molave that it is sold for it. It is recorded from the following regions: Mindoro; Guimaras; Culion Island; Palawan. A number of woods in the Philippines pass under the name of mulawin-aso and female molave as opposed to the hard molave (mulawin-bato) or male molave. The names of male and female are, of course, only a means of designating hard from soft molave. It is probable, as is maintained by some, that the wood of some trees of the same species (*V. parviflora*) is softer than the others. Young trees often have much softer wood than old trees and those growing in rich soils may be softer in texture. However, there are a number of distinct species of this family that do have the general name of mulawin-aso. One of the most important of these is kalipapa-aso or mulawin-aso (*Vitex pentaphylla*) which is a medium-sized tree usually found scattered in rich bottoms. This has a much softer wood than molave and has five leaflets instead of three. Another is lingo-lingo or mulawin-aso (*Vitex turczaninowii*) also with five leaflets. This tree is found scattered throughout Luzon and adjacent islands. A third species is alagao or mulawin-aso (*Premna nauseosa*) which has simple, opposite leaves, covered above and below with fine velvety hairs.

SASALIT. (Pl. CI.)

This is a medium-sized tree which reaches a height of 25 to 28 meters and a diameter of 75 centimeters, though usually it is considerably smaller. The bole is buttressed, usually crooked and fluted. It is found scattered in open places or as undergrowth in certain dipterocarp forests. The bark is 8 to 10 millimeters in thickness, gray to brown in color, slightly roughened by shallow saucer-like depressions; the inner bark is brittle. The leaves are opposite and palmately 3 to 7 compound; the leaflets are usually smooth, varying in size from 5.5 to 28 centimeters long and 2.5 to 12.5 centimeters wide. The wood of sasalit is light yellowish brown to dark yellowish brown. It is very heavy, very hard, durable, and less brittle than molave. It has practically the same uses as molave and is often sold for it.

Sasalit has been recorded from the following regions: Luzon (Cagayan, Pangasinan, Principe, Zambales, Tayabas, Albay, Sorsogon); Ticao Island; Samar; Negros; Zamboanga. It has the scientific name of *Vitex aherniana.* The following local names are known: Dalipapa (Cag.); dungula (Neg.); gualberto (Il.); igang (Principe); kalipapa (Sam., Al.).

Api-api (*Avicennia officinalis*) is a small tree common in the mangrove swamps. It has opposite leaves, white beneath. The wood is hard, heavy, very brittle and with a very peculiar structure.

TEAK. (Pl. CII.)

Teak is not native to the Philippines. Small plantations of it occur in the southern islands, especially in Zamboanga district, Basilan Island, and Sulu. Here it has been planted long enough to reach sizes up to 80 centimeters or more in diameter. It is intolerant of shade. The bark is 8 to 20 millimeters thick, light brown to gray, with vertical lines, giving it an indistinct ridged appearance, the outside being a soft papery layer shedding in long thin flakes. The inner bark is light colored with prominent brown pith rays; on exposure it turns rapidly to a yellowish brown. The leaves are simple, opposite, with a dense mat of velvety hairs beneath, and vary in size from 19 to 33 centimeters long and 13.5 to 22 centimeters wide, though sprout leaves are much larger.

The sapwood is light colored; the heartwood is dark golden yellow, turning brown and finally black with age. It is moderately heavy, moderately hard, with a coarse and straight grain. It has a distinct aromatic odor. Teak is the best known wood of the Tropics. It is used for ship-building; high-class construction of all kinds; furniture; carving.

Teak (teca, Sp.) has been collected in the Philippines in the following regions: Rizal; Zamboanga; Basilan Island; Jolo Island. The scientific name is *Tectona grandis.*

CATALPA OR BANAI-BANAI FAMILY.

(Bignoniaceæ.)

