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The Evergreen Forests of Liberia: A Report on Investigations made in the West African Republic of Liberia by the Yale University School of Forestry in Cooperation with the Firestone Plantations Company

G. Proctor Cooper

Samuel J. Record

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YALE UNIVERSITY · SCHOOL OF FORESTRY

BULLETIN NO. 31

THE EVERGREEN FORESTS
OF LIBERIA

A REPORT ON INVESTIGATIONS MADE IN THE WEST AFRICAN REPUBLIC OF LIBERIA
BY THE YALE UNIVERSITY SCHOOL OF FORESTRY IN COÖPERATION WITH THE
FIRESTONE PLANTATIONS COMPANY

BY

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NEW HAVEN
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1931

A Note to Readers

2012

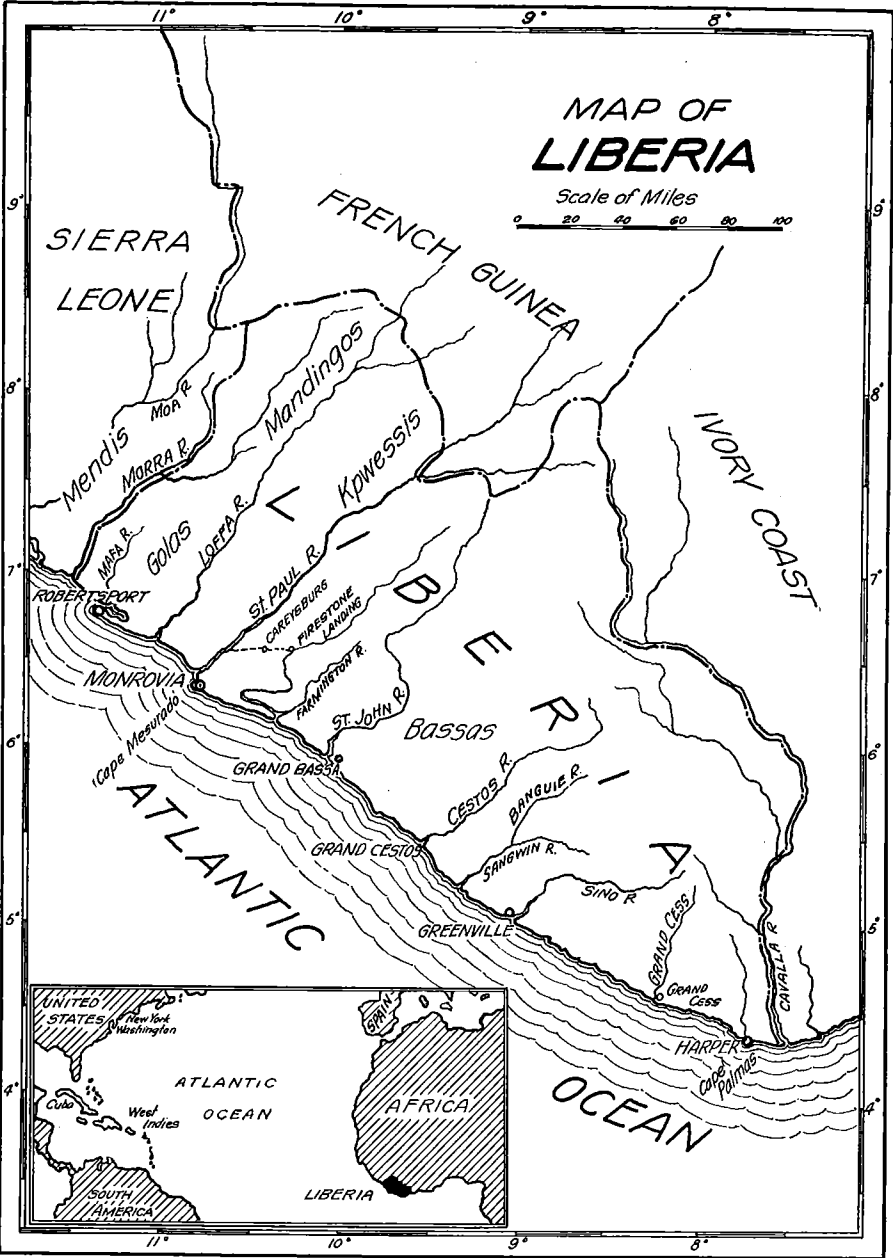
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FOREWORD

LATE in 1927, Mr. Harvey S. Firestone, President of the Firestone Tire and Rubber Company, and Mr. Harvey S. Firestone, Jr., President of the Firestone Plantations Company, offered to place the facilities of the latter company at the disposal of the Yale University School of Forestry for the purpose of making a scientific study of timberlands being cleared for rubber plantations in Liberia, West Africa. This generous proposal, which had its origin in a suggestion by Mr. Rudolph Block,¹ was promptly accepted by the School, as it provided an unusual opportunity for determining the composition of an important portion of the tropical evergreen forest and for collecting authentic specimens of wood for testing and systematic study in the laboratory.

It was realized at the outset that if the project was to have a scientific foundation it would be necessary to have the trees and other plants named by competent taxonomists associated with a large herbarium in which the West African flora was well represented. These conditions were ideally fulfilled at the Royal Botanic Gardens, Kew, England, where, under the supervision of the Director, a comprehensive *Flora of West Tropical Africa* was being prepared by Mr. J. Hutchinson, Assistant in the Herbarium, and Dr. J. M. Dalziel (late of the West African Medical Service), Assistant for West Africa. These eminent authorities obligingly assumed the important task of determining all the specimens of Liberian plants submitted to them, and they fulfilled their promise with accuracy and dispatch despite the inconvenience which it must have occasioned.

Mr. G. Proctor Cooper, 3d, a graduate of the School who had had experience as a collector in Central America, was appointed Field Assistant

¹ Rudolph Block, now residing in France, was for many years on the editorial staff of a newspaper syndicate in New York and is widely known as a writer under the pen name of Bruno Lessing. His attention was first attracted to the Firestone operations in Liberia during his world-wide search for rare and unusual woods to enrich his private collection of walking sticks, fourteen hundred of which have been on exhibit for the past three years in the United States National Museum, Washington, D. C. Yale gratefully acknowledges its indebtedness to him, not only in connection with the Liberian project, but also for his many important gifts to its collections and for his sustained interest in promoting scientific knowledge of woods and forests.

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in Tropical Forestry at Yale University for the duration of this project. He went to Liberia in August, 1928, and returned to New Haven in August, 1929. He was in direct charge of the field work, and his assistants were intelligent native employees of the Firestone Plantations Company. After a few months Mr. Cooper became seriously ill of some unknown malady that forced him to spend several weeks at different times in the hospital. On this account some of the objectives of his mission were abandoned, though he was able to complete the main part of the project as planned. That so much was accomplished under the circumstances is due to the coöperation of Mr. Firestone and his entire field staff, particularly Messrs. Gammie, Allen, Phillippe, and Drinkwater.

The present is only one of several scientific collections of Liberian plants, the first being made about 90 years ago. The most extensive one, still in progress, is that of Herr M. Dinklage, a German formerly in business at Grand Bassa, now retired and living in Monrovia. His earlier material, determined by Professor A. Harms, of Berlin-Dahlem, was made the principal basis for the first report published on the flora of Liberia, which was compiled by Dr. Otto Stapf for Sir Harry Johnston's *History of Liberia*. Three or four other botanists have visited the country, but prior to the present investigation comparatively little attention had been given to the larger trees and none at all to the woods.

The Yale-Firestone coöperative study was largely from the standpoint of the forester and wood technologist and had in view the practical as well as the scientific aspects of the situation. Trees, because of the difficulty they offer to the collector of botanical specimens, are very likely to be the least well known of plants. This is a serious handicap to the forester and one that, under ordinary circumstances, is very slowly overcome. In the present instance, however, large blocks of forest were being felled, thus making it possible to obtain samples of every tree in the stand, though of course not all were in flower or fruit. Nearly 500 specimens were obtained, representing 300 species, 222 genera, and 68 families; at least 18 species have proved new to science. No attempt was made toward a general collection, and the few herbs included were incidental to the forest survey.

The composition of the forest was studied on three different strips comprising a total of 52 half-acre sample plots. The size of every tree 2 inches and over in diameter at breast height (or above buttresses) was recorded and the results subsequently compiled so as to show in tabular form the relative abundance of the species and the distribution of size classes on

FOREWORD

typical areas of the Dukwia region. The forests there are of second quality, and for size of timber are easily surpassed in various other places in Liberia.

From the Dukwia region also were obtained 118 hewed bolts, representing nearly all of the principal timber trees. Tests on the physical and mechanical properties of 104 of them were made at Yale under the direction of Professor George A. Garratt. Although the number of tests is limited, the results are believed to be fairly indicative of the character of the material. In addition, various samples of lumber from local mills were made into panels for exhibit purposes at the School and to demonstrate the appearance and working qualities of the woods.

In most instances the amount of herbarium material was sufficient to make several sets in addition to the one retained at Yale, which have been distributed as follows: Royal Botanic Gardens, Kew; Imperial Forestry Institute, Oxford; British Museum of Natural History, London; Field Museum of Natural History, Chicago; U. S. National Herbarium, Washington; New York Botanical Garden; Arnold Arboretum, Jamaica Plain, Mass.; Gray Herbarium, Cambridge, Mass.; Botanisches Museum, Berlin-Dahlem; and the Academy of Natural Sciences of Philadelphia. Samples of the woods are being distributed to various scientists and institutions in connection with coöperative systematic studies now in progress.

SAMUEL J. RECORD

THE EVERGREEN FORESTS OF LIBERIA

INTRODUCTION

GENERAL CONSIDERATIONS

THE Republic of Liberia lies just to the east of the French Ivory Coast, West Africa. It fronts on the Atlantic Coast for about 350 miles and extends inland to a maximum depth of 265 miles. Its total area, 40,000 square miles, is a thousand square miles less than the State of Ohio. Its share of the total land surface of the African continent is about one third of one per cent.

Liberia is a forested country and a large proportion of it is covered with what is popularly known as jungle. This is the region of abundant rainfall and the forests are evergreen. The term "evergreen" refers to the fact that the forest appears in full leaf the year round and does not signify conifers, for in all the country there is not a Pine or Fir or Hemlock or Cedar, such as constitute the evergreen forests of the North. The West African forests are composed of broadleaf trees and palms.

Liberia, unlike its colonial neighbors, has no forest administration or any regulations for the cutting of timber. There is no reliable information available as to the abundance of valuable species. There is little local lumber business and practically no timber exports. The goal so far has been, and naturally so, to rid the land of the forest or "bush" as easily and as rapidly as possible to make way for the growing of rice, coffee, and cacao.

When the Firestone Plantations Company acquired the concession to hundreds of thousands of acres for the purpose of growing rubber trees, some interest in the possible salvaging of the timber was manifested. But, as is generally the case throughout the tropical world, the uncertainty of the abundance of the various species, the lack of knowledge as to the quality of the woods, and the high cost of transportation to markets (if any markets could be created) were decisive factors against the logging of the stands; the obvious method of preparing the ground for rubber was accepted and followed, i.e., clean felling and burning after drying. (See Plate XV.) But only a small part of the total concession has as yet been cleared, so that if some of the tree species are found to possess desirable qualities to the

THE EVERGREEN FORESTS OF LIBERIA

extent that they can be utilized even on a small scale, it will still be possible to salvage the timber from many thousands of acres. The Firestone Plantations Company has a small sawmill for cutting a few logs of some of the native-used timbers, and they also buy the hand-sawed planks from the native sawyers (Plate XIV, No. 1) and finish them into boards for making furniture and various items of equipment. A man with experience in manual training and cabinet-making has been in charge of the sawmill on the plantations for some time and has taught the native carpenters the fine points of the craft so that some very creditable pieces of furniture have been turned out for local use, made for the most part from the tree called Black Gum (*Afrormosia laxiflora* Harms), the wood of which is hard, heavy, attractively figured, and highly lustrous.

One of the essential features in successfully logging the tropical forest, with its great diversity of species, is the ability to utilize twenty or thirty different timbers, grouped into general classes such as cabinet woods, heavy construction timbers, light construction and utility woods, box and rough lumber, pulpwood, and firewood. In this way the bulk of the stand can be salvaged, and there is no need to hunt out a single species or two, as is the case with Mahogany operations. But before this sort of logging can be put into practice with any hope of success, the various trees to be saved must have previously been subjected to thorough study and practical tests to determine and classify their utility values.

Many of the Liberian timber trees are found in other parts of West Africa, and they have been exported from the British and French colonies for many years. Other large trees are being used locally or are being tried experimentally in Europe. The Samba (*Triplochiton* sp.) of the Ivory Coast is an example of a wood which, though abundant in parts of the forest, was never considered of value until German veneer mills experimented successfully with it. Large quantities are now being shipped to Europe. Okoumé (*Aucoumea Klaineana* Pierre) is another wood with a similar history, and there will be more frequent examples as the future temperate supply of hardwoods diminishes.

Although previous to the beginning of this century little or no progress had been made toward a systematic study and collection of the woods of the tropical evergreen forests, except for those few which have been in demand for cabinet-making over a long period of time, the British and French West African colonial governments have now organized this most important feature of tropical forest administration with a view of eventually bringing

HISTORICAL AND POLITICAL CONSIDERATIONS

into the markets a great variety of species now unused and even unknown. The colonial forestry officers are making studies of existing stands of timber with the idea of regulating the cut of species now exploited toward a continuous rotation, and are taking inventory of the "stocks in hand," both of the marketable woods and those having possible future or potential commercial value in the European markets or for local use. Laboratory and fabrication tests are being made and the results placed at the disposal of the importers and manufacturers. West African timbers are, in consequence, assuming a rapidly increasing importance in the European trade. This portends the coming of a new industry to Liberia, but an industry which needs wise control if its dangers are to be avoided.

HISTORICAL AND POLITICAL CONSIDERATIONS

Liberia was founded more than a hundred years ago by New England people interested in returning American slaves to their native country. Early in the nineteenth century the English had established a colony at Sierra Leone with Negroes taken from captured slave ships and from the Caribbean Islands. It was first intended to send the American Negroes to the same place, but unsatisfactory conditions prevailed at the time the first ship arrived, and after sailing up and down the coast the colonists finally returned to Sierra Leone to await further help from America. This was forthcoming in 1821 when the first settlement was made at Cape Mesurado, which is now the site of the present capital city, Monrovia.

The coast line claimed by the colonists was known as the Grain Coast, so called from the presence of the Malagueta Pepper, known as "grains of paradise," which the early Spanish and Portuguese explorers gathered for trade in Europe.

The early settlers met with more severe hardships than our own Pilgrim Fathers, having to fight the savages as well as the scourages of tropical disease. The survival of this colony as an independent state was probably due to the struggle of the European powers for African territory, the German, French, and English governments all casting covetous glances at the small, unprotected coast line and each watching the others to forestall a coup which would exclude any one of them. The Liberian Government managed to play one country against the other for a half a century, losing only minor portions of the original boundaries to the English and French bordering possessions. Finally, during President Taft's administration,

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the United States of America acknowledged its interest, and thereafter the country has been considered by European countries in the light of an American protectorate.

There are, of course, no visible signs of American dominance, no military or naval forces, and no interference with the political structure of the Liberian Republic. The presence of a Financial Advisor and a Supervisor of Customs, both appointed by the President of the United States and approved by the President of Liberia, are necessary to regulate the internal debt which was refunded by America a few years ago. The ties created by the missionary societies and churches through their endowed schools, and the influence of philanthropic organizations toward helping the Negro are sufficiently effective in maintaining very friendly relations between the two governments.

The political structure of Liberia is modeled after that of the United States of America, but the voting power is in the hands of the Americo-Liberians, some 15,000 in number, and half that many natives whose mission school education enables them to read and write. The million or more natives in the hinterland, from paramount chief to slave boy, have neither knowledge of nor interest in the government affairs at Monrovia. The chiefs assemble annually at the native capital, Kakatown, to hear the message and instructions of the President and other government spokesmen, but their presence is often involuntary and their interest only superficial. Native law and justice prevail in the interior domain of the chiefs, subject only to supervision by the Liberian district commissioners, who also collect the head monies and levies.

TOPOGRAPHY AND TRAVEL

The long axis of the country runs northwest-southeast. On the west and southwest is the southern Atlantic Ocean, on the northwest is the colony and protectorate of Sierra Leone, separated for the most part by the Mano and Morra Rivers. On the north and northeast is the French Guinea grass-and-desert land which meets the French Ivory Coast on the east and southeast.

The country is mostly rolling hills back of the Mangrove swamps, the elevation increasing to 1500-2000 feet at the French Guinea border. The headland of Cape Mount is close to the Sierra Leone border and is the first point in Liberia one sees when arriving from Freetown. Besides the pro-

TOPOGRAPHY AND TRAVEL

montory at Cape Mesurado, there are coastal hills at Bafu Point near the Sangwin River and at Cape Palmas near the Ivory Coast boundary.

Most of the soil in Liberia is a decomposed laterite mixed with gravel and clay. There is a purplish red color to the laterite which is due to the presence of iron. In some parts of the interior, crude iron bars are made from the ore mined in the hills. The gravel is chiefly a quartz, feldspar, and mica formation and is mixed with volcanic laterite, sand, and red clay.

The country is well drained by several rivers all flowing in the same general direction—southwest. Starting from the Sierra Leone border with the Morra River, the important streams are the Loffa, St. Paul, Dukwia-Junk, Farmington, St. John or Manni, Cess or Cestos, Sangwin, Sino, and Cavalla. The only one navigable for any great distance is the French-controlled Cavalla River, which admits of vessels of light draft for a distance of 60-70 miles. Most of the streams have low falls or rapids from ten to twenty-five miles inland. Very little is known about the navigability of the Loffa River beyond the Mangrove flats. St. Paul River is important as a communication and transportation link between Monrovia and trading posts in the hinterland, but beyond White Plains the passage is often badly choked even for canoes. Dukwia-Junk River has been cleaned out as far as the Firestone Plantations landing, thirty miles inland, and is open to barges and launches at all times. Farmington River flows into the Dukwia at its mouth and is important as a potential source of power at the rapids about fifteen miles inland; its broad channel below the falls makes it suitable for logging operations tapping the hardwood forests in the vicinity. St. John River, with Grand Bassa at its mouth, drains a large area of rain forest concerning which little is known. The River Cess taps a dense forest of hardwoods, rubber, and oil nuts. The Sangwin divides the counties of Grand Bassa and Sino, and although not a large stream it is said to flow through comparatively level country for twenty or thirty miles, and ought to be suitable for logging rafts. The Sino flows mostly west, according to its location on the best maps; though not large it reaches a territory covered with high forest. Grand Cess River is small and divides Maryland and Sino Counties.

Travel in the interior is by foot or hammock over narrow trails, sometimes leading through swamps, across rivers, or over steep hills. A road was being reconstructed in 1928 from the Firestone Plantations boundary to meet the government highway at Careysburg, and this highway was being made over in places at the same time. The improvements now make it pos-

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sible to travel from the Firestone Plantations to Monrovia during the entire year, whereas formerly in the flood season parts of the road were completely submerged. At one point in this road the bed was built up from ten to twenty feet over a stretch of half a mile, all the earth being carried in head baskets by road-gang boys brought down from the interior. The government has also recently completed the road improvements to Kakatown, with a bridge erected across Vorquelli Creek so that the road can penetrate further inland. The only other highway of importance is that from Harper to the Firestone Plantation in the Cape Palmas region. This road is a very old one, but was never fit for automobile travel until improved by the joint efforts of the Firestone engineers and the government.

There is no railroad in Liberia, the only country on the West Coast to be without this form of transportation. This is probably one of the reasons for Liberia's slower development of her natural resources as compared with the West African colonies. A narrow gauge line running into the interior a hundred miles would open up a vast area containing valuable forest products and greatly stimulate trade with the interior tribes.

CLIMATE AND HEALTH

The climate of the West African Coast is not healthy, in spite of strenuous efforts by the British and French governments to create and maintain sanitary improvements. Liberia has made no progress in public health, having neither funds nor personnel for such work. A government hospital has been established at Monrovia in the building formerly occupied by a German radio company, but when one leaves the immediate environs of the hospital grounds, one leaves all evidences of sanitation and medical activity behind.

As a contrast to conditions in the Liberian capital, the Firestone Plantations colony some thirty miles back from the coast offers a pleasant surprise. Here the land has been cleared over thousands of acres and planted in rubber. Modern bungalows have been erected, and, at the Central Headquarters, a water supply, sewer system, refrigerating plant, and electricity have been installed for the convenience and comfort of the staff. The climate is less enervating on the plantations than in Monrovia, probably due as much to the better housing as to any other factor. Most of the substantial houses in Monrovia are built with little or no provision for ventilation, and at night when the shutters are closed tightly to keep out insects and rain (most houses have neither screens nor glass windows), any breeze which might

CLIMATE AND HEALTH

otherwise reach the interior of the house is completely cut off. On the plantations the temperature seldom exceeds 90° F., except for a few hours in the middle of the day during January and February when almost no rain falls over the entire country. But with this higher temperature the humidity is also considerably less so that no discomfort is felt unless one has to work in the sun. It is the "soggy" or "sticky" atmosphere which greatly lowers the working capacity of the white man, slowly sapping his vitality and reducing his resistance to disease.

The seasons are generally divided into the rainy and the dry, with a short dry spell, called the "middle dries," in July–August. The annual cycle is something like this: The rains decrease in frequency in late November until by the middle of December they appear as infrequent showers. The mornings in December are refreshing and cool. There is almost no rain at all in January or February, and the harmattan wind from the French Sudan gives the atmosphere a smoky appearance and causes the sun to appear as a red or yellow disk. Fine dust often settles everywhere, being carried from the interior sands by the strong winds. In March there are a few windstorms which sometimes bring brief showers toward the end of the month. The wind and rain first appear a few hours before daylight and gradually come earlier and more frequently toward the first of April. These storms are sometimes of great violence, tearing up trees, lifting the roofs off houses, demolishing huts, and, when accompanied by rain, flooding the plantations for a few hours. The parched vegetation and the sunbaked soil absorb the water so quickly that by morning the surface of the ground is dry. Toward the end of April these showers come four or five times a week. The storms can be seen approaching for an hour before they strike, and the advance notice given by violent gusts of wind is an effective warning to close the shutters and make the house secure. Often an inch of rain will fall during a half-hour's "shower," accompanied by such terrific thunder and lightning that the natives hide away in their huts with their charms scattered about them.

The heavy rains set in during the latter part of May and early June, the phases of the moon having something to do with this, according to native theory. It will rain hard for four or five days and then be clear for the same length of time. July and August are the wettest months, even with the brief dry spell lasting perhaps a week. It rains almost every day in September, but not with the intensity of the previous months. October is more pleasant with less frequent rainfall. The coolest weather comes with the heavy rains

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in July to September. Frequently, after an early morning shower, the native axeboys cannot hold their implements because of their shivering from the cold and resulting fever chills. The "muggy" atmosphere as a result of an almost absolute humidity is rather trying on one's nerves and vitality. From October to December the days are hot, but partly clear and breezy, while the nights are cool. Although the temperature at midday during the dry months of January and February may exceed 100° F., there is generally a strong breeze that keeps the air moving, and the humidity is so decreased that the cooling effect of evaporation of bodily moisture is quite pronounced. At night, during the dry months, a heavy dew drenches the vegetation, so that when walking through the grass before nine o'clock in the morning one gets as wet as from wading a stream.

It is at the beginning and the end of the rainy weather that yellow fever and malaria epidemics are most likely to occur, because at this time more favorable conditions prevail for the hatching of the eggs and the development of the larvae. During the torrential floods the insects and eggs are carried away, but when stagnant pools form with the drying up of the "flood lakes" and the retarding of the overflow of the rivers, the mosquito has an opportunity for propagation which it never overlooks. Even in the interior at elevations from 1500-2000 feet these annual-forming stagnant swamps breed countless numbers of malaria-carrying mosquitoes and subject the interior tribes to ravages of the disease such as visit the people living on the coast. In spite of the efforts by the Firestone Plantations toward sanitation, this breeding-swamp menace remains as the greatest source of infection, and only a stupendous campaign for the isolation of malaria sufferers and protection of all healthy persons from the bite of the mosquito for several cycles can accomplish any permanent benefits.

The seasons in the interior resemble those on the coast, except that they are somewhat retarded and less varied. The country is much drier and the rainfall less severe. The daily variation in temperature may be thirty or forty degrees, sometimes going as low as $50-55^{\circ}$ F. before dawn. The natives generally build fires to counteract the effects of cold, and the missionaries have charcoal or oil stoves to take the chill from the rooms. Although the coastal region has an annual rainfall of from 150 to 200 inches, mostly between May and October, the interior may have less than a third as much. The rainfall decreases gradually until the evergreen rain forest gives way to deciduous growth, which finally becomes open park forest and savannah grass-land. Trees which reach a height of 150 feet in the vicinity

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of Kakatown will become low and gnarled in the savannah country, often being mistaken for different species.²

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The forests of Liberia can be divided into the usual types prevailing along the Gulf of Guinea, the whole of West Africa being considered as the Guinea forest to differentiate it from the Sudanese forest on the north and west and the Cameroons-Congo equatorial forest on the east and southeast. These types are as follows:

1. *Coastal Mangrove Swamps*, which also border the streams for varying distances from the coast.

2. *Tropical Evergreen Forests*, merging from the Mangrove swamps with a mixture of palms and finally reaching a dense closed forest canopy 150 feet in height. Generally extending into the

3. *Fringing Forests*, similar in composition to the evergreen rain forests, except that the trees are somewhat smaller and more scattered. This growth occurs only along the streams penetrating into the parkland and gradually merges into it. Adjacent to this type as it follows inland is the

4. *Deciduous Forest*, containing large trees, but with the canopy more open and grass appearing on the forest floor. Rainfall is much less than in rain-forest area and the dry season more pronounced, causing a general shedding of the foliage by many species. Finally this stand gives way to the

5. *Parkland Forests*, emerging from the deciduous stand and located in the drier parts of the country along the French Sudan border. The trees are stunted, gnarled, and widely scattered. Many of the species are thorny. Scrub growth and grasses cover the open spaces and finally succeed the tree growth almost entirely in the

6. *Savannah Grassland*.

It will be seen that this grouping of the forest types is based on rainfall entirely, and with little or no consideration for topographical or geological

² Much confusion has arisen in the past—and continues to arise—over the ecological factors affecting the inflorescence, leaves, and general appearance of the species of tree as found under such extreme differences of environment due to the rainfall. Such trees as *Lophira alata* Banks and *Lophira procera* A. Chev. are considered synonymous in the herbarium, but are separated in the field because of the striking difference in habitat. *L. alata* Banks is a huge forest tree 150 feet tall, with large spreading crown, and its range is considered as being confined to the evergreen rain forest, while *L. procera* A. Chev. is found in the deciduous and parkland region and is a medium-sized tree 30–50 feet tall, with rather gnarled bole and crown. The genera *Prosopis* (of the savannah) and *Tetrapleura* (of the rain forest) are so very closely related that it is difficult, if not impossible, to make distinctions.

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factors. Where the annual precipitation is less than 40 inches, the thorn forest generally becomes established; from 40 to 80 inches of rain yearly will sustain the deciduous forest, while the tropical evergreen forest never seems to have too much.

Liberia has been said to have the largest area in high forest of any of the West African colonies—in spite of its smaller size. This seems to be true in a general sense, that is, the evergreen rain forest extends farther inland and covers a greater area than in the Gold Coast, for instance, where at one place the open parkland extends right down to the coast. Much of the Liberian high forest, however, is of secondary growth and inferior species which have covered the abandoned native farms according to the cycle in plant succession. Most inferior tree species have light wind-borne seeds and are generally rapid growers and heavy shade producers. Chipp³ lists the following second-growth species coming in to replace the original forest which has been cut away by natives for temporary cultivation: (1) Seeds very fine: *Musanga*, *Myrianthus*, *Ficus*; (2) Seeds hairy: *Eriodendron*, *Bombax*, *Funtumia*; (3) Seeds winged: *Triplochiton*, *Petersia*, *Terminalia*.

All of the above are of rapid growth and have light woods that can be utilized only to a limited extent. It is stated that the average secondary forest consists of only about 30 species, as contrasted to 250 to 300 in the original virgin forest.

The secondary growth in the Liberian forests is most prevalent in the vicinity of Monrovia, extending beyond Careysburg and White Plains. It is also the typical forest cover back of Harper at Cape Palmas.

However, there are vast unexplored tracts containing billions of feet of hardwoods as yet untouched by man. The Gola forest back of Cape Mount, between the Mano and Loffa Rivers, is known to contain Mahogany as well as other valuable species. It is hardly accessible for exploration, as the villages are scattered and the population very scanty. If the Loffa River is ever cleaned out for a distance of 30 miles so that rafts can be floated down the stream, this would be the first choice for timber operations. A Liberian company has recently been organized to exploit this forest.

While the Firestone Plantations Company has cleared over 35,000 acres of the Dukwia River Forest, there is still a large stand of timber on both sides of the upper Farmington River available for immediate cutting. Mahogany is scarce in this region, but *Lophira*, *Tarrietia*, *Afrormosia*,

³ Chipp, T. F.: "*Aims and methods in the study of vegetation*," page 227.

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Azelia, *Pterocarpus*, *Turræanthus*, *Guarea*, *Carapa*, *Lovoa*, *Berlinia*, *Canarium*, *Calpocalyx*, *Terminalia*, *Ochrocarpus*, *Oldfieldia*, *Diospyros*, *Chlorophora*, *Sarcocephalus*, *Piptadenia*, *Fagara*, and *Detarium* are present in sufficient quantity to make the forest important and valuable.

In the vicinity of the Finlay Mountains 25 miles inland from Grand Bassa is a large forest covering a thousand square miles and reaching the Satro Mountains 50 miles up the River Cess. Many reports have come as to the presence of Mahogany in this region, but little or none has been cut and sold.

Explorers and cruisers for the Rubber Company report heavy stands of hardwoods in the Sino Basin and also back of the Cape Palmas plantation. It seems evident that the entire country is covered with a belt of valuable hardwoods which stretches across the long axis for a width of from 25 to 60 miles—all of which could be made accessible by stream clearing and narrow gauge logging railroads.

The coastal Mangrove forest is of no value, except for the bark of *Rhizophora*, which might be gathered in commercial quantities. The wood is excellent for fuel and also suitable for dock piles and timbers.

The deciduous forest has most of the species present in the high evergreen bush, but they are smaller and more scattered. *Pseudocedrela* grows in this type, also some of the *Terminalias*, *Azelias*, and the Shea Butter Tree (*Butyrospermum Parkii*), which is valued for its edible oil and fat. *Lophira alata* Banks, *Detarium senegalense* Gmelin, and *Afromosia laxiflora* Harms are listed for the savannah and deciduous forest, but all are very poor secondary trees in this region, and it has been seriously questioned if they are identical with their fellows of the rain forest—all top-story timber trees of commercial importance.

DESCRIPTIONS OF LIBERIAN PLANTS AND WOODS

THE plants and woods described in the following pages are those obtained in connection with the Yale-Firestone cooperative study. While it is far from being a complete list of Liberian plants, it is fairly representative of the woody vegetation of the area investigated and includes most of the important timbers of the evergreen forest.

The descriptions of the trees and shrubs and the notes on the uses which natives make of the plants are almost exclusively the work of the collector. He has attempted, so far as possible, to avoid technical terms which might not be readily understood by persons unfamiliar with botanical terminology. Those who desire other diagnoses, as well as keys to the genera and species, are referred to Hutchinson & Dalziel's *Flora of West Tropical Africa*. The arrangement of the 59 families follows the order given in that work, but within the families the genera and species are listed alphabetically to facilitate reference to them.

The descriptions of the woods are by Professor Record. Consideration of the minute anatomy has been left for systematic investigations that are being pursued independently. The log specimens (Yale 15735-15854. Cooper L 1-L 122.) were not accompanied by botanical material, and their identities have been determined by comparison with authentic samples of the woods. Any which could not be matched with a reasonable degree of certainty have been omitted.

As previously stated, the determinations of the herbarium specimens were made by Mr. Hutchinson and Dr. Dalziel, Royal Botanic Gardens, Kew. In most instances the material was fertile, but there were numerous cases when only leaves could be obtained. A collector following a felling operation in high forest cannot wait until the trees are all in flower or in fruit, but must take some of them in sterile condition. To assist in overcoming this defect, effort was made to obtain fertile specimens of the same species in a different locality or at another season of the year. Furthermore all provisional classifications were carefully checked by studies of the wood anatomy, and the evidence thus adduced was transmitted to the botanists for their consideration. As a result only a few doubtful cases remain, and the residue of undetermined is exceptionally small.

In considering the uses to which new timbers are adapted it is always helpful to know of their indigenous applications. In Liberia, however, the native demand for wood is small and limited to such purposes as dugout

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canoes, where convenient size and ease of working are the principal requisites; to house poles, which must be slender, strong, and durable (see Plate XIV); to spring traps for catching wild animals, a use which implies strength, elasticity, and resilience; and to certain primitive household utensils and various kinds of paraphernalia for ceremonials. The Liberian native is well acquainted with all the plants about him, and if he chooses a particular wood for a special purpose it may be assumed that he has good reason for doing so.

The principal demand by natives on the wild vegetation of Liberia is for things that cure disease or ward off harm. There is scarcely a plant to which is not imputed some medicinal virtue or some miraculous power. Such beliefs are interesting as folklore, if nothing else, and enough of them probably have sufficient foundation in fact to justify investigation by pharmacologists.

The following list includes description of 286 species, representing 208 genera of 59 families of Dicotyledons. To these is appended a short miscellaneous list of plants, nearly all herbaceous, representing 9 additional families, mostly of Monocotyledons.

I. ANNONACEAE

An important family of about 50 genera, mostly tropical, well represented in India, Malaya, Tropical America, and West Africa. Some species, such as the Pawpaw, Custard Apple, Soursop, and Sweetsop, are cultivated for their edible fruits. The woods vary from exceedingly light and spongy as in *Cleistopholis*, to very hard and resilient as in *Oxandra*, the commercial Lancewood of the West Indies. An anatomical feature, common to nearly all the woods of this family, is the ladder-like arrangement of the parenchyma running at right angles to the rays at regularly spaced intervals. Parenchyma in the Ebenaceae is arranged somewhat similarly, but the woods of this family are all dense and the rays are fine and inconspicuous in contrast to the generally prominent rays of the Annonaceae, so that there should be no occasion to confuse them. Some of the Annonaceae contain large oil cells.

Cleistopholis patens Benth. NEE-WAHN-JOHR (Bassa); MOIGBWAMY (Mendi). Tree 50-60' tall and 12-18" in diam., with horizontal branches and blackish twigs; leaves simple, alternate, oval-oblong, 3-4" long, very glabrous, with prominent venation; flowers greenish yellow; fruits (im-

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mature?) over 1" long with dark green, leathery husk inside of which are many small seeds, almost fig-like in their arrangement.

The timber has no use except in floating rafts of heavy timbers. It has the properties of tropical American Balsa (*Ochroma*) and should be suitable for the same purposes. The roots and leaves of this, as well as other members of this family, are used as a vermifuge, leaves being cooked in the palaver sauce and eaten, while only a decoction of the roots is taken. The Bassa name means literally "tree which gushes water," in allusion to the wetness of the fresh wood.

Wood gray or nearly white throughout. Lustrous. Odorless and tasteless. Very light and soft, but firm and tough in proportion to its weight; texture coarse; grain straight; very easy to cut, saws woolly when fresh, but can be finished smoothly when dry; is perishable in contact with the ground. Seasonal growths apparently absent. Parenchyma barely visible, in fine, wavy or broken, concentric bands, somewhat narrower than the widest rays and spaced 1-3 pore-diams. apart. Pores open, visible, rather few and scattered, occurring singly or sometimes in small, radially flattened groups. Vessel lines distinct. Rays narrow, distinct on cross and tangential sections; high and conspicuous on radial surface. Large oil cells apparently absent. (Yale 15294; 15825. Cooper L 93; 430.)

Enantia chlorantha Oliv. SOHN (Bassa); BELVI; KPAINI (Mendi); YELLOW WOOD (English). Common tree growing to 50' with a slender bole, high crown, and no buttresses; outer bark pale greenish gray and roughened, the inner portion yellow and stringy; leaves lanceolate to obovate, leathery, glabrous, 6-8" long; flowers solitary; fruits reddish to black when mature, not edible, borne on long pendulous stalks which are distinctive, as they remain on the twigs for some time after the fruits have fallen.

The inner bark and the wood are used in making a yellow dye, and the bark is also used in treating sores and skin infections. The name "sohn" means "hand" and may refer to the finger-like pedicels which are so conspicuous.

Wood bright, clear yellow with a slight greenish tinge. Luster satiny. Without distinctive odor or taste when dry. Light in weight, but firm and tough; texture uniform, medium; grain straight; very easy to work, finishes smoothly, takes a glossy polish, holds its place well when manufactured; is probably durable. Seasonal growth rings apparently absent. Parenchyma in numerous, fine, concentric lines, much narrower than the rays and spaced about 2 pore-diams. apart; not distinct without lens. Pores open, small, not visible to unaided eye, not very numerous, occurring singly or in radial rows

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of from 2 to 6, without pattern. Vessel lines scarcely distinct. Rays distinct on all sections, being high and conspicuous on radial surface where they give rise to attractive "silver grain." No oil cells visible with lens. (Yale 13789; 15183; 15753. Cooper L 19; 146; 268.)

Isolona Cooperi Hutch. & Dalz., sp. nov. (*ined.*). KOO-GBEH (Bassa). Small tree with oval-oblong leaves 8-10" long, and conspicuous solitary flowers having six thick yellow petals each.

This tree has great significance among the natives, the bark being considered a powerful antidote against witchcraft and so used by all chiefs and important men. The ashes of the bark are mixed with palm oil to make a salve or paste. When in a strange country and in danger from eating food that has been witched or poisoned, the native licks the paste and the poison is cast out. (Yale 15283. Cooper 417.)

Monodora brevipes Benth. KRAY-BU (Bassa); YELLOW-FLOWERING NUTMEG (English). Rather common tree growing to 50' with slightly fluted bole and thin, greenish black, roughly ridged bark; twigs black and speckled; leaves oval to oblong, 3-5" long; flowers large, yellow-orange with purple blotches, solitary, pendulous from long stalks; fruits spherical, about 1½" in diam., woody when mature.

The seeds are used as a flavoring for sauce by grinding to a powder and mixing with the country pepper. A decoction of the roots is taken internally to relieve venereal strictures.

Wood pale brown, with greenish brown streaks in vicinity of injuries. Luster silky in proper light. Odorless and tasteless when dry. Of medium weight and hardness; texture rather coarse; grain straight; easy to work, splits readily, finishes smoothly, holds its place well when manufactured; is not durable. Seasonal growth rings apparently absent. Parenchyma in very numerous, fine, concentric lines about 1 pore-width apart and forming net-like pattern with the rays; invisible to unaided eye. Pores open, small, not distinct without lens, rather few and scattered, occurring singly or in radially flattened groups of 2-5. Vessel lines scarcely distinct. Rays rather coarse, distinct on all sections, high silver grain. No oil cells visible under lens. (Yale 13733; 15304; 15798. Cooper L 66; 83; 441.)

Monodora Myristica Dunal. KRAY-BU (Bassa); GBOITE (Mendi); CALABASH NUTMEG (English). Tree similar to preceding, but mostly confined to swamps; leaves 6-10" long; fruits 3 or 3½" in diam. The seeds are also used for flavoring and are called African Nutmegs or Calabash Nutmegs because of their large size. (Cooper 352.)

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Pachypodanthium Staudtii Engl. & Diels. ZREE-CHU (Bassa). Tree 60-75' high and 2' in diam., with distinctive brownish gray, pungent, roughly furrowed, and rather thick bark; leaves lanceolate, up to 10" long, with crinkled margin; flowers pale yellow; fruits aggregate, greenish red, fleshy when ripe. (Plate II, No. 1.)

A decoction of the bark, prepared by beating and boiling, is considered an excellent remedy for intestinal worms. The wood is used for planks and house poles and is considered durable.

Wood light greenish brown throughout; not very lustrous. Without distinctive odor and taste. Moderately hard, tough and strong, rather coarse-textured, straight-grained, easy to work, finishes smoothly. Growth rings indicated by slight differences in color, due to relative abundance of parenchyma, which is in fine parallel lines spaced $\frac{1}{2}$ - $\frac{1}{3}$ pore-diam. apart, becoming finer and closer in late wood. Pores visible, open, scattered, occurring singly or in radial pairs, without pattern. Vessel lines distinct. Rays visible on cross and tangential sections; rather high and very conspicuous on radial surface, appearing darker than background. No oil cells visible with lens. (Yale 15208; 15755. Cooper L 21; 296.)

Polyalthia Oliveri Engl. & Diels. PE-OHN (Bassa). Common tree less than 50' tall, with a slender bole covered with branches most of its length; bark thin, grayish green, blotched, either finely cracked or pitted, but otherwise smooth; leaves oval, 3-5" long; flowers greenish white, pubescent, about $\frac{1}{2}$ " long, axillary and solitary, fragrant; fruits globose, somewhat like wild cherry, hanging from stipes in small clusters; exocarp fleshy, red, finally drying to black when mature; seed white with meaty endosperm.

The only local use is of the bark for a vermifuge. The wood appears suitable for use in small sizes where strength and resilience are required. It is attractively figured when quarter-sawed.

Wood yellowish brown, with golden luster. Odorless and tasteless. Hard, heavy, tough, and strong; texture medium; grain straight; easy to split, not difficult to work, finishes very smoothly, requires care in seasoning to prevent checking; does not appear resistant to decay or insect attacks. Seasonal growth rings sometimes present, but poorly defined. Parenchyma not visible without lens; in very fine, closely spaced, concentric lines about 1 pore-width apart and forming web-like pattern with rays. Pores open, small, not visible to unaided eye, rather few and scattered, occurring singly or in radial groups of 2 or 3. Vessel lines scarcely distinct. Rays coarse, very distinct on all sections; high and conspicuous on radial surface, producing silver grain. No oil cells visible with lens. (Yale 13712; 15137; 15172; 15763. Cooper L 31; 62; 208; 255.)

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Popowia ferruginea Engl. & Diels (probably). NE-BOR-VAH (Bassa). Vine or climbing shrub; leaves 6-10" long, pale gray on undersurface, with brown pubescent veins; fruits are bead-like strings containing small beans, in stipitate clusters from central receptacle.

The pleasantly scented leaves are beaten and mixed with chalk and clay to make a paste which the native women rub on their skin. (Yale 15129. Cooper 199.)

Stenanthaer bakuana A. Chev. BLAHN (Bassa). Shrub or small, slender tree along river banks or in low places; leaves papery, glabrous, dark green above, pale gray below, lanceolate or oval, 3-5" long; pendulous solitary female flowers in axils of the leaves, greenish yellow in color, as also are the fruits.

The natives make a snuff of the dried leaves and inhale it to cure a sort of nasal tumor. (Cooper 306; 416.)

Stenanthaer Yalensis Hutch. & Dalz., sp. nov. (*ined.*). JE-AH-CHU (Bassa). Infrequent, slender tree 40-50' tall and 8-10" in diam.; outer bark greenish, rather thin, finely furrowed; inner bark brownish and stringy; leaves 3-5" long, lanceolate to oval, with velvety brown pubescence on the pale green undersurface; female flowers solitary, axillary, and pendulous, borne on separate branches from the male, which are in pendulous stipitate clusters from a central stalk; flowers velvety brown, as also are the stipes. (Plate II, No. 2.) The only use is for the bark as a vermifuge.

Color of wood light olive brown, sometimes with greenish black streaks due to injury. Rather lustrous. Odorless and tasteless when dry. Moderately light and soft, but firm and tough; texture medium coarse, with soft feel; grain straight; easy to cut, saws woolly when fresh, but finishes smoothly when dry; holds its place well when manufactured; is not resistant to decay or insect attacks. Growth rings sometimes distinct, due to slight differences in density. Parenchyma not visible to unaided eye; in very numerous, fine, tangential bands about one pore-diam. apart and about one half the width of the rays with which the lines form a web-like pattern. Pores open, small (requiring lens), few and scattered, occurring singly or more often in radially flattened groups of 2-7. Vessel lines indistinct. Rays fine, near limit of vision on cross and tangential sections; rather low but conspicuous on radial surface, appearing darker than background. No oil cells visible with lens. (Yale 15263; 15767. Cooper L 35; 371.)

Uvaria Afzelii Sc. Elliot. GBAR-BEE-MLEH (Bassa). Low tree or a shrub with lanceolate oval leaves 4-6" long, finely pubescent on both surfaces, but

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more so on veins and densely hairy on twigs and petioles; flowers yellowish, emitting a heavy fragrance.

A decoction of the macerated roots is used in treating inflammation of the bladder and kidneys, and as a stomachic.

The name "gbar-bee-mleh" refers to the medicinal properties of the roots, but the literal translation is not known. (Cooper 471.)

Xylopia aethiopica A. Rich. DEO (Bassa); GUINEA PEPPER (English). Infrequent tree up to 50' and 12-16" in diam., generally with low prop roots; bark grayish brown, finely cracked, but smooth and thin; leaves leathery, 3-5" long with distinctive tapering to the hooked apex; flowers greenish white with thick petals; fruits clustered, 2-3" long, somewhat curved and finger-like and with contractions between each seed.

The tree is protected, mainly because of the medicinal value ascribed to the oily, highly aromatic, and peppery fruits, from the pulp of which a paste is made and rubbed on the body at the seat of the pain. Smoke from a mixture of dried paste and tobacco is inhaled to relieve respiratory ailments. The fruits are also used as food. The wood is useful for oars, paddles, and spars, because it combines lightness with strength and stiffness. The anatomy of the wood is similar to that of *Cleistopholis patens*, described above, but the density is considerably higher. (Yale 15109; 15823. Cooper L 91; 174.)

Xylopia Quintasii Engl. & Diels. GBAY OR GBAY-DEE (Bassa). Common tree 60-75' with straight, low-buttressed bole and mottled greenish bark, smooth and finely cracked on the surface and stringy within; twigs speckled; leaves oval, 4-6" long, glabrous above, light green (drying to brown) below; flowers white; fruits 1-2" long, finger-like in small clusters.

This wood is considerably harder and finer-textured than that of the other two species of *Xylopia* collected. It has the general properties of Lancewood and appears suitable for use in small sizes when strength and resilience are required, as in tool handles. It is employed locally for rice pestles and the poles for corner posts in native houses. The bast is the source of fiber for cordage and is also used for medicine. The beaten inner bark is rubbed on the hands to reduce knot-like swellings; scrapings from the soft layer are soaked in water and used as a mouth wash in cases of pyorrhea.

Wood brownish, sometimes with dark streaks. Taste somewhat acrid and astringent. Hard, heavy, tough and strong; texture medium; grain straight; fairly easy to cut, finishes smoothly, does not appear very durable. Growth

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rings indicated by slight differences in color and in parenchyma arrangement. Parenchyma in usual network with the rays, the spacing being about one pore-width. Pores near limit of vision, scattered singly or in radial pairs, without pattern. Vessel lines fine and inconspicuous. Rays narrow, scarcely distinct without lens on cross and tangential sections; rather low but distinct on radial surface. No oil cells visible with lens. (Yale 15148; 15243; 15264; 15323; 15766. Cooper L 34; 222; 337; 372; 464.)

Xylopia Staudtii Engl. DREHN (Bassa); BUSH PEPPER (English). Common forest tree 60-70' tall with a slender bole clear for most of its length and a rounded crown confined to extreme top; base is formed by a huge tangle of prop roots, sometimes 8-10' high; outer bark dingy gray brown, scaly, roughened, or mossy; inner bark stringy; leaves glabrous above and brownish below, conspicuously reticulate, 2-3" long; flower buds grayish; fruits pod-like with black beans in a husk with bright red lining; fruits 1-3" long and 12" thick, the shell generally bursting at maturing and exposing the crimson lining.

This tree is widely used by the natives, the slender bole being suited for house poles; the readily worked wood for planks, and the tough, stringy bark for rope and for siding of huts.

Wood light brown. Lustrous in proper light. Odorless and tasteless. Fairly light and soft, but tough and strong; texture medium coarse; grain straight; very easy to work, finishes smoothly, holds its place well when manufactured; not highly durable. Seasonal growth rings sometimes present, due to slight differences in density. Parenchyma not distinct to unaided eye; in numerous, narrow, concentric bands, spaced $\frac{1}{2}$ -1 pore-width apart and of about half the thickness of the rays with which the lines are in web-like pattern. Pores readily visible, rather few and scattered, occurring singly or about as often in radial pairs. Vessel lines distinct. Rays fine, but visible on cross and tangential sections; not very high, but very distinct on radial surfaces, appearing darker than background. No oil cells visible with lens. (Yale 13710; 13782; 15160; 15769. Cooper L 37; 60; 139; 234.)

