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MADRAS TIMBERS 1919

By

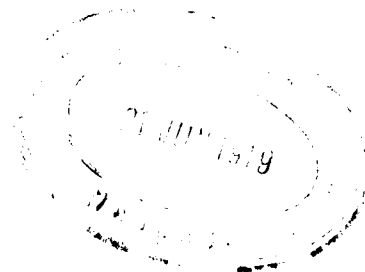
A. W. LUSHINGTON, C.I.E.

(Retired Conservator of Forests, I.E.S.)



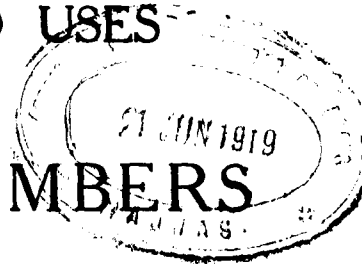
Printed and Published at the
S. C. PRESS, VEPERY, MADRAS

1919



MADRAS TIMBERS

NATURE AND USES
OF
MADRAS TIMBERS

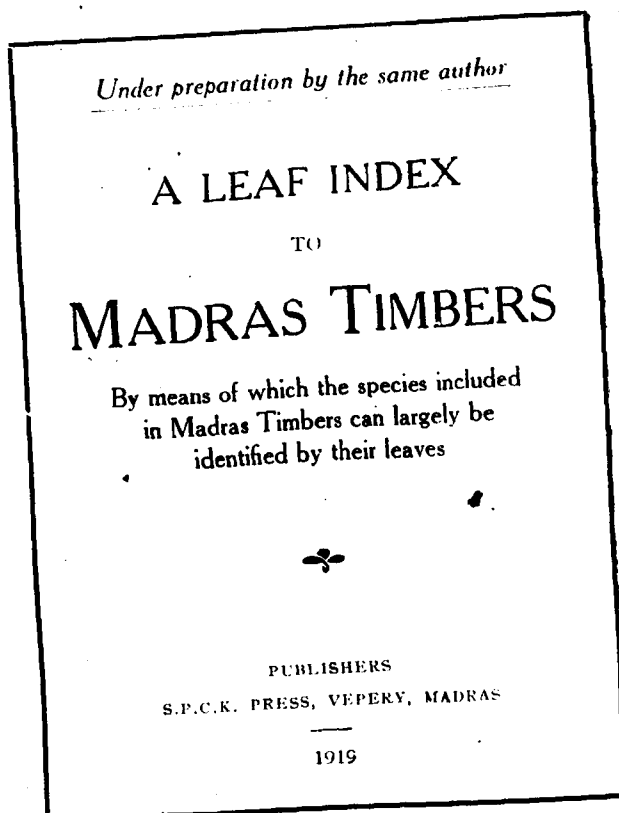


Arranged in categories containing similar woods,
and critically compared with corresponding
European and Philippine Timbers

*(Completely revised and remodelled from the work issued for the
Madras Exhibition, 1917, with copious useful additions.)*

BY
A. W. LUSHINGTON, C.I.E.
(Retired Conservator of Forests, I.F.S.)

Price Rs. 4-8-0



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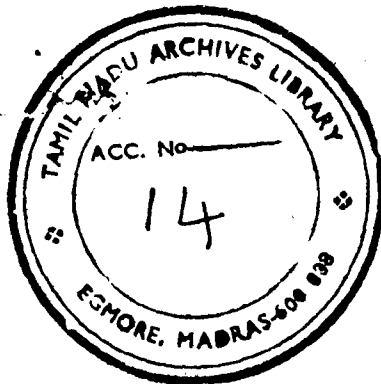
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Date: 27.10.77

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ADDENDA AND CORRIGENDA

Page	Line from	
27	Last line	for 'father', read 'faster'.
66	7 top	for 'Brassia', read 'Brassaia'.
67	9 bottom	for 'Pshychotria', read 'Psychotria'.
81	7 top	below 'Castanea vesca', insert. 'Fagus sylvatica (Beech, Hêtre of the French) (N) (120' x 6') * 27''.
88	Last line	for 'Lunitzera', read 'Lumnitzera'.
103	22 top	after V.C. = III, insert 'Note.—Nutmegs (Myristica) contain a red balsamic resin, fairly copious on incision of the bark; imported species contain a cedary turpentineous oil.'
111	10 bottom	after 'Bankanakkera', insert 'Iriki, Virigi'.
120	10 top	for 'Nagari', read 'Nagarai'.
	16 top	for 'Duvvudippe', read 'Duvvudippa'.
	18 top	for 'Vällari', read 'Vallāri'.
133	7 top	for 'Popular', read 'Poplar'.
146	8 bottom	for 'Kayea', read 'Cratoxylon'.
158	6 bottom	for 'Cennāli', read 'Cannāli'.
178	14 top	for '15. accopetalum', read '15. Sac-copetalum'.
192	22 top	for 'CNTC: i', read 'CNTC:)'.
198	4 bottom	for 'Palāngādai', read 'Palāngādcī'.
203	9 top	for 'Konargāram', read 'Kōnargāram'.
223	3 bottom	after 'Vatica', insert 'Isoptera'.
235	2 bottom	for 'Avil', read 'Āvil'.
252	14 top	for 'Marukkāniram', read 'Marukkān-niram'.
259	4 top	after 'Prickly Nārra', insert ('Pterocar-pus').
230	2 bottom	for 'Kaccaikkattai', read 'Kaccaik-katti'.
288	6 top	for 'Bittulla', read 'Bitulla'.
13, 14	top	for 'Mayisāle', read 'Māyisele'.

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com	common
CPT	Chingleput district
CRG	Coorg state
dist.	districts
DKN	the Deccan, including Kurnool, Cuddapah, Bellary and Anantapur districts
degn	dry evergreen forest (see Gamble pp. 129, 623, etc.)
dtts	dry tracts
ECT	East Coast
epph	epiphytic
fswp	fresh water swamps
GDV	Godavari district
GJM	Ganjam district
GTR	Guntur district
Jprs	Jeypore hills of Vizagapatam district
KAN	South Kanara district
KNL	Kurnool district
KSN	Kistna District
Ktlm	Courtallam in Tinnevely district
litl	littoral, along the coast
MBR	Malabar district
Mhgi	Mahendragiri hill in Ganjam district
MPLT	Mysore plateau, including the uplands of Mysore, Bellary, Anantapur, Cuddapah, North Arcot, Salem and Coimbatore districts adjoining Mysore
MRA	Madura district
mtts	moist tracts
MYS	Mysore state
NAC	The old North Arcot district
NCCS	The Northern Circars, Ganjam, Vizagapatam and Godavari districts
NEL	Nellore district
NLGS	Nilghiri district
Nlms	Nallamalai hills of Kurnool and Cuddapah districts
Pgt	Palghat on the borders of Coimbatore and Malabar
Pnis	Palni Hills of Madura
ravs	ravines
Rpas	Rampa hills of Godavari

rvrs	river banks
SAC	South Arcot district
sarm	sarmentose shrub with long trailing branches, not quite a climber
scat	scattered
SLM	Salem district
sswp	salt swamps
Svys	Shevaroy hills of Salem
TCH	Trichigopoly district
TJR	Tanjore district
TRV	Travancore state
TVY	Tinnevely district
VZM	Vizagapatam district
WFTS	Western forests, including Mysore, Coorg, South Kanara, Malabar, Cochin, Travancore, Tinnevely, Anaimalais, Palnis and Nilghiris
WGTS	Western Ghats
Wnd	Wynaad of Malabar and Nilghiri districts
WTCT	Western coast

Alphabetical Utilization List.

The abbreviations of the headings are similar to those adopted in the other parts, notably the Category Tables.

Vernacular names :—

U.	Uriya
TL.	Telugu
Ta.	Tamil
M.	Malayalam
K.	Kanarese

Prices :—

mc. or	} Cubic metre = 35.3 c.ft.
cm.	

Cft or	} Cubic foot (or feet)
cbc. ft.	

M Bd ft 1000 Board feet; in all lumber under 1 inch in thickness, each square foot of surface is considered as 1 Board foot; but over 1 inch in thickness, the measurement in Board feet is the actual volume of the piece.

P	Peso = Rs. 3
Rs	Rupees

INTRODUCTION

1. **The Madras Exhibition.** The original edition of the 'Madras Timbers: their use in place of European Timbers, with suggestions for their classification' was published in a somewhat hurried manner, in order to be in time for the Madras Exhibition of December 1917. It achieved its object, in that the scheme attempted received the distinct approval of a considerable number of Forest Officers, Engineers, Railway Officials, Commercial Men, and many other classes of the community. Since it was originally drafted, considerable further experience has been gained (1) from that Exhibition, partly by a careful observation of the specimens so brought together, partly from conversation with persons who were interested in the proposals; (2) during the collection of various samples in the forests for different purposes; and (3) by bringing together information recorded in books in connection with the strength of the various timbers. One result of the Exhibition was to show that the number of Categories might be still further reduced, and that it is advisable to designate the Categories rather as given in the Revised Edition than as given in the original pamphlet.

2. **Tables of Strength, Stiffness and Toughness.** Tredgold, in his 'Principles of Carpentry' (1840), laid down the axiom that 'strength, stiffness and toughness are the principle properties required in any wood'; and worked out these properties for several of the English timbers relative to those of Oak, giving Oak a standard of 100 in each case, thereby clearly showing the relative strength, stiffness and toughness of each of the species dealt with. The strength is its resistance to cross-breaking when a weight is placed in the centre; the stiffness is its relative elasticity; whilst toughness, often an exceedingly important feature, is a term that usually has been most loosely applied; thus, in various works we find White Willow, Beech and Lignum-vitae all called tough woods, and so, indeed, they

are, but in very varying degree; it has now been found by working out Tredgold's figures, although he does not seem to mention this mode of calculation in his work, the square of the relative strength of any wood, divided by its relative stiffness, gives its relative toughness. Schneider considers that the best measure of toughness is derived from torsion or twisting tests, and points out that no such tests have been undertaken; but says:—'Relatively to one another, some indication of their toughness may be gained from the figures under the headings of Modulus of Rupture and Modulus of Elasticity, taking into account the fact that toughness is the ability to be deformed without rupture when loaded beyond the elastic limit, and can be best demonstrated when the wood is dry'. The principle deduced from Tredgold's figures complies, as near as may be, with the enunciation by Schneider. At the time that the original pamphlet was written, it was impossible to give figures for Elasticity and Toughness; but, in this revised edition, tables have been prepared, as far as statistics are available, for each of the Categories on the lines of Tredgold's figures for the different species; and it is believed that this forms a very useful addition to the work.

3. **Basis of Categories on Hardness and Colour.** It will be noticed that, in this work, the division into Categories has been based firstly on hardness, secondly on colour, and lastly on strength of the three kinds, durability, weight and structure; and this requires some explanation. First, as regards hardness. As a rule, the qualities of hardness, weight, durability and strength are nearly co-terminous; that is to say, the harder the wood so also the heavier, the stronger and the more durable it is, and, *vice versā*, the softer the wood, the lighter and less strong and durable it is. As a very rough test, the hardness of a wood can be gauged with a thumb-nail and with a pen-knife; if the thumb-nail under pressure goes deeply, moderately or slightly into the wood, the wood is very soft, soft or moderately hard respectively; and similarly with the pen-knife, where the thumb-nail will not penetrate, the wood is hard, very hard or extremely hard according the

depth that it scratches. Thus, at the very outset, there is a ready, though admittedly very rough, way of arriving approximately at the principle qualities of a wood; wherefore this has been taken as the starting basis of separating the confusingly numerous woods. On the other hand, the hardness of a wood is often such an important factor in connection with its employment,—that is to say, for some purposes a soft wood is essential, for others nothing but a hard wood could be employed,—that it is one of the very first considerations in sorting the different woods. Secondly, in respect of colour. Colour, again, is often an important factor in respect of the utilization of a wood; for some purposes, a rich colour makes a considerable degree of difference in its value, as for cabinet-work; in other instances, as in ceiling or wood-engraving and the manufacture of scales, a white or pale-coloured wood is essential. The classification by colour may not be scientifically correct; indeed, within certain limits, the same species may somewhat vary in colour, and sometimes two Categories are almost identical except for colour, such as the Plums and the Malletwoods; nevertheless, because on the one hand the difference in colour often modifies the power of utilization, and on the other hand it furnishes again a rough and ready mode of separation, the feature furnishes a fair secondary basis of classification. The final separation into Categories brings together the species that have, within reasonable limits, the distinct properties of the species after which they are named, in respect of hardness, colour, weight, strength, elasticity, toughness, durability, and structure (size and nature of the Rays and Pores). The Categories have now been reduced to thirty-four in number, a reduction which tends very largely to eliminate confusion of nomenclature. The bulk of these Categories are named after either European woods, or well-known woods imported into Europe; the naming is not a fanciful one, but has been worked out on fairly scientific lines, such that within a justifiable latitude each species within a category *has* the main and distinct properties of the species it is said to represent; it is believed that there is not

so large an amount of difference between any two species in the Categories of the Madras Timbers as exists in the qualities and properties of many single European species. For instance, if we take the Spruce or White Deal, that grown in low situations is soft, spongy or brashy, and very inferior, whilst that grown on the mountains is very homogeneous, compact and excellent, and commands high prices ; yet all is sold as Spruce or White Deal. Or again, take the Scotch Fir or Red Deal ; here, the sapwood is distinctly inferior material, it frequently comprises the whole tree, and, as a matter of fact, a very large part of the material in the market consists of this class of Red Deal ; on the other hand, the well grown heartwood of the Baltic furnishes some of the best mast-wood and construction wood in the world, whilst another type of heartwood from Scandinavia forms some of the best joinery and industrial wood available ; nevertheless, all is sold as Scotch Fir or Red Deal. Finally, let us take the Oak ; that grown in high forest is totally different in quality and properties to that grown in open coppice ; nevertheless, all is sold as Oak. It is true that, when it comes to *retail* sales of European species, the timbers are separated into a variety of grades and classes for sale purposes ; this does not alter the fact that the Madras Category fairly represents the general term that it is said to represent in its properties and qualities in a *wholesale* comprehension ; the grades can always be separated by retail dealers, whenever such a class, on the lines recognized in Europe, comes into existence ; it should not be expected that the Forest Department should usurp such a position. The clubbing together of several botanical species, and even genera, into Categories, or 'Commercial Species', is not a new practice in the commercial world ; it will be seen that the Lancewood of commerce consists of at least two, and probably more, species of different genera ; the South American Rosewood of several species of at least two genera ; Schneider points out that the Baticulin is obtained from several genera of the Lauraceae, Lanete of several genera of Apocynaceae, and White Lanutan is practically any species of any genus of the

Anonaceae. One of the great distinctions between the European and Madras floras lies in the fact that in Europe the number of species is very small, taken as a whole the intrinsic value of each species is poor, but their quantities are very great and their very abundance makes them valuable commercially ; on the other hand, in Madras the number of species is very large, the intrinsic value of the majority of species is generally considerably superior, but their want of abundance vitiates their commercial value and utility. If, then, it can be accepted commercially that the various botanical species here clubbed together into each category forms one commercial species, not only will the abundance of that commercial species be materially increased, and, consequently its utility and value, but the hopeless confusion in the nomenclature arising from the multitude of species will be avoided.

4. Utilization, and Schneider's Pamphlet on Philippine Timbers.

There are several reasons why Madras Timbers are not utilized to their full capacity ; a few need only be noted here. *Firstly*, it has not been the custom to season our timbers in the proper way ; how this should be undertaken is dealt with later in this work ; ordinarily, it has been deemed sufficient to fell the trees and leave the logs lying in the forest to dry without much in the way of further precautions ; and, because, under such treatment, the softer woods decay, they have been characterized as 'worthless woods' ; a very large proportion of the European woods have just as little durability as these, but in Europe they are properly seasoned and used under conditions where they will last for many years or for the purposes for which they are suitable, and so form the larger part of the woody material that is consumed. *Secondly*, in Europe there are a multitude of wood industries, each with its own special experts at the craft, and each with its own special type of machinery ; carpentry, joinery, cabinetwork, veneering, furniture, sculpture, carving, wood-engraving, fancy-ware, inlaying, turnery (including rollers, spindles and shuttles, bobbins and spools, handles of tools and shafts of all conceivable kinds, wooden tools, household implements, sporting appliances, etc., etc.),

wheelwrightery and carriage-building, boat-building, cooperage and box-manufacture, and various other crafts and manufactures. Out here, practically nothing of the kind or magnitude exists. *Thirdly*, many of our best timbers are too hard and too large to be felled with the tools and appliances in vogue; no really wholesale dealers are available, the practice is to select a few of our multitude of species as alone being suited to the requirements of purchasers, drain on them to the utmost and leave the bulk; some of our best species are located in dense forests, often in inaccessible places with a lack of communications, and the above method of extraction is impracticable; extraction requires to be placed on proper commercial lines on a businesslike basis, taking into consideration that wholesale extraction (and not mere picking) is necessary, and that costly apparatus is required and costly lines of communication must be opened. At a time when we are considering how to utilize our Madras species on European lines, Schneider's pamphlet on the Philippine Timbers is invaluable. In those islands they appear to be *far* in advance of the conditions in this country, their method of seasoning on the right lines, and their mode of utilization very much greater. A large number of the Philippine species are precisely the same as our own; and he shows that a very large number of species botanically different are 'commercially identical', and from his descriptions it is evident that the greater number of our species though botanically different are commercially identical with the species he has described and can be put to the same uses. In this revised edition, therefore, the comparison between the Philippine species and our own has been prominently brought into view; his prices have been quoted in the places where they fall into line with our own species, as they are exceedingly instructive as to what can be done with properly seasoned material; and an alphabetical Utilization List in the present work has been based on the lines laid down in that pamphlet.

5. **Separation of Large Trees from Small Material.** In this work, the trees capable of attaining a diameter of 1 foot or

more have been separated from the small material that does not attain those dimensions. If the forests are to be worked on a business footing, the major operations must depend very largely on the larger sized trees; for, not only does the volume increase in proportion to the square of the radius, but the trees of larger diameter are almost invariably the taller also. But, whilst the small sized material could hardly in themselves form the basis of a large operation, they must by no means be excluded from consideration. *Firstly*, they form an exceedingly useful complement to the major operation. It has been said that hitherto there has been a run on certain defined species,—Teak, for instance,—which have been used for almost every conceivable purpose; a very considerable proportion of the uses to which they are put require only small stuff, and very frequently not only would some other material do just as well, but, indeed, better. By ranging the small material into their proper categories, it is hoped that not only will the drain on isolated species be stopped, but the waste of large material be reduced by using the smaller species in their proper functions. *Secondly*, at present waste occurs also amongst these smaller species. Take, for instance, the Climbers; they are now ordinarily considered a pest to the forests, and often large sums are spent annually for cutting them out; as an instance, *Zizyphus oenoplia* and *Acacia pennata* both fall into the Category of Red Cedars, and they could be perfectly well used for the cheaper Cigar-boxes, instead of the large and valuable *Cedrela toona*; again, at the Exhibition a section of *Gnetum scandens* was on view, its appearance equalled that of fine specimens of gnarled Oak, and it could well—as could many other climbers in the same Category—be used for cabinet-work and fancy-ware. *Thirdly*, it must be remembered that some of the most valuable timbers never reach large dimensions; cases in point are the Box and *Lignum-vitæ*, which seldom attain a diameter of 1 foot; several of our smaller species, now ordinarily cut merely for firewood, would answer these purposes; even if the small species do not possess that fineness of grain which makes Boxwood unique.

for wood-engraving, they would answer many of the purposes to which Box is put, such as shuttles and spindles. It is probable that if the Working Plans of the Presidency adopted this mode of classification, and that if, instead of a division (part of a division, or even a single forest) being treated solely on its own merits, the Working Plans of all divisions blended harmoniously into one another, these valuable minor species could be developed into a proper systematic market.

6. **Nomenclature.** The Palms and Endogens generally have not been dealt with in this work. For the rest, the names in Hooker's Flora of British India have, almost invariably, been adhered to; it is recognized that since that work was published many alterations in the names have been accepted at Kew; nevertheless, Hooker's work still remains the standard work in India, and those who know the recent alterations will understand what is meant, but the majority who do not know the newer names might be confused.

7. **Aims of this Work.** The aims of this work are the following:—(1) to help people in Europe to know what timber we have in this country which will meet their requirements in the place of the individual species of Europe; (2) to help people in this country to know what species they could send to Europe in the place of specified European species; (3) to help people in this country to know the uses to which each category can be put; and, from the Alphabetical Utilization List, what wood would be suitable for any given purpose; and here it must be remarked that, when as is usually the case a series of categories is given, the timbers usually increase in hardness durability and value as the numbers ascend the scale, and as different persons require different qualities of wood for a given purpose, by referring to the categories they can see what would suit them best; (4) to help towards identifying any given piece of timber; the categories being arranged first according to hardness, then to colour, then to special differences noted in each category, it forms a step towards identification; (5) to help to reduce the run on certain few species, which alone there is at present a tendency to use, to reduce

the run on large timber when small species would do as well, and to utilize 'such rubbish as' climbers; (6) to help those who know what the European species are like to realize what our Madras species are like, and, *vice versā*, those who know our species to understand what the European species are like; (7) to help the preparation of Working Plans, in that, if each plan indicated the extent to which each category were represented over the area for which it is framed, all such plans would gradually blend into one another, and a far better knowledge of where, and to what extent, valuable but at present unmarketed materials exist, would be developed.

I. ANATOMY, CHEMICAL AND PHYSICAL PROPERTIES OF WOOD

1. Pith, Wood, Bark, Cambium. If we examine the twig of a tree cut across cleanly, we see in the centre a more or less circular patch of very soft spongy material, which is the *Pith* or *Medulla*, surrounded by firmer material, which is the *Wood*; and outside the wood, easily separable from it, is the *Bark*, which is generally more or less green, but is covered with a *Skin*, or *Epidermis*, that modifies the green colour. If we separate the bark from the wood, we find that there is a damp, slimy or mucilaginous matter between the bark and the wood; this is the *Cambium Layer*, which is really the joint material that is forming fresh wood on the *outside* of the already formed wood and fresh bark on the *inside* of the already formed bark. If the twig be now cut longitudinally, the pith forms a translucent column in the centre, the wood—forming the mass of the twig—shows as white wood-columns on either side of it, and on the outside is the thin greenish bark.

2. Cellular Tissue or Wood Cells, Wood Fibre, Wood Vessels (Pores), Pith or Medullary Rays, Soft Tissue. The pith consists of *wood-cells* or *cellular tissue*, which are more or less thinly-walled and nearly isometric cells, usually with flattened ends, and superposed one above the other like brickwork or rubble stonework. *Wood-fibres* are the chief constituent of the wood, and are elongated (a fraction of an inch long) and closed organs, pointed at both ends, with very thick walls such that their hollow interiors (*lumina*) are very contracted; consequently, the tissue thus formed is much firmer than that of the pith. In many cases, if we examine this tissue in the longitudinal section of the twig, we see a series of darker or lighter coloured streaks or minute channels (they can be very clearly seen in a piece of Cigar-box wood), which are the *Wood-vessels*; in the cross-section, they look like small holes in the wood, and are called *Pores*; these wood-vessels are more or less narrow tubes which run longitudinally through the stems and branches of trees for the purpose of conveying air, or sometimes sap, to the different organs; their walls are thin compared with their hollow interiors (*lumina*), and although they appear as pores when cut across, their ends are really closed. No wood-vessels or pores occur in Deal or other Coniferous woods. Again, if we

examine the longitudinal section of the twig carefully, we often see specks, lines, bands or strands of what seems like minute pieces of straw, often somewhat shining but sometimes dull, usually of a slightly or distinctly different colour to the rest of the wood; these are the Pith Rays or Medullary Rays; they are of the same nature as the pith, flattened cellular tissue, and run radially through the wood, so as to maintain connection between the pith and the cambium, and between the cambium and the outer cellular tissue of the bark which underlies the skin; in the cross-section, these form distinct rays, or radial lines from the pith to the bark, of lighter or darker colour than the wood. The *Soft-tissue* of the wood consists of cellular tissue, and is almost invariably lighter in colour and of a more spongy appearance than the wood-fibres which form the *Hard-tissue*; this soft tissue forms rings, narrow or broad, or irregular patches around the pores in a cross section; frequently these patches run together and form more or less regular patterns of either continuous parallel and concentric lines, or else broken, wavy, diagonal or branching lines.

3. Growth-rings or Annual-rings, Resin Ducts, Tyloses, Ripple-marks. It has been said that the cambium forms fresh wood and fresh bark; in some cases this continues regularly throughout the year and succession of years, and there is nothing to indicate the amount of a year's growth. In other cases, however, there is a period of distinct lessening, or even temporary cessation, in the flow of sap, upwards from the roots to the leaves and back again, after it has been elaborated into cambium, from the leaves into the root; for, the crude sap which passes upwards is almost entirely mineral matter in a watery solution, whilst the elaborated sap which passes down is almost entirely organic matter either in solution or held in suspension. The fall of the leaf usually causes a suspension of flow of sap until the new leaves appear; in Europe, this period is from late autumn through the winter to early spring; there is then a period every year when the new wood ceases to form or else becomes much condensed, and the difference in the spring wood and autumn wood is generally very marked, the wood consequently assumes the appearance of concentric rings, and these are recognized as *Growth Rings* or *Annual Rings*. In some species, the pores are arranged in rings, the largest pores being formed in the spring and consequently appearing in the inner or early part of each ring; but growth rings are marked by various other features; in some

woods the outer portion is darker, in some denser, than the inner portion, and often these two conditions go together; often the dense tissue forms only a narrow belt at the end of the ring; sometimes, on the other hand, the inner edge, or beginning, of the ring is marked by a distinct line of loose-textured soft tissue; there may be, in fact, any gradation from perfect distinctness of annual rings to a total absence of any indication of such rings. Further, other than annual causes may cause temporary cessation of sap, which may result in spurious rings; such are forest fires, perhaps even the difference in tides in the case of *Avicennia*, and various other causes. *Resin ducts* are cells or cavities in the wood which not only contain resin, but have special secreting cells lining them for promoting the formation of resin. Such ducts in the wood are only found in the *Dipterocarps* and in certain (but not in all) *Conifers*. In the *Pines*, they are found scattered singly or in very small groups; but, in the *Dipterocarps*, they are arranged in conspicuous concentric lines, occurring, however, at irregular intervals from the heart outwards, and seldom forming complete circles like the annual rings with which they are apt to be confused. *Tyloses* are growths, or in other words cells, which grow from the soft tissue surrounding a wood-vessel into its cavity; when few and thin, they are frequently iridescent; when somewhat thicker, they frequently present the appearance of cross-partitions in the pores; when still more massive, the pores become completely choked with soft tissue. Whilst the above are observed in the cross-section, *Ripple-marks* are extremely fine transverse parallel slightly wavy lines that occur in the longitudinal sections of some species in which, they are characteristic, and are most common in tangential sections of the longitudinal section.

