
Timber trees of Liberia

University of Liberia, Monrovia

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Timber Trees of Liberia

by

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A student at the University of Liberia's Forest Project (WFP/FAO Photo by Banoun/Caracciolo)

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PREFACE

Mr J W A Jansen was Assistant Professor of Forest Botany in the College of Agriculture and Forestry of the University of Liberia from 1968 to 1971. His inside information on the role and importance of forests and timber in the economy of Liberia and his experience make him well qualified to write this book, which deals with twenty-seven economically important timber species of Liberia.

This is not a technical study designed for a few specialists, but one which is intended for undergraduates as well as secondary school students who are interested in knowing trees that play an important role in the economic development of Liberia. In addition, Mr Jansen's book is a useful guide in the selection of suitable Liberian timber for domestic uses.

The significance of Mr Jansen's research is emphasized by the fact that most of the lectures in our various institutions of learning are based on European or North American sources. This lack of local teaching materials prompted me to encourage local research that will, hopefully, result in the publication of textbooks based entirely on our own resources.

In congratulating Mr Jansen for his efforts, I hope that the publication of his book will accelerate the process by encouraging scholars in our various institutions to publish studies in other areas.

Rocheforte L Weeks
President
University of Liberia

December 1971
Monrovia, Liberia

INTRODUCTION

In connection with the Centennial Celebrations of the University of Liberia, a booklet was published in 1961 under the title "Timber Trees of Liberia". It was written in the introduction to this booklet that it was to give a brief "layman's" description of the more common trees in Liberian forests.

In 1965, "Liberian High Forest Trees" by A G Voorhoeve appeared. This is an excellent, botanical study of Liberian forest trees, as is Report No 3 of the German Forestry Mission to Liberia, entitled "The Trees of Liberia" (1965) by G Kunkel.

In 1970, the Dean of the College of Agriculture and Forestry asked me to revise "Timber Trees of Liberia" and bring it up to date in accordance with the increased knowledge then available of Liberian forest trees.

To avoid duplication, the botanical descriptions of the different trees have here been kept short and more attention has been given to the characteristics of the wood. Lists of timber used for different purposes are appended.

The line drawings, for which I am very grateful, were made by Mrs Emmelien Thyn, amateur botanist in Kakata. Photographs are by Mrs Emmelien Thyn and the author. A number of photographs are copies of transparencies belonging to the College.

I am deeply indebted to Dr Paul C Ma who encouraged me in this undertaking, and for his help in organizing field trips. Grateful thanks are also due to my wife for typing the script and for her active participation in visits to the field.

J W A Jansen
FAO Associate Expert in Forest Botany

November 1971
Monrovia, Liberia

ABURA

Mitragyna ciliata Aubrév - et Pellegr.

Family: Rubiaceae

Trade name: abura, bahia (I.C.), subaha (Ghana).

Description: A large forest tree, growing in the swamps of rain forests, with a maximum height of 100 feet or more and a diameter of up to four feet, Abura has a straight cylindrical bole and low buttresses. Its bark is greyish brown and the slash is fibrous, whitish grey inside, turning yellowish and then brown.

The leaves are simple, oppositely arranged, broadly elliptic, twelve inches long and eight to nine inches wide with relatively big stipules at their base. The white flowers grow in globose heads. The fruit is globose, later disintegrating to free the seeds.

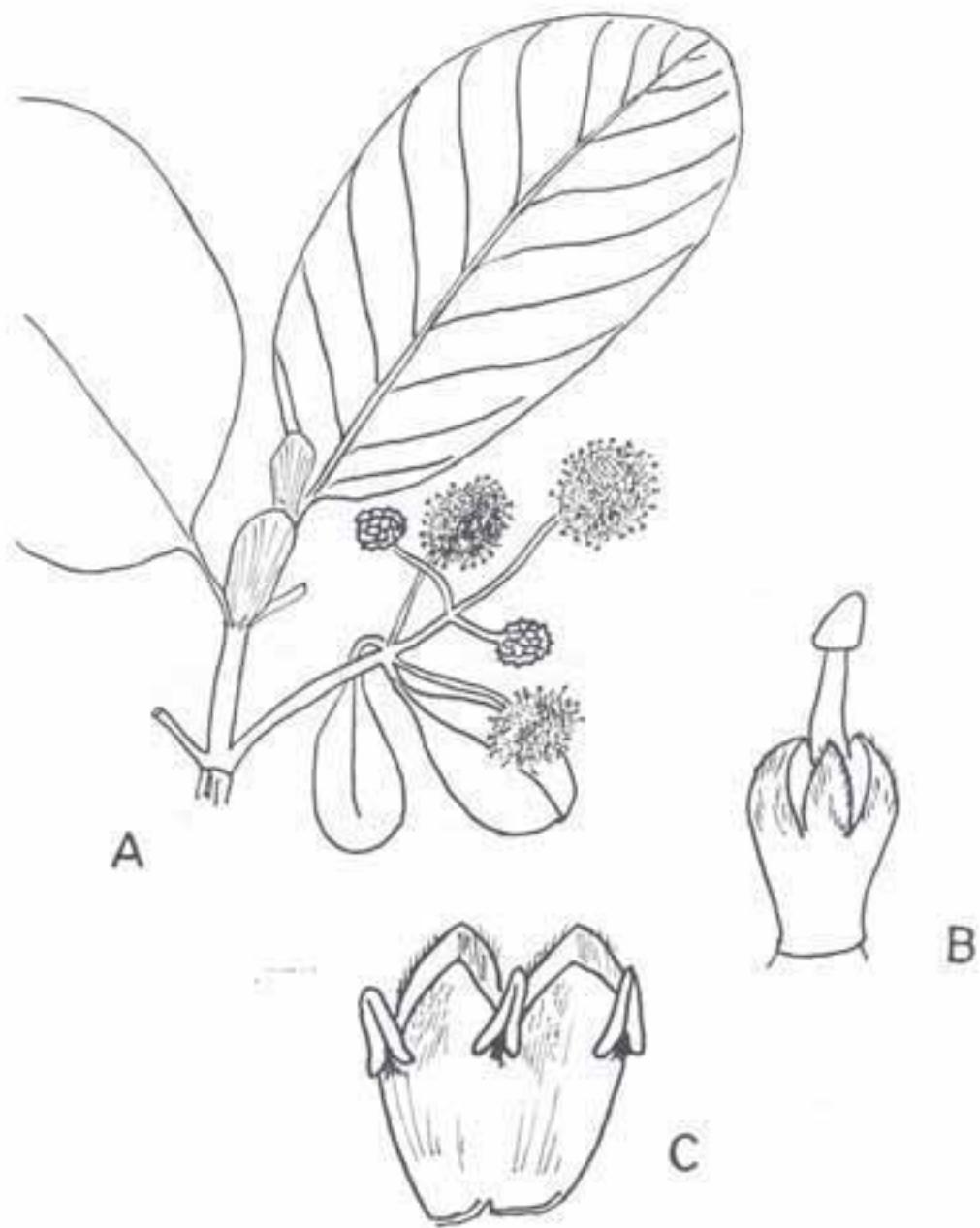
Distribution: Abura grows along the West Coast of Africa, from Liberia to the Congo. It is found throughout the country, but has a definite preference for swamps and marshy places. It has a gregarious tendency.

Wood: The sapwood is wide to very wide and there is almost no difference between the sapwood and the heartwood. The wood is pale brown with a pinkish tint, darkening when exposed to the air. The texture is fine and the grain is straight, although very weak cross grain may be present. Occasionally the wood may be figured with a short curled grain or with an eccentric heart.

Abura has a specific gravity of 0.54 and is a moderately strong wood, fairly soft with a slight tendency to warp. There are no drying or seasoning problems. It dries and seasons rapidly with very little degrade. The ends of the boards may sometimes split. It is not very durable and may be attacked by fungus when used for external purposes. Due to the attacks by fungus and the occasional splitting of the ends of logs, rapid conversion after felling is necessary. It is resistant to marine borers. To improve its durability, it can be easily impregnated with wood preservatives. Abura is strongly resistant to acids. It is easy to work, both with hand and machine tools. The silica sometimes present in the wood has a blunting effect on tools. The wood has no lustre after planning. Abura stains easily.

Abura is one of the chief exports from Nigeria and is the cheapest timber exported. During and after the Second World War it was one of the most popular timbers imported into Europe from Africa.

Uses: This light timber can be used for a wide variety of purposes. Due to its resistance to acids, it can be used successfully for battery and accumulator boxes, laboratory benches, containers for chemicals, etc. It is a good insulator and is therefore used for radio box fittings and electric switch boards. Further, it can be used for joinery, cheap furniture, carving, light constructional work, drawers, plywood, toys, turnery, brushes, wagon building, etc.



Mitragyna ciliata

A: branchlet with flowers, fruit and leaves (2/3x)

B: flower (10x)

C: corolla (10x)

ACAJOU BLANC

Khaya anthotheca (Welw.) C.DC.

Family: Meliaceae

Trade name: acajou-blanc, white mahogany, smooth-barked African mahogany, African mahogany.

Description: This large to emergent tree may reach a height of 150-180 feet; it has thick buttresses and a diameter above the buttresses ranging from one to four feet. The term African mahogany refers to all the Khaya species in Africa, but it is more specifically used for Khaya ivorensis. The bark is light coloured, smooth with green patches here and there. The slash is not thick, generally slightly scented; pink on the buttresses and on the bole pinkish red to bright red. The bole is straight or slightly sinuous and may be over 75 feet long.

The leaves are pinnately compound, tufted at the end of the branches while the branchlets and leaves are glabrous. The difference between K. ivorensis and K. anthotheca is that the former has petiolules of 0.6 cm long and the latter has in general, longer petiolules. The fruit is a grey woody capsule nearly three inches in diameter, opening with four to five valves.

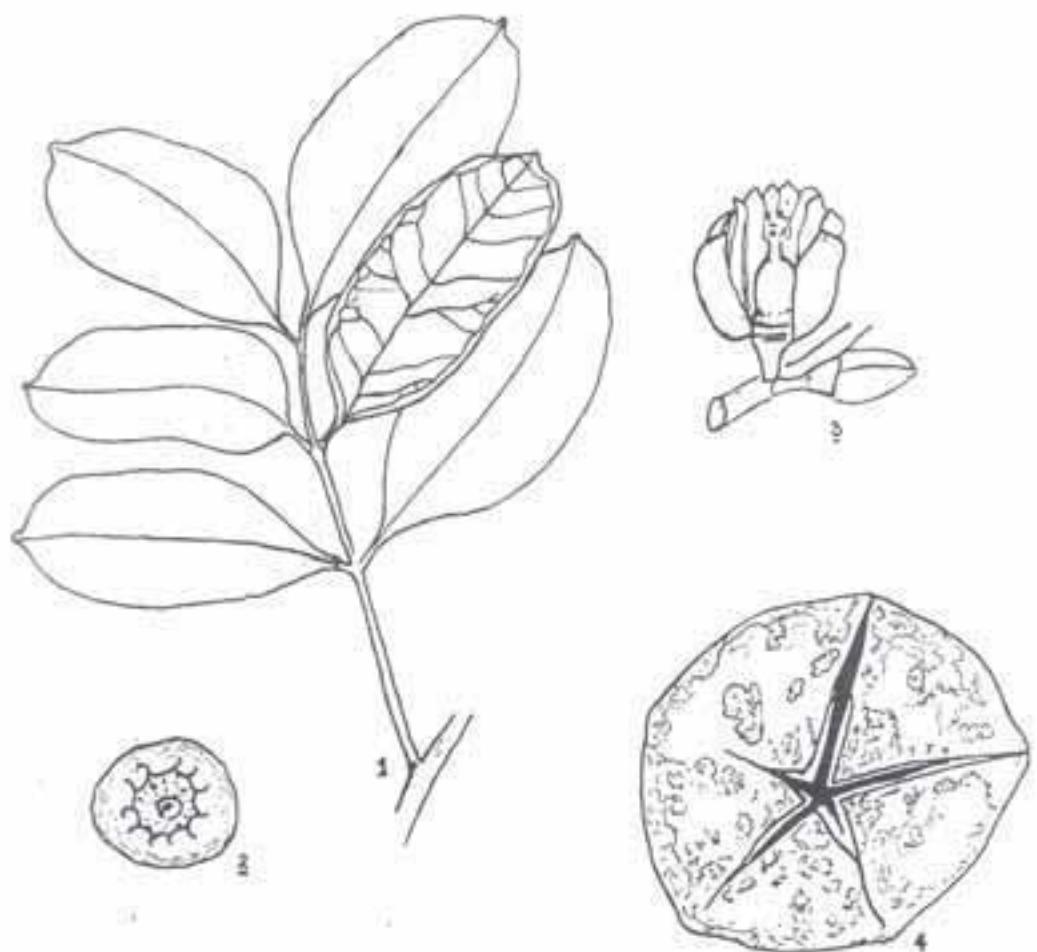
Distribution: Acajou-blanc is a species growing in the drier forests from Guinea to Uganda and Angola. It is absent in the forests along the coast.

Wood: The heartwood is pinkish white when freshly cut, much lighter than that of K. ivorensis but when exposed to air, it becomes rather dark brownish red, a typical mahogany colour. The wood may be well figured. The sapwood, 1-2 inches wide, is yellowish brown and not very well defined from the heartwood. It has a fine texture and is straight grained, though sometimes cross grain is evident. Occasionally gum veins are present as a defect in the wood, being the result of injury to the growing tree. The specific gravity is 0.53 (33 lbs/cub ft). The interlocked grain yields a striped figure on quarter-sawn boards. However, much more figure may be present in the wood, much as scrotch, swirl, mottle, fiddle back, etc. In appearance there is no difference between the woods of K. ivorensis and K. anthotheca.

Seasoning and drying can be done easily with little degrade; however, when tension wood is present, distortion will occur during the drying process. Acajou-blanc is easy to work, using both hand and machine tools. When interlocked grain occurs, it may result in "picking" during planing, but with proper adjustment of the cutting angle, there will be no difficulties.

The wood is not very resistant to fungal and insect attack and is, therefore, not recommended for exterior situations. The timber nails and screws well. It is easy to glue and polish. In contact with iron under humid conditions, the wood may stain. Therefore for such purposes galvanized nails should be used.

Uses: It is used in cabinet making, plywood manufacture, high-class joinery and furniture. Because of its excellent working properties and decorative appearance, it is often used as a substitute for Honduras mahogany. It has further advantage over Honduras mahogany in that it can be obtained in a wide range of sizes at competitive prices.



Khaya anthotheca

- 1: branchlet with leaves (1/2x)
- 2: couronne staminale seen from above (10x)
- 3: flower opened at front (3x)
- 4: fruit (1x)

AFRICAN OAK

Oldfieldia africana Benth. et Hook.F.

Family: Euphorbiaceae

Trade name: African oak, dantoué, fu or fou (Ivory Coast).

Description: A large forest tree with brown, very strong wood. The stem is straight and cylindrical. The base of the stem may be swollen or may have wide-spreading root ridges. The bark is scaly, brown with vertical fissures. The slash is light brown to reddish brown with a little bitter water. The young branches are covered with reddish brown hairs but the older branches are without hairs.

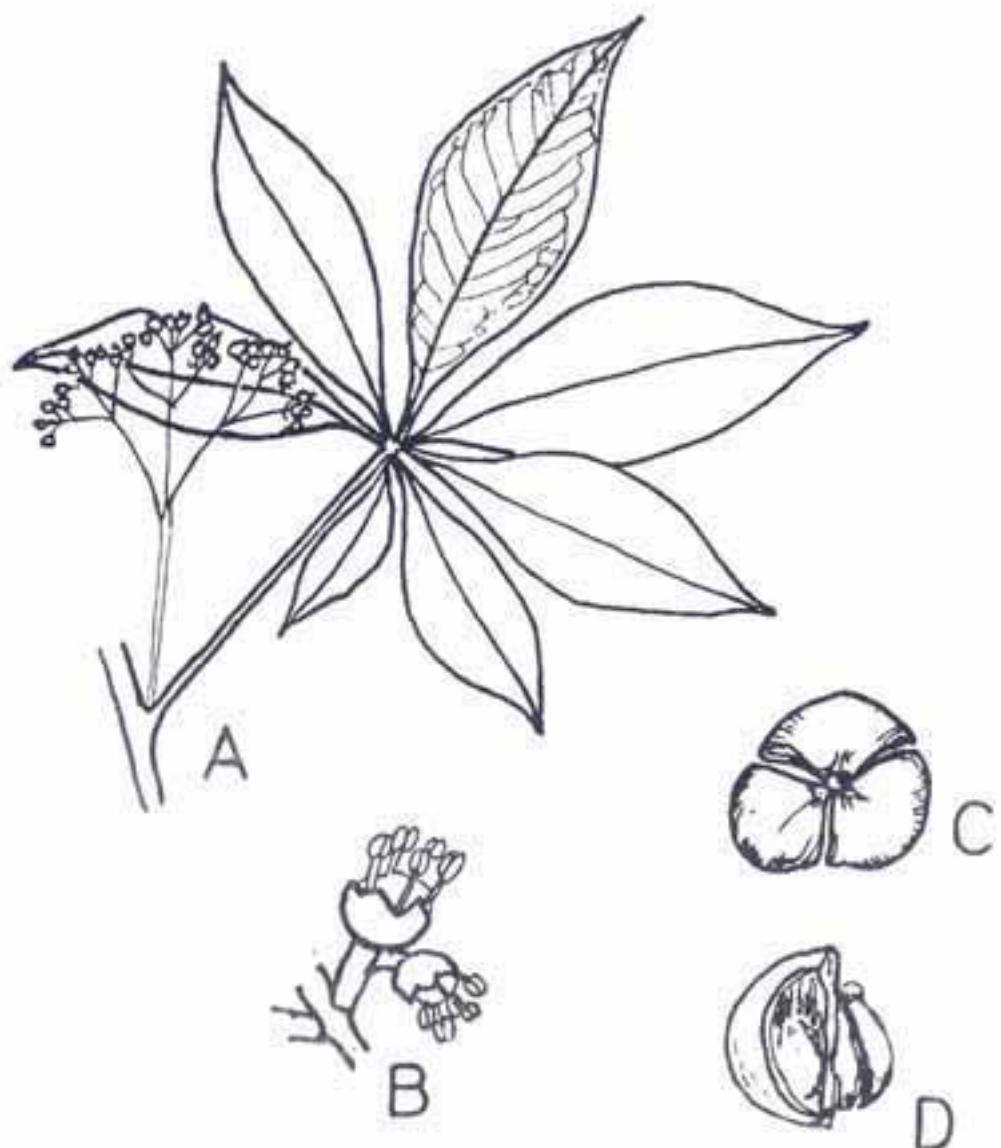
The leaves are opposite, digitately compound of five to eight leaflets. Male and female flowers are on different trees. The inflorescences develop in the axil of shed leaves. Fruits are globular capsules, orange coloured with usually one or two seeds in each of the three locules.

Distribution: Sierra, Leone, Liberia and the Western part of Ivory Coast. Voorhoeve (21) states that Oldfieldia africana has also been collected in the Cameroon. It grows throughout Liberia, scattered or in groups, without preference for any particular site. It grows in marketable quantities.

Wood: The very hard and heavy heartwood is dark reddish brown to purplish brown while the sapwood is lighter, greyish olive, not sharply demarcated from the heartwood. The specific gravity is 0.97 and the freshly timber sinks in water. The texture is medium fine and the grain is irregular, often interlocked. It looks somewhat like teak.

In earlier times it was exported from Sierra Leone under the name of African teak. The timber is very hard and strong and can therefore be used for work requiring strength, such as heavy carpentry and construction. As it is resistant to marine borers, it can be used for ship-building and has been used in the past for wooden ships. It is also suitable for construction of bridges, quays, bridge floor planking, etc. Trials should be made on its resistance to termite attack. If resistant to termites, it could be used in Liberia for railway sleepers, construction purposes etc.

Uses: Bridges and heavy construction purposes.



Oldfieldia Africana

A: branchlet with leaves and inflorescence (1/2x)

B: male flower (5x)

C: fruit (1x)

D: fruit (1x)

AIELE

Canarium schweinfurthii Engl.

Family: Burseraceae

Trade name: aiele, white mahogany, aieli.

Description: Canarium schweinfurthii is a large forest tree with its crown reaching to the upper canopy of the forest. The total height of a large tree may exceed 150 feet, free of branches, straight and cylindrical bole. The diameter above the heavy root swellings may be up to 5 feet. The slash is reddish or light brown and has a turpentine-like odour, exuding a heavy, sticky oleoresin which colours to sulphur yellow and becomes solid. This resin is used as bush candles, torches, etc.

The leaves, which are clustered at the end of the branches, alternate and may be 6 to 20 inches long. The lower leaflets are bigger than the upper ones. The lower part of the petiole is winged on the upper side. The flowers grow in inflorescences which stand in the axils of the leaves. They are unisex and creamy white. The inflorescences may be up to 11 inches long.