2. LAURACEAE

An important family of about 40 genera and over 1000 species of aromatic trees and shrubs with wide distribution throughout the warmer regions of the world. Some of the best known products are cloves, cinnamon, camphor, and avacado pears, while the list of commercial timbers includes Demerara Greenheart, Brazilian Imbuia, North American Sassafras, and the Bois de Rose of French Guiana. The woods vary from exceedingly hard

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and strong to soft and light; many are spicily scented; some are noted for their durability; in general they possess excellent technical qualities and the number of commercial species will materially increase. This family is comparatively rare in West Africa, only three genera being listed, *Tylostemon* with 17 species, and the other two with one each.

Tylostemon Mannii Stapf. ЗОЕ-КРОЕ; БЕ-АУ (Bassa); SPICY CEDAR (Eng.). Tree 65-75' tall and 18-24" in diam., perhaps considerably larger, with long, clear bole and no buttresses; bark mottled, blue green to brown, smooth, thin; leaves narrow oval, 5-7" long with curved and pointed apex, subopposite or alternate, glabrous, reticulate; flowers in small, axillary, branched racemes, fragrant; fruits not observed.

This tree is said to be common in the high forest. It is used for planks, furniture, and for making canoes, and is suitable for many other purposes requiring an attractive, easily worked, durable timber. The seeds are edible; they are dried, powdered, and used to thicken soup. Because of their fragrance the flowers are beaten up with rice and cooked.

Heartwood cherry-red, with lasting scent suggesting extract of witch-hazel. Sapwood gray, sharply defined, nearly odorless and tasteless. Not highly lustrous. Of medium density and weight; somewhat brittle; texture medium; grain straight to roey; very easy to work, finishes smoothly, will doubtless hold its place well when manufactured and be highly resistant to decay and insect attack. Growth rings distinct, due to terminal parenchyma lines. Parenchyma in irregular patches about pores and in narrow, concentric lines limiting growth rings; visible without lens. Pores small, but visible, open, not very numerous, uniformly distributed, occurring singly or in radial pairs, occasionally in small clusters. Rays faintly visible on cross and tangential sections; uniformly low and not conspicuous on radial surface. Oil cells are present in the wood and speckle the end surfaces with their exudations. (Yale 15221; 15267; 15782. Cooper L 50; 314; 375; 384.)

3. MYRISTICACEAE

A rather small family of tropical trees, comparatively rare in Africa, but well represented in Asia and equatorial America. The nutmeg and mace of commerce come from the Asiatic tree, *Myristica fragrans* Houtt. There are four genera in tropical America, two of which (*Virola* and *Dialyanthera*) contain timber trees. In West Africa there are four genera with a total of but eight known species, some of which are very large trees. The woods are soft to moderately hard, straight-grained and easy to work, not durable on exposure, varying in color from gray to deep reddish brown.

MYRISTICACEAE

They are used locally in Central America and in Africa for temporary building material, boxing, canoes, and occasionally as a substitute for Cedar.

Coelocaryon aff. **oxycarpum** Stapf. WRAHN-BEH (Bassa); WILD NUTMEG (English). Forest tree attaining a height of 100' and a diam. of 4', with long, clear bole and no buttresses; twigs blackish and speckled; leaves dark green, glabrous, leathery, oval-obovate, 4-8" long, on stout petioles 1" long; male flowers in heads; female flowers axillary, solitary or in small clusters; fruits oval or globose, 1½-2" long, pendulous from stalks, solitary or in small bunches, the green or light orange husk splitting open to expel single large seed, which is covered with red mace-like aril; seed has slight spicy fragrance. (Plate III, No. 1.)

The tree is used for canoes, planks, and timbers, because the wood is easy to work and is available in large sizes. It is not durable in contact with soil and is attacked by small shot-hole borers. The fruits and leaves are sometimes used medicinally to overcome abnormal drowsiness.

Heartwood yellowish brown, merging gradually in lighter sapwood. Luster satiny. Odorless and tasteless when dry. Moderately light and soft, but firm; texture medium; grain straight; very easy to work, finishes smoothly, holds its place well when manufactured; not resistant to decay or to insect attacks. Growth rings present, but not very distinct. Parenchyma in inconspicuous, concentric bands, usually widely spaced and apparently terminating growth rings. Pores open, visible, not numerous, occurring mostly in 2's or 3's, the groups well distributed. Vessel lines very distinct, appearing darker than background. Rays near limit of vision on cross and tangential sections; low but prominent on radial surface, appearing darker than background. (Yale 15297; 15297A; 15849. Cooper L 117; 433.)

Pycnanthus Dinklagei Warb. BAY-DOO (Bassa). Woody climber, with stout stem often resembling small tree; bark thick, rough, brownish; leaves oval, 4-6" long, glabrous, lateral veins conspicuous, widely spaced; male flowers in minute heads on lax, pendulous stalks, resembling tiny bunches of grapes.

The bark is used in treating leprosy. It is macerated and rubbed over the body and spread on the sleeping mat of patient. (Cooper 299.)

Pycnanthus kombo Warb. DEEHN (Bassa); BOYE (Mendi); WHITE CEDAR (English). Tree 70-80' tall and 24-30" in diam., with long, straight bole and no buttresses; crown flat and confined to extreme top; bark dingy gray, finely cracked or scaly; leaves glabrous and leathery, oblong, 6-9" long, cordate at base, underside covered with fine brown pubescence; male

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flowers in tiny, head-like, almost sessile cluster in loose panicles; female flowers axillary, solitary; seed nutmeg-like with colored aril.

This tree is well distributed through the evergreen forest. It is used for canoes and planks. When freshly cut it exudes a reddish sap. The inner bark is macerated and mixed with salt and applied as a poultice for toothache. The seeds, under the name of Kombo seed or Kafu seed, have been sold in Liverpool for their oil.

Wood the color of oatmeal. Luster rather low. Odorless and tasteless. Rather light, but fairly hard; rather coarse-textured; mostly straight-grained; easy to work, finishes smoothly, holds its place well; is not resistant to decay or to insect attacks. Growth rings indistinct. Parenchyma not visible. Pores open, visible, few and scattered, occurring singly or in radial pairs. Vessel lines prominent, appearing darker than background. Rays near limit of vision on cross and tangential sections; low but conspicuous on radial surface, appearing darker than background. (Yale 15211; 15747. Cooper L 13; 301.)

4. NYMPHÆACEAE

Small family of aquatic herbs, found in temperate and tropical regions of both hemispheres. They are the well-known Water Lilies, easily recognized by their floating peltate or heart-shaped leaves and solitary, large, showy, often sweet-scented flowers.

Nymphaea Lotus L. WATER LILY (English). Aquatic herb; leaves sharply toothed, with prominent veins and pubescent below, arising from submerged, prostrate, perennial rhizomes; flowers showy, with many petals. (Cooper 16.)

5. MENISPERMACEAE

A family of twining or rarely erect shrubs and small trees, generally distributed throughout tropical regions. Eleven genera, with 33 species, have been recorded from West Africa, occurring for the most part in forest areas. Only one species is represented in the present Liberian collections.

Stephania Dinklagei Diels. DREHN-GBAR-DOO (Bassa). Climbing shrub, often reaching a height of 40-50'; leaves heart-shaped and peltate, about 2" long; flowers greenish, in axillary, much-branched cymes; fruits black, flattened, disk-like, with membranous ribbed husk. Occurs scatteringly through the forest, but more plentiful in the swamps. The leaves, cooked with rice, are used in native medicine to overcome barrenness in women,

POLYGALACEAE

three handfuls of the food being taken at three successive meals; the tender part of the vine is also wrapped around the loins. (Cooper 434.)

6. PIPERACEAE

A family of several genera and more than 1000 species of herbs, climbers, epiphytes, shrubs, and small trees, mainly tropical. The condiment, black pepper, is obtained from a species of *Piper*. The West African representatives are of no economic importance.

Piper guineense Sch. & Thonn. PEHN (Bassa). Climber 20-30' long, on trees or sometimes along ground; leaves narrow oval, 3-4" long, papery, pale gray-green underneath; flowers in small axillary racemes; fruits red-brown when ripe. The seeds are used by natives as a body rub, the aromatic juices producing an exhilaratory effect on the skin; another use is for flavoring in cooking. (Cooper 134; 305.)

7. VIOLACEAE

A widely distributed family of herbs, shrubs, and trees with most of the woody members in the tropics and the herbaceous at higher altitudes or in the temperate regions. It contains no timber trees of commercial importance. Of three genera listed for West Africa, *Rinorea*, with 30 species, is the only one with trees and they are all small.

Rinorea liberica Engl. (probably). Shrub; leaves light green, glabrous, 6-9" long, oblong, abruptly acuminate, margins coarsely toothed; flowers small, yellow-green, in short axillary panicles; fruit oval, 1/4" in diam. (immature?), greenish yellow, berry-like, with white fleshy endosperm. Wood creamy white, rather light and soft, fine-textured; not utilized. (Yale 15098. Cooper 157.)

8. POLYGALACEAE

Rather small family of tropical and temperate herbs, shrubs, climbers, and a few, usually small, trees. The woods are not at present of any commercial importance.

Carpolobia parvifolia Stapf and **C. lutea** G. Don. PLEHN (Bassa); GIBOFOYOI (Mendi); POOR MAN'S CANDLE (English). These two species are very much alike in appearance and properties; shrubs or low trees; bark thin, green; leaves glabrous, 1-2" long, narrowly oval to broadly ovate

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on same branch; flowers pea-like, with yellowish white petals; fruit $\frac{1}{2}$ " in diam., greenish yellow, 3-celled; pendulous and solitary; seeds hairy.

The name "Poor Man's Candle" refers to the fact that the wood is so rich in tallow-like material that, even when cut green, it will burn like a torch. The wood is used locally for making combs and the handles of cutlery. It appears suitable for small articles of turnery, manicure sticks, and certain of the purposes for which Boxwood is employed.

Color of wood a rich yellow throughout; looks rather waxy. Odor and taste mildly suggestive of tallow. Hard and heavy; very fine-textured, suggesting Boxwood; grain somewhat irregular; cuts fairly easily, carves smoothly, takes a very high natural polish due to the waxy contents. Growth rings not clearly defined. Parenchyma irregularly distributed, in very narrow wings from pores, sometimes short and sometimes confluent or even forming concentric lines; also diffuse. Pores invisible without lens, rarely in contact, scattered irregularly, often linked into tangential rows by parenchyma. Vessel lines minute, scarcely visible. Rays indistinct without lens on cross section and scarcely visible with it on tangential; low and inconspicuous on radial surface. (Yale 13751; 15102. Cooper 101; 165.)

9. AMARANTACEAE

Mostly annual or perennial herbs, rarely shrubs or climbers. Leaves alternate, simple; flowers regular, generally perfect, and in clusters or spikes; fruit capsule sometimes opening by a lid. The family is of no importance in Liberia. Some species are cultivated by the natives for their edible spinach-like leaves. There are eleven species listed for West Africa.

Celosia argentea L. Herb 3' high with pink-white flowering spikes. Grows as a weed in the open lands. Probably introduced. (Observed but not collected.)

Cyathula prostrata Blume. Herb with flowers in spikes. (Cooper 3; 25.)

10. LINACEAE

A family of herbs, shrubs, climbers, and a few trees, widely distributed. Its best known plant is the common flax. In West Africa, four genera are known to occur, one of which is represented in the collections.

Hugonia Planchonii Hook. f. BU-AH-VOHN-DOO (Bassa). Shrub; leaves narrowly oval, sharply pointed, 3-4" long, leathery, glabrous; hooked tendrils sometimes replacing leaves; flowers yellow, $\frac{1}{2}$ " long, mostly solitary, on spiny axillary bracts.

The only use of this plant is for medicinal purposes, a decoction of the

FLACOURTIACEAE

leaves being taken at intervals to alleviate whooping cough. (Yale 15316. Cooper 456.)

11. THYMELÆACEAE

A family of about 40 genera, mostly shrubs and small trees, rarely large trees. Two of the best known American plants are the Leatherwood (*Dirca*) and Lacebark (*Lagetta*), which are characterized by their very soft wood and exceedingly tough and pliable bark. The Eaglewood, the Lign-aloes of the ancients, is obtained from certain trees of the genus *Aquilaria* in the Indo-Malayan region. Eight genera and 22 species have been found in West Africa, all of them shrubs or low trees without economic value. Only one is represented in the present Liberian collections.

Dicranolepis disticha Planch. Low shrub with oval acuminate leaves up to 3" long; flowers solitary, growing upright like the country Pepper Bush; corolla slender, white, fragrant; anthers exposed; stigma club-shaped. (Cooper 164.)

12. DILLENiaceae

A family of 11 genera and about 260 species of trees, shrubs, lianas, and rarely herbs, widely distributed in the tropics and in Australia. Some of the climbers are water lianas. The leaves are usually leathery and sometimes so covered with silicated hairs as to be serviceable as a substitute for sandpaper. The few timber trees produce wood of good quality for furniture and cabinet work, the conspicuous rays giving it the appearance of Oak. The family is represented in West Africa by a single genus, *Tetracera*, with 8 species, all climbing or erect shrubs or small trees of no economic value.

Tetracera leiocarpa Stapf. WATER TREE (English). Climbing shrub with coarse, rough, shiny, oval leaves, 2-3" long on petioles $\frac{3}{4}$ " long; veins deeply sunken above; inflorescence a compound cyme, the flowers fragrant, yellowish white, with many stamens; fruits small, reddish, ribbed capsules $\frac{1}{4}$ " long with persistent, imbricate sepals and long slender beaks, opening by sutures to release the yellowish arillate seeds. Called "Water Tree" because a clear refreshing drink of water may be had from the freshly severed stem. (Cooper 45.)

13. FLACOURTIACEAE

A family of over 70 genera and several hundred species, mostly small trees or shrubs, widely distributed in the tropics. It is closely related to the

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Samydaceae and the Bixaceae. One of the best known members is the *Chaunmoogra* of the Far East, the seeds of which supply the oil used in treating leprosy. The woods are mostly creamy yellow or light brown, fine-textured and without figure or other distinctive marking. The one of greatest importance is the Venezuelan "Boxwood" (*Casearia praecox* Gris.). Five genera are represented in the Liberian collections. The two woods described are typical.

Caloncoba brevipes Gilg. KLEHN (Bassa). Tree 40-50' tall and 8-10" in diam., with slender bole and no buttresses; bark greenish brown, smooth, thin; leaves papery, 7-10" long, broadly oval, sometimes tapering gradually to long petiole, apex abruptly pointed; flowers white, large and conspicuous, solitary in axils of the leaves; fruit a ridged, fibrous, indehiscent capsule, 2-3" long, tapering to a point at each end, with green, leathery husk, later becoming hard and black; seeds numerous, imbedded in white pulp.

A rather common tree along rivers and the borders of swamps. The slender, clean, strong boles are well suited for house posts. The natives express the oil from the seeds and mix it with clay or chalk to form an ointment for the treatment of scrofula or other skin infections, such as craw-craw. The inner bark and leaves, either in the form of a poultice or as a decoction, are used as a remedy for headache.

Wood light brown or pinkish brown; sapwood grayish. Not highly lustrous. Odorless and tasteless. Moderately hard, heavy, tough, and strong; texture fine; grain straight to variable; not difficult to work, finishing very smoothly; of doubtful durability. Growth rings apparently absent. Parenchyma not visible. Pores open, invisible without lens, few to numerous, distributed without pattern, occurring singly or more often in radial pairs or short rows. Vessel lines very fine, silky. Rays very fine, scarcely visible without lens on cross section, indistinct with it on tangential; rather high but inconspicuous on radial surface. (Yale 13739; 15108; 15237; 15329; 15785. Cooper L 53; 89; 173; 331; 470.)

Caloncoba echinata Gilg. FLAN-CHU; DOOH (Bassa). Tree less than 20' tall and 2" in diam.; leaves broadly oval, 5-8" long, with apex abruptly pointed; flowers solitary, petals white, showy; fruit an indehiscent capsule, 1½" in diam., 1" long, covered with spines more than ½" long; seeds imbedded in a white, watery pulp.

The wood from this tree is used for walking sticks, small implement handles, and country combs. The roots, bark, and seeds are all used in native medicine, mostly in treating skin diseases. The English colonial forest

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services are experimenting with this species as a possible source of oil for treating leprosy; it is also being cultivated in Costa Rica by the United Fruit Company for similar purposes. (Yale 13772. Cooper 122; 215.)

Casearia Dinklagei Gilg. NU-EH-BLAY-CHU (Bassa). Unimportant tree, rarely 50' tall; bark light gray; leaves glabrous, leathery, oval to obovate, 3-4" long, with abruptly pointed apex and tapering unequally to the base; flowers small, in axillary clusters; fruit oval-oblong, about 1½" long, with persistent calyx at base. (Yale 15277. Cooper 408.)

Dioncophyllum peltatum Hutch. & Dalz. GOE-DOO (Bassa). Climber, 3-4" thick, reaching a height of 50' on large trees; bark greenish gray, warty, covered with moss; leaves glabrous, leathery, narrowly oval, 3-5" long, tapering at the base; apex of some leaves supplied with a pair of recurved tendril-like hooks, characteristic of the genus; veins parallel; flowers appear to be terminal and solitary, pendulous, 1" or more across, showy; fruit capsular; seeds said to be concavo-convex, with wing attached.

This liana is fairly common and has an important place in native medicine, the inner bark and leaves beaten up fine and rubbed on parts of body affected with elephantiasis, or made into hot poultices for abdominal pains. (Yale 15213. Cooper 303.)

Homalium dolichophyllum Gilg. BRO-KPAR (Bassa). Tree, sometimes 50' tall and 1' in diam., with low buttresses; bark greenish gray, somewhat coarse and ridged, with whitish blotches; leaves leathery, glabrous, flattened at base or spear-shaped, up to 12" long and 4" wide at the base.

This tree is rather plentiful and is used for house poles and small timbers because of its strength and hardness. The bark of the tree has a place in native witchcraft. The witch doctor blows some of the finely powdered bark into the lair of the dragon snake to stupefy the supposititious monster before slaying it. The Bassa name for the tree means "hard as bone," and refers to the dense wood. (Yale 15155. Cooper 229.)

Homalium Smythi Hutch. & Dalz. BRO-KPAR; PLEH-JU-EH (Bassa). Tree sometimes 50-60' tall and 2' in diam., with buttresses; bark grayish, finely plated but fairly smooth; leaves glabrous, oval-oblong, 3-5" long with long tapering apex; flowers small, creamy white, in much-branched compound racemes. A conspicuous feature is a dwarfed leaf, curled or recurved and about ½" broad, at base of many normal leaves.

A rather plentiful tree used by the natives for house poles and small timbers because of its strength; also for making charcoal. The ash of the

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bark is mixed with palm oil to make an ointment for relieving pains in the back. (Yale 15231; 15328. Cooper 324; 469.)

Scottellia coriacea A. Chev. MEHR-CHU; NE-MOR-BA-DAY (Bassa). Tree up to 50-60' in height and 18-24" in diam., but generally smaller; outer bark reddish; leaves glabrous, leathery, narrowly oval, 3-5" long, tapering toward petiole; flowers small, creamy yellow, faintly scented, in short axillary racemes; fruits clustered, long-pendulous, dehiscent, capsular, 2- or 3-valved, with few large, angular, orange-red seeds.

This tree had great significance in native witchcraft. When the juju horns or amulets lose their magical or protective powers, an ointment made from a mixture of the bark, leaves, and palm oil is rubbed over the amulet, especially the "car-foo" (kaf-foo) medicine amulet used by the government in taking solemn oaths from natives during trials. It is used by all herbalists and witch doctors and considered infallible in its restorative effect.

Wood pale yellow or straw-colored throughout; subject to blue stain. Fairly lustrous. Odorless and tasteless when dry. Moderately hard, heavy, and strong, being of about the consistency of Sugar Maple (*Acer saccharum* Marsh.); texture fine; grain mostly straight; easy to work, finishes very smoothly, takes a glossy polish; probably holds its place well when manufactured; is not resistant to decay. Growth rings apparently absent. Parenchyma not visible. Pores open, not visible without lens, numerous, well distributed without definite pattern, occurring mostly in radial pairs or short flattened rows. Vessel lines indistinct. Rays rather coarse, very distinct on cross section, but not on tangential; rather high and prominent on radial surface, appearing lighter than background and producing attractive silver grain. (Yale 15204; 15261; 15284; 15772; 15817. Cooper L 40; L 85; 292; 369; 420.)

14. PASSIFLORACEAE

A family of tropical or subtropical distribution, closely related to Flacourtiaceae. Usually climbers, but the African representatives are mostly trees and shrubs. There are eight genera listed for West Africa, of which six are represented in Liberia, though none has any commercial importance.

Androsiphonia adenostegia Stapf. GBAH-CHU; SEHN-CHU (Bassa). Shrub or low tree with thin, scaly, greenish brown bark; leaves glabrous, papery, 4-8" long, oblong-oval, with basal glands, faintly toothed; flowers in terminal panicles, calyx and bracts green, petals white; flower bracts leafy, with two large glands; fruits greenish yellow, globose, 3-celled, each cell containing one large seed.

PASSIFLORACEAE

The twigs are used by the natives to clean their teeth. An ointment made by macerating the leaves in palm oil is applied to the scalp to destroy vermin. (Yale 15140; 15191. Cooper 211; 276.)

Crossostemma laurifolium Planch. Climber or vine with glabrous branchlets; leaves oval-oblong, obtuse or cuneate at base, up to 6" long; tendrils axillary with the scanty inflorescence; flowers yellow; fruit pod-like, oval, acute at ends, 6-sided, the valves boat-shaped with the sticky seeds attached down the middle. (Cooper 161.)

Passiflora foetida L. Creeper or twiner with soft pubescent branchlets; leaves papery, digitately trilobed, 2-4" across, fringed with hairs; flowers axillary, solitary, with white petals and bluish purple corona; three fern-like bracts with gland-tipped hairs surround each flower; fruit glabrous, oval, shaped like a wild cucumber, surrounded by persistent calyx. (Cooper 12.)

Smearthmannia pubescens Soland. JU-WRAH (Bassa). Tree less than 30' tall; leaves broadly oval, 3-6" long, with abruptly pointed apex, and rounded base, short petioles, coarsely toothed, tipped with glands, glabrous above, pubescent below; flowers axillary, fragrant, showy with yellow-white petals and brown calyx and bracts; bud, sepals, and ovary covered with coarse hairs; fruit white or brownish red, crustaceous, shorter than the persistent sepals.

The wood is little utilized. It is of about the consistency of Red Gum (*Liquidambar*) and appears suitable for the same purposes. Poultices made from the macerated inner bark are used by natives for alleviating toothache.

Heartwood dull brown, sapwood lighter, not sharply demarcated. Odorless and tasteless when dry. Moderately hard, heavy, tough, and strong; of fine and uniform texture; grain fairly straight; easy to work, finishes very smoothly, probably holds its place well when manufactured; not resistant to decay or insect attacks. Growth rings sometimes indicated by narrow parenchyma-less zones. Parenchyma in exceedingly numerous tangential lines of approximately the same width and spacing as the rays and forming a network with them; not distinct without lens. Pores open, small, barely visible without lens, not very numerous, occurring singly or more often in short radial rows without definite pattern. Vessel lines very inconspicuous. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 13701; 15305; 15839. Cooper 51; L 107; 442.)

Soyauxia grandifolia Gilg & Stapf. DON-DOH (Bassa). Tree less than 50' with brownish gray, thin, slightly scaly bark; leaves smooth and leathery,

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oval-oblong, 6-8" long; flowers slightly fragrant, on long axillary spikes or racemes, with many stamens and rusty pubescent sepals; fruit 3- or 4-valved, the broadly ovate, leathery valves curling back on opening to discharge the angular, woody seed. (Plate III, No. 2.)

The wood is employed for native house poles and corner posts. Saplings, because of their toughness and resilience, are used for spring traps. Seeds and twigs are used to clean and whiten teeth.

Color of wood dull purplish brown. Faintly scented. Hard, heavy, tough and strong; rather fine-textured; grain fairly straight; easy to work, finishes smoothly, but is not lustrous; probably fairly resistant to decay. Growth rings indicated by narrow zones deficient in pores and parenchyma; not always distinct. Parenchyma in exceedingly numerous, fine, irregular, tangential lines forming a network. Pores not visible without lens, open, numerous but only occasionally in contact, well distributed without definite pattern. Vessel lines scarcely visible. Rays minute, invisible without lens on cross section and scarcely discernible with it on the tangential; rather high, but inconspicuous on radial surface, due to lack of contrast with background. (Yale 13756; 15159; 15175. Cooper 106; 233; 259; 286.)

15. OCHNACEAE

A family of 18 genera and about 250 species, mostly trees and shrubs, throughout the tropics. The genus *Lophira* from West Africa contains the only species of commercial importance for its timber. There are four genera listed for West Africa, all of which are represented in Liberia.

Lophira alata Banks. FAUH (Bassa); ENDWI (Mendi); AFRICAN OAK; RED IRONWOOD (English). Very large forest tree over 100' tall with full spreading crown, straight, clear bole, and low buttresses; conspicuous at certain seasons because of the bright red leaf shoots; bark plated or scaly, medium thick, brownish ochre on surface but reddish inside; leaves glabrous, leathery, obovate-oblong with rounded or notched apex, mostly 6-12" long but sometimes larger, bunched at ends of stout blunt twigs, the secondary veins in closely packed parallel lines at right angles to midrib; flowers white to golden, fragrant, conspicuous in loose panicles; fruits bottle-shaped and surrounded with the three sepals, one of which is much longer than the others.

The very heavy, durable, strong timber is one of the very best produced by tropical forests anywhere. It is noted for its long life when exposed to the weather and for its resistance to wear. It is highly appreciated in Europe, being known in Germany as Bongosiholz and in France as Azobé.

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In Liberia the natives use the leaves and the oily seeds as a medicine for treating leprosy, the afflicted person sleeping on a bed of the leaves and rubbing the oil over his body.

Color of heartwood dark reddish or chocolate brown; sapwood much lighter, about 2" thick. Luster rather low. Odorless and tasteless when dry. Exceedingly hard, heavy, tough, and strong; texture medium; grain fairly straight; not very difficult to work, considering its density; finishes very smoothly; holds its shape exceptionally well when manufactured; is notably resistant to insects and decay. Seasonal growth rings apparently absent. Parenchyma distinct on all sections, in concentric bands about two pore-diams. apart, often in contact with the pores but rarely including them; sometimes also in short lines. Pores open, few, rather large, fairly evenly distributed without definite pattern, occurring singly or in radial pairs. Vessel lines coarse and often conspicuous because of the whitish walls. Rays not visible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 13729; 15230; 15756. Cooper L 22; 79; 323.)

Ouratea amplexans Hutch. & Dalz. Tall shrub or low tree; leaves up to 12" long, obovate-oblong, with auricled base and blunt-pointed apex, serrated, leathery, glabrous; flowers in compound racemes with long lateral branches; persistent red sepals surrounding base of fruiting carpels, which remains like a knob after fruit has fallen. (Yale 15096. Cooper 155.)

Ouratea calophylla Engl. Low tree with smooth creamy gray bark; leaves gray-green, glabrous, leathery, 6-8" long, oblong-obovate to broadly oval, with abruptly pointed or blunt apex, reticulate with fine parallel secondary veins; flowers creamy yellow, on pendulous racemes; fruit drupaceous as in other species of *Ouratea*. The poles are used for native houses because strong and flexible. (Yale 15116. Cooper 184.)

Ouratea reticulata Engl. Low tree or tall shrub; leaves glabrous, leathery, 3-5" long, narrowly oval or lanceolate, faintly serrated, reticulate; flowers golden yellow, in loose terminal panicles; fruiting carpels globose. (Yale 15101; 15114. Cooper 162; 182.)

Ouratea subcordata Hutch. & Dalz. Low tree or tall shrub with leaves and inflorescence at extreme top; leaves 12-18" long, obovate with blunt apex, margins finely toothed, secondary veins evenly spaced and parallel at right angles to thick midrib; inflorescence an unbranched raceme with pendulous, red-yellow flowers 1" across, persistent calyx surrounding the central "peg" after carpels have fallen. (Yale 13694; 13734; 15103. Cooper 30; 84; 166.)

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16. MYRTACEAE

A large family of over 70 genera and 2800 species of trees and shrubs distributed throughout the tropical and subtropical world. Many of the species contain an aromatic, volatile oil, and some produce edible fruits. The woods are generally hard and heavy and a few of them are of commercial importance. There are two genera listed for West Africa, both of which are found in Liberia, but only one was collected.

Eugenia Whytei Sprague. MOR-WAY-DAH (Bassa); BLOE (Grand Bassa). Low and shrubby when growing along beach, but a medium-sized tree in the high forest, where it sometimes develops prop roots; leaves glabrous, leathery, narrow-oval, 3-5" long, with very short petiole; flowers in short axillary fascicles, white, faintly fragrant, with numerous stamens; fruit a dehiscent, one-seeded, globular capsule $\frac{1}{2}$ " in diam., with remnant of calyx persistent.

Color of wood olive gray throughout; slightly streaked. Not highly lustrous. Odorless and tasteless. Very hard, heavy, tough, and strong; fine-textured; fairly straight-grained; not easy to cut, inclined to be rather splintery, takes a very smooth finish; does not appear resistant to decay. Growth rings indicated by narrow zones deficient in parenchyma and hence of darker color. Parenchyma in exceedingly numerous, irregular, broken lines forming a network giving a grayish appearance to cross section; also in occasional heavier, concentric lines or bands; fine, ulmiform pattern, visible on tangential surface. Pores invisible without lens, rather few, irregularly distributed, sometimes tending to form diagonal lines; they vary considerably in size and are infrequently in contact. Vessel lines indistinct. Rays not visible without lens on cross and tangential sections; fine and inconspicuous on radial surface. (Yale 15120; 15313; 15819. Cooper L 87; 188; 412; 452.)

17. LECYTHIDACEAE

This family is best represented in northern South America, where some species are among the largest and commonest trees of the forest. Although their timbers are of good quality, they have not yet come into extensive use. Well-known commercial products are the Brazil nuts and Sapucaia nuts from the lower Amazon region.

Of the three genera listed for West Africa, two are known to occur in Liberia, though only one species was collected.

Napoleona leonensis Hutch. & Dalz. WEDI-WA-DOON; WEDI-QUAH-DRO (Bassa). Tree 15-20' tall and 2" in diam.; leaves oval-oblong, 4-6" long

MELASTOMACEAE

with long tapering apex, glabrous, dark green; flowers from old twigs and bole, solitary, axillary, almost sessile, showy when fully opened, the thick yellow petals tipped with purple; fruit globose, 1" or more in diam., woody; seeds bean-like, imbedded in fleshy pulp.

The finely chopped bark is mixed with rice and used as food. The raw inner bark and the roasted roots are chewed for coughs and asthma. Wood not utilized because of the scarcity and small size of the trees.

Color of wood yellow or yellowish brown throughout. Rather lustrous. Odor and taste not distinctive. Hard and heavy or moderately so; rather brittle; texture medium; grain mostly straight; not difficult to work, finishes smoothly, takes a high natural polish; of doubtful durability under exposure. Growth rings poorly defined or absent. Parenchyma in exceedingly numerous, fine, very closely spaced, tangential lines extending between rays like a spider web. Pores not visible without lens, open, rather few, scattered irregularly and tending to form small tangential groups. Vessels indistinct. Rays light-colored, very large and conspicuous on cross and radial sections, producing attractive silver grain on quarter-sawed lumber. (Yale 13736; 13736A. Cooper 86; 86A; 171.)

18. MELASTOMACEAE

A large tropical family of over 150 genera and 300 species of herbs, shrubs, and small trees. The leaves are usually distinctive, being simple, opposite or whorled, and generally with 3-9 longitudinally parallel nerves. Some of the shrubs are cultivated for their beautiful flowers and foliage. The woods are of little or no commercial importance. There are 18 genera listed for West Africa, most of which have but one or two species. The Liberian collection contains representatives of five genera.

Dicellandra Barteri Hook. f. Tall epiphyte or herb found in moist places, sometimes rooting at the nodes as it trails along the ground; leaves broadly oval, 6-8" long with petiole 2-3" long, margins finely serrated, mostly with five main veins, two on each side of midrib; flowers in small terminal heads, with reddish purple tubular corollas. (Cooper 365.)

Dissotis rotundifolia Triana. Herb or creeper found on moist ground, rooting at nodes; flowers large, with pink corolla and yellow anthers. This plant is allowed to spread over rubber plantations as a cover crop. (Cooper 23.)

Memecylon polyanthemos Hook. f. TE-AY-CHU (Bassa). Small tree less than 25' tall, with thin, brownish gray, finely cracked bark; leaves paired, broadly oval, 2-3" long, long tapering at base, very green, leathery

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and thick, glabrous, veins very indistinct and not parallel as in other genera; flowers azure blue, fragrant, in small axillary cymose clusters; fruits purple-green berries, $\frac{1}{4}$ " in diam., with remnant of calyx sometimes present at apex.

The tree is said to be very scarce in this region. The inner bark is used as a poultice for toothache, and stems for making stools, beds, and house poles.

Heartwood purplish brown. Sapwood pale brown. Luster low. Odorless and tasteless. Very hard, heavy, tough, and strong; rather fine-textured; grain fairly straight to irregular; inclined to be splintery; not easy to work, finishes very smoothly; is probably durable. Growth rings indicated, but poorly defined. Parenchyma sparingly developed about pores, scarcely visible with lens. Pores small, barely visible, scattered irregularly, with tendency to formation of short tangential or diagonal chains. Small islands of interxylary phloem diffused irregularly among the pore groups. Vessel lines indistinct. Rays very fine on all sections. (Yale 13747; 15201. Cooper 97; 289.)

Memecylon sessile A. Chev. Shrub; leaves narrow-oval to ovate, 5-6" long with long tapering apex; three parallel veins, one on each side of midrib; flowers axillary in very small, almost sessile clusters; fruit a small berry $\frac{1}{4}$ " in diam., sessile in axils of leaves, violet-blue in color. (Cooper 251.)

Memecylon sp. JAY-WREE (Bassa). Tree less than 20' tall; leaves leathery, 6-9" long, narrow lanceolate-oblong or slightly ovate, long tapering with curved apex, the secondary veins numerous, indistinct, parallel, but at right angles to midrib; flowers in axillary cymose clusters; fruit a tiny cup-like berry or capsule.

This tree is used by the witch doctors to produce good luck and wealth to those natives who will bring a present to the tree (for the doctor!) before cutting the bark. This bark is made into a snuff with some white substance gathered in the bush, and when the native wants the aid of the juju he sprinkles some of the dust on his forehead and calls out the magic words "jay wree." (Yale 15281. Cooper 414.)

Preussiella kamerunensis Gilg. Epiphytic herb; leaves 3-4" long, broadly oval-ovate, glabrous, bright green, with pink petioles $\frac{1}{2}$ " long, and five parallel veins, two on each side of midrib; flowers rose, in short terminal cymes; fruit small, cup-shaped. (Cooper 74.)

Tristemma incompletum R. Br. Low undershrub with angular

COMBRETACEAE (TERMINALIACEAE)

branches; leaves 4-6" long, broadly ovate-oval, with 5 parallel veins; flowers pinkish to purple, in terminal cymes. (Cooper 13.)

19. COMBRETACEAE (TERMINALIACEAE)

A family of about 15 genera of wide distribution in the warmer parts of the world. It includes some very important forest trees in India, while in recent years West African timbers of *Terminalia* have been used in Europe. Bark, leaves, and fruit of some species are used in the tanning and dyeing industries, and some plants are known for their medicinal properties. The Liberian collections contain representatives of three genera.

Combretum calobotrys Engl. & Diels. Climbing shrub with spikes of scarlet flowers and prominent stamens. (Cooper 49.)

Combretum grandiflorum G. Don. Climbing shrub with showy scarlet flowers on dense one-sided spikes. (Yale 13704. Cooper 54.)

Strephonema Pseudocola A. Chev. TENTOUT (Bassa). Tree 60-70' tall with slender, unbuttressed bole 12-15" in diam. and narrow crown at extreme top; leaves alternate, glabrous, leathery, 8-10" long, with stout petioles; fruits in short terminal stalks; seed solitary, up to 2" in diam., with short acute beak or nipple at apex, and containing two reddish yellow cotyledons, suggesting a Kola-nut. (In all other members of the family the fruits are winged.)

The tree is said to be plentiful, but did not appear so when making the collections. The liquor from the macerated bark is used as an astringent in treating diarrhea. The wood apparently is not used, though suitable for purposes requiring strength and toughness rather than resistance to decay.

Wood tan or light olive color throughout. Not highly lustrous. Odorless and tasteless. Hard, heavy, tough, and strong; rather fine-textured; grain irregular; not easy to work, being somewhat splintery, but takes a smooth finish; is not durable. Growth rings apparently absent. Parenchyma abundant about pores and wing-like, often confluent; not conspicuous, being of the same color as the ground mass. Pores open, visible, scattered irregularly without definite pattern, mostly solitary. Vessel lines inconspicuous. Rays not visible without lens on cross and tangential sections; low and indistinct on radial surface. The general structure suggests certain of the Leguminosae. (Yale 13771; 15786. Cooper L 54; 121.)

Terminalia superba Engl. & Diels. BAYE (Bassa); KOJAGEI (Mendi). Infrequent forest tree 80-90' tall; buttresses low or lacking; bark scaly or plated; leaves 2-3" long, oval-obovate, glabrous, brownish, medium thin,

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subopposite, bunched at ends of twigs; flowers creamy white, in small terminal racemes partially concealed by the tufts of leaves; fruits winged, much broader than long.

A decoction of the bark is used as an antiseptic lotion for sores and wounds; also as a dye. The wood is used locally for planks. In other parts of West Africa, the timber of this and other species of the same genus is exported in limited quantities to Europe.

Color of wood olive tan. Luster rather high. Odorless and tasteless. Moderately hard, heavy, tough, and strong; texture rather coarse; grain irregular, producing attractive figure on finished specimens; not very difficult to work, takes a high polish, appears fairly durable. Growth rings fairly distinct due to fine lines of terminal parenchyma and slight difference in arrangement of pores. Parenchyma about the pores, sometimes wing-like and confluent; also terminal. Pores open, readily visible, numerous but not crowded, rather irregularly distributed without pattern, occurring singly or in radial pairs. Vessel lines inconspicuous. Rays not visible without lens on cross and tangential sections; fine and inconspicuous on radial surface. Vertical gum ducts observed in peripheral row as result of injury. (Yale 15262; 15804. Cooper L 72; 370.)

20. RHIZOPHORACEAE

A rather small family of 15 genera and around 50 species of large shrubs or trees, scattered over tropical and subtropical regions. Some species form large, pure stands in tidal marshes and estuaries, while others grow in the high forest. The bark of *Rhizophora mangle* L. and related species is an important commercial source of tannin. Four genera are listed for West Africa, and representatives of three of them were collected in Liberia.

Anopyxis ealaensis Sprague. КРОЕ (Bassa). Large forest tree over 100' tall and 4' in diam., with tall, narrow buttresses and clear bole 60-70'; bark thick, roughly furrowed or scaly, light gray on surface, reddish within; leaves whorled or bunched at twig ends, 3-4" long, oval-oblong with blunt apex; flowers in short cymes, with hairy calyx lobes; fruit 5-celled, indehiscent, woody, velvety pubescent; seeds flat, angular, with wing 1" long.

The wood is used locally for planks and general building purposes. The tanniferous bark is used by natives for treating skin infections and ulcers.

Color of wood pale olive brown throughout. Luster rather dull. Odorless and tasteless when dry. Hard, heavy, tough, and strong; coarse-textured, with harsh feel; grain somewhat irregular; hard to cut; does not appear resistant to decay. Growth rings apparently absent. Parenchyma short

RHIZOPHORACEAE

aliform, rarely confluent. Pores visible, open, solitary, numerous but not crowded, uniformly distributed without definite pattern. Vessel lines distinct. Rays readily visible on cross section, indistinct without lens on tangential; distinct but not conspicuous on radial surface, lacking contrast with background. (Yale 15200; 15743. Cooper L 9; 288.)

Cassipourea Afzelii Alston. JU-EHN-JRAH (Bassa). Tree less than 30' tall, with gray-green bark; young twigs reddish; leaves 3-4" long, oval or slightly obovate, tapering at base and apex, margins toothed or wavy, pale green, glabrous; flowers less than $\frac{1}{4}$ " long, petals white, sepals green, stamens abundant, appearing in small axillary clusters, almost sessile.

The tree is used for house poles and picket enclosures because of its strength and toughness. The name "ju-ehn-jrah" means literally "elephant-cannot-break-it" or "elephant-tusk tree." The wood is very similar to that of *C. Firestoneana*. (Yale 15142. Cooper 214.)

Cassipourea Firestoneana Hutch. & Dalz., sp. nov. (*ined.*). KUT-WAHN (Bassa). Forest tree 75-85' tall and 2-2 $\frac{1}{2}$ ' in diam., with low buttresses, long, clear bole, and spreading crown having large crooked branches; bark greenish gray, slightly plated or scaly; leaves oval; cuneate at base, abruptly pointed at apex, margin entire, 1-5" long, glabrous above, softly pubescent underneath; flowers greenish, $\frac{1}{2}$ " long, axillary, on pendulous stalks 1" long, the pedicel, bracts, and calyx covered with velvety pubescence.

The wood is used for native house construction because of its durability and for canoe paddles because of its strength combined with flexibility. The tree is scattered in the high forest and has a very important place in the native juju. It is believed that this tree, through the medium of a piece of its bark, has power to grant requests, protect travelers from danger, and bewitch one's enemies. An atmosphere of strictest secrecy and one of humility are necessary and required by the witch doctor before he allows the native "to sit before Kut-wahn."

Color of wood brownish yellow throughout. Fairly lustrous. Without distinctive odor or taste. Hard, heavy, tough, and strong; rather fine-textured; somewhat splintery; grain fairly straight; not easy to cut or to work, but finishes smoothly; does not appear resistant to decay. Growth rings absent or poorly defined. Parenchyma in very numerous, fine, wavy, tangential to concentric lines, mostly in contact with the pores and uniting them; distance apart about one pore-width. Pores small, not distinct without lens, open, solitary, numerous but not crowded, uniformly distributed without special pattern. Vessel lines fine and inconspicuous. Rays not distinct without

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lens on cross section, barely visible with it on tangential; low and inconspicuous on radial surface, lacking contrast with background. (Yale 13746; 15142A; 15821. Cooper L 89; 96; 214A.)

Rhizophora racemosa G. F. W. Mey. DINGI (Mendi); RED MANGROVE (English). Common tree in maritime swamps, sometimes with long, straight bole and sometimes sprawling, always with many prop roots; leaves opposite, 3-5" long, narrowly oblong to obovate, generally rounded at apex; flowers in short axillary cymes; fruit oval, 1-1½" long. The seed germinates on the tree, the radicle growing about a foot long before the seed falls. The bark is rich in tannin. The reddish wood is hard, strong, and durable; suitable for fuel and for small timbers for general construction. (Observed but not collected.)

21. HYPERICACEAE

A small tropical family of herbs, shrubs, climbers, and trees, with resinous juice. The woods afford evidence of their close relationship to the Guttiferae, but none is of any importance commercially. Of five genera listed for West Africa, two are represented in the Liberian collections.

Psorospermum sp. (probably). Tree 40-50' tall and 9-12" in diam., with low buttresses; bark smooth, brown with greenish tinge; leaves oval, abruptly terminated, 6" long, glabrous, leathery, the conspicuous secondary veins in parallel lines at right angles to the midrib; flowers in terminal clusters; fruits not seen.

Occurs commonly along river banks. It is sometimes confused with *Homalium dolichophyllum* Gilg, because of the superficial resemblance of the woods. Timber used for boat keels because it is hard, tough, and durable. (Cooper 382.)

Vismia leonensis Hook. f. GE-AHN-DE-PAY (Bassa). Infrequent tree less than 40' tall and 8-10" in diam., without buttresses; bark thin, brown, roughened, scaly, exuding a yellowish resin; leaves oval-ovate, 3-4" long, of soft papery texture, with brown pubescence underneath, especially on new leaves and on veins; flowers in axillary cymes from long stalks, the sepals and styles persistent; fruit a small berry.

The bark is macerated and mixed into a paste with palm oil, the salve being used for treating craw-craw, a skin eruption. The tree is of importance in the mysterious juju practiced by the native herbalists. The Bassa expression "ge-ahn" means "grave" or "the spirit world from which no living man returns."

GUTTIFERAE

Color of wood pinkish brown; probably reddish in old trees. Luster low. Without distinctive odor or taste. Rather hard, heavy, and strong as in Oak (*Quercus*); texture medium; grain straight to irregular; not very difficult to work, finishes smoothly, takes a high polish; does not appear resistant to decay. Growth rings only occasionally defined. Parenchyma visible in numerous, wavy, irregularly spaced, concentric bands, mostly independent of the pores, generally 2-4 times the width of the rays, the average spacing 3 or 4 pore-diams. Pores open, visible, not very numerous, mostly in short radial rows which tend to form oblique lines. Vessel lines inconspicuous. Rays not distinct without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 15254; 15303; 15801. Cooper L 69; 348; 440.)

Vismia leonensis, var. **macrophylla** Hutch. & Dalz. GE-AHN (Bassa). Tree 30-40' tall and 8-10" in diam., without buttresses; bark brownish, furrowed, plated, with resinous juice at first orange-brown, later reddish; leaves 6-9" long, oval-ovate, glabrous; flowers in terminal or axillary compound heads or cymes. The wood is of a reddish color and softer than the preceding; not utilized.

Said to be plentiful in second growth. Its rôle in native witchcraft is as follows; The inner bark is macerated and placed in a country pot containing raw palm oil, after which some of the sticky resin is mixed in. Three branches from the tree are set in the ground, forming a tripod upon which the pot is set, over a fire. A suspected criminal is tried by immersing his hands in the boiling oil, and his guilt or innocence established by noting whether or not he is scalded. (Yale 15337. Cooper 396.)

22. GUTTIFERAE

A family of over 40 genera and 1000 species of trees and shrubs widely distributed in the tropics. The leaves are entire, simple, and opposite. The bark usually contains a viscid resinous sap that is sometimes utilized. A few of the timbers are of present commercial importance and nearly all of them have potential value. If readily available in temperate regions they would serve a great many useful purposes of general utility. The five genera listed for West Africa are all represented in the Liberian collections.

Allanblackia parviflora A. Chev. GBAR-CHU (Bassa). Tree over 75' tall and 2½' in diam.; bark reddish brown, roughly furrowed; inner bark stringy, containing sticky yellow resin; leaves glabrous, leathery, lanceolate-oblong, 5-7" long, feather-veined, the secondary veins very numerous and

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parallel; flowers pale reddish brown, showy, faintly fragrant, in terminal clusters; fruit sausage-like with large seeds imbedded in white pulp.

Natives use the resin for pitch and the timber for planks. The wood shows attractive figure when quarter-sawed, being of the type of *Platanus* known on the market often as Lacewood.

Wood light colored; rather dull. Odorless and tasteless. Of medium density, weight, and texture; grain fairly straight; easy to work, finishes smoothly, will probably hold its place well when manufactured; does not appear resistant to decay. Growth rings apparently absent. Parenchyma in very coarse, concentric bands, fairly evenly spaced about one large pore-width apart, forming a distinct crosshatch with the rays. Pores open, large to moderately so, few and scattered, mostly solitary, but sometimes in pairs. Vessel lines few and inconspicuous. Rays large, coarse-celled, numerous, very distinct on cross section, fairly so on the tangential; high and conspicuous on radial surface, producing silver grain. (Yale 15232; 15790. Cooper L 58; 325.)

Garcinia kola Heckel. SWA-MEH (Bassa); KOFÉ (Mendi). Tree 50-60' tall; bark thick, greenish brown, surface-pitted, containing a sticky brown-yellow resin; leaves glabrous, lanceolate, 3-5" long; flowers greenish white, globose, 1/2" in diam., with large petal-like stamen and knob-like stigma; fruits reddish yellow, about the size of an orange, with orange-yellow pulp containing large seeds.

Common tree throughout West Africa and of special interest because it is the principal source of chewsticks, small pieces of the wood which the natives chew to whiten the teeth. The sticky brown resin is used in treating skin infections.

Wood greenish or brownish yellow. Somewhat lustrous. Odorless and tasteless when dry. Very hard, heavy, and strong; rather coarse-textured; grain straight to roey; fairly easy to work, finishes smoothly, takes a good polish; is probably moderately resistant to decay. Growth rings absent or poorly defined. Parenchyma in distinct, wavy, concentric bands, often connecting but usually not including the pores; spacing 2-4 pore-diams. Pores open, barely visible, few, irregularly scattered, mostly solitary. Vessel lines few and inconspicuous. Rays barely visible on cross section, indistinct on tangential; rather prominent in proper light on radial surface, appearing lighter than background. (Yale 15143. Cooper 216.)

Garcinia Mannii Oliv. KAR (Bassa); CHEWSTICK (English). Tree sometimes 40-50' tall and 8-12" in diam., generally smaller, with long, clear bole and no buttresses; outer bark rather thin, gray, smooth; inner bark

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light brown; leaves dark green, 3-4" long, with sharply tapering apex and many fine parallel veins at right angles to midrib; flowers in small axillary clusters, globose, almost sessile; fruit large, edible; sticky yellow resin from all parts of tree.