4. Liber or Bast or Fibre, Cork. It has been mentioned that the cambium forms not only the wood—in concentric rings gradually developing more and more remotely from the pith by additional layers outside the old wood—but also forms new bark on its inner side. But in the case of the bark, not only is the distinction of rings hardly perceptible but the process is reversed to what takes place in the wood. In the wood, the cellular tissue is the pith, which is in the interior and is exceedingly small or even non-existent in old trees, whilst the wood-fibres form the large mass of wood on the outside of the pith. In the bark, it is the fibres that are on the inside, and these are usually only comparatively little

developed, and form what is known as the *Liber* or *Bast*, or simply *Fibre*; whilst outside the fibres, the cellular tissue is generally largely developed and comprises two distinct layers; the layer next to the fibres is known as the Middle Bark, and in it the cells contain green colouring matter and are laid horizontally but are usually polyhedral; the layer outside the Middle Bark and under the skin (which latter in trees after a few years growth breaks up and falls off) is the *Corky Layer*, the cells of which contain no green colouring matter and are flattened cubical in shape and laid longitudinally; in some cases, this Corky Layer is highly developed, as instanced in the Cork Oak, which produces the Cork of commerce. As in the wood connection is kept up between the pith and the cambium by means of pith rays through the wood, so in the bark connection is kept up between the cambium on the one hand and the Middle Bark and Corky Layer, on the other hand, by means of strands of cellular tissue through the Liber, but, the Liber being usually little developed, these strands are not noticeable as are the pith rays. Occasionally, the Liber is developed somewhat more than usual, and Flax, Hemp, Jute, and other fibres form commercial products.

5. Carbohydrates, Cellulose, Starch, Sugars; Proteins; Tannins; Resins; Ash; Water. *Carbohydrates* are a large class of cognate but distinct compounds of carbon, oxygen and hydrogen, where the elements of hydrogen and oxygen always in their molecular formula seem to be in the proportion 2:1 as in water; they include cellulose, starch, various forms of sugars, gum, mucilage, and other bodies. *Cellulose*, a typical and pure form of which is cotton-wool, is the matter of which the original cell-walls consist; it is soft, flexible, highly hygroscopic, and permeable by liquids, and it is owing to this permeability that liquid sap can pass from cell to cell; but it has a feature which distinguishes it from practically all other ingredients in wood, and that is that, whilst all others are soluble, it is insoluble in caustic alkalies, a property which is utilized in the manufacture of paperpulp, which in its purest form consists of pure cellulose. As the wood develops, however, the cell-wall thickens or lignifies, that is becomes incrustated with a degenerated product of the cellulose, called *lignin*, which makes the cells harder, stiffer, and less likely to swell by the action of water. *Starch* and the other carbohydrates other than cellulose have a great deal in common (and hereafter will often be collectively referred to as starches), exist in all living cells and chiefly

occur in the cambium and in the adjacent sapwood, some being soluble in water whilst others are not so; but one of their chief features is that almost all are liable to a form of decomposition, called *fermentation*, by the action of moisture combined with a heat between 150 and 160 degrees Fahrenheit, a decomposition which is accelerated by the action of dilute acids and which often forms organic acids in the sap. In almost all fermentations of starches, the operation gives rise to the generation of various classes of Fungi, amongst which may be mentioned Mildew, and those which cause Rot in wood; in India, it is a common event to find a pot of starch paste, which has been left in some hot damp confined place, covered with mildew, which does not frequently happen in Europe because the climate is not hot enough for it; this fact has an important bearing on the question of seasoning in the next chapter. *Proteins* are another class of bodies, all of which contain nitrogen and all very complex in chemical structure; amongst them are included Albumen, a typical form of which is white of egg, and Protoplasm which is the living portion invariably of a cell and lines the cell-wall, and is soft and gelatinous with a granular turbid appearance; like all complex organic bodies, the proteins are exceedingly prone to decomposition, especially when damp, and to cause decomposition in other compounds with which they are in contact, and they are consequently among the chief accelerators of decay in wood. *Tannins*, and other *colouring matters*, are very closely allied; the former is a class of astringent substances soluble in water, varying considerably in chemical constitution, but all having the common property of precipitating gelatine, and thus are used for converting skin into leather; they are chiefly found in the bark, but are rarely absent from the wood of any species of tree, and the deep red and brown colour in the heartwood of so many trees is due to them or their action or to some product formed from them. The term *Resin* is very loosely applied; it usually embraces solid resins, such as Rosin, Pitch, Dammer, Copal, also fluid balsams such as Turpentine, Copaiba, etc., and sometimes even essential oils; solid resins are usually the oxidation products of such balsams and essential oils as are of a class of hydrocarbons known as Terpenes. Sometimes india-rubber and gutta-percha are classed as resins, which they are not, being hydrocarbons, but are usually associated with resins that are oxidation products of themselves. Occasionally resin is found in

special ducts, as in the case of some Conifers and the Dipterocarps (see para. 3); sometimes it merely pervades the wood, as in the case of the essential oils of Sandal and the Camphor Laurels, of which oxidation products (e.g. Camphor) may be found in casual crevices; rubber (Caoutchouc) and gutta-percha occur in special laticiferous vessels chiefly in the bark. Resin increases the hardness and weight of timber, the more so the more solid the resin is; a certain amount of it increases both the elasticity and durability of timber, but an excess makes the timber brittle; tapping trees for resin improves the timber when there is an excess, but when there is no excess it deteriorates it. *Ash*, or the Ash-constituents of the wood, is the term applied to the mineral matter found therein; if wood is burnt in air, all the organic constituents decompose and pass off, mostly as carbonic dioxide and monoxide, steam, a small amount of ammonia, and a few other gases; and the residue that is left is solely inorganic mineral matter. The ash constituents are generally more abundant in the young than in the older wood, and predominate in the cambium and in the bark (especially in the bast), and especially in the upper and outer parts of the tree. *Water* exists in considerable quantity in freshly felled wood, varying from 30 to 53 per cent, or roughly 45 per cent, of the total weight of the wood; it varies with the species, with the season of the year, with the part of the tree, with the locality, and from various other causes. Water is absorbed, together with mineral matter, by the roots, and is drawn up in the form of 'crude sap' by the action of the sun on the leaves, from the roots chiefly through the cambium and juxtaposed tissues to the leaves; there it undergoes a chemical change through the action by respiration of the leaves, and is mostly converted into 'elaborated sap', which largely consists of the compounds enumerated above in this para; it then passes down again to the roots, depositing the organic matter on the way, chiefly in the form of cambium; there is thus a continuous circulation passing up and down through the living portions of the tree. *Air-dry wood*, such as has been kept for a long time under cover in timber yards, always retains 10 to 12 per cent of moisture. Some experiments in America tended to show that, in drying, the loss of weight in the first three weeks is over 30 per cent of the green wood; at the end of the next two weeks, another 6 per cent, bringing the loss to 36 per cent; but at the end of the next six weeks, only another 4 per cent, or a total of 40 per cent, showing

the great rapidity of drying at the outset and the slowness with which the balance of moisture dries up after a month or two. *Absolutely dry*, or *Oven-dry*, wood can only be obtained by placing the wood in drying chambers at a temperature of 105 degrees Centigrade; and it only retains that state of dryness in the drying chamber; when it returns to the air, it reabsorbs moisture nearly to the extent described as air-dried. (See also para. 9.)

6. Heartwood and Sapwood. It has been stated that all trees (we here refer only to Exogenous trees and Conifers) grow in diameter by adding successive layers of wood, by annual rings as a rule, to the outside of the trunk just under the bark; this young wood is less dense, contains a greater amount of sap, and the cell-walls are thinner than is the case of more mature wood in which the processes of cell-wall thickening and of deposition of organic and inorganic matters have contributed to produce ultimately a dense, hard, and usually deeply coloured wood; the white or light coloured porous wood with thin cell walls, and which contains the larger proportion of sap, is called the *Sapwood*, and forms the bulk of the living portion of the tree; whilst the harder, denser, darker coloured wood with thicker walled cells, which contains less sap, is called the *Heartwood*, and forms the bulk of the no longer living portion of the tree. In some trees, the colour changes little or not at all as the tree grows older, and then there is said to be no distinct heartwood; but, in the majority of trees, there begins at a certain age the formation of heartwood due to the infiltration of colouring matters, tannins, oils and resins into the cell-walls, and sometimes mineral matters in the cell cavities; the process starts over a more or less large area about the centre, and, once well started, usually, but not always, keeps about even pace with the diameter growth of the tree. In trees having no distinction of colour between heartwood and sapwood, there is generally little difference between these in strength and durability; where the colouring of the heartwood gradually merges into that of the sapwood, the difference is not great; but in species where there is a sharp line of demarcation between the dark heartwood and light sapwood, the latter is generally very much inferior to the former, especially as regards decay and insect attacks. In some cases, as in the Tamarind and Ebony, there seems to be at first an uncoloured heartwood, which by degrees develops an irregular patch of colour near the centre of the bole. In some very rapidly growing trees,

the inner portion of the heartwood, instead of being the strongest and best, is formed of large thin-walled cells and softer wood owing to the rapid growth in the early years compared with that of later years; and, in such cases, when fungi and insects gain access to the interior through wounds in the bark, fire scars, etc., they naturally penetrate the softer wood of the interior more rapidly than the hard shell that surrounds it.

7. Weight, Specific Gravity, Density, Hardness. As a rule, the heavier the wood, the more highly represented are its desirable qualities, namely, hardness, strength, toughness and durability; and a glance through the various categories will tend to show that, as a whole, our Indian woods are superior to the European woods for this reason, provided that the Indian woods are properly treated. There are certain occasions, however, where great weight is an objectionable feature; for instance, in increasing cost of transport, or in the case of requiring costly foundations to support heavy superstructures; in a great many industrial uses light woods are preferred, especially where durability is of minor importance, or where, by being used in dry airy places, the durability sufficient for the purpose can be assured. Often in scientific works the weight of woods is given by their *Specific Gravity*, or the ratio between the weight of a given volume of wood compared with that of an equal volume of water. To obtain the weight per cubic foot of a timber where the specific gravity is known, the decimals are converted into a whole number, and that number is divided by 16; or, *vice versa*, when the weight per cubic foot is known, that figure is multiplied by 16, and the result converted into decimals. Woods weighing less than 62.4 lbs. per cubic foot float; and they are light, not because the substance of the wood differs materially from that of a heavier wood, but because of the relatively large amount of air contained in the various wood elements; in heavy woods the material is *denser*, the cell-walls thicker, and the size of the cell cavities or pores not so large. *Hardness* is a property that is easily recognized, but is difficult to measure; it has been defined as a resistance to indentation and abrasion or scratching; the wood-worker defines it as resistance to penetration by tools, which may mean indentation, scratching or cutting, according to the way in which the tool is used. Various ways have been adopted of testing hardness; in the United States, by measuring the load necessary to imbed a steel ball of 0.444 inches diameter into the surface of the

wood to half its depth; on the Continent in Europe, the number of kilograms required to force a punch of 1 sq. centimetre to a depth of 1.27 millimetres into the wood perpendicularly to the direction of its fibres; in the Philippines, a steel point is drawn with a pressure of 3.3 lbs. across the grain on a smoothed surface, the depth of the scratch being the measure of hardness, and a scratch of 1/32 of an inch was recorded for very soft woods, whilst on very hard woods the point had very little effect. A rough and ready method has been described in the Introduction.

8. Strength of Wood; Cross-bending, Crushing, Shearing, Tension, Stiffness, Elasticity, Pliability or Flexibility, Toughness and Brittleness, Fissibility. One of the most conspicuous and valuable properties of wood is its resistance to breaking when subjected to a bending strain, as is a beam when supported at the ends and itself bearing a load; it is this property which fits wood to be used in construction in the form of long beams, where stone would be too brittle, and steel too heavy and too costly. The strength of a beam is directly proportional to its breadth, directly proportional to the square of its depth, and inversely proportional to its length. The *Coefficient of Transverse Strength* is generally written as P, and is calculated from the formula $\frac{W \times L}{b \cdot d^2}$, where W = weight in lbs. which will break the beam, L = the span in feet between the supports, b and d the breadth and depth of the beam in inches; the *Modulus of Transverse Rupture* is 18 times the value of P; Molesworth uses the coefficient K, which is 1/6 of the Modulus of Rupture. *Crushing parallel to the grain* is the stress to which wood is subject in pillars, struts, etc.; the resistance of the wood in the case of short thick pieces is closely related to its hardness, but in the case of long columns, which bend under such stress, rather to its stiffness and toughness. *Crushing across the grain* is the stress to which a block of wood is compressed between two surfaces of equal or larger area than its own, the grain being parallel to the crushing surfaces; and, here again, the resistance is closely related to the hardness of the wood. *Shearing along the grain* takes place when a tenon forces out the material at the edge of a mortise situated close to the end of the piece, or when a beam bends and, owing to compression at the top and tension at the bottom, splits horizontally. *Shearing across the grain* takes place when two pieces, joined by a wooden pin, slide over each other, cutting off the pin; the resistance is closely

dependent on hardness and toughness. *Tensile Strength* in wood is very great; in ordinary Yellow Pine, for instance, it is a little greater than that of cast iron, and $1/5$ that of Bessemer steel, but, as the latter weighs about 12 times as much, the wood has more than twice the tensile strength of such steel; in actual construction, wood is practically never torn in two by a longitudinal pull, shearing or splitting occurring long before this can take place. Across the grain, the tensile strength of wood is very low, a fact which causes cross-grain and knots to be a serious source of weakness in large timbers, especially when these defects occur in the lower half of a horizontal loaded beam. *Stiffness* is closely related to, and constant and only measurable within the limit of, *elasticity*; it is directly proportional to the breadth, proportional to the cube of the depth, and inversely proportional to the cube of the span. *The Modulus of Elasticity*, usually written E , is the force that would lengthen a bar of material of 1 inch section to double its length, or would compress it to zero, supposing it possible to stretch or compress the bar to this extreme extent without breaking it. The formula is: $E = \frac{W \cdot L^3}{4bd^3 \cdot X}$, where L is the clear length between supports in inches, b and d the breadth and depth of the beam in inches, W the weight in lbs., X the deflection (the Greek α in Gamble, expressed in decimals) produced by W . As $L = 12$ inches, $b = 1$ inch, $d = 1$ inch, and therefore $\frac{L^3}{4bd^3} = 432$, to obtain the Modulus of Elasticity from E in Gamble, that letter must be multiplied by 432; to obtain it from the figure given for deflection, that figure must be multiplied by 40×432 , as, in order that a beam may be sufficiently stiff for the carpenter's use, the deflection should not exceed $1/40$ of an inch for each foot of the total length. *Flexibility or Pliability* (Plasticity of the Americans) is the opposite of stiffness and of Elasticity or Resilience; all woods are more or less pliable when deformed beyond the elastic limit, and acquire a permanent set; soft woods are usually more pliable than hard ones; heat and moisture increase pliability, and, for this reason, steaming and boiling are employed in the manufacture of bent-wood furniture, carriage shafts and felloes, boat ribs, and other curved material. *Toughness* has been explained in the Introduction, and may be defined as a property which is directly proportional to the square of the strength whilst inversely proportional to the stiffness. *Brittleness* is the opposite of toughness; and a brittle

wood breaks more or less suddenly and completely soon after deformation beyond elastic limits. As a tough wood is one that resists complete rupture under deformation considerably beyond this point, its value in some crafts can be readily realized; from this also can be understood the difference between a tough and an elastic wood, terms frequently confused because many elastic woods are both tough and elastic, as, for instance, the Yew, which has fair elasticity *up to* the elastic limit, and considerable toughness *beyond* the elastic limit. *Fissibility* is the property which a wood possesses of being split by a wedge driven in the direction of its fibres; it is clearly a form of hardness, but is mainly due to wood possessing long straight and elastic fibres. A wavy or twisted condition of, or a lack of homogeneity in, the fibres implies considerable power in resisting fission; a cross or spiral grain is much more common in tropical than in Northern woods, and consequently only few Indian woods are fissile from an industrial point of view; they may split more or less readily, but they will not split straight, as do the European woods for commercial purposes such as cask-staves, spokes and felloes, shingles, common veneers, and so forth. The property is closely connected with shearing along the grain.

9. Effects of Moisture on Mechanical properties; Fibre-saturation Point; rate of Evaporation; Shrinkage; Case-hardening. All mechanical properties of wood are strongly influenced by the presence of moisture in wood. It increases the weight; the wood is then softer; it is more flexible and less elastic than when dry; mechanical tests also show that wet wood is weaker in the bending, crushing and shearing tests; quite wet or quite dry wood is, however, more fissile than partially dried wood; in torsion tests alone is the strength very little affected by moisture content. All of these statements refer to the natural water content of the wood; air-dry wood may absorb moisture from the atmosphere, or may even be soaked until it contains as much water as in the green condition, without becoming weaker than when it was green. Kiln-dry wood, on the other hand, and wood which has been steamed, will, on being re-soaked, become weaker than even the natural green condition; and the higher the temperature at which it has been dried, the more deleterious are the effects in this way; wherefore, where strength is of importance, wood should only be kiln-dried to the point where the moisture content will correspond to that of a thoroughly air-dry

condition, and it should not be subjected to steam at high pressure; where strength is not, but freedom from shrinkage is, of importance, high temperature and high pressure steam can be employed. *Fibre-saturation Point* is the point at which the free water in the cell-cavities and pores is completely evaporated, and the evaporation of the water saturating the cell-walls begins; it corresponds to a moisture content ranging in various woods from 22.5 to 31.0 per cent. As a rule, light soft woods dry out more rapidly than dense hard ones; water evaporates twice as fast from a radial section ('Rift' or 'Quartered' face, see Chap. III, para. 9), and four times as fast from a cross section, as from a tangential section ('Flat' or 'Slash' face); thin boards dry out rapidly and completely, and soon reach a stage of equilibrium; veneer dries faster than any other kind of converted timber; a 1-inch board dries more than four times as fast as a 4-inch plank and more than 20 times as fast as 10-inch timber; in large timbers, many months or even years are required to evaporate moisture from the interior; after 30 years, an Ebony log was sawn up, and every piece of board sawn cracked and warped more or less; with Sal, the ratio of drying has been found to be $\frac{3}{4}$ -inch depth all round the wood per annum, but it dries very rapidly on the surface and very slowly in the interior. Finally, barked timber dries much faster than unbarked timber. To sum up, the smaller the piece, and at the same time the greater the surface area exposed to drying, the more rapidly will it dry. *Shrinkage* begins when the process of drying has reached the fibre-saturation point. Wood is not a homogeneous substance, and shrinks not only to varying extents in different directions, but usually irregularly even in one direction; lengthwise, it shrinks only about 0.1 per cent, but across the grain from 2 to 14 per cent; transverse shrinkage is generally about twice as great tangentially along the rings as radially across the rings. Sapwood and young wood shrink more than old heartwood; but soft woods, though they seem to do so, do not shrink more than hard woods, but dry out and shrink more rapidly, so that the shrinkage is more easily noticed; the amount of shrinking varies greatly in different woods. From the excess of tangential over radial shrinkage (a) round logs develop wedge-shaped radial splits with the largest part of the crack on the circumference; (b) boards on either side of the heart of a log tend to warp outward, more and more towards the tangent to the circumference. Timber, especially scantlings and boards,

left to lie on the ground, warp and curl up, because the surface touching the ground is kept damp whilst the upper surface dries and shrinks; this is especially the case if the material is left in the sun. *Case-hardening* is a condition which occurs when freshly cut timber is exposed to the air or artificial heat, when water naturally evaporates from the surface leaving the interior green; the outer shell cannot shrink except within its own thickness, for, to contract as a whole, it would have to compress the wet core; generally the shell cracks more or less deeply from the surface inward, widely and deeply in few places in the case of straight grained woods, cross grained woods becoming covered with a network of small fine surface cracks; when the core begins to dry out, it shrinks in its turn, and tries to pull the shell with it; and in loose-structured woods the shell follows the core, and the cracks tend to close up, but the faces shrink more than the corners and become more or less hollow; if the case is, however, very hard, the core in shrinking, but restrained by the shell, splits internally, forming 'Internal cracking, or checking' or 'Honey-combing'. Most woods, dried in the air but not in the sun, will not case-harden enough to do harm; but fresh-sawn wood exposed to the sun, or placed in a steam—or fire—heated dry-air kiln (in kilns where moist air is admitted, case-hardening is largely circumvented) will develop, and the more rapid the process of drying in the beginning the more pronounced will be the, case-hardening; also, if a large timber is dried, and then sawn into boards, the outer boards will warp, as one surface is drier than the other.

II. SEASONING

1. Absence of seasoning in Madras; Lessons from the Philippines.

In the Introduction, it has been stated that there has hitherto been in Madras an absolute disregard for proper seasoning of timbers, and consequently the softer woods have been despised and considered valueless; as will be understood when this chapter has been perused, such operations as are carried on in Madras cannot be called seasoning; the mere leaving of logs lying about in the forest, often with their bark still on, is not seasoning, but in many cases is conducive to rot and the attacks of insects. It has been often assumed that, when authorities like Beddome and Gamble say that a timber cracks and warps in seasoning, such a timber cannot be seasoned without these defects, and its value is depreciated accordingly; this is a mistake; there are precautions that can be taken against every such defect, and, if taken, the timber will, with very few exceptions, season quite sound. The following list of Philippine woods, ranged in their classes of seasoning defects, is very instructive, as it will serve largely to warn users of Madras timbers what defects have to be guarded against and enable them to take the necessary precautions, whilst it also shows that even soft woods, and so-called 'worthless species', can be seasoned properly and have material value.

A—Seasons well :—

- Acle** (and 5 other Albizzias—*23—Rs. 13½–21).
- Agaru** (and 1 other Dysoxylum—*26—only sold as sleepers, Rs. 4½–5½ each, but worth far more for Cabinet work).
- Alakaak** (and 7 other Palaquiums and 1 Bassia (soft)—*9—Rs. 2½–5).
- Almaciga** (Agathis—*6—Rs. 3½).
- Alapag** (Euphoria and 1 Litchi and 1 Nephelium—*30 and 34—Rs. 8½–12½).
- Amamanit** (Soft Eucalyptus—*9—Rs. 2½–6).
- Amugan** (and 1 other Pygeum—*19—Rs. 4).
- Antipolo** (and 3 other Artocarpus—*14—Rs. 3½–4).
- Bacuan-gubat** (Carallia—*12—no fixed prices).
- Bahai** (Ormosia—*17—usually with mixed lumber at Rs. 3½–4, but sometimes as substitute for Tindalo at Rs. 14–20).
- Bakan** (and 7 other Lauraceæ—*15—in log only at Rs. 1½ c.ft.). *
- Balacat** (and 2 other Zizyphus—*17—Rs. 5–5½).
- Balinghasay** (and 5 other Huchananias—*8—Rs. 3½–5).
- Bangkai** (and 1 other Nauclea—*5 and 8—Rs. 6½).

- Banuyo** (Wallaceodendron—*8—Rs. 11½–17½).
 - Batukanag** (and 9 other Aglaias and 1 Aphanomyxis—*29—Rs. 10–12½; but worth much more, rarely come into the market).
 - Bayok** (and 2 other Pterospermums—*11—Rs. 4).
 - Benguet Pine** (and 1 other Pine—*24—Rs. 6).
 - Binggas** (and 2 other Terminalias—*32—Rs. 6½–8½).
 - Bitanhol** (and 2 other Calophyllums—*11—Rs. 8–14½).
 - Bitnag** (Calophyllum—*20—Rs. 10–14½).
 - Botong** (Barringtonia—*12—no fixed price).
 - Canafistula** (Cassia—*23—no fixed price).
 - Dallasi** (and 2 other Terminalias—*32—Rs. 6½–8½).
 - Dugkatan** (and 3 other Lauraceæ—*15—Rs. 10).
 - Guntapal** (and 2 other Alangiums—*26—no fixed price).
 - Himbaba-o** (and 1 other Allaranthus—*3—Rs. 10).
 - Kalamansakat** (and 1 other Terminalia—*17—Rs. 2½–4).
 - Kamingi** (Santiria and 2 Canariums—*9—Rs. 4–5).
 - Kulasi** (and 1 other Lumnitzeria—*26—only sold as sleepers, Rs. 4½–5½ each).
 - Lanutan** (and 1 other Bombycidendron—*11—sold as shafts at Rs. 10 per pair, or bolts at Rs. 15–24 each).
 - Magabuyo** (and 1 other Celtis—*16—Rs. 4).
 - Malasantol** (and 1 other Sandoricum—*10—sold as bolts at Rs. ½–1½ c. ft.).
 - Malubago** (and 1 other Hibiscus—*5—no fixed price).
 - Malugay** (Pometia—*30—Rs. 6½–10).
 - Miao** (Dysoxylum—*26—Rs. 10½).
 - Narra** (and 2 other Pterocarpus—*29—Rs. 16½–27).
 - P'lagao** (and 1 other Xylocarpus—*19—Rs. 5–6½, worth much more for export).
 - Red Lauan** (and 2 other soft Shoreas—*9—Rs. 2½–6).
 - Sudiang** (Ctenolophon—*29—Rs. 12½–16½).
 - Tambulian** (Eusideroxylon—*34—Rs. 12½–16½).
 - Tanglin** (Adenanthera—*21—only sold as substitute for Ipil at Rs. 12½–16½).
 - Tindalo** (Pahudia—*21—Rs. 14–20).
 - Unik** (Soft Albizzia—*10—Rs. 3½–4).
- B—Seasons fairly well warping and cracking but little—**
- Aranga** (and 3 other Homaliums—*20, 26 and 33—Rs. 9–15).
 - Catmon** (and 2 other Dillenas—*12—Rs. 8½–10).
 - Kato** (Amoora—*19—no fixed price).
- C—Liable to stain if not rapidly seasoned—**
- Almon or White Lauan** (and 5 other soft Shoreas and 1 Parashorea and 1 Pentacme—*9—Rs. 2½–6).
 - Anableng** (Trema—*2—as shoe bolts at Rs. ½ c.ft.).
 - Apt-apt** (Avicennia—*18—no fixed price).
 - Balukanad** (and 1 other Aleurites—*7—Rs. 3½, or as match logs Rs. ½ c. ft.).
 - Banalbanal** (11 other Radermacheras—17—Rs. 3½).