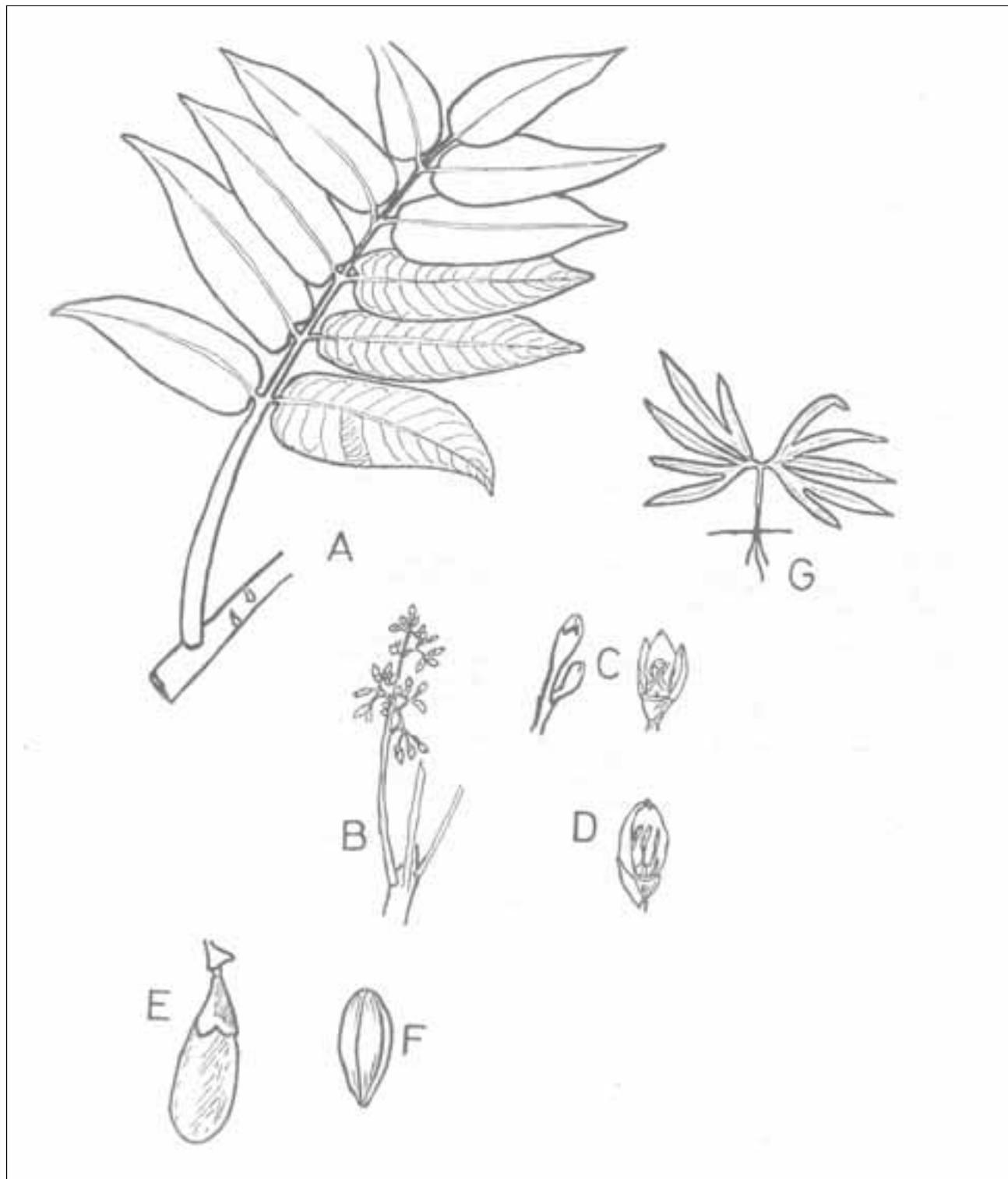
The fruits are blueish-purple and are like olives or dates, nearly one inch long and $\frac{1}{2}$ inch thick, while the calyx is persistent and remains attached to the fruit. The outer pulp of the fruit yields an oily substance which is edible and therefore the fruits are sold on the market.

Distribution: Canarium schweinfurthii grows from Senegal to Southern Angola and to Sudan and Uganda. In Liberia, it is found in the Western as well as in the Eastern Province and in the Nimba region. Although it is found in different vegetation types, it prefers well-drained slopes.

Wood: The sapwood, often very thick (up to 6 inches), is whitish with pinkish reflections. The heartwood is pink when freshly cut but darkening to light brown mahogany colour. This is the reason why it has been sold under names like Gabon mahogany and it has served as a substitute for true mahogany. The texture is slightly coarse and the grain interlocked which causes a fine striped figure on quarter-sawn boards. The specific gravity is 0.50. The wood seasons slowly but fairly well. End splitting may happen and existing shakes may extend during the drying process. Therefore the use of s-shaped irons at the ends of the logs to prevent their splitting is recommended. The timber is rated as non-durable and may be attacked by fungi and insects. (Not resistant to termites).

Impregnation of the heartwood is difficult. It works easily with hand and machine tools, although sharp tools are recommended, otherwise a woolly surface will result. Canarium stains and polishes well; when polished it is sometimes used as a substitute for mahogany.

Uses: Core veneer, decorative panelling (because of the figure in the heartwood), general utility purposes, parquetry, furniture, flooring and doors. Used locally for mortars, planks, canoes, general building purposes and fuel.

Canarium schweinfurthii

A: leaf (1/2x)

C: female flower (1x)

E: fruit (1x)

G: seedling (1/2x)

B: inflorescence (2/3x)

D: male flower (1x)

F: seed (1x)

Lophira alata Banks ex Gaertn.f.

Family: Ochnaceae

Trade name: azobé, ekki, iron wood, bongossi.

Description: A large tree which has a straight trunk with heavy buttress-like root swellings. The maximum height of the three to four-root swellings along the stem is 3 feet. Lophira alata may reach a height of 120-150 feet with a branch-free trunk of 70 feet. The diameter may be up to 6 feet. The bark is scaly and red brown in colour. The slash shows the outer bark red brown with a conspicuous yellow layer deeper in the bark. A watery juice may collect in the slash wound.

During the changing of the leaves Lophira alata is easy to recognize in the forest because the whole crown is covered with bright red young leaves which remain red for two to three weeks and finally turn green when they are full-grown. The leaves are simple with many very fine nerves. The flowers which appear after the new leaves are formed, are in panicles. They are whitish and fragrant. The fruits are winged, one of the wings, being much bigger than the other. These wings are formed by the outgrowth of two sepals.

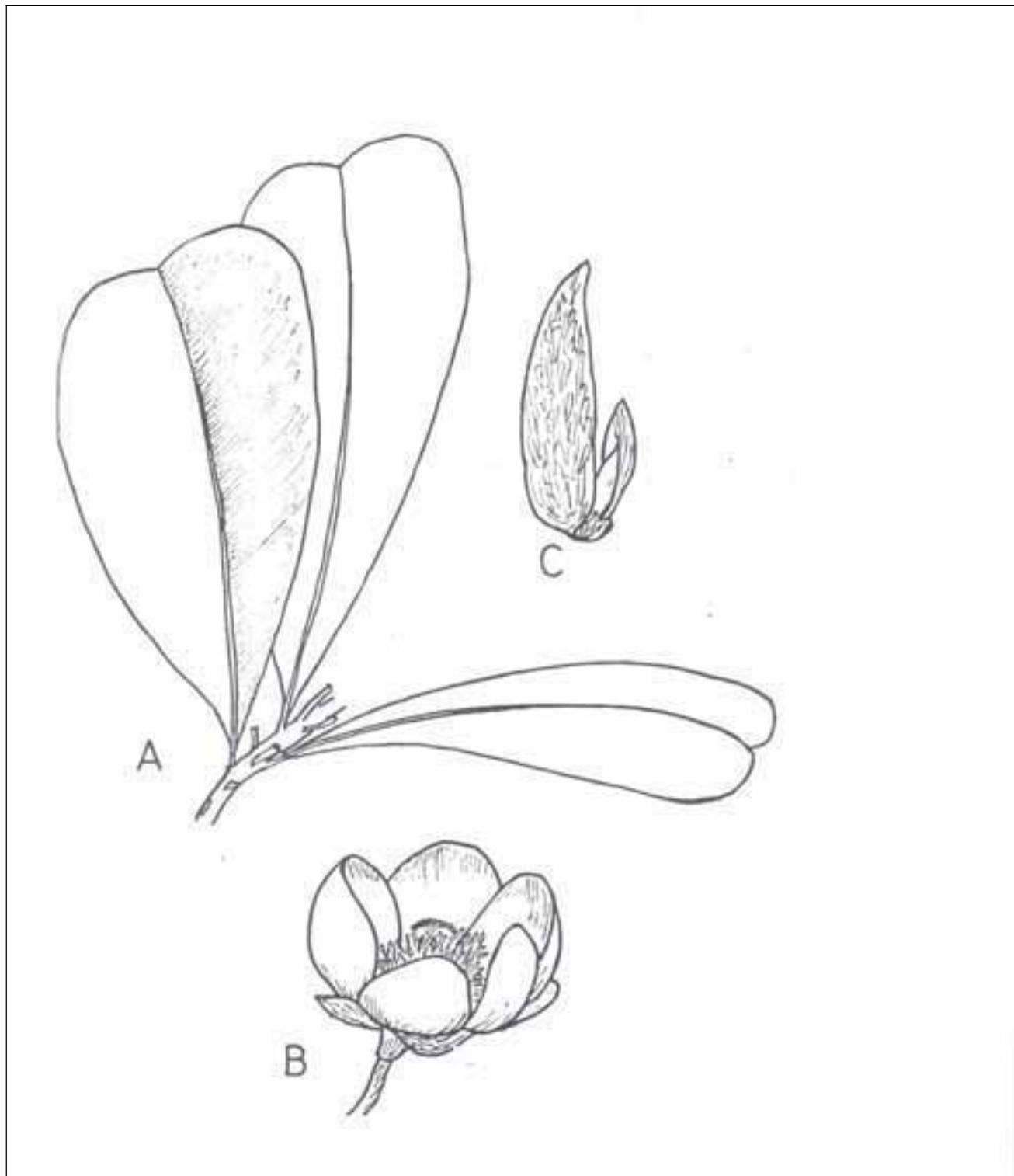
Distribution: In West Africa: Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Cameroon, Angola and the Congo. It is found throughout Liberia in good quantities. In Sierra Leone, it is reported that this species in certain parts of the forest is very abundant and forms up to 80 per cent of the stands.

Wood: The heartwood is purplish brown to chocolate brown; sapwood is of a lighter colour. Azobé is a very hard wood with a specific gravity of 1.06 which is remarkably constant in all the samples collected in its distribution area. The wood is very hard and strong and performs excellently when compression forces are applied. It seasons with difficulty; dries slowly and severe splitting and distortion may occur. Precautions must, therefore, be taken. Once it is dry it is reasonably stable and shows little variation to atmospheric conditions. It is reported from France that a board 8 inches thick and 30 inches wide still had an average moisture content of 30 per cent after thirty years of seasoning.

It is one of the most durable woods in the world. It is highly resistant to termites but not totally immune. Marine borers may also attack it, but maritime constructions in the temperate belt have remained, intact for more than twenty years.

Azobé is a difficult wood to work, especially when it is dry. For this reasons, it should be converted before the wood has had a chance to dry. The grain is interlocked. Nailing and screwing have to be done after pre-boring the holes.

Uses: Underwater constructions (e.g. ports of Le Havre, Dieppe, Bordeaux, etc.); heavy construction work, railway sleepers, piles, piers, bridges, heavy-duty flooring, etc.



Lophira alata:

A: branchlet with leaves (2/3x);
B: flower (1x);
C: fruit (1/2x)

BOSSÉ

Guarea cedrata (A.Chev.) Pellegr.

Family: Meliaceae

Trade name: bossé, guarea, obobo, bosassa, mutig banayé

Description: A large tree with a dense crown and a straight cylindrical bole. The tree may reach a height of 140 feet and a diameter of 3½ feet above the buttresses. Young trees have nearly no buttresses but older trees have concave buttresses and the base of the bole may be fluted. The bark is silvery grey with “mussel-shell” markings, while the slash is soft, pinkish and sweet scented.

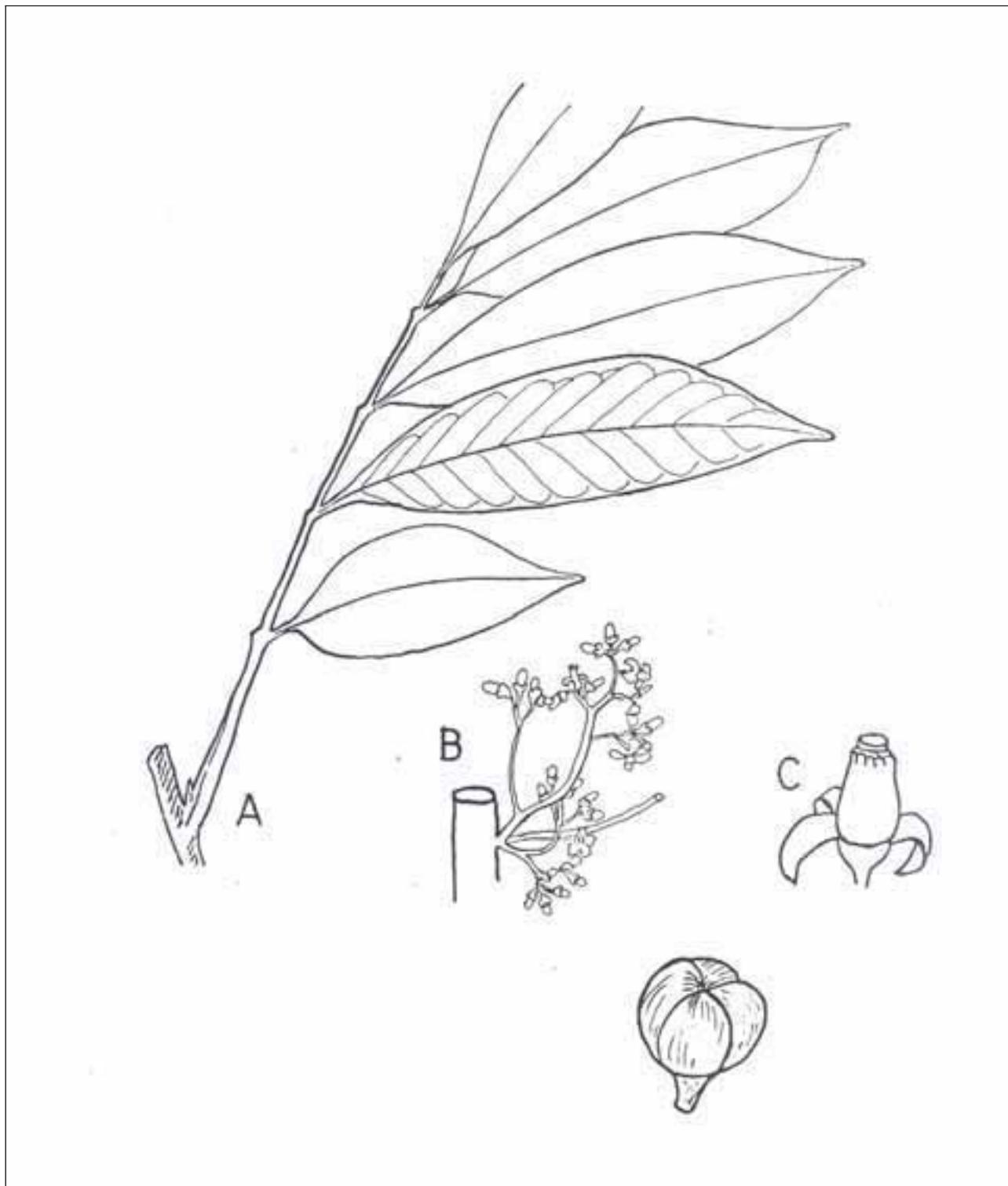
The leaves are pinnately compound with four to six pairs of leaflets up to 16 inches long with opposite leaflets. The fruits are 1¾ inches in diameter and of leathery texture. The fruit has a capsule form with two to four cells, each cell containing one seed. When the fruits mature, monkeys and parrots eat the seeds. Two other *Guarea* species grow in Liberia: *Guarea Leonensis*, an understorey tree and *G. thompsonii*, a large forest tree which according to Voorhoeve may be as common as bossé but in Ghana and Ivory Coast is much less common.

Distribution: From Guinea to Uganda and the Congo. It is found throughout Liberia in the evergreen forests as well as in the moist semi-deciduous forests. In Ivory Coast, near Abidjan, only a few old ones are growing but many young ones which grow in the shade are present as regeneration.

Wood: The heartwood has a pinkish brown colour with a cedar smell and it darkens when exposed to the light. The sapwood, not well defined from the heartwood, is normally quite broad and is yellowish brown in colour. The texture is very fine and after planing it has a silky and lustrous surface. The grain may be either straight or wavy which may cause some difficulty in planing. Logs have a rough appearance and may have a slightly curved shape, but this does not affect the timber quality. Export logs have only medium diameters and in peeling for plywood and veneer are excellent.

It has a moderate tendency to warp but careful seasoning might be able to avoid this. In air seasoning it has to be protected from sun and rain, but otherwise seasons well. It is reasonably resistant to decay and dry rot and is impervious to impregnation. It works rather well with both hand, and machine tools. The interlocked grain may pick up in planing. The wood tends to split in nailing. For polishing, it is advisable to season to a very low moisture content and then expose the wood to heat. This treatment eliminates the resin in the wood. After this, good results will be obtained with wax and furniture oil. The growth rings give an attractive appearance to the wood used in Scandinavian styled furniture. Sawdust may irritate the respiratory system of the workers.

Uses: Bossé yields a good and attractive veneer in peeling, suitable for panelling and furniture; in slicing it may be also used for decorative purposes. It is used for interior fittings, shop fittings, high-class joinery, boat-building and cigar boxes.



Guarea cedrata:

A: Leaves (1/2x);
C: flower (4x);

B: inflorescence (1/2x);

D: fruit (1x)

COTTON TREE

Ceiba pentandra (L.) Gaertn.

Family: Bombacaceae

Local names: cotton tree, silk cotton tree, fromager (Ivory Coast).

Description: The cotton tree is one of the biggest trees in Liberia and may reach a height of 150-200 feet and a diameter of 6-7 feet. The stem of the young tree is armed with numerous sharp prickles which may disappear when the tree grows older. Some cotton trees never have these sharp prickles. The base of the trunk is characterized by large spreading plank buttresses and the trunk itself is straight and cylindrical.

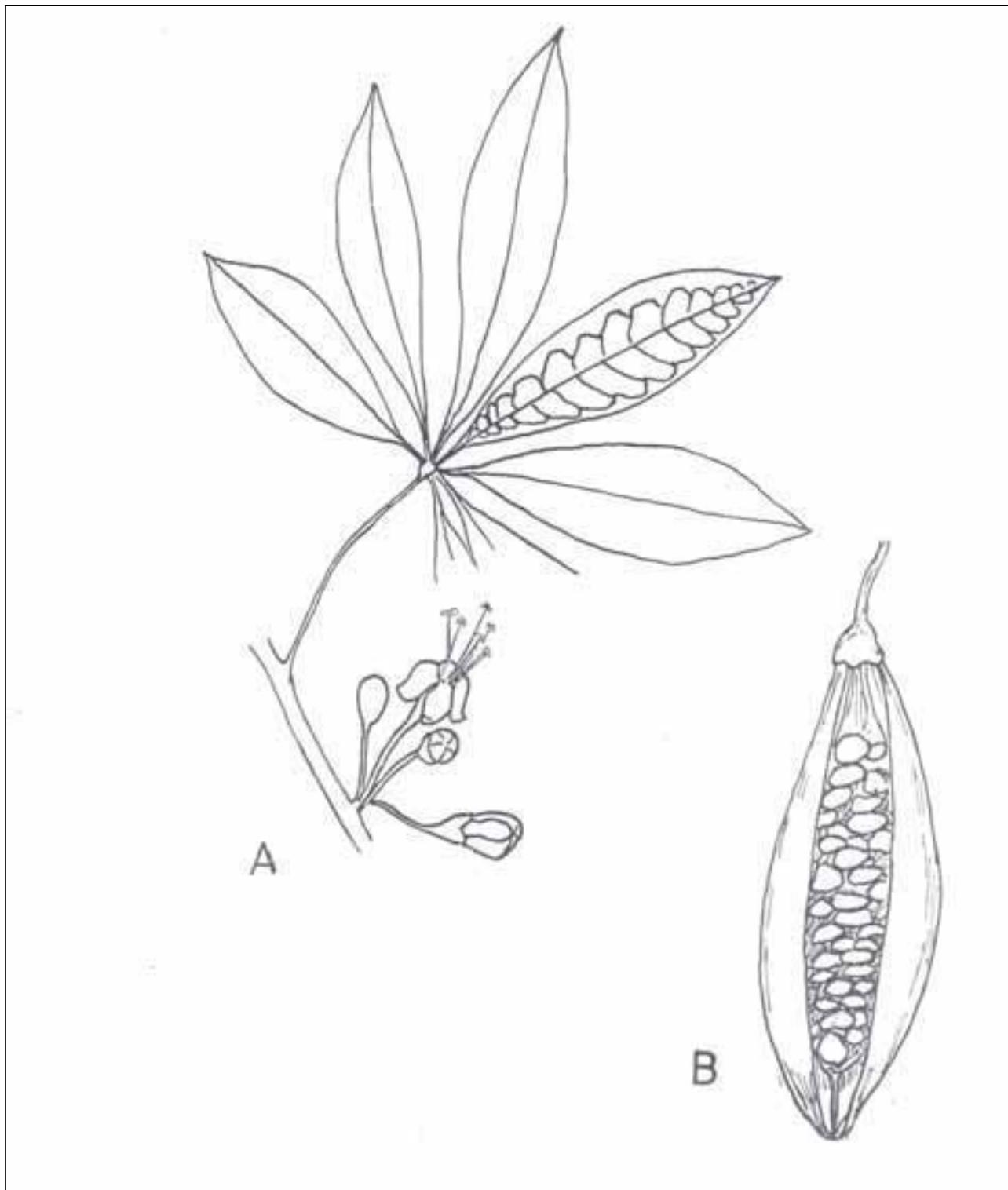
The tree drops its digitate leaves at irregular intervals. Outside the forest the leaves drop while the new leaves are already appearing, or nearly appearing, in such a way that the tree is never bare for more than a week. In the forest, leaf fall is more per branch than per whole tree. The flowers appear at the same time as the leaves are being dropped. The cucumber-shaped fruits mature three months later. The numerous seeds are embedded in a mass of grey to white kapok or silk-cotton, hence the name of the tree.