Color of wood olive, sometimes with pinkish hue. Fairly lustrous. Odorless and tasteless. Very hard, heavy, tough, and strong; texture coarse; harsh feel; grain often irregular; not easy to work, finishes smoothly, takes a high polish; probably not very resistant to decay. Growth rings indicated, but poorly defined. Parenchyma visible in narrow wings from pores, often confluent into wavy tangential or concentric lines; sometimes the lines are fairly regular and evenly spaced 2 to 4 pore-diams. Pores small, not visible without lens, rather numerous, uniformly distributed, mostly solitary. Vessel lines fine and inconspicuous. Rays visible on cross section, indistinct on tangential; prominent on radial surface, appearing somewhat darker than background. (Yale 15187; 15259; 15780. Cooper L 48; 272; 367.)

Garcinia sp. DU-KPAY (Bassa). Climbing shrub; leaves oval, 3-4" long, long tapering apex; flowers very small, in little axillary clusters. (Cooper 213.)

Ochrocarpus africanus Oliv. BAHN (Bassa); KAIKUMBA (Mendi); AFRICAN APPLE; AFRICAN APRICOT; BASTARD MAHOGANY (English). Tree sometimes 100' tall and 3' in diam., with long, clear, straight bole and no buttresses; bark dingy yellow to greenish brown, rough plated or scaly; inner bark reddish, exuding bright yellow resin when cut; leaves glabrous, leathery, broadly oval, 5-7" long, 2-3" wide, reticulate between the parallel secondary veins; petiole stout, ribbed or angular; flowers not seen; fruit speckled yellowish brown, oval or slightly recurved, 3-4" long, with leathery husk and a few large seeds imbedded in yellowish pulp; sepals and stamens persistent and conspicuous at base of fruit.

A rather common forest tree, used for planks and timbers by the natives and locally for lumber and furniture. Timber appears to be of good quality, suitable for heavy and durable construction. The oily seeds are edible. The bark is beaten or ground and thrown into small streams to poison the fish. The practice of stripping the bark results in the death of many of the trees.

Heartwood dull reddish brown; sapwood lighter, rather sharply defined. Odorless and tasteless when dry. Hard, heavy, and strong; texture coarse; grain fairly straight to wavy; not difficult to work, finishes smoothly; appears durable. Growth rings apparently absent. Parenchyma not abundant; invisible without lens; associated with the pores and very irregularly aliform; also diffuse. Pores readily visible, fairly numerous, irregularly dis-

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tributed, tending to form diagonal rows; mostly open, but sometimes filled with white substance. Vessel lines inconspicuous, except for white deposits. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 13735; 15149; 15180; 15745. Cooper L 11; 85; 223; 265.)

Pentadesma butyracea Sab. WAVE or WAVE-KPAY (Bassa); MDAYEN (Mendi); TALLOW TREE (English). Tree 80-90' tall and 2½-3' in diam., with generally high and narrow buttresses and straight, clear bole; branches verticillate; bark reddish brown, rough or scaly, exuding a thick yellow resin when cut; leaves bunched at ends of twigs, oval, 3-5" long, leathery, glabrous; secondary veins parallel and at right angles to the midrib; petioles ribbed, sometimes twisted; flowers 2" across, very showy in large terminal clusters, each with stout pedicel ½" long; fruits large, with tough, leathery, yellow rind and yellowish pulp inclosing few large seeds; stamens and sepals persistent. (Plate IV, No. 1.)

The timber is employed locally for planks and rough construction. The fruit is said to be edible. The roots are used for chewsticks. The seeds supply an oil or fat used in cooking and soap making.

Wood pale brown throughout. Luster low. Odorless and tasteless. Moderately hard and heavy; very coarse-textured; rather stringy; easy to cut, finishes smoothly, but does not take a high polish; not resistant to decay. Growth rings indicated by darker bands. Parenchyma in distinct, irregular, heavy, concentric bands, 2-4 pore-widths apart. Pores few, open, mostly in small, scattered groups. Rays rather coarse, distinct; producing silver grain on radial surface. (Yale 13730; 15188; 15750. Cooper L 16; 80; 273; 379.)

Symphonia gabonensis Pierre, var. *macrantha* Hutch. & Dalz. WAVEPU (Bassa). Tree sometimes 80' tall and 2½' in diam., with horizontal branches; bark brown, very rough, yellow inside; leaves leathery, glabrous, lanceolate, 3-4" long, with fine parallel secondary veins; flowers in terminal clusters, with brownish red petals and sepals, globose in bud, showy when open; fruit 1" in diam., with leathery rind, globose, the apex extended into an umbrella-like projection; seed one, occasionally more.

The timber is used locally for the same purpose as the preceding and appears suitable for carpentry and general construction, plywood, and lower grades of furniture.

Color of heartwood orange-yellow, with a golden subluster; sapwood sharply demarcated, nearly white. Odorless and tasteless. Of medium

SCYTOPETALACEAE

weight, fairly hard, rather brittle; coarse-textured; straight-grained; easy to work, finishes smoothly; looks moderately durable. Growth rings absent or poorly defined. Parenchyma distinct, in very irregular and wavy, tangential to concentric lines or bands, commonly connecting but not including the pores; lines spaced 1 or 2 pore-diams. Pores open, large, distinct, fairly numerous, occurring singly or in radially flattened groups of 2 to several pores each. Vessel lines coarse. Rays rather narrow, visible on cross section and producing fine silver grain on radial surface. (Yale 13755; 15239; 15829. Cooper L 97; 105; 333.)

23. SCYTOPETALACEAE

A small family of trees confined to tropical West Africa and the Congo and closely related to Tiliaceae. Only one genus, with a single species, is known to be represented in Liberia.

Scytopetalum Tieghemii Hutch. & Dalz. ZEB-BLO (Bassa). Tree 50-60' tall and 12-16" in diam., with long, clear bole and almost no buttresses; bark thick, dingy brown, pitted and roughened; twigs fine, dense, blackish brown; leaves narrow to broadly oval, 2-3" long with long tapering curved apex and wedge-shaped base, dark green; glabrous, brittle; flowers in short axillary racemes, pale creamy buds opening to expose wavy stamen and white petals; fragrant pedicels flattened or twisted, sometimes angular; fruits unequally oval, under 1" long, tipped with remnant of stigma; calyx persistent as a basal disk. (Plate IV, No. 2.)

This tree is used for house poles because of its strength and straight bole. Wood suitable for various purposes requiring toughness and strength rather than beauty or durability. The macerated bark is used medicinally as an antacid.

Color of wood gray or grayish brown throughout, with little luster. No odor or taste when dry. Hard, heavy, tough, and strong; texture medium, with rather harsh feel; grain irregular; not easy to work, having a decided tendency to woolliness and pulling out of the fiber; not resistant to decay. Growth rings defined by differences in spacing of parenchyma lines. Parenchyma in exceedingly numerous, fine, tangential lines in web-like arrangement with the rays, becoming more crowded in late wood. Pores readily visible, open, not very numerous, rather irregularly distributed, occurring singly, in radial pairs, or less frequently in groups. Vessel lines fairly distinct. Rays visible without lens on cross section, but not on the tangential; inconspicuous on radial surface. (Yale 15150; 15168; 15176; 15777. Cooper L 45; 224; 247; 260; 356.)

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24. TILIACEAE

A family of 35 genera and upward of 400 species of trees, shrubs, and herbs of general distribution. The textile fiber jute is obtained from certain species of *Corchorus*. The best known tree is the Linden or Basswood, highly esteemed for its light colored, soft, easily worked wood. Of the ten genera listed for West Africa, there are at least six representatives in Liberia, all being shrubs or weeds. The present collection contains but one, possibly a new species.

Duboscia sp. VAHN-MLEH-DOO (Bassa). Climbing shrub; leaves 3-4" long, broadly oval, rounded at base, sharply acuminate at apex, bright green, glabrous above, petiole and branchlets covered with rusty brown pubescence; flowers very small, inclosed in involucre of 3 or 4 bracts, inflorescence axillary or terminal in loose panicles, rusty brown; fruit woody, ribbed, 1" long, pubescent. (Yale 15276. Cooper 407.)

25. STERCULIACEAE

A family of about 50 genera and over 700 species of herbs, shrubs, woody climbers, and trees distributed over the warmer regions of the world. The best known member is the Cacao (*Theobroma*), the seeds of which are the source of cocoa and chocolate. The woods vary from light and soft to moderately hard and heavy; they are coarse-textured and unattractive, with the exception of *Tarrietia utilis*, which resembles Mahogany. They are of little economic importance.

There are 14 to 15 genera listed for West Africa, but only four of them are represented in the present Liberian collection.

Cola acuminata Schott & Endl. DOE-FIAH (Bassa); TOLUI (Mendi); KOLA TREE (English). Medium-sized tree with dark green, finely roughened bark; leaves glabrous, broadly oval to oblong, apex blunt-pointed or flattened; petioles 2½" long; flowers crowded on short axillary stalks; fruit 3-4" long and 1-2" broad, with fibrous or leathery husk and large cotyledons.

This tree is scarce in the forest and is sometimes said to have been introduced from Nigeria. The seeds are edible. The oil from the seeds is used medicinally, as are also the leaves, in fact, the tree has so many uses in medicine that the natives sometimes term it "wood doctor."

Heartwood pale brown; sapwood white, subject to blue stain. Fairly lustrous. Odorless and tasteless. Of moderate density, suggesting Ash

STERCULIACEAE

(*Fraxinus*); texture medium; grain mostly straight; easy to work, finishes smoothly; is not resistant to decay or insect attacks. Seasonal growth rings not distinct. Parenchyma abundant, distinct; in fairly regular, concentric bands, often including the pores; spacing 3-6 pore-diams. Pores open, barely visible, few and scattered. Vessel lines inconspicuous, except in stained specimens. Rays rather fine, faintly visible on cross section; low and inconspicuous on radial surface. Ripple marks absent. (Yale 15233; 15789. Cooper L 57; 326.)

Cola angustifolia K. Schum. DEN-BE-HAW (Mendi). Shrub or low tree; leaves glabrous, narrow-obovate, 3-5" long, abruptly acuminate; flowers in short axillary fascicles on the young leafy shoots; calyx tube yellowish with spreading sepals; fruit reddish, globose, with pointed apex, 1" in diam.; seeds black. (Yale 15104. Cooper 167.)

Cola Buntingii Bak. f. KAR-WE-EH (Bassa); BUSH KOLA (English). Tree 20-30' tall, with no buttresses; bole straight, but rather gnarled; bark greenish black, smooth, thin; leaves digitately compound; leaflets leathery, narrowly obovate, 6-8" long, shortly acuminate; flowers yellowish brown, 1/2" long, in very short clusters from old wood; fruits reddish, glabrous, up to 4" long, oblong, bluntly beaked. A common tree used for native house construction.

Heartwood orange-brown; sapwood gray. Not highly lustrous. Odorless and tasteless. Rather hard and heavy; texture coarse, with harsh feel; grain straight to irregular; not easy to work, finishes rather smoothly; requires care in seasoning; is not resistant to decay; subject to sapstain. Seasonal growth rings apparently absent. Parenchyma abundant, very distinct on all sections; in numerous concentric bands spaced 1 or 2 pore-diams. and forming web-like pattern with the rays. Pores open, not distinct without lens, few and scattered, solitary, mostly between parenchyma bands. Rays very coarse and conspicuous on all sections, much wider than parenchyma bands, producing silver grain on radial surface; not storied. Ripple marks present, exceedingly fine, due to storied parenchyma cells; other elements not distinctly storied. (Yale 13713; 15225; 15800. Cooper 63; L 68; 318.)

Cola caricifolia K. Schum. BLOM-POE (Bassa). Shrub or low tree; leaves simple, deeply lobed, 8-10" wide, on petioles up to 6" long, lobes obovate, acuminate; flowers with brownish pubescence, in crowded, axillary cymes from old wood; fruit a reddish follicle, 2" long, with fibrous husk and 8-10 seeds.

The stems are used for spring traps and bows because of the strength and resilience of the wood. (Yale 15257. Cooper 364.)

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Cola digitata Mast. DAY-NE-WAYE (Bassa). Tree less than 30' high and 6" in diam.; leaves digitately compound, with stalk over 12" long; leaflets 5-7, deeply cleft, up to 12" long, sharply acuminate; flowers in axillary fascicles; fruits reddish, 4-6" long, with slightly pubescent, leathery husk; seeds red.

This tree is common in the bush and is sometimes used for house poles. The macerated bark foams when mixed with water, and this mixture is used as a hair tonic. (Yale 15315. Cooper 455.)

Cola heterophylla Schott & Endl. Shrub or low tree. (Yale 13695; 15095. Cooper 31; 154.)

Cola lateritia K. Schum. BO-AH (Bassa); BOONI (Mendi). Tree up to 50' tall and 12-15" in diam., with full crown and buttressed bole, and dark brown, furrowed bark; leaves rounded to broadly oval, notched at base, the margin 5-7 lobed in young leaves, which may be as much as 12" wide; flowers yellow to red; fruit reddish, wrinkled, 2-3" long, with 4-6 large seeds imbedded in fleshy pulp.

The wood is used for casks. A salve of macerated inner bark mixed with clay is used for eruptions, while a decoction of the leaves is used for bathing parts affected.

Heartwood pinkish brown; sapwood gray. Fairly lustrous. Odorless and tasteless. Of medium weight and hardness, tough and stringy; texture very coarse, with harsh feel; grain mostly straight; not difficult to cut, does not finish very smoothly; is not resistant to decay or insect attack; liable to blue stain. Anatomy similar to *C. Buntingii*. (Yale 15249; 15749; 15759; 15802. Cooper L 15; L 27; L 70; 343.)

Cola nitida A. Chev. TOHN-WE-EH (Bassa); BITTER COLA (English). Large, buttressed forest tree with reddish brown, roughened bark; twigs, branches, and petioles black; leaves 6-8" long, broadly oval to oblong, with very abrupt apex, petiole over 2" long; flowers in axillary cymes, covered with brown pubescence; fruit an oval, wrinkled pod with two cotyledons 2-3" long.

The tree is fairly common in the forest and is sometimes cultivated for its edible seeds. Canoes and planks are made from the trunks. An infusion of the bark is employed to alleviate the pain of fire burns. (Yale 15242. Cooper 336.)

Leptonychia urophylla Welw. KRU-ADA-WRAH (Bassa); MBAG-BOLD-EDE (Mendi). Low tree or tall shrub, with smooth greenish black bark often covered with moss; leaves oval, 4-6" long, with few conspicuous lateral

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veins; flowers axillary from short stalks; fruit a three-valved rounded capsule, $\frac{1}{2}$ " in diam., with red-coated black seeds.

The macerated leaves are used to cure fire burns by direct application to the wound. (Yale 15275. Cooper 406.)

Scaphopetalum amoenum A. Chev. BAH; BLEH (Bassa). Small tree, generally growing in a slanting position; bark purplish gray, roughened, dotted with lenticels; leaves coarse, leathery, 6-9" long, broadly oval to narrow oblong, with tapering or wedge-like apex and rounded or wedge-like base, lateral veins conspicuous, reticulations coarse; flowers in small axillary clusters on young leafy shoots; greenish outside with purple lining; fruit a capsule with elongated seeds.

The wood is highly elastic and is used for country bows. The bark is sometimes made into brooms. The seeds are edible and have a flavor suggesting peanuts. (Yale 13707; 15162. Cooper 57; 237.)

Scaphopetalum macranthum K. Schum. (probably). Similar to preceding species, but the flowers are borne on the old branchlets. (Yale 15179. Cooper 264.)

Tarrietia utilis Sprague. DE-ORH (Bassa); YAWI (Mendi); RED CEDAR; HARMON; WISH-MORE (English). Forest tree 75-85' tall and $2\frac{1}{2}$ -3' in diam., with huge prop roots, straight, clear bole, and a flat crown confined to extreme top; bark grayish brown, slightly scaly; twigs with rusty brown pubescence; leaves glabrous, digitately compound, with petiole up to 12" long, or one-foliolate by reduction, with petiole 2-3" long; leaflets 6-10" long, obovate-oblong with long tapering apex and base when one-foliolate, dark green above, brown below; flowers in axillary panicles, buds creamy white with soft pubescence, bracts lanceolate; fruits winged, in clusters of 2-5, wing 2" long.

A fairly common tree, with attractive, easily worked wood in general use both by natives and for house building and carpentry work in the towns. It has a superficial resemblance to Mahogany and is occasionally included in exports of that timber from various parts of West Africa. It is closely related to and much the same as the Philippine Lumbayao and the Australian Tulip "Oaks."

Heartwood a rich reddish brown with a golden sheen; sapwood gray. Odorless and tasteless. Moderately light and soft, but firm and strong for its weight; medium-textured; mostly straight-grained; very easy to cut, finishes smoothly, takes a lustrous natural polish; is resistant to insects and decay. Growth rings fairly distinct. Parenchyma about pores, sometimes

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wing-like; also in concentric lines or narrow bands, usually rather widely spaced and apparently limiting seasonal growths; not distinct without lens. Pores open, readily visible, not very numerous, fairly well distributed without definite pattern, occurring singly or occasionally in pairs or small, flattened groups. Vessel lines very distinct. Rays near limit of vision on cross section, fairly distinct on tangential; rather high and very conspicuous on radial surface, appearing darker than background and producing silver grain. Ripple marks present, but irregular and not very distinct; most of the rays not storied. (Yale 13711; 15170; 15736. Cooper L 2; 61; 103; 253; 353.)

26. BOMBACACEAE

This family, sometimes included with the Malvaceae to which it is very closely related, contains about 20 genera of soft-wooded trees all noted for their rapid growth and for their huge trunks, often with peculiar basal swellings as in *Adansonia*. The best known commercial timber is Balsa, produced by members of the genus *Ochroma* native to tropical America. Three genera are found in West Africa, all being present in Liberia.

Adansonia digitata L. SACKWI-MBAUWI (Mendi); BAOBAB or MONKEY BREAD (English). This tree is generally found throughout the savannah forest and open country and is common all over West Africa. A large specimen was observed at Cape Palmas, but not collected. The natives eat the acid pulp of the fruit and also use the dried seeds for a condiment. The wood fiber has been of great commercial importance, valued at over \$500 per ton in London at one time.

Bombax brevicuspe Sprague. JU-IHN (Bassa); KINGUE (Mendi). Huge deciduous tree, widely distributed in the evergreen forest, growing 125' tall and over 4' in diam., with low buttresses or flanges and a basal swelling; outer bark greenish black, thick, rough but not furrowed; inner bark brownish and stringy; leaves digitately compound with small obovate glabrous leaflets, 1-2" long, the apex either rounded with a short point, indented, or flat; flowers large and showy, pink to reddish; fruit a glabrous brown capsule about 3" long, containing many seeds, about 1/3" long, imbedded in reddish yellow floss.

Because of its lightness and easy working combined with toughness, the timber is occasionally used for planks and the trunks for making native canoes. The floss serves as stuffing for pillows and mattresses. The bark and leaves are employed in the treatment of venereal diseases. The bark is also said to contain a dye (color not ascertained).

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Wood pale reddish brown to dark brown. Not lustrous. No odor or taste when dry. Light in weight, but firm and tough; rather fibrous; coarse-textured; straight-grained; easy to cut, does not take a high polish, looks fairly durable. Growth rings poorly defined or absent. Parenchyma in exceedingly numerous and fine tangential lines forming network with the rays and not visible without lens. Pores large, open, scattered irregularly, occurring singly or less commonly in radial pairs. Vessel lines coarse and distinct. Rays scarcely visible without lens on cross and tangential sections, rather high and conspicuous on radial surface. Large vertical gum ducts or "veins" sometimes present in concentric lines or arcs as result of injury. Ripple marks present, fairly regular, readily visible, all elements storied, although some of the rays occupy two tiers. (Yale 15285; 15815. Cooper L 83; 421.)

Ceiba pentandra Gaertn. UNGWE (Mendi); COTTON TREE (English). This massive tree, so common in the tropical American forest, is believed to be of ancient introduction to West Africa, rather than indigenous. The wood is very light in color and weight and very perishable in contact with the soil. It is not utilized. (Observed, but not collected.)

27. HUMIRIACEAE

Small family of only three genera and about 30 species of trees and shrubs confined to tropical America and Africa.

Saccoglottis gabonensis Urban. DAUH (Bassa); CHERRY; MAHOGANY⁴ (English). Tree 80-100' tall and 3-4' in diam., with fluted and buttressed bole; bark reddish brown, rough, cracked, medium thin, containing reddish sap; leaves oval, 3-5" long, margins wavy or faintly serrated, glabrous, bright green with grayish tint; flowers in many-flowered axillary cymes, pubescent; fruit a globose or oval, woody husk, 1" long, with cavities filled with sweetish exudation sought by bees.

The tree, which is said to be plentiful, occurs in the forest on low ground extending almost into the Mangrove formation. It is used locally for making canoes and is also cut in box lumber, planks, and timbers. The fruit is eaten by monkeys. The bark is sold in native markets for mixing with gin to make it bitter.

Color of wood reddish or purplish brown. Fairly lustrous. Odorless and tasteless, at least when dry. Hard, heavy, tough and strong; texture medium; rather harsh feel; grain irregular or roey; works readily, finishes smoothly, takes a high polish; appears moderately resistant to decay. Growth rings

⁴ This is not the timber sold in the European and American markets either as African Cherry or as African Mahogany.

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apparently absent. Parenchyma sparingly developed; not distinct with lens. Pores visible, numerous but not crowded, well distributed without distinct pattern, mostly solitary; some white gum deposits present. Vessel lines fine and inconspicuous. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 13718; 15189; 15740. Cooper L 6; 274.)

28. EUPHORBIACEAE

A very large family of about 250 genera and over 5000 species of trees, shrubs, and herbs with watery or milky, acrid or poisonous juice; widely distributed, but most abundant in the tropics. The cassava and tapioca, castor oil and croton oil, and Chinese wood oil or tung oil are well-known products, while from the latex from *Hevea* is produced most of the rubber of the world. The woods vary greatly in appearance and properties and are of little economic value.

Of the 61 genera listed for West Africa, 17 are represented in the present collection; at least 14 more, mostly shrubs and herbs, are known to be present. *Hevea* has been introduced for rubber plantations, *Hura* has been planted for shade, and *Ricinus* for its seeds, the source of castor oil.

Alchornea cordifolia Muell. Arg. BLU-KOH (Bassa). Small tree, often with erect or leaning, much-branched, gnarled trunk; bark brownish to dark gray, dotted with lenticels; leaves broadly ovate, rounded or notched at base, 6-8" long, 4-5" broad at base, margins coarsely notched with blunt teeth, petiole 4-5" long; male flowers very small on axillary, compound racemes, petals absent, calyx greenish white; female flowers on axillary simple racemes; fruiting spikes pendulous; fruits under 1/2" long, oval, wrinkled or flanged, covered with gray pubescence; style persistent, somewhat longer than fruit; seeds black, but coated with a bright red skin.

The liquor from a mixture of water and macerated leaves is used as an antiseptic in washing sores. The pith is chewed to relieve sore throat. The wood is not utilized, although it is very plentiful. It is light, soft, and perishable; the tangential surface speckled with small, open, radial canals. (Yale 15126; 15296; 15845. Cooper L 113; 195; 432.)

Alchornea hirtella Benth. Shrub with pubescent twigs; leaves lanceolate, purple when young; flowers reddish white, in long slender spikes. (Observed but not collected.)

Antidesma membranaceum Muell. Arg. DU-AH-DOR (Bassa). Tall shrub or low tree under 20-25' tall; leaves 4-6" long, oblong-oval, sharply

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acuminate, tapering to base; male flowers 2-4" long, in slender axillary catkins, pendulous; female flowers in pendulous axillary racemes; fruits flattened, $\frac{1}{4}$ " wide and slightly longer, with hooked apex.

The milky juice of this shrubby tree is mixed with clay and used as a cosmetic by the girls of the Gre-Gree bush. The wood is not used. (Yale 15090; 15099; 15100; 15141. Cooper 149; 158; 159; 212.)

Discoglyprena caloneura Prain. LEH-BOHN (Bassa). Tree 60-70' tall and 2-3' in diam., without buttresses; leaves glabrous, broadly oval, 4-5" long, abruptly acuminate, margins finely toothed at wide intervals, petiole 1-1 $\frac{1}{2}$ " long; male flowers very small, in terminal panicles; fruit deeply 3-lobed, somewhat fleshy and pubescent, reddish when ripe, with bitter taste.

The tree is well distributed in the forest, but the wood is too soft and perishable for building purposes and canoes. It is used for making rice bowls and other food containers and also for carving devil heads, because of its easy working qualities. (Yale 13776. Cooper 126.)

Drypetes Afzelii Hutch. (?). DUAY-GRAY (Bassa); TO-YE (Mendi). Tree sometimes 30-40' tall and 8-18" in diam., with greenish gray, smooth or finely plated bark; leaves glabrous, oval, oblong, 6-8" long, 2" wide, tapering at apex and base, margins entire but slightly wavy; flowers in fascicles on old wood, male flowers with slender pedicel and yellow sepals; fruit oval-oblong, about 1" long, covered with fine brown pubescence.

This tree is very common and is often used for native house poles because of its strength and reputed resistance to insect attack. (Yale 15222. Cooper 241; 315.)

Drypetes ivorensis Hutch. & Dalz. KPAHN-WEE (Bassa). Tall shrub or possibly a small tree; leaves glabrous, oblong-lanceolate, 4-6" long, tapering at apex, margins faintly serrated; flowers globose, greenish yellow, growing from main stem; fruit globose, 1" in diam., short-stalked, finely pubescent, reddish when ripe, black when dry, edible.

The macerated bark and fruits are used as poultice for boils and carbuncles. (Cooper 418.)

Drypetes ovata Hutch. (probably). SWAM-BEH (Bassa); PEPPER BARK (Eng.). Tree 40-50' tall and 12" in diam., with low buttresses; bark greenish brown with white or gray blotches, plated; leaves glabrous, 2-3" long, ovate-lanceolate, sometimes hooked, base unequal; flowers in fascicles from old wood; fruits oval, $\frac{1}{2}$ " long, on short, axillary pedicels, solitary or in small groups, covered with rusty brown pubescence.

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A decoction of macerated bark and fruits is used as a liniment for external application in cases of fever, rheumatism, and general fatigue. The powdered bark is also employed in treating a blotched condition of the skin. The Bassa name means "sting pepper" in allusion to the spicy taste of the bark.

Wood pale yellow; likely to be stained blue or brown. Fairly lustrous. Odorless and tasteless. Hard, heavy, and strong, suggesting Sugar Maple (*Acer saccharum* Marsh.); texture rather fine; grain straight to irregular; not difficult to work; finishes smoothly, takes high polish; is probably poorly resistant to decay; subject to fungous stain. Growth rings indicated by narrow parenchyma-less bands. Parenchyma in exceedingly numerous, fine lines forming a meshwork with the rays; individual lines invisible without lens. Pores not distinct without lens, rather few, occurring mostly in radially flattened groups. Vessel lines indistinct. Rays slightly wider than parenchyma lines; invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 15153; 15224; 15318; 15738; 15781. Cooper L 4; L 49; 227; 317; 458.)

Drypetes principum Hutch. Tree less than 25' tall, the main bole thorny; bark green, smooth or finely grooved; twigs grooved; leaves oblong-lanceolate, 6-8" long, 2" wide, with abruptly acuminate apex and margins plainly toothed; fruit yellowish, 1" long, oval, with 3 hard angular seeds imbedded in scanty pulp. (Yale 15248. Cooper 342.)

Macaranga huraefolia Beille. Tree 35-40' tall and 10-12" in diam.; twigs pubescent, thorny; leaves densely gland-dotted, broadly ovate, up to 6" long with petiole of equal length, margins coarsely toothed; flowers in small axillary panicles; fruits very small, globose, with single round seed inclosed by the leathery green husk.

A common tree, used for firewood and occasionally for house poles. Suitable for many of the same purposes as soft Pine.

Heartwood pale brown, with purplish tinge; sapwood white, sharply defined. Luster rather silky. Odorless and tasteless. Light and soft; medium-textured; cuts very easily, finishes smoothly, holds its place well when manufactured; is probably not resistant to decay or to insect attack. Growth rings poorly defined or absent. Parenchyma scarcely distinct with lens, occurring in irregular tangential lines of various lengths, sometimes as wings from pores. Pores open, small, but distinct, rather numerous, occurring mostly in radially flattened groups of few to several pores each. Vessel lines distinct. Rays very fine, requiring lens on cross and tangential sections; low but distinct on radial surface. (Yale 13702. Cooper 52.)

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Macaranga sp. GARFOE (Bassa). Tree 40–50' tall and 12" in diam.; twigs black, thorny, and covered with fine pubescence; bark smooth, gray-green, thin; leaves alternate, coarsely serrate, broadly oval or rounded, 3–4" long on petiole half as long, apex acuminate; flowers numerous, in short fascicles or racemes from the twigs.

A rather common tree of the second growth on abandoned farms. The dried young leaf shoots are mixed with rice and used in treating bronchitis. The wood is similar to that of the preceding species. (Yale 15334; 15834. Cooper L 102; 393.)

Macaranga sp. ZAR-ZREH-WEHN-YE (Bassa). Tree 50–60' tall and 12–15" in diam., with low buttresses; bark grayish, mostly smooth, but with some warts and cracks; twigs black and with fine thorns; leaves glabrous, alternate, oval, 3–5" long on petioles 1–2" long; flowers in small axillary racemes with tiny leaf-like bracts.

A rapidly growing tree often found on abandoned farmland. A decoction of the macerated bark is used in native medicine as an antidote for poison. The wood is like that described above and has no local uses. (Yale 15336; 15835. Cooper L 103; 395.)

Mareya spicata Baillon. CHEW (Bassa); NGUANGUA (Mendi). Tree 30–40' tall; leaves oval-oblong, tapering to base, rather shortly acuminate apex, 4–6" long with 1" petiole, margins faintly toothed; flowers very small, monoecious, in small sessile clusters on long axillary spikes.

A decoction of the bitter leaves is used as a violent purge or as a poison. The perishable wood is not utilized. (Yale 15273. Cooper 404.)

Maesobotrya edulis Hutch. & Dalz. Common tree 20–30' tall; branchlets with rusty pubescence; leaves glabrous, oval, 2–4" long, sometimes unequal at the base, petiole $\frac{1}{2}$ " long; flowers in short racemes on old wood; fruit oval, size of wild cherry, red-skinned and succulent. (Yale 13703. Cooper 53.)

Microdesmis puberula Hook. f. NIKLI (Bassa). Small tree of the under story, with greenish gray, finely furrowed bark; leaves oblong oval to ovate, 3–5" long (sometimes 1–2" long), apex long tapering and hooked, margins wavy or faintly toothed, petiole $\frac{1}{2}$ " long; male flowers very small, pale yellow, in axillary fascicles; fruit a drupe with roughened reddish skin.

This tree is used for spring traps because of the strength and resilience of the wood; also for making combs and handles of cutlery. It has been suggested as a substitute for Boxwood by Nigerian foresters. Some of the

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more credulous natives believe that for each fruit swallowed a year's immunity from boils is secured.

Wood pale brownish yellow throughout. Luster fairly high. Odorless and tasteless. Hard, heavy, strong, and elastic; texture very fine; grain fairly straight; easy to work, finishes very smoothly, takes a lustrous polish; is probably not resistant to decay. Growth rings indicated, but poorly defined. Parenchyma scarcely distinct with lens, occurring as narrow, sometimes confluent, wings from the pores. Pores minute, invisible without lens, numerous but not crowded, fairly uniformly distributed, mostly solitary. Vessel lines indistinct. Rays distinct on cross section, invisible on tangential; rather high and, in proper light, rather prominent on radial surface. (Yale 13774; 15094; 15127; 15128; 15136. Cooper 124; 153; 196; 197; 207.)

Necepsia Afzelii Prain. ZAH (Bassa). Tree 40-50' tall and 12" in diam., with gray-green, black-spotted, smooth bark; young branchlets pubescent; leaves with finely toothed margins, oval-oblong, 6-8" long, tapering to apex and base, with 1" petiole; flowers monoecious, in small fascicles from long stalks; bracts persistent.

An excellent wood, though apparently its only use is for rice pestles. It appears well adapted for articles of turnery.

Wood lemon yellow. Fairly lustrous. Odorless and tasteless. Moderately heavy and hard; fine-textured; fairly straight-grained; easy to work, finishes very smoothly, takes a glossy polish, holds its place well when manufactured; is not resistant to decay; subject to fungous stain. Growth rings apparently absent. Parenchyma in very numerous, indistinct, finely wavy, concentric lines, mostly independent of the pores; spacing 2-4 pore-diams. Pores open, very small, near limit of vision, solitary or more often in radially flattened groups of 2 to several pores each, and arranged in continuous rows or loose radial bands that are highly distinctive. Vessel lines fine and inconspicuous. Rays minute, scarcely distinct with lens on cross section; low and inconspicuous on radial surface, being of the same color as the background. (Yale 13726; 15178. Cooper 76; 263.)

Neoboutonia glabrescens Prain. BOAH (Bassa). Small tree or tall shrub. (Yale 15301. Cooper 438.)

Oldfieldia africana B. & H. f. SAYE (Bassa); PAU-LAI (Mendi); AFRICAN OAK (English). Huge forest tree over 100' tall and 4-5' in diam., with long, clear bole (when grown in high forest) and low buttresses or prop roots; bark grayish, scaly or flaky; leaves opposite, digitate, 5-8-foliate from petioles 2-3" long; leaflets glabrous, evergreen, brittle, 2-5" long, narrowly oval-oblong, acute at base and apex; male flowers in axillary cymes; fruits

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flattened, oval, woody, nut-like capsules containing 4 or 5 seeds attached to central placenta. (Plate V, No. 1.)

This tree produces one of the best timbers on the African coast for heavy and durable construction. It is used locally for keelsons in seagoing boats.

Heartwood brown or reddish brown; sapwood olive gray, not very sharply demarcated; sometimes with greenish discoloration. Luster not very high. Unscented, but with slightly bitter taste. Very hard, heavy, tough, and strong; texture medium, with rather harsh feel; grain irregular, often interlocked; difficult to work when dry, finishes smoothly; is highly durable and said to hold its place well. Growth rings poorly defined by narrow parenchyma-less bands. Parenchyma diffuse and in very numerous, short, disordered lines producing irregular reticulation scarcely distinct with lens. Pores open, very small, numerous, fairly well distributed, occurring singly or in short radial rows. Vessel lines scarcely distinct. Rays minute, invisible without lens on cross section; low and inconspicuous on radial surface. (Yale 13738; 13761; 15207; 15226; 15250; 15302; 15744. Cooper L 10; 88; 111; 295; 319; 344; 439.)

Phyllanthus discoideus Muell. Arg. Tree sometimes 60' high and 2' in diam., with clear, unbuttressed bole; branchlets brown, speckled with lentils; leaves alternate, glabrous, ovate, the larger ones 3-5" long and 1½-2" wide, on short petioles; male flowers numerous in fascicles in the leaf axils; female flowers paired; fruit a small brown capsule with 3 or 4 lobes.

Wood pale brown throughout. Fairly lustrous. Odorless and tasteless when dry. Rather heavy and hard and decidedly tough; is of about the consistency of Birch (*Betula*); texture medium fine; grain straight to irregular, sometimes wavy; not difficult to work, finishes very smoothly, takes a lustrous polish; is not resistant to decay or insect attacks. Growth rings poorly indicated. Parenchyma not visible with lens. Pith flecks sometimes present. Pores open, small, not distinct to unaided eye, numerous, occurring mostly in radially flattened rows of 2-6, the groups well distributed without pattern. Vessel lines scarcely distinct. Rays faintly visible on cross and tangential sections; low and inconspicuous on radial surface. (Yale 15299; 15852. Cooper L 120; 436.)

Phyllanthus profusus N. E. Brown. Shrub; leaves very thin, ovate-oval, 1-3" long; flowers creamy white, slightly fragrant, dioecious, the male flowers in fascicles on slender stalks which grow from the axils of leafy shoots; flower stalks generally with leaves at the tips. (Yale 15167. Cooper 246.)

Protomegalaria Stapfiana Hutch. W. A. H. (Bassa). Tree 50-60' tall and

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12-18" in diam., with no buttresses when growing in high forest, but with prop roots and low branching bole when found in swamps; bark brownish with mossy green blotches, smooth; leaves 8-12" long, obovate to oval-oblong, rounded or pointed at apex, tapering at base; flowers dioecious, the male flowers in small axillary racemes, about 3" long; fruit a globose angular capsule about 2" in diam.; seeds oval, $\frac{1}{4}$ " in diam.

The tree is rather scattered in high forest, where it reaches best development. The wood is used for planks.

Wood pale brown throughout. Fairly lustrous. Odorless and tasteless. Of medium density and weight, but hard, suggesting Beech (*Fagus*); texture medium; grain mostly straight; not difficult to work, finishes smoothly; does not appear resistant to decay. Growth rings indistinct or absent. Parenchyma in very numerous, fine, tangential lines, not visible without lens; spaced about $\frac{1}{2}$ pore-diam. apart. Pores open, not distinct without lens, numerous, well distributed, occurring singly or in small radial groups. Vessel lines very inconspicuous. Rays very distinct on cross section, but not on the tangential; high and prominent on radial surface, producing attractive silver grain. (Yale 13759; 15206; 15742. Cooper L 8; 109; 294.)

Ricinodendron africanum Muell. Arg. KOOR (Bassa); GBOLEI (Mendi). Tree 70-80' tall and 18-24" in diam., with low buttresses; leaves digitate, 3-5-foliolate from petiole 3-5" long; leaflets sessile, broadly obovate, tapering to hooked apex, terminal leaflet largest, up to 5" long, margins dotted with fine glands; male flowers in panicles 10-12" long, covered with yellow pubescence; fruit flattened-globose, 1" in diam., with green leathery rind and 2 or 3 large seeds imbedded in white pulp.

The wood is very light, soft, and perishable. It is used for planks, coffins, and for many native utensils, because it can be so easily worked. (Yale 15317. Cooper 457.)

Spondianthus ugandensis Hutch. BU-EHN-WAYE (Bassa). Tree 50-60' tall and 12-16" in diam., with no buttresses; bark scaly; leaves coarse, glabrous, broadly oval or obovate with rounded apex and base, 6-8" long on petioles from 1-4" long; flowers dioecious, the male inflorescence in terminal panicles 6-8" long; fruit oval, pointed, 1" long, reddish brown when mature.

The bark is used for a rat poison, made by boiling it with rice or other rat food. The tree is plentiful and is sometimes cut into planks. The wood is similar in appearance, structure, and properties to that of *Uapaca guineensis*. (Yale 13783; 15838. Cooper L 106; 140; 472.)

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Tetrorchidium didymostemon Pax & Hoff. P_{LOR}-P_{LOR} (Bassa). Small tree 30-35' high and 8-18" in diam.; bark smooth, thin, grayish; leaves glabrous, alternate, oval to slightly obovate, 2-4" long, sharply pointed at apex, tapering to base; flowers dioecious, the male flowers on short yellowish spikes opposite the leaves, the female solitary or in small groups from short axillary pedicels. Wood soft, colorless, and perishable; not utilized. (Yale 15300; 15844. Cooper L 112; 437.)

Tetrorchidium oppositifolium Pax & Hoff. P_{LOR}-P_{LOR} (Bassa). Small tree very similar to preceding, but with opposite branchlets and leaves, leaf margins dentate, male spikes axillary. (Cooper 377.)

Uapaca guineensis Muell. Arg. B_E-Y_{OR} (Bassa); K_{INDI} (Mendi); SUGAR PLUM; RED CEDAR (English). Forest tree 75-90' tall and 2-3' in diam., with stout prop roots and fluted bole; outer bark reddish gray, roughened or plated; inner bark reddish, with red sap; leaves glabrous, leathery, bunched at twig ends, broadly obovate, rounded or bluntly pointed at the apex, tapering to base, 4-6" long, with petiole up to 2" long; male flowers in globose heads, surrounded by 6 bracts resembling sepals, on axillary pedicels $\frac{1}{2}$ - $\frac{3}{4}$ " long; female flowers solitary within involucre; fruits greenish yellow, indehiscent capsules, 1" in diam., with 3 or 4 seeds. (Plate V, No. 2.)

The fruits, which are sweet and aromatic, are used for cough medicine when the capsules are green and spongy. The wood is used for canoes, planks, and timbers. It is hard, durable, and very attractively figured when quarter-sawed. Because of its reddish color it is occasionally exported with Mahogany.

Heartwood reddish or chocolate brown; sapwood light brown. Not highly lustrous. Odorless and tasteless when dry. Hard, heavy, and strong; texture coarse, with rather harsh feel; grain straight to irregular; not difficult to work, finishes smoothly; holds its place well when manufactured; appears highly durable. Growth rings apparently absent. Parenchyma not visible with lens. Pores open, distinct, numerous, well distributed, occurring singly or in radial pairs, without definite pattern. Vessel lines coarse, but not conspicuous. Rays distinct on cross section, visible on the tangential; high and very prominent on radial surface, appearing darker than background and producing attractive silver grain. (Yale 13790; 15210; 15741. Cooper L 7; 147; 298.)

Uapaca Heudelotii Baill. Tree 50' tall and 2' in diam. when growing in high forests, but shorter and with coppice shoots when found along streams; outer bark grayish brown, scaly or plated; inner bark thin, with red sap;

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leaves glabrous, oblong, oval to slightly obovate, 2-5" long, with bluntly pointed apex, male flowers with creamy white bracts, fragrant, otherwise similar to *U. guineensis*. The wood is similar to that of *U. guineensis* in appearance, structure, properties, and uses. (Yale 15113. Cooper 179.)

29. AMYGDALACEAE

This family (often included with the Rosaceae) consists of trees, shrubs, or herbs with compound or simple leaves, mostly alternate, generally with paired stipules; flowers mostly perfect, either regular or irregular; fruit may be a pome, drupe, follicle, or achene. Woods generally hard and heavy, grayish to reddish pink in color, and of local importance for use in carpentry and heavy construction, although not very resistant to decay in exposed situations.

Acioa Barteri Engl. (probably). MONKEY-FRUIT (English). Tree of common occurrence, 40-50' tall and 6-10" in diam. with no buttresses; leaves simple, 1-2½" long, oval, glabrous; flowers white, fragrant, on simple racemes; fruits solitary, egg-shaped, with greenish, leathery rind, watery pulp; seed cavity with finely pubescent lining. The fruit has a sweet odor and taste and is eaten by animals. The bark liquor is used for a purge by natives. Wood has no use except for firewood.

The wood is similar to those of the following species, the principle difference being that the rays are not aggregated. (Yale 13770. Cooper 120.)

Acioa scabrifolia Hua. SEE (Bassa). Tree, said to be plentiful, 50-60' tall with long slender bole, sometimes forked; buttresses very low or lacking; leaves simple, alternate; flowers in racemes, white with pink tint; fruit ovoid, greenish, turgid with watery pulp. The wood is used for native rice pestles and mortars and is suitable for implement frames and heavy construction not too exposed to decay.

Wood pale brown. Odorless and tasteless. Hard and heavy; rather coarse-textured; suggests Live Oak (*Quercus virginiana*). Growth rings absent or indistinct. Parenchyma in numerous, fine, very irregular, concentric lines. Pores large, readily visible, open, in radial bands. Vessel lines distinct. Rays very fine and numerous; some of them aggregated, giving the appearance of very broad and high, Oak-like rays; a very unusual feature for this family. (Yale 13748. Cooper 98.)

Acioa sp. DEE-WAYE (Bassa). Fairly plentiful; much like preceding. Wood is used for rice mortars because strong and durable; occasionally also for small timbers. (Yale 13749. Cooper 99.)

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Chrysobalanus ellipticus Soland. TAH; PAHN-DOH (Bassa). Rather plentiful tree, up to 60' tall and 2' in diam., but smaller and with branching bole when found in swamps and along rivers; buttresses low or absent; outer bark finely cracked, scaly, creamy brown; inner bark dark brown; leaves simple, alternate, obovate, glabrous, reticulate; flowers white or with pink tint, axillary in small clusters; twigs speckled; fruit plum-like and purplish red. Natives use the timber for purposes requiring strength and durability.

Wood brownish. Odorless and tasteless when dry. Very hard, heavy, and strong; medium-textured; fairly straight-grained; not easy to work, but finishes smoothly. Growth rings apparently absent. Parenchyma in very numerous, fine, wavy, concentric lines spaced about two pore-diams. apart; faintly visible without lens. Pores barely visible, not very numerous, arranged in irregular diagonal rows. Vessel lines fine, not distinct. Rays very numerous, fine, invisible on cross and tangential sections; fine and inconspicuous on radial surface. (Yale 15123. Cooper 191.)

Parinarium excelsum Sab. KPAR (Bassa); NDANWI-BADGI (Mendi); ROUGH-SKIN PLUM (English). Large, plentiful, widely distributed forest tree with high narrow buttresses, fluted bole, huge branches, and full crown; bark light gray-brown with fine lenticels, roughened, and medium thick; twigs speckled; leaves glabrous, bright green on upper surface, but with brown tinge underneath, simple, alternate, conspicuous parallel veins on each side of the midrib and at right angles to it; flowers in axillary clusters, showy, rose-colored, fragrant; fruit large, egg-shaped, about size of plum, with rough, leathery skin and mealy aromatic flesh relished by natives. Wood used locally for planks, timbers, and furniture. It is hard and heavy, but not very durable when exposed to weathering. The inner bark is soaked in rum or gin for medicinal purposes.

Wood rather dull gray-brown with pinkish hue. Odorless and tasteless when dry. Hard and heavy, tough and strong; medium-textured, with rather irregular grain, not easy to work, but finishes smoothly. Growth rings not visible. Parenchyma in fairly regular concentric lines less than one pore-width apart; visible. Pores large, readily seen, rather few in number, with tendency to diagonal arrangement. Vessel lines distinct. Rays exceedingly fine, scarcely distinct with lens on cross and tangential sections; fine and inconspicuous on radial. (Yale 13743; 15185; 15811; 15828. Cooper L 79; 93; L 96; 270.)

Parinarium Kerstingii Engl. ZWAHN (Bassa). Forest tree, sometimes

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75-85' tall and 2' in diam., with long, clear bole, low prop roots or flutes; outer bark scaly and grayish; inner bark brown; leaves simple, alternate, with few pairs of parallel veins; flowers and fruits somewhat similar to preceding.

A decoction of the inner bark is used for treating dysentery. The wood is of the same general character as that of the preceding. (Yale 15251; 15314; 15793. Cooper L 61; 345; 454.)

Parinarium sp. VE-AY-DWEH (Bassa). Forest tree, frequently 75' tall and sometimes 2' in diam., with straight bole and low buttresses, if any; bark reddish green, pitted; twigs speckled; leaves glabrous on top but light brown underneath, the veins conspicuous, parallel; flowers in clusters; fruits said to be plum-like with stony centers. Wood used for planks and timbers, being strong and heavy, but not durable on exposure. Bark said to be poisonous. The name "ve-ay-dweh" (or "ve-ay-du-ah") means literally "to hide oneself," the reference being to the habit of a red monkey, called "dweh," to get into the foliage for concealment against the brown underside of the leaves.

The structure of the wood is similar to that of *P. excelsum*. (Yale 15158; 15209; 15308. Cooper 232; 297; 446.)

30. CAESALPINIACEAE

A large family of trees, shrubs, and a few herbs, mainly tropical and subtropical; one of the subdivisions of the Leguminosae. Most of the plants have pinnate or bipinnate leaves and clusters of showy flowers. The woods are typically hard, heavy, highly colored, and durable. Two species widely planted are the Flamboyant (*Delonix regia* Raf.), a highly decorative tree of Madagascar, and Logwood (*Haematoxylon campecianum* L.), a tropical American dyewood. Of the 37 genera listed for West Africa, at least 22 are known to be represented in Liberia.

Azelia bracteata T. Vogel. SMAR-NE-EH (Bassa). Tree 70-80' tall and 2-3' in diam., with clear bole and large gnarled branches forming heavy crown; buttresses absent or stout and about 4' high; bark brownish yellow, ridged; leaves compound, alternate, 6-10" long; leaflets very glabrous and shiny above, 4 or 5 pairs, 3-5" long, broadly oval-oblong, with very bluntly pointed apex and wedge-shaped base, with reticulations and veins conspicuous; flowers in flat panicles; one petal developed, creamy white, with pink streaks or lines, green softly pubescent; calyx lobes 4, fruit pods

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numerous, showy, 6" long, 2½" broad, flattened, pointed or hooked at apex; seeds bean-like, black set in a bright red aril; cells white. The trees supply material for canoes and for planks, the thick white sapwood being discarded because perishable. The wood is of excellent quality for general construction.