This family is of little importance to the lumberman. Three trees are common, however, and need a brief mention in this place. Banai-banai (*Radermachera pinnata*) is a small to medium sized tree with doubly compound leaves and large showy flowers. It and other species of *Radermachera* are found scattered usually in open places. Pinkapinkahan (*Oroxylum indicum*) is a small to medium sized tree with large doubly compound leaves and long, flat, broad pods containing winged seeds. It seems to be confined to the region where the dry season is pronounced, and so far as observation goes is bare of leaves longer than any other tree in the Philippines. The wood is soft, light in weight and is used for matches. Tui (*Dolichandrone spathacea*) is a small tree usually confined to the sandy beaches and along tidal rivers. It has a soft light-colored wood used principally for making wooden shoe-soles.

COFFEE OR BANCAL FAMILY.

(Rubiaceæ.)

This family contains a large number of undergrowth, small and medium sized trees and a few that can be classified as large. The trees have opposite leaves with interpetiolar stipules (small leaf-like appendages between the leaf stalks of the opposite leaves) by which the trees can usually be readily distinguished from those of other families.

BANCAL. (Pl. CIII.)

Bancal is a small to medium sized tree with a straight regular bole, the length of which is about one-half the height of the tree. It is intolerant of shade, and is found usually along streams, in coastal plains, and occurs as scattered trees in grass lands in the deforested areas of the lauan-hagachac type. It owes its success here to the fact that it resists well the effects of fires. The bark is 14 to 18 millimeters in thickness, grayish yellow to ashy red in color, very rough and scaly and has a bitter taste; the inner bark is yellow. The leaves vary in size from 12 to 24 centimeters long and 6.5 to 18.5 centimeters wide.

The sapwood is light yellow; the heartwood darker yellow in color. It is soft to moderately hard, moderately heavy, and has a decided waxy feeling. It has the following uses: House construction (partitions, posts, rafters, flooring, ceilings); small boats; furniture (chairs, desks); barrel staves; tubs; paddles for beating clothes (palopalo), and kitchen and other household implements; firewood; carving.

This or closely related species occur in nearly all provinces. The scientific name is *Sarcocephalus cordatus.* Besides bancal, it has the Ilocano name of bulala.

A number of other species much like bancal in many respects produce bancal lumber. Of these, mambog or bancal (*Sarcocephalus junghuhnii*) is confined to regions where the dry season is not pronounced. It differs from bancal in having smaller leaves.

CALAMANSANAY.

This name seems to apply to a number of species of this and, perhaps, other families that have a light rose-colored wood. (See pp. 79, 87.) The lumber on the market in Manila, however, comes from several species of *Nauclea* found in many parts of the Islands. The following description applies to a specially large species found in the Zamboanga district of Mindanao.

It is a tree that reaches a height of 40 meters and a diameter of 70 centimeters. The bole is straight and regular with slight buttresses. It is intolerant of shade and is very scattered. The bark is 8 to 10 millimeters in thickness, light gray to brown in color, with a surface broken into more or less continuous lines of corky pustules. The middle bark is brown; the inner bark is bright yellow when freshly cut, but on exposure quickly turns to brown. The leaves are simple and opposite.

The sapwood is yellowish with a tinge of pink; the heartwood when freshly cut is a brilliant red, but soon changes to the same color of the sapwood. The wood is heavy and hard, close and straight grained.

Calamansanay has the following uses: House construction (flooring, beams, posts, siding, window sills); masts for boats; furniture; telegraph poles; ties; tool handles.

While the above applies to a particular species of *Nauclea,* yet the character of the bark seems to be rather uniform for a number of species. The following is a list of common names of calamansanay: Bankalauag (V.); bayaho (Il.); bisal (Pang); himbabalut (Il.); kalamansauan (T.); kalumagon (B.); kamansak (Z.); malatumbaga (Zam.); subosubo (Z.).

GENERAL INDEX.

[NOTE.—Official common names are in **heavy-faced** type; local names not official (i. e., synonyms), in Roman type.]

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