Distribution: Although the cotton tree grows in all tropical regions of the world, there are indications that the tree is originally from Tropical America. In Liberia, it grows in and around towns and cities and in the secondary or transitional forests, seldom if ever growing in tropical high forests.

Wood: The heartwood when freshly cut is whitish, but may darken to pale pinkish brown after exposure to the air. It is difficult to distinguish sapwood from heartwood. The wood is not resistant to insect and fungus attacks, so when cut, the logs have to be extracted rapidly from the forest and converted quickly. This light wood works easily with both hand and machine tools but cutting edges have to be kept very sharp otherwise a woolly surface appears. It is considered difficult to season although some sources claim that seasoning is easy with little degrade. The main qualities of the wood are its lightness and acoustic qualities.

Uses: It is used for sound insulation, cabin panelling, radio cabinets, core for plywood (Nigeria), shuttering, light interior joinery, shelving, stools, crates, boxes, paper pulp. It is sometimes used locally for purposes like mortars, canoes, tables, etc.

The kapok from the fruit is used for furniture filling, stuffing mattresses, cushions, car seats, etc. The main properties of kapok are its elasticity and filling capacity. The bulk of the world production of kapok comes from Java (Indonesia) from Ceiba pentandra var. indica. Although the kapok is used locally in Liberia, it has so far not been a commodity for export.



Ceiba pentandra: A: leaf with flower and flower buds (1/2x);
B: fruit (1/2x)

COULA

Coula edulis Baill.

Family: Olacaceae

Trade name: coula, African walnut, Gabon nut, almond wood.

Description: A medium-sized forest tree with a rather short bole which may be up to 25 feet long. The total height may be 80 feet. It is a middle-storey tree, growing in the evergreen and, deciduous forests. The diameter, above the sometimes present butt flares or low root ridges, can be 2 - 2½ feet. The bole is cylindrical or angular. The slash is brown or yellow and small droplets of latex appear in the slash wound. The bark is fairly smooth, thin and brown coloured.

The leaves are simple, alternatively arranged. The young parts are reddish brown pubescent. The leaves are up to 12 inches long and 3½ inches wide. The flowers, which are very small, are arranged in lax panicles. The fruit is a drupe, as in most Olacaceae, nearly round with a hard shell. The fruit is edible (see uses).

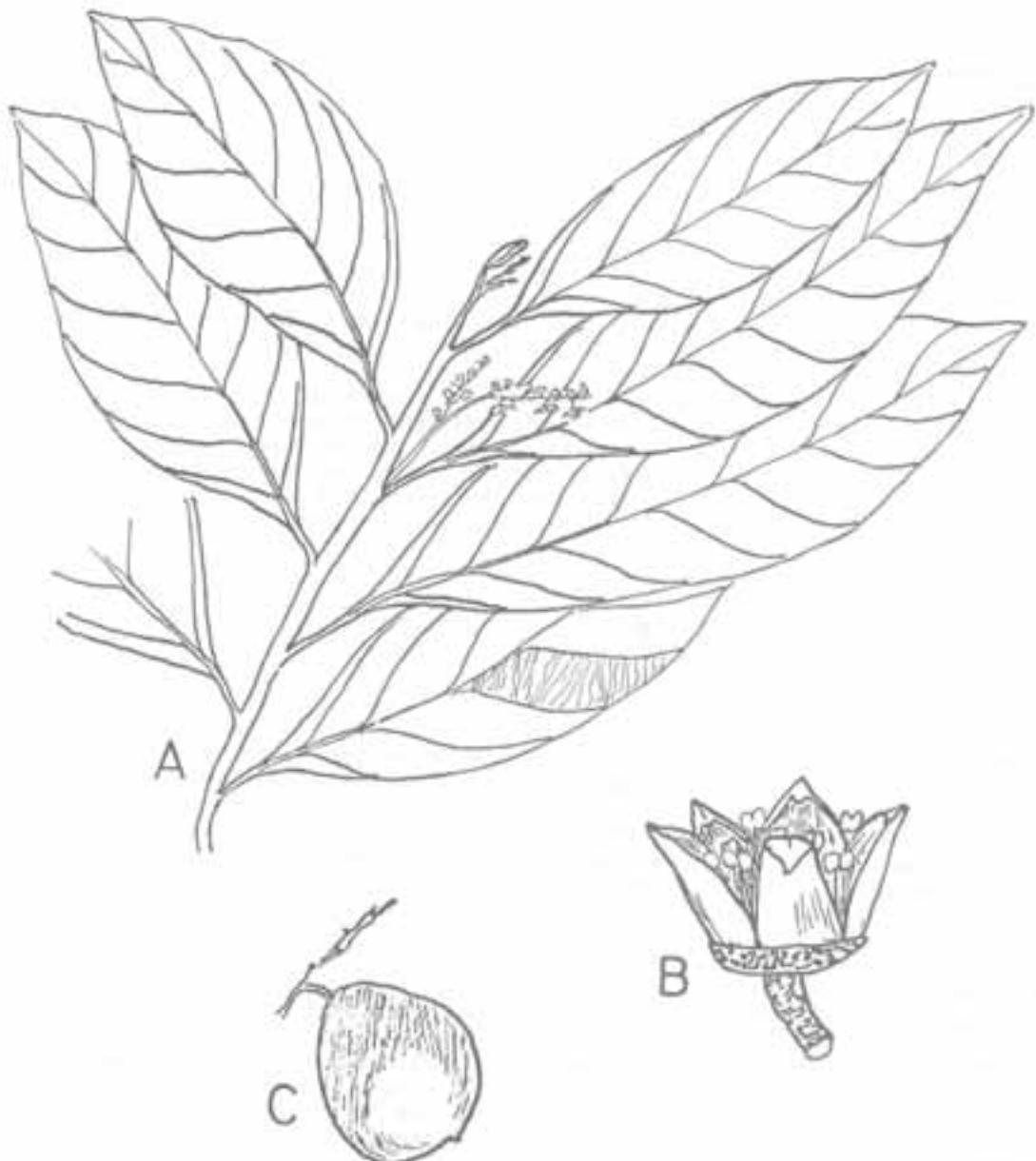
Distribution: Growing from Sierra Leone to the Congo, Coula is widespread in Liberia with no special preference for site.

Wood: Very hard and heavy with a specific gravity of 0.85-0.95. The heartwood is salmon red to reddish brown; the sapwood is pinkish brown to pale brown. It has a fine texture. There is almost no information available about drying the wood, although it is reported that it may split during seasoning. It may also split when nailed or screwed. It is therefore recommended to pre-bore holes before fixing the nails and screws. Coula saws easily but rather slowly. Planing may be difficult. It can be painted and varnished and has the great advantage of being resistant to water and immune to attacks of insects.

Coula is also marketed under the name "African walnut". This name is also used for Lovoa trichilioides. "African black walnut" is used as a trade name for Mansonia altissima. The use of the word "walnut" should be avoided as it may be confused with the real walnut wood.

Uses: Coula is used for house posts, railway sleepers, bridge piles and also in the production of charcoal. It is recommended for heavy carpentry, stair treads, doors, turnery, boat and carriage construction. It can be used where danger of termite attack is present.

The fruits are sold in the local markets. When the hard shell is broken, a light brown edible kernel appears (50 per cent of the kernel consists of oil) and resembles in taste hazelnuts or chestnuts. They can be boiled or roasted and the pulp of the nuts is used to prepare cakes.



***Coula edulis*:** A: branchlet with leaves and inflorescence (2/3x);
B: flower (4x);
C: fruit (1/2x)

DABEMA

Piptadeniastrum africanum (Hook. f) Brenan

Family: Mimosaceae

Trade name: dabema, dahoma, African greenheart, agboin, ekhmi

Description: One of the most common trees of Liberia. The tree may have a height of 120-170 feet and a diameter of 3-4 feet and even 6 feet. The bole is 30-50 feet long, straight and cylindrical above the buttresses. The older tree has a typical flat spreading crown which facilitates identification from a distance. The buttresses are thin, plank-like, branched and reach a height near the tree of 10-5 feet.

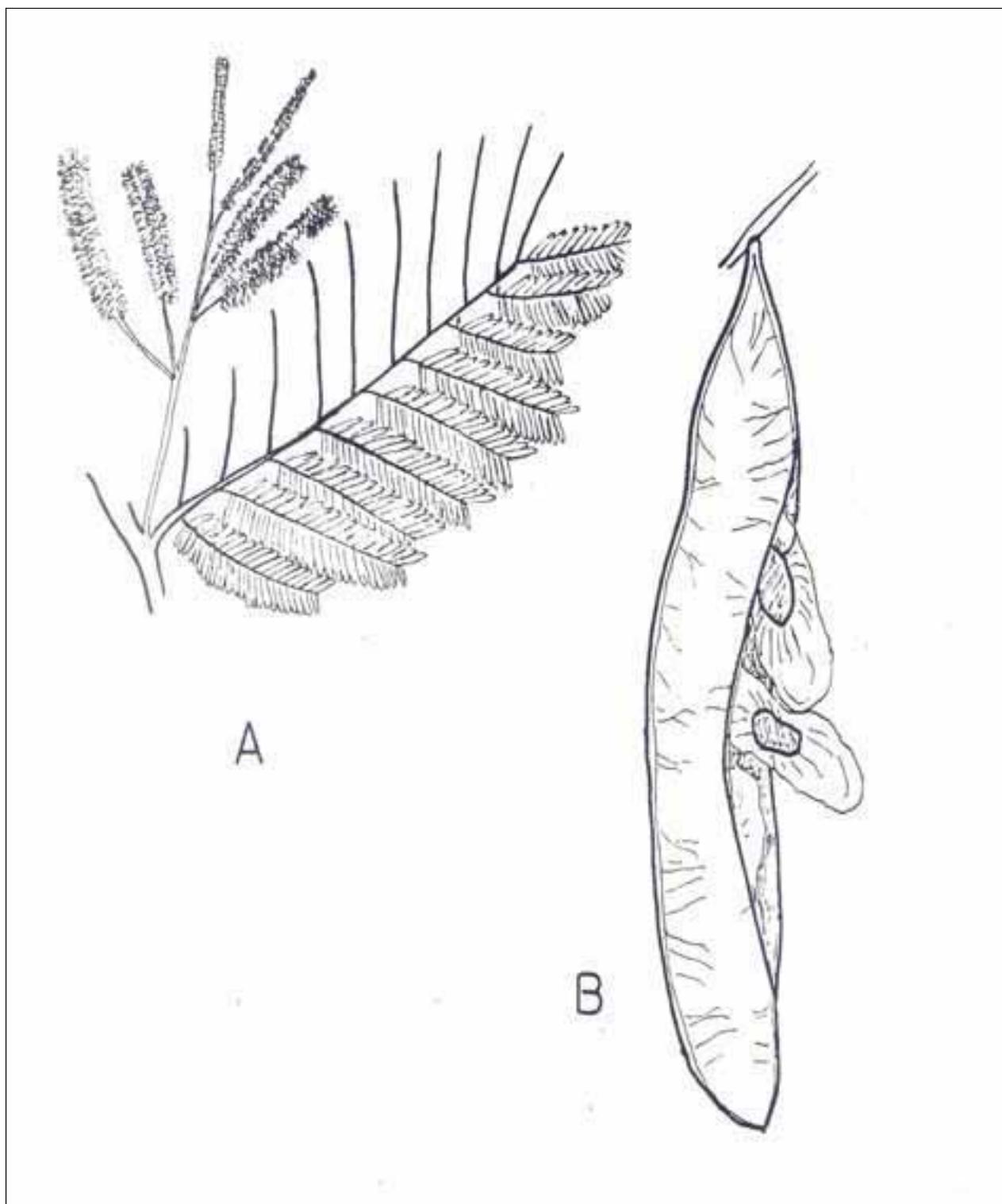
The alternate leaves are bipinnately compound. The leaflets are very small, 45 mm long and 1 mm wide. The flowers are placed in inflorescences, panicles of spikes. The fruit is a long flat pod containing several winged seeds.

Distribution: From Senegal to Angola and the Congo, in Sudan and Uganda. In Liberia, is a very common tree in high forests as well as in secondary formations. Sometimes it is gregarious.

Wood: The grey greenish to yellow brown or golden brown heartwood is quite different from the sapwood which is grey white. The heartwood is similar in appearance to iroko and oak. During sawing it has a fishlike unpleasant smell which disappears after drying. The texture is coarse. The grain is interlocked, producing a broad stripe figure on the quarter-sawn boards.

It is a moderately hard and strong wood with a specific gravity of 0.75. Seasoning slowly but stable and has a tendency to distort and collapse. Air seasoning where possible is recommended. Because it has a tendency to warp, it is better to use it in heavy construction. It is good to saw, turn, polish, glue, but difficult to plane. Screwing and nailing may give difficulties at the ends of boards. Sometimes pre-boring of holes is necessary. Dabema is resistant to termites and is classified as moderately durable. Difficult to impregnate. In strength properties it compares favourably with oak and iroko when used in fairly large dimensions. Due to its interlocked grain, it is better not to use smaller dimensions.

Uses: In England it is used for car building, railway carriages, as replacement for oak in construction, after careful drying. Useful for floor fitting. Although supplies are large in the countries where it grows, it has been exported in relatively small quantities.



Piptadeniastrum africanum: A: branchlet with inflorescence (1/2x);
B: fruit with winged seed (1/2x)

Entandrophragma angolense (Welw.) C.DCFamily: MeliaceaeTrade name: edinam, tiama, gedu nohor (Nigeria), mukusu (East Africa).

Description: As all Entandrophragma species, edinam belongs to a genus of very beautiful, emergent forest trees majestic when full grown and because of its wood, much sought after by foresters and wood exploitation companies.

When fully grown it may reach a height of over 150 feet and a diameter of 6 to 10 feet. The bole is cylindrical but not always straight, and the first branches may be at a height of 100 feet. Buttresses may reach a height of 20 feet and sometimes extend along the ground for more than 60 feet. The bark is smooth and grey, peeling off in thin large scales. The slash is reddish with white stripes.

The pinnately compound leaves, up to 20 inches long, have 7-11 pairs of leaflets. The tip of the leaflet often has folded edges. The flowers are in panicles which may be 12 inches long while the fruit is 6 to 8 inches long, opening from the base with five thick woody valves to release approximately thirty winged seeds. The columella, to which the seeds in the fruit are attached, is reddish to blackish.

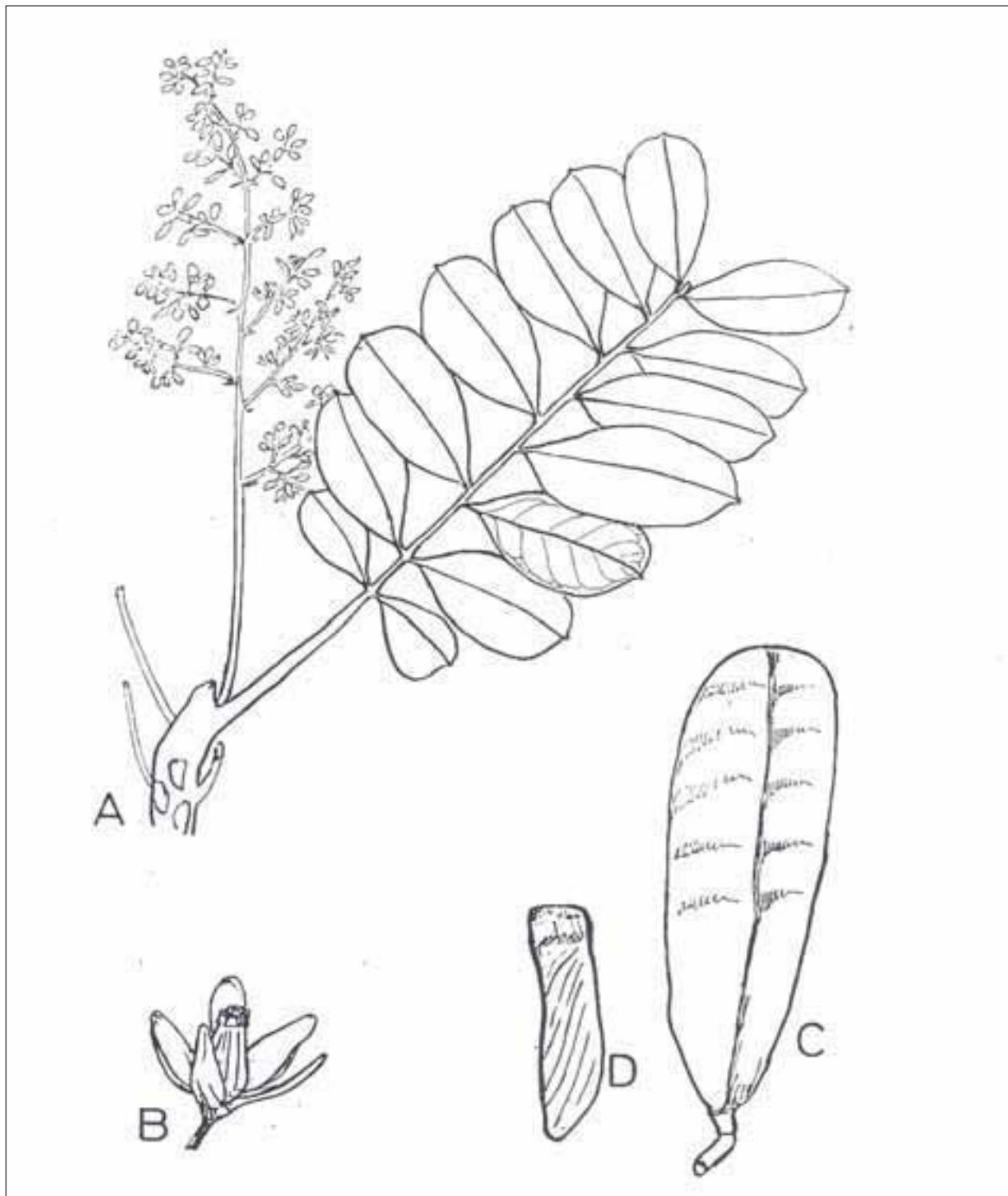
Distribution: From Guinea to Angola and Uganda. In Liberia, it is found all over the country, in high forests as well as secondary formations. Its frequency is higher in the drier forests of the Eastern Province (regions of Zwedru).

Wood: The heartwood is reddish brown, darkening after exposure to the air. The sapwood is greyish white, sometimes up to 4 inches wide. Occasionally the heartwood is of a much lighter colour, sometimes a pale pink. It is a fairly hard and strong wood with a moderately fine texture, having a characteristic interlocked grain which produces a broad irregular stripe figure in the radial surfaces. The specific gravity is 0.56.

Seasoning has to be carried out carefully because the wood has a tendency to distortion. When dry, edinam does not change in size very much due to atmospheric variations. Edinam is moderately resistant to insect and fungal attacks. Damage by Ambrosia beetles and termites may occur. Improvement of its resistance is difficult because the wood is difficult to impregnate with preservatives.

Edinam is easy to saw and works well with both hand and machine tools. The interlocked grain may cause picking up on quarter-sawn faces but with proper adjustment of the cutting angle (less than 150), this can be avoided. Good results can be achieved in staining, polishing and gluing. In varnishing and polishing, a pore filler may be used.

Uses: Like all other Entandrophragma woods, it can be used and recommended for furniture, cabinet work, panelling, high-class fitting and joinery. It is very suitable for veneer production and decorative veneer production. In cases where very stable wood is required, e.g. drawer sides, etc., other wood, should be used.



Entandrophragma angolense : A : branchlet with leaf and inflorescence (1/2x) ; B : flower (3x) ;
C: columella (3/4x); D: seed (3/4x)

Klainedoxa gabonensis Pierre ex Engl.

Family: Irvingiaceae

Trade name: eveuss, kroma, iron wood.

Description: Klainedoxa gabonensis belongs to the largest forest trees of Liberia. Reaching a height of 150 feet or more and a diameter above the high buttresses of 4 to 5 feet, it has a very conspicuous crown, spreading, half-globular with many crowded branches. The buttresses, up to 12 feet high along the stem, are sharp and wide spreading. The bark, grey to reddish brown, is thin and scaly and when the tree is young it is covered with many sharp spines. The slash is thin, hard and granular, light brown or nearly white. From Ghana, it is reported that the colour of the slash turns purple after some time.