- Bangulo** (and 1 other Litsa—*5—Rs. 2½-5).
Banilad (and 7 other Sterculias and 1 Pterocymbium—*1 and 3—Rs. 3½).
Batino (and 3 other hard Alstonias and 1 Paralstonia—*5—Rs. 15, or as sleepers at Rs. 3½-4½ each).
Binuang (Octomeles—*3—Rs. 2½-3½).
Binunga (Macaranga, various species—*7—as shoe bolts, at Rs. ½ c.ft.).
Cupang (and 1 other Parkia—*8—Rs. 3½-4).
Dallnas (and practically any of the ANONACEAE—*16—Rs. 3½-4).
Dapdap (Erythrina—*1—no fixed price).
Dita (Soft Alstonia—*6—no fixed price).
Duguan (and 3 other Myristicas and 1 Knema—*2—Rs. 2½-3½).
Dukiltan (and 1 other soft Sideroxylon—*6—Rs. 3½-5).
Gapasgapas (Cumingia—*5—only sold as substitute for Lanete, q. v.).
Guyungguyung (and 2 other Cratoxylons—*10—occasionally with mixed lumber at Rs. 3½-4).
Gubas (Endospermum—*1—Rs. 3½, or as match logs at Rs. ½ c.ft.).
Kaliwas (and 1 other Kayea—*3—no fixed price).
Kapok (Ceiba—*1—no fixed price).
Lanete (and 1 other Wrightia and various other genera of APOCYNACEAE—*5—Rs. 5-25, or as bolts for carving at Rs. 1½ c.ft.).
Ligas (and 11 other Semecarpus—*3—Rs. 3½-4).
Loktob (Duabanga—*7—Rs. 3½ or less).
Malabulak (Bombax—*6—scarce, no fixed price).
Malanangka (Gymnartocarpus and Yellow Figs—*5, 6 and 7—Rs. 2½-3).
Malapaho (and 2 other Mangiferas—*6—Rs. 3½-4).
Malapapaya (Polyscias—*4—as march bolts at Rs. ½ c.ft.).
Pinkapinkahan (Oroxylum—*7—as shoe and match bolts at Rs. ½ c.ft.).
Putat (and 3 other Barringtonias—*4—no fixed price).
Putlan (Softer Alangium—*17—Rs. 2½-4).
Sampalok (Tamarindus—*27—scarce, no fixed price).
- D—Liable to stain if not rapidly seasoned and warp if not carefully stacked—**
Afu (and 2 other Anisopteras—*9—Rs. 4).
Amugis (Koordersiodendron—*21—Rs. 11-12½).
Malabog (Parishia—*21—Rs. 3½).
- E—Liable to warp if not carefully stacked—**
Allintatau (and 5 other Neonaucleas—*6, 27 and 33—Rs. 13½-15).
Anubing (and 5 other Artocarpus—*14—Rs. 15-15½).
Apliong (and 2 other Dipterocarpus—*9—Rs. 5-6).
Batete (Kingiodendron—*19—Rs. 8½-10½).
Bayabas (Psidium—*25—no fixed price).
Bao (and 1 other Dracontomelum—*6—Rs. 3½-4).
Kalingag (and 1 other Cinnamomum—*9—no fixed price).
Liusin (and 1 other Parinarium—*34—Rs. 8½-11½).
Tangai (and 1 other Ceriops—*21—Rs. 8½-10).
Tanguile (moderately hard Shorea—*9—Rs. 5-6½, much more for export).

- Yacal** (and 2 other Hopeas and 1 Vatica and 1 hard Shorea—*24—Rs. 5-10).
- F—Liable to split at ends if not painted—**
Banaba (and 1 other Lagerstroemia—*11—Rs. 15-16½).
Banakkbok (and 1 other hard Sideroxylon—*21—Rs. 4-5).
Basan (and 6 other Garcinias and 1 Fagraea—*21, 26, 27, 30, and 33—whole supply consumed locally and not sent to market).
Lumbayao (Tarrietia—*22—Rs. 5½-8½).
Sasalit (Vitex—*26 and 33—Rs. 15-21).
- G—Liable to stain if not quickly seasoned and split if not painted at ends—**
Banaul (and 3 other Cyclostemons—*26 and 27—Rs. 7½ or more).
- H—Difficult to season from various causes, given below—**
Anang (and 3 other Diospyros—*26 and 27—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M. Bd. ft.)
Camagon (and 3 other Diospyros—*21 and 28—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M. Bd. ft.)
Kanomol (and 2 other Diospyros—*17—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M. Bd. ft.)
Batulinau (Maba—*27 and 28—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M. Bd. ft.)
(Logs crack in several directions from heart outwards, while sawn timbers warp if not very carefully stacked and weighted, but once thoroughly seasoned it becomes very stable.)
Anislag (Securinega—*12—no fixed price). (Cracks and warps badly if not carefully seasoned.)
Bacauan (and 1 other Rhizophora and 4 Bruguiers—*34—Rs. 8½-10). (Logs and large timbers liable to crack badly, but if properly sawn and carefully stacked seasons with little warping and splitting.)
Bansalagin (and 1 other Mimusops and 1 hard Bassia—*34—Rs. 12½-16½). (Large timbers liable to crack badly, but seasons well in boards if carefully stacked.)
Binolao (and 11 other Eugenas—*25—Rs. 10-13½) (Logs and planks liable to crack internally, but seasons well in board.)
Calantas (Toona and 1 Melia—*10—Rs. 11½-15). (Thick planks liable to internal cracking, otherwise seasons well.)
Dungon (Tarrietia and 1 Heritiera—*34—Rs. 12½-18½). (Logs and large timbers liable to split deeply in seasoning, boards less liable to split, but must be piled carefully and heavily loaded to prevent warping.)
Guljo (Shorea—*24—Rs. 3½-8½) Dries very slowly and liable to split and warp if not seasoned carefully.)
Molave (and 3 other Vitex—*13—Rs. 15-21). (Seasons with very little warping, but very liable to develop large deep irregular cracks, so much so that in tests of 4 x 4 inch x 6 ft. beams the average modulus of rupture was about 20% lower than that of unseasoned ones.)
Iplil (and 1 other Intsia—*23—Rs. 12½-16½). (In large sizes liable to crack badly if not seasoned carefully, does not warp much.)
Kamuning (Murraya—*33—no fixed prices). (Seasons very slowly, but with very little warping and splitting.)
Kuyuskuyus (Taxotrophis—*33—no fixed prices). (Seasons very slowly, but with very little warping and splitting.)
Katabang (and 6 other Quercus—*12—Rs. 10-12½). (Seasons well if carefully stacked, otherwise liable to split and warp considerably.)

- Bangulo** (and 1 other Litsa—*5—Rs. 2½-5).
Banilad (and 7 other Sterculias and 1 Pterocymbium—*1 and 3—Rs. 3½).
Batino (and 3 other hard Alstonias and 1 Paralstonia—*5—Rs. 15, or as sleepers at Rs. 3½-4½ each).
Binuang (Octomeles—*3—Rs. 2½-3½).
Binunga (Macaranga, various species—*7—as shoe bolts, at Rs. ½ c.ft.)
Cupang (and 1 other Parkia—*8—Rs. 3½-4).
Dalinas (and practically any of the ANONACEAE—*16—Rs. 3½-4).
Dapdap (Erythrina—*1—no fixed price).
Dita (Soft Alstonia—*6—no fixed price).
Duguan (and 3 other Myristicas and 1 Knema—*2—Rs. 2½-3½).
Dukilitan (and 1 other soft Sideroxylon—*6—Rs. 3½-5).
Gapasgapas (Cumingia—*5—only sold as substitute for Lanete, q. v.).
Guyungguyung (and 2 other Cratoxylons—*10—occasionally with mixed lumber at Rs. 3½-4).
Iubas (Endospermum—*1—Rs. 3½, or as match logs at Rs. ½ c.ft.).
Kaliwas (and 1 other Kayea—*3—no fixed price).
Kapok (Ceiba—*1—no fixed price).
Lanete (and 1 other Wrightia and various other genera of APOCYNACEAE—*5—Rs. 5-25, or as bolts for carving at Rs. 1½ c.ft.).
Ligas (and 11 other Semecarpus—*3—Rs. 3½-4).
Loktob (Duabanga—*7—Rs. 3½ or less).
Malabulak (Bombax—*6—scarce, no fixed price).
Malanangka (Gymnartocarpus and Yellow Figs—*5, 6 and 7—Rs. 2½-3).
Malapaho (and 2 other Mangiferas—*6—Rs. 3½-4).
Malapapaya (Polyscias—*4—as match bolts at Rs. ½ c.ft.).
Pinkapinkahan (Oroxylum—*7—as shoe and match bolts at Rs. ½ c.ft.).
Putat (and 3 other Barringtonias—*4—no fixed price).
Putian (Softer Alangium—*17—Rs. 2½-4).
Sampalok (Tamarindus—*27—scarce, no fixed price).

D—Liable to stain if not rapidly seasoned and warp if not carefully stacked—

- Afu** (and 2 other Anisopteras—*9—Rs. 4).
Amugis (Koordersiodendron—*21—Rs. 11-12½).
Malabog (Parishia—*21—Rs. 3½).

E—Liable to warp if not carefully stacked—

- Alintatau** (and 5 other Neonaucleas—*6, 27 and 33—Rs. 13½-15).
Anubing (and 5 other Artocarpus—*14—Rs. 15-15½).
Aplong (and 2 other Dipterocarpus—*9—Rs. 5-6).
Batete (Kingiodendron—*19—Rs. 8½-10½).
Bayabas (Psidium—*25—no fixed price).
Bao (and 1 other Dracontomelum—*6—Rs. 3½-4).
Kalingag (and 1 other Cinnamomum—*9—no fixed price).
Lilasin (and 1 other Parinarium—*34—Rs. 8½-11½).
Tangal (and 1 other Ceriops—*21—Rs. 8½-10).
Tangalle (moderately hard Shorea—*9—Rs. 5-6½, much more for export).

- Yacal** (and 2 other Hopeas and 1 Vatica and 1 hard Shorea—*24—Rs. 5-10).

F—Liable to split at ends if not painted—

- Banaba** (and 1 other Lagerstroemia—*11—Rs. 15-16½).
Banakbok (and 1 other hard Sideroxylon—*21—Rs. 4-5).
Basan (and 6 other Garcinias and 1 Fagraea—*21, 26, 27, 30, and 33—whole supply consumed locally and not sent to market).
Lumbayao (Tarrietia—*22—Rs. 5½-8½).
Sasalit (Vitex—*26 and 33—Rs. 15-21).

G—Liable to stain if not quickly seasoned and split if not painted at ends—

- Banaul** (and 3 other Cyclostemons—*26 and 27—Rs. 7½ or more).

H—Difficult to season from various causes, given below—

- Anang** (and 3 other Diospyros—*26 and 27—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M.Bd. ft.)
Camagon (and 3 other Diospyros—*21 and 28—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M.Bd. ft.)
Kanomol (and 2 other Diospyros—*17—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M.Bd. ft.)
Batulinau (Maba—*27 and 28—Rs. 3½-8 or small lots of sound Camagon and Batulinau heart at Rs. 900 per M.Bd. ft.)

(Logs crack in several directions from heart outwards, while sawn timbers warp if not very carefully stacked and weighted, but once thoroughly seasoned it becomes very stable.)

- Anislag** (Securinega—*12—no fixed price). (Cracks and warps badly if not carefully seasoned.)

- Bacauan** (and 1 other Rhizophora and 4 Brugnieras—*34—Rs. 8½-10). (Logs and large timbers liable to crack badly, but if properly sawn and carefully stacked seasons with little warping and splitting.)

- Bansalagin** (and 1 other Mimusops and 1 hard Bassia—*34—Rs. 12½-16½). (Large timbers liable to crack badly, but seasons well in boards if carefully stacked.)

- Binoloan** (and 11 other Eugenias—*25—Rs. 10-13½). (Logs and planks liable to crack internally, but seasons well in board.)

- Calantas** (Toona and 1 Melia—*10—Rs. 11½-15). (Thick planks liable to internal cracking, otherwise seasons well.)

- Dungon** (Tarrietia and 1 Heritiera—*34—Rs. 12½-18½). (Logs and large timbers liable to split deeply in seasoning, boards less liable to split, but must be piled carefully and heavily loaded to prevent warping.)

- Guljo** (Shorea—*24—Rs. 3½-8½). Dries very slowly and liable to split and warp if not seasoned carefully.)

- Molave** (and 3 other Vitex—*13—Rs. 15-21). (Seasons with very little warping, but very liable to develop large deep irregular cracks, so much so that in tests of 4 x 4 inch x 6 ft. beams the average modulus of rupture was about 20% lower than that of unseasoned ones.)

- Ipli** (and 1 other Intsia—*23—Rs. 12½-16½). (In large sizes liable to crack badly if not seasoned carefully, does not warp much.)

- Kamuning** (Murraya—*33—no fixed prices). (Seasons very slowly, but with very little warping and splitting.)
Kuyuskuyus (Taxotrophis—*33—no fixed prices). (Seasons very slowly, but with very little warping and splitting.)

- Katabang** (and 6 other Quercus—*12—Rs. 10-12½). (Seasons well if carefully stacked, otherwise liable to split and warp considerably.)

Kayugala (and 1 other Sindora—*21—Rs. 10). (Seasons slowly but with very little cracking and warping.)

Lamog (Planchonia and 1 Petersianthus—*21—Rs. 6-10). (Liable to honeycomb badly if seasoned in large pieces, and crack and warp if not seasoned very carefully in smaller ones.)

Malabayabas (and 2 other Tristanias and 1 Xanthostemon—*34—Rs. 6-11). (Large logs have often several large heart cracks, and fresh sawn pieces crack superficially if not carefully seasoned, and need to be carefully piled to prevent warping.)

Malapiggan (Trichadenia—*26—Rs. 6½ and upwards). (Liable to crack internally, but seasons with little warping.)

Pagatpat (Sonneratia—*14—Rs. 10-13½). (Rather difficult to season, logs and planks liable to crack internally, but boards season fairly well.)

Tamayuan (Strombosia—*20—Rs. 4-8, or as sleepers at Rs. 3½-4½ each). (Subject to internal cracking in logs and large pieces, but seasons with but little warping.)

Tual (Bischofia—*12—Rs. 4-6). (Cracks and warps badly if not carefully seasoned.)

I—Species concerning seasoning of which no details given—

Agoho (and 1 other Casuarina—*30—Rs. 8½).

Anonang (Cordia—*3—no fixed prices).

Balu (Cordia—*33—no fixed prices).

Banalo (Thespesia—20—no fixed prices).

Bogo (and 2 other Garugas—*10—no fixed prices).

Manggis (Koompassia—*19—no fixed prices).

Note 1.—The rates are given in the Philippine pamphlet in pesos per cubic metre; 1 peso = 5 francs = 3 Rupees; 1 cubic metre = 35.3 c. ft.; roughly, then, the rate per cubic metre divided by 12 gives the rate in rupees per cubic foot; the rates are those existing in the Philippines between 1900 and 1915 (see Chapter IV, para. 8).

Note 2.—From this list it will be seen that it is not possible to lay down principles upon which these defects depend, with perhaps the exception that softer light coloured woods stain; side by side amongst those that season well are the soft to moderately hard Palaquiums (Dichopsis) and the hard to very hard Nepheliums; and similar remarks apply to species liable to other defects. The information here given is the result of practical experience gained after working for many years on a very large commercial scale.

Note 3.—Where the Philippine name includes more than one species in this list, all those species are recognized as commercially identical as far as their timber is concerned.

Note 4.—The Category—*2, 3, 4 (as the case may be)—has been entered in this list for easy reference to the corresponding Madras timbers, and any other information in connection with the woods that may be required. (Chap. V).

2. Phases and Methods of Seasoning. The operation of seasoning comprises two phases: (1) the speedy elimination, as far as practicable, of fermentable or decomposable matters, and especially

proteins and carbohydrates; and (2) the drying of the moisture content of the timber, combined with necessary precautions against staining, warping, cracking and splitting. There are two principal ways of conducting seasoning: (a) Natural, and (b) Artificial, both of which have their champions but the advantages and appropriateness of each is discussed in para. 8.

3. Natural System of Seasoning; Separation of Soft and Hard Woods; Features Common to Both. For the most part, hard woods and soft woods are required for totally different purposes, and, in seasoning, require almost diametrically opposite treatment. Hard woods are ordinarily required for construction or structural parts of machinery, and must be durable being often exposed to alternations of moisture and dryness or to the weather; soft woods are ordinarily required for industrial utilization or temporary purposes, and are adapted only for use under cover away from extreme alternations of climatic influences. The two types must always be considered separately, and be treated on quite different lines. It may be urged that there is a gradual transition in the matter of hardness through the stages very soft, soft, moderately hard, hard, and very or extremely hard; this is so, and here it is impracticable to deal with each individual case, common sense must indicate to which of the two methods of treatment, and with what minor modifications, a timber on the borderland between the two classes should be subjected, taking into consideration chiefly to which of the two classes of utilization the material is intended to be put, and secondly to which of the main defects it is most liable. Although, however, there should be an almost opposite mode of treatment in respect of the soft and hard woods, there are certain features common to both methods: (1) the timbers should be cut up as expeditiously as possible after felling into the scantlings, planks or boards for which they are, or likely to be, ultimately required, and not *ordinarily* left in large logs or baulks; if they are to be so left, the treatment required for their seasoning must be *far* more careful, and must take *far* longer; this will be understood from the difference in time necessary to dry large material compared with small sizes as given in Chapter II, para. 9, added to the fact that the longer the material takes to dry, the greater are the chances of it developing defects; and (2) it is essential that, *during the period drying*, the timbers be kept out of the range of either the sun or of rain, and off the ground; if left lying on the ground they absorb

moisture from the soil on the surface touching the ground, and there is unequal drying and, in consequence, unequal shrinkage and a tendency to both warp and crack; they must therefore be kept under cover raised up in a well-ventilated place, so that all parts of the exterior of the seasoning timber have equal ventilation.

4. Soft Woods; Elimination of Fermentable Material; Bluing and Staining; Barking; Conversion; Soaking; Drying. Soft woods for the most part have no heart-wood; some, such as the Willows and Nutmegs, are more or less highly coloured, but there is no real distinction between the sapwood and heartwood, and soft woods practically consist wholly of coloured or uncoloured sapwood. The sapwood, including in this the thin layer of cambium, is essentially the part that contains the sap, and it is the sap that essentially consists of the easily disintegrating proteins and fermentable carbohydrates, such as starch, sugars, gums and mucilage, and these in decomposing generate first Mildew—which *stains*, or '*blues*', the tissues usually to a dirty bluish grey or green or brown—and later Rot. Fermentation sets in under conditions: (1) when the normal circulation of the living tree ceases; (2) when there is insufficient ventilation; (3) where the temperature rises to between 150 and 160 degrees Fahrenheit; and (4) where there is moisture. Although in Europe the temperature seldom rises to this extent, and consequently there is but little chance of fermentation setting in, yet in this country in the sun and in unventilated places such temperature is common for the greater part of the year, and, unless precautions are taken to prevent it, the fermentation of the sap may be said to be a normal feature, a fact that must be strongly emphasized in considering the comparison of our species with those of Europe. Moisture exists in sufficient quantity in the newly felled tree to allow fermentation to set in. The circulation of sap in the tree ceases immediately after the tree is felled; at once the sap begins to stagnate. As imperviousness is one of the characteristics of cork, which forms the outer layer of the bark, whilst the bark is still left on the felled portion of the tree, free ventilation cannot possibly get to the interior. Wherefore, the very first precaution to be taken against fermentation, and consequent staining, is to *bark the tree*. Another reason why immediate barking is so essential is that, when the tree has been felled, insects can, and almost invariably do, penetrate to the succulent cambium layer; and the longer that layer remains moist and soft, the longer will be the time, and the

greater the chances, during which they can commit depredation. But mere barking is not enough; moisture will remain long in, and ventilation cannot get to, the interior so long as the timber remains in the form of a large log. *Expeditious conversion* into smaller pieces—such as the boards, planks or scantlings as may be intended for the ultimate destiny of the wood—is essential for the preparation of clear unstained material of the soft species. It may be remarked that Gamble, in his *Manual of Timbers*, clearly shows this in his remarks on Bombax, Butea, Hymenodictyon, Alstonia, and Trewia; and says that the instruction applies to all soft pale-coloured woods. *Soaking in water* is the next operation to be undertaken immediately after conversion; but, if immediate conversion after felling is impracticable, then the logs themselves should be soaked in water immediately after barking and until they can be so converted; and, being floaters, they should not merely be thrown into the water, but weighted so as to keep them entirely submerged. As a rule, running water is best, as must be obvious; but, where this is impracticable, there must always be a sufficiency of water to prevent stagnation, and, as the object is to prevent discolouration, the water must be as clean as possible. Many of the proteins, sugars and gums are soluble in water, whilst others are changed first and then wash out; fermentation cannot take place under water during the decomposition of the last, as the water prevents the access of any atmospheric oxygen, a certain amount of which is essential for fermentation. The process of soaking should last for at least ten days; it is obvious that the operation is both more complete and more expeditious with smaller boards, planks and scantlings than would be the case with more bulky logs. Schneider says: 'Logs wholly submerged in water suffer no damage from insects, and little or none from rot, while all manufacturers are agreed that they saw more easily, and that lumber sawn from them seasons more easily and even more rapidly. The more quickly logs are taken from the stump to water, and the less time passes after their being taken from the water and before sawing, the less the logs will deteriorate. Timbers known to stain badly in fresh water or salt, and those known to be attacked by terebo in log-ponds, should, of course, remain in water as short a time as possible'. Tredgold says that salt water is the best medium for soaking timber intended for ship-building, but, for timber to be employed in the construction of dwelling houses, fresh water is better; and this

can be understood seeing that salt is hygroscopic and, if remaining in the wood, would always be liable to draw moisture in damp weather. Tredgold further points out that whilst soaked timber loses in strength, it gains appreciably in lessening the shrinkage and consequently both warping and cracking. These soft woods are not wanted for strength; they are essentially required for common joinery, box-making, spools and other small turned articles, and such purposes; consequently freedom from shrinkage is far more important than strength. Beddome and Brandis point out that *Pongamia glabra* and *Terminalia belerica* are not only better seasoned, but less liable to insect attack, after being soaked in water; Tredgold, too, considers 'water seasoning as a remedy against the worm'; whilst Mathieu shows that, whereas the wood of Holm Oak is normally subject to bad warping and cracking, if soaked in water for a period it becomes considerably absolved from the liability to those defects. *Drying* is the final operation to be undertaken, and a most important one it is. In the case of soft woods, the tendency to deteriorate is far more from fermentation and consequent staining and decay than from warping and cracking, because their softness and open structure assists in warding off the last defects; in shrinking, the tissues close up and become harder in a manner that is not possible in already hard and dense and but little porous woods. (1) In consequence of the above, it is essential that drying should be as rapid as possible, and the best time of the year to carry it out is the *hot weather*; (2) all drying should be carried on under cover in well-ventilated sheds out of the action of the sun on the one hand and of rain or dew on the other; the necessity for a cover is far more important in the tropics than it is in Europe, and for the broad-leaf species than it is for Conifers; (3) the wood must be raised off the ground, so that no moisture can be absorbed from the soil, and so that each piece can receive ventilation on all parts of its surface; stone, concrete or wooden cross-sills should be provided to hold the pile of lumber above the ground, and—especially if the material is to be weighted to prevent warping—these sills must be very firmly constructed; (4) no two pieces should be piled one on top of another touching, but cross-sticks of uniform thickness—one-inch squares of the perfectly dry heartwood of any hard wood are the best arrangement—must be put between every two layers and at not more than three feet apart, preferably two feet, carefully laid in vertical rows above the sills, directly above

one another to prevent the boards being bent, the two end rows being placed at the very end of the lumber in the pile to prevent cupping of the ends and to minimize splitting; except in extremely broad piles, cross-sticks should be long enough to go clear across, so that they will keep the whole pile straight and level; cross-sticks must also be put on each sill under the bottom layer in the pile. If the sills are fixed in place, and not so spaced as just to catch the two ends of the lumber, a platform of heavy planks—as long as, or slightly longer than, the lumber—should be placed on the sills, and the cross-sticks be placed on this platform to suit the exact length of the boards. In the case of very valuable lumber, or of small lots for special purposes, cross-sticks should be put on top of the pile, and loaded with other lumber, to prevent the uppermost boards from warping. Too much care cannot be taken in the first piling of green lumber, especially anything thinner than 2 inch planking; careless piling may cause green boards to take twists that no subsequent treatment can ever straighten out; (5) heavier timber, such as 2.5 inch plank or large dimension stuff, may be laid on sills more than three feet apart, but no dimension stuff should have less than three points of support unless it be unusually short and heavy; (6) the piles of lumber should be given a slope from one side to the other, and there should be spaces between each two courses or layers of lumber, in a way that such spaces and those between any two cross-sticks form 'Chimneys' for circulation, and through which any sawdust lying on the boards, as well as any dust brought by the wind, together with any moisture or rain that may happen to accumulate or beat in on to the boards, may all tend to roll across the boards and fall through the spaces between them; these 'chimneys' also set up a draught and create better ventilation; (7) end-cracking, especially in 2-inch and heavier timber, can to a great extent be prevented by nailing a cover of boards, or even by standing a sloping fence of boards, against the end of the pile; this lessens the rapid evaporation from the ends by excluding the heat of the sun and by lessening somewhat the free access of air; nailing strips on the ends of green boards and planks, though excellent for purely temporary purposes such as during transportation, is a mistake if left for any length of time, as the boards naturally shrink in drying, and split if they are prevented from doing so by nailing; the best arrangement is a wooden clamp with a slot of the depth, but rather longer than the breadth, of the

board, the free end of the slot being filled in by wedges which should be inspected and tightened up by a tap of the hammer every day or two at first, and every week later. If a board is still fresh, and little or not at all cracked at the ends, a coat of any thick oil paint or shellac will often largely prevent cracking, or the ends may be dipped in melted lard and rosin to prevent them from cracking. It must be noted, however, that these precautions of loading for saving from warping and for the prevention from end-cracking are required rather for hard woods than for soft ones.