Heartwood uniform olive brown, with somewhat oily appearance; sapwood gray, sharply demarcated. Luster low. Odorless and nearly tasteless. Of medium weight and hardness; texture coarse, uniform; grain straight; very easy to work, finishes smoothly, holds its place well when manufactured; is resistant to decay and insect attacks. Growth rings visible, usually limited by fine parenchyma line or band. Parenchyma abundant but not conspicuous; in rounded or diamond patches about pores and sometimes connecting them; also in fine, continuous or broken, lines terminating growth rings. Pores open, distinct, fairly numerous, well distributed without definite pattern, occurring singly or in small radial groups. Vessel lines deep and distinct, but not very conspicuous. Rays invisible without lens on cross and tangential sections; low but distinct on radial surface. Ripple marks absent. No gum ducts observed. (Yale 13744; 15245; 15794. Cooper L 62; 94; 339.)

Berlinia auriculata Benth., *B. bracteosa* Benth., and *B. grandiflora* Hutch. & Dalz. (Plate VI, No. 1.), GBOR-DU-ORH (Bassa); KPENDEI (Mendi); RED OAK (English). Forest trees, attaining a height of 100' and diam. of 3-4'; sometimes with low, wide buttresses; bole generally clear for most of its length, occasionally fluted; crown spreading and at extreme top only; bark medium thin, gray-brown, scaly or plated. The last two species have 4 pairs of glabrous, leathery leaflets, 6-8" long, oval-oblong, with bluntly pointed apex; inflorescence in terminal compound racemes or panicles; flowers fragrant, on pedicels 2" long, bracts and pedicels covered with grayish velvety pubescence; petals creamy white, fan-like from constricted base, 2" long; anthers 3" long, needle-like; fruit a flat pod shaped like sole of shoe, 8-12" long, 2-3" wide; seeds angular, ¼" thick. The pods project horizontally from branches and are very conspicuous. *B. auriculata* has much smaller leaflets, which are eccentric and hooked at apex, the flowers and fruits are smaller, and the foliage is dark green and lacks the grayish hue of the other species.

The woods are employed for carpentry and general cabinet-making without discrimination as to species. The reddish heartwood is resistant to the boring insects, but the thick, pale sapwood is perishable. The natives use the seeds as bait for rodents, and the juice of the inner bark of *B. auriculata*

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sometimes for earache, the liquid being dropped into the ear with a leaf funnel.

Heartwood reddish brown, sometimes with darker streaks; sapwood gray, sharply demarcated. Luster rather low. Without odor or distinctive taste when dry. Moderately hard, heavy, tough, and strong; texture coarse to very coarse, with harsh feel; grain mostly irregular; fairly easy to cut, not very easy to finish smoothly; holds its place well when properly manufactured; is highly durable. Growth rings distinct, being limited by parenchyma in line or band of variable width. Parenchyma abundant about pores and pore groups, appearing in distinct rounded or diamond patches, sometimes confluent; occasionally in isolated patches independent of the pores; also terminal. Pores open, very distinct, not very numerous, fairly well distributed without definite pattern, occurring singly or sometimes in small groups. Vessel lines coarse and very distinct. Rays invisible without lens on cross and tangential sections; low and very inconspicuous on radial surface. Ripple marks absent. Large, vertical, intercellular canals ("gum veins") of the gummosis type, common in peripheral rows as result of injury. (*B. auriculata*: Yale 15145; 15197. Cooper 218; 283. *B. bracteosa*: Yale 15111. Cooper 177. *B. grandiflora*: Yale 15144. Cooper 217.)

Bussea occidentalis Hutch. DAHN-KAY (Bassa). Tree 75-90' tall and 2½-3' in diam., without buttresses; leaves bipinnate, leaflets alternate; subleaflets alternate or subopposite, glabrous, dark green, reticulate, oblong-oval, 3-5" long, with long tapering apex; flowers slightly fragrant, in racemes 5-8" long, the entire closed inflorescence covered with heavy velvety brown pubescence; petals bright yellow, showy; fruit an erect, oblong-lanceolate pod 5-6" long and 1-2" broad, densely pubescent, rather elastic when young, becoming smooth and brittle after breaking open and curling back to free the thick, oily seeds. (Plate VI, No. 2.)

The seeds are rather sweet and are roasted over fire before being eaten. Both seeds and inner bark are considered good medicine for heart trouble. The wood is too hard for local utilization.

Heartwood lustrous olive brown; sapwood gray. Odorless and tasteless when dry. Very hard, heavy, tough, and strong; texture coarse, with harsh feel; grain roey; difficult to cut, being rather flinty; not easy to work, being splintery and tending to tear out; probably highly resistant to decay and insect attacks. Growth rings absent or poorly defined. Parenchyma fairly abundant, in distinct rounded or diamond patches about pores and pore groups, sometimes uniting them. Pores open, visible, numerous but not crowded, occurring singly or in small, radially flattened groups fairly well distributed without definite pattern. Vessel lines inconspicuous. Rays barely

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visible on cross and tangential section; low and inconspicuous on radial surface. Ripple marks absent. (Yale 15269; 15840. Cooper L 108; 400.)

Cynometra ananta Hutch. & Dalz. DAH (Bassa). Forest tree, sometimes 100' tall and 3' in diam., having straight clear bole with narrow buttresses 6-10' high; bark gray-green on young trees, reddish brown on old ones, scaly or rough; leaflets glabrous, 1 pair (rarely 2 pairs), eccentric, sharply pointed, broadly oval, 2-3" long; flower buds grayish, in stout racemes, covered with brown pubescence; fruit a flat, oblong pod, 2-3" long and 1" wide.

The leaves are used in native witchcraft. When a man wants to get a message to a friend far away or wants this person to return to the village, he makes a snuff out of the dried leaves and blows it from his hand in the direction of the far-off friend, at the same time calling his name or giving the message.

The wood is used locally for posts and timbers. It should be suitable for railway crossties, bridge timbers, and other heavy, durable construction.

Heartwood dull reddish brown; sapwood light brown, with very sharp line of demarcation. Odorless and tasteless when dry. Very hard, heavy, tough, and strong; texture rather fine; grain straight to somewhat roey; not easy to work when dry, being rather flinty to cut across the grain, but can be finished very smoothly; appears highly durable. Seasonal growth rings indicated by wider spacing and more orderly arrangement of parenchyma lines. Pores open, small, scarcely distinct without lens, not very numerous, occurring singly or less often in pairs or radially flattened groups; connected tangentially by parenchyma bands. Vessel lines inconspicuous. Parenchyma in very numerous, wavy, continuous bands connecting the pores; average spacing about 2 or 3 pore-diams.; visible on cross section and showing as fine pattern on tangential. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks present, though often of local occurrence and very irregular; readily visible. (Yale 15280; 15814; 15822. Cooper L 82; L 90; 411.)

Daniella similis Craib. WHOE (Bassa); COPAL (English). Very large evergreen tree, with thick reddish brown bark dotted with lenticels; flowers blue-violet and conspicuous when the tree is in full bloom; leaves and fruits much the same as preceding. The tree is found in clumps or groves and not scattered singly over any extensive area. This is probably due to the easy germination of the seeds, which immediately take root in the soil near the

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seed tree. The anatomy of the wood is similar to that of the species described. (Yale 15229. Cooper 322.)

Daniella thurifera Bennett. SRU-AH (Bassa); GUM COPAL (English). Forest tree sometimes 125' tall and 4-5' in diam., with unbuttressed bole equal to half the height; bark dark green-gray, very thick, rough but not broken; leaves pinnate, sometimes 12" long, alternate; leaflets glabrous with a grayish cast, subopposite, oblong, somewhat eccentric or unequal at base and with tapering apex, 2-4" long, smaller on flowering branches; flowers slightly fragrant, in open panicles on pedicels $\frac{1}{2}$ " long; calyx lobes brownish, marked with resinous dots; anthers reddish and covered with dense hairs near the base; fruit an angular, oval, flat pod 3" long.

The large trunks are made into canoes and also cut into planks because the wood works easily. The resin in heartwood renders it durable; the white sapwood is 2-3" thick and perishable. The living tree is often tapped for the resin, which is used by the native women to anoint their bodies. It is sticky, creamy colored, and has a pungent odor. A clear oil is extracted from the seeds which is used for the same purpose and for hairdressing.

Heartwood brown, with darker striping and a golden luster; sapwood gray, sharply defined. Without distinctive odor or taste when dry. Light and soft, but tough and strong for its weight; darker zones considerably harder than remainder of wood; texture medium coarse, with soft feel; grain mostly straight; easy to cut, but not easy to finish smoothly as the surface is woolly and tends to tear out; holds its place well when manufactured; is resistant to decay. Growth rings distinct, due to differences in color and also to parenchyma band. Parenchyma distinct, in concentric lines or narrow bands, mostly widely spaced and terminal, occasionally doubled or tripled; also in narrow circlets around pores, rarely aliform. Pores open, distinct, not very numerous, fairly well distributed, occurring singly or less often in pairs or small groups. Vessel lines prominent, the short segments showing clearly under lens. Rays faintly visible on cross and tangential sections; low, distinct, but not conspicuous, on radial surface, appearing darker than background. Ripple marks present, readily visible, fairly uniform, all elements storied, though some of the rays occupy more than one tier. Vertical gum ducts present normally; small, scattered, inconspicuous. (Yale 13727; 13745; 15805. Cooper L 73; 77; 95; 350.)

Detarium senegalense Gmel. KPAY (Bassa); KOLEI (Mendi); DITA (English). Tree sometimes 125' tall and 6" in diam., with low buttresses, straight bole clear for 50-60"; crown rounded, spreading; bark bluish gray, scaly; leaves alternate, pinnately compound, 6-12" long; leaflets coarse, glabrous, 2-2 $\frac{1}{2}$ " long, oblong-ovate, with rounded or slightly notched apex

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and rounded or flat base; flowers small, creamy, fragrant, buds globose, in short axillary panicles; fruit flattened, oval or circular, 2" in diam., with leathery green husk when young and a fibrous covering at maturity, containing one large, flat, white seed. (Plate VII, No. 1.)

The ripe fruit is succulent and edible, with a sweet flavor; most palatable when cooked. Rotting fruits have a nauseating odor. The dried fibrous husk has a superficial resemblance to *Irvingia* and the natives occasionally confuse the two trees. The wood has the general appearance and properties of Walnut (*Juglans*) and is used locally for planks, canoes, and furniture; the heartwood is said to be resistant to termites.

Heartwood a rich, lustrous, dark brown; sapwood gray, sharply demarcated. Odorless and without distinctive taste when dry. Of medium weight; hard and strong; texture rather coarse; grain straight; easy to work, finishes very smoothly, though with some tendency of the fibers to pull out; holds its place well when manufactured; appears highly resistant to decay and insect attacks. Growth rings rather clearly defined. Parenchyma in terminal bands of variable width, sometimes doubled or trebled; sparingly developed about pores, occasionally short aliform. Pores open, distinct, not very numerous, well distributed without definite pattern, occurring singly or occasionally in short, radially flattened groups. Vessel lines rather coarse, but not conspicuous. Rays faintly visible without lens on cross and tangential sections; low but distinct on radial surface, being somewhat darker than background. Ripple marks absent. Vertical gum ducts normally present, very few, and small, mostly in association with terminal parenchyma. (Yale 15270; 15810. Cooper L 78; 401.)

Erythrophloeum guineense G. Don. JRU (Bassa); GOGWI (Mendi); SASSYWOOD; ORDEAL TREE (English). Forest tree sometimes 100' tall and 6' in diam., with somewhat crooked or gnarled bole, low broad buttresses, and stout limbs forming a large spreading crown; bark moderately thick, plated but not deeply furrowed, sometimes pitted, reddish brown in color with white spots below surface; leaves doubly pinnate; primary leaflets opposite, 6-10" long; subleaflets alternate, glabrous, dark green, oval-ovate, 2-4" long, with long tapering apex and wedge-shaped base; finely reticulate; flowers fragrant, creamy to reddish in color, in spike-like racemes; fruit sometimes 5" long, flat, glabrous, leathery when green, brittle and woody when mature, with 5-10 flat seeds which remain for some time in pod after it opens.

This tree is the notorious "Ordeal Tree" of Africa, the bark of which contains a virulent poisonous alkaloid used in native court procedures to

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test the guilt or innocence of accused. The victim must drink a bowl of liquor made from the macerated bark. If he dies from the poison he is voted guilty, if he lives he is declared innocent. If the victim can vomit he will generally recover, and this reaction is construed as proof that the "Sassywood" does not want to hurt the accused. The timber is used locally for heavy construction because of its strength, durability, and immunity to termite attack. It is attractive in grain and figure and suitable for veneers for cabinet-work and furniture.

Heartwood rich orange-brown, becoming reddish brown upon exposure; sapwood gray, rather sharply demarcated. Luster golden. Odorless and without distinctive taste when dry. Hard, heavy, tough, and strong; texture coarse; grain roey; not easy to work, tending to dull tools, finishes smoothly and takes a glossy polish; is highly durable. Growth rings poorly defined. Parenchyma distinct, abundant, mostly in diamond patches about pores and tending to connect them tangentially or diagonally, sometimes forming irregular concentric bands. Pores distinct, fairly numerous, rather uniformly distributed without definite pattern except as joined by parenchyma, occurring singly or occasionally in radial pairs; some of them closed with gummy deposits. Vessel lines coarse and rather conspicuous. Rays minute, invisible without lens on cross and tangential sections; low and scarcely distinct on radial surface. Ripple marks absent or local, in the latter case very irregular. No gum ducts observed. (Yale 13791; 15751. Cooper L 17; 148; 386.)

Loesenera kalantha Harms. JEN-NEE or GENI (Bassa). An infrequent tree 50-60' tall, 12-16" in diam., with clear, straight bole and low wide buttresses; leaves pinnate, alternate, 6-8" long; leaflets opposite, 3-4 pairs, glabrous above, leathery, 2-3" long, oval-lanceolate, with tapering apex and unequal, wedge-shaped, finely pubescent below; flowers in terminal racemes, shortly stalked, pinkish; fruit pod very hard when dry, 6-8" long, broadly oblong with angular base and pointed apex, the surface covered with brownish velvety pubescence.

This tree has great significance in native witchcraft. Before governmental control of the interior was established it was so serious an offense for a native to damage the tree in any way without authority that the death penalty was sometimes invoked. It is reputed to be the "medicine reviver" and to have power of strengthening all jujus and charms which have become ineffective. By paying a fee to the witch doctor and obtaining his permission, a native can consult the tree on important matters. In doing so he first takes ashes from the hearth and sprinkles them below the tree very

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early in the morning. He then slashes off a piece of the bark, and in the way it falls on the ground reads the answer to the questions he has put to the spirit of the tree.

Heartwood slightly pinkish or brownish; sapwood white, not clearly demarcated. Luster rather bright. Odorless and tasteless. Of moderate weight and hardness, but tough and strong; texture rather fine; grain mostly straight; easy to work, finishes smoothly; is not durable. Growth rings absent or poorly defined; occasionally indicated by pore-less zones. Parenchyma about pores and in long, wavy, often confluent lines or narrow bands, scarcely distinct without lens. Pores open, faintly visible, rather few, fairly well distributed, occurring singly or in 2's or 3's, without pattern. Vessel line fine but distinct. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 15320; 15851. Cooper L 119; 461.)

Macrolobium Chevalieri Harms. SEHN (Bassa). Tree sometimes 60' tall and 2' in diam., with straight bole and no buttresses; twigs rusty brown; leaflets 5 or 6 pairs, oblong-obovate, with very abruptly pointed apex; flower buds $\frac{3}{4}$ " long; one white petal very large with claw-like appendage; pistil covered with velvety pubescence; fruit pod 8" long, rusty brown. (Plate VII, No. 2.)

The wood is used for planks and timbers. The juice from the inner bark is applied to the eyes as a remedy for certain fevers.

Heartwood dull reddish brown to purplish brown, somewhat streaked; sapwood brownish, sharply demarcated. Odorless and tasteless. Hard, heavy, tough, and strong; texture rather fine; grain straight to irregular; not difficult to work, finishes smoothly; appears durable. Growth rings poorly defined, sometimes indicated by differences in color. Parenchyma distinct in diamond patches about pores, rarely confluent; also in occasional, fine tangential lines, of indeterminate length, independent of the pores; perhaps terminal. Pores open, distinct because of parenchyma, fairly numerous, uniformly distributed without pattern, occurring singly or infrequently in pairs. Vessel lines fine, but mostly distinct because of parenchyma sheaths. Rays minute, invisible on cross and tangential sections without lens; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 15291; 15850. Cooper L 118; 427.)

Macrolobium Heudelotii Planch. GOB-BOH; ZOE (Bassa). Tree 50-60' tall and 15-18' in diam., with low buttresses; leaflets 3 pairs, oval, 2-3" long, pale green, with stout black petioles, reticulate; inflorescence much elongated, up to 18", with short lateral branches containing clusters of

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flowers; flower buds $\frac{1}{4}$ " long, gray-green to yellow; pods flat, 6" long, curved, with ridged nerves, velvety brown. The tree is scarce in this locality. The wood is used for planks and the seeds for food.

Heartwood rather dull purplish brown; sapwood pale brown with yellowish luster. Odorless and tasteless. Very hard, heavy, tough, and strong; texture moderately coarse; grain fairly straight; not easy to cut, finishes smoothly; is highly durable. Growth rings present. Parenchyma distinct, in rounded to diamond patches about pores, occasionally confluent; also in concentric lines or bands mostly widely spaced and apparently terminating seasonal growth rings, occasionally closely and irregularly spaced. Pores small, distinct because of parenchyma, not very numerous, well distributed without pattern, occurring singly or in radial pairs. Vessel lines fine, but prominent, appearing lighter than background. Rays minute, invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. Gum ducts not observed. (Yale 13750; 13757; 15788. Cooper L 56; 100; 107.)

Maclobium macrophyllum Macbr. GAB-BOH; GBAY-VLEHN; ZOE (Bassa). Fairly common tree 75' tall, sometimes with clear bole, but often with low branching crown; bark dark gray-brown, finely ridged or roughened; inner bark and wood with resinous sap suggesting *Prioria*; branchlets covered with rusty brown pubescence; leaflets glabrous, mostly 3 or 4 pairs, oval to obovate, 2-4" long, sometimes with hooked apex; flowers white to yellow, in pubescent panicles; fruit pod flat, curved, ridged with many veins, containing 4-8 flat, angular seeds. The resin is employed as a liniment for body pains.

When the natives are making clearings for farms they first cut out the undergrowth and small trees and then wait until the pods of this tree have burst, which is near the end of the rainy season, before felling the large trees. The proper season is indicated by the expression "Zoe-rah-gah," meaning "Zoe is opened."

Heartwood reddish or purplish brown, streaked or variegated; sapwood pinkish, sharply demarcated. Not highly lustrous. Odorless and without distinctive taste when dry. Very hard, heavy, tough, and strong; texture rather coarse; grain straight to roey; not easy to cut, finishes smoothly; appears highly durable. Growth rings absent or poorly defined. Parenchyma distinct, abundant about pores and extending in long, irregular wings, often confluent; also more or less in short to long, irregular lines or bands independent of pores, but not appearing to be terminal. Pores rather small, distinct because of parenchyma, fairly numerous, well distributed without pattern, occurring singly or less commonly in small, radially flattened

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groups; many of them with yellowish gum deposits. Vessel lines fairly distinct. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. Large, vertical gum ducts, gummosis type, sometimes present and producing "gum veins." (Yale 15151; 15761; 15797. Cooper L 29; L 65; 225.)

Oligostemon pictus Benth. КРОЕ-KOHN; JE-YE-NEH-DOO (Bassa). Climbing shrub; leaves pinnate; leaflets 3 pairs, opposite, ovate to oval with acuminate apex and rounded base, 3-4" long; flowers on erect terminal racemes with velvety brown sepals and pink, yellow, or white, unequal petals; fruiting pod 3-4" long, becoming twisted after opening.

The macerated stem of this shrub is used to accelerate the fermentation of the native palm wine. (Yale 13714. Cooper 64; 135; 245; 390.)

Oxystigma Stapfiana A. Chev. KAHN (Bassa); RED PINE (English). Forest tree sometimes 100' tall, with slight basal prop roots; bark gray-brown, slightly rough; leaflets 3 or 4 pairs, the uppermost pair 6-8" long and oblanceolate, the lowest much smaller and oval; inflorescence in densely crowded spikes, 3-4" long, several arising from same stem and hanging like tassels; petals 5, conspicuous in bud, white to pink; base of pistil red; pods open with loud report, scattering seeds.

The leaves are used for thatching huts. The wood is not durable against termites and is little used for lumber.

Heartwood red and yellow striped; sapwood pinkish gray, rather sharply defined. Luster fairly high. Odorless and tasteless when dry. Moderately hard, heavy, tough, and strong; texture medium; grain mostly straight; easy to work, finishes very smoothly, takes a glossy polish; not very resistant to decay or insect attacks. Growth rings poorly defined; sometimes indicated by narrow pore-less zones. Parenchyma abundant but inconspicuous in heartwood, in irregular diamond patches about pores, sometimes aliform and confluent. Pores small, distinct, numerous, well distributed without pattern, occurring singly or in radial pairs; many closed with gum in heartwood. Vessel lines fine but very distinct. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 15173; 15770. Cooper L 38; 256.)

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A family of trees and shrubs, very rarely herbs, mainly tropical and subtropical; often a prominent component of the thorn forests of dry regions. The leaves are mostly bipinnate and the flowers are small and in spikes, racemes, or heads. One of the trees most widely planted in semiarid coun-

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tries is the American Mesquite or Algarroba (*Prosopis*). Among the common low trees of the tropical American forest are numerous species of *Inga*, often planted to shade coffee and cacao. The woods vary from very hard and heavy to light and soft. Among the commercial timbers are the so-called East Indian Walnut (*Albizzia*), the Argentine Timbo and the Mexican Guanacaste (*Enterolobium*), the Cuban Sábicu (*Lysiloma*), and the southern South American Angico and Curupay (*Piptadenia*). There are 21 genera listed for West Africa, but only six of them are represented in the present Liberian collections.

Albizzia sassa Macbr. This species closely resembles the next one, but has smaller and more numerous leaflets. The wood is somewhat coarser-textured. The pores are larger, and parenchyma more abundant. (Yale 15271x. Cooper 402x.)

Albizzia Zygia Macbr. QUEH-MAHR; BLORH-FEH (Bassa); BPAK-PEI (Mendi). Tree 75-90' tall and 2-4' in diam., with straight bole and no buttresses; leaves bipinnate, pinnae 2 or 3 pairs; leaflets 3-5 pairs, inequilateral, 1-1½" long; flowers capitate, creamy white with reddish stamens; fruit a flat, papery, netted-veined pod with flat, disk-shaped seeds.

This tree is well distributed through the forests. The wood is used for planks and for making canoes, because it is easy to work. An excellent timber for general carpentry and plywood where attractiveness of color or figure is not a consideration.

Heartwood pink or pinkish brown; sapwood gray, sharply defined. Luster silky. Odorless and tasteless. Light and soft, but firm and tough in proportion to its density; texture medium, uniform; grain straight to somewhat roey; very easy to work, saws rather woolly, finishes smoothly when dry, holds its place well when manufactured; does not appear durable under exposure. Growth rings sometimes distinct, due to slight differences in density and color. Parenchyma rather sparingly developed in partial circles about pores; indistinct without lens. Pores open, small but distinct, fairly numerous, occurring singly or more often in radially flattened groups, well distributed without definite pattern. Vessel lines fine but distinct. Rays near limit of vision on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 13769; 15813; 15818; 15824; 15846. Cooper 81; 86; 92; 114; 119.)

Calpocalyx brevibracteatus Harms. KPU-AH (Bassa). Tree 60-80' tall and 1-1½' in diam. (occasionally 100-125' and 3-4' in diam.), with long slender bole and no buttresses; bark purplish brown, smooth, thin; leaves doubly compound, the pinnae in pairs; leaflets glabrous, opposite, ovate,

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2-4" long with tapering and sometimes hooked apex; inflorescence brownish, the small flowers clustered on spikes branching from central stalk; anthers reddish; fruits paired, sickle-shaped, flat pods, 6-10' long, with flat angular seeds.

The macerated bark is used to make a mouth wash. The wood is little used because of the difficulty in working it, though it is very attractive when properly finished.

Heartwood variegated brown, red, and black with pencil striping of parenchyma lines; sapwood gray. Not highly lustrous. Odorless and tasteless when dry. Very hard, heavy, tough, and strong; texture rather coarse; with harsh feel; grain mostly irregular; difficult to work; requires care in seasoning; appears durable. Growth rings absent or poorly defined. Parenchyma abundant, in irregular masses about pores and often confluent into a disordered mass; conspicuous on tangential surface of darker zones. Pores rather small but visible, numerous but not crowded, fairly well distributed with some tendency to diagonal arrangement, occurring singly or in small radially flattened groups; many of them closed with gum deposits in heartwood. Vessel lines fine. Rays minute, invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 13706; 13777; 15241; 15758. Cooper L 25; 56; 127; 335.)

Parkia bicolor A. Chev. BOE (Bassa); GUMNI (Mendi); LOCUST BEAN (English). Tree sometimes 100' tall and 4' in diam., with tall narrow buttresses or low basal swelling; bark blackish brown, scaly or roughened, somewhat stringy; twigs speckled; leaves doubly pinnate, 12-15" long; pinnae opposite, 3" long; leaflets less than 1/2" long, sessile, oblong, with rounded apex; flowers pink to yellow, fragrant, in ball-like clusters hanging from long stalks; fruit pods very numerous, clustered, sometimes 16" long, somewhat flattened, constricted between the seeds. (Plate VIII, No. 1.)

A tree of common occurrence on the drier areas, especially near the deciduous forest. The seeds are eaten by animals. The wood is medium soft and easy to work into canoes and planks. The fresh wood has a fetid odor.

Heartwood brown, with golden luster; sapwood nearly white. Odorless and tasteless when dry. Rather light and soft, but firm and tough; texture coarse; grain straight to roey; very easy to cut, saws rather woolly, can be finished smoothly when dry; durability doubtful. Growth rings absent or poorly indicated. Parenchyma in diamond patches about pores, often aliform and irregularly confluent; not very distinct. Pores open, rather small but visible, not very numerous, fairly evenly distributed without definite pattern,

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occurring singly or less often in radially flattened groups. Vessel lines distinct. Rays indistinct without lens on cross and tangential sections; low and not very prominent on radial surface, though darker than background. Ripple marks absent. No gum ducts observed. (Yale 15117; 15244; 15768. Cooper L 36; 185; 338.)

Pentaclethra macrophylla Benth. BLAY-BU (Bassa); FAI (Mendi); OIL-BEAN TREE, WILD LOCUST (English). Tree 60-70' tall and 2' in diam., with long, clear bole and no buttresses; bark greenish yellow, slightly furrowed or scaly; leaves doubly compound, 12-18" long; pinnae 4-6" long, opposite; leaflets glabrous, $\frac{1}{2}$ - $\frac{3}{4}$ " long, rectangular, sessile, midrib oblique; rachis of main leaf and pinnae covered with rusty brown pubescence; flowers in spike-like panicles, creamy yellow, fragrant, very small and tubular in bud, the anthers conspicuous in bloom; fruiting pod about 12" long and 3" wide, with thick woody valves which open explosively and re-curve, discharging the large flat angular seeds.

This tree is plentiful, especially in second growth. The wood is used for planks and timbers. The fragrantly scented seeds are beaten up and used to flavor palaver sauce.

Heartwood olive brown to reddish brown, with a subdued golden luster; sapwood nearly white, rather sharply demarcated. Odorless and tasteless when dry. Very hard, heavy, tough, and strong; texture coarse; grain irregular, often interlocked; difficult to work, but finishes smoothly and takes a glossy, waxy polish; requires care in seasoning; is highly resistant to decay and insect attack. Growth rings absent or poorly indicated. Parenchyma very distinct, in large rounded or diamond patches about pores and frequently connecting them irregularly; occasionally also in fine lines, perhaps terminal. Pores distinct, mainly because of parenchyma halos, fairly numerous, uniformly distributed without pattern, occurring singly or occasionally in pairs; often closed with whitish gum deposits in heartwood. Vessel lines coarse and conspicuous. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 15125; 15246; 15321; 15792. Cooper L 60; 193; 340; 462.)

Piptadenia africana Hook. f. GAW (Bassa); MKELI (Mendi); AFRICAN GREENHEART (English). Common tree sometimes 120' tall and 6' in diam., with bole often clear for 50-60', with huge flanges or buttresses up to 15' high and extending 20' on each side at base; crown spreading, with stout umbrella-like branches; bark brownish gray, slightly furrowed or roughened, stringy; leaves doubly pinnate, 6-8" long, alternate; pinnae 2-3" long,

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alternate; leaflets $\frac{1}{4}$ - $\frac{1}{2}$ " long, linear, sessile; main leaf rachis and pinnae rachis deeply ridged and speckled; flowers yellow-white, very minute, arranged on spikes in lax panicles; fruit a flat pendulous pod 12" long, opening on one edge to free the flat, entirely winged, rectangular seeds which are 2" long and $\frac{1}{2}$ " wide. (Plate VIII, No. 2.)

This tree is well known through West Africa and is used for planks, timbers, and canoes because of its durability and strength. Suitable for furniture and veneers; also for durable construction. The heartwood has a nauseating odor when fresh. A decoction of the bark is used for treating toothache.

Heartwood olive brown, with golden luster; sapwood gray or nearly white. Odor of dry wood suggesting old leather; taste not distinctive. Moderately heavy, hard, tough, and strong; texture coarse; grain straight to irregular; not difficult to work, finishes smoothly, takes a high polish; holds its place well when manufactured; is resistant to decay and insect attacks. Growth rings present, but not always distinct. Parenchyma distinct, variable in abundance, about pores in circles, rounded patches, or sometimes in confluent wings; also in widely spaced lines or narrow bands apparently terminal. Pores readily visible, numerous but not crowded, well distributed, mostly solitary but sometimes in radial rows, no definite pattern, though with tendency to diagonal arrangement. Vessel lines very distinct. Rays faintly visible on cross and tangential sections; low and not prominent on radial surface. Ripple marks absent. No gum ducts observed. (Yale 13784; 15115; 15326; 15739. Cooper L 5; 141; 183; 467.)

Undetermined. PE-AY-CHU (Bassa); GUMGUI (Mendi). Tree 60-75' tall and 2-3' in diam., with long, clear bole and low buttresses; bark reddish brown with green blotches, finely cross-furrowed or cracked; leaves doubly compound, 8-10" long, alternate; pinnae 1-3" long, alternate; leaflets $\frac{1}{4}$ " long, linear, sensitive to touch, rachis brown; flowers in globose heads or spikes, creamy white to yellow, fragrant; fruit a flat persistent pod, opening on one edge to discharge the disk-like seeds.

The tree is scarce in this locality, but is more plentiful near the deciduous zone. The wood is used for planks and timbers. It is attractively colored and suitable for fancy veneers. The macerated bark is used by the natives as a substitute for soap.

Heartwood variegated orange, yellow, and dark brown; sapwood nearly white, rather sharply demarcated. Luster fairly high. Without distinctive odor or taste. Very hard, heavy, tough, and strong; texture medium coarse; grain mostly irregular; hard to cut across the grain, but difficult to work,

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finishes very smoothly and takes a glossy polish, but the dust from dry wood is irritating to nose and throat of workmen; probably resistant to decay and insect attacks. Growth rings poorly indicated. Parenchyma abundant, distinct, in rounded or diamond patches about pores and often uniting them into irregular tangential or diagonal chains. Pores distinct, rather numerous, uniformly distributed, occurring singly or less frequently in pairs or small radial groups. Vessel lines distinct, but not very prominent. Rays minute, invisible without lens on cross and tangential sections; low and very inconspicuous on radial surface. Ripple marks absent. No gum ducts observed. (Yale 15268; 15806. Cooper L 75; 376.)

32. PAPILIONACEAE

Large and important family of trees, shrubs, climbers, and herbs of general distribution throughout the world, though most numerous in warmer regions; a division of the Leguminosae characterized by its clusters of pea-like blossoms. Among the herbaceous members are such valuable food and forage plants as beans, peas, peanuts, vetches, clover, and alfalfa. One of the commonest North American trees, widely planted in Europe, is the Black Locust (*Robinia*). Best known of the commercial timbers are Rosewood (*Dalbergia*) and Padouk (*Pterocarpus*). The woods range from very heavy, hard, durable, and attractively colored to the lightest and softest known (e.g., *Herminiera*). There are 79 genera and over 355 species listed from West Africa, most of them being herbs and shrubs.

Amphimas pterocarpoides Harms. VAHN-CHU (Bassa). Tree 60-70' tall and 18-24" in diam., with long, clear bole and low buttresses; bark thick and brittle, the outer part purplish green, scaly or furrowed, the inner brownish; leaves compound, 8-12" long; leaflets glabrous, coarse, finely reticulate, opposite, 3-4" long, oval-oblong to ovate, with blunt apex and rounded base; flowers yellow, in spike-like racemes forming panicles; pods papery, flattened, oblong-oval, 6" long, containing one or two bean-like seeds.

The tree is not plentiful in this locality. The wood has no local use. A blood-red, sticky resin which exudes when the bark is cut is employed by the natives in treating dysentery.

Heartwood yellowish brown; sapwood white, not very sharply demarcated. Not highly lustrous. Odorless and tasteless when dry. Very hard, heavy, and strong; texture very coarse; grain fairly straight to roey; not easy to work, finishes smoothly; is not durable. Seasonal growths not visible. Parenchyma conspicuous, very abundant, in wavy, concentric bands, sometimes as wide as the intervening fiber layers, and spaced 1-3 pore-diams. apart.

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Pores open, distinct, few and scattered, occurring singly or in small radial groups, entirely or partially included within parenchyma bands or situated between them. Vessel lines coarse and very distinct. Rays distinct on cross section, scarcely visible on the tangential; low and not conspicuous on radial surface. Ripple marks visible, fairly regular, all elements storied, although some of the rays occupy portions of two tiers. No gum ducts observed. (Yale 13773; 15796. Cooper L 64; 123; 354.)

Angylocalyx oligophyllus Bak. f. (?). GBOE-DAH; KRAH-DRO (Bassa). Low tree with green smooth bark; leaves compound, glabrous; leaflets alternate or subopposite, 3-8" long, broadly oval-ovate with very long, sharply pointed apex and rounded or tapering base; flowers creamy white, curved back when open, 1" long; in short crowded racemes from old twigs; fruit a finger-like pod 4" long, beaked, constricted between seeds. (Yale 15133; 15203. Cooper 203; 291.)

Haplormosia monophylla Harms. KAH (Bassa); BLACK GUM (English). Forest tree over 100' tall and 3-4' in diam. above the high flanged or buttressed base; bark grayish, blotched, somewhat furrowed and stringy; leaves bright green, glabrous, one-foliolate, oval-oblong, bluntly pointed or rounded at apex, 2-4" long with petiole 1" long, margins toothed; flowers bright blue, in axillary few-flowered racemes; fruit pod woody, smooth, oval-obovate, beaked, 3" long, 1½" wide, containing a single seed.

The larger trees occur in the deep swampy forest, forming small groves in some places. It is conspicuous at certain seasons on account of the brilliant red color of the young leaves. The wood is one of the best known and most widely used locally. It is very hard and heavy, but works fairly well with proper tools. It shrinks considerably on seasoning and should be stacked for over a year before being used for furniture. There is a figure to the grain when properly cut, showing fine bands of brown and black on tangential surface. (Yale 15121. Cooper 189.)

Lonchocarpus cyanescens Benth. BLU; WEE-CHU (Bassa); WALWEI (Mendi); BIG-LEAF INDIGO (English). Woody climber or shrub; young shoots turn black on drying; leaves compound, odd-pinnate; leaflets glabrous, 4 or 5 pairs, broadly oval, tapering at apex and base, sometimes 5" long, terminal leaflet largest; flowers reddish blue, in axillary panicles; fruit a flat pod containing 1-5 seeds plainly indicated by the enlargements of the reticulated valves.

This shrub is sometimes planted for the leaves which yield a blue-black dye used locally and also sold in Europe as an indigo substitute. Fresh

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leaves are rubbed over the surface of the newly carved devil masks to stain the white wood shiny black. (Cooper 132.)

Millettia lasiantha Hutch. & Dalz., sp. nov. (*ined.*). Woody climber or straggling shrub; leaves glabrous, alternate, 6-12" long, with 4 or 5 pairs of oval-oblong opposite leaflets; flowers brownish, in terminal panicles; petioles, branchlets, and inflorescence covered with rusty brown pubescence; pods flat, 4-6" long, 1" wide, slightly recurved, covered with plush-like brown pubescence. (Cooper 131.)

Millettia Lane-Poolei Dunn. JU-EHN-JRAH (Bassa); TOG-BELI (Mendi). Small tree, less than 20' high, with light brown, pitted bark; leaves compound, 6-10" long, alternate; leaflets papery, oblong to ovate, with long tapering apex and rounded base, 1-2" long, light green above with gray cast underneath; flowers in simple terminal racemes, calyx and bracts brown, petals creamy white; fruit a flat pod.

The Bassa name "ju-ehn-jrah" means "elephant-tusk tree" and refers to the hardness of the wood. The wood has alternating bands of fibers and parenchyma of equal width, distinct rays, and few, irregularly scattered pores. Parenchyma cells in horizontal seriation, producing very fine ripple marks not visible without lens. (Yale 15163. Cooper 238.)

Millettia pallens Stapf. JU-EHN-JRAH (Bassa). Tree 40' high and 12" in diam.; leaves odd-pinnate; leaflets 5 or 6 pairs, thin, glabrous, 3-5" long and 1½-2" broad, with long-pointed apex; inflorescence a simple raceme; flowers purplish, about ¾" long; pods nearly glabrous. (Yale 15205. Cooper 293.)

Ostryocarpus major Stapf. Climbing shrub; leaves odd-pinnate, 6-12" long; leaflets 5, glabrous, 3-4" long, broadly oval, rounded at base and pointed at apex; flowers in short lateral branches in clustered panicles 12" long; pod broadly oval, flat, glabrous, 3" long, 2" wide. (Cooper 194.)

Ostryocarpus riparius Hook. f. TU-EH (Bassa). Semi-aquatic climbing shrub; leaves large, odd-pinnate; leaflets 5, glabrous, leathery, 3-8" long and 2-4" broad, rounded at each end, apex twisted; inflorescence with numerous lateral branches; panicles elongated, many-flowered; flowers yellowish white, small, less than ½" long; pod smooth, flat, broadly elliptic, about 3" long and 2" wide. (Yale 15319. Cooper 460.)

Pterocarpus santalinoides L'Hér. ZAHN (Bassa). Medium large tree with wide buttresses; bole sometimes divided; leaves odd-pinnate; leaflets 5 or 7, glabrous, coarse, alternate, oval-oblong, 2-4" long, with abruptly pointed apex and rounded base, dark green above, lighter below; flowers in

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slender racemes; calyx bright yellow, pubescent; fruit very wrinkled, sub-spherical, with narrow wing; husk leathery, covered with fine brown hairs; seeds resemble a wrinkled peanut, the meaty cotyledons beneath the brown skin being yellow and oily, edible.

This tree is almost always evergreen, even in the dry season. It is used by some tribes as a talisman, in which case it is planted in the village and cared for. If the tree dies the natives immediately desert the village. It is sometimes planted over a grave. The light wood is only fairly durable and of no export value. It is occasionally used for local building and is suitable for box boards and general carpentry if not exposed to decay or insects.

Wood nearly white throughout, except around old wounds. Fairly lustrous. Odorless and tasteless. Light in weight, but firm and fairly tough; texture medium fine; grain mostly straight; easy to work, finishes smoothly, holds its place well; is perishable in contact with the ground. Seasonal growth rings not distinct. Parenchyma in numerous, wavy, tangential or concentric lines joining the pores; average spacing 2 or 3 pore-diams.; average width about half the distance between rays. Pores open, small, scarcely distinct, rather few and scattered, occurring singly or in radially flattened groups of 2-5. Vessel lines very fine. Rays minute, invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. Ripple marks scarcely distinct, fairly regular, all elements storied. No gum ducts observed. (Vale 15325. Cooper 466.)

33. MORACEAE

A family of about 70 genera and 1000 species of trees and shrubs, some epiphytic, often with milky juice. They are mostly in tropical and subtropical, but a few occur in temperate climates, e.g., Mulberry (*Morus*), Osage Orange (*Maclura*), and the edible Fig (*Ficus carica* L.). The genus *Ficus* embraces about half of the known species.

The woods vary from extremely dense, as in Letterwood (*Piratinera*), to light and soft, as in some of the Fig trees. Yellow is the predominating color, becoming russet brown upon exposure. Red is also represented, as in the Satiné (*Brosimum paraëense* Huber) of French Guiana and the Amazon region. Fustic (*Chlorophora tinctoria* [L.] Gaud.) is one of the best known dyewoods, while a related species (*C. excelsa* Benth.) supplies the West African timber, called Iroko or Kambala, which is used locally for furniture and exported in limited quantities to Europe and the United States for veneers.

Chlorophora excelsa B. & H. f. GE-AY (Bassa); SEMLI (Mendi); MUL-

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BERRY (English, local); KAMBALA; IROKO (Trade). Huge forest tree over 100' tall and 4' in diam., with low buttresses and sometimes spreading crown; bark dark gray, smooth when young but soon becoming ridged and scaly; leaves leathery, 4-7" long, broadly and unequally ovate with abruptly pointed apex and notched base; flowers dioecious, catkin-like, male catkins much longer than female; fruits said to be similar to Mulberry (*Morus*).

This tree is used by the natives for planks, timbers, rice basins, and canoes. It is being grown in plantations in Gold Coast and Nigeria in mixtures with Teak (*Tectona grandis* L. f.). The ripe fruits are edible and attract birds and other game, a fact taken advantage of by hunters. The ash of the bark is mixed with raw palm oil to make an ointment for reducing swellings on the body.

Heartwood a rich olive yellow when fresh, sometimes with darker stripes, deepening to russet; sapwood white, sharply defined. Luster very high and satiny in proper light. No distinctive odor or taste when dry. Of medium hardness and weight; rather coarse-textured; grain roey, the alternating bands narrow; easy to cut, finishes smoothly, though sharp tools must be used because of the irregular grain; takes a very lustrous polish; holds its place remarkably well when manufactured; is highly resistant to insects and decay. Growth rings poorly defined. Parenchyma abundant, in irregular patches including the pores, often extending wing-like and confluent into short or long, wavy lines, readily visible. Pores rather large, distinct on account of parenchyma, not very numerous, occurring singly or less often in radial pairs or small groups; well distributed, without pattern except as linked tangentially by parenchyma; tyloses present. Vessel lines distinct; rather conspicuous in proper light. Rays fine but visible on cross and tangential sections; low and inconspicuous on radial surface, usually appearing lighter than background. (Yale 15238; 15774. Cooper L 42; 332.)

Ficus Thoningii Blume. BOWAE (Bassa); SMALL FIG TREE (English). Climbing shrub or small tree, often twining vine-like around larger trees; leaves dark green, glabrous, leathery, 2-3" long, oval, obovate with rounded apex; flowers not observed; fruits small, globose, with slight beak at apex, in axillary clusters or in pairs.

This tree is often planted for shade along West Coast, but the fruits are not large enough to be edible. The bark is macerated and mixed with gunpowder as poultice for wounds. The wood is soft and perishable. (Yale 13787. Cooper 144.)

Ficus Vogeliana Miq. (probably). BLORH (Bassa); GONWI (Mendi);

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FIG TREE (English). Tree 50-60' tall, with buttresses; bark greenish gray, covered with fine warts or swellings, somewhat cracked, containing a copious milky latex; leaves broadly oval, 5-7" long and 3" wide, serrated at long intervals; petioles up to 2" long and sometimes ribbed; flowers in long slender panicles with raceme-like lateral branches; fruits in small clusters from main bole, resembling common fig, edible. The thick latex is sometimes used to adulterate wild rubber. The bark is used as a laxative. (Cooper 381.)

Musanga Smithii R. Br. DOE (Bassa); GOVWI (Mendi); **CORKWOOD** (English). Tree 40-50' tall and 12-13" in diam., with large prop roots and broad umbrella-like crown; bark gray, medium thick, rough; leaves palmately compound on stout petiole 1-1½' long; leaflets oblong-obovate, 6-8" long, with abruptly pointed apex; male flowers in a compact knob-like head on short stalk; female flowers stalked, solitary, oval, ½" long; fruit yellowish, succulent. The inflorescence and buds are enclosed in a deciduous stipular sheath, which is of a conspicuous red-wine color, hairy outside and with a thick silky pubescence within. (Plate IX, No. 1.)

This tree quickly invades clearings, forming nearly pure stands. It is able to spread vegetatively by means of aerial runners. The wood, which is similar to Balsa (*Ochroma*), is used for native planks, floats on fish nets, and for making temporary rafts. Occasionally trees are large enough to be made into canoes. Pieces of the bark suspended over the door of a hut are believed to be effective against lightning. (Yale 15253; 15799. Cooper L 67; 347; 358.)

Myrianthus libericus Rendle. This small tree is similar to the next species and has the same names and uses. The leaves are larger and have longer petioles, and the arrangement of the flowers is slightly different. The wood is yellowish brown, coarse-textured, somewhat harder than that of the other species. The rays are distinct and parenchyma is in coarse, concentric bands. (Yale 13778; 15198; 15827. Cooper L 95; 128; 285.)

Myrianthus serratus B. & H. f. VAHN-VEHN (Bassa); FOFI (Mendi). Tree 40-50' tall and 12" in diam., without buttresses; bark brownish gray, smooth and thin; leaves simple, oval 5-7" long, sharply toothed, rough and coarse-textured, pale gray above, brown below, especially the veins, which are conspicuous and reticulate; male flowers on short-branched stalks, catkin-like, yellowish; fruits mulberry-like (aggregate) and edible, in small sessile clusters at ends of axillary stalks.

Of common occurrence along the rivers and in swampy places. The

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yellowish, light but firm wood is used for making domestic articles, such as wooden spoons, combs, stools, etc. The young leaves are said to be edible as "greens." (Yale 15110. Cooper 176.)

34. HIPPOCRATEACEAE

A small tropical or subtropical family, consisting mostly of small trees or shrubs, the latter sometimes scandent. Two genera are listed from West Africa, both of which are to be found in the collections.

Hippocratea guineensis Hutch. & Moss. Climbing shrub 10-12' high; twigs pubescent; leaves 2-3" long, oval, finely serrated, glabrous; flowers very small, brownish, arranged in axillary cymes from long, slender pubescent stalks; fruits 2" long, flat, narrow-elliptic, pubescent. (Cooper 181.)

Hippocratea Loesneriana Hutch. & Moss. WEHN-FLAY (Bassa). Shrub 10-12' tall with broadly oval leaves, 4-6" long, glabrous, entire; flowers very small and fine, greenish white, in loose axillary cymes; fruits narrow-oblong, 1½-2" long, marginate.

This plant is used in native medicine, a decoction of the macerated leaves being used for cleansing sores; the macerated roots are used as a poultice. (Yale 15278. Cooper 409.)

Salacia senegalensis DC. Bushy shrub or low tree with conspicuous lenticles on the dark reddish brown branches; leaves oval, 1½-2½" long, faintly serrated, apex sometimes curved; flowers in axillary clusters, yellow to white, petals spreading to expose stamens; fruit globose, 1" in diam., leathery or woody, axillary, solitary; seeds large. (Yale 15119. Cooper 187.)

Salacia Whytei Loes. Climbing shrub; leaves 2-3½" long, oval to ovate, tapering at apex, dark green above, pale green below, glabrous, veins reticulate; flowers pale yellow, very small, axillary; fruits solitary, oval, under 1" long (immature), with beaked apex and persistent sepals, husk green, spongy (like a small *Annona*). (Yale 15171. Cooper 254.)

35. ICACINACEAE

A family of about 45 genera and over 150 species of trees, shrubs, and a few climbers inhabiting tropical and subtropical regions. The Australian "Maple," *Villaresia Moorei* F., is one of the few timber trees of value. The giant climber of Burma, *Phytocrene gigantea* Wall., yields fresh water when the stem is severed. The leaves and fruits of some of the Brazilian species are used locally for tea or food. There are ten genera listed for West Africa,

ICACINACEAE

six of which are known to exist in Liberia, although only three are represented in the present collections.

Chlamydocarya capitata Baill. TE-OHN-WAY-DOO (Bassa). Woody climber; twigs pubescent; leaves trilobed, 6" long and 4" broad, with long brown hairs on veins of upper surface and more pubescent underneath, petioles $2\frac{1}{2}$ " long, pubescent; flowers white, both sexes capitate; fruits reddish, enclosed by the large, oval, persistent, pubescent perianth, which is slightly longer than fruits; compressed cluster of dried fruits suggests a starfish. (Cooper 363.)

Desmostachys Vogelii Stapf. JU-EH-YE-NEH-CHU (Bassa); GBOE-KPAR (Mamba Bassa). Tree 20-30' tall and 3-5" in diam., with somewhat gnarled bole; bark thin, greenish gray, finely furrowed, smooth; young twigs covered with brown pubescence; leaves glabrous, broadly oval, 4-6" long; flowers white, in long pendulous spikes; fruit drupaceous, oval, 1" long, orange-red at maturity, with fleshy endosperm.