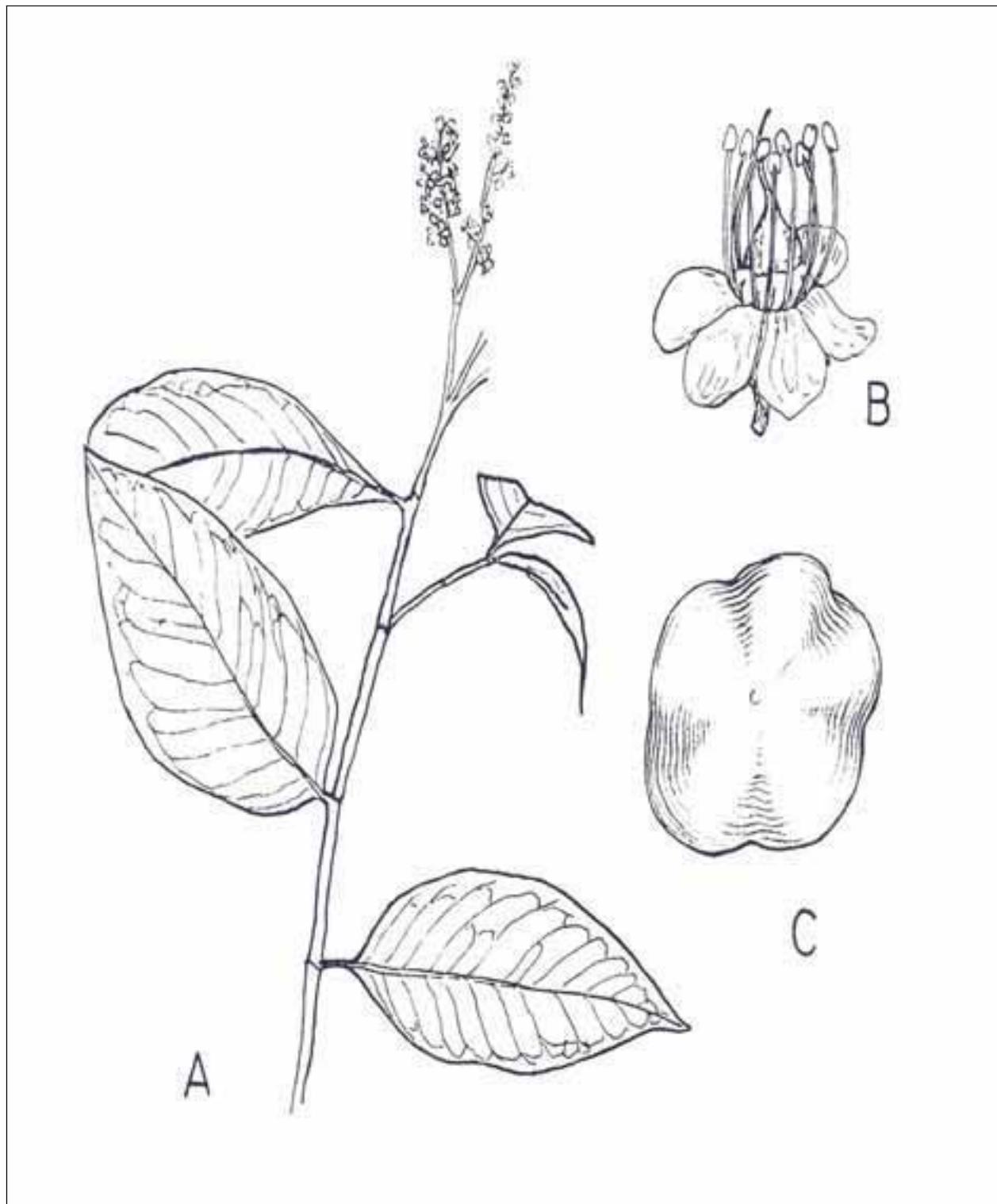
The leaves are simple, ovate to broadly elliptic, cuneate at the base, with an acute top, 6 to 8 inches long and 3½ inches wide. The numerous flowers, small, white with a pale pink tinge, grow in small terminal panicles. The fruit is 2 to 3 inches in diameter, 4 to 6 angled with 4 to 6 woody nuts inside. It is a drupe.

Distribution: Klainedoxa grows from Portuguese Guinea to Uganda. In Liberia, it is spread throughout the country in the evergreen forests as well as in moist semi- deciduous forests.

Wood: Sapwood and heartwood are distinct. The sapwood is greyish, while the heartwood is reddish to golden brown. It has an open texture and the grain varies from straight to irregular. The colour of the wood darkens after exposure to air and has a dark veining.

Its specific gravity varies from 0.94 to 1.15. It is a very hard, heavy and strong wood. Eveuss is reported to be durable although no laboratory tests have been published. It is sometimes called iron wood, but this name is to be avoided, as many other species have been called iron wood. It is a tough wood to work with.

Uses: It is an excellent wood for railway sleepers. It is used for canoes, planking of ship decks, piles, wooden paving, heavy carpentry, stair treads, poles and firewood. Eveuss has no value as an export timber, but for local use it is well suited for heavy construction purposes.



Klainedoxa gabonensis: A: branchlet with florescence (1/2x); B: flower (5x); C: fruit (3/4x)

Terminalia ivorensis A. Chev.

Family: Combretaceae

Trade name: framiré, black afara, emeri, idigbo.

Description: A large to emergent tree which is found not only in the high forests but also in secondary formations. When mature it has low and heavy root swellings. The bark is dark brown with vertical cracks. The slash is dark or bright yellow.

The leaves, simple and alternate, are clustered (as with all Terminalia species) at the end of the branchlets. The petiole is shorter than in the limba, and the glands present in the limba on the upper part of the petiole, are not present. The inflorescences are up to 4 inches long with many small white flowers. The fruits are winged but the wings extend in a longitudinal direction and not in a lateral direction (as with limba).

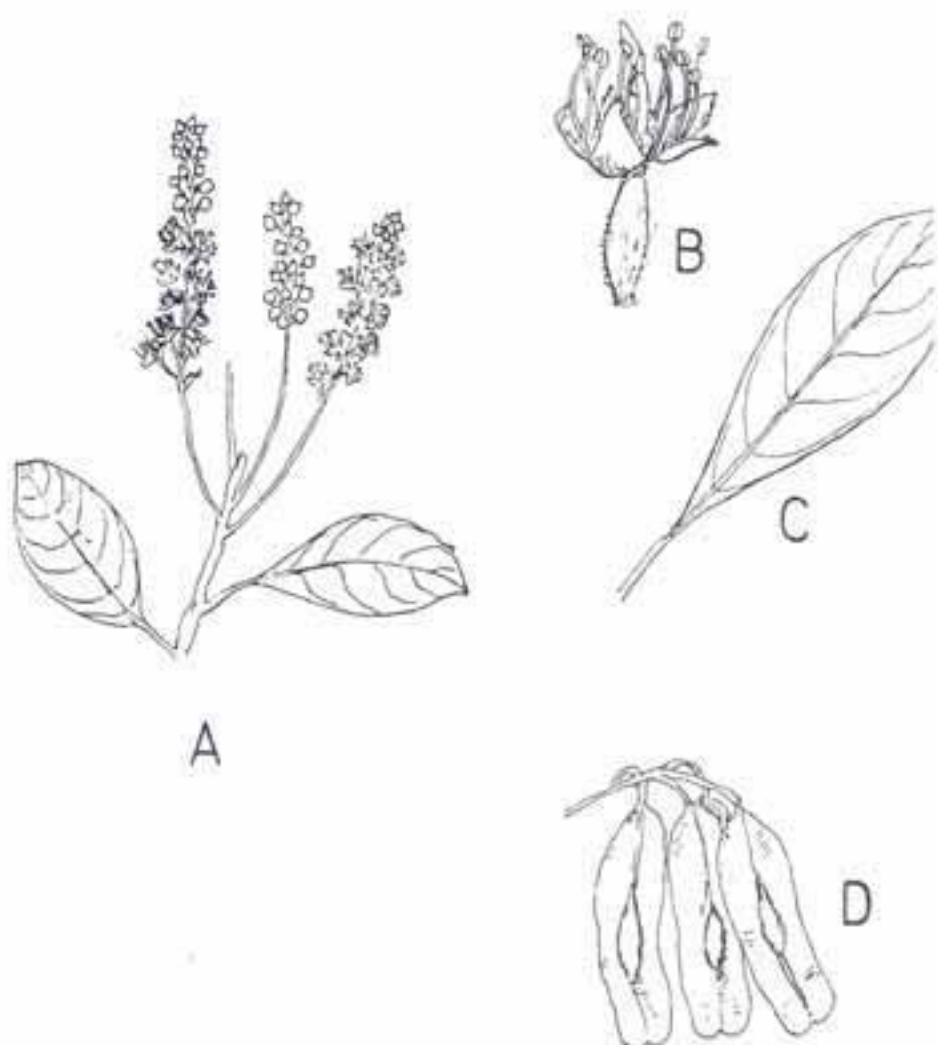
Distribution: Along the West Coast of Africa, from Guinea to the Cameroon. It is found in all parts of Liberia. The tree prefers moist conditions.

Wood: The average density is 0.54 (0.45-0.67). Framire and limba are closely related. The heartwood is straw yellow to light brown, sometimes slightly darker with brown stripes. Differences between heartwood and sapwood are nearly non-existent. The texture is rough while the grain is straight or slightly wavy. In quarter-sawn boards this wavy grain gives a nice figure, useful for decorative purposes. The wood has a yellow coloured substance.

The best quality timber comes from logs with a diameter of 25 inches to 35 inches. Logs with larger diameters are sometimes affected with brittle heart, a defect which reduces the strength properties of the wood. Drying of the wood is quick and good in the open air as well as artificially, with little degrade. Almost no deformation occurs. Because it is a relatively light wood, it has correspondingly low strength properties.

Framiré is a good wood to work with and finishes well. It easily takes screws and nails but the wood has a tendency to split. In contact with iron, green framiré changes colour and can cause corrosion of metals. It stains and polishes well. The wood is resistant to termite and other insect attacks, although information from different sources is contradictory. The sapwood is much less resistant than the heartwood. The latter is difficult to impregnate.

Uses: It is mainly used for the furniture industry, fine carpentry and joinery. Framiré can also be used for turning purposes and for panelling, car and railway car building. It is not fit for kitchen furniture because of the yellow substance in the wood. It should not be used where it would regularly come into contact with iron.



Terminalia ivorensis: A: branch with inflorescence (1/2x); B: flower (5x); C: leaf (2/3x); D: fruit (1/2x)

ILOMBA

Pycnanthus angolensis (Welw.) Warb.

Family: Myristicaceae

Trade name: ilomba, lolako, pycnanthus, okume (Ghana).

Description: The tree may reach a height of 80 to 100 feet and is therefore classified as a medium-size tree. The maximum diameter may be 5 feet, but normally the diameter is between 2 and 4 feet. The base is straight and heavy, while old trees have concave, butt flares up to 5 feet high. The stem is cylindrical, straight, sometimes sinuous and the first branches are at a height of 60 feet. The bark is greyish brown with thin bark scales. The slash yields a clear juice which becomes immediately reddish in contact with the air.

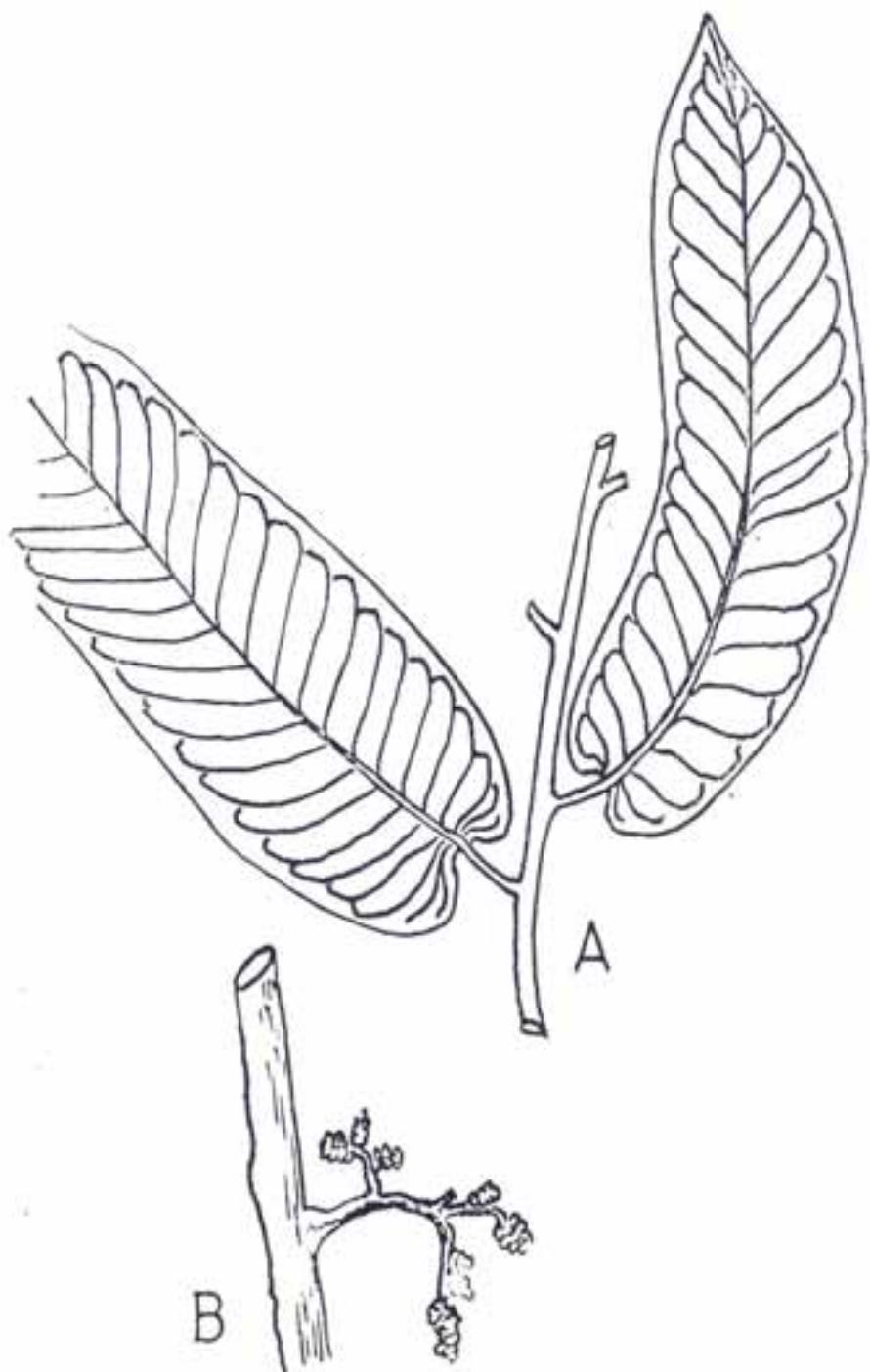
The leaves are simple, alternate with short petiole. The flowers are uni-sexual but the same tree has, in general, male and female flowers in different inflorescences. The fruits, growing together in large bunches, are $1\frac{1}{4}$ to $1\frac{3}{4}$ inches long and $\frac{3}{4}$ to $1\frac{1}{4}$ inches thick, opening with two valves. The single seed is brownish black with a pinkish red lacinate aril around it.

Distribution: In West Africa, from Guinea to the Cameroons, Congo, Angola, Uganda and Tanzania. Pycnanthus angolensis grows throughout Liberia in secondary as well as in high forests. It seems to be more frequent in the northern part of the country. Ilomba has no site preference.

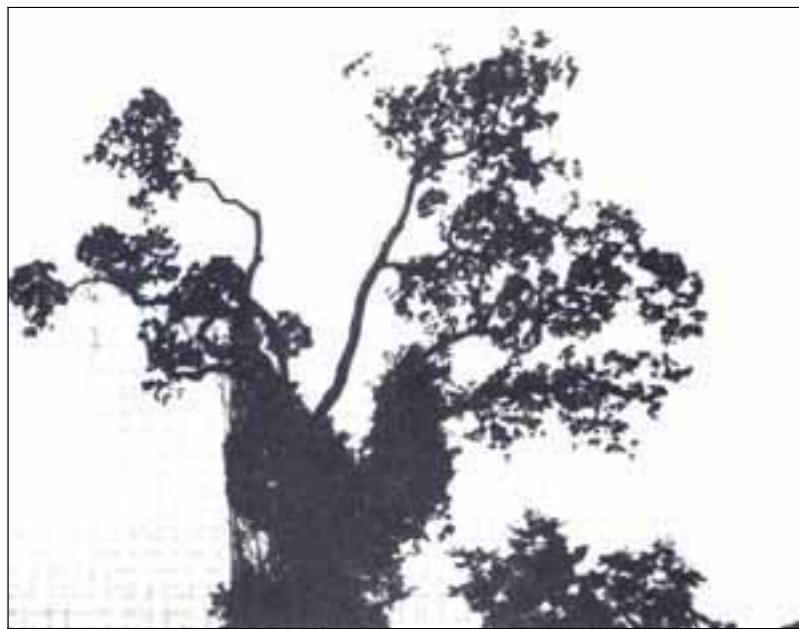
Wood: The heartwood is whitish when freshly cut but greyish white to pinkish brown or yellowish when dry. The sapwood which is rather wide, does not differ very much from the heartwood. The wood has a moderately coarse texture, straight grain and rather low lustre when planed. Because it suffers from insect and fungus attacks (discoloration), logs cannot stay for long periods in the forest. Extraction and conversion should not be delayed. The wood is fairly light and has low strength properties, in general. For its weight, it is moderately strong. Ilomba requires slow and careful drying as it has a tendency to split, distort or collapse. It may stain during seasoning. Once dry, it is known as a moderately stable timber. It works well with hand and machine tools, easy to plane and sand, excellent to glue and polish. It is easy to finish, but may need filling due to its open texture. It cannot be used for outside purposes unless treated with a preservative. It is easy to impregnate.

In Liberia, ilomba is sold under the name of Bassa Wishmore. It is preferable to use the name ilomba to avoid confusion with the real Wishmore.

Uses: Local production of plywood (Nigeria), cigar boxes, packing cases, radio cabinets, furniture parts, interior construction, joinery, fittings and shelving.



Pyonanthus angolensis: A: branchlet with leaves (2/3x); B: inflorescence (1x)



Mitragyna ciliata: crown of old tree (Page 3)



Khaya anthotheca: young tree (Page 5)



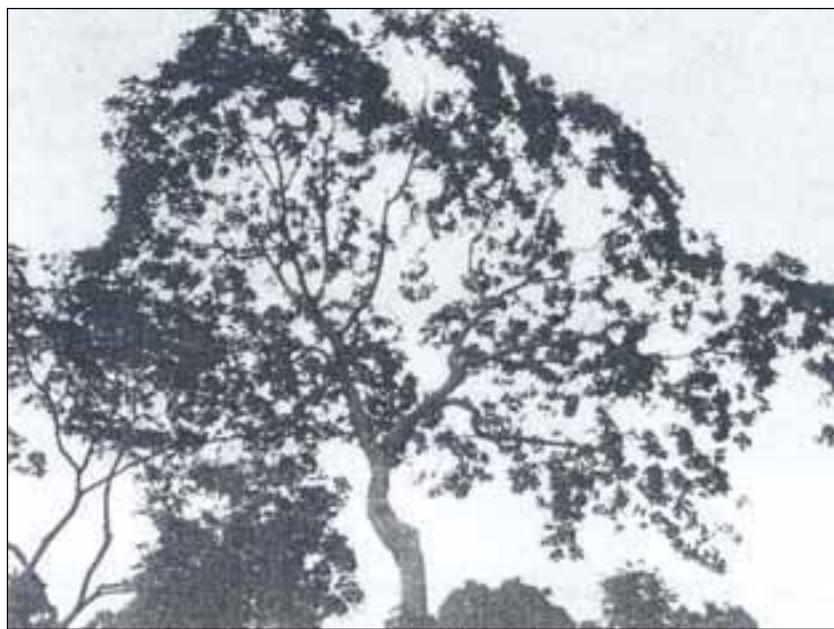
Oldfieldia Africana: tree along road (Page 7)



Oldfieldia Africana: base of tree in young secondary forest (Page 7)



Canarium schweinfurthii: medium-sized tree (Page 9)



Canarium schweinfurthii: crown of medium-sized tree (Page 9)



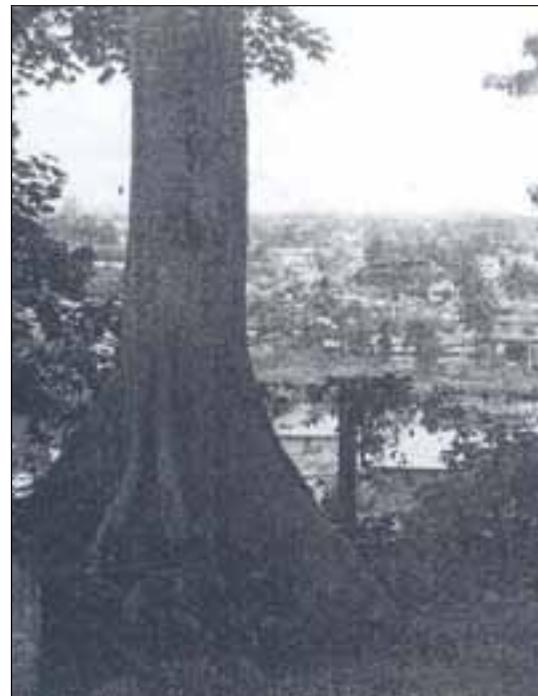
Lophira alata: medium-sized tree in high forest (20 miles north of Greenville) (Page 11)