5. Time required for Seasoning. Schneider appears to have made a slip in his calculations on this point, which would not have been worth noticing except that it might mislead some people in this country. He shows that certain tests were conducted by the United States Bureau of Forestry in 1902, made during the hottest and driest months, July to September, on some green railroad ties (sleepers) of Pine, piled in open piles out of doors, which lost 30 % of the weight of the green wood in the first three weeks; at the end of the next two weeks, they had lost 6 % more, or 36 % in all of the green wood; at the end of the following six weeks they had lost another 4 %, bringing up the total to 40 % of the weight of the green wood. He then says: 'Now, the significant fact here is not the rapidity of evaporation in the beginning, but its extreme slowness, during the last six weeks. Probably one half or more of the original weight of the ties was water (see table on page 21), so that having lost two-fifths only (40 %) of their weight in eleven weeks, and the rate of loss but 6 % in six weeks, it is easy to see that it would take many months to reduce them to an even approximately air-dry condition'. Now, an approximately air-dry condition is one where the wood still contains 10 to 12 % of moisture; if we add this 10 to 12 % to the 40 % lost in the eleven weeks, it brings the total moisture in the green sleepers up to 50 to 52 %, but that is half or more of the original weight; so, seemingly the sleepers *had* in the eleven weeks been reduced to an air-dry condition. Turning now to the table referred to on page 21 of the pamphlet, we find the following: 'Water lost in drying 100 lbs. of green wood in the kiln: Pines, Cedars, etc.: sapwood 45-65 lbs., heartwood 16-25 lbs.; Poplar, Cottonwood, Basswood: sapwood 60-65 lbs., heartwood 16-25 lbs.; Oak, Ash, Beech, Elm, Maple, Hickory, Chestnut, Walnut, Sycamore: sapwood 40-50 lbs., heartwood 30-40 lbs. . . . The highest figure in the table, 65 lbs., is equivalent to a

'moisture content of 185.7 per cent of the resulting dry wood'. It is impossible to suppose that he was referring to the last figure, because that is impracticable for the purposes of such calculations; and throughout he has been dealing with the percentages of the original green weight and not on the totally different basis of the ultimate dry weight. Nor is it likely that he was calculating on the *maximum* percentage of moisture: in the hot weather such maximum is not likely to exist, and besides it is more than probable that sleepers of Pine contained an appreciable amount of heartwood, which would reduce this maximum perceptibly. The heat in this country is greater than in almost any part of America, and drying during the hot weather months here is likely to be accomplished, therefore, in a much shorter period, and probably six weeks for similar scantlings would suffice; but the time of drying would of course depend on the sizes of the boards or scantlings (see Chap. II, para. 9).

6. Hard Woods; Girdling; Barking; Squaring; Soaking; Conversion; Drying. Hard woods, for the most part, consist mainly of heartwood, even if in some cases this is but lightly coloured. In these hard woods, the fermentable matters lie almost wholly in their small sapwood; and the operations take a different course. As before, we want to get rid of the fermentable matters as expeditiously as possible, but in this case we do not require to fell the tree first to effect this. *Girdling* consists in making a deep circular cut through the bark and sapwood into the heartwood of a tree, so as to sever completely the connexion of both sapwood and bark above the cut from below the cut. It is generally made from as near the ground level as possible to about one foot above that, the whole of the bark and sapwood being removed within those limits. The object is the interruption in the upward flow of sap; the leaves draw up such crude sap as remains in the tree above the cut, and passes it down transformed to the roots, or, rather, as far as the cut, where most of it exudes and is evaporated, until finally all the moisture in the tree is exhausted; in course of time (varying from a few days to several weeks; in Burma, 1-2 years is allowed for teak, so as to be quite on the safe side), the tree dies from inability to take up further moisture. The severing of the sapwood and bark band must be absolutely complete, as even a small contact by a very narrow strip of sapwood between the two edges of the cut will often allow the tree to live and occasionally completely recover,

throwing out fresh bark over the wound. The operation is only of service where there is a clear distinction between the heartwood and sapwood; it is based on the principle that the sap flows entirely through the sapwood and not through the heartwood: it is useless for the majority of soft woods which practically consist entirely of sapwood, and which must therefore be completely severed from their roots to stop the flow of sap. By means of girdling, then, the sap with its fermentable matters is removed before the operation of felling is undertaken. After felling, hard woods are ordinarily, and should be, *barked and squared*; owing to the sap having been already eliminated, the barking is, not of such primary importance as in soft woods, nevertheless insects are liable to work their way underneath if it not quickly removed. Squaring is an operation that cuts off the sapwood (except at the angles) down to the heartwood, and forms the round log into a square baulk. The sapwood in the majority of hard wooded trees is valueless compared with the heartwood, and it usually spoils a beam, scantling or plank of hard wood if part of the sapwood is left adhering to the heartwood. The following information given by Schneider for the Philippine woods, however, shows how the sapwood compares with the heartwood: although not completely, it largely holds good for the Madras timbers:—*Sapwood poor*:—Acle (and 5 other Albizzias *23); Amamanit (Soft Eucalyptus *9); Amugis (Koordersiodendron *21); Anislag (Securinega *12); Antipolo (and all Artocarpus *14); Apitong, Palosapis (Dipterocarpus and Anisoptera *9); Bahai (Ormosia *17); Bacauans. (Rhizophora *34); Balinghasay (all Buchanania *8); Banuyo (Wallaceodendron *8); Batete (Kingiodendron *19); Batitinan (Lagerstroemia *11); Calumpit (and 4 other Terminalias *32); Canafistula and Ipil (Cassia and Intsia *23); Dao (Dracontomelum *6); Dungon (Tarrietia and Heritiera *34); Himbaba-o (Allaeanthus *3); Kamatog. (Erythrophloeum *21); Lumbayao (Tarrietia *22); Malugay (Pometia *30); Narig (Vatica *24); Narra (Pterocarpus *29); Pagsahingin (Canarium *9); Tamayuan (Strombosia *20); Tanglin (Adenanthera *21); Tindalo (Pahudia *21); Toog (Petersianthus *21); Unik (Albizzia *8); *Sapwood fair*:—Alintatau (Neonauclea *6 and 27); Baticulins (Litsaea and other Lauraceae *15); Banaba (Lagerstroemia *11); Bangka! (Nauclea *5 and 8); Bangulo (Litsaea *5); Baturakanag and Salakin (Aglaias except 1, see next list, *29); Bitanhol (Calophyllum *11); Catmon (Dillenia *12); Guijo (Shorea *24);

Kato (Amoora *19); Lamog (Planchonia *21); Lanutan (Bombycidendron *11); Macaasim (all Eugenia *25); Malapinggan (Trichadenia *26); Mangachapuy and Yacals (Hopeas *24); Manggis *19); Natos (all Palaquiums and Dichopsis *9); Pagatpat (Sonneratia *14); Supa (Sindora *21); Tuai (Bischofia *12); Urung (Fagraea *26); *Sapwood almost as good as heartwood*:—Agaru, Kayatau and Miao (Dysoxylum *26); Agoho (Casuarina *30); Almaciga (Agathis *6); Alupag, Bulala (Nephelium *30 and 34); Aranga (Homalium *20, 27 and 30); Banau (Cyclostemon *26); Bansalagin (Mimusops *34); Batino (Hard Alstonias *6); Bayok (Pterospermum *11); Betis (Hard Bassia *34); Binggas (Terminalia *32); Binukau (all Garcinias *21, 26, 27 and 30); Guyung-guyung (Cratoxylon *10); Lago (Pygeum *19); Liusin (Parinarium *34); Malabayabas and Mancono (Tristania and Xanthostemon *34); Malacadios (Beilschmiedia *15); Malasantol and Santol (Sandoricum *10); Molave (Vitex *13); Palomaria (Calophyllum *21); Pototans (Bruguiera *34); Sasalit (Vitex *26 and 33); Sudiang (Ctenolophon *29); Tabau (Lumnitzera *26); Tambalau (Myristica and Knema *2); Tambulian (Eusideroxylon *34); Tucangcalao (Aglaias *29). *Soaking* is another operation that is not nearly so important for hard woods as for soft; the main object in soaking the latter is to remove the sap, which in the case of hard woods is effected by girdling, whilst squaring takes off the whole of the sapwood. According to Tredgold, soaking reduces the strength of timber, but he qualifies this statement by saying: 'Tender woods, or those of medium quality, are more altered by these operations than hard woods, or those of good quality'. It is believed by some that because Burma Teak is floated down the Irawaddy it is not so strong as Madras Teak, which ordinarily is not floated; but the Burma Teak is undoubtedly the better for joinery and other purposes where it is essential that there should be little or no shrinkage and warping; and in this connexion attention is drawn to Mathieu's remark about Holm Oak, quoted in para. +. If hard woods are felled at any other period than the beginning of the rainy season, they undoubtedly should be soaked until that season sets in. In hard woods that have undergone girdling and squaring, nothing is to be feared in the way of staining; but, owing to the wood being hard, of dense structure, and usually with small and few pores, the surface drying is invariably faster than the interior drying, and the faster the

surface drying the greater the liability to surface cracks and to case hardening; the only chance, therefore, to avoid or reduce to a minimum cracks of this nature is to start drying in the rains, when the temperature is not so great as in the hot weather and when the prevalent moisture is likely to affect the surface rather than the interior. From the experiment in the United States on sleepers, referred to in the last para., it is evident that the larger part of the evaporation takes place in the first three weeks; it is then, when starting the drying, that the greatest caution has to be taken; and hard woods must be soaked until the rains commence.

Expedition conversion is just as important in the case of hard woods as it is for soft woods, for, the wood being dense and but little porous, it is difficult to get at the interior moisture; but it is just the elimination of this interior moisture at a rate as nearly as fast as the exterior moisture that will save the hard wood from unequal shrinking, warping and splitting, and it can only be brought about by cutting up the logs and baulks; they should thus be cut up green and soaked, unless the log is kept submerged till the rains and then cut up. Schneider says: 'Practically all lumbermen are agreed that, with the exception of a slight loss of weight, there is no advantage in long seasoning in the log. The slight amount of drying that takes place in no way compensates for the severe surface checking, splitting of ends, and damage done by insects and fungi. . . . The more quickly logs are taken from the stump to the water (for floating down to the mills), and the less time passes after their being taken from the water and before sawing, the less the logs will deteriorate'.

Drying:—As already mentioned, the drying of hard woods should be started in the rains; either the logs should be rapidly be taken from stump to water, and completely submerged until the rains begin, or else sawn up and then submerged until the rains begin; the first rapid evaporation from the wood must be arranged to take place when the atmosphere is most humid; the drying in hard woods must be slow; and herein lies the great difference between seasoning hard woods and soft ones. As the drying is to be slow, it starts in the rains, passes through the cold weather, and finally at the end of the hot weather it is probable that all the moisture will have been eliminated down to the air-dry stage, provided that the pieces being dried are not excessively large. Herein we have another difference between what takes place in Europe and in this country; in Europe a joiner does not consider

this wood seasoned unless it has been in store for at least three, or preferably five, years, because the temperature is insufficient to dry the material sooner; in this country one full year should normally suffice, because the final drying during the hot weather is so much more rapid; an exception may perhaps be on the West Coast where the atmosphere is never truly dry as in other parts of the Presidency. Schneider strongly recommends painting the ends of logs immediately after felling and barking, for two purposes: (1) to prevent end-cracking by retarding the excessively rapid evaporation from the cross-section (see Chapter II, para. 9), and (2) chiefly to exclude all possible germs that may induce bluing and other forms of decay. Liquid tar, either hot or cold, or any very thick oil paint, are the most efficient materials; but, in default, a thick paste of clay, or of cow—or buffalo—dung, can be used. When logs have begun to crack, in order to avoid deep splitting, he advocates the use of S-irons, of narrow wedge-shaped cross-section, driven into the logs at right angles to the largest and longest cracks. Other details in connexion with the drying of soft woods given in para. 4, apply also to hard woods; in the case of hard woods, however, loading the scantlings or planks to prevent warping, and painting or clamping the ends to prevent splitting, are usually much more necessary than is the case with soft woods.

7. Benefits of Drying; Surfacing and Finishing; Insects; Durability under Water and under Ground; Wet-rot and Dry-rot

To summarize the advantages of drying timber: (1) it decreases the weight, almost always an advantage, as great weight is desirable in wood only for special purposes; (2) by bringing about the maximum possible shrinkage, it lessens the liability of future changes of form or size; (3) it increases the strength very largely, at least in selected pieces; (4) it prevents or arrests decay, unless the wood is subsequently subjected to moisture, but even under the most severe conditions a well-seasoned piece begins to decay more slowly than a green one; (5) it lessens the liability to attacks of insects; (6) it increases its capability for receiving and retaining a fine and permanent finish. As regards the question of *surfacing and finishing*, on account of the greater hardness and density acquired in the process of drying, especially in the case of soft woods, it can be surfaced more perfectly and given a smoother finish of paint or varnish than can green wood; and the finish is more intimately incorporated into it, and is, so, less likely to peel

off, crack, or become dim, as it so commonly does on unseasoned wood. *Insects*.—Dry wood is less liable to be attacked and destroyed by insect enemies than is green or moist wood, principally because the green wood is softer, and partly also because the nutritive elements are easier of assimilation than those of dry wood. It is certain that both various fungi and some insects work only in living trees, dying—or abandoning the wood, as the case may be—when the trees are felled, or when the wood is sawn up and seasoned. Schneider shows that Calantas (*Toona calantas*, corresponding with our *Cedrela toona*) is often attacked by borer in the living tree; the same is the case with Venteak (*Lagerstroemia lanceolata*); whilst the living *Chrysophyllum* (corresponding to the White Nato and Duklitan *Sideroxylons* of the Philippines) is attacked by a saw-fly, or some such insect, that makes a semi circular arc in the living trees. The question of these defects is other than that of seasoning. Two other classes of insects that seasoning cannot appreciably prevent are termites or white-ants and the teredo. For the most part, termites will not attack the heartwood of hard woods, but they practically attack everything else; to this, however, there are certain exceptions; firstly, it is not certain that they will not attack the heartwood of several hard woods provided that it still contains sap; it is then, of course, softer, and probably it also contains nutritive elements which are easier of assimilation than the absolutely dry wood; wherever there is moisture, white ants find it easier to work and to make their tunnels, but because they make their tunnels over a piece of wood it is not invariably the case, as is sometimes assumed, that they actually devour the wood. Secondly, there are undoubtedly some species which they will not attack, which are neither hard woods nor heart wood; in this connexion may be mentioned *Strychnos nux-vomica*, the wood of which, according to a recent analysis at Dehra Dun, contains 0.49% of Strychnine and 0.75% of Brucine (the seed, according to Watts' Dictionary of Economic Products contains 0.2–0.5% of Strychnine and 0.12–1.20% of Brucine); it has been suggested that by impregnating other non-immune woods with an acid solution containing 1% of Strychnine and 1.5% of Brucine, might make them also immune. *Ailanthus* and *Samadera*, also supposed to contain Brucine, are likewise said to be immune from the attacks of termites, as are some other woods containing bitter principles, such as the Neem tree (*Azadirachta*

indica) and *Berberis*. Against teredo, there seems at present to be no remedy, but certain woods are immune, and it is especially for this reason, as well as its great toughness, that the Guiana Greenheart (*Nectandra Rodiaei*) is so valuable, and a special category of our Madras woods have been ranged with the Greenheart endowed with the same properties. Returning to the question of simple borers, it is evident that from the time a tree is felled to the time that it is completely dried and seasoned is always a period of danger from attack by these pests; and it stands to reason that the quicker this period can be passed the greater is the chance that the material will escape them; as the rapidity of drying, the longest part of the whole process, depends upon the size of the piece to be dried, early conversion is again called for; there is one procedure alone that will safeguard the material during this period, if it is impossible to carry out the conversion or be getting on with the drying of the converted stuff, and that is total submersion. *Durability under water*. This leads us up to the question of durability under water. Schneider has pointed out that so long as a log is totally submerged it suffers no damage from insects, and little or none from rot. Some woods have been known to have been submerged for centuries, and found perfectly sound when taken up. The Alder and the Beech are two European woods that suffer very much from insects when exposed to the air, and have but little durability generally in such conditions; yet under water they are excellent; the same applies very similarly to our common Figs, *Bombax* and *Butea*; and, generally, it may be stated that the majority of woods with little durability in the air are durable for prolonged periods when totally submerged, for the reason that fungi producing decay must have a certain amount of oxygen to develop and live upon, and this they cannot obtain in a piece of submerged wood; whilst aerial insects cannot get at such an object. When, however, it comes to alternations of dry and moisture, such as lock and sluice gates, it is one of the very severest tests a wood can undergo; and only certain species can stand this test; in this connexion, the use of *Gmelina arborea* is brought to notice. *Durability under ground*. Underground, so long as the earth is perpetually wet, as in the case of permanent mud, the same conditions exist as in the case of water. When, however, the soil is not permanently wet, the case is different; the wood in such cases may be practically without air, and yet there is a sufficiency to allow insects to live; and should there be any moisture in the

soil at the same time, there will usually be quite enough oxygen for fungi to develop; amongst the European woods that last well in the ground are the Elm and the resinous Pines, our corresponding woods being the Eugenias and the Dipterocarps. But for this purpose the usual method is to impregnate timbers with creosote, and when creosoted many of the very inferior woods become immune both from insects, including termites, and from fungus; in Europe, the commonest wood used for this purpose is Beech, which, as has been said, is much subject to attacks of insects when not treated; a far larger number of our species could be used for underground work if they were creosoted. Other methods and ingredients are used besides creosote, but here it is unnecessary to discuss the advantages and disadvantages of each. Charring the outside surface of timber before putting it in the ground tends greatly towards its preservation, but great care must be taken that no cracks or crevices leading into the uncharred portion exist, otherwise insects and fungus can penetrate the interior through them. *Wet-rot and Dry-rot*:—Wet-rot is the decay that takes place from the attacks of fungi, when the presence of moisture is more or less evident to the eye; otherwise, it does not materially differ from dry-rot; in the latter, the fungi that cause it are such as can live and grow with only the small amount of moisture present in apparently dry wood; the fungi, that cause these rots, grow through all the elements of the wood, and more or less completely destroy the cell-walls, and bring about in course of time the entire disintegration of the wood.

8. Artificial Seasoning; Choice of Methods. The first attempt to season wood artificially on a commercial scale was made by storing lumber in closed chambers, with a circulation of air heated by means of furnaces or of steam coils. Except a few of the softer woods and Deals, a very large proportion suffered so much from warping, case-hardening, superficial and internal cracking, that kiln-drying was deemed by many to be worse than useless; and when it was realized that the chief defect of air-dry kilns was the uncontrolled and excessively rapid evaporation from the surface, dry-air kilns became obsolete, and experiments were made with moist air; exhaust steam, live steam, and water-jets were all tried to give the proper degree of moisture. Of these, the early ones failed mostly to provide for the heating of the timber through its entire thickness, and maintaining it at a sufficiently high temperature throughout the whole process, and of maintaining the necessary

circulation and proper degrees of heat and humidity; later, the use of thermometers, hygrometers, etc., did much to improve the results. The use of live steam under high pressure for a certain period, ranging from a few hours to several days, and then completely shutting off the steam, by which it was supposed that the removal of the pressure would be sufficient to drive out and evaporate all the moisture in the wood, failed to take into account the fact that the heat in the interior of the timber was absorbed by expansion and evaporation before all the water was driven out; and, further, the use of steam at high pressure involves also the danger of permanently weakening the wood; steam pressure, for four hours on pine sleepers, ranging from 10–100 lbs. permanently weakened them from 11–59%. The following have been shown to be the main points to be observed: (1) the timber should be heated through before drying begins; (2) the air should be very humid at the beginning of the drying process, and should be made drier only gradually; (3) the temperature of the lumber must be maintained uniformly throughout the entire pile, for this an exceedingly large circulation of air is essential; (4) control of the drying process at any given temperature must be secured by controlling the relative humidity, and not by decreasing the circulation; (5) in general, high temperatures permit more rapid drying than low ones do; the higher the temperature of the lumber, the more efficient the kiln; it is believed that temperatures as high as the boiling point of water are not injurious to most woods, provided that all other fundamentally important factors are taken care of; some species, however, may not be able to stand as high temperatures as others; (6) the degree of dryness attained, where strength is the prime requisite, should not exceed that at which the wood is to be used. *Steaming as a preliminary to air drying*:—Recently, however, steaming has been adopted, not to dry the timber—an object in which most processes of steaming previously failed—but merely to *prepare* it for rapid air drying. As long ago as Tredgold's time, it was found that though steaming or boiling impairs the strength and elasticity of timber, it gives another property, which for some purposes is still more desirable than even strength; for boiled or steamed timber shrinks less and stands better than that which is naturally seasoned. Therefore it may often be useful to season timber in this manner when joiner's work is to be executed in British Oak, as without this precaution it requires a long time to season it so as to be fit for

such purposes. The timber should not remain long in boiling water or steam; four hours will in general be sufficient; and after boiling or steaming the drying goes on very rapidly, but it is well not to hasten the drying too much. The recent process is on the above lines; the felling, transportation of logs, and sawing are all carried on with the greatest possible rapidity, so that the timber may enter the steam cylinder as nearly as may be in the green state. After steaming at a low pressure for a short time, the lumber is taken out and left to dry in the open, or, better still, under sheds. Great care, however, must be taken in sorting the timber by species and sizes, and in stacking it very carefully. From the time of Tredgold, it seems to be a recognized fact that (a) material soaked in cold water dries more quickly than that which is not so soaked; (b) that which is soaked in boiling water dries more quickly than that which is soaked in cold water; and (c) that which is steamed dries more quickly than that which is soaked in boiling water. The principle throughout appears to be the same; soaking in cold or boiling water, or steaming, all dissolve out, but to a greater and greater extent, fermentable and other matters which are hygroscopic and tend to retain moisture in the wood fibres and tissues; drying thereafter becomes more and more expeditious. A rag soaked in water will dry more rapidly than one soaked in sugary syrup; and so with wood when the sugary and cognate matters are more and more extracted from it; if the soaking and steaming only removed such components, no material damage would be done to the strength, but it is easy to understand that the more exaggerated and prolonged is the action of soaking and steaming, the greater is the chance of dissolving out components others than those that are both deleterious and retarders of drying. *Choice of Methods*:—The choice between various methods depends in each case on many different circumstances. Schneider says that it has been stated that it is impossible to season wood naturally as well as can be done in a kiln, or, by others, that kiln-drying is only a rapid way of doing what nature does better but at the expense of more time; and that both these statements must be accepted with a measure of reserve. It is probably true that in spite of the most recent improvements made in kilns, certain very refractory woods season better if at least the first steps are taken in drying by the natural slow process, provided that the lumber is in the meanwhile protected from the weather; also wood will, if given time enough, dry out so far that it no

longer swells and contracts except to the slight extent caused by changes in the atmosphere; but thorough kiln-drying reduces even this to a still slighter amount, because it lessens the capacity of the wood to reabsorb atmospheric moisture. Woods much subject to fungus and insect attacks are protected by being seasoned quickly in the kiln. Finally, certain very refractory woods, which formerly had no market value whatever, have become available for even fine cabinet-work, solely through the agency of careful and thorough kiln-drying. Taking into account the lessening of waste, the economy of time and the improvement of the product, there can be no doubt that kiln-drying on the whole is the better process. In small operations, however, the construction of expensive sheds, or of still more expensive drying kilns, or steaming apparatus may be economically impossible. Where a very large number of species are to be handled, kiln-drying, though not impossible, is rendered difficult by the fact that woods of widely varying character do not respond equally to the same treatment, and the separation and increased handling make the operations more expensive; while in handling a comparatively small number of woods, the saving of time in putting a seasoned product on the market compensates for the outlay in preparing it. On the other hand, the question of results attained may be more important than that of expense. Broadly speaking, rapid drying is liable to produce poorer lumber than slow, as it intensifies all the bad results of rapid and uneven shrinkage. Yet, in the case of woods liable to bluing, or to fungus and insect attacks, rapid drying is necessary; while durable woods, not subject to these dangers, may be seasoned as slowly as is convenient.

9. Sawing; Working and Finishing. Before closing this chapter a few other excerpts from Schneider's pamphlet must be given in connection with the above heading. Previous to the American occupation of the Philippines in 1898, there were only a few small water-power and steam sawmills, and probably 99% of the timber was hand-sawn; the Americans have established a considerable number of large steam sawmills, and this contrasts greatly with what prevails in Madras! Even now, in the Philippines, a great deal of sawing continues to be done by hand, mostly by expert Chinese, who can compete with machinery for two causes. (1) they can easily supply small lots of material in odd sizes for special jobs; (2) owing to the close utilization practised by both sawyers

and consumers, there is practically no waste beyond trimmings of ends and sawdust (another contrast with Madras customs!) Further, sawdust is reduced to a minimum by the use of extremely fine thin whip-saws; the kerf of the Chinese whip-saw is less than $\frac{1}{8}$ inch, whilst that of various gang-saws, band-saws, and circular saws in the Mills ranges from $\frac{1}{8}$ to $\frac{1}{4}$ inch. Wood sawn tangentially through a log is said to be 'flat', 'bastard', or 'slash' sawn; sawn radially, it is 'quarter' or 'rift' sawn. Boards sawn radially are those least liable to warp. Originally, the radial sawn logs were sawn first into halves and then into quarters; but, except in very large timbers, that involves more handling and waste in edging than does the newer method, which as nearly as may be effects the same principle, and which usually consists in cutting out the central one-third by means of two cuts, and the three large cants thus produced are then resawn on another machine; the centre cant is resawn parallel to its original cuts, whilst the two outside cants are sawn at right angles to the original cuts; these give large radial planks from the central cant, and smaller nearly radial planks from the outside cants. Radially sawn boards show a much finer grain, the 'Silver grain' in Oaks and the 'Ribbon grain' in cross-grained woods, as the pith-rays are shown to the best advantage, which is not the case with tangentially sawn material. Softer commercial woods are ordinarily both more abundant in bulk and easier to work than hard woods, and, from the Philippines, they are exported in much larger quantities; the heavier woods are, as a rule, difficult to work only on account of their hardness and not especially on account of other qualities, such as crossed or curly grain. Regardless of all the inherent properties of a given wood, which make it suitable for certain purposes, the prime requisite in selecting and preparing material for a job is that it be *well seasoned*; perfection of finish and lasting qualities of the product depend absolutely on this; moreover, the lumber for a given job should have been seasoned in sizes approximating as nearly as possible the rough size of the pieces to be gotten out. Large pieces, whether air-dried slowly for years, or kiln-dried by the most perfect of modern processes, are likely to have their inner and outer portions in different conditions of strain, which may cause even thoroughly dry wood to warp, twist or shrink slightly when these strains are released by cutting up a large piece into smaller dimensions. In all work involving *jointing and gluing*, again, only thoroughly

seasoned material should be used; by means of battens, cross-banding, rim-binding, etc., wood can be prevented from swelling sufficiently to prevent unsightly results, but no amount of battens, screws, dowels or gluing can prevent wet wood from shrinking when it dries; and, if a piece is so firmly held that it cannot shrink as a whole, it must split. Another reason for using dry wood is that glue takes a much firmer hold on dry than on wet wood; firstly, as it penetrates the surface and so incorporates itself thoroughly with the wood, and secondly, as it dries and hardens more thoroughly. *Paints and Varnishes*:—These have two chief purposes, preservation and ornament. A piece of wood, thoroughly seasoned, cannot decay as long as it is kept covered with an unbroken coat of paint or Varnish, for these prevent the entrance of both fungus spores and moisture; on unseasoned wood, however, paint is worse than useless, for fungus infection usually exists under the surface, and the paint in that case facilitates its growth by retarding evaporation of moisture; the same applies to insect attacks; even termites will generally attack only at points not covered with paint, such as cracks, joints, etc. *Enamels* are paints mixed with a varnish base or vehicle instead of oil; they are superior to paints in giving a smoother, harder, tougher and more durable surface; they are also capable of being rubbed, like varnishes or polishes, to either a gloss or matt finish; they are generally applied, for the best results, over one or more coats of the same colour as the finish. *Stains* are solutions (not being solid pigments held in suspension) of colouring matter in oil, alcohol or water, intended to colour the wood without in any way covering or obscuring the natural texture; many substances are employed for staining, which, while not conveying colour in themselves, cause changes in the colour of the wood by chemical means. Stains should, as a rule, be applied to the wood before any filler or first coat is used, as only in this way the full colouring effect can be obtained; if it should roughen the surface, the latter should be gone over lightly with fine sandpaper before applying a filler or a first coat of polish; chemical stains are not affected by subsequent applications of varnish, but solutions are sometimes redissolved by the vehicle of the fillers, varnishes, etc., and, with such, the first coat of finish should be applied rapidly without much rubbing or brushing. *Fillers* are more or less thin pastes used to fill the pores, fine superficial cracks, or joints to a firm and level surface before

applying the first coat of varnish; and are usually of starch coloured with pigments to match the stain applied to the wood; the commercial 'paste fillers' are generally intended to be thinned with some solvent before applying, such as alcohol or turpentine, or, still better, gasoline; the fillers should be mixed to the consistency of thick paint, and applied with cotton-waste or with a large stiff brush, rubbing it well in across the grain of the wood; no fixed rule can be given for the time to elapse between applying it and rubbing it down, the surface must be watched to see whether it has set enough and yet not too hard to make it difficult to remove the surplus from the surface; excess of filler on the surface can be removed by lightly passing a scraper over it, the remainder should be very thoroughly rubbed down across the grain, and left to harden and dry before applying varnish or polish. As the colour effects cannot be judged accurately before drying, several samples of the wood to be used should be tested with the stains and fillers beforehand. *Wax finishes*:--Bees' wax is one of the oldest and most widely known methods of polishing wood, and has the advantage of being both filler and polish; but, in very open grained woods, it is better to use a good filler first; with sufficient rubbing, it gives a highly polished surface, but is not hard and durable, and frequently requires repolishing. A variety of substances are employed instead to give a more resistant surface to the finish. Wax finishes are among the easiest to apply with satisfactory results, while practically all varnishes and polishes require a certain amount of skill. Wax, however, cannot be used as a filler or undercoat on surfaces to be finished with paint. *Varnishes* are compounded of many different kinds of resin, generally combined with oils that dry quickly and completely, both dissolved in turpentine as vehicle; they are transparent, and dry as a homogeneous mass which can be rubbed down with sandpaper, powdered pumice, etc., so as to remove all brush marks, and leave a smooth surface of even texture. For very fine work, such as coach and piano finishing, several coats are rubbed down almost to the grain of the wood, each with successively fine polishing materials.