This tree is scattered throughout the forests and its hard, tough wood is sometimes used for implement handles, house poles, or traps. The true Bassa name means "elephant-tusk tree"; the Mamba Bassa, "dog bone"; both allude to the hardness of the wood.

Color of wood pale orange. Luster satiny. Odorless and tasteless. Very hard, heavy, and strong; texture fine; grain variable; fairly easy to carve, finishes smoothly, takes a glossy polish; appears durable. Growth rings poorly defined. Parenchyma distinct, in narrow wings from the inner edge of the pores, often confluent, sometimes into concentric lines. Pores not distinct without lens, rather few and scattered, occurring singly or in tangential pairs. Vessel lines very fine and inconspicuous. Rays distinct on cross section; high and rather conspicuous on radial surface, producing an attractive silver grain. (Yale 15097. Cooper 156.)

Iodes liberica Stapf. Slender climbing shrub; leaves glabrous, papery, 3-5" long, broadly ovate, abruptly acuminate; petioles and twigs finely pubescent; flowers in axillary cymes with tendril opposite; fruit less than 1" long, broadly oval, husk yellowish, becoming red at maturity, with reticulate surface. (Cooper 204.)

Leptaulus daphnoides Benth. Small tree, sometimes 25' tall; leaves glabrous, oblong-oval, broadly acuminate, 4-5" long; flowers tubular, white, perfect, numerous, in extra-axillary clusters; fruit with persistent calyx, $1-1\frac{1}{2}$ " long, pointed. The tree is rather common in the understory and is used for house poles. (Observed but not collected.)

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36. OLACACEAE

A family of about 27 genera and over 150 species of trees, shrubs, and vines, widely distributed in the tropics. The hard and heavy timbers are at present of little commercial importance, but some of them are esteemed locally; for example, *Minquartia guianensis* Aubl., one of the most durable woods of northern South America and Panama, being known in the latter country as Black Manwood. It is similar in many ways to *Coula edulis* Baill. of West Africa. Of the eight genera of the family listed for West Africa, five are known to be represented in Liberia.

Coula edulis Baill. SRAH (Bassa); TOKEI (Mendi); AFRICAN WALNUT (English). Forest tree, sometimes 70' in height, with somewhat crooked or fluted bole, often forked near base; outer bark smooth, thin, greenish; inner bark brownish; leaves glabrous, leathery, oval-oblong, 6-10" long, stout-petioled and conspicuously veined with fine parallel tertiary nerves; flowers on axillary stalks in short rusty panicles; fruit drupaceous, with hard woody shell and meaty endosperm.

The wood is suitable for heavy, durable construction. The fruits are somewhat like walnuts, which accounts for the local designation of African Walnut, not to be confused with the commercial timber (*Louoa*) of that name. The nuts are eaten, either raw or roasted. A decoction of the bark is used as a stomachic and for dysentery.

Heartwood reddish brown; sapwood pale brown. Rather dull. Odorless and tasteless when dry. Very hard, heavy, tough, and strong; texture medium; grain straight to irregular; not very difficult to work, finishes smoothly; appears resistant to decay. Growth rings sometimes indicated, but poorly defined. Parenchyma in exceedingly numerous, closely spaced, fine and irregular, mostly very short lines making a network with the rays; invisible without lens. Pores fairly numerous, in radially flattened groups of 2 to several pores each, the groups visible and rather evenly distributed; tyloses present. Vessel lines distinct, but not conspicuous. Rays minute, and invisible without lens on cross section, indistinct with it on tangential; visible but low and very inconspicuous on radial surface. (Yale 15177; 15260; 15757. Cooper L 23; 262; 281; 368.)

Heisteria parvifolia Smith. BALSAM; POE-NEH-DAY (Bassa). Small tree under 30' tall, often growing in slanting position; bark greenish, smooth, thin; leaves narrowly oval, 4-6" long, glabrous, reticulate; flowers minute, 2 or 3 together, on short axillary pedicels; fruit solitary, about the size of

OLACACEAE

a pea, surrounded by the enlarged 5-lobed calyx; seeds edible. (Yale 13709; 15164. Cooper 59; 239.)

Olax Mannii Oliv. PLAY-JE-NEE (Bassa). Small crooked tree sometimes with liana-like appearance; bark greenish, smooth, thin, sometimes gnarled; leaves light green, oval-ovate, 4-6" long, on very short petioles; flowers axillary in small racemes, brownish white, with long calyx; fruit is plummet-shaped, with seed enclosed in bladder-like calyx. (Yale 15165. Cooper 240; 257.)

Ptychopetalum anceps Oliv. FLOR-FLOR (Bassa). Tall shrub or low tree with flanges or sharply angled branchlets; leaves glabrous, almost sessile, 3-5" long, oval-oblong with long tapering apex; flowers creamy white, small, on short racemes; fruits single or in pairs, drupaceous, with soft wrinkled surface covering the stony center. (Yale 13722; 15091; 15138; 15157. Cooper 72; 150; 209; 231.)

Strombosia pustulata Oliv. ZEN-NIEH; WHA-LA-KOH (Bassa). Forest tree not over 50-60' tall and 18" in diam., generally smaller, with straight, clean bole with no buttresses; bark gray-black, smooth except for shallow pits, medium thin; leaves glabrous, oval-oblong or sometimes broadly oval to ovate, 3-5" long on 1/2" petioles; flowers few, axillary, on short petioles; fruits pea-like, surrounded by persistent calyx.

The wood is employed for native poles and posts because of its strength and durability. The bark and roots are used in making an ointment for treating withered hands or feet.

Heartwood purplish brown; sapwood thick, yellowish, sharply defined. Fairly lustrous. Without distinctive odor or taste. Exceedingly hard, heavy, tough, and strong; rather fine-textured; grain fairly straight; heartwood cuts rather flinty across the grain, but otherwise is not very difficult to work, taking a very smooth finish and high polish; appears durable. Growth rings sometimes indicated by slight variation in color. Parenchyma in very numerous, short, tangential lines joining rays in a meshwork, invisible without lens. Pores very small, fairly numerous, in radial rows of 2 to several pores each, the groups visible in heartwood, and well distributed without pattern. Vessel lines fine and indistinct. Rays fine, but visible on cross section, indistinct on tangential; low and inconspicuous on radial surface. (Yale 15112; 15184; 15746. Cooper L 12; 178; 269.)

37. OPILIACEAE

A small tropical family of trees, shrubs, and woody climbers. Its products are of no economic importance. Two genera with a total of seven species are

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listed from West Africa, but only one is represented in the present Liberian collections.

Urobotrya trinervia Stapf. Tree 40-50' tall and 10-12" in diam., with smooth bole and no buttresses; leaves oval, 3-nerved, 6-8" long, on short petioles; flowers greenish, in long pendulous racemes; stamens long, exerted; fruits egg-shaped, greenish purple berries with 1" pedicels on pendulous racemes. (Cooper 249.)

38. OCTOKNEMATACEAE

A family consisting of a single genus with two known species of trees and shrubs confined to West Africa. It is closely related to the Olacaceae.

Octoknema borealis Hutch. & Dalz. DOE-PU; VAHN-TE-OHN (Bassa). Common forest tree 60' tall and 24" in diam. with straight, clear, slender bole and no buttresses; bark creamy gray, sometimes pitted, but generally smooth and thin; twigs covered with rusty pubescence; leaves oblong-oval, 5-8" long from 1" petiole; male flowers on axillary, finger-like stalks, very small, covered with rusty pubescence; female flowers in short axillary racemes; fruit globose or ovoid, 1/2" in diam., single-seeded, with inferior ovary and persistent calyx.

The strong and durable wood is used for native house construction. It is of about the consistency of Red Gum (*Liquidambar*) and could be employed for the same purposes. The figure of quarter-sawed lumber, though not conspicuous, is very attractive, due to the ribbon grain and high luster.

Color of wood pale brown or pinkish brown throughout. Luster satiny. Odorless and tasteless when dry. Moderately hard and heavy, tough and strong; fine-textured; commonly roe-grained; easy to cut, finishes smoothly, takes a lustrous natural finish; does not appear resistant to decay. Growth rings sometimes indicated by slight differences in color. Parenchyma not visible with lens. Pores invisible without lens, open, numerous, occurring mostly in radial rows of few to several pores each. Vessel lines indistinct. Rays near limit of vision on cross section, invisible on tangential; fine but distinct on radial surface, adding to the attractiveness of the quarter-sawed lumber. (Yale 13741; 13781; 15182; 15195; 15212; 15775. Cooper L 43; 91; 138; 267; 280; 302.)

39. RHAMNACEAE

A family of about 50 genera and several hundred species of shrubs, climbers, or trees distributed over the temperate and tropical regions of

AMPELIDACEAE (VITACEAE)

the world. The barks and roots yield dyestuffs or medicinal compounds. The woods, rarely of commercial value, are generally fine-textured and very hard. West Africa has five genera, none of which had previously been found in Liberia.

Maesopsis Eminii Engl. BU-AY-WREH. Tree sometimes 60' tall and 18" in diam. with clear bole and no buttresses; leaves subopposite, glabrous above, soft and dull below, broadly oval, 3-4" long on $\frac{3}{4}$ " petiole, margin wavy or bluntly toothed; flowers small, greenish, on short axillary cymes; sepals hairy; fruit glabrous, black at maturity, oval-oblong, $\frac{3}{4}$ -1" long, pendulous, solitary or in pairs or small clusters. (Plate IX, No. 2.)

The bark has a place in native medicine. Water in which bast scrapings have been soaked is used as a purgative and is reported "to take out all latent and chronic disease." The timber, which is used for house construction and planks, is unusual for this family, being strikingly like one of the softwooded Leguminosae, such as *Albizzia* or *Cassia*. The identity of the specimen studied seems to be well established, however.

Heartwood olive brown, becoming russet upon exposure; sapwood nearly white, sharply defined. Luster satiny. Odorless and tasteless when dry. Light and soft, but firm; medium-textured; grain somewhat roey; easy to work, finishes smoothly, presents attractive appearance; probably resistant to decay. Growth rings absent or poorly defined. Parenchyma in halos about pores, occasionally uniting a few of them laterally. Pores visible, open, variable in abundance but not crowded, in some places widely scattered, mostly solitary, but sometimes in radial groups of two or more. Vessel lines fine, but very distinct, being darker than background. Rays very fine, invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. (Yale 15293. Cooper 429. Also Yale 19742. Vigne 1724, from Gold Coast for comparison.)

40. AMPELIDACEAE (VITACEAE)

Mostly climbing shrubs or small trees with jointed stems, often with watery juice. Leaves mostly compound and alternate; stipules generally present; flowers regular; inflorescence in spikes, racemes, or cymes; fruit berry-like, generally with watery endosperm. Distributed through the tropics and warm temperate regions; unimportant in Liberia.

Cissus producta Afz. KRAY-DOO (Bassa). Climber with greenish white flowers, red centers; twigs angular or ribbed; leaves opposite; tendrils present. (Cooper 198.)

Leea guineensis G. Don. ZE-EH (Bassa). Small tree or shrub 10' high.

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Leaves compound; flowers in yellow or red cymes or corymbs; fruits reddish, turning black when mature, under $\frac{1}{2}$ " in diam.

This tree is used in native witchcraft to strengthen the oath medicine (car-foo), as it is believed to be impervious to the advances of even the most influential witch doctors, thereby assuring the natives of its purity or impartiality. Only one species is listed for West Africa. (Yale 15306. Cooper 444.)

41. RUTACEAE

An important family of over 110 genera and 1000 species widely distributed throughout temperate and tropical regions, especially in South Africa and Australia. It is the best known as the source of *Citrus* fruits (orange, lemon, grapefruit, etc.) and of West Indian and Ceylon Satinwoods.

The woods are mostly of a pale yellow color and vary from moderately light and soft to hard and heavy; some are oily or resinous and a few are scented. Seven genera are represented in West Africa, but only one species was collected in Liberia.

Atalantia, sp. Unarmed shrub; twigs smooth, green; leaves unifoliate, alternate, leathery, glabrous, broadly ovate, 3-5" long and $1\frac{1}{2}$ - $2\frac{1}{2}$ " wide, broadly wedge-shaped at base and mucronate at apex, margins crenulate; petioles about $\frac{1}{2}$ " long, slightly winged, distinctly jointed; fruit a small orange-colored, globose berry. Wood yellow, very fine-textured, exceedingly hard, similar to that of *Murraya exotica* L. (Yale 13699. Cooper 39.)

Fagara angolensis Engl. (probably). GBU-AYE (Bassa); PFUI (Mendi). Large forest tree 125' tall and 4' in diam. above the high flanged buttresses; bark light gray, smooth except for large conical spines; leaves pinnate, 12-18" long; leaflets 4-5" long, broadly oval, glandular and prickly; flowers unisexual; fruits with separate carpels.

The large trunks are made into canoes and sometimes cut into planks, as the wood is easy to work, but tough and strong for its weight. It is suitable for box boards, paper pulp, plywood, and general carpentry work not exposed to decay. The finely chopped leaves are mixed with rice broth for feeding infants.

Heartwood pale yellow; sapwood nearly white, not sharply demarcated. Luster rather silky. Odorless and tasteless when dry. Rather light, but firm and decidedly tough; texture medium coarse; grain straight to somewhat irregular; easy to cut, finishes smoothly, takes a glossy polish, holds its place well when manufactured; is not durable. Growth rings visible, but

SIMARUBACEAE

not clearly defined; due mainly to slight differences in density. Parenchyma sparingly developed about pores and occasionally in very narrow concentric bands at termination of growth rings. Pores open, distinct, fairly numerous, occurring mostly in radially flattened groups of 2-5, without definite pattern. Vessel lines very distinct. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface. No gum ducts observed. (Yale 15820; 15847. Cooper L 88; L 115.)

42. SIMARUBACEAE

A family of about 28 genera and 150 species of trees and shrubs, confined to the tropics and northern subtropical regions. The best known tree is the widely planted Chinese Tree of Heaven (*Ailanthus*). A recent introduction to the American timber market is the Brazilian Marupá (*Simaruba*). West Indies species are the source of Bitterwood and Quassia. There are nine genera listed for West Africa, at least five being represented in the Liberian flora. Of the three collected, *Hannoa* has pinnate leaves and soft, nearly white wood, while *Klaineodoxa* and *Irvingia* have simple leaves and hard, dark-colored wood.

Hannoa Klaineana Pierre & Engl. ZAUH (Bassa). Large, rather infrequent forest tree 90-100' tall and 3-4' in diam., without buttresses; bark greenish gray, medium thick, roughened or slightly furrowed; leaves compound; leaflets oblong-oval to ovate, apex blunt or notched, leathery, glabrous, pale brown below; flowers unisexual, in open terminal panicles, longer than the leaves, finely pubescent; fruit oval-oblong, about $\frac{3}{4}$ " long, glabrous, leathery, becoming brittle on drying; seed single, attached to wall.

The easily worked wood is used locally for planks and ceilings. Native canoes are made from the large trunks. The timber is suitable for the same purposes as the softer kinds of Pine.

Wood nearly white or buff throughout. Luster silky. Odorless, but with mildly bitter taste. Light and soft, but firm; texture medium to coarse; straight-grained; very easy to work, finishes smoothly, holds its place well when manufactured; is not highly resistant to decay and is subject to blue stain if not dried promptly and kept in that condition. Growth rings apparently absent. Parenchyma in long, narrow wings from the sides of the pores, rarely including them, and often confluent into long undulating lines visible without lens. Pores rather few, open, large, readily visible, occurring singly or in radially flattened groups of 2 to several, fairly uniformly distributed without pattern. Vessel lines coarse and rather conspicuous. Rays fine but visible on cross and tangential sections; low, but fairly conspicu-

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ous on radial surface. Ripple marks absent or of only local occurrence. No gum ducts observed. (Yale 13732; 13765; 15227. Cooper 82; 115; 320.)

Irvingia gabonensis Baill. Large forest tree with grayish bark; leaves simple, thin and papery, glabrous, oval-obovate, 3-5" long; stipules pointed, sometimes $\frac{1}{2}$ " long, deciduous; flowers in short open racemes; fruits yellowish, broadly oval, $1\frac{1}{2}$ -2" in diam., with bristly, fibrous exocarp and shell-like center with large, flat, disk-like seed. The wood is similar to preceding in structure and properties. (Cooper 401X.)

Klainedoxa gabonensis Pierre. GOË (Bassa). Forest tree 100' tall and 4-5' in diam., with low basal swelling; bark brownish green, medium thin, roughened; leaves simple, leathery, glabrous, 2-4" long, oval-ovate with wedge-shaped apex; stipules as long as leaves, needle-like, deciduous, on stalks $\frac{1}{2}$ " long, recurved and pointed; flowers in glabrous panicles; fruits globose, angled, hard-shelled, 2" in diam.

The timber is little used locally as it is too hard to cut. It is said to be durable and suitable for ground poles and timbers.

Color olive brown; sapwood gray. Not very lustrous. Odorless and tasteless. Exceedingly hard, heavy, tough, and strong; texture rather coarse; grain fairly straight to irregular; difficult to work, finishes smoothly; appears durable. Growth rings apparently absent. Parenchyma in distinct, wavy, tangential, concentric, or anastomosing bands connecting and sometimes including the pores. Pores rather few, open, uniformly distributed, occurring singly or less frequently in radial pairs. Vessel lines distinct. Rays much narrower than parenchyma bands, scarcely distinct without lens on cross and tangential sections; low and not conspicuous on radial surface. (Yale 13768; 15809. Cooper L 77; 118; 349.)

43. BURSERACEAE

This family contains about 20 genera and over 400 species widely distributed throughout the tropics. They are mostly resiniferous or aromatic and are the source of such products as true frankincense, myrrh, and gum elemi. The best known wood of this family is the Okoumé (*Aucoumea Klaineana* Pierre) from Gaboon, Africa, which is used in Europe in large quantities. Another wood closely resembling the Okoumé is that of *Canarium occidentale*, which is called Okoumé d'Ivoire. Most of the better known woods are light, soft, not durable in contact with the ground, but suitable for plywood, veneer, and cheap lumber. Of the four genera listed for West Africa, the Liberian collections contain but one.

MELIACEAE

Canarium Schweinfurthii Engl. GOE-QUEHN (Bassa); BERI (Mendi); AFRICAN ELEMI (Engl.). Forest tree, 100' tall and 3-4' in diam., with clear bole 45-50', buttresses low or lacking; narrow crown confined to extreme top; bark light gray, medium thick, characterized by plates and fissures; twigs with rusty pubescence; leaves pinnately compound, up to 18" long; leaflets oblong, apex tapering, base blunted, rounded, or notched; veins prominent below, being raised above the surface and noticeably reticulate; flowers small, pale yellow, in long, compound, axillary cymes; fruits drupaceous, yielding an aromatic oil.

The pleasantly scented wood is used by the natives for planks and canoes. They also collect the resin by making a gash in the bark and allowing it to run down the bole and solidify on the ground. When this resin is burned it produces a heavy black smoke which is collected on receptacles as carbon black. This is used to make the ink for tattooing.

Heartwood tan or buff, with pinkish hue; sapwood gray and likely to stain. Luster satiny. No odor or taste when dry. Wood light, but firm, tough and strong for its weight; texture medium; grain rather irregular, tending to be wavy or roey; easy to work, finishes smoothly, takes a high polish; does not appear resistant to decay. Growth rings apparently absent. Parenchyma not visible even with lens. Pores visible, numerous but not crowded, well distributed without pattern, being mostly single, but sometimes in radial groups. Vessel lines fine. Rays fine, not distinct on cross and tangential sections; low and inconspicuous on radial surface. This wood has some resemblance to Okoumé and could probably be used for the same purposes, particularly for plywood. (Yale 13775; 15124; 15752. Cooper L 18; 125; 192; 385.)

44. MELIACEAE

A highly important family of over 40 genera and 600 species of trees and shrubs, widely distributed throughout the tropics. It is the source of Mahogany, Spanish Cedar, and various other valuable timbers. The present collections contain representatives of three of the 11 genera known to occur in West Africa. The African Mahogany (*Khaya*) is said to be present in the Gola forest to the west of the Dukwia River.

Carapa procera DC. CHU-SAY-DOR-KOHN; TOON-KOR-DOH (Bassa); KOWI (Mendi). Tree 50-60' tall, with crown confined to extreme top of a long, clear bole; bark thin, greenish gray, long-furrowed; leaves pinnate, up to 3' long, with narrow oblong leaflets over 12" long, tapering to base but very abruptly pointed at apex, glabrous and slate gray above; flowers fra-

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grant, creamy white with brownish red centers; fruit a large woody capsule containing several meaty, large, unwinged seeds.

This species is closely related to the South American Crabwood (British Guiana) or Andiroba (Brazil), the timber of which is well known commercially. The Liberian tree supplies some lumber for furniture and construction. The roots and inner bark are used by natives to relieve children of intestinal parasites. The fruits contain an edible oil, which is also used as an unguent. The Bassa name "chu-say-dor-kohn," means "tree that has no branches," referring to the extremely small crown with the leaves bunched at ends of the twigs.

Color of heartwood reddish or chocolate brown; sapwood pinkish gray and rather sharply defined. Superficial luster low; subluster golden as in so many members of this family. Odorless and tasteless when dry. Hard, heavy, and strong; texture medium; grain mostly straight; fairly easy to work, finishes smoothly, takes a high polish, holds its place well; fairly resistant to decay and insect attacks. Growth rings limited by parenchyma, usually not very distinct. Parenchyma sparingly developed about pores and in fine terminal lines or bands; mostly not visible without lens. Pores small, barely visible, not very numerous, fairly uniformly distributed, occurring singly or less commonly in radial pairs, without definite pattern; reddish gum deposits often present in limited amount. Vessel lines fine and inconspicuous. Rays fine, not visible without lens on cross and tangential sections; low, but very distinct on radial surface. Ripple marks absent. (Yale 15240; 15791. Cooper L 59; 334.)

Guarea Thompsonii Sprague & Hutch. BO-IN-DAH (Bassa); KAFFI (Mendi); SWEET CEDAR (English). A small to moderately large tree, but said to attain a height of 100' in some localities; outer bark thin and greenish gray; inner bark brownish, stringy; leaves pinnate, 12-16" long; leaflets glabrous, 4-7" long, lanceolate; flowers in stout pyramidal panicles, petals pubescent, yellowish; fruits short, drupaceous.

This tree is scarce in some localities and plentiful in others. It has an excellent Cedar-like wood which is used for furniture, planks, and canoes.

Heartwood reddish brown, sometimes streaked with purple; sapwood 2" thick, pinkish, sharply defined. Superficial luster rather low; subluster golden. Tasteless, but with cedary fragrance. Of fairly light weight, but very firm; fine-textured; grain straight to roey; easy to work, finishes smoothly, takes a good polish; appears highly resistant to decay. Seasonal growth rings apparently absent. Parenchyma visible in numerous, wavy, tangential or concentric bands, connecting the pores but not completely surrounding them; spacing uneven, averaging about 3 or 4 pore-diams.

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Pores open, visible, not very numerous, well distributed, occurring singly or in radially flattened groups of 2 to 5 pores each. Vessel lines fine and inconspicuous. Rays invisible without lens on cross and tangential sections; very low and inconspicuous on radial surface. Ripple marks absent. (Yale 15282; 15816. Cooper L 84; 415.)

Trichilia Heudelotii Planch. BO-IN-DAH (Bassa). Tree 40-50' tall, with a long clear bole; twigs speckled brown; leaves pinnate, up to 12" long; leaflets glabrous, dark green, 3-6" long, narrow lanceolate or slightly obovate, sometimes tapering gradually to base and apex; flowers white to greenish yellow, fragrant, in short loose cymes; fruits small, under $\frac{1}{2}$ " in diam., depressed, 5-lobed, finely pubescent; seeds numerous, small, not winged. (Plate X, No. 1.)

This tree is evenly distributed in the forest. The wood is preferred by the natives for carving the devil masks and other tribal fetishes because it is light, can be worked with crude tools, does not crack readily, and is durable.

Heartwood pinkish to reddish brown; sapwood lighter. Fairly lustrous. Odorless and tasteless when dry. Of light weight, but firm; texture medium; grain fairly straight; easy to work, saws somewhat woolly when fresh, finishes smoothly; holds its place well when manufactured; fairly resistant to decay. Growth rings sometimes indicated, but poorly defined. Parenchyma not distinct without lens, in numerous, narrow, irregular wings extending from the pores and often uniting them. Pores open, small, but visible; numerous, but not crowded; well distributed, occurring singly or in small radially flattened groups. Vessel lines inconspicuous. Rays indistinct without lens on cross and tangential sections; very low and inconspicuous on radial surface. Ripple marks absent. (Yale 15288; 15812. Cooper L 80; 424.)

Turræanthus sp. BLIMAH-PU (Bassa). Tree usually 50-60' tall and 12-18" in diam., the trunk usually forked about 25' from ground; buttresses low or absent; bark blotched with green and gray patches, smooth on young trees, rough on old ones, containing an aromatic resinous sap; leaves pinnate, up to 18" in length; leaflets dark green, 4-6" long; fruit a fleshy, few-seeded capsule.

The tree occurs scatteringly in the forest, and the natives seem to confuse it with certain of the Anacardiaceae, which it superficially resembles. It is closely related to Avodiré (*T. africana*), a commercial timber of the Ivory Coast. The wood appears suitable for the same purposes as Avodiré. (See *Tropical Woods* 26: 1-9, June 1, 1931.)

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Wood colorless or pale yellow throughout. Luster satiny. Odorless and tasteless. Of medium weight, firm and strong, suggesting Soft Maple (*Acer rubrum* L.); texture medium, very uniform; grain straight to curly; very easy to work, finishes very smoothly, takes a lustrous natural polish; holds its place well when manufactured; is not resistant to insects or to decay and is subject to stain if not dried promptly and kept in that condition. Growth rings poorly defined, but sometimes indicated by flattening of the fibers in the late wood. Parenchyma sparingly developed about pores and pore groups. Pores small, visible but not distinct without lens; numerous, but not crowded, well distributed, occurring singly or more often in radially flattened rows of 2-5 pores each; open, except for occasional deposits of yellow gum. Vessel lines fine and inconspicuous. Rays fine, near limit of vision on cross and tangential sections; low but distinct on radial surface. Ripple marks absent. (Yale 15853. Cooper L 121.)

45. SAPINDACEAE

A large family of about 120 genera and over 1000 species of trees, shrubs, and climbers scattered over the warmer regions of the world. One of the best known members in tropical America is the Soapberry (*Sapindus Saponaria* L.), the fruit of which is used for soap because of the high percentage of saponin it contains. The fact that the foliage of the Sapindaceae bears a superficial resemblance to that of the Anacardiaceae and Meliaceae is a source of confusion in the native nomenclature of the West African representatives. The woods are mostly hard and are without commercial value. Of the twenty genera listed for West Africa at least ten are known from Liberia, the species varying from low shrubs to medium-sized trees.

Allophylus Talbotii Bak. f. DOO-VLEHN (Bassa). Climber 4-5" thick; bark greenish brown, smooth; leaves trifoliolate, petiole 1½" long, terminal leaflet 3-4" long, lateral leaflets 1-2" long, oval to obovate, bluntly acuminate; flowers very small, in axillary, pendulous panicles; fruits berry-like, oval or globose, under ¼" in diam.

This plant is used by natives as a treatment for elephantiasis, the bark being heated and tied around the affected parts, or the leaves and bark being beaten into a pulp, mixed with clay, and smeared over the body. (Yale 15274. Cooper 405.)

Aporrhiza aff. **Talbotii** Bak. f. DI-PEH (Bassa). Forest tree 50-60' tall and 18-24" in diam., sometimes larger; leaves pinnate, less than 12" long; leaflets entire, glabrous, oval, 2-3" long, bluntly acuminate; flowers creamy white, in terminal, much-branched, open panicles; fruit small, berry-like, softly pubescent.

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The tree is said to be plentiful in the forest and is used for house poles when small and for timbers and planks when mature. (Yale 13758. Cooper 108.)

Blighia sapida Koenig. **AKEE APPLE** (English). Tree up to 50' tall; leaves pinnate, leaflets 3-5 pairs, 3-5" long, slightly pubescent below; flowers fragrant, in greenish white racemes; fruit oval, 3-lobed capsule, bright red when ripe; seeds black, imbedded in yellow pulpy mass, which is edible when ripe but poisonous when immature. The tree is planted in villages for shade. (Observed, but not collected.)

Chytranthus setosus Radlk. (probably). **NYE-FE-OHN** (Bassa). Tree less than 50' high and 12" in diam., with light gray, somewhat roughened bark; leaflets papery, oval-oblong, up to 8" long, cuneate at base, acuminate at apex, lower two pairs rounded, about 1-2" long, like enlarged stipules; flowers in racemes, 2" long, covered with brown pubescence, in clusters from old branches; fruit fleshy, pubescent.

Although not common, this tree is used for timbers and boat oars because of its strength and toughness. The fragrant leaves are used as a flavoring for soups. (Yale 15220; 15831; 15837. Cooper L 99; L 105; 313.)

Deinbollia grandifolia Hook. f. **POHN** (Bassa). Infrequent tree 50-60' tall and 12-16" in diam., with tall narrow buttresses or prop roots; bark grayish, smooth or finely cracked, pungent when freshly cut; leaves pinnate, 18-24" long; leaflets 6-8" long, opposite, short-petioled, oval-oblong, with apex blunt or abruptly pointed; flowers yellow-white, in cluster-like panicles; fruit an indehiscent capsule, oval, 1" long, with style attached to flat side.

The wood is not durable and has no local uses; the seeds are oily and used for food. (Yale 13760; 15255; 15795. Cooper L 63; 110; 357.)

Deinbollia polyypus Stapf. **BU-EH** (Bassa). Similar to above, but with larger leaflets. The bark and leaves are crushed and placed in a large kettle of water which is heated until a vapor is given off. A fatigued native, to refresh himself, makes an improvised steam bath by placing a blanket around himself and over a pot containing hot water, crushed bark, and leaves of this tree. (Cooper 351.)

Eriocoelum racemosum Bak. (probably). **SEER** (Bassa). Tree 30' tall and 4-6" in diam., with low buttresses; leaves compound; leaflets 3 or 4 pairs, oval-obovate, 3-5" long; flowers small, white, in short, axillary, rusty brown racemes; fruit angular, 3- or 4-celled, yellowish, crustaceous, 1/2-1 1/2" long, covered with prickly pubescence and densely woolly within. (Yale 13788. Cooper 145.)

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Paullinia pinnata L. GBEH-SEH (Bassa). Climber with tendrils; leaves compound; leaflets 5, the terminal one $1-2\frac{1}{2}$ " long, with broadly toothed margins; rachis winged; flowers in short compact spike-like clusters in axillary racemes; fruit a woody capsule, about 1" long, slightly 3-lobed at top, with a short beak. (Cooper 443.)

Placodiscus pseudostipularis Radlk. FAH (Bassa). Tree less than 50' high and 12" in diam., with clear, slender bole; bark greenish black, finely plated or covered with bumps and warts; leaves compound, leaflets glabrous, leathery, up to 10" long, oval-oblong with wedge-shaped apex, lower pairs very small, rounded, stipule-like; male racemes short, axillary, with brownish green buds; female flowers in long, pendulous, simple, red-stalked racemes; fruits glabrous, hard, entire or lobed, unevenly oval, about 1" long.

This tree is used for house poles and axe handles because of its strength and resilience. A decoction of the macerated bark is used as a liniment for the relief of aching feet or leg muscles.

Wood light to dark brown. Fairly lustrous. Odorless and tasteless. Very hard, heavy, tough, and strong; fine-textured; mostly straight-grained; hard to cut, but finishes very smoothly; looks rather durable. Growth rings present. Parenchyma in narrow, concentric bands, apparently terminal in places, though tending to run together in part. Pores open, invisible without lens, few and scattered, mostly solitary. Vessel lines indistinct. Rays invisible without lens on cross and tangential sections; fine and inconspicuous on radial surface. (Yale 15181; 15266; 15737. Cooper L 3; 266; 374.)

46. MELIANTHACEAE

A recently segregated family with two genera, *Melanthus* and *Bersama*, confined to tropical and subtropical Africa. Only the latter genus is found in West Africa.

Bersama paullinioides Bak. JE-RAH-KPAR (Bassa). Tree sometimes 50-60' tall and 24" in diam., but generally smaller; leaves 12-16" long, with ridged rachis; leaflets opposite, oval-oblong, 1-3" long, glabrous; flowers white, in spike-like racemes 4-6" long; fruit a reddish, rounded capsule, $1-1\frac{1}{2}$ " long.

Among the Mendis the tree is regarded as evil and to be avoided, probably because the roots are said to be a source of virulent poison. In the witchcraft of the Bassa tribe, however, it occupies a unique place deserving of special mention. When a man breaks his leg he is placed on a mat with

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the leg set straight and held so by placing stones at each side and on top. A fowl is caught and its leg broken at the same point. Bark and wood from this tree are crushed, and mixed with palm oil to make a salve which together with some crushed leaves is placed on the leg of the fowl. The man is not treated in any way, but remains on his mat for several days. The mending of his fracture is supposed to parallel that of the fowl and when the latter begins to walk again it is time for the human patient to do likewise. The literal meaning of the Bassa name, "je-rah-kpar," is "bone-that-is-broken."

Color of wood (sapwood?) brownish gray throughout. Fairly lustrous. Odorless and tasteless when dry. Hard, heavy, tough, and strong; texture medium; grain straight; rather easy to work, finishes smoothly; is probably not resistant to decay. Growth rings absent or poorly defined. Parenchyma not visible with lens. Pores invisible without lens, open, numerous but not crowded, occurring singly or somewhat less frequently in radial pairs; well distributed without definite pattern. Vessel lines very fine. Rays very distinct on cross section, faintly visible on tangential; high and conspicuous on radial surface. The fibers and the vessel segments show a tendency to horizontal seriation, producing irregular ripple marks that are barely visible on tangential surface. (Yale 15312; 15854. Cooper L 122; 451.)

47. ANACARDIACEAE

Trees or shrubs, often with resinous bark; leaves generally alternate, simple or compound, without stipules; flowers mostly regular, perfect or unisexual; fruit usually drupaceous, with fleshy cotyledons. Contains over 60 genera and 500 species, principally tropical or subtropical. Some of the well-known members are the Mango (*Mangifera*), Pistachio (*Pistacia*), Sumacs (*Rhus* spp.), and Quebracho (*Schinopsis*). The woods vary from dull white, soft, and perishable, as in the Plums (*Spondias* spp.), to red or beautifully variegated, hard, and durable, as in *Schinopsis* and *Astronium*. Some of the genera are characterized by the presence of gum ducts or latex canals in the medullary rays. In the Liberian collections are representatives of three genera out of 14 listed for West Africa. *Mangifera* and *Anacardium* (Cashew) are probably introduced.

Pseudospondias microcarpa Engl. POHN (Bassa). Tree up to 40-50' tall and 8-12" in diam., said to grow to 75' or more and to be common in forest. Bark medium thick, somewhat roughened or ridged, greenish gray in color; leaves compound, alternate, with large leaflets; flowers arranged in panicles, small, white, showy against green background; fruit red

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when mature, edible. The wood is sometimes used for poles or planks. The resinous bark is used in the treatment of jaundice and other diseases affecting the eyes.

Wood grayish or vinous green, rather variegated; highly lustrous. Odorless and tasteless. Moderately hard, heavy, tough, and strong; rather fine-textured; grain straight or roey, with decided tendency to woolliness in finishing. Growth rings poorly defined or absent. Parenchyma sparingly developed about pores, not visible without lens. Pores at limit of vision, not crowded, uniformly distributed without definite pattern, occurring singly or less frequently in pairs. Vessel lines very fine. Rays not visible without lens on cross and tangential sections; fine but very distinct on radial surface; no canals observed. (Yale 13716; 15252. Cooper 66; 346.)

Sorindeia deliciosa A. Chev. SEE; POHN (Bassa). Closely resembles the preceding. (Cooper 357A.)

Sorindeia longifolia Oliv. BLIMAH (Bassa). Fairly common tree of the middle story, growing to a height of 60 or 75' with long, clear bole and no buttresses; bark brownish green, medium thick; leaves compound, up to 2' long, alternate; leaflets up to 5-6" long, dark green, glabrous; flowers in panicles, small with white petals; fruit drupaceous, with woody shell and a fleshy cotyledon that is oily and edible. (Plate X, No. 2.)

The natives use the wood in the form of planks and timbers, as it is fairly strong and tough. A clear, sticky, pungent resin exudes from the bark, twigs, and fruits, quickly turning black and proving very difficult to remove from hands or clothing. When the bark is boiled the liquor becomes black, and this is used as an antiseptic wash.

Wood grayish or greenish yellow, somewhat variegated; highly lustrous; without distinct odor or taste; hard, heavy, tough, and strong; somewhat splintery; texture fine; grain fairly straight; not easy to work when dry, but takes a high polish. Growth rings poorly defined or absent. Parenchyma not visible with lens. Pores small, at limit of vision; fairly numerous, but not crowded; occurring singly or in radial pairs, without definite pattern. Vessel lines inconspicuous. Rays not visible without lens on cross and tangential sections; fine, but distinct on radial surface; intercellular canals not observed. (Yale 15258; 15298. Cooper 366; 435.)

Trichoscypha arborea A Chev. BLIMAH (Bassa). A fairly common tree 75-80' tall, with narrow crown, no buttresses; bark light reddish to gray, smooth and thin, with a resinous sap; leaves alternate, compound, and up to 2' long, the leaflets large, pale gray-green in color; flowers in dense, stout,

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erect clusters; fruits drupaceous, fleshy, with a sweetish, edible pulp. The wood is occasionally used in the construction of native houses, being rather strong, tough, and durable.

Wood greenish or pinkish, often variegated; highly lustrous; odorless and tasteless when dry; moderately hard and heavy; rather fine-textured; not difficult to cut, but inclined to rough up and "pull" in surfacing. Growth rings indistinct or absent. Parenchyma sparingly developed about pores; not visible without lens. Pores small, barely visible, not very numerous, well distributed, occurring singly or in radial pairs. Rays very fine, not visible without lens on cross and tangential section; low but distinct on radial surface; no ducts observed. (Yale 13715; 15156; 15771. Cooper L 39; 65; 230.)

Trichoscypha ferruginea Engl. BLIMAH; GBEH (Bassa). Medium-sized tree similar to preceding; bark greenish gray, exuding a dirty orange-yellow resin; sepals and stigmas persistent; fruits drupaceous, with leathery husks (red when mature) and purple cotyledons. The wood is similar to the preceding species and is used for the same purposes, as the natives are not always able to distinguish the two. (Yale 13764; 15152. Cooper 114; 226.)

48. CONNARACEAE

A small tropical family of erect or more often climbing shrubs and a few trees of no commercial importance. There are 14 genera, with a total of 44 species, listed for West Africa, but only two of them are represented in the present Liberian collections.

Agelæa trifolia Gilg. Climbing shrub with trifoliolate leaves on petioles 2-3" long; leaflets broadly oval, 2" long with sharp apex, the underside covered with a velvety brown pubescence; flowers white, spicy fragrant, pubescent, in large, terminal panicles; fruits scarlet when mature, about $\frac{4}{5}$ " long and irregularly oval. (Cooper 20.)

Manotes macrantha (Gilg) Schellenb. Climbing shrub with pinnate leaves having large, leathery, oval leaflets 3-4" long; flowers yellowish; fruits about $\frac{1}{4}$ " in diam., irregularly oval with a sharp pointed beak at apex, rusty brown when mature, generally opening to free the large seed. (Yale 13723. Cooper 73.)

49. ARALIACEAE

A large family of 50 or more genera and 500 species of trees, shrubs, vines, and herbaceous plants with wide distribution in the tropics and to

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some extent in the temperate regions. The leaves are alternate (rarely opposite) and either simple or compound; flowers arranged as spikes, racemes, umbels, or in heads, either perfect or unisexual; fruit a berry or a drupe with copious endosperm, and indehiscent. In the Far East the wood of some species is used for making paper pulp and the pith for rice paper. There are only three genera listed from West Africa; *Cussonia* is scattered all along the coast in the Savannah forests.

Schefflera sp. ΚΡΛΟΕ (Bassa). Rather rare tree in this region and one concerning which little is known; said to grow to rather large size; bark yellowish gray, rough, plated, and medium thick, very bitter to the taste; leaves digitately compound on petiole 4-8" long, with 5 or 6 oval or slightly obovate leaflets, 6-9" long and glabrous above; flowers in umbels; fruits drupaceous. There is a tree called by the same name, which may be similar if not identical, that is used in native medicine. A mixture of bark and leaves, beaten to a fine pulp and salted, is eaten to relieve coughing. (Yale 15247. Cooper 341.)

50. EBENACEAE

A tropical or subtropical family with six or seven genera and many species. The genus *Diospyros* is by far the most important, containing over 200 species, some being cultivated for their fruits (called persimmons in U.S.A.) and others being a source of Ebony. The woods are very hard, fine-textured, strong, brittle or flinty, and highly durable. The color is sometimes black, but more often streaked or mottled with white, gray, or brown. The parenchyma is arranged in fine concentric lines, almost invisible to the naked eye. The rays are very fine and indistinct without a lens.

The Liberian collections contain representatives of the closely related genera *Diospyros* and *Maba*, species of both genera being fairly common, rather small trees having woods of variegated color, but not solid black. Such woods are suitable for purposes requiring great strength and resilience, as in tool handles, rather than resistance to decay.

Diospyros gabunensis Gürke. ΚΑΡΗΝ; ΡΟΟΚΡΑ (Bassa). Tree, sometimes 50-60' tall, but with slender bole under 12" in diam. and a rounded crown confined to extreme top; buttresses, if any, very low; bark grayish black, rather thin, roughened, finely furrowed; young twigs with a brown-black pubescence; leaves narrow oblong, up to 12" long and 3" wide with a beaked apex, glabrous, leathery, prominently veined, the petioles and under-surface of the midrib often pubescent; flowers white, fragrant, in almost

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sessile, axillary clusters; fruit a berry, about 1" long, somewhat the shape of an acorn, the persistent calyx resembling the cup; many long angular seeds imbedded in the pulp beneath leathery husk and arranged parallel to the axis of the fruit; calyx and husk both covered with a fine, velvety, black pubescence.

A fairly common tree, often employed by the natives for large house poles, because of its great strength and convenient form. It is also used to make wooden spoons, combs, and other small household articles for which its texture and hardness adapt it. In native medicine the fresh inner bark serves as a material for poultices and a decoction of leaves and bark as an antiseptic for bathing sores. The woods of the different species of *Diospyros* are usually confused, and the same vernacular names are applied indiscriminately. (Yale 13728; 13737; 15190. Cooper 78; 87; 275.)

Diospyros kamerunensis Gürke. SEFFLAY; DIB-BAH or DRE-BAH (Bassa). Common tree of the under story never over 30-35' tall and 5-6" in diam.; bark greenish gray, finely furrowed; leaves papery, pale green with grayish tint above, brownish below, 4-7" long, 1½-2½" wide; flowers in small axillary clusters, petals pale creamy yellow and about ½" long; fruit a berry with rind or husk leathery at maturity, under 1" long, oval with a beaked apex, covered with a greenish gray pubescence.

The wood is used for rice pestles because it is hard and heavy and for implement handles because of its toughness and strength. In making a war drum the natives stretch a piece of hide over the end of a hollow log and hold it in place with hoops made from the small and pliable saplings of this and other species of *Diospyros*. (Yale 13719; 13766; 15214; 15784. Cooper L 52; 69; 116; 304.)

Diospyros Linderi Hutch. & Dalz., sp. nov. (*ined.*). PAHN (Bassa). Shrub with alternate, broadly oval, glabrous, leathery leaves up to 12" long and 5" wide; twigs with velvety brown pubescence; fruits solitary, reddish brown, covered with large hairs when young and a soft pubescence at maturity, the apex beak-like; pulp watery, surrounding several long angular seeds. The plant is of no importance. The leaves are used to decorate the country arrows in native sports. (Yale 15130; 13780. Cooper 130; 200.)

Diospyros Sanza-Minika A. Chev. KOHR (Bassa). Common tree of the middle story, often in small clumps from a single stump; 40-50' tall and 4-6" in diam., with slender bole clear for most of its length; bark grayish black, thin, finely furrowed; leaves smooth and leathery, narrow oval to

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lanceolate, from 6-9" long and 1½-2" wide, tapering to a point; petioles and twigs blackened; flowers pearly white with pinkish hue, slightly fragrant, in short axillary clusters; fruit a berry 1½" long, 1" wide, cylindrical, with pubescent reddish black leathery husk and a sticky pulp containing several long narrow seeds.

This tree is very much like *Diospyros gabunensis* Gürke in appearance, properties, and uses. Poles of it are preferred for spring traps because of its elasticity. Other local uses are for monkey cages and as lances or spears. (Yale 13721; 15186; 15286; 15779. Cooper L 47; 71; 271; 422.)

Diospyros Thomasii Hutch. & Dalz., sp. nov. (*ined.*). GBOE-KPAY; GUAY-VE-NEY; SEFFLAY; DIB-BAH (Bassa). Tree 25-35' tall and 4-6" in diam., with crown confined to top; outer bark very finely furrowed, grayish; inner bark reddish, staining wood a pink color when cut; twigs covered with a mass of rusty brown hairs; leaves broadly oval, 4-5" long and 2-3" wide; female flowers in small axillary clusters from short petioles, covered with a velvety pubescence; male flowers appear to be solitary and almost sessile on the twigs; fruits oval, about 1½-2" in diam., hanging in short axillary clusters; leathery and hairy rind softens upon maturity, and the pulp inside is edible; seeds large and angular. Uses of the tree the same as for the other species. (Yale 13779; 15330. Cooper 129; 261; 378.)

Maba Cooperi Hutch. & Dalz., sp. nov. (*ined.*). BLU-CHU (Bassa). Tree 35-40' tall and 6-8" in diam. with no buttresses; bark greenish brown, smooth, thin; leaves narrow, oval, with long tapering or hooked apex, glabrous, 2-4" long; female flowers in small axillary clusters; fruits axillary from very short stalks; husk leathery; seeds imbedded in watery pulp.

A very common tree in the under story. The long, slender boles are used for poles and house rafters of native buildings because of their strength and suitable form. The leaves are a source of a black dye. (Yale 13742; 15223; 15735. Cooper L 1; 92; 316.)

51. SAPOTACEAE

A family of 50 genera and over 500 species of trees and shrubs widely distributed over the warmer regions of the world. Their milky sap is in some cases of commercial importance, e.g., gutta-percha, balata, and chicle. Most of the fruits are fleshy and edible, and some species are especially cultivated on this account. The woods are very hard and heavy, and either reddish or yellowish; the red ones, such as the Brazilian Massaranduba (*Mimusops*), are noted for their strength and durability. The anatomy of the wood is

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highly characteristic, with the pores radially grouped, the parenchyma in fine tangential or wavy lines, and the rays narrow. There are seven genera listed for West Africa, five of which are represented in Liberia.

Chrysophyllum ellipticum A. Chev. (probably). BEHN (Bassa); BEARI (Mendi). Tree 50–60' tall and 18–24" in diam., with low buttresses; bark thin and smooth, brownish, striped with green; leaves dark green, narrow-oval, 3–4" long, blunt tipped, glabrous above, brownish below; flowers and fruits similar to those of *C. obovatum* G. Don. Milky sap from all parts of tree.

The sweet, acidulous fruit eaten by natives and animals. The wood is used for planks and timbers because of its hardness and durability. (Yale 15196. Cooper 282.)

Chrysophyllum obovatum G. Don. BEH (Bassa); TUINYNELLI (Mendi). Forest tree 100' tall and 3–4' in diam., with low buttresses, long clear bole, and full, spreading crown; outer bark greenish gray, roughly pitted; inner bark light red, stringy; leaves glabrous, leathery, 4–7" long, broadly oval to obovate, very abruptly acuminate, the base wedge-shaped; flowers small, in little, rusty brown clusters from old twigs or main branches; fruit oval, 1" long, berry-like; seeds with meaty cotyledons. A copious milky latex exudes from all parts of the tree when cut.

The tree is fairly plentiful in the high forest; being difficult to cut, it is generally avoided by the natives. The wood is highly durable and suitable for timbers and flooring. A medicinal oil is extracted from the seeds.

Heartwood dull reddish or purplish brown, merging gradually into the pale brown sapwood. Odorless and tasteless. Very hard, heavy, tough, and strong; texture rather fine; grain mostly straight; not difficult to work, considering its density; finishes very smoothly; splits easily and requires care in seasoning; is highly resistant to decay and insect attack. Growth rings indicated by wider spacing of parenchyma lines at intervals. Parenchyma in numerous, fine, wavy, concentric lines, mostly independent of the pores; width of lines 1 or 2 times that of the rays; spacing variable, but average about 2 pore-diams. Pores closed, visible as whitish dots, well distributed, occurring singly or more often in short radial rows; pores and groups with tendency to diagonal arrangement. Vessel lines inconspicuous. Rays invisible without lens on cross and tangential sections; low and inconspicuous on radial surface, appearing somewhat darker than background. (Yale 15217; 15322. Cooper 310; 463.)