Lophira alata: base of tree in previous photograph (page 11)



Guarea cedrata: base of medium-sized tree (Page 13)



Ceiba pentandra: base of old tree on University Campus, Monrovia (Page 15)



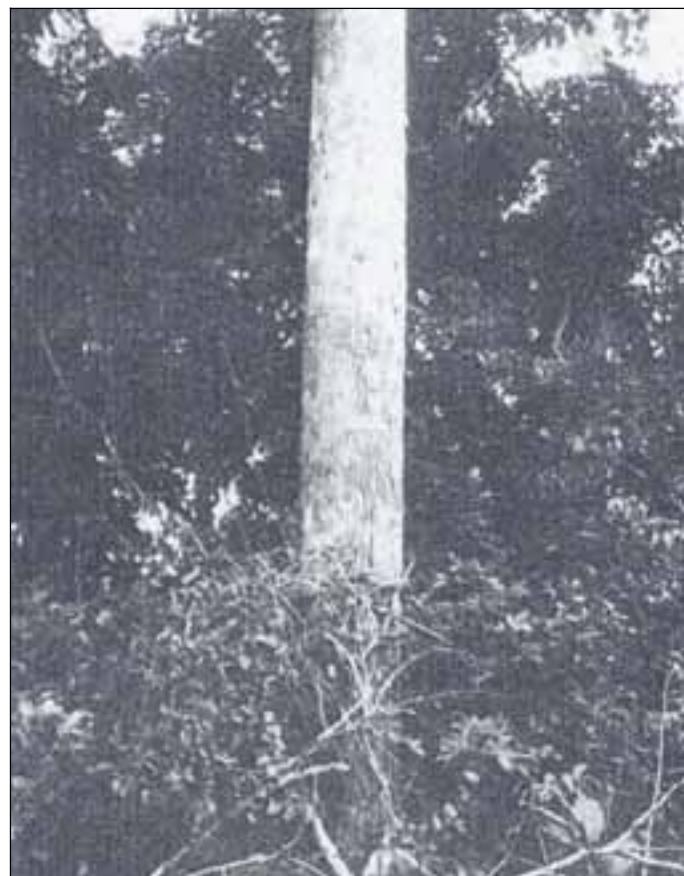
Coula edulis: base of tree in high forest (Page 17)



Piptadeniastrum africanum: old tree in exploitation area north of Chien (Page 19)



Klainedoxa gabonensis: tree in secondary forest (Page 23)



Terminalia ivorensis: bark of young tree (Page 25)



Pycnanthus angolensis: base of tree in high forest (Page 27)



Chlorophora excelsa: young tree (Fijnhout compound in Zwedru) (Page 49)



Chlorophora excelsa: young tree in secondary forest (Page 49)



Nauclea diderrichii: young tree in Fijnhout compound, Zwedru (Page 53)



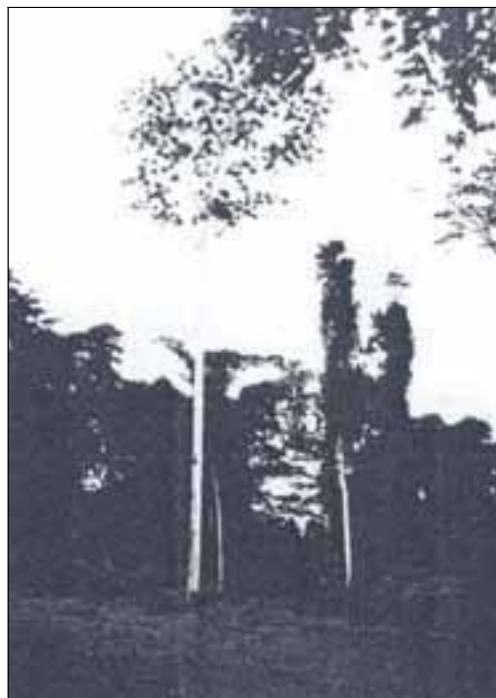
Terminalia superba: seven-year old plantation in University Forest Plantations (Page 55)



Gilbertiodendron preussii: tree along road (Page 57)



Lovoa trichilioides: logs of Lovoa (marked lov) on loading place in forest (Page 59)



Tieghemella heckelii: young tree (Page 62)



Tieghemella heckelii: old tree in farm area (Page 62)



Funtumia elastica: tree in secondary forest (Page 64)



Triplochiton scleroxylon: old tree in farm area (Page 65)



Parinari excelsa: mature tree in University School Forest (Bomi Hills) (Page 67)



Entandrophragma cylindricum: crown of tree alo



Tetraberlinia tubmaniana: Medium-sized tree in University School Forest, Bomi Hills (Page 71)



Entandrophragma utile: heavy buttress of old tree (Page 73)



Heritiera utilis: base of tree in high forest (Page 75)

IROKO

Chlorophora excelsa (Welw.) Beth.

Family: Moraceae

Trade name: iroko, mvule, odum, kambala, teck d'Afrique.

Description: A large forest tree with an umbrella-shaped crown. The tree may reach a height of 160 feet and a diameter of 4 feet above the butt flares. The butt flares may reach as high as 10 to 12 feet. The crown is dense and dark. The crown of the female tree is more spreading. The slash is hard, yellowish with reddish brown spots. Latex, which nearly all Moraceae have, is creamy white.

The leaves are simple, alternate, more or less cordate at the base, acute to acuminate at the top, up to 9 inches long and 4 inches wide. The male and female flowers, growing in catkins, are on different trees. Some characteristics such as "stones" in the wood seem to be more common in the male rather than in the female tree.

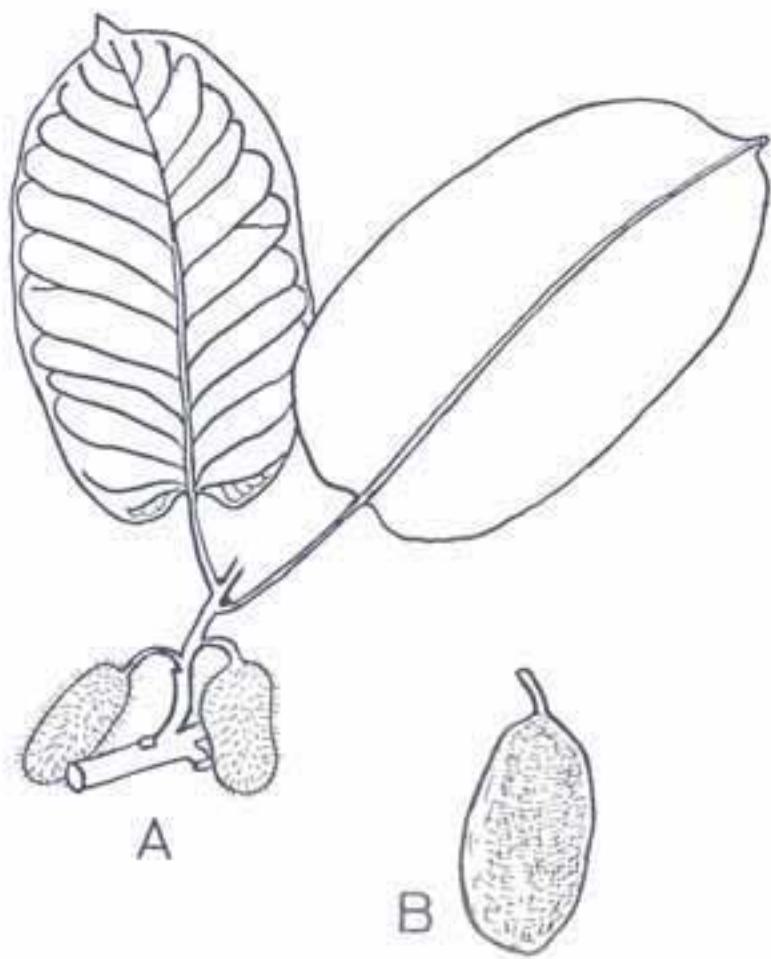
Many parts of the tree are used as local medicine, from the bark and its decoctions to the fruit and young leaves.

Distribution: Iroko grows all over Africa from Guinea to Mozambique. Ghana is the only country which has imposed a ban on its export. In Liberia it is found in the drier type of forests, although its complete distribution pattern is not known.

Wood: The timber of this tree resembles the teak of Burma or oak of Europe, it is therefore also named African teak, kambala teak or "Busch-eiche" (bush oak). The heartwood is yellow to brownish yellow, darkening after exposure to the air to become golden to dark brown, which colour looks very much like teak. The sapwood, which is 1 to 4 inches wide, is yellowish white. The texture is rather rough and straight or cross grained, sometimes wavy grained. Iroko dries well in the open air as well as in artificial kilns. No warping or shrinking takes place afterwards. Little degrade is expected during drying. With its specific gravity of 0.64 it is a moderately hard timber and it is very durable. Resistant to the weather and also immune to attacks of termites and fungi.

The wood has a dulling effect on tools. The wood of the male trees is believed to be harder than the female and may have more calcareous deposits ("stones") in streaks or lumps (due to injury). It is not possible to discover the presence of such deposits from the outside of the logs. Nailing and screwing are easy as is work with both hand and machine tools. Because of its coarse texture, a filler should be used before polishing; gluing will give no difficulties.

Uses: Constructions of all kinds, railway sleepers, doors, window frames, household posts, wagons, wheels, barrels, draining boards, laboratory benches, coffins. Locally, it is also used for canoes, drums, mortars, staircases, flooring, stools, furniture and cabinet work.



Chlorophora excelsa: A) branchlet with leaves and female inflorescence (2/3x);
B) fruit (1x)

KANDA

Beilschmiedia mannii (Meisn.) Benth. et Hook.f.

Family: Lauraceae

Trade name: kanda, spicy cedar

Description: A medium-sized to large tree which may reach a height of 110 feet and a diameter of over three feet. Most of the trees, however, never reach this diameter. Heavy root swellings or low and sharp buttresses occur up to three feet high. The bole is straight and cylindrical with its first branches at sixty feet high. In Liberia it is found in the high forests. The inner bark yields a sticky brownish sap.

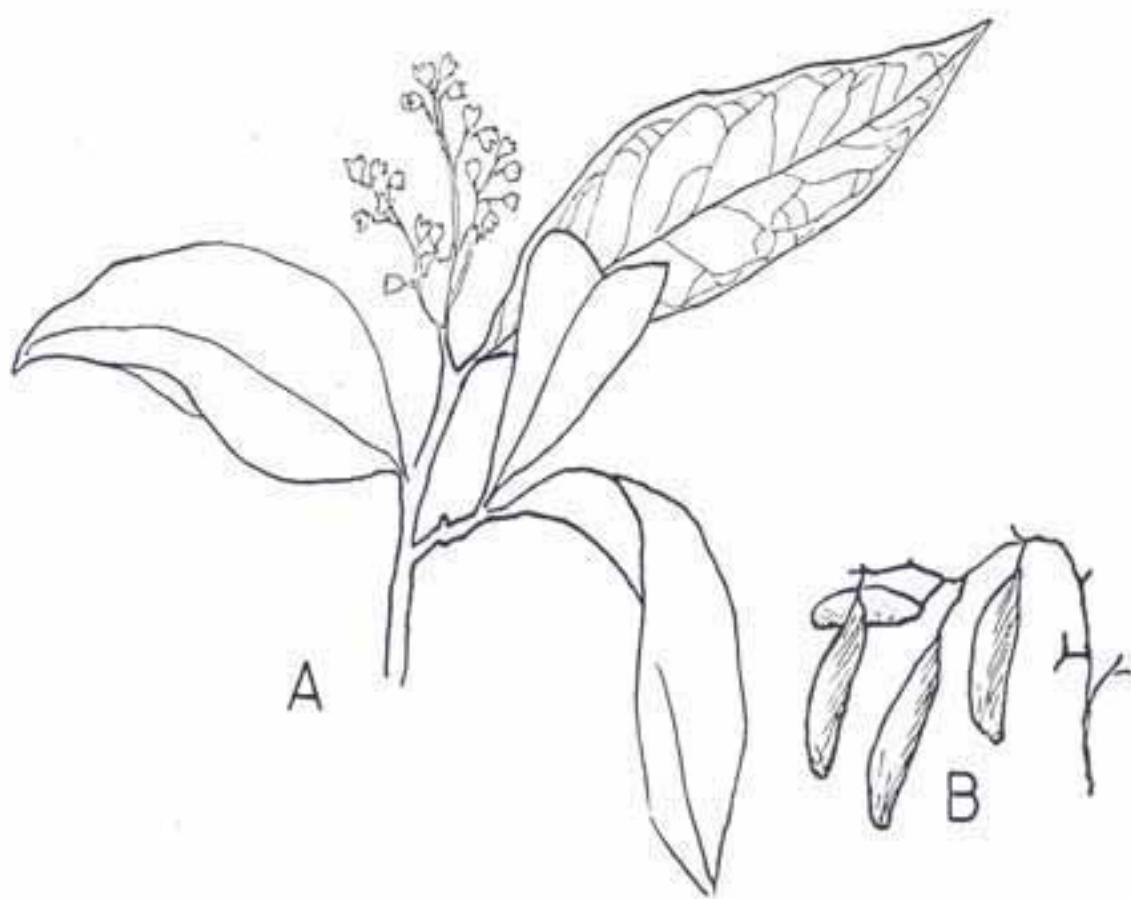
The leaves are alternate and simple. When young, the branchlets, buds, petioles and midribs of the leaves are covered with many hairs or, when older, glabrescent. Mature leaves are markedly folded and recurved, leathery and glossy above. Crushed leaves give a typical smell.

One of the most remarkable features of the flowers is the anthers which open with two flaps. Three whorls of stamen are present and in between a whorl of staminodes. The fruit when ripe is $1\frac{1}{2}$ inches long and $\frac{1}{2}$ inch wide and contains only one seed.

Distribution: From Guinea to the Congo. In Liberia it is a common tree.

Wood: The heartwood is cherry red with a lasting cedar smell. The sapwood is greyish and sharply defined. It is a wood of low lustre, medium textured and straight to cross grained. With a specific gravity of 0.69 it is rated as a medium-heavy wood. Little information is available about seasoning, but it is said to warp very little and hold its place well after manufacture. It is a very durable wood and highly resistant to fungus and insect attacks.

Uses: Kanda is suitable for carpentry and cabinet work because it works easily with both machine and hand tools, and has a smooth finish. Sometimes it is used as a substitute for mahogany. As a construction wood it is very satisfactory because of its resistance to termite attack. Although reasonable supplies are present, it has only been exported in small quantities and is not well known in Europe. Canoes are made locally out of this wood.



Beilschmiedia mannii:

A) branchlet with inflorescence and leaves (1/2x);
B) fruit (2/3x)

KUSIA

Nauclea diderrichii (De Wild.) Merrill

Family: Rubiaceae

Trade name: kusia, bilinga, brimstone, opepe.

Description: A large forest tree without buttresses, reaching a height of 160 feet or more and with a maximum diameter of 4-5 feet. The bark is greyish yellow, scaly and rough. The slash is yellowish brown to yellow and may become sticky. The taste is bitter and it has a fresh smell.

The leaves are simple, oppositely arranged with two relatively large stipules at their base. These drop off after some time. The many whitish flowers grow together in globose heads. The receptacles of the flowers grow together to form the globose pitted fruit. The lignified calyx lobes make the outside of the fruit rough.

Distribution: From Sierra Leone to the Cameroons, Congo, Uganda and Mozambique. Kusia grows throughout Liberia with a preference for fresh and deep forest soils.

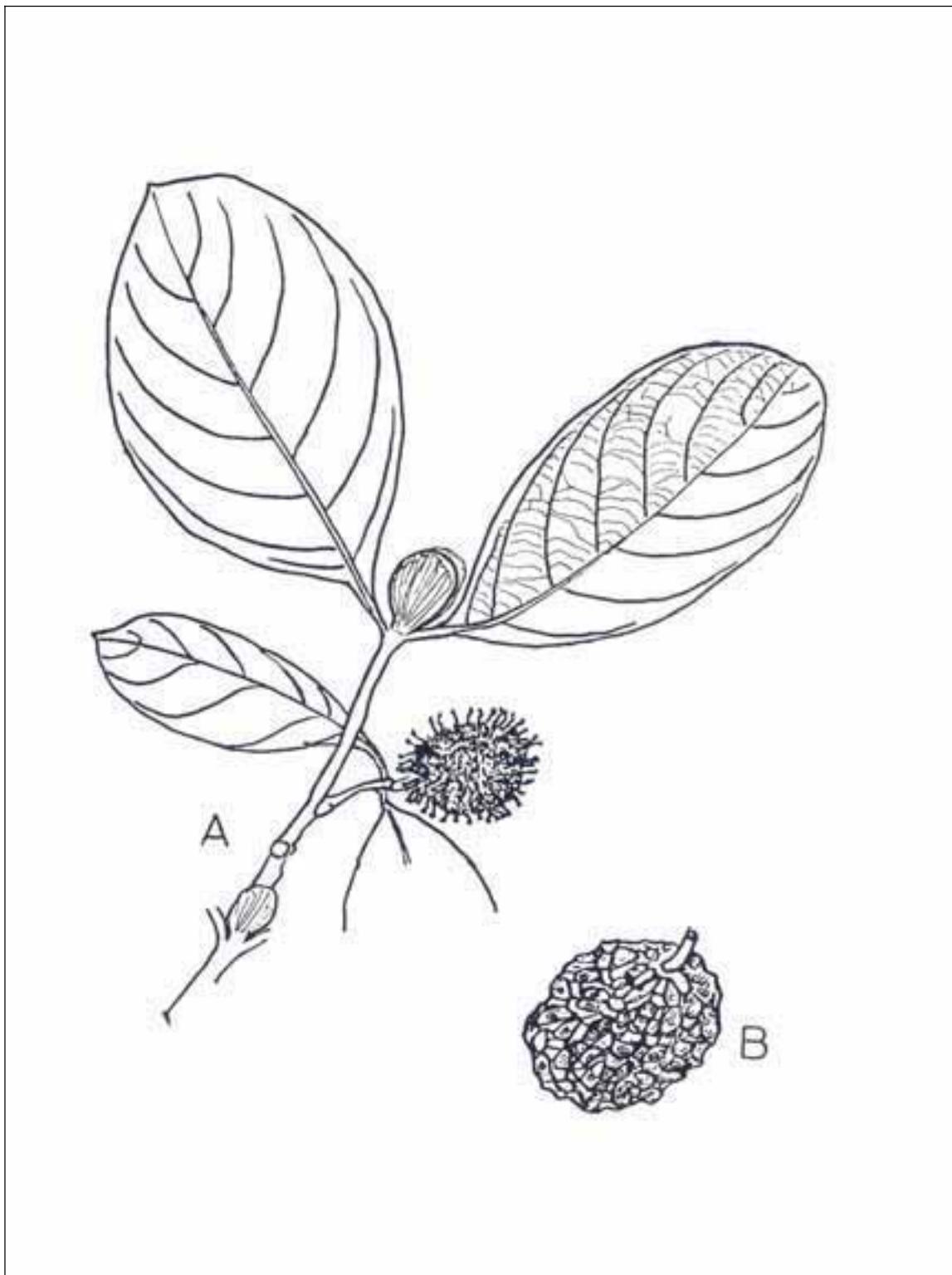
Wood: The heartwood of Kusia has a golden yellow to orange colour while the sapwood, which is quite distinct from the heartwood, is pale yellow to greyish or sometimes pinkish. The sapwood is one to three inches wide. Its texture is rather coarse whether the grain is interlocked or straight. When the grain is straight the quarter-sawn boards are very attractive due to the ribbon stripe figure.

Kusia has an average specific gravity of 0.75 and is a moderately heavy to heavy wood. It is hard and strong and heavier than the mahogany species. Quarter-sawn material seasons easily without any degrade, but the flat-sawn material tends to split and check, although nearly no deformation occurs.

Due to its immunity to termites, fungi and marine borers, it is a wood specially recommended to be used for outside construction purposes. Kusia presents little difficulty in working (except when dry). It has a tendency to pick up in planing but, with proper adjustment of the cutting angle, this can be avoided. Thin material has a tendency to split in nailing, therefore holes should be made first. Thick material can be nailed without pre-boring. Planed surfaces are lustrous. It can be glued and finished, but may require a filler due to its coarse texture.

From Ghana it is reported that the wood contains an alkaloid which may constitute a serious health hazard for those working with it over a long period.

Uses: Exterior and interior constructional work, flooring, cabinet work, fittings, railway sleepers, harbour works, sliced veneers, machine parts, wagon bottoms, turnery and transmission poles. Locally, it is also used for mortars, canoes, bridges and tables.



Nauclea diderrichii: A) branchlet with inflorescence (1/2x);
B) fruit (1x)

LIMBA

Terminalia superba Engl. et Diels.

Family: Combretaceae

Trade name: limba, fraké, afara, corina (U.S.)

Description: A gregarious species in its optimum distribution area, but in marginal places of its range only a few scattered trees are found. When mature it is over 150 feet high and has a diameter of three feet; however, sometimes diameters of up to five feet are found. When young no buttresses are present but the older tree has steep buttresses which may reach nine feet high. These steep buttresses have no extensions along the ground. The bark is grey and thin scaled. The slash is fibrous and pale yellow inside.