III. SCHEME OF VALUE CLASSES OF THE TREES IN THE MADRAS PRESIDENCY

1. Commercial Value of Timber. The commercial value of a timber depends on its quantity and on its quality; the quantity depends on the size to which the tree is capable of attaining on the one hand, and on its abundance on the other; whilst its quality depends on its durability on the one hand, and on its power of utilization on the other. A timber of good quality is not commercially valuable if it is not capable of being obtained in quantity; on the other hand, woods not intrinsically of more than inferior quality, become commercially valuable when they attain great size and are abundant, as is the case with Spruce in Europe. In this work, woods of like properties have been brought together into a single category, and, as has been already explained, there is not so much difference between any two species in such category as in the different grades of a single species in Europe, so that the whole of the different botanical species in a category can be classed as one commercial species for wholesale transactions; this increases the abundance of that commercial species as compared with the abundance of any of the botanical species, which can rather be compared with the grades of retail sales in the case of European species; thus, by clubbing them together, we increase the value of the commercial species.

2. Size Class. (= S.) Of this, five classes have been taken, as under—

1 = 4 ft. diameter and over, height being considered as 80 ft., aver.	
2 = 3-4 ft. do. do. 60 „	
3 = 2-3 ft. do. do. 50 „	
4 = 1-2 ft. do. do. 40 „	
5 = under 1 foot. do. do. 25 ft. or less.	

The bulk of the lowest size class trees have not been brought into the tables, and those that have been so brought in almost invariably approach the 1 foot diameter limit.

3. Durability Class. (= D.) This has been abridged from Schneider's Pamphlet on the Philippine timbers; and our timbers have been worked out, as nearly as practicable, on those lines; many of our timbers are precisely the same as the Philippine species, as will

be seen from Chapter IV ; whilst others are commercially identical, as based on his lines of commercial identity.

- 1 = **'Very durable'** ; such woods as are probably rarely attacked by insects, except after having been softened by decay, that is, by attacks of fungi after long exposure to exceptionally severe conditions. They resist exposure to the weather, or contact with the ground, for long periods. All timbers in this class are believed to surpass in durability any commercial timber of the Temperate Zone.
 - 2 = **'Durable'** ; these woods are very rarely attacked by insects, and will last many years even in contact with the ground, or even exposed to weather.
 - 3 = **'Fairly durable'** ; woods of this class are not commonly or severely attacked by insects. They resist the weather fairly well, and last several years even in contact with the ground. Most of the woods of this class would, it is believed, compare with the woods of average durability in the North Temperate Zone.
 - 4 = **'Not durable'** ; these woods, although not termite-proof, are not specially subject to attacks of other insects, i.e., not invariably attacked as are certain other woods ; but the sapwood is often poor in this respect, and woods of this class, unprotected by paint or preservatives, should not be exposed to conditions of constant moisture or of constant alternations between moisture and dryness ; thus, they are not recommended for use in the ground, or for exposure to the weather, when woods of other classes are available. There is included in this class no wood believed to be inferior to the medium grade timbers of the United States, e.g. Oregon Pine.
 - 5 = **'Poor ; attacked by beetles, etc.'** ; certain woods known to be less resistant than the last class to decay and insects ; usually this class is not designated by a number.
4. **Utility Class. (=U.)** Four classes of utility have been adopted:—
- 1 = Many inajor uses ; comprising all big construction works, cabinet work and furniture which demand a high class timber. Engraving, carving, etc., although

major uses, do not command large demands, and have, therefore, been included under the 'few major uses' of the next class.

- 2 = Few major uses, or many medium uses ; these include construction of ordinary buildings, secondary boat-work, carts, agricultural implements, and such like, which demand a good, but not very fine, timber ; oil and sugar-presses, demanding special tough wood, but in limited amount, also come in this class.
- 3 = Few medium uses, or many minor uses ; minor uses are such as box-lumber and other demands, where common woods are used.
- 4 = Few minor uses.

5. **Abundance Class. (=A.)** The Presidency has been taken as the unit of distribution. Four abundance classes have been adopted, as under :—

- 1 = Abundant in many districts.
- 2 = Abundant in few, or common in many districts.
- 3 = Common in few, or scattered in many districts.
- 4 = Scattered in few districts.

Rare species have either been eliminated altogether, or, if the timber is commercially identical with a commoner species, clubbed together with it.

6. **Value Class. (=VC.)** This is computed from the above four classes, by giving the class figure as marks or points, adding all these points together, and if the total comes to

6 or under, the species goes into	...	Class	I
7 to 9,	do.	..	II
10 to 12	do.	...	III
13 to 15	do.	...	IV
16 to 18	do.	...	V

The very best timber imaginable is one that would come into the first class in all four classes, that is, it would be marked with

1 plus 1 plus 1 plus 1, or a total of 4 points ;

it can hardly be expected that any timber would reach this acme of goodness, and a latitude of two points is therefore allowed ; similarly the worst timber imaginable would come into the last class in all four classes, and would receive 5 (size) plus 5 (durability) plus 4 (utility) plus 4 (abundance) or a total of 18 ; here again, a similar

latitude of two points is given ; and so also in the other value classes. When it comes to a complete category, the class cannot be inferior to that of the best species ; as previously remarked, the inferior species of the category merely represent inferior grades of the same commercial species, and can be used for inferior jobs ; their capability of being so used increases the abundance of the category, or commercial species, as a whole ; so, although the category value class cannot be inferior to that of the best species, it may—but it is very rarely, in this work, considered to be so, in order to avoid any appearance of exaggeration—pass into a higher value class.

7. Analysis of Species in Value Classes. Working out the Madras species in the above fashion, and not giving the numerous species of the III and IV class by name, we obtain the following list :—

VC. I — *Calophyllum tomentosum*, *Mesua ferrea*, *Vatica Roxburghiana*, *Hopea parviflora* (incl. *glabra* and *racophloea*), *Hopea Wightiana*, *Filicium decipiens*, *Cedrela toona*, *Schleichera trijuga*, *Dalbergia latifolia*, *Hardwickia binata*, *Xylia dolabriformis*, *Bassia latifolia*, *Tectona grandis*, *Vitex altissima* (incl. *alata* and *pubescens*), *Artocarpus hirsuta*.

VC. II — *Dillenia pentagyna*, *Michelia champaca*, *Michelia nilagirica*, *Garcinia indica* and *Wightii*, *Garcinia cambogia*, *Garcinia echinocarpa*, *Calophyllum Wightianum*, *Poeciloneuron indicum* and *pauciflorum*, *Dipterocarpus indicus*, *Dipterocarpus Bourdillonii*, *Shorea talura*, *Shorea robusta*, *Shorea tumbaggaia*, *Vateria indica*, *Cullenia excelsa*, *Heritiera littoralis*, *Heritiera papilio*, *Pterospermum rubiginosum*, *Azadirachta indica*, *Aglaiia Roxburghiana* (and other sp.), *Soyimida febrifuga*, *Chukrassia tabularis*, *Chloroxylon swietenia*, *Lophopetalum Wightianum*, *Nephelium longana*, *Nephelium stipulaceum*, *Gluta travancorica*, *Ougeinia dalbergioides*, *Dalbergia sissooides*, *Pterocarpus santalinus*, *Pterocarpus marsupium*, *Hardwickia pinnata*, *Tamarindus indica*, *Acrocarpus fraxinifolius*, *Acacia arabica*, *Acacia suma*, *Acacia catechu* (and *sundra*), *Albizzia odoratissima*, *Albizzia amara*, *Terminalia arjuna*, *Terminalia tomentosa*, *Anogeissus latifolia*, *Eugenia hemispherica*, *Eugenia Arnot-*

tiana, *Eugenia Gardneri*, *Eugenia alternifolia*, *Eugenia operculata*, *Eugenia jambolana*, *Lagerstroemia parviflora*, *Lagerstroemia lanceolata*, *Lagerstroemia flos-Reginae*, *Homalium tomentosum*, *Homalium zeylanicum*, *Adina cordifolia*, *Mimusops elengi*, *Mimusops Roxburghiana*, *Mimusops hexandra*, *Maba luxifolia*, *Diospyros assimilis* and *ebenum*, *Diospyros melanoxylon* (incl. *tomentosa* and *tupru*), *Strychnos nux-vomica*, *Gmelina arborea*, *Beilschmiedia fagifolia* and *Wightii*, *Alseodaphne semecarpifolia*, *Bischofia javanica*, *Artocarpus integrifolia*, *Artocarpus Lakoocha*.

VC. III — 179 species.

VC. IV — 132 species.

VC. V — *Cochlospermum gossypium*, *Bombax insigne*, *Sterculia colorata*, *Balsamodendron Berryi* and *mukul*, *Gomphandra axillaris* and *polymorpha*, *Spondias mangifera* and *acuminata*, *Moringa concanensis* and *pterygosperma*, *Sesbania aegyptiaca*, *Barringtonia racemosa*, *Pentapanax Leschenaultii*, *Brassia capitata*, *Euphorbia antiquorum* (incl. *tortilis* and *tirucalli*), *Sapium insigne*, *Ficus asperima*, *Ficus cunia*.

8. Prices of Philippine Timbers. The following extract from Schneider's pamphlet on the Philippine Timbers is both interesting in connection with the above scheme of Value Classes, and also explains how the figures given in Chapter III, para. 1 have been arrived at. 'One of the most difficult matters in any discussion concerning timber is to give a just estimate of prices. The price of a given wood, even when lumber of the same dimensions and quality is in question, may vary in accord with many external conditions. Broadly speaking, as in every other business, supply and demand are the chief governing factors in the long run. Periods of activity and depression in the business world in general have their influence in supply and demand. When, in addition to these general conditions, it is remembered that the same wood varies in price greatly according to the dimensions and quality, (or 'grade', to use the technical term in the lumber trade), it will be seen that any price that is not a quotation for a given class of lumber, for a specific time and place, can only be a broad approximation. The prices cited for the various woods in part V are such approximations,

the maximum and minimum being taken from a great many miscellaneous sources from transactions that date from the years 1900 to 1915. The lowest prices quoted are, in many cases, the prices of Mill run lumber, excluding, of course, slabs and culls, at the Mills in Manila or in the Provinces, whilst the highest prices quoted are for selected lots of lumber of high grade or special dimensions, etc. These prices are included only for the purpose of giving a very general idea as to what these woods have sold for in the past, and should by no means be used as a guide for a prospective purchaser as to what he will have to pay for these woods at present. The fact that the qualities of many woods are not yet well known makes a definite statement as to prices unsafe, as the price for any particular wood is liable to increase or decrease considerably as its uses or suitability become better known, or the supply becomes greater or less. It must be borne in mind that these general prices apply to local use, and do not apply to exported lumber. The natural factors of export must be considered by the foreign buyer and taken into consideration when looking over the figures. Such figures are freight, grade, seasoned material, etc.'

In Madras, no such data and figures for a number of years have ever been put together; nor, indeed, is such statistical information possible; with the exception of the few mills on the West Coast, there is no vestige of any wholesale business, any petty transactions that take place consisting in the picking out of a few species in the most limited quantity, such as in any other business would be on the standard of a very small shopkeeper. The destruction of forest vegetation during the war, whether by fellings for military and naval purposes, or by bombardment on the various battle-fields, or by wilful destruction by the enemy, must all have tended to make the stocks of timber in Europe considerably lower, and even in Canada and America vast quantities have been used for war purposes, which cannot fail to have reduced stocks in those countries as well; on the other hand, vast quantities of material will be required for rebuilding the territories that have been overrun and so greatly destroyed; in these circumstances, the demand for timber throughout the world is bound to be very great indeed for very many years to come, and the value of forest material will be very considerably enhanced.

IV. LIST OF MADRAS, PHILIPPINE AND EUROPEAN TIMBERS

Arranged botanically, **MADRAS** and **PHILIPPINE** side by side for comparison, with the **EUROPEAN** [including Exotic but cultivated (E) and Imported timbers (I), as well as Naturally Indigenous (N) species] arranged at the end of each order.

* **VS.** W = (1. Corks); **S.—R** = (2. Willows); **PkYBsg** = (3. Alders); **Wsg** = (4. Hazels); **W** = (5. Birches, 6. White Deals, 7. Aspens); **M.—R** = (8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); **YB** = (13. Teaks, 14. Jacks, 15. Camphors); **W** = (16. Ashes, 17. Sycamores); **Anom** = (18. Bast-rings); **H.—R** = (19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); **YB** = (23. Walnuts, 24. Sals, 25. Elms); **W** = (26. White Cedars, 27. Malletwoods); **VH.—Bk** = (28. Ebonies); **R** = (29. Rose-woods, 30. Lancewoods, 31. Greenhearts); **YB** = (32. Turkey Oaks); **W** = (33. Olives); **XH.—RYB** = (34. Lignum-vitæ).

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
DILLENIACEÆ		
Dillenia	VC. Cat	Dillenia Cat
1. indica	III*12	luzoniensis (Malacatmōn) *12
2. bracteata	III*12	philippinensis (Catmōn) *12
3. pentagyna	II*12	Reifferschiedia (Catmōn-calabāu) *12
EUROPEAN—(None)		
MAGNOLIACEÆ		
Michelia		
4. champaca	II*13	
5. nilagirica	II*13	
EUROPEAN—(None; Magnolias are cultivated for ornament.)		
ANONACEÆ		
Polyalthia (Mast Tree)	Uvaria	Canangium (2½')
7. coffeoides and fragrans	473. narum (CL.) *5	odoratum (Ilangilang) *16
9. cerasoides	Cyathocalyx	Cyathocalyx (1½')
	474. zeylanicus (t. 20 × 6") *16	globosus (Dalinās) *16

* An abbreviated synopsis of the categories.

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
ANONACEÆ— contd.		
Popowia	Artabotrys	A large number of species belonging to the following genera, much alike in general character, being light to moderately heavy, soft to moderately hard, tough and elastic, of rather fine texture and straight grain, whitish pale-yellow or light-brown, with a conspicuous ladder-like pattern of soft tissue on cross section, are all called (White Lanutan) *16
10. Beddomeana III*16	475. odoratissimus (SH) *16	
Mitrephora	Unona	
11. Heyneana and grandiflora III*16	476. pannosa (t. 30 × 6") and discolor (SH) *16	
Xylopia	478. viridiflora (CL) *5	
13. parvifolia III*16	Polyalthia	
Millusa	479. suberosa (t. 20 × 6") *16	
14. velutina III*16	Phæanthus	
Saccopetalum	480. malabaricus (t. or SH) *16	
15. tomentosum III*16	Goniothalamus	
Alphonsea	481. Thwaitesii and cardiopetalus and Wightii (t. 20 × 6") *16	Alphonsea; Goniothalamus; Mitrephora; Orophea; Phæanthus; Polyalthia; Popowia; Saccopetalum; Sageræa; Xylopia.
16. lutea and zeylanica and madraspatana IV*16	Anona (Custard Apple and Bullock's-heart)	
Orophea	484. squamosa and reticulata (t. 20 × 6") *16	
19. erythrocarpa IV*16	Millusa	
Sageræa	485. indica and nilagrica and Wightiana (t. 20 × 8") *16	
20. laurina and Dalzellii IV*16	Orophea	
	488. uniflora and Thomsoni and zeylanica (t. or SH) *16	
EUROPEAN—		
Orophea (Gnatteria) virgata	(Lancewood of Guiana and Cuba) (I) *30	
Duguetia quitarensis		
MENISPERMACEÆ		
	Cocculus	
	492. laurifolius (t. 20 × 6") *18	
	Tillacora	
	493. racemosa (CL) *18	
BERBERIDACEÆ		
	Berberis	
	494. nepalensis and aristata (t. 20 × 6" or SH) *27	
EUROPEAN—Berberis vulgaris (Barberry, Epine-vinette of the French) (N) *27		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
CAPPARIDACEÆ		
Crataeva	Niebuhria	
22. <i>religiosa</i> IV*5	496. <i>linearis</i> (t. 20 × 6") *18	
Capparis (Caper)		
23. <i>grandis</i> IV*17	Maerua	
	497. <i>arenaria</i> (CL) *18	
	Cadaba	
	498. <i>trifoliata</i> (t. or SH) *18	
	Capparis	
	499. <i>divaricata</i> (t.) *27	
	500. <i>aphylla</i> (t.) *33	
	501. <i>sepiaria</i> (SH sarm) *27	
	502. <i>horrida</i> (CL) *5	
EUROPEAN (None)		
VIOLACEÆ		
	Alsodela	
	503. <i>zeylanica</i> (t. 20 × 6") *5	
EUROPEAN— (None)		
BIXACEÆ		
(Note.—Schneider joins <i>Samydaceæ</i> with the <i>Flacourtiaceæ</i> tribe of this order, making an order <i>Flacourtiaceæ</i> .)		
Cochlospermum (Gold-flowered Cotton)	Flacourtia	Trichadenia (2')
24. <i>gossypium</i> V*1	504. <i>sepiaria</i> (SH) *20	<i>philippinensis</i> (Malapinggan) *26
Scolopia		
25. <i>crenata</i> III*21		
Flacourtia		
26. <i>cataphracta</i> III*21		
27. <i>Ramontchi</i> III*21		
Hydnocarpus		
28. <i>Wightiana</i> III*7		
29. <i>alpina</i> III*26		
Asteriastigma		
30. <i>macrocarpum</i> IV*7		
EUROPEAN— (None)		
PITTOSPORACEÆ		
	Pittosporum	
	505. <i>tetraspermum</i> and <i>nilgherrense</i> and <i>floribundum</i> (t. 30 × 8") *17	
EUROPEAN— (None)		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

POLYGALACEÆ

- Polygala* (Milkwort)
508. *arillata* (SH) * 5
Xanthophyllum
509. *flavescens* (t. 20 × 8") * 27

EUROPEAN—(None)

TAMARISCACEÆ

- Tamarix* (Tamarisk)
31. *gallica* IV* 3
Tamarix
510. *dioica* (t. 15 × 6") * 3
511. *ericoides* (SH) * 3

EUROPEAN—*Tamarix gallica* (Tamarisk) (N)

HYPERICACEÆ

(see note in Gutt)

- Hypericum* (St. John's-wort)
512. *mysorensense* and *Hookerianum* (SH) * 20

EUROPEAN—(None)

GUTTIFERÆ

(Note.—Schneider places *Cratoxylon* in Guttifera and not in Hypericaceæ.)

- Garcinia* (Gamboge)
32. *indica* and *Wightii* II* 26
33. *ambogia* II* 26
34. *echinocarpa* II* 21
35. *morella* III } * 26
36. *travancorica* III } and * 33
37. *xanthochy-mus* III } * 27
38. *spicata* III* 27
Ochrocarpus
39. *longifolius* III* 21
Calophyllum (Poon Spar)
40. *inophyllum* (Alex-andrian Laurel) III* 21
41. *tomentosum* (elatum) I* 11
42. *Wightianum* II* 11
Mesua (Ceylon Ironwood)
43. *ferrea* I* 34

- Cratoxylon* (1½'-2½')
Blancoi (Guyunggayung) * 10
celebicum (Paguringon) * 10
formosum (Salinggogon) * 10
Garcinia (1½'-3')
Benthami (Bunög) * 30
Cumingiana (Malabunög) * 21
binucao (Binukau) * 26
27 and 33
dulcis (Taklanga-nak) * 26
eugeniaefolia (Ba-san) * 27
venulosa (Gatā-san) and 33
Vidali (Piris)
Calophyllum (1½'-4')
Blancoi (Bitanböl) * 11

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

GUTTIFERÆ—contd.

- Poclloneuron*
44. *indicum* and *pauciflorum* II* 30

EUROPEAN—(None)

- Cumingii* (Marabitaog) * 11
inophyllum (Bitāog or Pālo Maria de la Playa) * 21
Whitfordii (Pamitaog-en) * 11
Kayea (1½')
paniculata (Kaliwas) * 3
(sp. ?) (Tandu) * 3

TERNSTROMIACEÆ

- Ternstroemia*
46. *japonica* IV* 10
Eurya (Wild Tea)
47. *japonica* IV* 3
Gordonia (Wild Tea)
48. *obtusata* III* 22

EUROPEAN—(None)

DIPTEROCARPACEÆ

- Dipterocarpus* (Wood Oil, Gurjun Oil)
49. *indicus* II* 9
50. *Bourdillonii* II* 9
Vatica
51. *Roxburghiana* I* 24
Shorea
52. *talura* II* 24
53. *robusta* (Sal) II* 24
54. *tumbaggaia* II* 24
Hopea
55. *parviflora* and *glabra* and *racophloeia* I* 24
56. *Wightiana* I* 24
Vateria (White Dammer)
59. *indica* II* 9
Balanocarpus
60. *utile* and *erosa* III* 9

- Dipterocarpus* (up to 5½')
affinis (Apitong) * 9
grandiflorus (Apitong) * 9
Hasseltii (Apitong) * 9
pilosus (Hagachac) * 9
speciosus (Apitong) * 9
verniciifluus (Pānao) * 9
Anisoptera (3'-6')
brunnea (Afu) * 9
Curtisii (Dāgang) * 9
thurifera (Palosāpis) * 9
Hopea (3'-5½')
basilanaica (Yacāl) * 24
philippinensis (Gisok-gisok) * 24
plagata (Yacāl) * 24
acuminata (Mangachapūy) * 24
Foxworthii (Mangachapūy) * 24
Pierrei (Dalingdinganisak) * 24
Isoptera
borneensis (Yacāl) * 24

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

DIPTEROCARPACEÆ—contd.

Parashorea (5')	
plicata (Bagtican)	* 9
Pentacme (4½')	
contorta (White Lauan)	* 9
Shorea (4½'-5½')	
balangeran (Gisok)	* 24
eximia (Almön)	* 9
guiso (Guljo)	* 24
malaanonan (Mala-anö-nang)	* 9
negrosinensis (Red Lauan)	* 9
polysperma (Tanguile)	* 9
squamata (Mayapis)	* 9
Teysmanniana (Tiaong)	* 9
(sp. ?) (Kalunti)	* 9
(sp. ?) (Danlig)	* 9
(sp. ?) (Mangasinöro)	* 9
(sp. ?) (Malakayän)	* 9
Vatica (2')	
mangachapoi (Närig)	* 24

EUROPEAN—(None)

MALVACEÆ

Thespesia (Portia, Tulip)	Hibiscus (Shoe-Flower)	Thespesia
61. (bis.) populnea IV* 21	515. tiliaceus and canescens and collinus (t. 30 × 8")	populnea (Banalo) * 21
Kydia		Cumlingia (3')
62. calycina IV* 5		philippinensis (Gapas-gapas) * 5
Bombax (Red Silk Cotton)		Bombax (2½')
63. malabaricum III* 6		malabaricum (Malabulak) * 6
64. insigne V* 1		Celba (Eriodendron, True Silk Cotton)
Cullenia		pentandra (Käpok) * 1
65. excelsa II* 11		Bombycidendron (?)
		campylosiphon (Lanütan) * 11
		Vidalianum (Vidal's Lanütan) * 11

EUROPEAN—(None)

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

STERCULIACEÆ

Sterculia		Sterculia		Sterculia (1½'-3')
66. foetida IV* 3		518. populifolia (t.) * 3		Blancoi (Magulipäk) * 3
67. urens IV* 10		Helicteres		crassiramea (Tapinäg) * 3
68. villosa IV* 1		519. Isora (SH) * 16		cuneata (Malabonöt) * 3
69. guttata IV* 1		Eriolaena		foetida (Kalumpäng) * 3
70. colorata V* 3		520. Candollei and Stocksii and Hookeriana and quinquelocularis (t. 30 × 9") IV* 22		luzonica (Malakalumpäng) * 3
71. alata III* 3		Leptonychia		montana (Mountain Tapinäg) * 3
Heritiera		523. moacurroides (t. 30 × 6")		oblongata (Malaböho) * 3
72. littoralis II* 32				philippinensis (Banilad) * 3
73. papilio II* 30				(Note.—If very soft) * 1
Pterospermum				Pterocymbium (3')
74. suberifolium III* 11				tinctorium (Talöto) * 1
75. diversifolium and obtusifolium III* 11				Heritiera (2½')
76. rubiginosum II* 11				littoralis (Dungonläte) * 32
77. reticulatum III* 11				Tarrietia (3'-4')
78. Heyneanum III* 11				javanica (Lumbayao) * 22
79. glabrescens IV* 2				sylvatica (Düngon) * 32
				Pterospermum (1½'-2')
				diversifolium (Bayök) * 11
				niveum (Bayokbayökan) * 11
				obliquum (Kulatingan) * 11

EUROPEAN—(None)

TILIACEÆ

Berrya (Ceylon wood)	Lance-	Grewia
81. ammonilla III* 30		526. populifolia (SH) * 22
Grewia		529. abutilifolia (t. 20 × 6") * 22
82. excelsa III* 22		
83. salvifolia IV* 22		
84. orbiculata III* 22		
85. tiliæfolia III* 22		
87. laevigata IV* 5		
88. microcos IV* 4		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter...	Small material under 1 foot diameter	(Diameters in feet given in brackets)

TILIACEÆ—contd.