Mimusops clitandrifolium A. Chev. (= *Sideroxylon Aylmeri* Scott).⁵

⁵ The specimen of this tree (Cooper 311) was identified by the authors of the

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MAHR-CHU (Bassa); TEYEI (Mendi). Forest tree 75-85' tall and 2-3' in diam., with long, clear bole, flanged buttresses, and huge roots spreading out for many feet along the surface; outer bark brownish gray, finely plated; inner bark reddish; leaves bunched at twig ends, glabrous, leathery, narrowly oval to obovate, 3-5" long, apex pointed or blunt, margin wavy; flowers small, in short axillary clusters, the pedicels up to 1" long; fruit pendulous, drupe-like, with edible pulp.

The hard, reddish wood is used for planks and timbers because of its durability. Oil from the seeds is used for frying food and dressing hair.

Wood reddish or purplish brown; sapwood pinkish. Luster low. Odorless and tasteless. Very hard, tough, and strong; texture medium; grain fairly straight; rather difficult to work because of its density, but not gritty; finishes very smoothly; requires care in seasoning; is highly durable. Growth rings absent or poorly defined. Parenchyma visible, in numerous, fairly regular, concentric lines, about twice the width of the rays and spaced about the diameter of one of the larger pores. Pores open, barely visible, arranged in radial or diagonal chains. Vessel lines inconspicuous. Rays not distinct without lens on cross and tangential sections; low and not prominent on radial surface. (Yale 15218; 15808. Cooper L 76; 311.)

?*Mimusops* sp. SUKAI (Mendi); AFRICAN PEARWOOD (English). Tree medium-sized to large, with very hard, reddish timber noted for its strength and durability. The anatomy of the wood is similar to that of the preceding. (Yale 13763. Cooper 113.)

Omphalocarpum elatum Miers. DEH (Bassa). Forest tree, sometimes 100' tall and 3-4" in diam., with long, clear bole; buttresses low or absent; bark brownish green, furrowed or plated; leaves 5-7" long, obovate, blunt or rounded at apex, long tapering to base, bunched at twig ends, glabrous, dark green above, brownish below; flowers in clusters from main stem; corolla white, showy, with a comb-like lining; fruit oval or globose, berry-like, of the size and shape of a grapefruit (*Citrus*), with leathery husk becoming a hard shell on drying, and filled with pulpy mass containing a great number of flat, pumpkin-like seeds, each 1" long. Milky juice present in all fleshy parts of the tree.

Large tree trunks are made into canoes and planks; smaller ones into

Flora of West Tropical Africa as *Sideroxylon Aylmeri* Scott and is so listed in Vol. II, no. 1, p. 12. *Mimusops clitandriifolium* A. Chev. is given as a synonym. The woods of *Sideroxylon*, however, are typically yellow and their anatomical details are distinct from *Mimusops*, to which this specimen closely conforms.—S. J. R.

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rice mortars. Fresh wood and bark have a slightly fetid odor. Strings of dried seeds are worn as ornaments by dancing girls. An oil is extracted from the seeds and used for treating "yaws" of the feet.

Heartwood pale reddish brown, merging gradually into the lighter sapwood. Luster low. Odorless and tasteless when dry. Of medium density and weight; texture rather coarse; grain fairly straight, sometimes curly; easy to work, finishes smoothly, holds its place well when manufactured; is only moderately durable. Growth rings indicated by narrow bands deficient in parenchyma lines. Parenchyma in very numerous lines, finer than the rays with which they form a web-like pattern; average spacing about one half the width of a pore. Pores open, readily visible, rather few, mostly in radial groups or rows, with decided tendency to diagonal arrangement. Vessel lines distinct. Rays not distinct without lens on cross and tangential sections; conspicuous in proper light on radial surface. (Yale 13731; 15787. Cooper L 55; 81; 383.)

52. LOGANIACEAE

A family of trees, shrubs, and climbers, widely distributed in the tropics and subtropics. It is not the source of any important commercial timber, being best known for its medical products, such as nux vomica and strychnine.

Anthocleista nobilis G. Don. DWEH (Bassa); PONGOI-HINI (Mendi). Tree 50-60' tall and 12-18" in diam., with buttresses low or absent; bark furrowed, greenish gray, armed with twin-set thorns; leaves glabrous, leathery, up to 18" in length, oval, tapering along petiole at base and rounded at apex; flowers showy, at ends of long stout stalks; tubular corolla over 1" long, divided at rim and turned back, exposing large anthers and stigma.

This tree is generally found close to rivers or in other wet situations. The wood, though soft and easy to cut, is very heavy when green because of the very high moisture content. For these reasons, as well as on account of the thorns, the natives use the logs in making dead-fall traps for animals. The wood is of excellent quality for general carpentry, box boards, plywood, etc., requiring ease of working rather than attractive figure or durability. An infusion of the bark is employed in veterinary medicine.

Color of wood creamy white; blue stain present in sapwood. Fairly lustrous. Odorless and tasteless when dry. Rather light and soft, but firm; texture medium; grain straight; very easy to work, finishes smoothly, would probably hold its place well when manufactured; does not appear resistant

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to decay. Growth rings not clearly defined. Parenchyma in numerous, wavy, tangential lines, visible on all sections without lens, connecting the pores but not completely surrounding them; spaces between lines about two pore-widths. Pores open, readily visible, suggesting small pinholes, not numerous, fairly uniformly distributed, occurring singly or less commonly in radial pairs. Vessel lines rather prominent, appearing darker than background. Rays fine, near limit of vision on cross section, scarcely visible with lens on tangential; not very distinct on radial surface; some of the rays contain open intercellular canals appearing to unaided eye as tiny dark specks on tangential surface. (Yale 15122; 15292; 15833. Cooper L 101; 190; 380; 428.)

Gaertnera Cooperi Hutch. & Moss, sp. nov. (*ined.*). ZAR-DEH-JAY; DWEH-VAH (Bassa). Tree less than 30' high and 5" in diam., with gray, scaly or roughened bark; leaves opposite, glabrous, leathery, oval-oblong, 4-6" long, tapering at both ends, with 6-8 pairs of lateral nerves, petiole $\frac{1}{2}$ " long; tubular flowers in terminal panicles or heads, with white corolla, pubescent inside; fruit a greenish black, 2-celled capsule with many very small seeds.

The leaves are used in making monkey traps, being placed as a camouflage over the top of the picket fence. They are also dried and made into a powder which is blown into the wind when calling the monkeys. The name "dweh-vah" means "monkey herbs" and is similar to the Bassa name for another tree in this family, *Anthocleista parviflora* Bak. The purpose of trapping the monkeys is to prevent their destroying the maturing rice and maize. (Yale 15132; 15199; 15324. Cooper 202; 287; 465.)

Gaertnera salicifolia Hutch. & Gillett, sp. nov. (*ined.*). MOHR-CHU (Bassa). Said to be a fairly large tree, but specimen only 20' tall and 3" in diam.; bark reddish green, lumpy, finely cracked; leaves opposite, lanceolate, 2-4" long, with long-tapering, sometimes hooked apex; flowers small, in pendulous terminal panicles; fruits drupaceous, oily.

The oil from the fleshy fruit is used in treating craw-craw, a disease of the skin. (Yale 15192. Cooper 277.)

Strychnos Afzelii Gilg. Vine or climbing shrub; leaves opposite on long twigs giving appearance of pinnae, obovate, 1-2" long, glabrous, reticulate with one large secondary vein on each side of midrib; twigs and petioles with few hairs; flowers from axils of leaves in very tiny clusters at end of stalks 1" long; tendrils sometimes replace flower stalks; fruits not observed. (Cooper 180.)

Strychnos Cooperi Hutch. & Moss, sp. nov. (*ined.*). Vine or climbing

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shrub; leaves opposite on twigs giving the appearance of pinnae, oval, 2-2½" long with beaked apex; flowers very small in short axillary racemes less than 1" long; fruits not observed. (Cooper 300.)

53. APOCYNACEAE

A large family, mostly tropical, containing over 130 genera and 1000 species of trees, shrubs, and climbers, generally characterized by a copious milky latex in the bark or by conspicuous fragrant flowers. Some *Landolphia* vines and *Funtumia* trees are commercial sources of excellent rubber. The texture of the wood is generally fine, and some species have been used successfully for carvings and shuttles and for general carpentry. They are mostly pinkish or yellowish, without attractive figuring, and are not resistant to decay. Liberian collections contain seven genera, only two of which are trees of any importance.

Clitandra leptantha Hallier f. Vine with glabrous, lanceolate leaves and small clusters of tiny, yellow, axillary flowers. (Cooper 235.)

Clitandra nitida Stapf. Vine with glabrous, leathery, broadly oval leaves having conspicuous herringbone venations; globose fruit, 1" in diam., with greenish black husk having wart-like surface; tendrils from axils of leaves. (Cooper 43.) Some closely related species found in Nigeria are sources of wild rubber of good quality.

Conopharyngia durissima Stapf. WEH-BOH; BO-GAR (Bassa). Infrequent tree 60-70' tall, 2' in diam., sometimes with buttresses or divided trunks; bark brownish gray, finely cracked, thin, with prominent lenticels; leaves glabrous, leathery, oval, 6-10" long; flowers long-stalked, corolla tube over 1" long, pale yellow-white, strongly scented; fruits hanging in pairs, berry-like, globose, 2-3" in diam., hooked at tip, with leathery rind of greenish brown color, and a mass of seeds imbedded in the sticky white pulp; white sticky latex abundant in all parts of the tree.

The wood is light, easy to work, and is used occasionally for making rice mortars even though highly susceptible to fungous stain. The latex is used to treat ringworm by direct application after the infected part has been scraped clean.

Wood yellowish white, with brown stains. Fairly lustrous. Odorless and tasteless. Moderately hard, compact, fine-textured, straight-grained, easy to work, finishes smoothly, is not resistant to decay. Growth rings apparently absent. Parenchyma not visible with lens. Pores visible without lens, fairly numerous but not crowded, occurring singly or more often in radially flat-

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tened rows of two to several pores each. Vessel lines indistinct. Rays near limit of vision on cross section, invisible on tangential, distinct but not conspicuous on radial surface. Wood suitable for general carpentry, plywood, box boards, and miscellaneous common uses when decay is not a factor. (Yale 13767; 15147; 15166; 15760. Cooper L 28; 117; 221; 242.)

Funtumia africana Stapf. BU-AY-BOH (Bassa); BUBOI (Mendi); RUBBER TREE (English). Tree 75' tall and 18-24" in diam., with straight bole; bark greenish, thin, with fine scales; twigs flattened or ribbed; leaves leathery, glabrous, variable from broadly oval to almost lanceolate; flowers $\frac{1}{2}$ " long, with tubular corolla, in axillary clusters.

This tree is scarce in some places, but composes small groves in others. The milky latex is as thick as bird lime and is not suitable for rubber. The species is often confused with the large *Funtumia elastica*, the Rubber Tree, which yields the commercial latex and which is said to be plentiful in the Lino Basin of Liberia. The wood of *F. africana* is much like that of *Conopharyngia durissima* (described above) and is used locally for making doors and planks because it is easy to work and said to be reasonably durable, although subject to sapstain and to the attack of stag beetles. The powdered dry leaves are used to treat fire burns. (Yale 15265; 15327; 15754. Cooper L 20; 373; 468.)

Landolphia leonensis Stapf. WAYE-DOO (Bassa); NALI (Mendi); WITCH VINE (English). This is one of the false rubber vines. The leaves are broadly oval, 5-6" long, slightly pubescent on both surfaces, especially along brownish midrib; flowers in small clusters which branch out from the central stalk. The viscid latex is of no commercial importance. The natives use the leaves, together with the bark of a tree called "gbu-aye" (probably *Fagara angolensis*), as a poultice in treating what they call "mumps." (Yale 15287. Cooper 423.)

Pleiocarpa Simii Stapf. Shrub with glabrous, oval leaves, 3-4" long; fruits in pairs, oval, hooked at ends, $1\frac{1}{2}$ " long, of orange-red color. (Yale 15105. Cooper 169.)

Pleiocarpa mutica Benth. Tree 25' tall and 4" in diam., with a drooping crown; leaves up to 8" long, rather papery, broadly oval, glabrous, with a grayish tint; flowers with white corolla about 1" long, fragrant, in few-flowered axillary clusters. (Cooper 248.)

Rauwolfia vomitoria Afz. KAWOGEI (Mendi); SWIZZLE-STICK (English). Small tree under 20' in height, sometimes appearing as a shrub along streams and near beach; twigs angular, dotted with white lenticels; leaves

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papery, 5-6" long with a tapering base; flowers in small head-like clusters on short terminal stalks; fruits small, globose, greenish.

This tree is of no importance as timber, but is sometimes planted as a live fence. The whorled arrangement of the upper branches makes it suitable for swizzle-sticks. The wood is considered a poor substitute for Boxwood. (Yale 15118. Cooper 186.)

Voacanga bracteata Stapf. VOO-FOHN (Bassa). Tree less than 20' tall; leaves 2-10" long, tapering at the base; flowers in clusters on long terminal stalks, each flower having a stalk 1½" long and corolla 1" long, with yellowish white petals spread out in a flat plane; paired fruits, finger-like, 1-2" long, with greenish leathery skin. The milky latex is used in adulterating rubber. The woods of this and the next species are of the same type as that previously described. (Yale 15146. Cooper 219.)

Voacanga obtusa K. Sch. JE-RAY-KREHN (Bassa). Tree 40-50' tall and 12-16" in diam.; twigs black; leaves glabrous, leathery, 6-8" long, tapering at base and rounded at apex; veins almost at right angles to the midrib and conspicuous because of regularity; flowers creamy white, large, and conspicuous, heavily scented, appearing in small clusters on long stalks; fruits oval or globose, 2-3" in diam., with blunt or round apex and rough or leathery husk, growing in pairs pendulous from stout stalks. (Plate XI, No. 1.) The natives scatter the ripe fruits in the rice fields to keep out wild hogs. (Yale 15295; 15107. Cooper 431; 172.)

54. ASCLEPIADACEAE

A family of perennial herbs, undershrubs, shrubs, and climbers, occurring mostly in the warmer regions of the world and very numerous in South Africa. A total of 94 species, representing 32 genera, are recorded for West Africa, but they are of no economic importance.

Periploca nigrescens Afz. DOE-DOO (Bassa). Climbing shrub or herb with oval or ovate glabrous leaves 2-4" long on petioles 2" long; flowers cymose; buds oval, about ¼" long; fruit a follicle. There is a distinctive bract at each joint in the cyme which might be mistaken for a stipule. The juice from the leaves of the plant is used as a remedy for diarrhea. (Cooper 453.)

55. RUBIACEAE

A family of over 350 genera and 6000 species of trees, shrubs, and herbs, mostly tropical. Its two best known commercial products are coffee from

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Coffea arabica L., and others, and cinchona or quinine bark from species of *Cinchona*. The trees are mostly small and the timbers are of little economic importance. *Calycophyllum* of the West Indies supplies the "Lemonwood" of the archery bow-makers; species of *Gardenia* are sometimes used as substitutes for Boxwood; various others fill local needs requiring a fine-textured and tough material in small sizes and not expected to resist decay. Some of the West African trees attain large size, and one of them (*Sarcocephalus*) supplies an attractive orange-yellow timber that is in growing demand for fine veneers. Another large tree, of considerable local importance, is *Mitragyna stipulosa* O. Kuntze, which is found throughout the entire West Coast; its easily worked, tan-colored wood serves for general utility purposes. The Brimstone Tree (*Morinda* sp.) and *Pausinystalia Lane-Poolei* Hutch. are used locally for general building. Of the 73 genera listed for West Africa, 22 are represented in the present Liberian collections.

Amaralia Sherbourniae Wern. SE-BO-BU-AY (Bassa). Climbing shrub; leaves obovate, 4-6" long, with shortly beaked apex and long tapering base; flowers solitary, axillary, whitish or faintly pink purple, petals 1" long; fruit oblong-oval, 2-celled, many-seeded. The fruits are chewed as a cough medicine by natives. (Cooper 328.)

Aulacocalyx jasminiflorus Hook. f. PLAY-JE-NEE (Bassa). Tree 30-45' tall and 6-9" in diam., with somewhat fluted bole but no buttresses, often with a bend near base; leaves oval, 3-4" long, with acuminate apex and wedge-shaped base, pale green and glabrous above, brownish gray beneath; flowers fragrant, in short fascicles between the new branches; calyx oblong, notched, 1/4" long, pale brown; corolla slender, funnel-shaped, over 1" long, divided for last half of length, silvery white, all parts with velvety pubescence; stamens linear. The bole is very strong and resilient, and saplings are often employed for spring traps and for fence poles. The naturally bent trunks are used for boat ribs. (Yale 13740; 13785. Cooper 90; 142.)

Bertiera racemosa K. Sch., var. **glabrata** Hutch. & Dalz. GBAH-CHU (Bassa). Tree less than 25' tall; bark light brown, cracked; leaves broadly oval, up to 10" long, with shortly pointed apex and wedge-shaped or rounded base; inflorescence in terminal, spike-like, pendulous panicles of reflexed tubular flowers under 1" long with white petals; fruit a berry in small clusters, greenish brown, softly pubescent, oval or egg-shaped, under 1/2" long (immature?) with fringe-like beaked apex. The bark is used by natives as a poultice for treating snake bite. (Yale 13705; 15174. Cooper 55; 258.)

Canthium acutiflorum Hiern. JOR-WEE (Bassa). Climbing shrub or low

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tree 10-15' tall; twigs armed with short sharp spines; leaves glabrous, glossy, somewhat leathery, oval-ovate, 3-4" long, rounded at base, with tapering, wedge-like apex; flowers in short clusters from common stalk, corolla tube $\frac{1}{4}$ " long; fruit a subglobose berry with persistent sepals at apex, paired, pendulous. The macerated leaves and fruits are used as a body rub for treating rheumatism. (Yale 15234. Cooper 327.)

Canthium hispidum Benth. WRO-DOO (Bassa). Unarmed shrub with conspicuous short bristly hairs on twigs and leaf margins; new shoots dark reddish brown; leaves dark green, glossy, up to 2" long, oval-oblong, with rounded base; inflorescence a dense panicle composed of flowers $\frac{1}{4}$ " long, on short hairy pedicels; fruit a globose berry $\frac{1}{4}$ " in diam., reddish or black when ripe, depressed into two equal parts, in short clusters, pendulous.

The name "wro" refers to a poisonous insect, the sting of which is said to be neutralized by applying a poultice of the burnt and powdered bark mixed with palm oil. The juice from the leaves is used to bathe the swollen parts. (Cooper 309.)

Canthium setosum Hiern. Woody climber; twigs ciliate; leaves broadly oval-ovate, 3-4" long, with shortly beaked apex and rounded or notched base, both surfaces covered with bristly hairs; flowers in short axillary clusters from common stalk; fruit drupaceous, globose, $\frac{1}{2}$ " in diam., with woody husk when ripe. (Cooper 389.)

Canthium venosum Hiern. KAY-NE-DOO. Climbing shrub, hairy pubescent, without spines; leaves 2-3" long, oval, tapering at both ends, dark green and glabrous above, pale brownish underneath; young twigs, petioles, under side of veins and upper side of midrib covered with fine brownish pubescence; flowers very small, in pairs clustered on common stalk; fruit a globose berry $\frac{1}{2}$ " in diam., woody when mature. The burnt wood (charcoal ?) is mixed with palm oil and used as a poultice on boils. (Yale 15310. Cooper 448.)

Chasalia elongata Hutch. & Dalz., sp. nov. (*ined.*). Low bushy shrub; leaves papery, glabrous, dull green, narrowly oblong, 8-10" long, with abruptly acuminate apex and wedge-shaped base, lateral nerves prominent, 12-14 pairs; flowers in terminal purplish corymbs, corolla $\frac{1}{2}$ " long, tubular, glossy, pale yellow. (Cooper 33.)

Coffea humilis A. Chev. Shrub found along streams or in wet situations; leaves glabrous, narrowly obovate lanceolate, sometimes 12" long, with abruptly acuminate apex and long tapering base, midrib and lateral nerves prominent, about 12 pairs; flowers fragrant, perfect, in terminal, bracteolate

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clusters or fascicles, corolla white; fruit an oval, fleshy, red berry less than 1" long, in terminal clusters. (Cooper 28; 137.)

Gardenia Abbeokutae Hiern. PLEH-CHU (Bassa). Tree 15-25' tall and 3-5" in diam.; leaves dark greenish black, shiny glabrous above, broadly oval, 3-4" long, with hook-pointed apex and wedged or rounded base; flowers very showy, solitary, stalked; sepals small, pointed; corolla tubular, funnel-shaped, 2" long, creamy white; stamens and pistil also very long. The inner bark is scraped and used as a poultice on boils. (Yale 15202. Cooper 290.)

Geophila cordiformis A. Chev. and **G. hirsuta** Benth. Creeping herbs on forest floor. (Cooper 50 and 41, resp.)

Heinsia pulchella K. Schum. PEE-DOH; SO-NI-NI-CHU (Bassa); PEG-BLAGEI (Mendi); BUSH APPLE (English). Tree less than 30' tall, often with crooked bole; bark thin, light gray, with numerous fine warts or scales; leaves dark green above, lighter beneath, glabrous, papery, narrow-oval, 2-4" long, apex sharply pointed or sometimes hooked, base rounded or wedge-shaped; flowers slightly fragrant, showy, in cymes or solitary, with white petals and yellowish center, suggesting Wild Jasmine; fruit globose, 1" in diam., with persistent sepals at apex, hairy leathery green rind and white pulpy center when fresh, later turning reddish brown and drying to hard shell.

This tree is said to be plentiful in the lower under story of the forest. It is too small to be of any commercial value, but is utilized locally for tool handles and spring traps on account of its strength and resilience. (Yale 13752; 15139; 15161. Cooper 102; 210; 236.)

Ixora congesta Stapf. WAR-BUEH (Bassa). Tall shrub; leaves leathery, smooth but dull, sometimes 12" long, oval-lanceolate, wedge-shaped at base and long pointed at apex; inflorescence dense, long-stalked corymbs; flowers slender, 1" long before open; fruit a small, reddish brown berry.

The leaves are used by the natives as a juju during the burning of the freshly felled jungle. They are tied into large bundles and beaten upon the ground to invoke high winds. (Yale 15131. Cooper 201.)

Ixora divaricata Hutch. & Dalz., sp. nov. (*ined.*). KPON-DOE (Bassa). Tree 15-20' tall; bark dingy gray-brown, sometimes mossy; leaves glabrous, narrowly oval, 3-5" long, tapering at both ends, petiole up to 1" long; flowers in open corymbs, buds very slender, $\frac{1}{2}$ - $\frac{3}{4}$ " long, pointed; fruit a small red berry, $\frac{1}{4}$ " in diam., eaten by birds. (Yale 15215; 15216. Cooper 307; 308.)

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Ixora laxiflora Smith. TUD-WAN (Bassa). Tall shrub or a tree less than 25' tall; leaves dull green above, brownish below, narrowly lanceolate, 4-5" long, 1-2" wide, long tapering at both ends, margins wavy but entire; flowers slender, up to 1" long in bud, fragrant, pale creamy white to pink, loose, often pendulous corymbs; fruit a small reddish berry, $\frac{1}{4}$ " in diam., eaten by birds. (Yale 13708. Cooper 58; 361.)

Mitragyne stipulosa O. Kuntze. BOH; M'BOY (Bassa); POPLAR (English). Tree over 100' tall, 4-5' in diam., with low buttresses, and long, straight, clear bole; bark dingy brown, ridged, but not rough, $\frac{1}{2}$ - $\frac{3}{4}$ " thick; leaves glabrous, broadly oval, sometimes almost rectangular, up to 10" long and 8" wide on petiole 1-2" long, rounded at apex and base, lateral veins very conspicuous, about 8 pairs; stipules deciduous, leaf-like, 1-1 $\frac{1}{2}$ " long, very conspicuous; flowers in globose heads on short stalks in cymose arrangement, heads over $\frac{1}{2}$ " in diam., corolla greenish white, fragrant; fruiting heads 1" in diam.; seeds very small, winged at both ends.

The leaves are sometimes employed in thatching, and the powdered bark is used by native women for applications to the skin. Canoes and building lumber are made from the larger trunks. The wood is durable when not exposed to the weather and is well suited for interior construction work and box lumber, because of its straight grain and light weight combined with stiffness and strength.

Wood brown or tan throughout. Not highly lustrous. No distinctive odor or taste. Moderately light, but firm, tough, and strong; texture rather coarse, uniform; grain straight; very easy to work, finishes smoothly, does not take a glossy polish, holds its place well when manufactured; well suited for utility plywood; is probably not resistant to decay and insect attacks. Growth rings present, mostly determined by narrow parenchyma-less bands and sometimes also by concentric arrangement of pores. Parenchyma diffuse and also in very numerous, short, tangential lines, in irregular network with the rays; invisible without lens. Pores open, small but visible, very numerous and crowded, mostly in radial groups or rows. Vessel lines inconspicuous. Rays not distinct without lens on cross and tangential sections; distinct but not very prominent on radial surface. (Yale 13754; 15219; 15748. Cooper L 14; 104; 312.)

Morinda geminata DC. SBAY-CHU (Bassa). Tree 25-30' tall and 5-6" in diam.; leaves dark greenish black, leathery, broadly oval, almost rounded, 6-8" long, 4-6" wide, rounded at base, flattened apex with very short blunt beak, lateral nerves prominent, 7 or 8 pairs; flowers sessile in axillary, stalked, bracteolate heads, with white or yellow tubular corolla and linear

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stamens; fruit globose, reddish when ripe, succulent, composed of united carpels with wavy, oval seeds.

The tree is said to be plentiful, but the wood is not used except for fuel. A decoction of the macerated bark and leaves is used to bathe the body and feet to allay fevers and cure internal inflammations. (Yale 15307. Cooper 445.)

Mussaenda Afzelii G. Don. JEE-JERAY-FLAY (Bassa). The National Flower of Liberia. Climbing shrub or bush; branchlets rather harshly pubescent; leaves oval-obovate, 4-6" long, with short petiole, acuminate or hooked apex and wedge-shaped base; stipules less than $\frac{1}{4}$ " long; flowers in short, terminal pubescent cymes; calyx tubular, $\frac{1}{4}$ " long, sepals very short except one on each flower which is enlarged like a leafy bract, 2-3" long, fan-like, pale creamy white or yellow, very conspicuous; corolla yellow, tubular, 1-1 $\frac{1}{2}$ " long; fruit oval when ripe, over 1" long, slightly ribbed, covered with short hairs. (Plate I.)

The juice from the macerated leaves is used by natives as an eyewash when the eyeball is inflamed and swollen and is said to bring quick relief. (Cooper 413.)

Oldenlandia lancifolia Schwein. Herbaceous plant with glabrous, lanceolate leaves and small white flowers solitary or in fascicles. (Cooper 4.)

Pausinystalia Lane-Poolei Hutch. TROEHN-DRU-PLOHN (Bassa); GIBOWALI (Mendi). Infrequent forest tree sometimes 100' tall and 4' in diam., with straight, clear bole 40-50' long; buttresses low; bark reddish brown with green blotches, pitted with prominent scars wherever a plate or scale has fallen away; leaves glabrous, dark green above, brownish beneath, oval-oblong, up to 6" long and 2 $\frac{1}{2}$ " wide on petiole $\frac{1}{2}$ - $\frac{3}{4}$ " long, rounded at base, abruptly pointed at apex, margins wavy, entire, lateral veins conspicuous; flowers clustered in dense heads on long, slender stalks; petals yellow-white, sometimes turning purple-pink when fully developed; stamens long-pointed.

The powdered bark is used in treating ground itch (yaws) by applying as a poultice. The branches are used for making spring traps because of their strength and elasticity. The wood, though plain and not resistant to decay, should be useful for interior finish and for utility veneers.

Wood pale brown when fresh, turning pinkish (as in *Sickingia*), and then superficially light olive brown; little distinction between heartwood and sapwood. Luster low. Odorless when dry; taste slightly bitter. Mod-

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erately heavy and hard; tough and strong; fine-textured; grain straight to irregular; easy to work, finishes very smoothly, holds its place well; is probably not highly resistant to decay and insect attacks. Growth rings poorly defined. Parenchyma diffuse, indistinct with lens. Pores open, not distinct without lens, very numerous, rather crowded, uniformly distributed, solitary or in short radially flattened groups. Vessel lines indistinct. Rays fine, faintly visible on cross section, but requiring lens on the tangential; distinct on radial surface, appearing somewhat darker than background. (Yale 13786; 15193; 15807. Cooper L 75; 143; 278.)

Psychotria rufipila A. Chev. SAYR-CHU (Bassa). Small tree with narrowly oval leaves, 2-4" long, gray green above, brownish beneath; bracts and stipules hairy. A decoction from the macerated bark and leaves is used as an astringent for native children. (Yale 15309. Cooper 447.)

Psychotria sp. KRA-KPAR-DOO (Bassa). Climbing shrub; leaves dark green, papery, obovate, 6-8" long, with hooked apex; flowers very small, white, clustered. The literal meaning of the native name of the plant is "running away," and refers to its climbing habit. (Cooper 360.)

Psychotria sp. A shrub with cymose heads of very fine white flowers, and oval, green-skinned fruits, $\frac{1}{4}$ " long. (Cooper 163.)

Psychotria sp. KOR-WAH (Bassa). Small tree with broadly oval, prominently veined leaves and small gooseberry-like fruits in terminal heads. A decoction of the macerated leaves is used to alleviate bronchitis. (Yale 15279. Cooper 410.)

Randia acuminata Benth. NEH-MLE-CHU (Bassa). Tree less than 20' tall, often growing in a leaning position; stipules persistent; bark greenish gray, somewhat roughened or warty; leaves dark dull green, narrowly oval to obovate, 6-9" long, wedge-shaped at both ends, but with the base notched or cordate, sessile, lateral veins prominent, 12-15 pairs; twigs brownish black; flowers in short axillary pedunculate cymes; calyx deep green, less than 1" long, funnel-shaped; corolla pointed in bud, as long as calyx, deep pink to white; fruit conical or oval, sometimes pointed, ribbed, about 2-4" long, with greenish gray, spongy, scaly husk; seeds angular, flattened. The bark, leaves, and fruits are used as a fish poison. (Yale 15169. Cooper 252.)

Randia genipaeiflora DC. BLAR-JEE (Bassa). Tree 15-20' tall; leaves glabrous, dull blackish green, oval, 2-5" long, tapering at both ends, petiole $\frac{1}{2}$ " long; flowers less than 1" long, tubular, greenish white, in short axillary cymes; fruit globose, $\frac{1}{2}$ " in diam., spongy, solitary.

The bole is strong and elastic and is used for spring traps. The powdered

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leaves are used as a snuff to attract leopards to a blind. (Yale 15272. Cooper 403.)

Randia malleifera B. & H. f. MEHR (Bassa); PONDEI (Mendi). Shrub or low tree less than 15' tall; leaves leathery, glabrous, oval, 5-7" long, wedge-shaped at both ends, petiole $\frac{1}{2}$ -1" long; flowers solitary, 1-2" long, terminal or at ends of short lateral branches; corolla funnel-shaped, white; fruits globose, sometimes 2" in diam., with greenish leathery husk inclosing several large seeds.

The seeds contain a blue-black dye which is used by the native girls for decorating their bodies for ceremonial occasions. (Yale 15311. Cooper 450.)

Sabicea lasiocalyx Stapf. GOR-VAH (Bassa). Climbing shrub; leaves glossy, broadly oval or rounded, 6" long and 3-4" wide, with very shortly beaked apex and rounded or wedge-shaped base, petiole 1" long; lateral veins prominent; flowers less than 1" long, with slender corolla, crowded in dense, capitate, cup-like cymes; bracts under 1" long; fruit of the size and shape of a pea; petioles, twigs, flower stalks, and under side of leaves covered with soft velvety pubescence.

The dried leaves are used as a snuff to counteract the effect of enemy witchcraft. (Cooper 459.)

Sarcocephalus esculentus Afz. DOE-VAH (Bassa); GOLLI-NYUM-BUY-AMBEI (Mendi); SIERRA LEONE PEACH; COUNTRY FIG (English); KISHIA (Trade). Forest tree sometimes 100-125' tall and 4-5' in diam., generally 80-90'; trunk slightly fluted, with low buttresses; twigs speckled, blackish; bark brownish gray, cracked or scaly; leaves glabrous, broadly oval, 5-7" long, with wedge-shaped apex and rounded base, petiole under 1" long, lateral nerves conspicuous, 5-6 pairs; stipules obovate, 1" long, prominent; flowers fragrant, in terminal globose heads 2" in diam.; corolla $\frac{1}{2}$ " long, pale yellow and pink, or white; stigma white and style brownish pink; fruits 2-2 $\frac{1}{2}$ " in diam. when ripe, orange-red color, very succulent, edible, with slightly pitted, rough, but soft, skin.

There are two forms of this species, one a small tree 25-35' tall growing in open deciduous regions, the other a huge forest tree. The fruit is edible raw and much sought by natives; it is also stewed and sometimes dried and stored away. The wood is used for native rice mortars as it combines durability and tenacity with ease of working with primitive tools. It is exported from other parts of West Africa to Europe and America for furniture making and veneers.

RUBIACEAE

Heartwood a rich orange-yellow; sapwood white or gray. Fairly lustrous. Slightly fragrant; taste rather bitter. Moderately heavy; hard, tough, and strong; texture rather coarse; grain interwoven; easy to cut and carve, fairly easy to work, finishes smoothly, takes a high polish; requires care in seasoning but will hold its place well when manufactured; appears durable. Growth rings poorly defined. Parenchyma sparingly developed, mostly diffuse, scarcely distinct with lens. Pores open, readily visible, not numerous, scattered, mostly solitary, with tendency to arrangement in diagonal rows. Vessel lines very distinct. Rays fine, near limit of vision on cross section and requiring lens on tangential; low and inconspicuous on radial surface. (Yale 15194; 15773. Cooper L 41; 279.)

Tarena nitidula Hiern. Shrub of common but irregular occurrence in the high forest; twigs greenish brown; leaves glabrous, oval, 3-4" long with beaked acuminate apex and wedge-shaped base; flowers in terminal or subterminal bracteolate cymes; corolla white, funnel-shaped, divided and rolled back at the upper part exposing the long stamens; fruit a 2-celled berry. (Yale 15135. Cooper 206.)

Urophyllum Afzelii Hiern. Shrub; leaves coriaceous, narrowly oval or lanceolate, 3-5" long, with long tapering apex and wedge-shaped base, petiole $\frac{1}{4}$ " long; flowers with slender corolla $\frac{1}{4}$ " long, in short axillary clusters; fruit a small berry, red when ripe, under $\frac{1}{4}$ " in diam. on pedicel $\frac{1}{2}$ " long. (Yale 13700. Cooper 48; 250.)

Urophyllum Linderi Hutch. & Dalz., sp. nov. (*ined.*). JE-RAY-WAR-BE-DEH (Bassa); MONKEY FRUIT (English). Tall shrub; young twigs pubescent; leaves lanceolate, 3-5" long, with acuminate apex and wedge-shaped base, petiole $\frac{1}{4}$ ", pubescent; flowers pubescent, with fringe-like calyx or bract, sessile, axillary, solitary or in small clusters; stamens long pointed; fruit an oval berry, $\frac{1}{2}$ " long, black or red when ripe, with persistent stamen or calyx. (Yale 13697; 15092. Cooper 36; 151.)

Urophyllum stipulosum Hutch. & Dalz., sp. nov. (*ined.*). Shrub with pubescent twigs and hairy leaf shoots; leaves tough, leathery, narrowly oval, 5-7" long, long tapering at both ends, lateral veins very conspicuous, the midrib with long hairs; stipules $\frac{1}{2}$ - $\frac{3}{4}$ " long, ovate-lanceolate; flowers in sessile axillary clusters, the calyx green and pubescent, the corolla white; fruit a very small berry, brown when ripe. (Yale 13698; 15134. Cooper 37; 205.)

Vangueriopsis discolor Robyns. KPAR-WEE (Bassa). Tree less than 30' tall; bark contains a pale orange-red sticky sap which soon congeals on exposure to the air; twigs with fine spines; leaves soft and papery, oval-oblong,

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2-3" long, acuminate, pale green beneath; stipules pointed, $\frac{1}{4}$ " long, conspicuous; flowers in short axillary panicles; corolla very slender, tubular, $\frac{1}{4}$ " long; sepals persistent; fruit a small drupe.

The leaf shoots are cooked with rice and fed to a person afflicted with a nervous disease called "fits." The patient also chews the bark. (Yale 15289. Cooper 425.)

Virecta procumbens Smith. Creeping herb on forest floor. (Cooper 6; 18.)

56. COMPOSITAE

A very large family of world-wide distribution consisting mostly of herbs and shrubs, many of them common weeds. The Liberian collections contain seven species, one of which, a small tree, was collected by S. T. Hunting.

Adenostemma Perrottetii DC. Herb with white flowers in aster-like heads. (Cooper 2.)

Ageratum conyzoides L. Common tropical weed. (Cooper 24.)

Emilia sagittata DC. Herb with thistle-like red-topped flowers. (Cooper 1.)

Microglossa volubilis DC. GBAN-GBAH (Bassa). Climbing shrub or herb with compound heads of white, floss-like flowers; leaves spear-like or ovate, under 2" long; seed ribbed. Infusion of the leaves used as a vermifuge, enema, and inhalent. (Cooper 449.)

Mikania scandens Willd. Low, creeping herb with tufts of very small sessile white flowers. (Cooper 40.)

Vernonia conferta Benth. KONGOLI (Mendi); GLABE (Grebo); SOAP TREE; CABBAGE TREE (English). Small tree with large, obovate leaves over 12" long; flowers in long, branching racemes, each flower or head with a short stalk and a series of star-like bracts at base. The ashes from this plant are used by the natives in making soap. (Yale 12448. Hunting 7.)

57. CONVULVULACEAE

A widely distributed family of herbaceous or woody, often climbing, plants, usually with milky juice. The best known member is the common morning-glory. There are 17 genera with a total of 66 species listed for West Africa.

Aniseia uniflora Choisy. Creeping herb with heart-shaped leaves and white flowers having three wing-like bracts. (Cooper 9.)

Bonamia cymosa Hall. f. Doo (Bassa). Climbing shrub or vine with

VERBENACEAE

spike-like heads of flowers; sepals brown, pubescent; petals white; fruit a dehiscent oval-shaped capsule $\frac{1}{4}$ " long. (Cooper 220.)

Ipomoea digitata L. A kind of morning-glory with 5-lobed leaves and purple trumpet-shaped flowers. (Cooper 15.)

Ipomoea involucrata Beauv. Another kind of morning-glory with cordate leaves and pink flowers. (Cooper 11.)

58. ACANTHACEAE

A family of about 200 genera and over 200 species distributed throughout the tropics, mostly herbaceous or climbing, rarely shrubs or trees; of no importance in Liberia. Leaves opposite, simple, without stipules; flowers perfect, irregular; fruit a dehiscent capsule. The woods of the family vary from soft to moderately hard.

Lankesteria brevior C.B.Cl. Herb or shrub with spike-like heads of white flowers, yellow centers, large, green, leaf-like bracts. (Cooper 44; 160.)

Physacanthus nematosiphon Rendle & Britton. Herb or creeper with white flowers. (Cooper 17.)

Thunbergia cynanchifolia Benth. Slender climbing plant on trees, with triangular leaves and pure white flowers. (Cooper 10.)

Whitfieldia colorata C.B.Cl. Shrub 10' high with terminal clusters of reddish brown flowers having large bracts. (Yale 13696; 15093. Cooper 34; 152.)

59. VERBENACEAE

A family of 75 genera and over 1300 species of trees, shrubs, and herbs of very extensive distribution. The best known member is Teak (*Tectona grandis* L. f.), the most important timber tree of India, which has also been planted in West Africa and tropical America. At least six woody genera are represented in West Africa, but only *Vitex* contains trees producing usable woods.

Vitex micrantha Gürke. SAH-SAH (Bassa). Tree sometimes 60-70' tall and 2-2 $\frac{1}{2}$ ' in diam., without buttresses but with slightly fluted or angular bole; bark grayish; leaves opposite, digitately compound; leaflets $\frac{1}{2}$ -2" long, lanceolate to obovate, with tapering apex; leaf stalk 2-3" long, notched near apex; flowers white to yellow, in axillary clusters; fruits greenish, oval, drupaceous, cherry-like, $\frac{1}{2}$ -1" long, with persistent calyx disk at base.

The fruits are edible and are sometimes used for making rum. The bole

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of medium small trees is hollowed out to make native drums. The timber is used locally for light construction and is well suited for general millwork, joinery, plywood, etc., where ease of working and lack of color are more important than great strength or figure.

Wood nearly colorless or light yellowish brown. Luster rather high. Odorless and tasteless. Moderately light, but firm and comparatively strong; texture medium; grain mostly straight; easy to work, finishes smoothly and takes a good polish; probably holds its place well when manufactured; does not appear resistant to insect attacks and decay. Growth rings distinct, due to terminal parenchyma and local tendency to be ring-porous. Parenchyma in narrow terminal layers and indistinctly about pores. Pores open, variable in size, some of them rather large; not very numerous; irregularly distributed, the larger ones tending to form concentric or diagonal rows. Vessel lines inconspicuous. Rays distinct on cross section, barely visible on tangential; low but fairly prominent on radial surface. (Yale 13720. Cooper 70.)

Vitex oxycuspis Baker. KPAR-SEH (Bassa). Small tree 30-35' tall and 6-8" in diam. with greenish gray, roughly furrowed, rather thin bark; leaves digitate, on stalks 3" long; leaflets up to 6" long, mostly smaller, obovate, coarsely toothed, especially near tapering apex; flowers and fruits similar to preceding.

The tree has no use except for house poles. The wood is similar to that of preceding species. (Yale 15228; 15765. Cooper L 33; 321.)

Vitex rufa A. Chev. KPAR-SEH (Bassa). Tree less than 40' tall and 8-9" in diam., with thin, gray-green, scaly bark; leaves digitate on stalk 3-4" long; leaflets oval-obovate, 3-5" long, with rounded or blunt pointed apex, glabrous except for coarse brown hairs on all veins of both surfaces; leaf stalk, entire inflorescence, and the branchlets covered with a heavy brown pubescence; flowers in lax cymes, small, with disk; fruits in pendulous clusters, oval, $\frac{1}{2}$ -1" long, drupaceous, black with wrinkled surface when dry; disk persistent. (Plate XI, No. 2.)

The bole is hollowed and used for the dancing "devil drums." The wood is similar to those of the two preceding species. (Yale 13717. Cooper 67; 355.)

60. MISCELLANEOUS

ARACEAE

Culcasia liberica N. E. Brown. (Cooper 19; 144.)

Raphidophora africana N. E. Brown. (Cooper 284.)

MISCELLANEOUS

COMMELINACEAE

- Aneilema beninense* Kunth. (Cooper 7.)
Commelina capitata Benth. (Cooper 32.)
Palisota thyrsofolia Benth. KOR-DRU-BOE (Bassa). (Cooper 359.)

CYPERACEAE

- Cyperus distans* L. f. (Cooper 27.)

GRAMINEAE

- Isachne miliacea* Roth. (Cooper 26.)

LILIACEAE

- Dracaena humilis* Baker. (Cooper 168.)
D. sessiliflora C. H. Wright. (Yale 15106. Cooper 170.)

ORCHIDACEAE

- Lissochilus roseus* Lindl. (Cooper 35.)

PEDALIACEAE

- Sesamum indicum* L. (Cooper 133.)

SOLANACEAE

- Physalis minima* L. (Cooper 5.)

ZINGIBERACEAE

- Costus afer* Ker. (Cooper 14.)
Renealmia longifolia K. Sch. (Cooper 47.)

COMPOSITION OF 52 SAMPLE PLOTS IN THE LIBERIAN EVERGREEN FOREST

EXPLANATORY NOTES

THE preceding descriptive list is a qualitative analysis of the Liberian evergreen forest as a whole. In order to obtain data for a quantitative analysis, 52 half-acre sample plots were laid out in three strips bordering clearings for rubber plantations, and all of the trees 2" and over in diameter were measured at breast height or, in the case of large specimens, above the root swellings.

The three strips were typical of the Dukwia region, which in general is second-class forest. Occasional stumps were found, indicating that the natives had done some selective cutting on the area from time to time. In one or two places there were evidences of long-abandoned rice farms. For these reasons one does not encounter the massive trees characteristic of the virgin forest of the Grand Bassa region or of the Gola country back of Cape Mount, but finds a large number of small trees and lower size-classes of the larger species.

Strip No. 1 (Plots 1-16) was situated along the south side of a stand of what is locally designated as heavy bush. Strip No. 2 (Plots 17-32) extended north from the boundary of Plot 16 and was heavy to medium heavy bush, with a few openings. Strip No. 3 (Plots 33-52) was to the eastward of the plantation clearing and differed somewhat from the others in having some swampy spots covered with inferior growth. The largest trees were found on this strip.

In order to show the results in convenient tabular form the diameters for the different species are arranged in four size-classes. The average number of trees per acre for the three strips and for the total 26 acres measured is as follows:

AVERAGE NUMBER OF TREES PER ACRE

<i>Plots</i>	<i>2-8"</i>	<i>9-16"</i>	<i>17-30"</i>	<i>31" up</i>	<i>All sizes</i>
Nos. 1-16	66	33	8	1	108
Nos. 17-32	116	30	10	1	157
Nos. 33-52	110	27	6	2	145
Gen. average	98	30	7½	1½	137

COMPOSITION OF SAMPLE PLOTS

Strip No. 1 contains representatives of 84 species of at least 70 different genera; Strip No. 2, 75 species and 61 genera; Strip No. 3, 77 species and 65 genera. The reduction in the number of species with increase in diameter is shown in the following tabulation:

NUMBER OF SPECIES REPRESENTED

<i>Plots</i>	<i>2-8"</i>	<i>9-16"</i>	<i>17-30"</i>	<i>31" up</i>
Nos. 1-16	71	61	27	4
Nos. 17-32	64	49	21	5
Nos. 33-52	73	45	23	9

The number of trees 24" and over in diameter for the three strips is 42, 44, and 47, respectively; total, 133 on 26 acres, or about 5 per acre. There were only 8 trees with a diameter of 40" or more; the largest was 50". The tallest was about 110', but very few trees are 100'. The height for the different diameter classes shows a wide range, as would be expected where many different species are grouped together, but a rough average is about as follows: 2-8"—15-30'; 9-16"—35-60'; 17-30"—65-70'; 31" and over—80-100'.