The leaves are simple, clustered at the end of the thin branchlets where the scars of other leaves are also found. The petiole is 1.5 to 3 inches long with a pair of glands in the upper part (glands are not present in Terminalia ivorensis). The inflorescences are placed in the axil of the leaves. The flowers are small, covered with many short hairs. The fruits have two lateral wings.

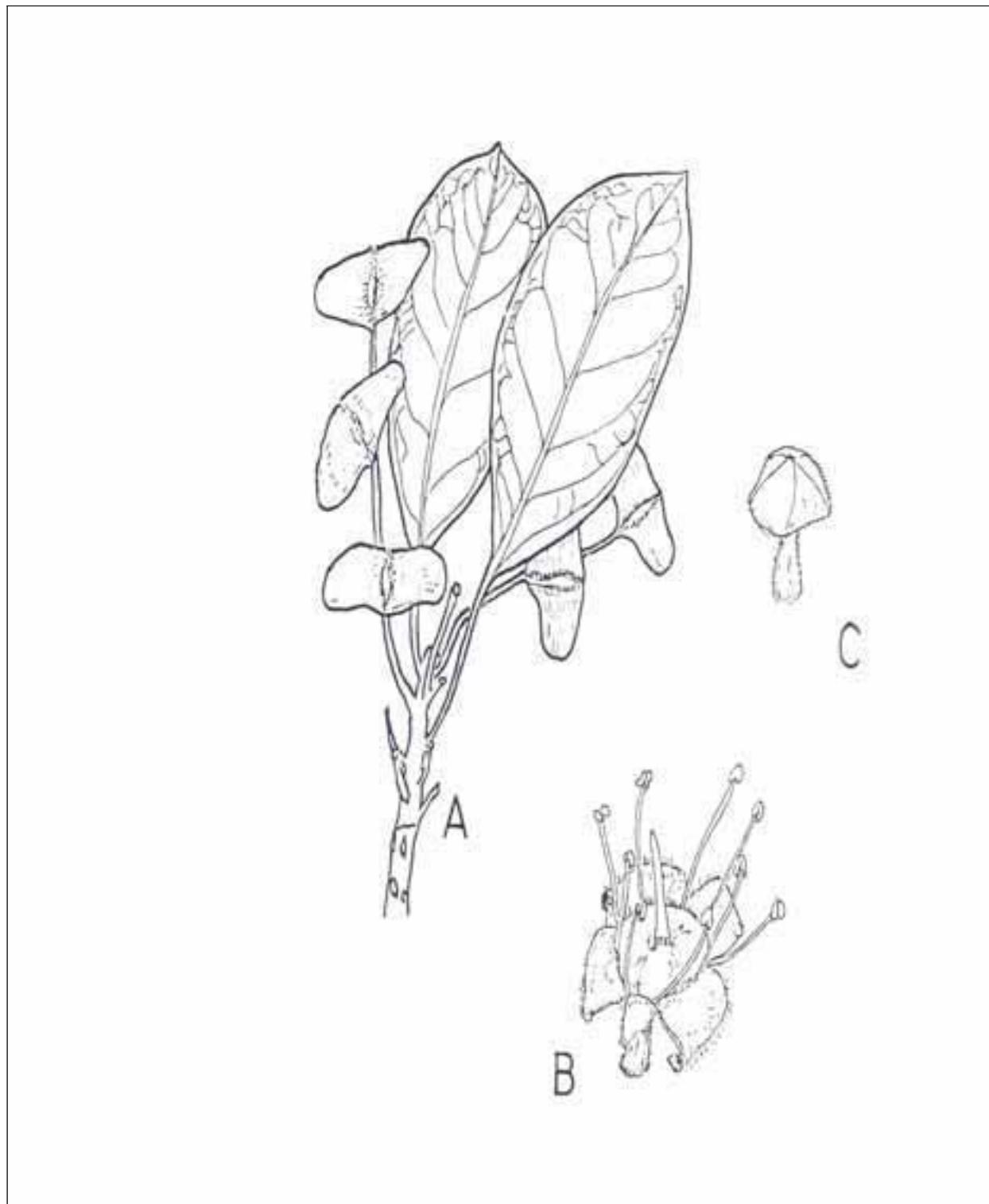
Distribution: Along the West Coast of Africa, from Guinea to the Cameroon, Congo, Gabon and Angola. In Liberia, limba is found in the northern and drier part of the country; in the regions of Zwedru, Tapeta, Ganta, Voinjama and Zorzor.

Wood: The colour may vary. In French-speaking countries, three different types of limba are distinguished: "limba claire" (pale creamy, darkening a little upon exposure to light), "limba brun" (brown), and "limba noir" (dark brown or reddish brown). The latter two are figured and therefore are also called "limba bariolé". Although the dark figured limba could be used for decorative purposes, the light coloured is more in demand on the wood market. The density of limba varies between 0.47 and 0.68. When lighter, it is commonly affected by brittle heart.

In seasoning there is no difficulty and little degrade. Once dry it is rather stable. Strength properties vary according to its density. Trees with lower densities should be inspected for brittle heart. Such wood should be rejected for construction purposes. Limba is subject to both insect and fungal attacks. Logs are frequently attacked by Ambrosia beetles and therefore extraction from the forest after felling should be done as soon as possible. It is not easy to impregnate the wood. to make it more resistant.

The timber is easy to work with hand and machine tools. Sometimes interlocked grain may give difficulties, but sharp tools and good cutting angles overcome these problems. The wood has a slight tendency to split during screwing and nailing. It polishes well after using a filler, glues well and stains well.

Uses: Most limba is used for the production of multi-purpose plywood. Selected material may be used for decorative purposes. It is frequently used in the construction of houses, both outside and inside. It is also used for parquet floors with light traffic, as it darkens and becomes dirty unless considerable care is taken. Furniture of all kinds is made with limba, which is especially recommended for furniture in bathrooms and. kitchens where the finish remains intact for a long time.



Terminalia ivorensis :

- A) branchlet with fruit (1/2x) ;
- B) flower (5x);
- C) flower bud (5x)

LIMBALI

Gilbertiodendron preussii (Harms) J. Léonard

Family: Caesalpiniaceae

Trade name: African oak, red oak, limbali

Description: The genus Gilbertiodendron has seven representatives in Liberia. Gilbertiodendron preussii has been chosen because of its high frequency in the Liberian high forests. It is a medium-sized to large forest tree with a straight but irregular trunk. The lowest branches are sometimes found at a height of 80 feet. The bark is covered with thin flakes which are easy to remove. Colour under the flakes is yellowish. The flaky bark gives the stem a shabby appearance. The base may be slightly swollen. Buttresses or root-ridges are absent. Leaves are paripinnate with three to four pairs of leaflets.

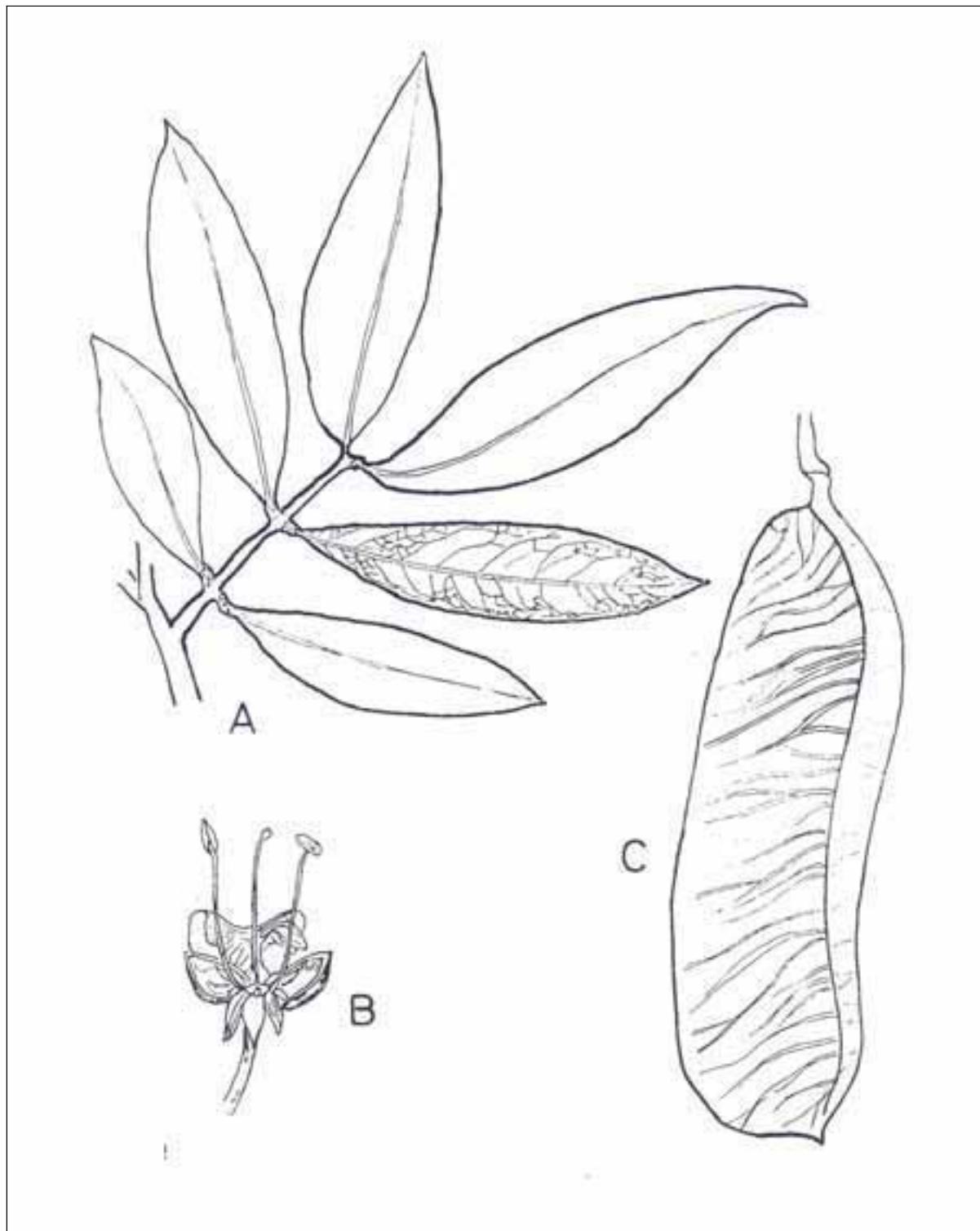
The flowers grow in inflorescences. The valves which enclose the flowers are densely covered with brown hairs. There is one big petal which is pale yellow. Other petals are normally much smaller. The fruit is a big pod up to seven inches long, blue-grey, which becomes woody and rolls up when dry.

Distribution: Along the west coast of Africa, from Sierra Leone to Gabon. It is found throughout Liberia and is much more frequent south of the line Chien-Tappita. Limbali has gregarious habits. The German Forest Mission Team mentioned that it is a characteristic and sometimes dominant species of the mixed tropical rain forest type.

Wood: It is difficult to season and it may fall to pieces when sawn. More research is necessary in this field.

The heartwood is golden brown with a somewhat reddish tinge. The wood has a low lustre. Texture is moderately coarse. The grain is straight to somewhat interlocked. It is a hard and heavy wood with a specific gravity of 0.73. During seasoning end checking may occur. No difficulties are reported in working both hand and machine tools, and finishing is easy.

Uses: It is reported to serve very well in boat and shipbuilding for which it is recommended, and also for construction purposes.



Gilbertiodendron preussii: A) branchlet with leaf (1x);
B) flower with one stamen removed (1x);
C) flower (1/2x)

LOVOA

Lovoa trichilioides Harms

Family: Meliaceae

Trade name: lovoa, apopo, dibetou, sida, African walnut, temariri.

Description: A large forest tree, up to 150 feet high with a dark heavy crown. The bole is cylindrical and the first branches appear at 50 to 90 feet high. The bark is greyish on younger trees, but brownish and scaly on older trees. The slash is reddish, cedar scented and produces a little sticky sap.

The compound pinnate leaves are alternate, with four to six pairs of leaflets. The petiole is flat above and narrowly winged. The flowers, small and numerous, are greenish white to white, growing in large lax panicles. The fruit, spindle shaped, opens with four valves to release the four to eight winged seeds.

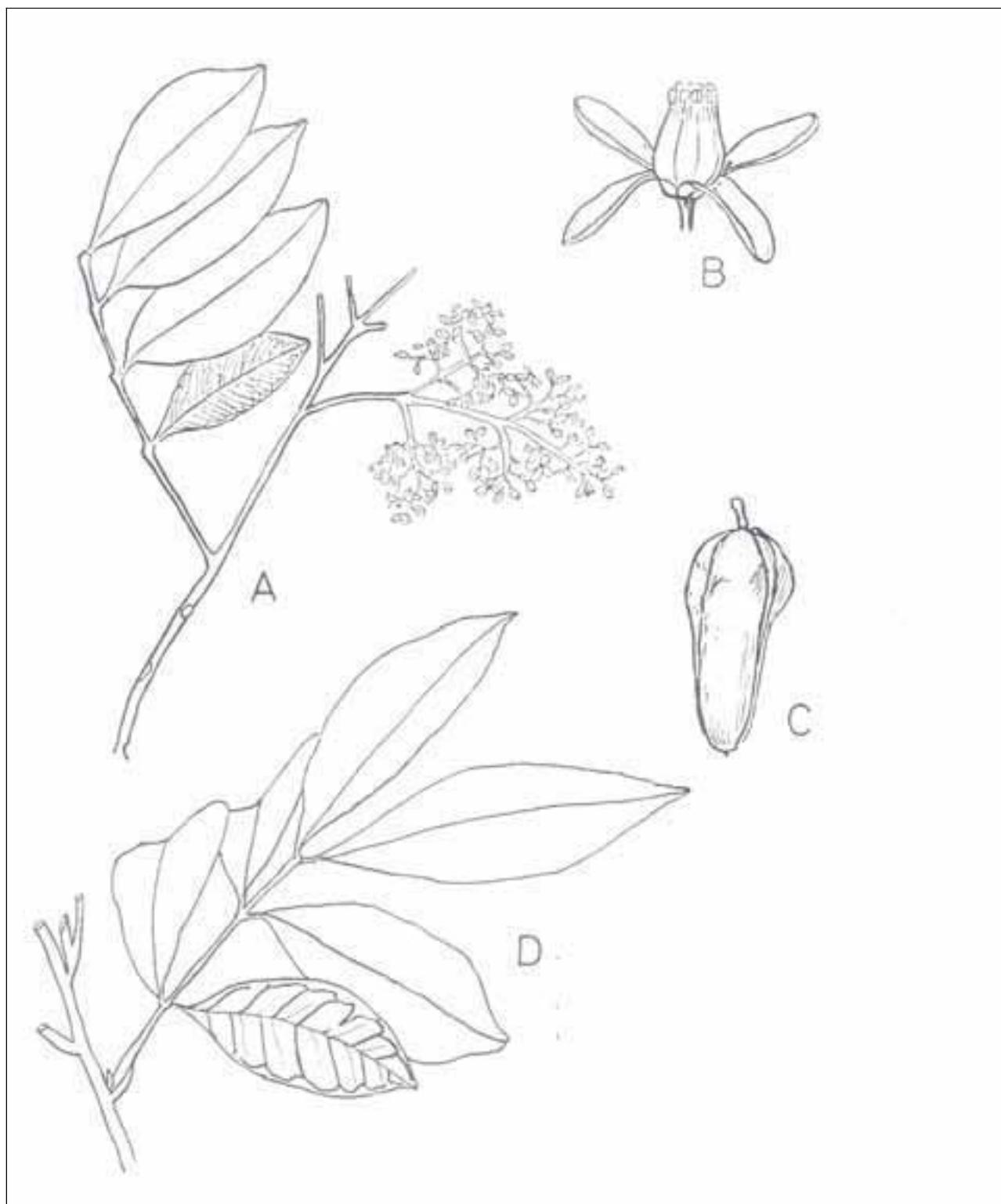
Distribution: From Sierra Leone to Angola. Lovoa grows throughout Liberia, preferring good, deep and humid soils

Wood: The narrow sapwood, which is quite distinct from the heartwood, is greyish to beige. The heartwood is golden brown to yellow brown, sometimes greyish brown with dark veins. These markings are frequently found in logs of irregular shape. The grain is interlocked which produces a striped figure on the quarter-sawn boards. The texture is moderately fine. It is a rather soft and strong wood with a specific gravity of 0.54. The fine pores, visible to the naked eye, are filled with a dark oily resin. Lovoa resembles African mahogany, especially in its grain and texture.

It dries easily but care should be taken to avoid cracking. Dry wood in service has no dimensional movements due to seasonal weather changes. It is moderately resistant to insect and fungal attacks. The sapwood is not durable, and the heartwood is difficult to impregnate with preservatives.

The wood is easy to work with, provided sharp tools are used. Planing of radial surfaces may lead to picking up when the cutting angle is not 15°. Nailing and screwing are easy but the wood may sometimes crack. Drilling, turning and milling are easy and gluing, varnishing and staining offer no difficulties.

Uses: Lovoa is mainly used as a substitute for true walnut in furniture and high-class joinery. Used solid as well as veneer and plywood. Other purposes include panelling, ship building, carriage and car building, pianos, radios, flooring, music instruments, etc.



Lovoa trichilioides: A) branchlet with inflorescence (1/2x);
B) flower (8x);
C) fruit (1/2x)

MAKORÉ

Tieghemella heckelii (A.Chev.) Roberty

Family: Sapotaceae

Trade name: makoré, baku (Ghana).

Description: Makoré is a beautiful forest tree with a very tall, straight and cylindrical bole, nearly no buttresses while butt flares are present. It may reach a height of 160 feet and a diameter of nine feet but the average makoré has a diameter of four feet. The bark is thick, grey with vertical ridges. The slash is bright pink or reddish and yields a white latex.

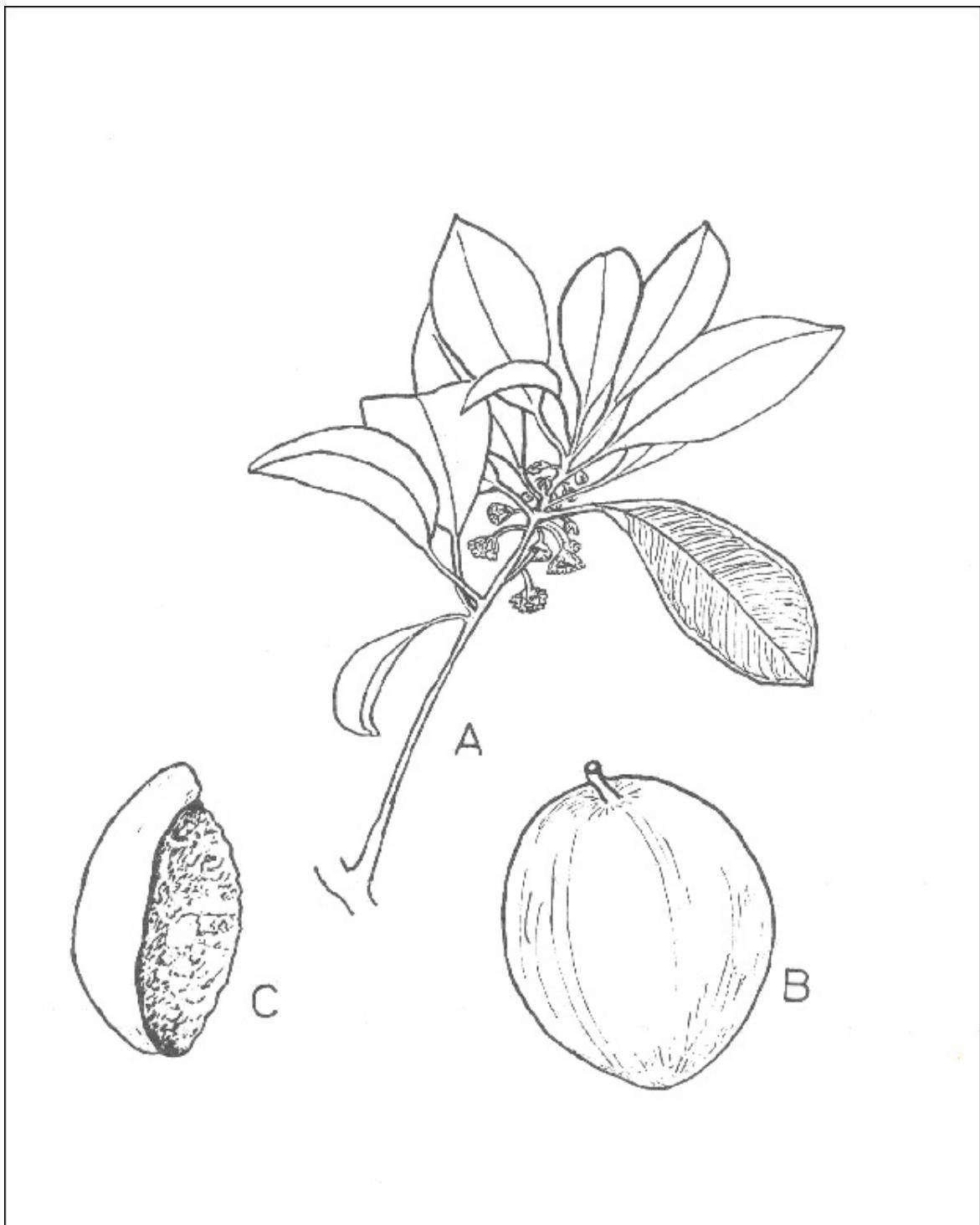
The leaves are simple and alternately arranged, obovate, six inches long and 2½ inches wide. The white flowers grow in pairs in the axils of the leaves. The fruit which is nearly round is four inches long and three inches wide, consisting of a yellow pulp in which are embedded one to three seeds. The seeds are big and yield an oil which is used locally for cooking and for the production of soap.