Elaeocarpus

89. ganitrus	IV* 5
90. serratus	IV* 5
91. lanceifolius	IV* 5
92. oblongus	IV* 6
93. amoenus	IV* 5
94. tuberculatus	and
aristatus	III* 6
97. ferrugineus	IV* 5
98. Munronii	IV* 6

EUROPEAN—*Tilia europæa* (Lime Tree, Linden, Tilleul of the French) (N) *

LINACEÆ

Hugonia	
530. mystax (SH. sarm)	*27
Erythroxylon	
531. monogynum and lanceolatum (t. 25 × 6")	*29

Ctenolophom (2')
philippinensis
(Sudiang) *29

EUROPEAN—(None)

MALPIGHIACEÆ

Hiptage	
532. madablota and parvifolia (CL. or SH. sarm)	*3

EUROPEAN—(None)

ZYGOPHYLLACEÆ

EUROPEAN—*Gualacum officinale* (Lignum-vitæ) (I) *

RUTACEÆ

Evodia		Melicope	
99. Roxburghiana	IV*17	534. indica (t. or SH.)	*27
Zanthoxylum (Prickly Ash)		Zanthoxylum	
100. Rhetsa	III*17	535. ovalifolium (SH. sar.)	*33
Feronia (Wood Apple)		536. alatum (t. 20 × 6")	*17
103. elephantum	III*26	537. tetraspermum (CL.)	*5
Egle (Bael)		Toddalia	
104. marmelos	III*27	538. aculeata (CL.)	*5

Murraya (2')
exotica (Kamuning) *33

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

RUTACEÆ—contd.

Acronychia	
539. laurifolia (t. 30 × 9")	*17
Glycosmis	
340. pentaphylla (t. 20 × 6")	*27
Murraya	
542. exotica (China Box, Andaman Satinwood) (t. 25 × 8")	*33
543. Koenigii (Curry Leaf) (t. 25 × 8")	*27
Clausena	
544. indica and Willdenovii (t. 30 × 9")	*27
Limonia	
546. acidissima (t. 25 × 8")	*33
547. alata (t. 20 × 6")	*27
Luvunga	
548. eleutherandra (CL.)	*27
Paramignya	
549. monophylla and armata (CL.)	*27
Atalantia (Wild Lime)	
550. monophylla and racemosa and zeylanica (t. 30 × 8")	*33
551. missionis (t.)	*17

EUROPEAN—(None)

SIMARUBACEÆ

Allanthus (Tree of Heaven)		Samadera	
105. excelsa	IV*3	552. indica (t. 30 × 8")	*7
106. malabarica	IV*1	Balanites	
		553. Roxburghii (t. 30 × 8")	*17

EUROPEAN—(None)

OCHNACEÆ

Ochna	
554. squarrosa and Gamblei (t. 30 × 8")	*22
556. Wightiana (t. 30 × 8")	*17
Gomphia	
557. angustifolia (t. 30 × 8")	*22

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
BURSERACEÆ		
Boswellia (Olibanum)	Balsamodendron (Balm of Gilead)	Santiria (2') nitida (Kamingi) * 9
107. serrata IV* 9	558. Berryi and mukul (t. 25 × 8") V* 1	Garuga (2'-3') abilo and Clarkii and littoralis (Bogo) * 10
Garuga		Canarium (2'-3') luzonicum (Pili) * 9
108. pinnata III* 10		villosum (Pagsahingan) * 9
Balsamodendron (Protium)		
109. caudatum IV* 9		
Bursera		
111. serrata III* 19		
Canarium (Black Dammer)		
112. strictum III* 9		
Filicium		
113. decipiens† I* 29		
(Note.—† This is sometimes considered to belong to Sapindaceæ.)		
EUROPEAN—<i>Icica altissima</i> (Guiana White Cedar) (I)		* 26

MELIACEÆ		Azadirachta
Azadirachta (Neem, Margosa)	Cipadessa	integrifolia (Maranggo or Curly Calantās) * 10
114. indica II* 19	560. fruticosa (t. 20 × 6") * 22	
Melia (Bead Tree, Persian Lilac)		Dysoxylum (1½'-3') decandrum (Agāru) * 29
115. composita III* 10		euphlebica (Mião) * 26
Dysoxylum		Turczaninowii (Kayātau) * 26
116. binectariferum and Beddomei and purpureum III* 19		Sandoricum (2'-3') koetjape (Santol) * 10
118. malabaricum (White Cedar) II* 26		Vidalii (Malasantol) * 10
Aglala		Aglala (1'-3') badia * 29
120. Roxburghiana and Maiae and minutiflora and travancorica II* 29		bicolor (Batukanāg) * 29
Lansium		Clarkii (Tucāngcalao) * 29
123. anamallayanum III* 33		diffusa (Malasiging) * 29
Amoora		elaeagnoides (Matamatā) * 29
124. Rohituka (? and canarana and Lawii) III* 19		Everettii (Bulōg) * 29
Walsura		Harmsiana (Malatumbāga) * 29
127. piscidia III* 29		kevigata (Gisihan) * 29
Heynia		Ilanosiana (Bayanti) * 29
128. trijuga III* 26		luzoniensis * 29
Carapa (Xylocarpus)		multifoliola (Kansolud) * 29
130. obovata III* 19		
Soymla (Indian Redwood)		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
MELIACEÆ—contd.		
131. febrifuga II* 34		Turczaninowii (Salamūngi) * 29
Chukrassia (Chittagongwood)		Aphanomyxis (1½') Cumingiana (Salakin) * 29
132. tabularis II* 19		Amoora (3½') Aherniana (Kāto) * 19
Cedrela (Red Cedar, Toon)		Xylocarpus (2'-3') granatum (Piagao) * 19
133. toona I* 10		obovatum (Tabigi) * 19
Chloroxylon (Satinwood)		Toona (2½'-3½') calantas and febrifuga and paucijuga (Calantās) * 10
134. swietenia II* 33		
EUROPEAN—<i>Cedrela odorata</i> (West Indian Red Cedar) (I)		* 10
Swietenia Mahagoni and macrophylla (Mahogany of Central and South America, Acajou of the French) (I)		* 19

CHAILLETIACEÆ		Chaillatia
	563. gelonioides (t. 20 × 6") * 12	
EUROPEAN—(None)		
OLACACEÆ		
Strombosia	Ximenia (W. Indian Seaside Plum)	Strombosia (1½') philippinensis (Tama-yūan) * 20
135. ceylanica III* 20	564. americana (SH) * 21	
Anacolosia	Ola	
136. densiflora III* 20	565. scandens and Wightiana (t. or CL.) * 7	
	Erythralum	
	567. populifolium (CL) * 7	
	Cansjera	
	568. Rheedii (CL) * 7	
EUROPEAN—(None)		

ICACINACEÆ		Gomphandra
Apodytes	138. Benthiana and Beddomeana IV* 4	569. axillaris and polymorpha (t. 30 × 10") V * 4
		Mappla
		570. foetida (incl. tomentosa, ovata, oblonga and elliptica) (t. 30 × 9") * 4
EUROPEAN—(None)		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

AQUIFOLIACEÆ (see note in Cornaceæ).

<i>Ilex</i> (Holly)	<i>Ilex</i>
140. denticulata and malabarica IV* 4	571. Walkeri and Gardneriana (t.) * 4
141. Wightiana IV* 4	

EUROPEAN—*Ilex aquifolium* (Holly, Houx of the French) (N) (30' × 14', usually SH) * 27

CELASTRACEÆ

<i>Euonymus</i> (Spindle Tree)	<i>Euonymus</i>
142. indicus and dichotomus IV* 17	573. crenulatus and paniculatus and ser-ratifolius and angulatus (t. or SH) * 17
<i>Microtropis</i>	<i>Glyptopetalum</i>
144. ramiflora IV* 5	577. zeylanicum and grandiflorum (t. or SH) * 27
<i>Lophopetalum</i>	<i>Microtropis</i>
145. Wightianum II* 10	578. Wallichiana and latifolia and densiflora and microcarpa and ovalifolia (t. 30 × 8" or SH) * 5
<i>Pleurostylia</i>	<i>Celastrus</i> (Staff Tree)
147. Wightii IV* 22	579. paniculatus (CL.) * 3
<i>Kurrimia</i>	<i>Gymnosporia</i> (Staff Tree)
148. bipartita and paniculata IV* 6	584. emarginata and ovata and Rothiana and Heyneana and Royleana and Wallichiana (t. or SH) * 27
<i>Elæodendron</i>	586. montana (t. 20 × 10")
149. glaucum III* 22	<i>Salacia</i>
	587. prinoides and oblonga and reticulata and fruticosa and macrosperma (t. or CL) * 18

EUROPEAN—*Euonymus europæus* (Spindle Tree, Fusain of the French) (N) (t. 20 × 6") * 17

RHAMNACEÆ

<i>Zizyphus</i> (Jujube, Baer)	<i>Ventilago</i>	<i>Zizyphus</i> (1'-3½')
150. jujuba III* 21	588. madraspatana and calyculata (CL) * 3	inermis (Ligāā) * 17
151. xylopyra and horrida III* 21	<i>Zizyphus</i>	trinervia (Duklāp) * 17
	589. trinervia (t. 30 × 10") IV* 17	zonulata (Balācat) * 17

MADRAS

PHILIPPINE

Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
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RHAMNACEÆ—contd.

590. ænoplia (CL) * 10
592. rugosa (t. 30 × 9" or CL) * 10
<i>Rhamnus</i> (Buckthorn)
593. virgatus (t. 10 × 6") * 33
594. Wightii (SH) * 17
<i>Scutia</i>
595. indica (SH. sarm) * 19
<i>Sageretia</i>
596. oppositifolia and hamosa (SH) * 10
<i>Colubrina</i>
597. asiatica and travancorica (SH) * 21
<i>Gouania</i>
598. leptostachya and microcarpa (CL) * 3

EUROPEAN—

Zizyphus vulgaris (Jujube, Acajou d'Afrique of the French) (E) (t. 25 × 8") * 21

Rhamnus

alaternus (Evergreen Buckthorn, Nerprun alaterne of the French) (t. 25 × 8") (N) * 21

catharticus (Buckthorn, Nerprun purgatif of the French) (N) (t. 25 × 6") * 20

frangula (Berry-bearing Alder, Black Alder, Bourdaine of the French) (N) (SH) * 3

AMPÉLIDACEÆ

<i>Vitis</i> (Grape, Vine)
599. pallida and gigantea and Linnæi and semi-cordata and anamallayana (CL. or SH) * 3
<i>Leca</i>
604. sambucina and robusta and integrifolia (t. or SH)

EUROPEAN—[None; *Vitis vinifera* (Grape) is grown for fruit only].

SAPINDACEÆ (see note in Burseraceæ).

(Note.—Sometimes split up into Aceraceæ, Hippocastanaceæ, Sapindaceæ and Staphyleaceæ.)

<i>Hemiglyssa</i>	<i>Allophylus</i>	<i>Euphoria</i> (2')
152. deficiens III* 33	607. cobbe (t. 20 × 5") * 5	cinerea (Alupāg)
153. canescens III* 27	<i>Sapindus</i>	Litchi (3')
<i>Erioglossum</i>	608. erectus and bifolius (t. 30 × 10") * 17	philippinensis (Alupāg-amō)
154. edule III* 30	(sometimes included in Aphania)	

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
SAPINDACEÆ (see note in Burseraceæ).— <i>contd.</i>		
Schleichera (Ceylon Oak)	Bodonaa	Nephellium (1½')
155. trijuga I*34	610. viscosa (t. 20 × 5") *34	mutabile (Bulala) *34
Sapindus (Soapnut)		Pometia (3')
156. trifolius III*27		pinnata (Malugay) *30
Nephellium (Litchi)		
(sometimes divided into		
Nephelium, Euphoria		
and Litchi)		
157. longana II*30		
158. stipulaceum II*30		
Harpullia		
159. cupanioides IV* 6		
Turpinia		
160. pomifera IV* 4		
EUROPEAN—		
Acer (Maple)		
pseudoplatanus (Sycamore, Érable sycomore of the French) (N) (120 × 6') *17		
platanoides (Norway Maple, Érable plane of the French) (N) (80 × 5') *27		
campestris (Common Maple, Érable champêtre of the French) (N) (45 × 4') *27		
monspessulanum (Montpelier Maple, Érable de Montpellier of the French) (N) (45 × 1') *27		
saccharinum (American and Canadian Maple) (I) *27		
Esculus hippocastanum (Horse Chestnut, Marronnier d'Inde of the French) (E) (60 × 3') *1		
Pteroxylon utile (Sneezewood of the Cape, South Africa) (I) *33		
SABIACEÆ		
Meliosma		
161. Wightii IV*10		
162. simplicifolia IV*10		
163. Arnotiana IV*10		
EUROPEAN—(None)		
ANACARDIACEÆ		
Mangifera (Mango)	Rhus (Sumac)	Mangifera (2½')
164. indica III* 6	611. mysorensis and	altissima (Pahutan) * 6
Gluta (Tinnevely Rose-wood)	parviflora (t. 20 × 6") *21	indica (Mangga) * 6
165. travancorica II*29		monandra (Malapaho) * 6
Buchananla		
166. latifolia II* 8		Koordersiodendron (3')
167. angustifolia IV* 8		pinnatum (Amugis) *21
168. lanceolata IV* 8		Buchananla (2')
Odina		arborescens and 5 other
170. wodier III*21		species (Balinghāsav) * 8
Semecarpus (Markingnut)		Parishia (4')
		malabog (Malabog) *21

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
ANACARDIACEÆ—contd.		
171. anacardium IV* 3		Semecarpus (1½')
172. travancorica IV* 3		cuneiformis and
173. auriculata IV* 3		11 other species (Ligas) * 3
Holigarna (Mala bar Black Varnish)		Bracontomelum (2'-3')
174. Arnotiana and fer- ruginea IV* 3		Cumingianum (Lamio) * 6
176. Beddomei and Gra- hamii IV* 3		dao (Dañ) * 6
Nothopegia		
177. Colebrookiana IV*27		
Spondias (Hog Plum)		
178. magifera and acuminata V* 4		
EUROPEAN—		
Pistacia (Pistachio Nut, Mastic)		
terebinthus (Terebinth Mastic, Pistachier térébinthe of the French) (N) (t. 45 × 2') *21		
lentiscus (Chios Mastic, Pistachier lentisque of the French) (N) (SH) *21		
Rhus cotinus (Sumac, Wig Tree, Sumac fustet of the French) (N) (SH) *17		
MORINGACEÆ		
Moringa (Drumstick, Horse Radish Tree)		
612. cancanensis (incl. pterygosperma, much cultivated and run wild) (t. 30 × 10") V*1		
EUROPEAN—(None)		
CONNARACEÆ		
Ellipanthus		
613. Thwaitesii (t. 30 × 10") *2		
EUROPEAN—(None)		
LEGUMINOSÆ		
Ougeinia (Oojoin Rose-wood)	Crotalaria (Rattlewort)	Erythrina (1½')
180. dalbergioides II*29	615. barbata and formosa (SH) * 5	indica (Dapdap) * 1
Erythrina (Coral Tree)	616. lanata and semper- florens and oblecta and fulva and pulcherrima (SH) * 5	Adenanthera
181. stricta IV* 1		intermedia (Tanglin) *21
182. suberosa IV* 1		Albizzia (1½'-4')
Butea		acle (Aclé) *23
183. frondosa III* 3		lebeck (Langil) *23
		lebeckoides (Kariskis) *23

MADRAS

PHILIPPINE

Large trees over 1 foot diameter Small material under 1 foot diameter (Diameters in feet given in brackets)

LEGUMINOSÆ—contd.

- Balbergia** (Rosewood, Blackwood)
184. latifolia (Malabar Rosewood or Blackwood, Bombay Rosewood) I*29
185. sissoides (Malabar Rosewood or Blackwood) II*29
186. lanceolaria III*26
187. paniculata IV*18
Pterocarpus
188. santalinus (Red Sanders) II*34
189. marsupium (Kino) II*29
Pongamia (Indian Beech)
190. glabra IV*17
Ormosia (Necklace Tree)
191. travancorica IV*17
Cassia
192. fistula (Indian Laburnum) III*30
193. marginata III*30
194. siamea III*23
195. timoriensis IV*23
Cynometra
196. ramiflora and Beddomei and travancorica and Bourdillonii III*21
Hardwickia
200. binata I*34
201. pinnata (Malabar Mahogany) II*19
Tamarindus (Tamarind)
203. indica (sap) II*27 (heart) III*34
Humboldtia
204. Brunonis IV*8
205. Vahlia IV*8
206. decurrens IV*8
Bauhinia (Camel's-foot)
207. racemosa IV*8
208. malabarica III*8
209. retusa IV*21
210. purpurea IV*8
211. variegata IV*8
Xyha (Burmese Ironwood, Pyingado)
Indigofera (Indigo)
622. pulchella (t. 6") *26
Milletia
624. racemosa and splendens and rubiginosa (CL) *3
625. auriculata (CL) *18
Mundulea
626. suberosa (t. 25 x 8") *26
Sesbania (Sesban)
627. ægyptiaca (t. 25 x 9") V*1
Aeschynomene (Sola)
628. aspera (t. 15 x 3") *1
Desmodium (Tick Trefoil)
629. umbellatum (SH) *27
630. cephalotes (SH) *27
631. pulchellum (SH) *27
Spatholobus
632. Roxburghii (CL) *18
Butea
633. superba (CL) *18
Balbergia
634. congesta and rubiginosa and coromandelana and rostrata and Gardneriana (CL) *5
637. volubilis and symphetica and tamarindifolia (CL) *27
638. spinosa and monosperma (CL) *18
Berlis
639. scandens and other spe. (CL) *5
640. uliginosa (CL) *18
Sophora
641. glauca and Wrightii and interrupta (SH) *27
Calpurnia
642. aurea (SH) *27
marginata (Unak) *10
procera (Aclengparang) *23
retusa (Kisai) *23
saponaria (Salingkngi) *23
Caesalpinia (1') (Sappanwood) sappan (Sibucão) *21
Cassia (1½')
javanica (Canastula) *23
Erythrophloeum (3')
densiflorum (Kamátog) *21
Gilclridia
sepium (Madrocacão) *23
Intsia (2')
acuminata and bijuga (Ipil) *23
Kingiodendron (3')
alternifolium (Batéte) *19
Koompassia (3')
excelsa (Manggis) *19
Ormosia (2')
calavensis (Bahai) (sap) *17 (heart) *21
Pahudia (4')
rhomboides (Tindalo) *21
Parkia (5½')
Sherfeseei (Kunding) *8
timoriana (Cupang) *8
Pterocarpus (6') (Philippine Rosewood)
Blancoi (Blanco's Narra) echinatus (Prickly Narra) indicus (Narra) all 3 *29
Sindora (5½')
inermis (Kayugalu) *21
supa (Supá) *21
Tamarindus (4')
indica (Sampalok) (sap) *27 (heart) *34
Wallacedendron (4½')
celebicum (Bantyo) *8

MADRAS

PHILIPPINE

Large trees over 1 foot diameter Small material under 1 foot diameter (Diameters in feet given in brackets)

LEGUMINOSÆ—contd.

212. dolabriformis I*34
Adenanthera
213. pavonina III*21
Prosopis (Mesquit, Hindu Penance Tree)
214. spicigera (sap) III*27 (heart) III*34
Acrocarpus (Pink Cedar, Shingle Tree)
215. fraxinifolius II*10
Acacia (Babul, Wattle)
216. planifrons (Umbrella Thorn) IV*21
217. arabica II*21
218. leucophloea III*21
219. suma II*34
220. catechu (incl. sundra) (Cutch or Catechu) II*34
221. ferruginea III*34
Albizia
222. lebbek III*23
223. Thompsoni III*23
224. odoratissima II*23
225. procera III*23
226. stipulata III*10
227. amara II*30
Pithecolobium
228. umbellatum IV*8
229. bigeminum IV*8
230. subcoriaceum and anamallayanum IV*8
Caesalpinia
643. Bonduc and bonducella (CL) *27
644. sepiaria and mimoides and nuga and digyna (CL) *8
Mezoneuron
647. cucullatum (CL) *5
Pterolobium
648. indicum (CL) *5
Wagetea
649. spicata (CL) *5
Cassia
650. glauca (t. 20 x 6") *23
Bauhinia
652. Vahlia and phoenicea and anguina (CL) *18
Entada (Giant's Rattle)
655. scandens (CL) *18
Dichrostachys
656. cinerea (t. 20 x 6") *34
Mimosa
657. rubicaulis and hamata and polyantra (t. 15 x 6") *20
Acacia
658. eburnea (t. 30 x 9") *21
659. latronum (t. 20 x 9") *34
660. concinna and intsia (CL) *5
662. pennata (CL) *10
Pithecolobium
663. geminatum (t.) *8

EUROPEAN—

- Cytisus** Laburnum, or **Laburnum** anagyroides (Laburnum, Cytise faux-ébénier of the French) (N) (30' x 1') *22
Brya ebenus (Jamaica Ebony, Green Ebony, Jamaica Boxwood, Cocus Wood) (I) *28
Robinia pseudacacia (False Acacia, American Locust, Robinier faux-acacia of the French) (E) (80' x 3') *26
Ceratonia siliqua (Carob, Algaroba, African Locust Bean, Caroubier of the French) (N) (60' x 3') *11
Hymenaea courbaril (Animé-Resin, West Indian Locust) (I) *20

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
Dalbergia sissoo (North Indian Rosewood) (I)		*29
Macharium firmum incorruptible legale	(South American Rosewood) (I)	*29
Pterocarpus erinaceus (African Rosewood) (I)		*29
dalbergioides (Andaman Rosewood, Andaman Redwood, Andaman Padouk) (I)		*29
macrocarpus indicus	(Burmese Rosewood, Padouk) (I)	*29
ROSACEÆ		
Pygeum 231. Wightianum and Gardneri III*19	Parinarium (Guinea Plum) 664. indicum and travancoricum (t. 50 x 10") III*31	Parinarium (1'-1½') corymbosum (Liusin) *31 laurinum (Tabontabon) *31
	Photinia 665. Lindleyan and Notoniana (t. 20 x 6") *21	Pygeum (1½'-2') glandulosum (Amugan) *19 Preslii (Lāgo) *19
	Cotoneaster (Rose Box) 666. buxifolia (t. 20 x 6") *33	
EUROPEAN—		
Prunus		
amygdalus (Almond, Amandier of the French) (E) (35' x 1')		*21
persica (Peach, Pêcher of the French; —b. lævis, Nectarine) (E) (25' x 1')		*19
cerasus (Cherry, Cerisier or Merisier of the French) (N) (70' x 2')		*8
mahaleb (Mahaleb Cherry, Cerisier mahaleb of the French) (N) (t. 35 x 8")		*21
communis		
(a) domestica (Plum, Prunier domestique of the French) (E) (35' x 1')		
(b) insititia (Bullace, Prunier sauvage of the French) (N) (35' x 1')		
(c) divaricata (Greengage, Mirabelle of the French) (E) (35' x 1')		*21
(d) damascena (Damson) (E) (35' x 1')		
(e) spinosa (Sloe, Blackthorn, Épine noire or Prunellier of the French) (N) (SH)		
serotina (American Black Cherry) (I)		*8
Cratægus monogynum (May, Hawthorn, Whitethorn, Aubépine of the French) (N) (t. or SH)		*27
Pyrus		
communis (Pear, Poirier of the French) (N) (45' x 3')		*30
malus (Apple, Pommier of the French) (N) (35' x 1')		*21
aria (White Service, Alisier blanc of the French) (N) (4'0 x 1½')		*27
aucuparia (Mountain Ash, Rowan, Alisier des oiseleurs of the French) (N) (40' x 1½')		*20
torminalis (Torminal, Wild Service, Alisier torminal of the French) (N) (45' x 1½')		*21
sorbus (Service, Sorbier domestique of the French) (N) (60' x 4')		*29

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
RHIZOPHORACEÆ		
Carallia 233. integerrima III*12	Rhizophora (Mangrove) 667. conjugata and mucronata (t. 20 x 6") *34	Rhizophora (1½') conjugata (Bacāuan) *34 mucronata (Bacāuan-babāe) *34
Blepharistemma 234. corymbosum III*6	Cerlops (Mangrove) 668. Candolleana and Roxburghiana (t. 20 x 6") *21	Cerlops (¾'-1') Roxburghiana and tagal (Tangāl) *21
	Kandelia (Mangrove) 670. Rheedii (t. 20 x 8") *10	Brugiera (1½'-2½') gymnorrhiza (Husāin) *34 eripetala (Potōtan) *34 caryophylloides (Potōtanlalaki) *34 parviflora (Langārai) *34
	Brugiera (Mangrove) 670. gymnorrhiza and eripetala and caryophylloides and malabarica (t. 30 x 6") *34 671. parviflora (t. 20 x 4") *34	Carallia (1½') integerrima (Bacāuan-gubat) *12
EUROPEAN— (None)		
COMBRETACEÆ		
Terminalia 235. belerica (Beleric Myrobalan) III*17	Calycopteris 673. floribunda (SH. sarm) *8	Terminalia (1½'-3') calamansanai (Malakalumpit) *17 catappa (Talisay) *32 comintana (Binggās) *32
236. chebula (Chebulic Myrobalan) and pallida III*32	Lumnitzera 674. racemosa (t. 20 x 10") *26	edulis (Calumpit) *32 nitens (Sācat) *32 oocarpa (Talisaygubat) *32
236. (bis.) travancor-ensis III*32	Combretum 675. decandrum and acuminatum and ovalifolium and extensum (CL) *5	Blancoi (Kalamansākat) *17
237. arjuna II*32	Quisqualis (Rangoon Creeper) 677. malabarica (CL) *5	Curranii and Darlingii? quadrialata (transferred to Petersianthus, Myrtaceæ; see note, Sch. p. 186).
238. tomentosa (Malabar Walnut) II*32		Lumnitzera littorea (1½') (Tabāu) *26 racemosa (¾') (Kulāsi) *26
240. paniculata III*32		
Anogeissus 241. latifolia (sap) II*27 (heart) II*30		
242. acuminata III*25		
Gyrocarpus 243. Jacquini IV*3		
(Note. Sometimes placed in Hernandiaceæ.)		
EUROPEAN—Terminalia latifolia (West Indian Broadleaf, W. I. Almond) (I) *32		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
MYRTACEÆ		
Eugenia	Rhodomyrtus (Nilgiri)	Eucalyptus (6')
244. Munronii III*25	Guava)	Naudiniana (Amamanit)
244. (bis.) mundagam III*25	678. tomentosa (SH) *30	*3
245. aquea IV*25	Eugenia	Eugenia (2½'-3½')
246. Beddomei III*25	679. Heyneana (t.) *25	Benthami (Macaasim)
247. hemispherica II*25	680. jossinia (t.) *25	*25
248. lata IV*27	681. codyensis and cal-	brevistylis (Sagimsim)
249. cylindrica III*25	cadensis (t.) *25	*25
250. Arnotiana II*25	682. Rottleriana (t.) *25	calucob (Kalubkub) *25
251. Wightiana III*25		clausa (Panglongbōien)
252. zeylanica III*25		*25
253. montana III*25		claviflora (Kurasim) *25
254. Gardneri II*34		costulata (Paitan) *25
255. corymbosa (caryo- phyllæa) III*25		glaucicalyx (Marig) *25
256. utilis III*25		jambolana (Duhāt) *25
257. revoluta III*25		mananquil (Manangkil)
258. myhendra: III*25		*25
259. Neesiana III*25		saligna (Binolban) *25
260. calophyllifolia III		similis (Malarhat) *25
*25		xanthophylla (Malatam- pāi) *25
261. rubicunda III*25		Psidium (1') (Guava)
262. malabarica III*25		guyava (Bayabas) *25
263. alternifolia II*25		Tristania (1½'-2½')
264. operculata II*25		decorticata (Malabayā- bas) *34
265. Stocksii III*25		littoralis (Tāba) *34
266. jambolana II*25		(sp. ?) (Tiga) *34
267. floccosa III*25		Xanthostemon (3½')
268. bracteata IV*27		(Philippine L i g n u m- vitæ or Ironwood)
268. (bis.) Mooniana III		Verdugonianus (Manco- nō) *34
*27		(Note. The following Schneider places in a separate order, Lecy- thidaceæ.)
Barringtonia (Indian		Barringtonia
Oak)		asiatica (2½') (Bōtong)
269. racemosa V*4		*12
270. acutangula III*12		luzonensis and racemosa
Careya		and reticulata and re- voluta (½') (Putat) *4
271. arborea III*21		Planchonia (3')
		spectabilis (Lamōg) *21
		Petersianthus (6')
		quadrialatus (Tōog) *21