TABLE I. COMPOSITION OF SAMPLE PLOTS 1-16

Species	Diameter classes				Total number of trees	Average number of trees per acre
	2-8"	9-16"	17-30"	31" up		
Albizzia Zygia	..	I	I	..	2	0.25
Allanblackia parviflora	I	..	..	..	I	0.125
Amphimas pterocarpoides	I	I	3	..	5	0.625
Anopyxis ealaensis	2	2	4	I	9	1.125
Anthocleista parviflora	I	..	..	..	I	0.125
Berlinia spp.	4	9	I	..	14	1.75
Calpocalyx brevibracteatus	14	3	I	..	18	2.25
Canarium Schweinfurthii	..	..	I	I	2	0.25
Carapa procera	2	..	..	..	2	0.25
Cassipourea Afzelii	..	I	..	..	I	0.125
Chlorophora excelsa	..	I	I	..	2	0.25
Chrysophyllum ellipticum (?)	I	3	I	..	5	0.625
Chrysophyllum obovatum	I	I	..	..	2	0.25
Cola Buntingii	13	..	..	..	13	1.625
Cola lateritia	2	..	..	..	2	0.25
Cola nitida	..	I	..	..	I	0.125
Conopharyngia durissima	8	..	..	..	8	1.0
Coula edulis	12	19	4	..	35	4.375
Daniella thurifera	..	I	..	..	I	0.125
Deinbollia polypus	I	..	..	..	I	0.125
Diospyros gabunensis	16	11	..	..	27	3.375
Diospyros Sanza-Minika	3	..	..	..	3	0.375
Diospyros spp.	31	I	..	..	32	4.0
Drypetes Afzelii (?)	10	8	..	..	18	2.25
Drypetes ovata (?)	8	2	..	..	10	1.25
Enantia chlorantha	31	2	..	..	33	4.125
Erythrophloeum guineense	..	..	5	I	6	0.75
Funtumia africana	I	4	..	..	5	0.625
Gaertnera salicifolia	..	I	..	..	I	0.125
Garcinia Mannii	2	..	..	..	2	0.25
Hannoa Klaineana	6	2	I	..	9	1.125
Heinsia pulchella	4	..	..	..	4	0.5
Klainedoxa gabonensis	I	I	3	..	5	0.625
Lophira alata	..	2	I	..	3	0.375
Maba Cooperi	9	4	..	..	13	1.625
Macrolobium macrophyllum	2	I	..	..	3	0.375
Macrolobium spp.	14	2	..	..	16	2.0
Memecylon polyanthemos	3	..	..	..	3	0.375
Microdesmis puberla	I	..	..	..	I	0.125
Millettia sp.	I	I	..	..	2	0.25
Mitragyne stipulosa	..	I	..	..	I	0.125
Musanga Smithii	3	I	I	..	5	0.625

Continued on next page

TABLE I (continued)

Species	Diameter classes				Total number of trees	Average number of trees per acre
	2-8"	9-16"	17-30"	31" up		
<i>Myrianthus serratus</i>	1	1	..	..	2	0.25
<i>Necepsia Afzelii</i>	20	3	..	..	23	2.875
<i>Ochrocarpus africanus</i>	17	18	1	..	36	4.5
<i>Oldfieldia africana</i>	5	2	..	..	7	8.75
<i>Oxystigma Stapfiana</i>	8	2	..	..	10	1.25
<i>Pachypodanthium Staudtii</i>	3	1	..	..	4	0.5
<i>Parinarium excelsum</i>	1	2	8	..	11	1.375
<i>Parinarium Kerstingii</i>	..	1	..	..	1	0.125
<i>Parinarium sp.</i>	3	2	2	..	7	0.875
<i>Parinarium spp.</i>	1	3	..	..	4	0.5
<i>Parkia bicolor</i>	4	3	4	..	11	1.375
<i>Pausinystalia Lane-Poolei</i>	3	..	1	..	4	0.5
<i>Pentaclethra macrophylla</i>	..	1	..	..	1	0.125
<i>Pentadesma butyracea</i>	9	6	1	..	16	2.0
<i>Placodiscus pseudostipularis</i>	29	20	..	..	49	6.125
<i>Polyalthia Oliveri</i>	20	1	..	..	21	2.625
<i>Protomegabaria Stapfiana</i>	26	2	..	..	28	3.5
<i>Pseudospondias microcarpa</i>	10	5	..	..	15	1.875
<i>Pterocarpus santalinoides</i>	1	..	..	..	1	0.125
<i>Pycnanthus kombo</i>	1	1	1	..	3	0.375
<i>Randia acuminata</i>	1	..	..	..	1	0.125
<i>Saccoglottis gabonensis</i>	8	5	7	2	22	2.75
<i>Sarcocephalus esculentus</i>	3	6	3	..	12	1.5
<i>Scaphopetalum amoenum</i>	5	..	..	..	5	0.625
<i>Scottellia coriacea</i>	3	4	..	..	7	0.875
<i>Scytopetalum Tieghemii</i>	25	31	..	..	56	7.0
<i>Soyauxia grandifolia</i>	6	1	..	..	7	0.875
<i>Stenanthera Yalensis</i>	2	..	..	..	2	0.25
<i>Strombosia pustulata</i>	36	8	..	..	44	5.5
<i>Tarrietia utilis</i>	9	2	2	..	13	1.625
<i>Terminalia superba</i>	..	1	1	..	2	0.25
<i>Tetrorchidium didymostemon</i>	1	..	..	..	1	0.125
<i>Trichoscypha and Sorindeia spp.</i>	14	9	1	..	24	3.0
<i>Tylostemon Mannii</i>	2	1	..	..	3	0.375
<i>Uapaca guineensis</i>	6	3	3	..	12	1.5
<i>Vitex spp.</i>	9	7	..	..	16	2.0
<i>Xylopia aethiopica</i>	1	..	..	..	1	0.125
<i>Xylopia Quintasii</i>	4	1	..	..	5	0.625
<i>Xylopia Staudtii</i>	18	24	..	..	42	5.25
"Gboe" (indet.)	4	..	..	..	4	0.5
"Pe-ay-chu" (Mimosaceae indet.)	1	1	0.125
"Sohn-chu" (indet.)	1	2	3	0.375
TOTALS (for 8 acres)	530	266	63	5	864	

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TABLE II. COMPOSITION OF SAMPLE PLOTS 17-32

Species	Diameter classes				Total number of trees	Average number of trees per acre
	2-8"	9-16"	17-30"	31" up		
Amphimas pterocarpoides	2	..	I	..	3	0.375
Berlinia spp.	13	6	4	..	23	2.875
Caloncoba brevipes	4	..	..	..	4	0.5
Calpocalyx brevibracteatus	17	6	..	..	23	2.875
Carapa procera	3	I	..	..	4	0.5
Cassipourea Afzelii	..	2	..	..	2	0.25
Chlorophora excelsa	..	I	..	..	I	0.125
Chrysophyllum ellipticum (?)	..	I	..	..	I	0.125
Chrysophyllum obovatum	I	2	I	..	4	0.5
Chytranthus setosus (?)	2	..	..	..	2	0.25
Cola Buntingii	17	..	..	..	17	2.125
Cola lateritia	..	I	..	..	I	0.125
Conopharyngia durissima	I	..	..	..	I	0.125
Coula edulis	4	4	..	..	8	I.0
Daniella similis	3	2	3	..	8	I.0
Deinbollia polypus	..	I	..	..	I	0.125
Diospyros gabunensis	31	3	..	..	34	4.25
Diospyros Sanza-Minika	25	..	..	..	25	3.125
Diospyros spp.	58	..	..	..	58	7.25
Drypetes Afzelii (?)	121	..	..	..	121	15.125
Drypetes ovata (?)	16	4	..	..	20	2.5
Enantia chlorantha	33	..	..	..	33	4.125
Erythrophloeum guineense	..	..	..	I	I	0.125
Eugenia Whytei	2	..	..	..	2	0.25
Garcinia Mannii	16	I	..	..	17	2.125
Hannoa Klaineana	14	6	2	..	22	2.75
Heinsia pulchella	3	..	..	..	3	0.375
Klainedoxa gabonensis	..	2	..	..	2	0.25
Lophira alata	7	3	18	..	28	3.5
Maba Cooperi	16	2	..	..	18	2.25
Macrobium macrophyllum	17	4	4	..	25	3.125
Memecylon polyanthemos	I	..	..	..	I	0.125
Millettia sp.	I	..	..	..	I	0.125
Mimusops clitandrifolium	4	3	2	..	9	I.125
Mitragyne stipulosa	3	6	2	I	12	I.5
Monodora spp.	2	..	..	..	2	0.25
Musanga Smithii	4	I	..	..	5	0.625

Continued on next page

COMPOSITION OF SAMPLE PLOTS

TABLE II (continued)

<i>Species</i>	<i>Diameter classes</i>				<i>Total number of trees</i>	<i>Average number of trees per acre</i>
	<i>2-8"</i>	<i>9-16"</i>	<i>17-30"</i>	<i>31" up</i>		
<i>Necepsia Afzelii</i>	58	2	1	..	61	7.625
<i>Ochrocarpus africanus</i>	25	37	3	..	65	8.125
<i>Octoknema borealis</i>	1	..	..	..	1	0.125
<i>Oldfieldia africana</i>	13	7	..	..	20	2.5
<i>Parinariium excelsum</i>	1	15	11	3	30	3.75
<i>Parinariium Kerstingii</i>	3	3	3	..	9	1.125
<i>Parinariium sp.</i>	2	1	1	..	4	0.5
<i>Parinariium spp.</i>	1	..	..	..	1	0.125
<i>Parkia bicolor</i>	3	3	2	..	8	1.0
<i>Pausinystalia Lane-Poolei</i>	..	..	..	1	1	0.125
<i>Pentaclethra macrophylla</i>	..	1	4	..	5	0.625
<i>Pentadesma butyracea</i>	26	21	2	..	49	6.125
<i>Placodiscus pseudostipularis</i>	41	7	..	..	48	6.0
<i>Polyalthia Oliveri</i>	18	1	..	..	19	2.375
<i>Protomegabaria Stapfiana</i>	8	..	..	..	8	1.0
<i>Pseudospondias microcarpa</i>	47	5	1	..	53	6.625
<i>Pterocarpus santalinoides</i>	1	..	..	..	1	0.125
<i>Saccoglottis gabonensis</i>	..	4	9	..	16	2.0
<i>Sarcocephalus esculentus</i>	..	2	..	..	2	0.25
<i>Scaphopetalum amoenum</i>	2	..	..	..	2	0.25
<i>Scottellia coriacea</i>	13	..	..	..	13	1.625
<i>Scytopetalum Tieghemii</i>	36	13	..	..	49	6.375
<i>Soyauxia grandifolia</i>	4	..	..	..	4	0.5
<i>Stenantha Yalensis</i>	3	..	..	..	3	0.375
<i>Strombosia pustulata</i>	36	4	..	..	40	5.0
<i>Symphonia gabonensis, var. macrantha</i>	6	10	3	..	19	2.375
<i>Trichoscypha and Sorindeia spp.</i>	44	15	1	..	60	7.5
<i>Tylostemon Mannii</i>	18	2	..	..	20	2.5
<i>Uapaca guineensis</i>	16	3	..	..	19	2.375
<i>Vismia leonensis</i>	1	..	..	..	1	0.125
<i>Vitex sp.</i>	18	4	..	..	22	2.75
<i>Xylopia Quintasii</i>	1	..	..	..	1	0.125
<i>Xylopia Staudtii</i>	39	18	..	..	57	7.125
TOTALS (for 8 acres)	926	240	78	9	1253	

TABLE III. COMPOSITION OF SAMPLE PLOTS 33-52

Species	Diameter classes				Total number of trees	Average number of trees per acre
	2-8"	9-16"	17-30"	31" up		
Albizzia Zygia	1	..	..	..	1	0.1
Allanblackia parviflora	1	2	..	..	3	0.3
Amphimas pterocarpoides	3	..	..	..	3	0.3
Anopyxis calaensis	6	4	3	..	13	1.3
Anthocleista parviflora	1	..	..	..	1	0.1
Berlinia spp.	42	31	7	1	81	8.1
Bertiera racemosa, var. glabrata	3	..	..	..	3	0.3
Caloncoba brevipes	4	1	..	..	5	0.5
Calpocalyx brevibracteatus	35	4	..	..	39	3.9
Canarium Schweinfurthii	1	1	1	..	3	0.3
Carapa procera	8	..	..	..	8	0.8
Cassipourea Afzelii	4	6	1	..	11	1.1
Chrysophyllum ellipticum (?)	6	5	1	..	12	1.2
Chrysophyllum obovatum	4	..	..	..	4	0.4
Chytranthus setosus (?)	2	1	..	..	3	0.3
Cola Buntingii	25	..	..	..	25	2.5
Cola lateritia	3	..	..	..	3	0.3
Conopharyngia durissima	7	..	..	..	7	0.7
Coula edulis	4	5	..	..	9	0.9
Daniella similis	1	..	..	..	1	0.1
Deinbollia polypus	..	1	..	..	1	0.1
Diospyros gabunensis	16	1	..	..	17	1.7
Diospyros Sanza-Minika	9	..	..	..	9	0.9
Diospyros spp.	72	..	..	..	72	7.2
Drypetes Afzelii (?)	18	2	..	..	20	2.0
Drypetes ovata (?)	53	13	..	..	66	6.6
Enantia chlorantha	22	..	..	..	22	2.2
Erythrophloeum guineense	..	..	2	..	2	0.2
Funtumia africana	2	..	..	..	2	0.2
Garcinia Mannii	15	2	..	..	17	1.7
Hannoa Klaineana	23	6	..	..	29	2.9
Heinsia pulchella	1	..	..	..	1	0.1
Homalium dolichopetalum	1	1	..	..	2	0.2
Klainedoxa gabonensis	4	2	..	..	6	0.6
Lophira alata	8	2	4	5	19	1.9
Maba Cooperi	38	..	..	..	38	3.8
Macrolobium macrophyllum	45	4	..	..	49	4.9
Memecylon polyanthemus	6	..	..	..	6	0.6
Millettia sp.	6	..	..	..	6	0.6
Millettia spp.	4	6	..	..	10	1.0
Monodora Myristica	1	..	..	..	1	0.1

Continued on next page

COMPOSITION OF SAMPLE PLOTS

TABLE III (continued)

Species	Diameter classes				Total number of trees	Average number of trees per acre
	2-8"	9-16"	17-30"	31" up		
Musanga Smithii	1	..	..	..	1	0.1
Myrianthus serratus	5	..	..	..	5	0.5
Necepsia Afzelii	7	..	..	..	7	0.7
Ochrocarpus africanus	42	15	5	..	62	6.2
Oldfieldia africana	3	1	..	..	4	0.4
Omphalocarpum elatum	..	..	1	..	1	0.1
Pachypodanthium Staudtii	1	1	1	..	3	0.3
Parinarium excelsum	..	5	11	8	24	2.4
Parinarium Kerstingii	1	1	..	..	2	0.2
Parinarium sp.	3	1	3	1	8	0.8
Parinarium spp.	3	2	..	..	5	0.5
Parkia bicolor	6	1	2	..	9	0.9
Pausinystalia Lane-Poolei	3	7	2	1	13	1.3
Pentaclethra macrophylla	3	1	1	1	6	0.6
Pentadesma butyracea	19	16	3	1	39	3.9
Placodiscus pseudostipularis	83	21	..	..	104	10.4
Polyalthia Oliveri	39	4	..	..	43	4.3
Pseudospondias microcarpa	30	4	..	..	34	3.4
Pterocarpus santalinoides	2	..	..	..	2	0.2
Pycnanthus kombo	1	..	..	..	1	0.1
Saccoglottis gabonensis	3	4	1	4	12	1.2
Scaphopetalum amoenum	2	..	..	..	2	0.2
Scottellia coriacea	13	..	..	..	13	1.3
Scyttopetalum Tieghemii	60	16	..	..	76	7.6
Smeathmannia pubescens	1	..	..	..	1	0.1
Soyauxia grandifolia	12	..	..	..	12	1.2
Strombosia pustulata	60	9	1	..	70	7.0
Symphonia gabonensis, var. macrantha	2	5	2	..	9	0.9
Trichoscypha and Sorindeia spp.	63	7	1	..	71	7.1
Tylostemon Mannii	33	11	1	1	46	4.6
Uapaca guineensis	25	4	2	..	31	3.1
Vitex spp.	36	10	..	..	46	4.6
Xylopia Quintasii	5	1	..	..	6	0.6
Xylopia Staudtii	26	21	1	..	48	4.8
"Gboe" (indet.)	1	..	..	..	1	0.1
"Je-or-we-chu" (indet.)	1	..	..	..	1	0.1
TOTALS (for 10 acres)	1100	268	57	23	1448	

RESULTS OF TIMBER TESTS ON 104 SPECIMENS OF LIBERIAN WOODS

EXPLANATORY NOTES

INCLUDED in the Liberian collections were 118 hewed bolts from the principal trees of the Dukwia region. They were from 4 to 6 inches square and 4 to 6 feet long. They were partially air-dried before shipment, and upon receipt at New Haven were stored in a close pile in the laboratory for four months. They were then sawed into sticks $2\frac{1}{2}$ inches square and placed in open piles for several weeks until they had attained approximately constant weight. These thoroughly room-dry sticks were afterward planed down to a nominal cross section of 2 by 2 inches and cut to the required lengths for tests in static bending, compression parallel to the grain, and resistance to indentation (hardness). In a few instances there was insufficient good material for all of these tests. Determinations of specific gravity, hardness, and, in some instances, endwise compression were made upon uninjured portions of the small beams which had been subjected to static bending. Fourteen bolts were discarded on account of defects or because the identities could not be established.

The tests were made by students of the Yale School of Forestry under the direction of Professor George A. Garratt. The procedure conformed to the methods of testing small clear specimens of wood adopted as standard by the American Society for Testing Materials (Serial designation D: 143, 1927 Book of Standards). The specimens were of different moisture content at time of test, so in order to make the derived strength values directly comparable the data were all adjusted to conform to a uniform moisture content of 12 per cent, through application of the adjustment factors given in U.S. Department of Agriculture Bulletin No. 556.

Two sets of specific gravity determinations were made: (1) using weight and volume of air-dry material; (2) using weight and volume of material after drying in an oven to a constant weight at a temperature of 100°C. The results of the first series were used in deriving the weights per cubic foot, air-dry; those of the second series are entered directly into Table IV to serve as an index of strength values other than those given in Tables IV and V.

To afford a basis for comparing Liberian woods with some well-known American timbers of commerce, test data of the same kind are included at the end of each table for Beech (*Fagus grandifolia* Ehrh.), Red Gum

RESULTS OF TIMBER TESTS

(*Liquidambar styraciflua* L.), Yellow Poplar (*Liriodendron tulipifera* L.), and White Oak (*Quercus alba* L.). These values are taken from published reports of the U.S. Forest Service.

It should be borne in mind that the results given for the Liberian woods were derived from tests of a very limited amount of material for each species. Consequently, the tabulated values are intended merely as indices of the approximate strength of the woods in question and are not to be considered as true average strength values.

Examination of Table IV should serve to refute the common belief that all tropical woods are hard and heavy. On the contrary, these range from 15 to 71 pounds per cubic foot. The woods of 96 species, representing 85 genera and 35 families, may be classified into the following arbitrary groups:

Very hard and heavy (60-71 pounds)	17 per cent
Hard and heavy (50-59 pounds)	24 per cent
Medium hard and heavy (40-49 pounds)	26 per cent
Medium light and soft (30-39 pounds)	25 per cent
Light and soft (20-29 pounds)	6 per cent
Very light and soft (15-19 pounds)	2 per cent

Most of the specimens tested, especially the denser ones, were characterized by irregular to interlocked grain. In several instances this feature made it next to impossible to get satisfactory results in static bending and endwise compression. Difficulty was also encountered in making end-hardness tests on the dense material, as in numerous cases there was a decided tendency for the wood to check or crack at the end and sides of the ball-like die, thus reducing the values too much to warrant their inclusion in the table.

TABLE IV. DENSITY AND HARDNESS OF LIBERIAN WOODS

Species	Yale number	Sp. gr., oven dry	Wt. per cu. ft., at 12%	Hardness		
				Radial	Tangen- tial	End
				Lbs.	Lbs.	Lbs.
Afzelia bracteata	15,794	0.75	49	1,280	1,440	..
Albizzia Zygia	15,813	0.47	31	560	600	1,010
Albizzia Zygia	15,818	0.47	32	650	580	1,000
Albizzia Zygia	15,846	0.42	30	660	720	1,030
Alchornea cordifolia	15,845	0.42	31	690	760	1,000
Allanblackia parviflora	15,790	0.76	56	1,760	2,310	2,140
Amphimas pterocarpoides	15,796	0.76	50	1,200	1,400	1,410
Anopyxis ealaensis	15,743	0.91	61	2,480	2,830	2,630
Anthocleista nobilis	15,833	0.37	25	380	410	600
Bersama paullinioides	15,854	0.76	50	1,990	2,300	2,100
Bombax brevisuspe	15,815	0.60	40	1,000	1,040	1,180
Bussea occidentalis	15,840	0.92	62	3,130	3,380	..
Caloncoba brevipes	15,785	0.69	46	1,570	1,460	..
Calpocalyx brevibracteatus	15,758	0.83	55	2,600	2,510	..
Canarium Schweinfurthii	15,752	0.46	31	670	590	740
Carapa procera	15,791	0.79	54	2,190	2,240	2,460
Cassipourea Firestoneana	15,821	0.81	54	2,120	2,300	2,470
Chlorophora excelsa	15,774	0.69	44	1,190	1,130	1,220
Chrysobalanus sp.	15,832	0.94	61	..	3,440	..
Chytranthus setosus	15,831	0.97	64	3,070	..	..
Cleistopholis patens	15,825	0.28	19	280	260	400
Coelocaryon aff. oxycarpum	15,849	0.46	32	600	740	1,050
Cola acuminata	15,789	0.55	37	1,090	1,050	1,310
Cola Buntingii	15,800	0.79	52	2,030	2,240	..
Cola lateritia	15,749	0.54	38	960	1,030	1,000
Cola lateritia	15,802	0.54	36	780	810	900
Conopharyngia durissima	15,760	0.59	40	1,300	1,300	1,380
Coula edulis	15,757	0.95	66	..	2,610	..
Cynometra ananta	15,814	0.87	57	2,620	2,710	..
Cynometra ananta	15,822	0.86	57	2,460	2,740	2,910
Daniella thurifera	15,805	0.62	41	1,220	1,280	1,540
Deinbollia grandifolia	15,795	0.53	35	660	900	1,000
Detarium senegalense	15,810	0.73	51	1,640	2,060	2,100
Diospyros kamerunensis	15,784	0.93	62	3,220	3,460	..
Diospyros Sanza-Minika	15,779	0.80	54	2,340	2,540	..
Drypetes ovata	15,781	0.93	60	3,550	3,740	..
Enantia chlorantha	15,753	0.53	36	920	1,160	1,810
Erythrophloeum guineense	15,751	0.81	53	1,820	2,230	..
Eugenia Whytei	15,819	0.95	62	3,240	3,400	..

Continued on next page

TABLE IV (continued)

Species	Yale number	Sp. gr., oven dry	Wt. per cu.ft., at 12%	Hardness		
				Radial	Tangen- tial	End
			Lbs.	Lbs.	Lbs.	Lbs.
Fagara angolensis	15,820	0.44	29	510	610	870
Fagara angolensis	15,847	0.50	34	1,160	1,160	1,010
Funtumia africana	15,754	0.35	28	300	290	480
Garcinia Mannii	15,780	0.94	61	2,630	2,680	..
Guarea Thompsonii	15,816	0.55	38	1,250	1,350	1,600
Klainedoxa gabonensis	15,809	1.10	71	..	..	..
Loesenera kalandia	15,851	0.57	38	1,100	1,150	1,570
Lophira alata	15,756	0.98	63	3,110	3,270	..
Maba sp.	15,735	0.86	57	2,570	2,780	..
Macaranga sp.	15,834	0.31	23	400	550	610
Macaranga sp.	15,835	0.32	22	380	390	610
Macrolobium Chevalieri	15,850	0.78	56	2,060	2,040	..
Macrolobium Heudelotii	15,788	0.93	62	2,920	3,520	..
Macrolobium macrophyllum	15,797	0.90	59	1,620	1,940	1,600
Mimusops clitandrifolia	15,808	0.91	59	2,940	3,000	3,020
Mitragyne stipulosa	15,748	0.54	37	910	960	1,060
Monodora brevipes	15,798	0.74	47	..	..	..
Musanga Smithii	15,799	0.21	15	130	200	330
Myrianthus libericus	15,827	0.45	31	760	820	940
Ochrocarpus africanus	15,745	0.74	49	1,610	1,590	1,690
Octoknema borealis	15,775	0.72	50	1,340	1,360	..
Oldfieldia africana	15,744	0.97	62	3,040	3,000	..
Omphalocarpum elatum	15,787	0.61	40	1,300	1,330	1,530
Oxystigma Stapfiana	15,770	0.72	47	1,750	1,690	2,040
Pachypodanthium Staudtii	15,755	0.76	47	1,970	2,100	..
Parinarium excelsum	15,811	0.84	54	2,280	2,440	..
Parinarium excelsum	15,828	0.63	46	1,560	1,710	1,850
Parinarium Kerstingii	15,793	0.83	55	2,320	2,400	..
Parinarium sp.	15,803	1.09	65	4,500	..	..
Parkia bicolor	15,768	0.41	29	510	600	680
Pausinystalia Lane-Poolei	15,807	0.68	45	1,540	1,400	1,700
Pentaclethra macrophylla	15,792	0.76	50	1,960	1,840	..
Pentadesma butyracea	15,750	0.83	53	1,750	1,850	..
Phyllanthus discoideus	15,852	0.73	46	1,690	1,700	1,840
Piptadenia africana	15,739	0.67	47	1,560	1,520	1,820
Placodiscus pseudostipularis	15,737	0.96	62	3,940	4,050	..
Polyalthia Oliveri	15,763	0.88	57	3,150	3,190	..
Protomegarbaria Stapfiana	15,742	0.66	44	1,540	1,500	1,700
Pycnanthus kombo	15,747	0.46	33	680	810	690
Saccoglottis gabonensis	15,740	0.88	57	2,420	2,530	2,810

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THE EVERGREEN FORESTS OF LIBERIA

TABLE IV (continued)

Species	Yale number	Sp. gr., oven dry	Wt. per cu.ft., at 12%	Hardness		
				Radial	Tangential	End
			Lbs.	Lbs.	Lbs.	Lbs.
<i>Sarcocephalus esculentus</i>	15,773	0.74	49	1,910	1,940	..
<i>Scottellia coriacea</i>	15,772	0.70	44	1,710	1,740	1,870
<i>Scottellia coriacea</i>	15,817	0.66	43	1,540	1,740	1,780
<i>Scytopetalum Tieghemii</i>	15,777	0.72	48	1,640	1,650	1,780
<i>Smeathmannia pubescens</i>	15,839	0.83	48	1,840	1,840	1,730
<i>Spondianthus ugandensis</i>	15,838	0.70	47	1,670	1,770	2,120
<i>Stenantha Yalensis</i>	15,767	0.47	32	820	790	810
<i>Strephonema Pseudocola</i>	15,786	0.76	49	1,800	1,560	1,720
<i>Strombosia pustulata</i>	15,746	1.01	64	3,180	3,250	..
<i>Symphonia gabonensis</i> , var. <i>macrantha</i>	15,829	0.46	33	1,030	950	1,250
<i>Symphonia</i> sp.	15,826	0.49	34	670	870	970
<i>Tarrietia utilis</i>	15,736	0.57	38	800	940	840
<i>Terminalia superba</i>	15,804	0.65	39	1,590	1,540	1,870
<i>Tetrorchidium didymostemon</i>	15,844	0.46	32	680	930	1,120
<i>Trichilia Heudelotii</i>	15,812	0.44	32	610	660	960
<i>Trichoscypha arborea</i>	15,771	0.86	53	2,040	1,980	..
<i>Turræanthus</i> sp.	15,853	0.60	38	1,200	1,350	1,570
<i>Tylostemon Mannii</i>	15,782	0.61	41	1,130	1,190	1,130
<i>Uapaca guineensis</i>	15,741	0.71	47	1,720	1,760	1,860
<i>Vismia leonensis</i>	15,801	0.68	44	1,980	1,590	2,030
<i>Vismia</i> sp. (?)	15,836	0.52	34	1,040	1,140	1,170
<i>Vitex oxycuspis</i>	15,765	0.54	36	840	1,380	1,260
<i>Xylopia aethiopica</i>	15,823	0.40	26	400	520	740
<i>Xylopia Quintasii</i>	15,766	0.90	60	2,990	3,160	..
<i>Xylopia Staudtii</i>	15,769	0.48	31	590	810	880
COMMON WOODS OF U.S.A. FOR COMPARISON						
<i>Beech (Fagus)</i>		0.69	45	1,150	1,160	1,360
<i>Red Gum (Liquidambar)</i>		0.59	34	690	700	950
<i>Yellow Poplar (Liriodendron)</i>		0.42	28	450	470	570
<i>White Oak (Quercus alba)</i>		0.75	48	1,370	1,350	1,520

RESULTS OF TIMBER TESTS

TABLE V. STRENGTH AND STIFFNESS OF LIBERIAN WOODS

Species	Yale number	Static bending			Compression parallel to grain		
		Modulus of elasticity	Modulus of rupture	Fiber stress at elastic limit	Modulus of elasticity	Maximum crushing strength	Fiber stress at elastic limit
		1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.	1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.
Afzelia bracteata	15,794	2,422	16,770	9,080	..	..	..
Albizzia Zygia	15,813	1,953	13,760	8,060	1,797	6,140	4,350
Albizzia Zygia	15,818	1,521	6,330	3,820	1,460	5,870	4,210
Albizzia Zygia	15,846	..	..	..	1,327	6,080	4,640
Alchornea cordifolia	15,845	760	6,210	3,510	..	..	..
Allanblackia parviflora	15,790	2,293	20,330	10,900	3,062	7,670	5,380
Amphimas pterocarpoides	15,796	2,361	16,070	9,130	2,453	9,290	5,060
Anopyxis ealaensis	15,743	3,295	23,860	13,850	3,495	10,950	6,400
Bombax brevicuspe	15,815	..	..	..	1,308	4,730	2,820
Bussea occidentalis	15,840	2,970	22,670	11,550	3,004	10,420	6,170
Calpocalyx brevibracteatus	15,758	2,416	19,630	12,900	2,150	8,600	5,380
Canarium Schweinfurthii	15,752	1,670	10,570	6,630	1,474	6,160	4,080
Carapa procera	15,791	2,411	18,430	10,120	..	..	..
Cassipourea Firestoneana	15,821	2,606	21,000	10,970	2,782	10,490	6,670
Chlorophora excelsa	15,774	2,190	14,760	8,260	..	..	..
Chytranthus setosus	15,831	2,693	22,160	13,620	..	..	..
Cleistopholis patens	15,825	881	4,170	2,531	..	..	..
Coelocaryon aff. oxycarpum	15,849	1,707	10,420	6,270	1,948	5,270	3,880
Cola acuminata	15,789	1,482	9,220	7,160	1,403	6,560	4,490
Cola lateritia	15,749	1,375	10,540	5,980	..	..	..
Cola lateritia	15,759	1,579	10,910	7,000	1,749	7,320	4,160
Conopharyngia durissima	15,760	1,547	11,520	6,100	1,614	7,050	6,060
Coula edulis	15,757	3,209	25,010	18,100	..	..	..
Cynometra ananta	15,822	2,588	18,300	14,175	2,864	10,850	7,780
Deinbollia grandifolia	15,795	1,722	12,280	7,630	1,674	6,200	4,300
Detarium senegalense	15,810	2,211	17,210	9,140	2,023	9,140	6,430
Diospyros kamerunensis	15,784	2,265	24,520	13,450	..	..	..
Diospyros Sanza-Minika	15,779	2,305	21,980	12,380	2,792	10,510	6,380
Drypetes ovata	15,781	2,880	26,080	14,510	3,331	11,020	6,010
Enantia chlorantha	15,753	1,796	14,180	9,360	1,644	6,830	4,670
Erythrophloeum guineense	15,751	2,913	17,720	9,230	2,050	9,500	6,830

Continued on next page

TABLE V (continued)

Species	Yale number	Static bending			Compression parallel to grain		
		Modulus of elasticity	Modulus of rupture	Fiber stress at elastic limit	Modulus of elasticity	Maximum crushing strength	Fiber stress at elastic limit
		1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.	1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.
Fagara angolensis	15,820	1,732	12,530	7,430	..	..	..
Funtumia africana	15,754	1,118	7,280	4,490	1,184	3,660	2,360
Garcinia Mannii	15,780	3,323	25,450	13,520	..	..	..
Guarea Thompsonii	15,816	1,968	15,020	9,390	1,680	7,550	4,860
Klainedoxa gabonensis	15,809	3,728	27,630	16,070	3,544	13,370	8,180
Lophira alata	15,756	2,801	24,940	15,150	2,143	9,980	6,720
Maba sp.	15,735	2,155	20,510	11,365	2,290	8,380	4,910
Macaranga sp.	15,834	1,273	6,420	4,110	1,360	5,040	3,520
Macaranga sp.	15,835	1,049	7,770	4,460	1,105	4,030	3,660
Macrolobium Chevalieri	15,850	1,739	18,230	8,360	..	..	..
Macrolobium Heudelotii	15,788	2,801	24,640	12,180	3,065	11,300	6,750
Macrolobium macrophyllum	15,797	2,460	23,080	14,100	..	..	..
Mimusops clitrifolium	15,808	2,901	26,760	15,420	2,820	11,640	8,430
Mitragyne stipulosa	15,748	1,786	14,030	7,940	1,719	7,170	5,400
Musanga Smithii	15,799	..	..	..	581	2,320	1,900
Myrianthus libericus	15,827	1,478	8,240	4,720	..	..	..
Ochrocarpus africanus	15,745	2,132	16,580	8,610	2,121	9,520	6,930
Octoknema borealis	15,775	2,426	18,480	12,020	..	..	..
Oldfieldia africana	15,744	3,304	25,480	13,820	3,230	12,150	7,100
Oxystigma Stapfiana	15,770	2,377	14,240	7,540	2,186	8,510	5,730
Pachypodanthium Staudtii	15,755	2,850	20,170	12,090	2,328	8,680	6,410
Parinarium excelsum	15,811	2,437	12,320	9,070	..	..	..
Parinarium excelsum	15,828	1,376	8,370	5,610	1,153	6,110	3,310
Parinarium sp.	15,803	3,478	29,840	15,210	3,170	13,980	9,590
Parkia bicolor	15,768	1,382	5,120	3,210	1,494	4,940	2,990
Pausinystalia Lane-Poolei	15,807	2,012	13,510	8,940	2,290	9,380	6,060
Pentadesma butyracea	15,750	2,767	20,050	13,840	2,694	8,140	5,780
Phyllanthus discoideus	15,852	2,036	10,870	6,030	..	..	..
Piptadenia africana	15,739	1,980	12,660	7,670	2,186	8,680	5,670
Placodiscus pseudostipularis	15,737	2,540	19,540	11,110	2,325	10,340	6,710
Polyalthia Oliveri	15,763	2,364	21,290	11,600	..	..	..
Protomegalaria Stapfiana	15,742	..	..	..	2,138	7,710	4,130
Pycnanthus kombo	15,747	1,754	8,910	5,640	1,913	5,510	3,250

Continued on next page

RESULTS OF TIMBER TESTS

TABLE V (continued)

Species	Yale number	Static bending			Compression parallel to grain		
		Modulus of elasticity	Modulus of rupture	Fiber stress at elastic limit	Modulus of elasticity	Maximum crushing strength	Fiber stress at elastic limit
		1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.	1000 lbs. per sq.in.	Lbs. per sq.in.	Lbs. per sq.in.
<i>Saccoglottis gabonensis</i>	15,740	2,690	16,490	8,480	2,451	10,510	7,170
<i>Scottellia coriacea</i>	15,772	2,138	17,810	10,320	..	..	..
<i>Scytopetalum Tieghemii</i>	15,777	1,953	17,820	9,070	2,375	7,940	5,160
<i>Spondianthus ugandensis</i>	15,838	1,880	15,910	8,780	1,650	7,530	4,750
<i>Strephonema Pseudocola</i>	15,786	2,143	17,480	8,940	1,988	7,780	5,380
<i>Strombosia pustulata</i>	15,746	2,472	21,170	9,740	..	..	..
<i>Symphonia gabonensis</i> , var. <i>macrantha</i>	15,829	1,803	11,870	6,970	1,841	6,120	4,370
<i>Symphonia</i> sp.	15,826	..	..	..	1,625	4,980	3,500
<i>Tarrietia utilis</i>	15,736	1,880	13,180	5,990	2,471	5,950	4,770
<i>Tetrorchidium didymos-</i> <i>temon</i>	15,844	1,722	10,890	8,100	1,458	6,580	4,990
<i>Trichelia Heudelotii</i>	15,812	1,330	9,140	6,020	1,420	5,790	4,260
<i>Trichoscypha arborea</i>	15,771	2,347	24,880	17,500	..	..	..
<i>Turræanthus</i> sp.	15,853	1,325	9,900	5,230	..	..	..
<i>Tylostemon Mannii</i>	15,782	1,968	14,250	7,840	1,815	7,250	4,520
<i>Uapaca guineensis</i>	15,741	2,025	16,280	8,360	..	..	..
<i>Vismia</i> sp. (?)	15,836	1,903	8,090	3,860	..	..	..
<i>Vitex oxycuspis</i>	15,765	1,556	13,270	9,440	1,470	7,220	4,660
<i>Xylopia aethiopica</i>	15,823	1,727	9,790	6,430	1,830	5,040	3,270
<i>Xylopia Quintasii</i>	15,766	3,320	26,240	15,290	3,198	10,780	6,610
<i>Xylopia Staudtii</i>	15,769	1,714	11,560	6,580	1,926	6,710	4,810

COMMON WOODS OF U.S.A. FOR COMPARISON

Beech (<i>Fagus</i>)	1,670	14,600	8,600	1,970	6,940	4,550
Red Gum (<i>Liquidambar</i>)	1,490	11,900	8,100	1,640	5,820	4,300
Yellow Poplar (<i>Liriodendron</i>)	1,520	9,300	6,200	2,140	5,420	3,530
White Oak (<i>Quercus alba</i>)	1,780	15,200	8,200	1,880	7,430	4,340

SUITABILITY OF LIBERIAN WOODS FOR SPECIFIC PURPOSES

ALTHOUGH the timbers of Liberia are as yet unknown to the trade, several of the species are the same as those exported to Europe and America from other parts of West Africa. In these cases no special introduction to established industry would be necessary if the usual commercial names for them were adopted, as for example, Avodiré for *Turraeanthus*, Iroko for *Chlorophora*, and Bongosi for *Lophira*. African Mahogany (*Khaya*), the so-called African Walnut (*Louoa*), and Ayous or Samba (*Triplochiton*) are not represented in the present collections, although they are known to occur, probably in commercial quantities, in other parts of Liberia, and a good market for the timbers is already in existence.

The kinds not yet exploited are typical of the West African forest and have counterparts in almost any tropical region. They range from exceedingly light and soft to exceedingly heavy and hard, with all intermediate stages represented. A like range is found in durability, texture, color, and other properties. In common with tropical woods generally, they are different from those of temperate regions. Not only are there no coniferous timbers in Liberia, but not one of the hardwood families of commercial importance for lumber in the United States and Europe is represented there. The bulk of the wood-using industries are in the North Temperate Zone and, with the exception of certain fancy woods, their raw material is the product of that zone. The principal handicap to the introduction of new tropical timbers of general utility is the lack of familiarity with them. Intrinsic merit is often of little avail against the inertia of custom.

Tropical woods as a whole are much less likely to be straight-grained than are those of temperate regions. While this increases their decorative value, being responsible for roe or ribbon grain and various kinds of mottle, it interferes with ease of working and may seriously impair strength, especially in small sizes subjected to bending stresses. The straightest-grained of the Liberian woods belong to the family Annonaceae. Liberian woods are all diffuse-porous, being in this respect like Beech, Birch, and Maple, instead of ring-porous like Oak, Ash, and Chestnut. They are not all fine-textured, however; on the contrary they exhibit a very wide range from very fine to decidedly coarse.

In the following lists the collector has attempted to classify the Liberian species with reference to their known or seeming adaptability to certain

SUITABILITY OF LIBERIAN WOODS

important uses. For the most part these are expressions of opinion based upon the study of limited material and are presented as suggestions rather than established facts. It is only through practical application that the suitability of a timber for a specific purpose can be established, but much unnecessary effort can be avoided by a preliminary survey that limits the field for intensive investigation.

For the sake of brevity and exactness only the scientific designations are included. The order in which the names appear indicates preference.

FURNITURE AND INTERIOR TRIM

- | | |
|-------------------------------------|---------------------------------------|
| 1. <i>Turraeanthus</i> sp. | 12. <i>Mimusops</i> spp. |
| 2. <i>Carapa procera</i> | 13. <i>Berlinia auriculata</i> |
| 3. <i>Guarea Thompsonii</i> | 14. <i>Calpocalyx brevibracteatus</i> |
| 4. <i>Haplormosia monophylla</i> | 15. <i>Maba Cooperi</i> |
| 5. <i>Sarcocephalus esculentus</i> | 16. <i>Diospyros</i> spp. |
| 6. <i>Azelia bracteata</i> | 17. <i>Tylostemon Mannii</i> |
| 7. <i>Detarium senegalense</i> | 18. <i>Piptadenia africana</i> |
| 8. <i>Chlorophora excelsa</i> | 19. <i>Albizia Zygia</i> |
| 9. <i>Tarrietia utilis</i> | 20. <i>Canarium Schweinfurthii</i> |
| 10. <i>Ochrocarpus africanus</i> | 21. <i>Uapaca guineensis</i> |
| 11. <i>Erythrophloeum guineense</i> | |

GENERAL CARPENTRY, BOXES, AND UTILITY VENEERS

- | | |
|--|--------------------------------------|
| 1. <i>Albizia Zygia</i> | 15. <i>Symphonia gabonensis</i> |
| 2. <i>Pentadesma butyracea</i> | 16. <i>Allanblackia parviflora</i> |
| 3. <i>Canarium Schweinfurthii</i> | 17. <i>Morinda geminata</i> |
| 4. <i>Tarrietia utilis</i> | 18. <i>Berlinia auriculata</i> |
| 5. <i>Parkia bicolor</i> | 19. <i>Vitex</i> spp. |
| 6. <i>Tylostemon Mannii</i> | 20. <i>Pachypodanthium Staudtii</i> |
| 7. <i>Uapaca guineensis</i> | 21. <i>Pausinystalia Lane-Poolei</i> |
| 8. <i>Spondianthus ugandensis</i> | 22. <i>Hannoa Klaineana</i> |
| 9. <i>Trichilia Heudelotii</i> | 23. <i>Psorospermum</i> sp. |
| 10. <i>Coelocaryon</i> aff. <i>oxycarpum</i> | 24. <i>Chrysobalanus ellipticus</i> |
| 11. <i>Terminalia superba</i> | 25. <i>Omphalocarpum elatum</i> |
| 12. <i>Saccoglottis gabonensis</i> | 26. <i>Vismia leonensis</i> |
| 13. <i>Daniella thurifera</i> | 27. <i>Enantia chlorantha</i> |
| 14. <i>Octoknema borealis</i> | |

THE EVERGREEN FORESTS OF LIBERIA

HEAVY AND DURABLE CONSTRUCTION

- | | |
|------------------------------------|---------------------------------------|
| 1. <i>Lophira alata</i> | 11. <i>Klainedoxa gabonensis</i> |
| 2. <i>Oldfieldia africana</i> | 12. <i>Iringia gabonensis</i> |
| 3. <i>Haplormosia monophylla</i> | 13. <i>Anopyxis ealaensis</i> |
| 4. <i>Mimusops</i> spp. | 14. <i>Coula edulis</i> |
| 5. <i>Bussea occidentalis</i> | 15. <i>Cynometra ananta</i> |
| 6. <i>Erythrophloeum guineense</i> | 16. <i>Calpocalyx brevibracteatus</i> |
| 7. <i>Azelia bracteata</i> | 17. <i>Macrolobium</i> spp. |
| 8. <i>Cassipourea</i> spp. | 18. <i>Pentaclethra macrophylla</i> |
| 9. <i>Piptadenia africana</i> | 19. <i>Parinarium</i> spp. |
| 10. <i>Chrysophyllum obovatum</i> | 20. <i>Loesenera kalandia</i> |

TOOL HANDLES, BENTWORK, AND TURNERY

- | | |
|--|----------------------------------|
| 1. <i>Diospyros</i> spp. | 9. <i>Scytopetalum Tieghemii</i> |
| 2. <i>Maba Cooperi</i> | 10. <i>Necepsia Afzelii</i> |
| 3. <i>Homalium Smythii</i> | 11. <i>Sorindeia</i> spp. |
| 4. <i>Garcinia</i> spp. | 12. <i>Trichoscypha</i> spp. |
| 5. <i>Millettia</i> spp. | 13. <i>Scottellia coriacea</i> |
| 6. <i>Polyalthia Oliveri</i> | 14. <i>Hannoa Klaineana</i> |
| 7. <i>Strombosia pustulata</i> | 15. <i>Soyauxia grandifolia</i> |
| 8. <i>Placodiscus pseudostipularis</i> | 16. <i>Xylopia Quintasii</i> |

WOOD PULP

- | | |
|--------------------------------------|--|
| 1. <i>Macaranga</i> spp. | 11. <i>Monodora</i> spp. |
| 2. <i>Phyllanthus</i> spp. | 12. <i>Coelocaryon</i> aff. <i>oxycarpum</i> |
| 3. <i>Ricinodendron africanum</i> | 13. <i>Pycnanthus</i> spp. |
| 4. <i>Neoboutonia glabrescens</i> | 14. <i>Anthocleista nobilis</i> |
| 5. <i>Tetrorchidium didymostemon</i> | 15. <i>Vitex</i> spp. |
| 6. <i>Discoglypsemna caloneura</i> | 16. <i>Fagara angolensis</i> |
| 7. <i>Stenanthera Yalensis</i> | 17. <i>Deinbollia</i> spp. |
| 8. <i>Xylopia</i> spp. | 18. <i>Hannoa Klaineana</i> |
| 9. <i>Enantia chlorantha</i> | 19. <i>Musanga Smithii</i> |
| 10. <i>Cleistopholis patens</i> | 20. <i>Myrianthus libericus</i> |

CHECK LIST OF BASSA, MENDI, AND ENGLISH NAMES

Akee Apple	<i>Blighia sapida</i> Koenig	Sapindaceae
Apple, African	<i>Ochrocarpus africanus</i> Oliv.	Guttiferae
Apple, Bush	<i>Heinsia pulchella</i> K. Schum.	Rubiaceae
Apricot, African	<i>Ochrocarpus africanus</i> Oliv.	Guttiferae
Bah	<i>Scaphopetalum amoenum</i> A. Chev.	Sterculiaceae
Bahn	<i>Ochrocarpus africanus</i> Oliv.	Guttiferae
Balsa	<i>Heisteria parvifolia</i> Smith	Olacaceae
Baobab	<i>Adansonia digitata</i> L.	Bombacaceae
Bay-doo	<i>Pycnanthus Dinklagei</i> Warb.	Myristicaceae
Baye	<i>Terminalia superba</i> Engl. & Diels	Combretaceae
Beari	<i>Chrysophyllum ellipticum</i> A. Chev.	Sapotaceae
Be-ay	<i>Tylostemon Mannii</i> Stapf	Lauraceae
Beh	<i>Chrysophyllum obovatum</i> G. Don	Sapotaceae
Behn	<i>Chrysophyllum ellipticum</i> A. Chev. (?)	Sapotaceae
Belvi	<i>Enantia chlorantha</i> Oliv.	Annonaceae
Beri	<i>Canarium Schweinfurthii</i> Engl.	Burseraceae
Be-yor	<i>Uapaca guineensis</i> Muell. Arg.	Euphorbiaceae
Blahn	<i>Stenanthera bakuana</i> A. Chev.	Annonaceae
Blar-jee	<i>Randia genipaeiflora</i> DC.	Rubiaceae
Blay-bu	<i>Pentaclethra macrophylla</i> Benth.	Mimosaceae
Bleh	<i>Scaphopetalum amoenum</i> A. Chev.	Sterculiaceae
Blimah	<i>Sorindeia longifolia</i> Oliv.	Anacardiaceae
Blimah	<i>Trichoscypha</i> spp.	Anacardiaceae
Blimah-pu	<i>Turraeanthus</i> sp.	Meliaceae
Bloe	<i>Eugenia Whytei</i> Sprague	Myrtaceae
Blom-poe	<i>Cola caricifolia</i> K. Schum.	Sterculiaceae
Blorh	<i>Ficus Vogeliana</i> Miq. (?)	Moraceae
Blorh-feh	<i>Albizia Zygia</i> Macbr.	Mimosaceae
Blu	<i>Lonchocarpus cyanescens</i> Benth.	Papilionaceae
Blu-chu	<i>Maba Cooperi</i> Hutch. & Dalz.	Ebenaceae
Blu-koh	<i>Alchornea cordifolia</i> Muell. Arg.	Euphorbiaceae
Bo-ah	<i>Cola lateritia</i> K. Schum.	Sterculiaceae
Bo-ah	<i>Neoboutonia glabrescens</i> Prain	Euphorbiaceae
Boe	<i>Parkia bicolor</i> A. Chev.	Mimosaceae
Bo-gar	<i>Conopharyngia durissima</i> Stapf	Apocynaceae
Boh	<i>Mitragyne stipulosa</i> O. Kuntze	Rubiaceae
Bo-in-dah	<i>Guarea Thompsonii</i> Sprague & Hutch.	Meliaceae
Bo-in-dah	<i>Trichilia Heudelotii</i> Planch.	Meliaceae
Booni	<i>Cola lateritia</i> K. Schum.	Sterculiaceae
Bowae	<i>Ficus Thonningii</i> Blume	Moraceae