Distribution: It grows in tropical West Africa, from Sierra Leone to Nigeria. It grows throughout Liberia but may be absent in the wettest parts of the evergreen forests.

Wood: Sapwood and heartwood are different in colour. Sapwood is two to four inches wide and lighter, whereas the heartwood is light to dark pinkish red. Makoré has occasionally a fine figure, particularly on quarter-sawn planks. It has a slight resemblance to mahogany although botanically it is not closely related. The texture is fine and the grain may be straight, cross wavy or curly. It is a moderately heavy timber (specific gravity 0.65 - 0.80), rather hard and moderately strong.

Seasoning or artificial drying in kilns is fairly satisfactory with very little degrade. Once makoré is dry, its dimensional movement in service is small. Due to the presence of silica granules in the cells, the wood has a severe blunting effect on the cutting edges of tools, which have to be sharpened frequently. For sawing dry lumber, saw teeth have to be tipped with tungsten carbide; otherwise it is an easy wood to work with. It tends to split in nailing. Makoré is easy to polish, finish, glue and stain. The interlocked grain tends to pick up in planing. Sawdust may cause trouble to the respiratory system of persons who may be sensitive to it. It is highly resistant to termite and fungal attacks and does not have to be impregnated.

Uses: It is very much preferred for high-class furniture, joinery, cabinet work. As veneer it is sliced to give a decorative surface. It is used for doors, stair railing banisters, flooring with heavy pedestrian traffic, laboratory tables, turning and sculpture, window frames, church organs, etc.



Tieghemella hackelii: A) branchlet with flowers (1/2x);
B) fruit (1x)
C) seed (1x)

MUTUNDU

Funtumia elastica (Preuss) Stapf.

Family: Apocynaceae

Trade name: mutundu, rubber tree, Lagos silk rubber

Description: A medium-sized forest tree which normally grows in the under-stories of high forests and in secondary bush. The tree may reach a height of 70 feet and a maximum diameter of 20 inches, but the average diameter lies between 8 and 16 inches.

Funtumia elastica has been used as a rubber-producing tree because wounds in the bark produce abundant white sticky latex. The native methods of coagulation vary from boiling with or without vegetable infusions to simple evaporation. Towards the end of the last century, Funtumia was discovered as a rubber-producing tree and plantations were established on a considerable scale in Ghana, Ivory Coast, Nigeria and the Cameroon. With the introduction of Hevea brasiliensis most plantations have been replanted with clones of this imported tree, but plantations of Funtumia elastica still exist in the Cameroon. The higher yield of Hevea makes this tree preferable for rubber production.

Funtumia elastica has simple and opposite leaves which are up to five inches long with short petiole and pits in the axils of the lateral nerves on the lower side of the leaves. The flowers are white and the fruit has a propeller shape.

Distribution: Along the West Coast of Africa, from Guinea to Congo and Uganda. It is found throughout Liberia, preferring, however, the drier regions and is found less frequently along the coast.

Wood: It gives a rather light and soft wood, density between 0.40 and 0.50. Like most light woods, it is not very strong. The wood is pale yellow with no definite difference between heartwood and sapwood. The texture is fine and the grain straight. The timber is not durable. For outside purposes it should be impregnated. It works easily with hand and machine tools.

Uses: The wood is used locally for doors, planks and furniture. It has achieved more importance for its rubber than for its timber.



Funtumia elastica: branchlet with leaves (2/3x)

OBECHE

Triplochiton scleroxylon K. Schum

Family: Sterculiaceae

Trade name: obeche, samba, wawa, abachi.

Description: A large to emergent forest tree which may reach a height of up to 160 feet and generally diameters of three to four feet, but occasionally more. The bole though sometimes straight is often angular. The sharp buttresses may reach heights of 25 feet. The bark is greyish, when young smooth but scaly on older trees. The slash is whitish 'to creamy inside, thick and fibrous.

The alternate leaves are palmately lobed with five to seven lobes. The very irregular flowers are arranged in panicles; they are whitish and scented. Obeche flowers every five, to seven years. Research has been carried out on the flowering habits of obeche as this tree could be useful in plantations. The winged fruits are very often attacked by insects which makes seed supplies very irregular.

Distribution: From Sierra Leone to Gabon. In Liberia it is found in the northern part of the country. It is more a tree of the secondary forests and has a gregarious tendency. In some areas it is quite abundant.

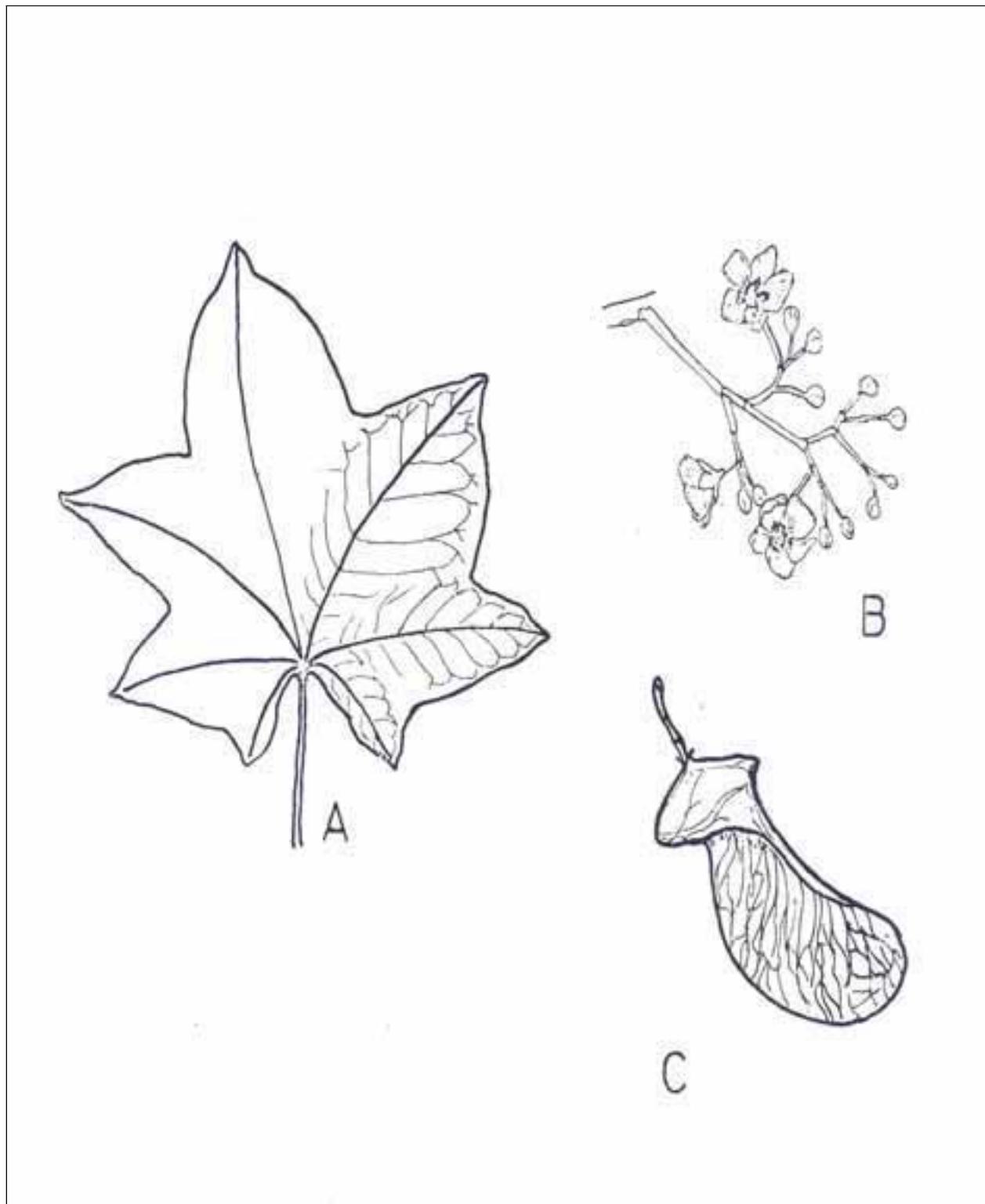
Wood: The colour of the wood varies from nearly white to pale straw yellow. There is almost no difference between the sapwood and the heartwood. The texture is fairly coarse and the grain may be cross or straight. The cross grained wood has a fairly conspicuous figure on quarter-sawn boards. From Ghana it is reported that the obeche is more straight grained which facilitate planing. The quality and colour of the wood is in general dependent upon the region where the tree grows.

It is a light wood (specific gravity 0.33 - 0.50) and dries as easily in the open air as in kilns. Seasoning may sometimes cause colouring of the wood (fungus attack). Rapid drying is advisable. The wood contains a resin-like substance. Large logs have generally brittle heart.

The wood is easy to work with. In planing, difficulties may arise when the grain is not straight. Nailing and screwing are easy. In finishing, the wood requires a filler due to its coarse texture. When planed it gives a lustrous surface. It stains well. Home workers should avoid the cross-grained type which is difficult to work owing to its tearing grain.

It is not resistant to fungal and insect attacks, and it is therefore recommended to treat the freshly cut timber with some preservative and dress off the sapwood from logs which will be exported.

Uses: Obeche is very often used for the production of plywood and it is rated among the five best plywood species. It is also used for piano and organ construction, furniture, panelling, ceilings, boxes shelves, school chairs, etc.



Triplochiton soleroxylon:

- A) leaf (1/2x);
- B) flower (1/2x);
- C) fruit (1x)

ROUGH SKIN PLUM

Parinari excelsa Sabine

Family: Rasaceae

Trade name: rough skin plum, grey plum, Guinea plum, mubura.

Description: A large forest tree growing throughout Liberia having a dense dome-like crown and a conspicuous golden appearance. Parinari may reach a height of 170 feet and a diameter of up to five feet. The bark is grey, rough and covered with lenticels, while the slash is thick, dark red with some watery sap.

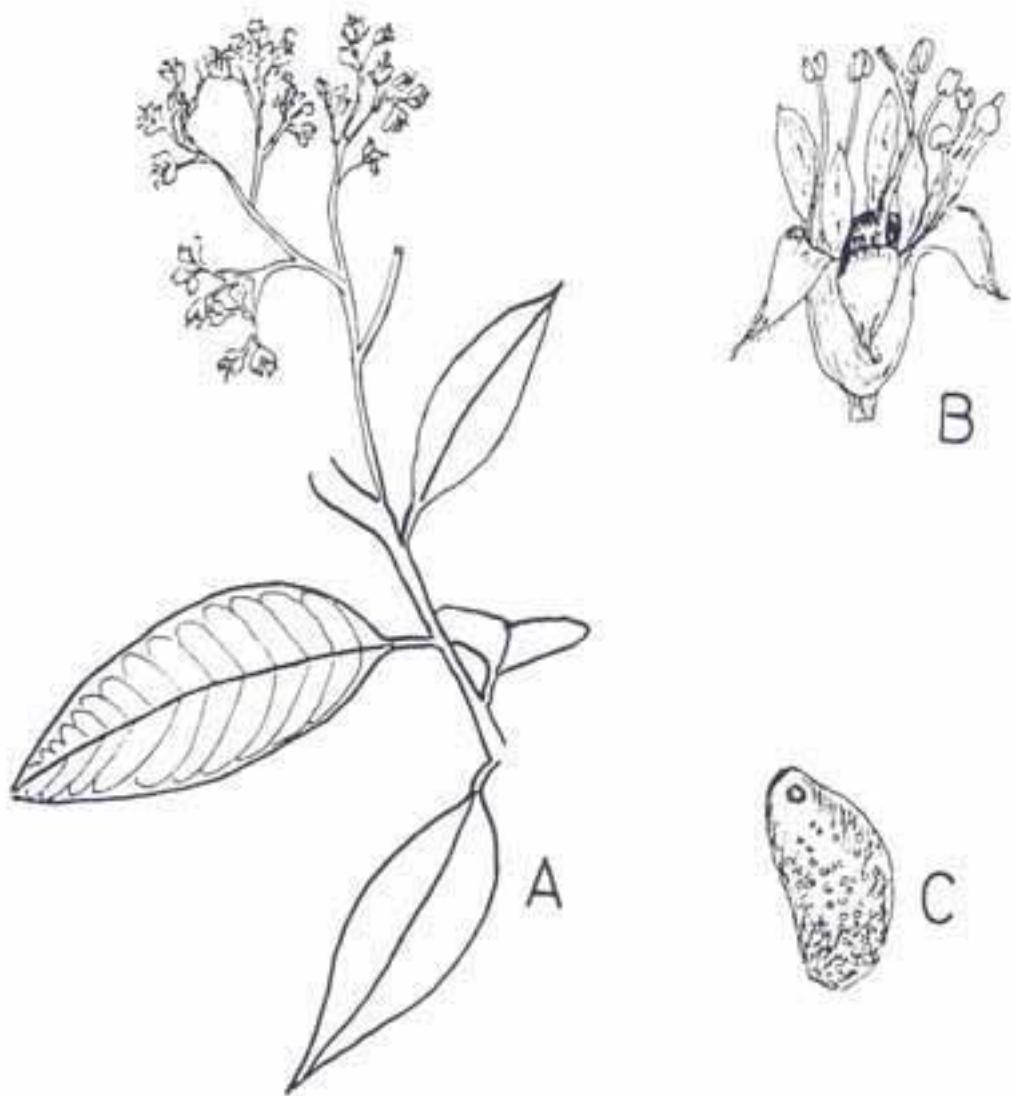
The leaves are simple, alternately arranged with stipules which drop early. They are elliptic, three inches long and one and a half inches wide. The flowers, arranged in dense panicles, are greyish white and smell sweetly. The fruit is a drupe, ellipsoid, with a rough skin, red-brown to grey when mature. This "plum" contains one seed. The flesh of the fruit may be used as food and tastes somewhat like the avocado.

Distribution: From Senegal to Tanzania. The tree grows in all parts of Liberia, has a definite gregarious nature and is especially abundant in the forests of the Nimba area.

Wood: The sapwood is yellowish white and hard, while the heartwood is reddish brown to chocolate brown. When the wood is sawn the sapwood has a distinctive waxy odour. The texture is moderately coarse and the grain is interlocked. The wood is very hard and heavy and has a specific gravity of 0.76 at 12 per cent moisture content. Seasoning is difficult as it has a tendency to split, check and distort. Thick material has to be air dried to give better results.

It is rated as durable wood, resistant to water and damp; moderately resistant to fungal attack. Resistance to termite attack is unknown. Parinari is difficult to work with hand and machine tools. Because of the presence of SiO_2 crystals in nearly every ray cell, the wood has a severe dulling effect on the cutting edges. Stellite-tipped saws are recommended, especially when the wood is dry. In the green stage, normal saws may give a good result, although sharpening of the saws has to be done more frequently. Because of this characteristic, Parinari is not recommended where re-sawing or machining of wood is required. It can be glued without difficulty; nailing will be difficult and can only be done satisfactorily after pre-boring holes. It seems to be suitable for plywood manufacture, but the high silica content of the wood requires that special measures be taken against the dulling effect on cutting edges.

Uses: Recommended for railway sleepers, general construction work, house posts, planks, door frames and furniture. Locally it is used for canoes firewood and charcoal. Although it has not a generally accepted export value, it may be used as a replacement for oak in Europe.



Parinari excelsa: A) branchlet with inflorescence (1/2x);
B) flower (6x);
C) fruit (1/2x)

SAPELE

Entandrophragma cylindricum (Sprague) Sprague

Family: Meliaceae

Trade name: sapele, aboudikro, sapelli, lifaki.

Description: A large tree with symmetrical crown, up to 160 feet high (Ghana 200 feet) with a maximum diameter in Liberia of 6 feet, but usually between two and three feet. The bole is straight with broad and low buttresses. The bark is brownish grey peeling off in patches. The slash is brown pink with creamy markings, sweetly scented, somewhat similar in smell to bosse. The bole is up to 130 feet long, branchlets angular and leaflets at the end of the branchlets.

Leaves pinnately compound, up to 13 inches long with six nine pairs of leaflets, opposite or sub-opposite. The flowers appearing during the period from November to February are numerous and small, growing in lax panicles. The fruit is a capsule with a thin woody wall opening at the top with five valves to release the brown winged seeds which were attached to the columella. Fruits and seeds are often attacked by insects.

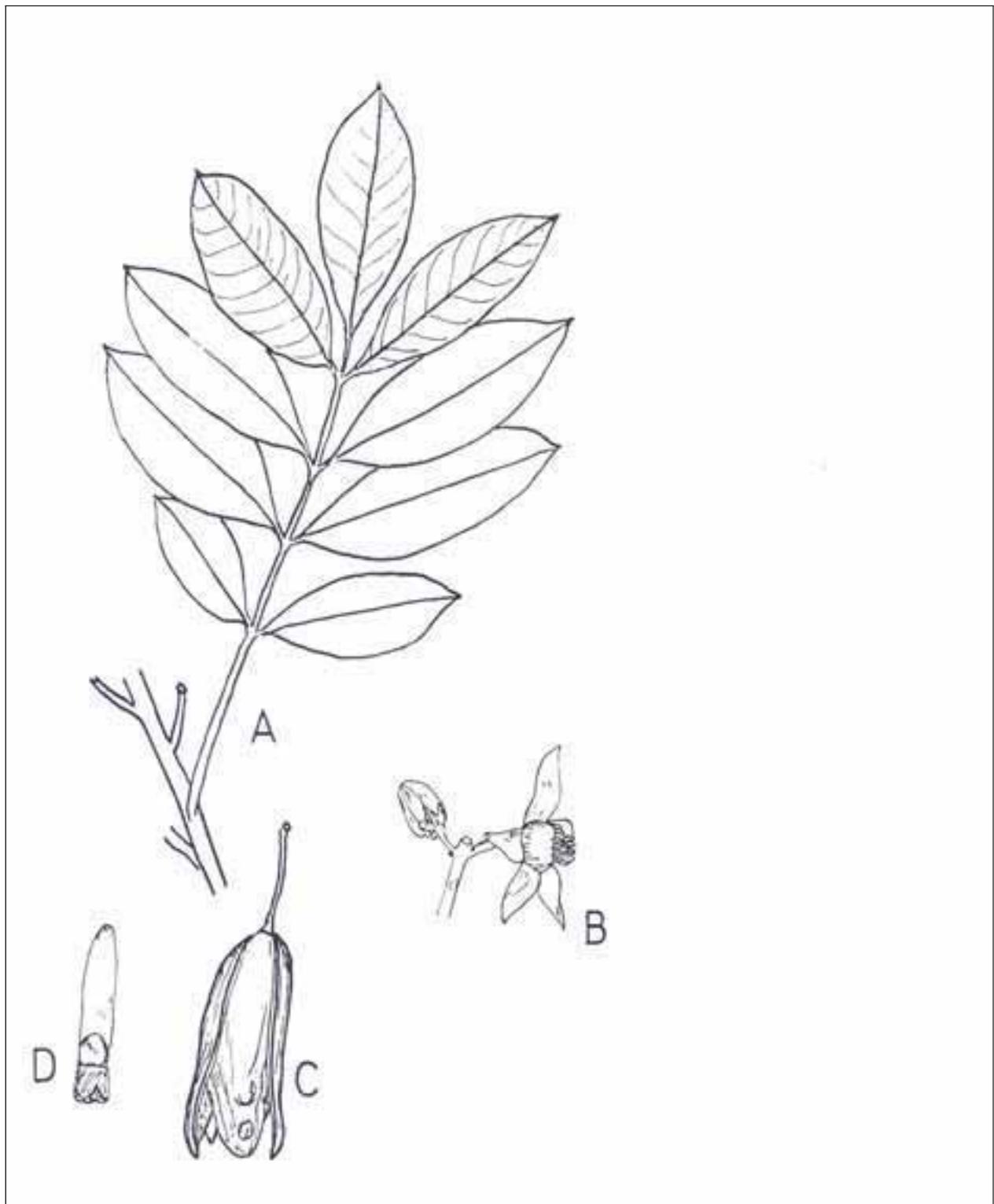
Distribution: From Guinea to Uganda and the Congo. Grows throughout Liberia but more frequently in the forests around Zwedru. It is a tree of the moist semi-deciduous forest type. In the evergreen forests it is rare.

Wood: It is a heavy, scented timber with a persistent fragrance. Its specific gravity is 0.75 - 0.70. The sapwood is greyish and one to four inches wide. The heartwood is light pink when freshly cut but when exposed to the air it darkens to reddish brown - a typical mahogany colour. Sometimes logs are beautifully figured, mottled or with a regular and marked stripe which shows well on quarter-sawn faces. The texture is moderately fine and the grain regularly interlocked. It is harder and heavier than African mahogany, resembling Honduras mahogany.

Seasoning has to be carried out carefully because it has a tendency to deform, check and split. Mild, kiln schedules are therefore required. It should be quarter-sawn to prevent warping and splitting. Although the timber is fairly resistant to fungus and insect attacks generally, damage by pinhole borers has been reported and the wood does not seem to be resistant to termites. Improvement of its resistance is not possible because sapele is difficult to impregnate with preservatives.