EUROPEAN—

Myrtus communis (Myrtle, Myrte of the French) (N) (SH)

*25

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
Eucalyptus		
	globulus (Australian Blue Gum) (I)	*25
	obliqua (Australian Stringy-Bark) (I)	*25
	marginata (Australian Jarrah) (I)	*25
	bicolor (Bastard Box of New South Wales) (I)	*33
	siderophloia (Iron-bark of Australia) (I)	*34
	viminalis-var.?—(Tewart of Australia) (I)	*34
MELASTOMACEÆ		
Memecylon	Melastoma	
272. edule and other	683. malabathricum	*13
species III*33	(SH)	
	Medinilla	
	684. Beddomei and	
	malabarica (SH epph)	*7
EUROPEAN—(None)		
LYTHRACEÆ		
Lagerstræmia (Crape	Woodfordia	Lagerstræmia (3')
Myrtle, Venteak)	685. floribunda (SH)	piriformis (Batitinan)
273. parviflora II*32	IV*22	*11
274. lanceolata I*11		speciosa (Banabā) *11
275. flos-Reginæ II*11		(Note. The following are placed by Schneider in a separate order, Sonneratiaceæ.)
Sonneratia		Duabanga (3')
276. apetala III*14		moluccana (Loktōb) *7
277. acida IV*7		Sonneratia
(roots) *1		caseolaris (1') ? *7
		pagatpat (3') (Pagatpat)
		*14
		(roots) *1
EUROPEAN—(None)		
SAMYDACEÆ		
Casearia	Casearia	(see note to Bixaceæ.)
278. esculenta III*27	686. graveolens and to- mentosa and rubescens	Homallium (2'-3')
Homallium	and wynaadensis (t.	bracteatum and luzoni- ense and oblongifolium
279. nepalense IV*27	30 × 10") *17	and Villarsianum
280. tomentosum (Moul- mein Lancewood) II*30		(Arānga) *20, 27 and 30
281. zeylanicum II*20		
EUROPEAN—(None)		
DATISCACEÆ		
Tetrameles		Octomeles (3')
283. nudiflora III*3		sumatrana (Binuāng) *3
EUROPEAN—(None)		

MADRAS

PHILIPPINE

Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
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ARALIACEÆ

Pentapanax	Aralia	Polyscias (2')
284. Leschenaultii V* 4	687. malabarica (t. 20 x 6") *17	nodosa (Malapapaya) * 4
Brassia	Polyscias	
285. capitata V* 4	688. acuminata (t.) * 4	
	Heptapleurum	
	689. venulosum and rostratum and racemosum and stellatum and Wallichianum (t. usually epph) * 4	

EUROPEAN—(None)

CORNACEÆ

Alangium		(Alangiaceæ of Schneider.)
286. Lamarkii III*26		
Mastixia		Alangium (1'-1½')
287. arborea IV* 7		longiflorum and brachyanthum (Malatapai) *26
288. pentandra IV* 7		salvifolium (Guntapai) *26
		Meyeri (Putian) *17

EUROPEAN—

Cornus	
mas (Cornel, Dogwood, Cornouiller mâle of the French) (N) (t. 25 x 4") *30	
sanguinea (Blood Cornel, Bugwood, Cornouiller sanguin or Bois punais of the French) (N) (SH) *21	
Curtisia faginea (Cape Lancewood, Assegai wood of South Africa) (I) *30	
(Note.—Sometimes considered as belonging to Aquifoliaceæ, which see.)	

CAPRIFOLIACEÆ

Viburnum (Wayfaring Tree, Gueidres Rose)	Viburnum
289. acuminatum IV*20	690. coriaceum (t.) *27
	691. hebanthum and erubescens (t.) *20

EUROPEAN—*Sambucus nigra* (Elder, Surean noir of the French) (N) (30' x 1') * 5

RUBIACEÆ

Sarcocapulus (Sierra Leone Peach)	Wendlandia	Nauclea (1½'-2½')
290. missionis IV*5	692. exserta (t. 30 x 10") *21	<i>Jungbuhnii</i> (Mambog) * 5
Anthocapulus (Cadamba)	693. tinctoria and glabrata (t. 30 x 10") * 2	orientalis (Bangkai) * 8
291. cadamba III* 6		

MADRAS

PHILIPPINE

Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
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RUBIACEÆ—contd.

Adina	Hedyotis	Neonauclea (½'-2½')
292. cordifolia II* 6	694. stylosa and swertiioides (SH) *17	<i>Bartlingii</i> (Lisak)
Stephegyne	Mussaenda	<i>Bernadoi</i>
293. parvifolia and tubulosa III* 6	695. frondosa (SH) * 5	calycina (Calamansanay media
Nauclea	Webera	<i>philippinensis</i> (Tirorön) * 6
295. purpurea IV* 8	696. corymbosa and monosperma and lucens (t. 30 x 8") *27	reticulata (Hambabälud) *27 and *33
Hymenodictyon	Byrsophyllum	<i>Vidalii</i> (Tikim)
296. excelsum III* 5	698. tetrandrum (t. 20 x 8") *27	(sp. ?) (Alintatäu)
297. obovatum IV* 5	Randia	
Wendlandia	699. uliginosa (t. 30 x 10") *37	
298. Notoniana and angustifolia III*21	700. dumetorum (t. 30 x 10") *27	
Randia	701. malabarica and densiflora (t. 30 x 10") *27	
300. Gardneri IV*27	Diplospora	
301. Candolleana IV*27	304. apiocarpa and sphaerocarpa IV*27	
Gardenia	Canthium	
302. latifolia III*27	306. pergracile III*27	
303. turgida III*27	307. didymum and umbelatum and neilgherrense and ficiforme III*27	
Diplospora	311. travancoricum III*27	
304. apiocarpa and sphaerocarpa IV*27	Morinda	
Canthium	312. tinctoria and citrifolia III* 3	
306. pergracile III*27		
307. didymum and umbelatum and neilgherrense and ficiforme III*27		
Octotropis		
705. travancorica (t.) *27		
Canthium		
706. parviflorum and Rheedii and angustifolium (t. 25 x 6") *27		
Ixora		
707. parviflora and brachiata and polyantha and Notoniana and elongata and nigricans (t. 30 x 10") III*22		
Pavetta		
712. indica and hispidula and breviflora (SH) *27		
Psychotria		
713. congesta and Thwaitesii and macrocarpa and elongata and bisulcata and anamallayana (t. or SH) *17		
714. sarmentosa (CL) *17		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

RUBIACEÆ—contd.

- Lasianthus**
715. venulosus and Blumianus (t. or SH) *27
- Saprosma**
716. indicum and fragrans and ceylanicum and corymbosum (t. or SH) *17
- Hamiltonia**
717. suaveolens (SH) *4

EUROPEAN—(None)

COMPOSITÆ

- Vernonia**
718. arborea and trancorica (t. 30 x 9") IV*17
- Microglossa**
719. zeylanica (SH) *17

EUROPEAN—(None)

ERICACEÆ

- Rhododendron** (Rhododendron and Azalea)
313. arboreum IV*10
- (including Vacciniaceæ.)
Vaccinium (Whortleberry, Bilberry)
720. neilgherrense and Leschenaultii (t. 20 x 8") *10
- Gaultheria** (Wintergreen)
782. fragrantissima (SH) *10

EUROPEAN—

Arbutus unedo (Arbutus, Strawberry Tree, Arbousier of the French) (N) (15' x 1') *21

Erica arborea (Tree Heath, Briar-pipe wood, Bruyère of the French) (N) (SH) *10

Rhododendron

ferrugineus (Rusty Azalea, Laurier rose des Alpes of the French) (N) } *10
 (Small shrubs)
 hirsutum (Hairy Azalea, Rhododendron hirsutiss of the French) (N)

MYRSINACEÆ

- Massa**
723. indica (t. 20 x 4") *7
- Myrsine**
724. capitellata (t. 20 x 4") *3

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

MYRSINACEÆ—contd.

- Embella**
725. ribes and viridiflora and adnata and Gardneriana (CL) *3
726. robusta (t. 20 x 4") *3
- Ardisia**
727. courtallensis (incl. paniculata and missionis (t. 20 x 4") *3
728. humilis and pauciflora and rhomboidea (t. 25 x 6") *3
- Egiceras**
729. majus (t. 20 x 4") *3

EUROPEAN—(None)

SAPOTACEÆ

- Chrysophyllum** (Star Apple)
314. Roxburghii IV *6
- Sideroxylon**
315. tomentosum III *21
- Isonandra**
316. lanceolata (incl. villosa, anfractuosa, Candolleana and Perrottetiana) IV *21
- Dichopsis** (Palaquium)
(Gutta-percha)
317. elliptica III *9
- Bassia**
318. latifolia I *31
319. longifolia III *31
320. malabarica IV *19
- Mimusops**
321. elengi II *31
322. Roxburghiana II *31
323. hexandra II *31

EUROPEAN—(None)

- Sideroxylon** (1½'-3')
duclitan (Duklitan) *6
ferrugineum (Mangkās) *21
luzoniensis (Banokbōk) *21
macranthum (White Nāto) *6
- Palaquium** (1½'-4½')
Abernianum (Kalipāya) *9
cuneatum (Malikmīk) *9
Foxworthyi (Tagātoi) *9
gigantifolium (Alakāak) *9
luzoniense (Nāto) *9
Merillii (Dulitan) *9
philippense (Malacmālac) *9
tenuipetiolatum (Manicnic) *9
- Bassia** (2'-3')
betis (Bētis) *31
ramiflora (Baniti) *9
- Mimusops** (2½')
elengi (Bansalāgin) *31

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
EBENACEÆ		
Maba		
324. buxifolia and nigrescens (sap) III*27		Maba (1½) (Spanish Ebony)
(heart) II*28		buxifolia (Batulināu or Ebony) (sap) *27
Diospyros (Ebony, with black heart; Calamander or Zebra Wood, if striped)		(heart) *28
326. pruriens III*20		Diospyros
327. montana III*17		Copelandii (1½) (Tālanggūbat) and discolor (2½) (Camagōn) and Mirandæ (2½) and Whitfordii (1') and pilosanthera (1½) (Bolongōta) and plicata (1½) (Tāmil); of these:—(sap) *20 or *21
328. embryopteris (sap) III*17		(heart) *28
(heart) III*28		philippinensis (1') and Velascoi (½); of these:—(sap) *27
329. toposia III*20		(heart) *28
330. foliolosa III*27		Ahernii (1') (Ānang) and Alvarezii (1½) and Curranii (1½) Malagaitmōn) and foveoreticulata (1½) (Atāāta):—*27
331. ovalifolia III*27		buxifolia (½) and camarinensis (1½) and maritima (1') (Malatinta) and multiflora (2½) (Kanōmoi) and nitida (1') (Katilmā):—*17
332. ebenum (sap) II*27		
(heart) II*28		
333. assimilis (sap) II*21 or II*27		
(heart) II*28		
334. sylvatica III*17		
335. microphylla III*20		
336. chloroxylon III*17		
337. oocarpa (sap) III*27		
(heart) III*27		
338. melanoxylon and tomentosa and tupru (sap) II*21		
(heart) II*28		
339. insignis III*27		
340. Candolleana III*21		
341. nilagirica III*17		
342. affinis III*27		
344. Bourdillonii (sap) III*27		
(heart) III*28		
345. paniculata III*17		

EUROPEAN—

Diospyros

- ebenum (Ebony, Ebène or Plaqueminier of the French) (I) *28
 quaesita (Calamander Wood of Ceylon, Zebra Wood) (I) *28

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
STYRACEÆ		
Symplocos		
346. spicata and kurgensis and Warburgi and macrocarpa and Gardneriana and Beddomei and foliosa and obtusa IV*4		730. racemosa and oligandra and subglabra and monantha and anamallayana and microphylla (t. 30 × 6") *4
EUROPEAN—(None)		
OLEACEÆ		
Schrebera (Weavers' Beam)		
353. swierenioides III*22		Jasminum (Jasmine, Jessamine)
Linociera (Hill Olive)		731. pubescens (CL) *17
354. malabarica III*33		732. arborescens and cordifolia (SH or CL) *5
355. intermedia and leprocarpa IV*17		734. brevilibum (CL) *18
Olea (Olive)		Nyctanthes
356. glandulifera (incl. Bournei) III*22		735. arbor-tristis (t. 20 × 10") *21
357. dioica III*22		Linociera
		736. Wightii and purpurea (t. 20 × 6") *27
		Olea
		737. polygama (t.) *27
		Ligustrum (Privet)
		738. neilgherrense and Walkeri and Roxburghii and Perrottetii and Decaisnei (t. 20 × 10") *27
EUROPEAN—		
Fraxinus —excelsa (Ash Tree, Frêne of the French) (N) (100' × 3') *16		
Olea europea (Olive, Olivier of the French) (N) (50' × 2', but usually t. or SH) *33		
SALVADORACEÆ		
Salvadora		
358. persica IV*5		Azima
		740. tetracantha (SH) *4
EUROPEAN—(None)		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

APOCYNACEÆ

Alstonia		Chilocarpus
359. scholaris III* 6		741. atroviridis (CL) * 5
Tabernaemontana		Carissa (Bengal Currant)
360. dichotoma IV* 5		742. carandas and spinarum and paucinervia (t. or SH) * 27
361. Heyneana IV* 5		743. macrophylla (t. or CL) * 5
Wrightia		Rauwolfia
362. tinctoria IV* 5		744. densiflora * 5
363. tomentosa IV* 5		Hunteria
		745. corymbosa (t. 30 x 8") * 33
		Cerbera
		746. odollam (t. 20 x 6") V* 1
		Thevetia (Yellow Oleander)
		747. neriifolia (t. 20 x 6") * 5
		Ellertonia
		748. Rheedii (CL) * 5
		Holarrhena (Conessi Bark)
		749. antidysenterica (t. 30 x 10") IV* 5
		Vallaris
		750. Heynei (CL) * 5
		Beaumontia
		751. Jerdoniana (CL) * 5
		Chonemorpha
		752. macrophylla (CL) * 5
		Aganosma (Clove Creeper)
		753. caryophyllata and cymosa (CL) * 5
		Anodendron
		754. paniculatum (CL) * 5

ASCLEPIADACEÆ

Gymnema
755. hirsutum (CL) * 18
Dregea
756. volubilis (CL) * 5

EUROPEAN—(None)

EUROPEAN—(None)

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

LOGANIACEÆ

Strychnos		Buddleia
364. nux-vomica (Nux-vomica) II* 27		757. asiatica (t. 15 x 6") * 17
365. potatorum (Clearing Nut) III* 27		Fagraea
		758. obovata and zeylanica (t. 30 x 8", often epph) * 5
		Strychnos
		759. colubrina and Dalzellii and Rheedii and Bourdillonii and Beddomei and cinnamomifolia (CL) * 27

EUROPEAN—(None)

BORAGINACEÆ

Cordia (Sebesten)		Cordia
366. myxa and obliqua IV* 3		760. monoica and Rothii and Perrottetii (t. 20 x 8") * 26
368. McLeodii and fulvosa III* 33		
Ehretia		
369. laevis and aspera and ovalifolia and Wightiana IV* 17		

EUROPEAN—(None)

CONVOLVULACEÆ

Erycibe
761. paniculata (CL) * 18
Argyrea (Elephant Creeper, Silverweed)
762. speciosa and other spe. (CL) * 18

EUROPEAN—(None)

SOLANACEÆ

Solanum (Nightshade)
763. verbascofolium and giganteum and pubescens (t. or SH) * 7

EUROPEAN—(None)

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
BIGNONIACEÆ		
Dolichandrone	Oroxylum	Dolichandrone (1½')
371. Rheedii IV* 7	indicum (t. 30×10") * 7	spathacea (Tuwl) * 7
372. crispa III*17		Oroxylum (2')
373. falcata and Lawii IV*17		indicum (Pinkapinkahan) * 7
375. arcuata IV*17		Radermachera (1½' - 2½')
Stereospermum		acuminata and Elmeri
376. chelonoides III*26		and fenicis and pin-
377. suaveolens III*26		nata (Banaibana) * 17
378. xylocarpum III*33		
Pajanella		
379. Rheedii III*33		
EUROPEAN—Tecoma pentaphylla (Jamaica Boxwood) (I)		* 26
VERBENACEÆ		
Callicarpa	Callicarpa	Vitex
380. arborea III*13	765. lanata (t. 25×8") * 13	Aherniana (2½') (Sasäl-it) * 26 and * 33
Tectona (Teak)		celebica (Kalipapamad-am) (1') * 13
381. grandis I*13	Premna	longifolia (1') (Long-leaf Molave) * 17
Premna	766. integrifolia and corymbosa and coriacea and villosa and Wightiana (t. or CL) * 13	parviflora (9') (Molave) * 13
382. tomentosa III*13	767. latifolia (t.) * 13	pentaphylla (1½') (Kalipapaasun) * 17
Gmelina (White Teak)	Vitex	philippinensis (1') (Tikoko) * 17
383. arborea II*13	768. negundo and trifolia (t. 20×8", usually SH) * 17	pubescens (1') (Hairy-leaf Molave) * 13
Vitex	768. (bis.) leucoxydon (t. 30×10") * 17	Turczaninowii (2') (Lingolingo) * 13
384. altissima and alata and pubescens I*13	Clerodendron	Avicennia (2½')
Avicennia (White Mangrove)	769. infortunatum (t. 30×8", but usually SH) * 13	officinalis (Api-api) * 18
386. officinalis IV*18	Symphorema	
	770. involucreatum and polyandrum (SH. or CL) * 5	
EUROPEAN—		
Tectona		
grandis (Teak) (I)		* 13
Hamiltoniana (?) (Johore Teak) (I)		* 32
LABIATÆ		
	Colebrookia	
	771. oppositifolia (SH) * 17	
EUROPEAN—(None)		

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)
NYCTAGINACEÆ		
	Pisonia	
	772. aculeata (t. or CL) * 8	
EUROPEAN—(None)		
CHENOPODIACEÆ		
	Suaeda (Salt Bush)	
	773. monoica (SH) * 4	
EUROPEAN—(None)		
MYRISTICACEÆ		
Myristica (Nutmeg)		Knema (2')
387. laurifolia and Beddomei III* 2		heterophylla (Tambalau) * 2
388. malabarica IV* 2		Myristica (1½' - 2½')
389. magnifica IV* 2		guatteriaefolia and philippensis and simiarum (Duguan) * 2
390. canarica III* 2		
391. attenuata IV* 2		
EUROPEAN—(None)		
LAURACEÆ		
Cryptocarya (Brazil Nutmeg)		Cryptocarya (1½')
392. Wightiana and Stocksii III*15		bicolor (Dugkatan) * 15
Apollonia		Eusideroxylon (3½')
394. Arnottii III*15		(Borneo Ironwood, Billian)
Bellischmiedia		Zwageri (Tambulan) * 34
395. fagifolia and Wightii II*15		Bellischmiedia (2½')
397. Bourdillonii and oppositifolia III*15		cairocan (Malacadias) * 15
Cinnamomum (Cinnamon, Camphor)		glomerata (Terukan) * 15
398. zeylanicum and sulphuratum and Wightii and macrocarpum III* 9		Behaasia
Machilus		trjandra (Margapali) * 15
402. macrantha III*15		Cinnamomum (2')
Phoebe		Mercadoi (Kalingag) * 9
403. lanceolata III*15		mindanaense (Mindanao Cinnamon) * 9
404. paniculata III*15		Machilus (2')
Alseodaphne		philippinensis (Margapali-kulislau) * 15
405. semecarpifolia II*15		Phoebe (2½')
Actinodaphne		sterculioides (Kaburo) * 15
406. campanulata and lanata and madraspatana and Hookeri III*15		Nothophoebe (2½')
		malabonga (Malabunga) * 15

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

LAURACEÆ—contd.

- Litsæa**
 410. sebifera and to-
 mentosa III*15
 412. polyantha IV* 5
 414. glabrata and Stock-
 sii III*15
 415. Wightiana and
 oleoides and coriacea
 III*15
 416. zeylanica III*15

- Litsæa** (1'-2')
 euphlebia (Matangusa)
 *15
 fulva and luzonica *15
 Garcin (Bangilo) * 5
 glutinosa (Sablöt) *15
 obtusata (Baticulin) *15
 Perrottetii (Mārang or
 White Baticulin) * 5
 philippinensis (Bakān)
 *15
 tayabensis (Sablöt) *15
Neolitsæa
 Vidalii (Pusopiso) *15

EUROPEAN—*Nectandra Rodiei* (Guiana Greenheart) (I) *31

PROTEACEÆ

EUROPEAN—*Grevillea robusta* (Australian Silver Oak, Silk Oak) (I) *12

THYMELÆACEÆ

- Lasiosiphon**
 774. eriocephalus (t.
 25 × 6") *27

EUROPEAN—(None)

ELÆAGNACEÆ

- Elæagnus** (Oleaster)
 775. latifolia (t. 30 × 10"
 or CL) *13

EUROPEAN—(None)

SANTALACEÆ

- Santalum** (Sandalwood)
 776. album (t. 40 × 12",
 rarely larger) *15
Osyris (Poet's Cassia,
 Nepal Tea)
 777. arborea (t.) *21
Scleropyrum (Buffalo
 Nut)
 778. Wallichianum (t.
 25 × 6") *21

EUROPEAN—(None.)

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

EUPHORBIACEÆ

- Euphorbia** (Spurge)
 417. antiquorum and
 tirucalli and tortilis
 V* 7

- Bridella**
 418. retusa III*12

- Phyllanthus**
 419. emblica (Emblie
 Myrobalan) III*12

- Glochidion**
 420. arboreum and
 Hohenackeri and
 neilgherrense and
 Heyneanum IV*12

- Putranjiva** (Amulet Tree)
 424. Roxburghii III*16

- Hemicyclia**
 425. venusta
 426. Wightii and elata
 and travancorica *12

- Cyclostemon**
 427. macrophyllus
 III*26

- Bischofia** (Nilghiri Red
 Cedar)
 429. javanica II*12

- Aporosa**
 430. Lindleyana IV*20

- Daphniphyllum**
 431. glaucescens

- Croton**
 433. malabaricus III*27

- Givotia**
 434. rottleriformis IV* 1

- Ostodes**
 435. zeylanica IV* 7

- Trewia**
 436. nudiflora and poly-
 carpa IV* 6

- Mallotus**
 437. albus IV* 7
 438. philippinensis
 (Kamela Dye Plant)
 III*20

- Clethra**
 439. javanicum IV* 7

- Macaranga**
 440. indica and Rox-
 burghii IV* 7

- Bridella**
 779. montana (t. 30 × 8")
 *21
 780. tomentosa (t.
 25 × 6") *27

- Cleistanthus**
 781. collinus and mala-
 baricus and patulus (t.
 25 × 8") *21

- Phyllanthus**
 782. polyphyllus and
 indicus (t. 20 × 6")
 *27

- Glochidion**
 784. littorale and multi-
 loculare and lancifolium
 and fagifolium and
 ellipticum and velutinum
 (t.) *12

- Flueggia**
 785. microcarpa and
 leucopyrus (t. 15 × 6")
 *21

- Breynia**
 787. rhamnoides (t. 20
 × 6") *21

- Hemicyclia**
 787. sepiaria (t. or SH)
 *33

- Antidesma**
 788. ghassembilla and
 bunius (t. 25 × 8")
 *12

- 789. diandrum and zey-
 lanicum and menasu
 (t. 20 × 8") *12**

- Baccaurea**
 792. courtallensis (t. 20
 × 6") IV* 4

- Croton**
 793. scabiosus (t. 20 × 6")
 *27
 794. oblongifolius (t.
 40 × 10") *17

- 795. caudatus and aro-
 maticus and Klotz-
 schianus and Gib-
 sonianus (t. 25 × 6") *27**

- Securinega** (1½')
 flexuosa (Anislag) *12
Bischofia (4½')
 javanica (Tuai) *12

- Cyclostemon**
 Bordeni (3') (Tinaa-
 pantai) *26
 grandifolius (1½')
 (Banāui) *26
 littoralis (5½')(Batobato)
 *26

- microphyllus** (2½')
 (Butongmanok) *26

- Endospermum** (2½')
 peltatum (Gūbas) * 1

- Aleurites**
 moluccana (Lumbāng)
 * 7
 trisperma (Balukanād)
 * 7

- Macaranga**
 various species (Bi-
 nunga) * 7

MADRAS

PHILIPPINE

Large trees over 1 foot
diameterSmall material under 1
foot diameter(Diameters in feet given
in brackets)

EUPHORBIACEÆ—contd.