THE EVERGREEN FORESTS OF LIBERIA

Boye	<i>Pycnanthus kombo</i> Warb.	Myristicaceae
Bpak-peì	<i>Albizia Zygia</i> Macbr.	Mimosaceae
Bro-kpar	<i>Homalium</i> spp.	Flacourtiaceae
Bu-ah-vohn-doo	<i>Hugonia Planchonii</i> Hook. f.	Linaceae
Bu-ay-boh	<i>Funtumia africana</i> Stapf	Apocynaceae
Bu-ay-wreh	<i>Maesopsis Eminii</i> Engl.	Rhamnaceae
Buboi	<i>Funtumia africana</i> Stapf	Apocynaceae
Bu-eh	<i>Deinbollia polypus</i> Stapf	Sapindaceae
Bu-ehn-waye	<i>Spondianthus ugandensis</i> Hutch.	Euphorbiaceae
Cabbage tree	<i>Vernonia conferta</i> Benth.	Compositae
Cedar, Red	<i>Tarrietia utilis</i> Sprague	Sterculiaceae
Cedar, Red	<i>Uapaca guineensis</i> Muell. Arg.	Euphorbiaceae
Cedar, Spicy	<i>Tylostemon Mannii</i> Stapf	Lauraceae
Cedar, Sweet	<i>Guarea Thompsonii</i> Sprague & Hutch.	Meliaceae
Cedar, White	<i>Pycnanthus kombo</i> Warb.	Myristicaceae
Cherry	<i>Saccoglottis gabonensis</i> Urban	Humiriaceae
Chew	<i>Mareya spicata</i> Baill.	Euphorbiaceae
Chewstick	<i>Garcinia Mannii</i> Oliv.	Guttiferae
Chu-say-dor-kohn	<i>Carapa procera</i> DC.	Meliaceae
Copal	<i>Daniella similis</i> Craib	Caesalpiniaceae
Corkwood	<i>Musanga Smithii</i> R. Br.	Moraceae
Cotton tree	<i>Ceiba pentandra</i> Gaertn.	Bombacaceae
Dah	<i>Cynometra ananta</i> Hutch. & Dalz.	Caesalpiniaceae
Dahn-kay	<i>Bussea occidentalis</i> Hutch.	Caesalpiniaceae
Dauh	<i>Saccoglottis gabonensis</i> Urban	Humiriaceae
Day-ne-waye	<i>Cola digitata</i> Mast.	Sterculiaceae
Deehn	<i>Pycnanthus kombo</i> Warb.	Myristicaceae
Dee-waye	<i>Acioa</i> sp.	Amygdalaceae
Deh	<i>Omphalocarpum elatum</i> Miers	Sapotaceae
Den-be-haw	<i>Cola angustifolia</i> K. Schum.	Sterculiaceae
Deo	<i>Xylopia aethiopica</i> A. Rich.	Annonaceae
De-orh	<i>Tarrietia utilis</i> Sprague	Sterculiaceae
Dib-bah	<i>Diospyros</i> spp.	Ebenaceae
Dingi	<i>Rhizophora racemosa</i> G. F. W. Mey.	Rhizophoraceae
Di-peh	<i>Aporrhiza</i> aff. <i>Talbotii</i> Bak. f.	Sapindaceae
Dita	<i>Detarium senegalense</i> Gmel.	Caesalpiniaceae
Doe	<i>Musanga Smithii</i> R. Br.	Moraceae
Doe-doo	<i>Periploca nigrescens</i> Afz.	Asclepiadaceae
Doe-fiah	<i>Cola acuminata</i> Schott & Endl.	Sterculiaceae
Doe-pu	<i>Octoknema borealis</i> Hutch. & Dalz.	Octoknemataceae
Doe-yah	<i>Sarcocephalus esculentus</i> Afz.	Rubiaceae
Don-doh	<i>Soyauxia grandifolia</i> Gilg & Stapf	Passifloraceae

CHECK LIST OF NAMES

Doo	<i>Bonamia cymosa</i> Hall. f.	Convolvulaceae
Dooh	<i>Caloncoba echinata</i> Gilg	Flacourtiaceae
Doo-vlehn	<i>Allophylus Talbotii</i> Bak. f.	Sapindaceae
Dreb-bah	<i>Diospyros kamerunensis</i> Gürke	Ebenaceae
Drehn	<i>Xylophia Staudtii</i> Engl.	Annonaceae
Drehn-gbar-doo	<i>Stephania Dinklagei</i> Diels	Menispermaceae
Du-ah-dor	<i>Antidesma membranaceum</i> Muell. Arg.	Euphorbiaceae
Duay-gray	<i>Drypetes Afzelii</i> Hutch. (?)	Euphorbiaceae
Du-kpay	<i>Garcinia</i> sp.	Guttiferae
Dweh	<i>Anthocleista nobilis</i> G. Don	Loganiaceae
Dweh-vah	<i>Gaertnera Cooperi</i> Hutch. & Moss	Loganiaceae
Elemi, African	<i>Canarium Schweinfurthii</i> Engl.	Burseraceae
Endwi	<i>Lophira alata</i> Banks	Ochnaceae
Fah	<i>Placodiscus pseudostipularis</i> Radlk.	Sapindaceae
Fai	<i>Pentaclethra macrophylla</i> Benth.	Mimosaceae
Fauh	<i>Lophira alata</i> Banks	Ochnaceae
Fig, Country	<i>Sarcocephalus esculentus</i> Afz.	Rubiaceae
Fig tree	<i>Ficus Vogeliana</i> Miq. (?)	Moraceae
Fig tree, Small	<i>Ficus Thonningii</i> Blume	Moraceae
Flan-chu	<i>Caloncoba echinata</i> Gilg	Flacourtiaceae
Fofoi	<i>Myrianthus serratus</i> Benth. & Hook. f.	Moraceae
Gab-boh	<i>Macaranga macrophyllum</i> Macbr.	Caesalpiniaceae
Garfoe	<i>Macaranga</i> sp.	Euphorbiaceae
Gaw	<i>Piptadenia africana</i> Hook. f.	Mimosaceae
Gbah-chu	<i>Androsiphonia adenostegia</i> Stapf	Passifloraceae
Gbah-chu	<i>Bertiera racemosa</i> K. Sch., var. <i>glabrata</i> Hutch. & Dalz.	Rubiaceae
Gban-gbah	<i>Microglossa volubilis</i> DC.	Compositae
Gbar-bee-mleh	<i>Uvaria Afzelii</i> Sc. Elliot	Annonaceae
Gbar-chu	<i>Allanblackia parviflora</i> A. Chev.	Guttiferae
Gbay; Gbay-dee	<i>Xylophia Quintasii</i> Engl. & Diels	Annonaceae
Gbay-vlehn	<i>Macaranga macrophyllum</i> Macbr.	Caesalpiniaceae
Gbeh	<i>Trichoscypha ferruginea</i> Engl.	Anacardiaceae
Gbeh-seh	<i>Paullinia pinnata</i> L.	Sapindaceae
Gboe-dah	<i>Angylocalyx oligophyllus</i> Bak. f. (?)	Papilionaceae
Gboe-kpar	<i>Desmochachys Vogelii</i> Stapf	Icacinaceae
Gboe-kpay	<i>Diospyros Thomasii</i> Hutch. & Dalz.	Ebenaceae
Gboite	<i>Monodora Myristica</i> Dunal	Annonaceae

THE EVERGREEN FORESTS OF LIBERIA

Gbolei	<i>Ricinodendron africanum</i> Muell. Arg.	Euphorbiaceae
Gbor-du-orh	<i>Berlinia</i> spp.	Caesalpiniaceae
Gbu-aye	<i>Fagara angolensis</i> Engl. (?)	Rutaceae
Ge-ahn	<i>Vismia leonensis</i> Hook. f., var. <i>macrophylla</i> Hutch. & Dalz.	Hypericaceae
Ge-ahn-de-pay	<i>Vismia leonensis</i> Hook. f.	Hypericaceae
Ge-ay	<i>Chlorophora excelsa</i> Benth. & Hook. f.	Moraceae
Geni	<i>Loesenera kalantha</i> Harms	Caesalpiniaceae
Gibofoyoi	<i>Carpolobia</i> spp.	Polygalaceae
Gibowali	<i>Pausinystalia Lane-Poolei</i> Hutch.	Rubiaceae
Glabe	<i>Vernonia conferta</i> Benth.	Compositae
Gob-boh	<i>Macrobium Heudelotii</i> Planch.	Caesalpiniaceae
Goe	<i>Klainedoxa gabonensis</i> Pierre	Simarubaceae
Goe-doo	<i>Dioncophyllum peltatum</i> Hutch. & Dalz.	Flacourtiaceae
Goe-quehn	<i>Canarium Schweinfurthii</i> Engl.	Burseraceae
Gogwi	<i>Erythrophloeum guineense</i> G. Don	Caesalpiniaceae
Golli-nyum-buy-ambei	<i>Sarcocephalus esculentus</i> Afz.	Rubiaceae
Gonwi	<i>Ficus Vogeliana</i> Miq. (?)	Moraceae
Gor-vah	<i>Sabicea lasiocalyx</i> Stapf	Rubiaceae
Govwi	<i>Musanga Smithii</i> R. Br.	Moraceae
Greenheart, African	<i>Piptadenia africana</i> Hook. f.	Mimosaceae
Guay-ve-ney	<i>Diospyros Thomasii</i> Hutch. & Dalz.	Ebenaceae
Gum, Black	<i>Haplormosia monophylla</i> Harms	Papilionaceae
Gum, copal	<i>Daniella thurifera</i> Bennett	Caesalpiniaceae
Gumgui	?	Mimosaceae
Gumni	<i>Parkia bicolor</i> A. Chev.	Mimosaceae
Harmon	<i>Tarrietia utilis</i> Sprague	Sterculiaceae
Indigo, Big-leaf	<i>Lonchocarpus cyanescens</i> Benth.	Papilionaceae
Iroko	<i>Chlorophora excelsa</i> Benth. & Hook. f.	Moraceae
Ironwood, Red	<i>Lophira alata</i> Banks	Ochnaceae
Jay-wree	<i>Memecylon</i> sp.	Melastomaceae
Je-ah-chu	<i>Stenantha Yalensis</i> Hutch. & Dalz.	Annonaceae
Jee-jeray-flay	<i>Mussaenda Afzelii</i> G. Don	Rubiaceae
Jen-nee	<i>Loesenera kalantha</i> Harms	Caesalpiniaceae
Je-rah-kpar	<i>Bersama paullinioides</i> Bak.	Melanthaceae
Je-ray-krehn	<i>Voacanga obtusa</i> K. Schum.	Apocynaceae
Je-ray-war-be-deh	<i>Urophyllum Linderi</i> Hutch. & Dalz.	Rubiaceae

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Je-ye-neh-doo	<i>Oligostemon pictus</i> Benth.	Caesalpiniaceae
Jor-wee	<i>Canthium acutiflorum</i> Hiern	Rubiaceae
Jru	<i>Erythrophloeum guineense</i> G. Don	Caesalpiniaceae
Ju-ehn-jrah	<i>Cassipourea Afzelii</i> Alston	Rhizophoraceae
Ju-ehn-jrah	<i>Millettia</i> spp.	Papilionaceae
Ju-eh-ye-neh-chu	<i>Desmostachys Vogelii</i> Stapf	Icacinaceae
Ju-ihn	<i>Bombax brevicuspe</i> Sprague	Bombacaceae
Ju-wrah	<i>Smeathmannia pubescens</i> Soland.	Passifloraceae
Kaffi	<i>Guarea Thompsonii</i> Sprague & Hutch.	Meliaceae
Kah	<i>Haplormosia monophylla</i> Harms	Papilionaceae
Kahn	<i>Oxy stigma Staphana</i> A. Chev.	Caesalpiniaceae
Kahrn	<i>Diospyros gabunensis</i> Gürke	Ebenaceae
Kaikumba	<i>Ochrocarpus africanus</i> Oliv.	Guttiferae
Kambala	<i>Chlorophora excelsa</i> Benth. & Hook. f.	Moraceae
Kar	<i>Garcinia Mannii</i> Oliv.	Guttiferae
Kar-we-eh	<i>Cola Buntingii</i> Bak. f.	Sterculiaceae
Kawogei	<i>Rauwolfia vomitoria</i> Afz.	Apocynaceae
Kay-ne-doo	<i>Canthium venosum</i> Hiern	Rubiaceae
Kindi	<i>Uapaca guineensis</i> Muell. Arg.	Euphorbiaceae
Kingue	<i>Bombax brevicuspe</i> Sprague	Bombacaceae
Kishia	<i>Sarcocephalus esculentus</i> Afz.	Rubiaceae
Klehn	<i>Caloncoba brevipes</i> Gilg	Flacourtiaceae
Kofé	<i>Garcinia kola</i> Heckel	Guttiferae
Kohr	<i>Diospyros Sanza-Mimika</i> A. Chev.	Ebenaceae
Kojagei	<i>Terminalia superba</i> Engl. & Diels	Combretaceae
Kola, Bitter	<i>Cola nitida</i> A. Chev.	Sterculiaceae
Kola, Bush	<i>Cola Buntingii</i> Bak. f.	Sterculiaceae
Kola tree	<i>Cola acuminata</i> Schott & Endl.	Sterculiaceae
Kolei	<i>Detarium senegalense</i> Gmel.	Caesalpiniaceae
Kongoli	<i>Vernonia conferta</i> Benth.	Compositae
Koo-gbeh	<i>Isolona Cooperi</i> Hutch. & Dalz.	Annonaceae
Koor	<i>Ricinodendron africanum</i> Muell. Arg.	Euphorbiaceae
Kor-dru-boe	<i>Palisota thyrsifolia</i> Benth.	Commelinaceae
Kor-wah	<i>Psychotria</i> sp.	Rubiaceae
Kowi	<i>Carapa procera</i> DC.	Meliaceae
Kpahn-wee	<i>Drypetes ivorensis</i> Hutch. & Dalz.	Euphorbiaceae
Kpainsi	<i>Enantia chlorantha</i> Oliv.	Annonaceae
Kpar	<i>Parinarium excelsum</i> Sab.	Amygdalaceae
Kpar-seh	<i>Vitex</i> spp.	Verbenaceae
Kpar-wee	<i>Vangueriopsis discolor</i> Robyns	Rubiaceae
Kpay	<i>Detarium senegalense</i> Gmel.	Caesalpiniaceae
Kpendei	<i>Berlinia</i> spp.	Caesalpiniaceae

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Kploe	<i>Schefflera</i> sp.	Araliaceae
Kpoe	<i>Anopyxis ealaensis</i> Sprague	Rhizophoraceae
Kpoe-kohn	<i>Oligostemon pictus</i> Benth.	Caesalpiniaceae
Kpon-doe	<i>Ixora divaricata</i> Hutch. & Dalz.	Rubiaceae
Kpu-ah	<i>Calpocalyx brevibracteatus</i> Harms	Mimosaceae
Krah-dro	<i>Angylocalyx oligophyllus</i> Bak. f. (?)	Papilionaceae
Kra-kpar-doo	<i>Psychotria</i> sp.	Rubiaceae
Kray-bu	<i>Monodora</i> spp.	Annonaceae
Kray-doo	<i>Cissus producta</i> Afz.	Ampelidaceae
Kru-ada-wrah	<i>Leptonychia urophylla</i> Welw.	Sterculiaceae
Kut-wahn	<i>Cassipourea Firestoneana</i> Hutch. & Dalz.	Rhizophoraceae
Leh-bohn	<i>Discoglypsemna caloneura</i> Prain	Euphorbiaceae
Lily, Water	<i>Nymphæa Lotus</i> L.	Nymphaeaceae
Locust bean	<i>Parkia bicolor</i> A. Chev.	Mimosaceae
Locust, Wild	<i>Pentaclethra macrophylla</i> Benth.	Mimosaceae
Mahogany	<i>Saccoglottis gabonensis</i> Urban	Humiriaceae
Mahogany, Bastard	<i>Ochrocarpus africanus</i> Oliv.	Guttiferae
Mahr-chu	<i>Mimusops clitandrifolium</i> A. Chev.	Sapotaceae
Mangrove, Red	<i>Rhizophora racemosa</i> G. F. W. Mey.	Rhizophoraceae
Mbag-bold-ede	<i>Leptonychia urophylla</i> Welw.	Sterculiaceae
M'boy	<i>Mitragyne stipulosa</i> O. Kuntze	Rubiaceae
Mdayen	<i>Pentadesma butyracea</i> Sab.	Guttiferae
Mehr	<i>Randia malleifera</i> B. & H. f.	Rubiaceae
Mehr-chu	<i>Scottellia coriacea</i> A. Chev.	Flacourtiaceae
Mkeli	<i>Piptadenia africana</i> Hook. f.	Mimosaceae
Mohr-chu	<i>Gaertnera salicifolia</i> Hutch. & Gillett	Loganiaceae
Moigbwamy	<i>Cleistopholis patens</i> Benth.	Annonaceae
Monkey bread	<i>Adansonia digitata</i> L.	Bombacaceae
Monkey fruit	<i>Acioa Barteri</i> Engl. (?)	Amygdalaceae
Monkey fruit	<i>Urophyllum Linderi</i> Hutch. & Dalz.	Rubiaceae
Mor-way-dah	<i>Eugenia Whytei</i> Sprague	Myrtaceae
Mulberry	<i>Chlorophora excelsa</i> Benth. & Hook. f.	Moraceae
Nali	<i>Landolphia leonensis</i> Stapf	Apocynaceae
Ndanwi-badgi	<i>Parinarium excelsum</i> Sab.	Amygdalaceae
Ne-bor-vah	<i>Popowia ferruginea</i> Engl. & Diels (?)	Annonaceae
Neh-mle-chu	<i>Randia acuminata</i> Benth.	Rubiaceae

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Ne-mor-ba-day	<i>Scottellia coriacea</i> A. Chev.	Flacourtiaceae
Nee-wahn-johr	<i>Cleistopholis patens</i> Benth.	Annonaceae
Nguangua	<i>Mareya spicata</i> Baill.	Euphorbiaceae
Nikli	<i>Microdesmis puberula</i> Hook. f.	Euphorbiaceae
Nu-eh-blai-chu	<i>Casearia Dinklagei</i> Gilg	Flacourtiaceae
Nutmeg, Calabash	<i>Monodora Myristica</i> Dunal	Annonaceae
Nutmeg, Wild	<i>Coelocaryon</i> aff. <i>oxycarpum</i> Stapf	Myristicaceae
Nutmeg, Yellow-flowering	<i>Monodora brevipes</i> Benth.	Annonaceae
Nye-fe-ohn	<i>Chytranthus setosus</i> Radlk. (?)	Sapindaceae
Oak, African	<i>Lophira alata</i> Banks	Ochnaceae
Oak, African	<i>Oldfieldia africana</i> Benth. & Hook. f.	Euphorbiaceae
Oak, Red	<i>Berlinia</i> spp.	Caesalpiniaceae
Oil-bean tree	<i>Pentaclethra macrophylla</i> Benth.	Mimosaceae
Ordeal tree	<i>Erythrophloeum guineense</i> G. Don	Caesalpiniaceae
Pahn	<i>Diospyros Linderi</i> Hutch. & Dalz.	Ebenaceae
Palm-doh	<i>Crysoalanus ellipticus</i> Soland.	Amygdalaceae
Pau-lai	<i>Oldfieldia africana</i> Benth. & Hook. f.	Euphorbiaceae
Peach, Sierra Leone	<i>Sarcocephalus esculentus</i> Afz.	Rubiaceae
Pearwood, African	? <i>Mimusops</i> sp.	Sapotaceae
Pe-ay-chu	?	Mimosaceae
Pee-doh	<i>Heinsia pulchella</i> K. Schum.	Rubiaceae
Pegblagei	<i>Heinsia pulchella</i> K. Schum.	Rubiaceae
Pehn	<i>Piper guineense</i> Sch. & Thonn.	Piperaceae
Pe-ohn	<i>Polyalthia Oliveri</i> Engl. & Diels	Annonaceae
Pepper bark	<i>Drypetes ovata</i> Hutch. (?)	Euphorbiaceae
Pepper, Bush	<i>Xylopia Staudtii</i> Engl.	Annonaceae
Pepper, Guinea	<i>Xylopia aethiopica</i> A. Rich.	Annonaceae
Pfui	<i>Fagara angolensis</i> Engl. (?)	Rutaceae
Pine, Red	<i>Oxystigma Stapfiana</i> A. Chev.	Caesalpiniaceae
Play-je-nee	<i>Aulacocalyx jasminiflorus</i> Hook. f.	Rubiaceae
Play-je-nee	<i>Olax Mannii</i> Oliv.	Olacaceae
Plechn	<i>Carpolobia</i> spp.	Polygalaceae
Pleh-chu	<i>Gardenia Abbeokuta</i> Hiern	Rubiaceae
Pleh-ju-eh	<i>Homalium Smythi</i> Hutch. & Dalz.	Flacourtiaceae
Plor-plor	<i>Ptychopetalum anceps</i> Oliv.	Olacaceae
Plor-plor	<i>Tetrorchidium</i> spp.	Euphorbiaceae
Plum, Rough-leaf	<i>Parinarium excelsum</i> Sab.	Amygdalaceae
Plum, Sugar	<i>Uapaca guineensis</i> Muell. Arg.	Euphorbiaceae
Poe-neh-day	<i>Heisteria parvifolia</i> Smith	Olacaceae
Pohn	<i>Deinbollia grandiflora</i> Hook. f.	Sapindaceae
Pohn	<i>Pseudospondias microcarpa</i> Engl.	Anacardiaceae

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Pohn	<i>Sorindeia deliciosa</i> A. Chev.	Anacardiaceae
Pondei	<i>Randia malleifera</i> B. & H. f.	Rubiaceae
Pongoi-hini	<i>Anthocleista nobilis</i> G. Don	Loganiaceae
Poor man's candle	<i>Carpolobia</i> spp.	Polygalaceae
Poplar	<i>Mitragyne stipulosa</i> O. Kuntze	Rubiaceae
Queh-mahr	<i>Albizzia Zygia</i> Macbr.	Mimosaceae
Rookra	<i>Diospyros gabunensis</i> Gürke	Ebenaceae
Rubber tree	<i>Funtumia africana</i> Stapf	Apocynaceae
Sackwi-mbauwi	<i>Adansonia digitata</i> L.	Bombacaceae
Sah-sah	<i>Vitex micrantha</i> Gürke	Verbenaceae
Sassywood	<i>Erythrophloeum guineense</i> G. Don	Caesalpiniaceae
Saye	<i>Oldfieldia africana</i> Benth. & Hook. f.	Euphorbiaceae
Sayr-chu	<i>Psychotria rufipila</i> A. Chev.	Rubiaceae
Shay-chu	<i>Morinda geminata</i> DC.	Rubiaceae
Se-bo-bu-ay	<i>Amaralia Sherbourniae</i> Wern.	Rubiaceae
See	<i>Acioa scabrifolia</i> Hua	Amygdalaceae
See	<i>Sorindeia deliciosa</i> A. Chev.	Anacardiaceae
Seer	<i>Eriocoelum racemosum</i> Bak. (?)	Sapindaceae
Sefflay	<i>Diospyros</i> spp.	Ebenaceae
Sehn	<i>Macrobium Chevalieri</i> Harms	Caesalpiniaceae
Sehn-chu	<i>Androsiphonia adenostegia</i> Stapf	Passifloraceae
Semli	<i>Chlorophora excelsa</i> Benth. & Hook. f.	Moraceae
Smar-ne-eh	<i>Azelia bracteata</i> T. Vogel	Caesalpiniaceae
Soap tree	<i>Vernonia conferta</i> Benth.	Compositae
Sohn	<i>Enantia chlorantha</i> Oliv.	Annonaceae
So-ni-ni-chu	<i>Heinsia pulchella</i> K. Schum.	Rubiaceae
Srah	<i>Coula edulis</i> Baill.	Olacaceae
Sru-ah	<i>Daniella thurifera</i> Bennett	Caesalpiniaceae
Sukai	? <i>Mimusops</i> sp.	Sapotaceae
Swam-beh	<i>Drypetes ovata</i> Hutch. (?)	Euphorbiaceae
Swa-meh	<i>Garcinia kola</i> Heckel	Guttiferae
Swizzle-stick	<i>Rauwolfia vomitoria</i> Afz.	Apocynaceae
Tah	<i>Crysobalanus ellipticus</i> Soland.	Amygdalaceae
Tallow tree	<i>Pentadesma butyracea</i> Sab.	Guttiferae
Te-ay-chu	<i>Memecylon polyanthemos</i> Hook. f.	Melastomaceae
Tentout	<i>Strephonema Pseudocola</i> A. Chev.	Combretaceae
Te-ohn-way-doo	<i>Chlamydocarya capitata</i> Baill.	Icacinaeae
Teyei	<i>Mimusops clitan-drifolium</i> A. Chev.	Sapotaceae
Tog-beli	<i>Millettia Lane-Poolei</i> Dunn	Papilionaceae

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Tohn-we-eh	<i>Cola nitida</i> A. Chev.	Sterculiaceae
Tokei	<i>Coula edulis</i> Baill.	Olacaceae
Tolui	<i>Cola acuminata</i> Schott & Endl.	Sterculiaceae
Toon-kor-doh	<i>Carapa procera</i> DC.	Meliaceae
To-ye	<i>Drypetes Afzelii</i> Hutch. (?)	Euphorbiaceae
Troehn-dru-plohn	<i>Pausinystalia Lane-Poolei</i> Hutch.	Rubiaceae
Tud-wan	<i>Ixora laxiflora</i> Smith	Rubiaceae
Tu-eh	<i>Ostryocarpus riparius</i> Hook. f.	Papilionaceae
Tuinyneili	<i>Chrysophyllum obovatum</i> G. Don	Sapotaceae
Ungwe	<i>Ceiba pentandra</i> Gaertn.	Bombacaceae
Vahn-chu	<i>Amphimas pterocarpoides</i> Harms	Papilionaceae
Vahn-mleh-doo	<i>Duboscia</i> sp.	Tiliaceae
Vahn-te-ohn	<i>Octoknema borealis</i> Hutch. & Dalz.	Octoknemataceae
Vahn-vehn	<i>Myrianthus serratus</i> Benth. & Hook. f.	Moraceae
Ve-ay-dweh	<i>Parinarium</i> sp.	Amygdalaceae
Voo-fohn	<i>Voacanga bracteata</i> Stapf	Apocynaceae
Wah	<i>Protomegabaria Staphana</i> Hutch.	Euphorbiaceae
Walnut, African	<i>Coula edulis</i> Baill.	Olacaceae
War-bueh	<i>Ixora congesta</i> Stapf	Rubiaceae
Water tree	<i>Tetracera leiocarpa</i> Stapf	Dilleniaceae
Waye	<i>Pentadesma butyracea</i> Sab.	Guttiferae
Waye-doo	<i>Landolphia leonensis</i> Stapf	Apocynaceae
Waye-kpay	<i>Pentadesma butyracea</i> Sab.	Guttiferae
Waye-pu	<i>Symphonia gabonensis</i> Pierre, var. <i>macrantha</i> Hutch. & Dalz.	Guttiferae
Wedi-quah-dro	<i>Napoleona leonensis</i> Hutch. & Dalz.	Lecythidaceae
Wedi-wa-doon	<i>Napoleona leonensis</i> Hutch. & Dalz.	Lecythidaceae
Wee-chu	<i>Lonchocarpus cyanescens</i> Benth.	Papilionaceae
Weh-boh	<i>Conopharyngia durissima</i> Stapf	Apocynaceae
Wehn-flay	<i>Hippocratea Loesneriana</i> Hutch. & Moss	Hippocrateaceae
Wha-la-koh	<i>Strombosia pustulata</i> Oliv.	Olacaceae
Whoe	<i>Daniella similis</i> Craib	Caesalpiniaceae
Wish-more	<i>Tarrietia utilis</i> Sprague	Sterculiaceae
Witch Vine	<i>Landolphia leonensis</i> Stapf	Apocynaceae
Wrahn-beh	<i>Coelocaryon</i> aff. <i>oxycarpum</i> Stapf	Myristicaceae
Wro-doo	<i>Canthium hispidum</i> Benth.	Rubiaceae
Yawi	<i>Tarrietia utilis</i> Sprague	Sterculiaceae
Yellow wood	<i>Enantia chlorantha</i> Oliv.	Annonaceae

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Zah	<i>Necepsia Afzelii</i> Prain	Euphorbiaceae
Zahn	<i>Pterocarpus santalinoides</i> L'Hér.	Papilionaceae
Zar-deh-jay	<i>Gaertnera Cooperi</i> Hutch. & Moss	Loganiaceae
Zar-zreh-wehn-ye	<i>Macaranga</i> sp.	Euphorbiaceae
Zauh	<i>Hannoa Klaineana</i> Pierre & Engl.	Simarubaceae
Zeb-blo	<i>Scytotetalum Tieghemii</i> Hutch. & Dalz.	Scytotetalaceae
Ze-eh	<i>Leea guineensis</i> Don	Ampelidaceae
Zen-nieh	<i>Strombosia pustulata</i> Oliv.	Olacaceae
Zoe	<i>Macrolobium</i> spp.	Caesalpinaceae
Zoe-kpoe	<i>Tylostemon Mannii</i> Stapf	Lauraceae
Zree-chu	<i>Pachypodanthium Staudtii</i> Engl. & Diels	Annonaceae
Zwahn	<i>Parinarium Kerstingii</i> Engl.	Amygdalaceae

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Scr. No.	Coll. No.
	413
MUSEUM	
YALE SCHOOL OF FORESTRY	
Com. Name	See-jee-Flg.
Bot. Name	<i>Mussaenda Afzelii</i> G. Don
Fam.	.....
Country	Liberia
Notes	Collected by G. B. Cooper, 1934, Upper River State
Illustrated by	.....
Printed at	.....

Plate I. The National Flower of Liberia (*Mussaenda Afzelii* G. Don).



Plate II. No. 1. *Pachypodanthium Standtii*
Engl. & Diels.



Plate II. No. 2. *Stenanthera Yalensis* Hutch. & Dalz.

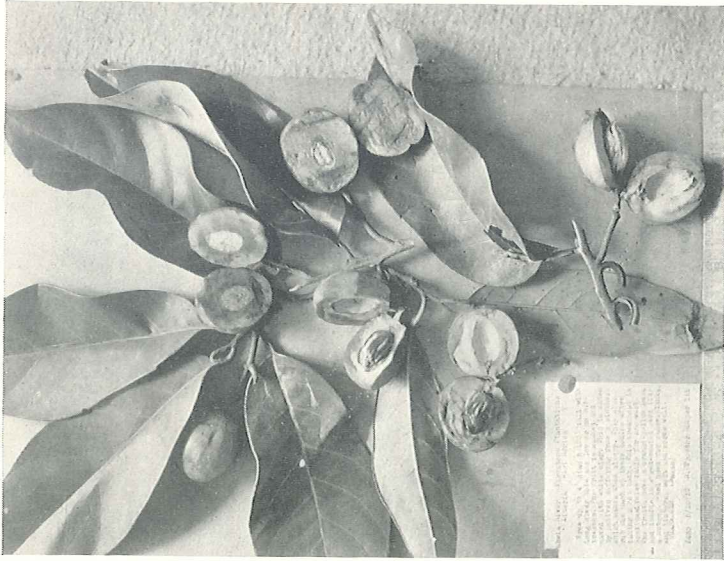


Plate III. No. 1. *Coelocaryon* aff. *oxycarpum* Stapf.



No. 2. *Soyaxia grandifolia* Stapf.

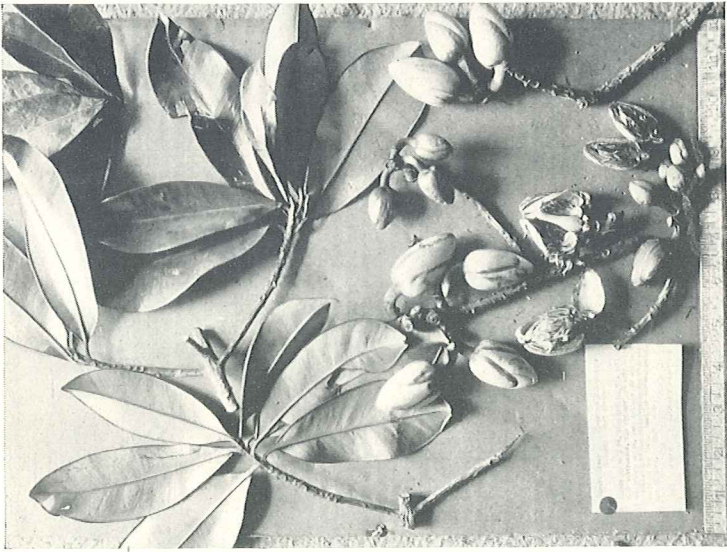
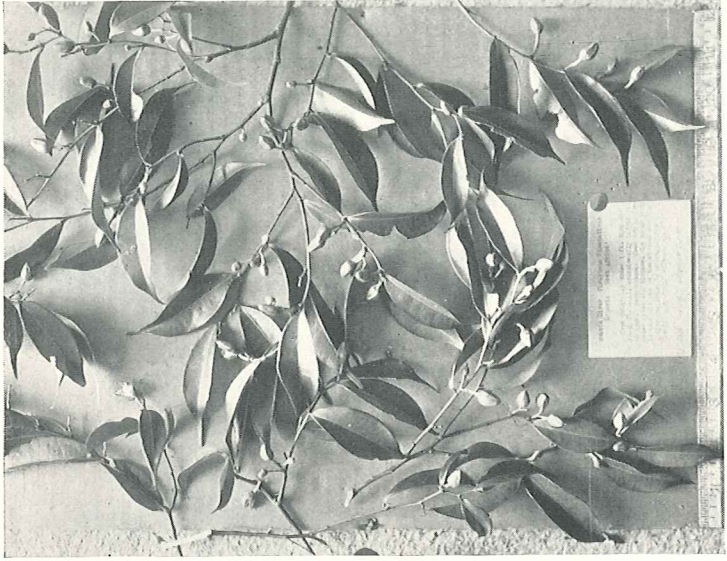


Plate IV. No. i. *Pentadesma butyracea* Sab.



No. 2. *Scytopetalum Tieghemii* Hutch. & Dalz.

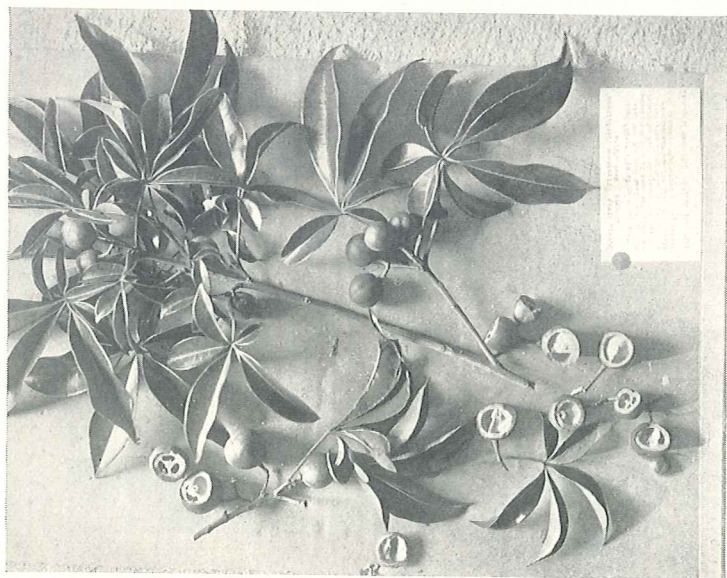
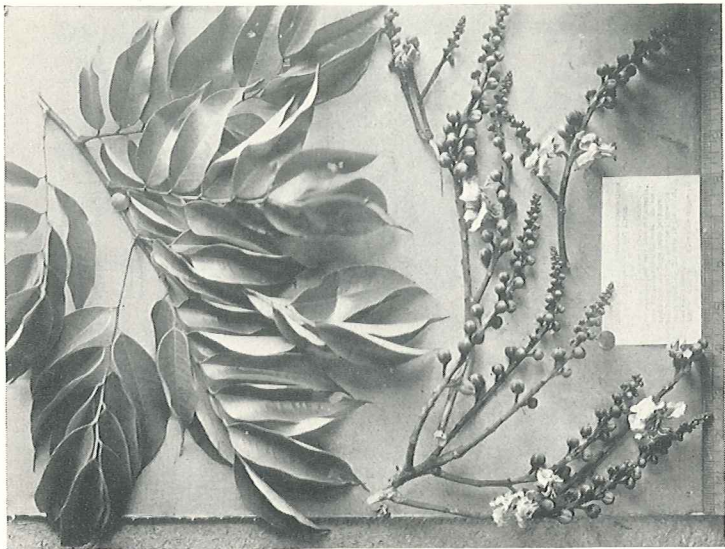


Plate V. No. 1. *Oldfieldia africana* B. & H. f.



No. 2. *Uapaca guineensis* Muell. Arg.



No. 2. *Bussea occidentalis* Hutch.

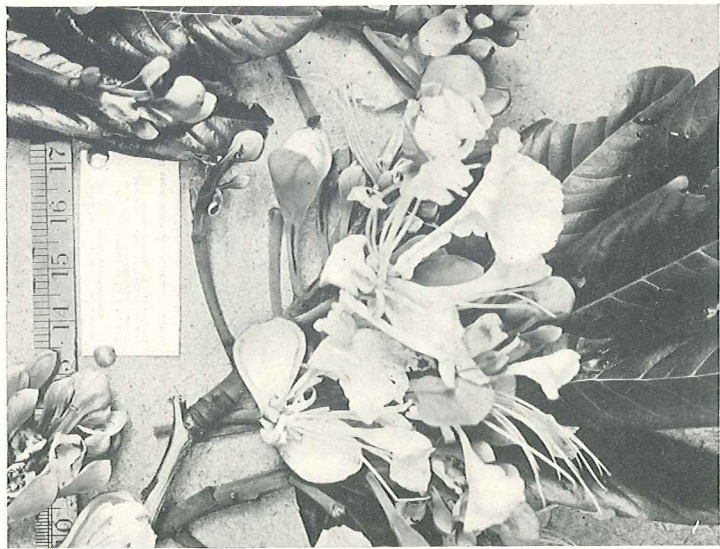


Plate VI. No. 1. *Berlinia grandiflora* Hutch. & Dalz.



Plate VII. No. 1. *Deterium senegalense* Gmel.



No. 2. *Macrolobium Chevalleri* Hams.

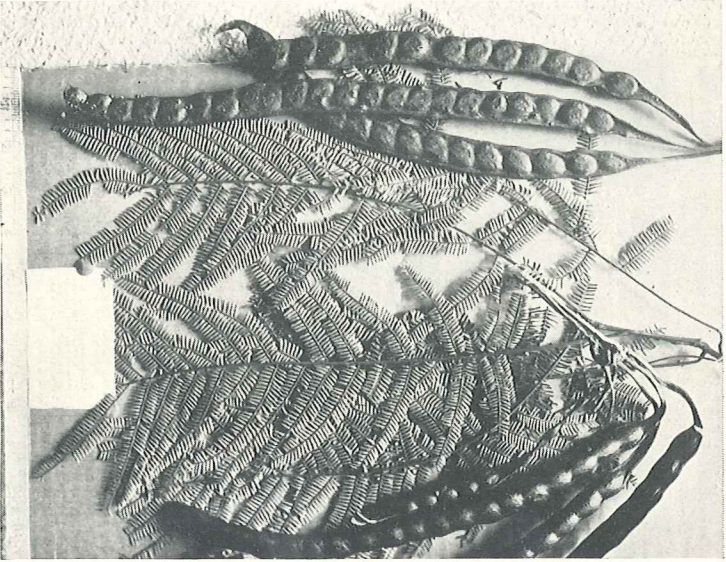


Plate VIII. No. 1. *Parkia bicolor* A. Chev.



No. 2. *Piptadenia africana* Hook. f.

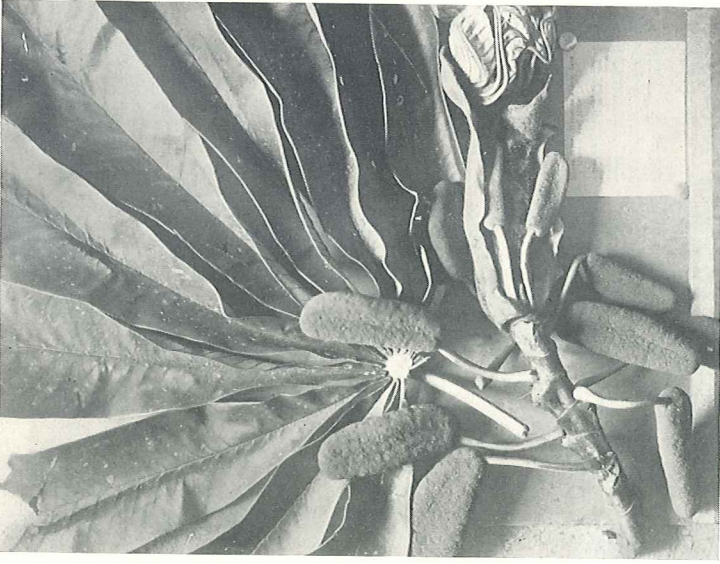


Plate IX. No. 1. *Maesanga Smithii* R. Br.



No. 2. *Maesopsis Eminii* Engl.

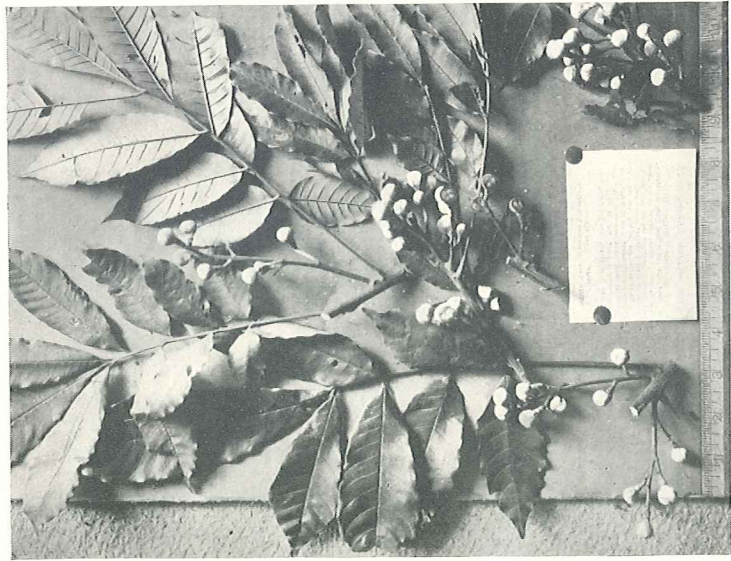


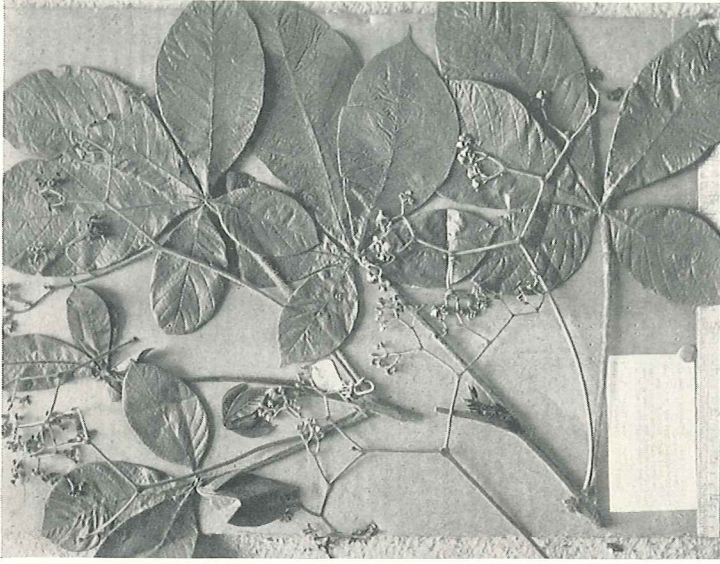
Plate X. No. 1. *Trichilia Heudelotii* Planch.



No. 2. *Sorindeta longifolia* Oliv.



Plate XI. No. 1. *Voacanga obtusa* K. Sch.



No. 2. *Vitex rufo* A. Chev.

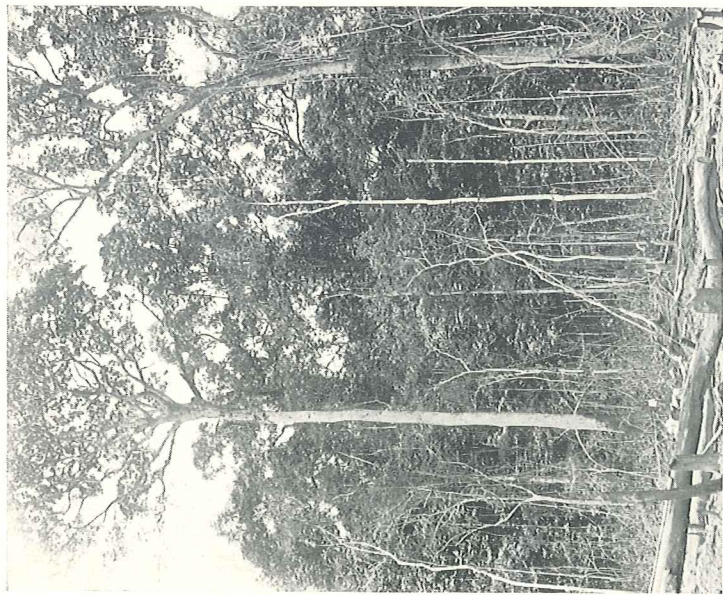


Plate XII. No. 1. Large trees in foreground are *Lophira alata* Banks.



No. 2. Middle tree and stump are *Cynometra ananta* Hutch. & Dalz.

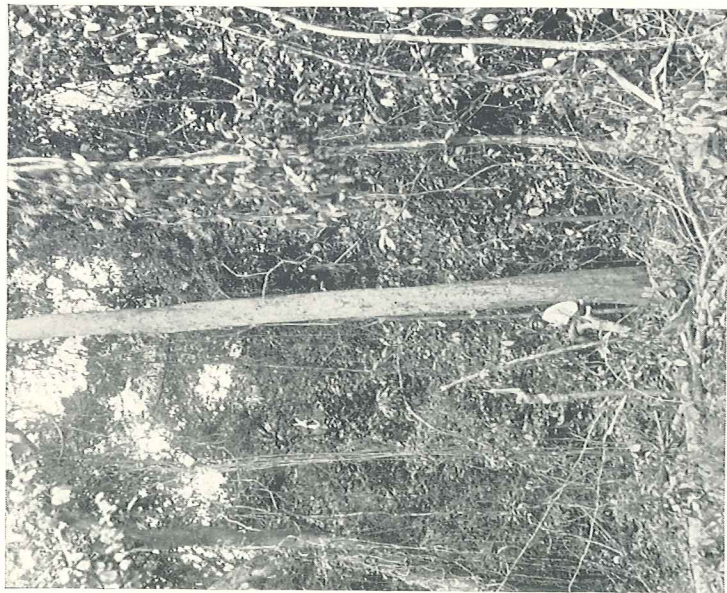
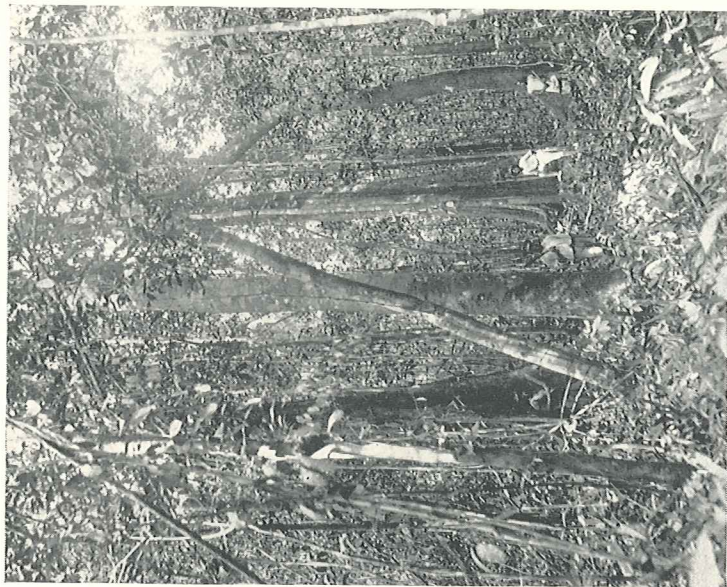


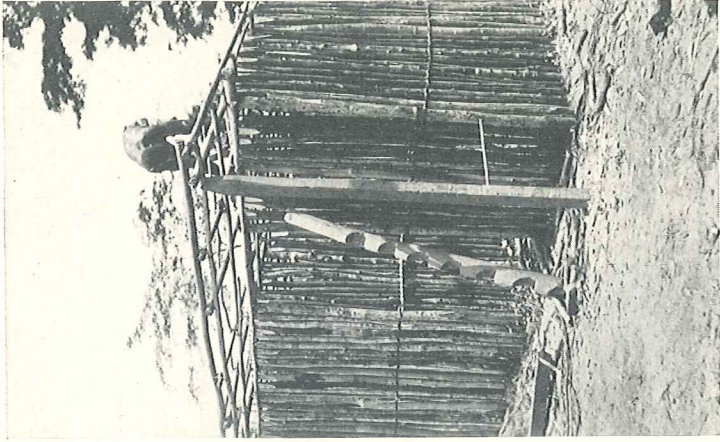
Plate XIII. No. 1. Edge of the jungle. Large tree is *Berlinia grandiflora* Hutch. & Dalz.



No. 2. Genera represented are *Saccoglottis*, *Daniella*, *Octoknema*, *Parkia*, and *Scytopetalum*.



Plate XIV. No. 1. Pit-sawing hewed logs
into planks.



No. 2. Framework of a native hut.



No. 3. Fisherman in small dugout canoe.



Plate XV. No. 1. Land deforested and burnt over on site of rubber plantation.



No. 2. Two-year-old rubber plantation with nursery between the rows.

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