It works quite well with hand and machine tools. In planning, the cutting angle has to be 15° to prevent picking up. Connection can be made easily and holds well. Further, it can be polished, stained, varnished and glued without difficulty. Sapele is very useful as veneer.

Uses: It is used for furniture - solid. as well as veneer - piano cupboards, panelling. It can also be used for boatbuilding and is used for canoes and locally for house building and furniture, flooring, railway carriages, staircases, window frames, cabinet working, musical instruments, etc.

Entandrophragma cylindricum:

- A) branchlet with leaf (1/2x);
- B) flower (4x);
- C) partially-opened fruit (1/2x);
- D) seed (1/2x)

Tetraberlinia tubmaniana J. Léonard

Family: Caesalpiniaceae

Trade name: sikon, African pine (no export species, although small quantities have been sent to Europe on trial)

Description: Tetraberlinia tubmaniana is a medium-sized high forest tree, mainly found in Liberia. It has a straight, slender, cylindrical bole with a grey smooth bark. The base is straight, with almost no root swelling. The slash is light brown.

The leaves are pinnately compound with four to six pairs of leaflets. The flowers growing in inflorescences are pale yellow to light brown. The fruits are flat pods three to five inches long with seeds inside. Tetraberlinia very much resembles Loesenera kalantha except that the latter grows in swampy areas, the leaflets have a gland at their base, and the slash is more pinkish than that of Tetraberlinia.

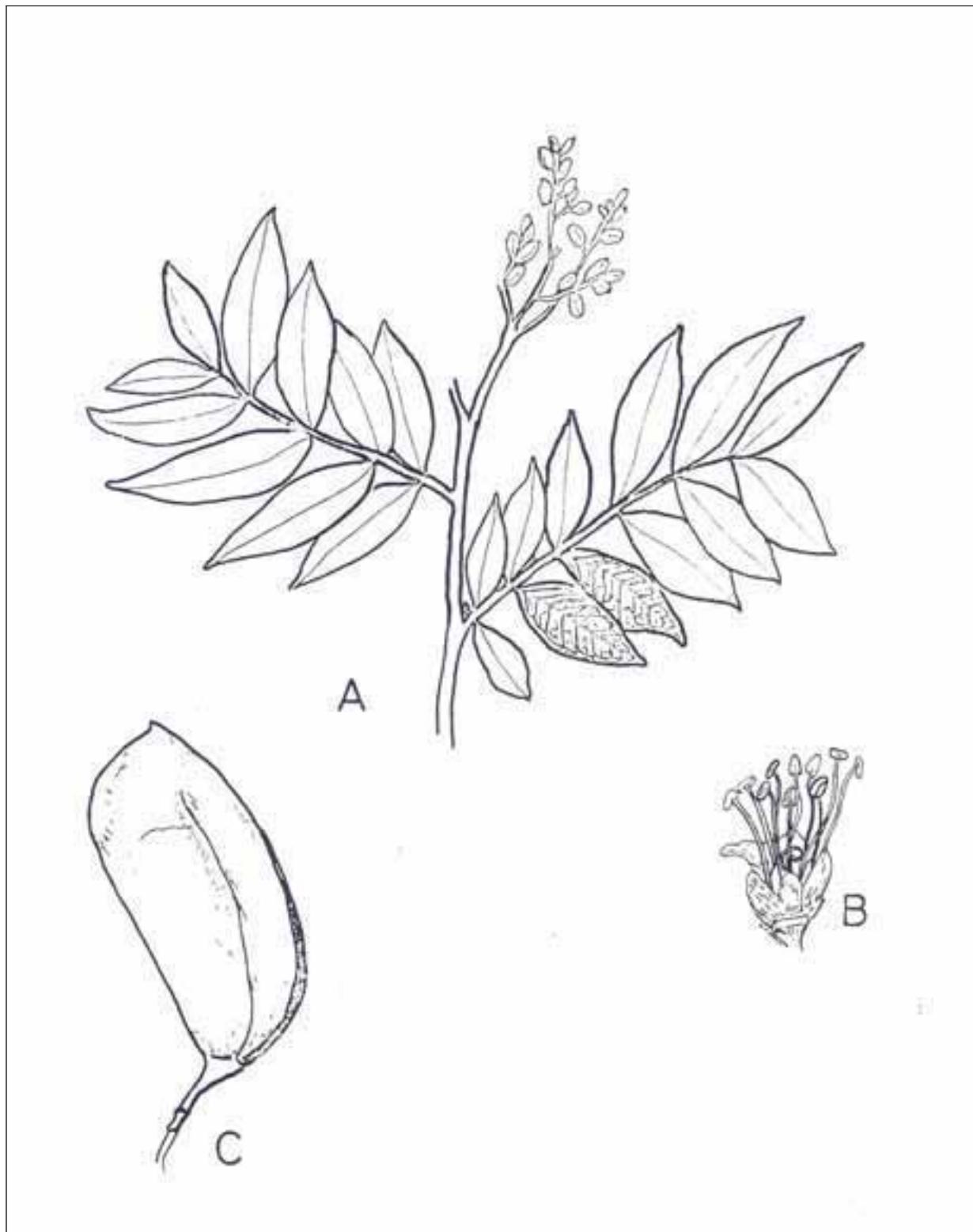
Distribution: Mainly in Liberia and the south west of Ivory Coast. Near the frontier with Ivory Coast quantities are rapidly diminishing. Tetraberlinia grows throughout Liberia but mainly in the south and in large quantities in the region of Greenville.

Wood: Heartwood and sapwood clearly differentiated. The heartwood is pale red to light reddish brown; sapwood reddish grey. Grain interlocked and the texture moderately coarse. The specific gravity is 0.6.

Seasoning is rather slow and has a strong tendency to produce surface and end checking. Careful drying in a kiln is therefore necessary. The wood is easy to work with hand and machine tools. Because the wood has a lustre, planed faces give a high-quality surface. On radical faces due to interlocking grain, rough surfaces may be produced. Compared to European timbers, sikon is stronger and tougher than oak, but less hard. Its durability is low and research on preservative treatment has to be carried out. It is therefore recommended only where no direct attacks from termites or fungus are likely.

A study of sikon was made by the German Forestry Team Mission determine its characteristics. It can be used successfully for the production of plywood where no decorative surface effect is required.

Uses: Recommended for plywood, indoor construction, floors, steps, furniture.



Tetraberlinia tubmaniana:
A) branchlet (1x);
B) flower (2x);
C) fruit (1/2x)

Entandrophragma utile (Daew et Sprague) Sprague

Family: Meliaceae

Trade name: sipo, utile, assie, mufumbi.

Description: A large and emergent forest tree. "One of the most beautiful trees of the forest" according to the Flore Forestière de la Côte d'Ivoire. The rounded, steep and thick buttresses may reach a height of eight to nine feet. The tree may reach a height of 200 feet and a maximum diameter of eight to nine feet. The bark is thick with deep vertical grooves. The slash is thick, fibrous, pinkish red with paler stripes and a faint smell.

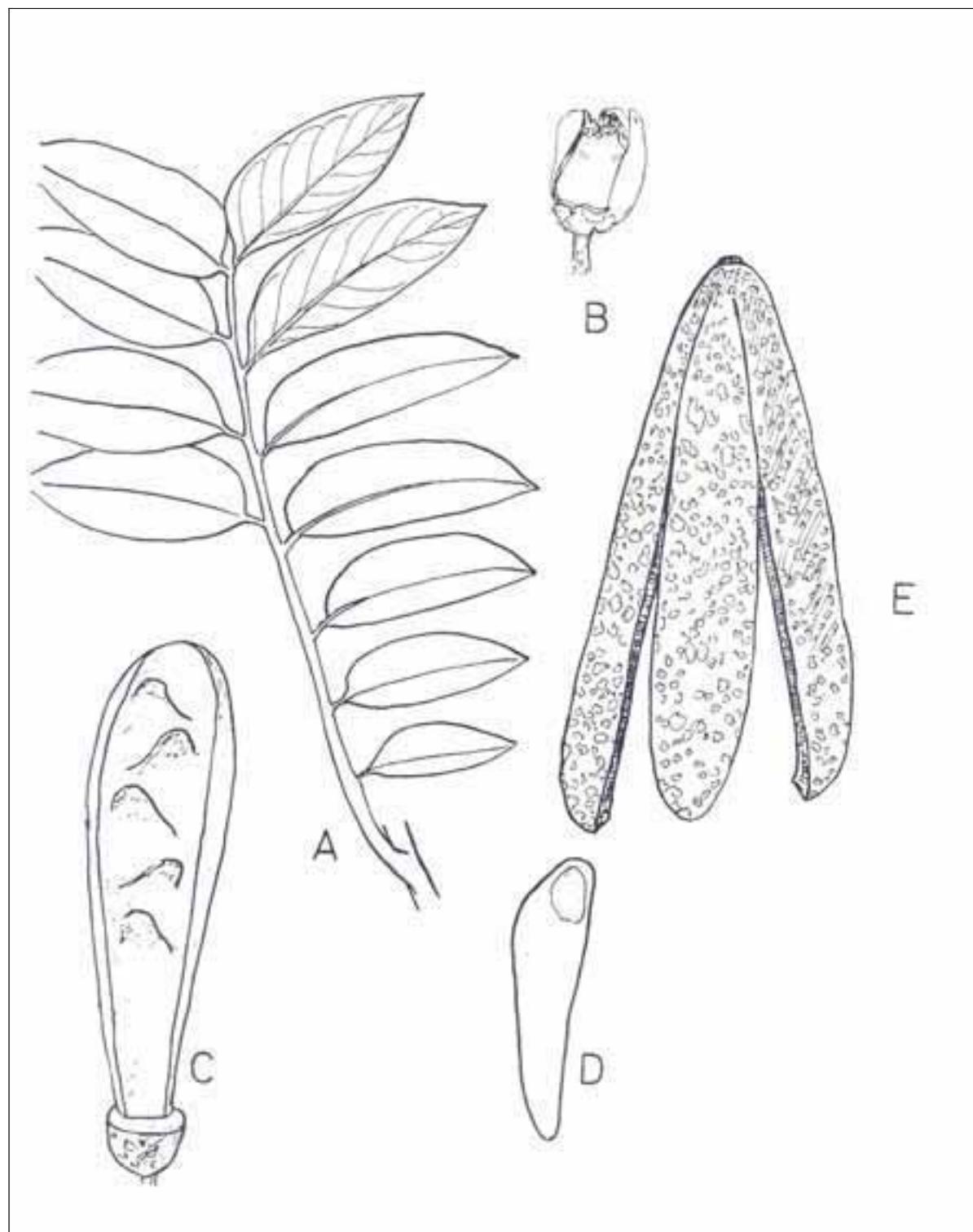
The compound leaves are eight to sixteen inches long, with the largest leaflets in the centre. Eight to twelve pairs of leaflets are in sub-opposite arrangement. The end of the branchlets where the leaves are clustered is densely covered with short hairs. The flowers are in panicles. The hanging fruit, a big capsule up to eight inches long, opens with five thick valves. Inside is a big cigar-like central axis to which the winged seeds are attached.

Distribution: The tree has a wide distribution in West and Central Africa and eastward to Uganda. In Liberia it is found in the northern part of the country, and most abundantly in the northern part of South East Liberia. It is plentiful in the adjacent regions of the Ivory Coast.

Wood: Heartwood and sapwood are easy to distinguish, the heartwood red-brown, sometimes with a violet tint and when exposed to the air, the colour darkens. The sapwood, one to three inches wide, is yellowish or light brown. The flat sawn boards may have a typical flame figure due to the parenchyma bands. Quarter-sawn boards are more or less striped by cross grain. Grain is irregular interlocked and the texture is reasonably moderate and uniform.

The specific gravity is 0.66 (41 lb/cub ft). This species is somewhat harder and heavier than other African mahoganies. Drying is not difficult but has to proceed slowly and carefully. Distortion or warping may occur but can be reduced by quartering instead of flat sawing. The wood is easy to work with hand and machine tools. Some times cross grain may give difficulties. Utile is slightly inferior in strength to sapele but considerably stronger than African mahogany. The wood is useful for turning purposes. It has good finishing properties.

Uses: Furniture, inside and outside panelling, boats, windows, parquet floors, veneer, plywood, construction of road vehicles.

Entandrophragma utile:

- A) leaf (1/2x)
- B) flower (4x)
- C) columella (3/4x);
- D) seed (3/4x); E) fruit

WISHMORE

Heritiera utilis (Sprague) Sprague

Family: Sterculiaceae

Trade name: wishmore (Liberia), niangon, nyankom.

Description: A medium-sized to large forest tree reaching a height of 100 feet or more, occasionally 130 feet. Its diameter above the buttresses may be up to three feet. The tree has thin arched buttresses or stilt-roots, or stilted buttresses. The bark is thin, vertically grooved and peels off in scales. The slash is pink, fibrous and often ripple marks are present.

The leaves are digitately compound or simple. The digitate leaves may have five to seven leaflets which are two to ten inches long and one to four inches wide. They are dark green and shining above the golden brown below. The flowers are in panicles. Calyx is whitish and the corolla is absent. The fruit is winged on one side.

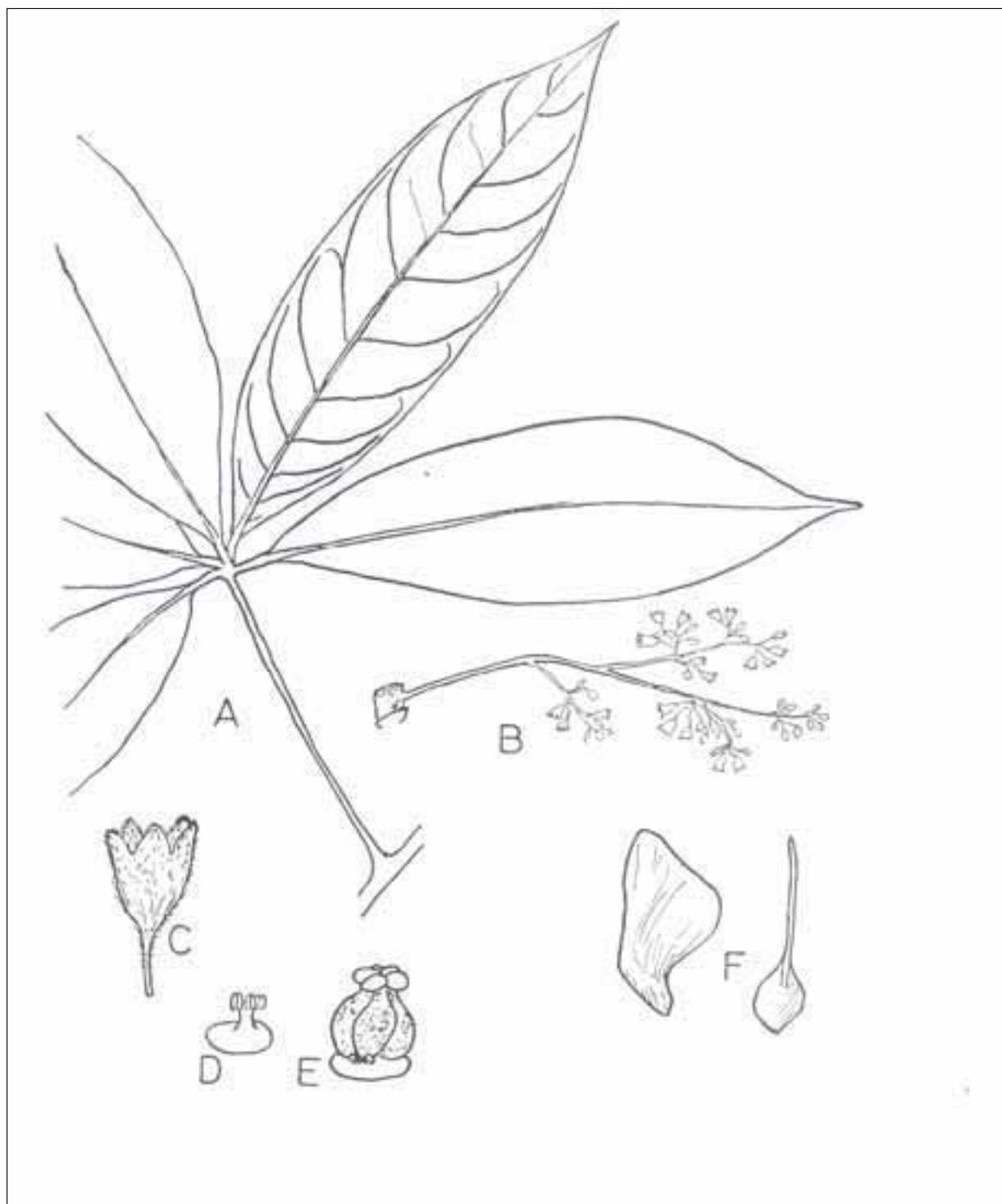
Distribution: From Sierra Leone to Ghana. Niangon exported from Gabon comes from Tarrietia densiflora. It grows throughout Liberia, except possibly the coastal regions. Wishmore has no special preference for soil type, although it is absent in permanently flooded swamps.

Wood: The heartwood varies in colour from pinkish, pinkish brown to brown red and is not very distinct from the sapwood which is normally two to three inches wide. Superficially it looks like mahogany but the texture is generally coarser. The grain tends to be interlocked. Wishmore is easy to recognize because the rays appear on the quarter-sawn material as dark brown spots whereas the rays in mahogany are hardly seen. The wood feels a little sticky on flat surfaces because it contains a resin-like substance which makes it difficult to impregnate.

In general, wishmore has an equal structure and a high lustre. Quarter-sawn planks have a vivid and decorative appearance. It is reported that wishmore from Ghana is harder than that found in the more western part of the West African forest belt. Wishmore is rated heavier than mahogany and its average specific gravity is 0.62 (0.51 - 0.84). It dries quickly and fairly well but results depend on the cross grain. In general, there is little degrade. It has a tendency to end and side cracks.

It is an easy wood to work with hand and machine tools. Sawing may sometimes prove difficult when the saw produces a fine sawdust which may glue between the blade and the wood. The increased friction may overheat the saw. For structural work, wood has to be selected because brittle heart may be present. The resin content of the wood may offer difficulties in finishing and the application of ammonia or diluted lye is recommended. Local experience in Liberia shows that application of ammonia is not necessary in many cases. Wishmore requires a large amount of filler in finishing. It is resistant to fungal attack and moderately resistant to insect attack. The wood has been exported in large quantities from Ivory Coast to Europe since 1930.

Uses: Furniture, panelling, flooring, window frames, frames, outside panelling, ship-building, water thresholds, greenhouses, turnery, veneer and plywood, structural work, cabinet work, etc



Heritiera utilis: A) leaf (2/3x);
B) inflorescence (2/3x);
C) flower (5x);
D) male flower (10x)
E) female flower;
F) fruit (2/3x)

WOODS RECOMMENDED FOR DIFFERENT USES

Barrels:	Iroko
Battery and accumulator boxes, chemical containers:	Abura
Bridges:	African oak, Azobé, Kusia, Eveuss
Canoes :	Ajele, Cotton tree, Eveuss, Iroko, Kusia, Sapele
Carriage building:	Abura, Coula, Dabema, Framiré, Iroko, Lovo, Sapele
Construction work (heavy):	African oak, Eveuss, Iroko, Kusia, Limbali, Wishmore
Construction work (light):	Abura, Aiele, Cotton Tree, Ilomba, Iroko, Kanda, Kusia, Rough skin plum, Sikon
Cigar boxes:	Bossé, Ilomba
Crates, boxes :	Cotton tree, Ilomba, Obechi
Doors:	Aiele, Coula, Makoré
Drawers:	Abura
Decorative purposes:	Acajou-blanc, Aiele, Bossé, Edinam, Framire, Limba, Lovo, Makoré, Sapele, Sipo, Wishmore
Flooring, parquetry, etc:	Abura, Aiele, Azobé, Dabema, Iroko, Kusia, Limba, Lovo, Makoré, Sapele, Sikon, Sipo, Wishmore
Furniture:	Acajou-blanc, Aiele, Edinam, Framire, Iroko, Kanda, Limba, Lovo, Makoré, Sapele, Sikon, Sipo, Wishmore
Furniture (cheap):	Abura, Framiré, Ilomba, Limba, Mutundi, Obechi, Rough skin plum
Joinery (high-class):	Acajou-blanc, Bossé, Edinam, Lovo, Makoré
Laboratory benches:	Abura, Iroko, Makoré
Mortars:	Aiele, Cotton tree, Iroko, Kusia
Plywood:	Abura, Acajou-blanc, Aiele, Bossé, Cotton tree, Edinam, Ilomba, Limba, Lovo, Sikon, Sipo, Obeche, Wishmore
Port building:	Azobé
Pulp:	Cotton tree
Radios:	Abura, Cotton tree, Ilomba, Lovo
Railway sleepers:	Azobé, Coula, Eveuss, Iroko, Kusia, Rough skin plum
Ship building:	Bossé, Coula, Eveuss, Limbali, Lovo, Sapele, Sipo, Wishmore
Transmission poles :	Kusia
Turnery :	Abura, Coula, Kusia, Makoré, Wishmore, Sipo
Wood carving :	Abura, Makoré, Baphia

WOODS RESISTANT TO TERMITE ATTACK

Highly resistant:	Makoré, Kusia, Kanda, Iroko, Eveuss, Coula, Azobé, African oak
Moderately resistant:	Bossé, Dabema, Edinam, Framiré, Limbali, Lovo, Rough skin plum, Sipo, Wishmore

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