Sapum (Devil's Milk)

441. *insigne* V*7

Blachia

797. *umbellata* and re-
flexa and *calycina* and
denudata (t. 20 × 6") *27

Dimorphocalyx

798. *glabellus* and
Lawianus (t. 20 × 6") *27

Agrostistachys

799. *longifolius* and in-
dicus (t. 30 × 8") *17

Mallotus

800. *muricatus* and
Beddomei and rham-
nifolius (t.) *17801. *repandus* (SH or
CL) *27

Homonola

802. *riparia* (SH) *12

Gelonium

803. *lanceolatum* and
multiflorum (t. 30
× 10") *27

Sapum (Devil's Milk)

804. *indicum* (t. 20 × 6") *7

Excoecaria (Devil's Milk)

805. *agallocha* and cre-
nulata and *robusta*
(t. 25 × 10") V *1

EUROPEAN—

Buxus sempervirens (Box, Buis of the French) (N) (50 × 2', but usually t. or
SH) *33*Quercus africana* (African Oak, African Teak, Turtosa) (I) *32

ULMACEÆ

(Note.—Sometimes joined with Moraceæ and Urticaceæ into one order)

Holoptelea (South Indian

Elm)

442. *integrifolia* III*25

Celtis (Nilghiri Elm, Net-

tle Tree, Lotus Tree,

American Hackberry)

443. *tetrandra* III*16

Trema (Charcoal Tree)

444. *orientalis* IV*2

Gironniera

444. (*bis.*) *reticulata*

III*25

Celtis

807. *cinnamomea* (t. 30
× 10") III*33808. *Wightii* (t. 40 ×
10") *33

Celtis (3'-3½')

luzonica (Magabuyo)

*16

philippinensis (Ma-

laikmo) *16

Trema

amboinensis (Ana-

biong) *2

MADRAS

PHILIPPINE

Large trees over 1 foot
diameterSmall material under 1 foot
diameter(Diameters in feet given
in brackets)

ULMACEÆ—contd.

EUROPEAN—

Ulmus (Elm)

campestris (Common Elm, Orme champêtre of the French) (N) (150' × 7') *25*montana* (Wych Elm, Mountain Elm, Orme de montagne of the French) (N)
(100' × 5') *25*americana* (American White Elm;—var.—Canadian Rock Elm) (I) *25*fulva* (American Slippery Elm) (I) *25*racemosa* (American Cork Elm) *25*Celtis australis* (Nettle Tree, Micocoulier of the French) (N) (60' × 3') *16

MORACEÆ

Streblus (Sand-paper Fig)

445. *asper* IV*5

Ficus (Fig)

446. *gibbosa* IV*5447. *bengalensis* (Ban-

yan) III*6

448. *mysorensis* IV*6449. *tomentosa* IV*5451. *altissima* and Bed-

domei and Talboti

IV*6

452. *Benamina* IV*3455. *retusa* IV*3456. *nervosa* and Tri-

meni IV*6

457. *Rumphii* IV*7458. *religiosa* (Peepul)

III*6

459. *Arnottiana* IV*5460. *tjakela* IV*3461. *tsiela* IV*6462. *infectoria* IV*6463. *callosa* IV*7464. *asperima* V*7465. *cunia* V*3466. *glomerata* IV*6

Antiaris (Sackcloth Fig,

Upas Tree)

467. *toxicaria* III*6

Artocarpus (Jack)

468. *hirsuta* (Wild Jack)

I*14

469. *integrifolia* (Com-

mon Jack) II*14

470. *Lakoocha* (Monkey

Jack) II*14

EUROPEAN—

Morus (Mulberry)

alba (White Mulberry, Mûrier blanc of the French) (E) (50' × 4½') *14*negra* (Black Mulberry, Mûrier noir of the French) (E) (50' × 4½') *14

Plecosperrum

809. *spinosum* (SH

sarm) *33

Ficus

810. *hispida* (t. 30 × 8")

*4

Cudrania

811. *javanensis* (SH

sarm) *14

Ficus

(no details) *5, 6 and 7

Gymnartocarpus (2½')*Woodii* (Malanangkā)

*5

Allacanthus (1½'-2') gla-

ber (Malabing) *3

luzonicus (Himbaba-ō)

*3

Taxotrophis

ilicifolia (Kuyuskoyus)

*33

Artocarpus

communis (Antipolo)

*14

Cumingiana (Anubing)

*14

integrifolia (Nangkā)

*14

lamellosa (Kūbi) *14*lanceolata* (Anubing)

*14

ovatifolia (Antipolo) *14*rubrovenia* (Anubing)

*14

subrotundifolia (Anu-

bing)

superba (Anubing) *14*Treculiana* (Antipolo)

*14

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

URTICACEÆ

Villebrunia	
812. integrifolia (t. 20 × 4")	* 4
Debregeasia	
813. velutina (t. 20 × 4")	* 11

EUROPEAN—(None)

PLATANACEÆ

EUROPEAN—

Platanus (Plane Tree)

orientalis (Plane Tree, Platane d'Orient of the French) (E) (110' × 10')	* 27
occidentalis (American Plane Tree, Buttonwood, Platane d'Occident of the French) (E) (100' × 6')	* 27

JUGLANDACEÆ

EUROPEAN—

Juglans (Walnut)

regia (Common Walnut, Noyer of the French) (E) 130' × 5')	* 23
nigra (American Black Walnut) (I)	* 23

Carya (Hickory)

glabra (Pignut Hickory) (I)	* 16
alba (Shell-bark Hickory, Shag-bark Hickory) (I)	* 16
tomentosa (Mockernut Hickory) (I)	* 16
olivæformis (Pecannut Hickory) (I)	* 16
amara (Bitternut Hickory) (I)	* 16
(?) (Nutmeg Hickory) (I)	* 16
aquatica (Water Hickory) (I)	* 16

CASUARINACEÆ

Casuarina—Beef wood, She Oak
(equisetifolia, extensively planted, see) * 30

EUROPEAN—(None)

Casuarina (23)
equisetifolia (Agôho) * 30
Rumphiana (Mountain Agôho) * 30

BETULACEÆ

EUROPEAN—

Betula alba (Birch, Bouleau of the French) (N) (75' × 2')	* 5
Alnus glutinosa (Alder, Aune of the French) (N) (100' × 3')	* 3
Carpinus betulus (Hornbeam, Charme of the French) (N) (60' × 1½')	* 27
Corylus avellana (Hazel, Cob-nut, Nut Tree, Noisetier of the French) (N) (t. or SH)	* 4

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

FAGACEÆ

EUROPEAN—

Quercus (Oak, Chêne of the French)

robur (Common Oak) (N) (175' × 20')	* 12
(a) pedunculata (Peduncled Oak, Black Oak, Chêne pédonculé of the French)	
(b) sessiliflora (Sessile Oak, White Oak, Chêne rouvre of the French)	
cerris (Turkey Oak, Chêne chevelu of the French) (N) (75' × 2½')	* 32
ilex (Holm Oak, Evergreen Oak, Chêne yeuse of the French) (N) (50' × 3')	* 29
suber (Cork Oak, Chêne liège of the French) (N) (40' × 5')	* 29
alba (American and Canadian White Oak) (I)	* 12
Castanea vesca (Chestnut, Châtaigner of the French) (N) (100' × 10')	* 11

SALICACEÆ

Salix (Willow)

471. tetrasperma and
ichnostachya IV * 2

EUROPEAN—

Salix

alba (White Willow, Saule blanc of the French) (N) (75' × 3')	* 2
fragilis (Crack Willow, Saule fragile of the French) (N) (40' × 1')	* 2
caprea (Sallow, Goat Willow, Saule marceau of the French) (N) (35' × 1')	* 2
pedicellata (Glaucous Sallow, Saule pédicellé of the French) (N) (SH)	* 2
Populus (Poplar)	
tremula (Aspen, Peuplier tremble of the French) (N) (100' × 1½')	* 7
nigra (Black Poplar, Peuplier noir of the French) (E) (110' × 12')	* 7
(b) pyramidalis (Lombardy Poplar, Peuplier d'Italie of the French) (E) (110' × 12')	* 1
alba (White Poplar, Abele, Peuplier blanc of the French) (N) (100' × 3')	* 2
canescens (Common Poplar, Grey Poplar, Peuplier grisaille of the French) (N) (70' × 2')	* 7
canadensis (Canada Poplar, Peuplier de Canada of the French) (E) (100' × 3')	* 7

GNETACEÆ

Gnetum

814. scandens (CL) * 18

EUROPEAN—(None)

CONIFERÆ

(Note.—Sometimes divided into Taxaceæ and Pinaceæ.)

Podocarpus

472. latifolia IV * 6

Agathis (6')

alba (Almāciga)	* 6
Pinus (4'–4½')	
insularis (Sālang or Benguēt Pine)	* 9
Merkusii (Tapōlau or Mindoro Pine)	* 9

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

CONIFERÆ—contd.

EUROPEAN—

Juniperus

- communis (Common Juniper, Pencil Cedar, Genévrier commun of the French) (N) (SH) * 2
oxycedrus (Oxycedar, Mediterranean Pencil Cedar, Genévrier oxycède of the French) (N) (30' x 2') * 2
virginiana (Virginia Red Cedar, Pencil Cedar) (I) * 2
bermudiana (Bermudas Red Cedar, Pencil Cedar) (I) * 2

Thuja

- orientalis (Chinese Arbor-vitæ) (E) (t.) * 2
sphaerædalis (American White Cedar) (I) * 2
Libocedrus Bidwilli (New Zealand Cedar) (I) * 2
Callitris Whytei (African Cedar) (I) * 2
Cupressus * 2

- sempervirens (Pyramidal Cypress, Cyprès pyramidal or Cyprès d'Italie of the French) (E) (75' x 2') * 15
glauca (Portuguese Cypress) (E) (75' x 2') * 15
funeris (Chinese Weeping Cypress) (E) (75' x 2') * 15
macrocarpa (Monterey Cypress of America) (E) (75' x 2') * 15
Taxodium distichum (American Bald Cypress) (I) * 2
Cryptomeria japonica (Japanese Cedar) (I) * 2
Sequoia sempervirens (California Redwood) (I) * 2
Taxus baccata (Yew, If of the French) (N) (45' x 5') * 9
Dacrydium * 22

- Franklinii (Huon Pine of Tasmania) (I) * 6
cupressinum (New Zealand Rimu or Red Pine) (I) * 6

Agathis

- excelsa (Cowrie, or Kauri, Pine of New Zealand) (I) * 6
Araucaria (Monkey Puzzle) * 6

- Cunninghamii (Moreton Bay Pine of Queensland) (I) * 6
exoelsa (Norfolk Island Pine of Australasia) (I) * 6

Podocarpus

- dacrydioides (New Zealand White Pine) (I) * 6
elongata (Yellowwood of the Cape, S. Africa) (I) * 6
totara (New Zealand Totara Pine) (I) * 9
ferruginea (New Zealand Miro Pine) (I) * 9
spicata (New Zealand Matai or Black Pine) (I) * 9

Larix

- europæa (Common Larch, Mëlèze } grown in the plains (100' x 3') * 9
of the French) (N) } grown on mountains (80' x 2') * 24
americana (American Larch, Tamarack, Hackmatack) (I) * 24

- Cedrus Libani (Cedar, Cedar of Lebanon) (E); (b) deodara (Deodar) (E and I) (120' x 9') * 15

- Abies pectinata (Silver Fir, White Deal, Sapin of the French) (N) (120' x 6') * 6

Picea

- excelsa (Spruce Fir, Norway Spruce, White Deal, Epicèa of the French) (N) (120' x 3') * 6

- alba (American Spruce) (I) * 6
Tsuga canadensis (Hemlock Spruce of Canada and America) (I) * 6

- Pseudotsuga Douglasii (Douglas Fir, Oregon Pine) (I) * 6

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

CONIFERÆ—contd.

Pinus (Pine)

- sylvestris (Scotch Fir, Scotch Pine, Red Deal, Pin sylvestre of the French) (N) * 9
English type (120' x 4') * 24
Scandinavian type (80' x 2') * 24
Baltic type (120' x 4') * 9
montana (Mountain Pine, Pin de montagne of the French) (N) (75' x 1½') * 24
laricio (Corsican Pine, Austrian Black Pine, Pin de Corse or Pin d'Autriche of the French) (N) (140' x 5') * 26
halepensis (Aleppo Pine, Pin d'Alep of the French) (N) (60' x 3½') * 24
pinaster (Maritime Pine, Star Pine, Cluster Pine, Pin maritime of the French) (N) (90' x 4') * 24
pinia (Stone Pine, Italian Pine, Pin pinier of the French) (N) (90' x 6') * 6
cembra (Cembro Pine, Pin Cembro of the French) (N) (75' x 4') * 6
strobus (Weymouth Pine, White American Deal, Pin Weymouth or Pin du lord of the French) (E and I) (180' x 8') * 6
glabra (American Spruce Pine) (I) * 6
variabilis (American Yellow Pine) (I) * 9
rubra (Red Pine of Canada and America) (I) * 24
rigida (Pitch Pine of America) (I) * 24

ALPHABETICAL LIST OF PHILIPPINE WOODS,
showing what species are reported by Schneider to be 'practically
identical' (=) for commercial purposes, and assumed to be identical
with Madras (=M.) species.

	No. of Cat.
Aclē (Albizzia acle) = Aclengpārang, Kariskis, Kāsai, Langil, Saling- kōgi; = M. 222-225 ...	*23
Aclengpārang (Albizzia procera) see Aclē; = M. 222-225 ...	*23
Afū (Anisoptera brunnea) = Dāgang, Palosāpis; = M. 59, 60 ...	*9
Agāru (Dysoxylum decandrum) = Kayātau; = M. 118 ...	*26
Agōho (Casuarina equisetifolia) = Mountain Agōho; = M. cult ...	*30
Alakāak (Palaquium giganteum) = Dulitan, Kalipāya, Malacmālac, Malikmik, Manicnic, Nāto, Tagātoi and Baniti; = M. 317 ...	*9
Alintatāu (Neonauclea sp. ?) = Calamansānay, Hambabālud, Lisāk, Tikim, Tirorōa; = M. 291, 293, and 300, 301, 302, 303, 304, 306, 307, 311 ...	*6 and 27
Almāciga (Agathis alba); = M. 472 ...	*6
Almōn (Shorea eximia) = White Lauān, Danlig, Kalūnti, Mala-anō- nang, Mangasinōro, Mayāpis, Bagtican (all known as 'White Lauāns'); = M. 107; and, except for colouring, = 'Red Lauāns', q.v. ...	*9
Alupāg (Euphoria cinerea) = Alupāgamō, Bulāla; = M. 155, 158... *30 and 34	
Alupāgamō (Litchi philippinensis) see Alupāg; = M. 155, 158 ...	*30 and 34
Amamanit (Eucalyptus Naudiniana); = 'Red Lauāns'; = M. 170 ...	*9
Amugān (Pygeum glandulosum) = Lāgo; = M. 231 ...	*19
Amūgis (Koordersiodendron pinnatum) = Malābog, but darker and finer; = M. 170 ...	*21
Anabiong (Trema amboinensis); = M. 444 ...	*2
Ānang (Diospyros Ahernii) = Ata-āta, Kulitōm, Malagaitmōn; = M. 330, 331, 339, 342 ...	*27
Anislāg (Securinea flexuosa); = M. 420 ...	*12
Anōnang (Cordia myxa); = M. 366 ...	*3
Antipōlo (Artocarpus communis, ovatifolia and Treculiana) = Nang- kā; = M. 468, 469 ...	*14
Anubing (Artocarpus Cumingiana, lanceolata, rubrovenia, subrot- undifolia, and superba) = Kūbi; = M. 470; nearly, but rather harder heavier darker brown and somewhat more difficult to work, = Antipōlo ...	*14
Api-āpi (Avicennia officinalis); = M. 386 ...	*18
Apitong (Dipterocarpus grandiflorus) = Hagachāc, Pānao; = M. 49, 50 ...	*9
Arānga (Homalium luzoniense and 3 other sp., all =); = M. 281, 279, 280 ...	*20, 27 & 30
Ata-āta (Diospyros mindanaensis) see Ānang; = M. 330, 331, 339, 42 ...	*27

Bacāuan (Rhizophora conjugata) = Bacāuan-babāe, and Busāin, Potōtan, Potōtan-lalāki, Langārai; = M. 667 ...	*34
Bacāuan-lalāki (Rhizophora mucronata) see Bacāuan; = M. 667 ...	*34
Bacāuan-gubat (Carallia integerrima); = M. 233 ...	*12
Bagtican (Parashorea plicata) see Almōn; = M. 107 ...	*9
Bāhai (Ormocoma calavensis); = M. 191 { (sap) ...	*17
{ (heart) ...	*21
Bakān (Litsaea philippinensis) = Baticulīn, Matāngusā, Pusopōso, Kabūro, Malabunga, Margapāli, Margapāli-kulislān; = M. 394, 402, 404, 410, 414, 416 ...	*15
Balācat (Zizyphus zonulata) = Duklāp, Ligāa; = M. 589 ...	*17
Balinghāsay (Buchanania arborescens and 5 other sp., all =); = M. 166, 167, 168 ...	*8
Bālu (Cordia subcordata); = M. 368 ...	*33
Balukanād (Aleurites trisperma) = Lumbāng; = M. 431, 435, 437, 439 ...	*7
Banabā (Lagerstroemia speciosa) = but somewhat pinker, softer and easier to work than Batitinan; = M. 274 ...	*11
Banaibānai (Radermachera pinnata and 11 other sp., all =); = M. 372, 373, 375 ...	*17
Banālo (Thespesia populnea); = M. 61 (bis) ...	*20
Banāui (Cyclostemon grandifolius) = Batobatō, Butongmantk, } *26 and 27 Tināanpantāi = M. 427, 428, 425, 426, 433 ...	
Bangkāl (Nauclea orientalis) = Mambōg, colour yellow or red; = M. 290, 296, 297 and 295 ...	*5 and 8
Bangūlo (Litsaea Garciae) = Mārang or White Baticulīn; = M. 412. ...	*5
Banilad (Sterculia philippinensis) = Kalumpāng, Malakalumpāng, Malabōho, Malabonōt, Magulipāk, Tapināg, Mountain Tapi- nāg, and Talūto; = M. { if very soft, 68, 69 ...	*1
{ if soft, 66, 70, 71, 518 ...	*3
Baniti (Bassia ramiflora) see Alakāak; = M. 317 ...	*9
Banokbōk (Sideroxylon luzoniense) = Mangkā; = M. 315 ...	*21
Bansalāgin (Mimusops elengi) = but slightly darker than Duyok- dūyok; = M. 321, 322, 323 ...	*31
Banūyo (Wallaceodendron celebicum); = M. 205, 211 ...	*8
Basān (Garcinia eugeniæfolia) except for slight differences in colour from yellow to reddish or red, all = ; Red, = Bunōg; = M. 44 ...	*30
Red, = Malabunōg; = M. 34, 39 ...	*21
Yellow to Reddish, = Binōkau, Gatāsan; = M. 36, 37 ...	*26, 27
All Yellow, Basān, Piris, Taklānganāk, and Urung; = M. 32, } 33, 35, 38 ...	and 33
Batōte (Kingiodendron alternifolium); = M. 201 ...	*19
Baticulīn, or Yellow Baticulīn (Litsaea obtusata) see Bakān; = M. 394, 402, 404, 410, 414, 416 ...	*15
Batino (Alstonia macrophylla and 3 other sp.) = Malabatino and Lanēte; = M. 360, 361, 362, 363 ...	*5
Batitinan (Lagerstroemia pyriformis) see Banabā; = M. 275 ...	*11
Batobatō (Cyclostemon littoralis) see Banāui; = M. 427, 428 and 425, 426, 433 ...	*26 and 27

Batukanāg (<i>Aglaia bicolor</i>) = Bayanti, Bulōg, Gisihan, Kansūdud, Malatumbāga, Malasāging, Matamatā, Salamūngi, Tucāng-cālaō and Salakīn ; = M. 120 and 113, 127	...	*29
Batulināu or Ebony (<i>Maba buxifolia</i>) ; = M. 324 { (sap) ...	...	*27
	(heart) ...	*28
Bayābas or Guava (<i>Psidium guyava</i>) ; = M. (cult.)	...	*25
Bayanti (<i>Aglaia Llanosiana</i>) see Batukanāg ; = M. 120 and 113, 127.	...	*29
Bayōk (<i>Pterospermum diversifolium</i>) = Bayokbayōkan, Kulatīngan ; = M. 74, 75, 77	...	*11
Bayokbayōkan (<i>Pterospermum niveum</i>) see Bayōk ; = M. 74, 75, 77.	...	*11
Benguēt Pine or Sālēng (<i>Pinus insularis</i>) = Mindoro Pine or Tapūlau ; = M. (none, but nearly) 49, 50	...	*9
Bētis (<i>Bassia betis</i>), not glossy and all elements coarser, otherwise = Bansalāgin ; = M. 318, 319	...	*31
Binggās (<i>Terminalia comintana</i>) = Calumpit, Talisay ; = M. 236, 237, 238	...	*32
Binolōan (<i>Eugenia saligna</i>) = Duhāt, Kalubkūb, Kurasām, Macasim, Malarūhat, Malatampūi, Manangkil, Mariig, Paitān, Panglongbōien, Sagimsim ; = M. 244-267	...	*25
Binuāng (<i>Octomeles sumatrana</i>) ; = M. 283	...	*3
Binūkau (<i>Garcinia binucao</i>) see Basān ; = M. 36, 37	...	*26, 27, 33
Binunga (<i>Macaranga varius</i> sp.) ; = M. 440	...	*7
Bitanhōl (<i>Calophyllum Blancoi</i>) = Marabitāog, Pamitaōgen ; = M. 41, 42	...	*11
Bitāog or Pālomaria (<i>Calophyllum inophyllum</i>) ; = M. 40	...	*20
Blanco's Nārra (<i>Pterocarpus Blancoi</i>) = Nārra, Prickly Nārra ; = M. 189	...	*29
Bōgo (<i>Garuga abilo</i> and 2 other sp., all =) ; = M. 108	...	*10
Bolongēta (<i>Diospyros pilosanthera</i>) = Camagōn, Tāmil, Tālang-gūhat ; = M. 326, 329, 333, 335, 338, 340 { (sap) ...	...	*20 and 21
	332, 338 { (heart) ...	*28
Bolongēta - (Camarines) (<i>Diospyros philippensis</i> and <i>Velascoi</i>) ; = M. 332	...	*27 and 28
Bōtong (<i>Barringtonia asiatica</i>) ; = M. 270	...	*12
Bulāla (<i>Nephelium mutabile</i>) see Alupāg ; = M. 155, 158	...	*30 and 34
Bulog (<i>Aglaia Everetti</i>) see Batukanāg ; = M. 120 and 113, 127	...	*29
Bunōg (<i>Garcinia Benthami</i>) see Basān ; = M. 44	...	*30
Busāin (<i>Bruguiera gymnorrhiza</i>) see Bacāuan ; = M. 670, 671	...	*34
Rutongmanūk (<i>Cyclostemon microphyllus</i>) see Banāui ; = M. 427, 428 and 425, 426, 433	...	*26 and 27
Calamansānay (<i>Neonauclea calycina</i>) see Alintatāu ; = M. 291, 293 and 300, 301, 302, 303, 304, 306, 307, 311	...	*26 and 27
Calantās (<i>Toona calantas</i>), slightly softer and more scented but = Marāngo ; = M. 133	...	*10
Calumpit (<i>Terminalia edulis</i>) see Binggās ; = M. 236, 237, 238	...	*32
Camagōn (<i>Diospyros discolor</i>) see Bolongēta ; sap = M. 326, 329, 333, 335, 338, 340 ; heart = M. 332, 338	...	*20 and 21

Camarines Bolongēta (<i>Diospyros philippensis</i> and <i>Velascoi</i>) ; M. = 332. *27 and 28	...	
Cana-fistula (<i>Cassia javanica</i>) = Madrecacão ; = M. 194, 195	...	*23
Catmōn (<i>Dillenia philippinensis</i>) = Catmōn-calabāu, Malacatmōn ; = M. 1, 2, 3	...	*12
Catmōn calabāu (<i>Dillenia Reifferschiedia</i>) see Catmōn ; = M. 1, 2, 3.	...	*12
Cupāng (<i>Parkia timoriana</i>) = Kunding ; = M. 228, 229, 230	...	*8
Dāgang (<i>Anisoptera Curtisi</i>) see Afū ; = M. 59, 60	...	*9
Dalinas (<i>Cyathocalyx globosus</i>) = Ilangilang, White Lanūtans ; = M. 7-20	...	*16
Dalingdinganisāk (<i>Hopea Pierrei</i>) = Mangachapūy ; = M. 52, 56	...	*24
Dalinsī (<i>Terminalia pellucida</i>) = Sācat, Talisay-gūbat ; = M. 236 (bis), 240 and 273	...	*32
Danlig (<i>Shorea</i> sp. ?) see Almōn ; = M. 107	...	*9
Daō (<i>Dracontomelum dao</i>) = Lamiō and Malapāho, Māngga, Pahūtān ; = M. 164	...	*6
Dapdap (<i>Erythrina indica</i>) ; = M. 181, 182	...	*1
Ditā (<i>Alstonia scholaris</i>) ; = M. 359	...	*6
Dugkātan (<i>Cryptocarya bicolor</i>) = Malacadiōs, Terūkan, Sablōt ; = M. 392, 395, 397, 403, 405, 406, 415	...	*15
Dugūan (<i>Myristica mindanaensis</i> and 3 other sp., all =) = Tamba-lāu ; = M. 387-391	...	*2
Duhāt (<i>Eugenia jambolana</i>) see Binolōan ; = M. 244-267	...	*25
Duklāp (<i>Zizyphus trinervia</i>) see Balācat ; = M. 589	...	*17
Duklitan (<i>Sideroxylon duclitan</i>) = White Nāto ; = M. 314	...	*6
Dulitan (<i>Palaquium Merrillii</i>) see Alakāak ; = M. 317	...	*9
Dūngon (<i>Tarrietia sylvatica</i>) = Dungonlāte ; = M. 72	...	*31
Dungonlāte (<i>Heritiera littoralis</i>) see Dūngon ; = M. 72	...	*31
Duyokdūyok (<i>Mimusops calophylloides</i>) see Bansalāgin ; = M. 321, 322, 323	...	*31
Ebony or Batulināu (<i>Maba buxifolia</i>) ; = M. 324	...	*27 & 28
Gapasgāpas (<i>Cumingia philippinensis</i>) ; = M. 62	...	*5
Gatāsan (<i>Garcinia venulosa</i>) see Basān ; = M. 36, 37	...	*26, 27 & 33
Gisihan (<i>Aglaia laevigata</i>) see Batukanāg ; = M. 120 and 113, 127...	...	*26
Gisok (<i>Shorea balangeran</i>) = Gisokgisok, Nārig, Yacūl ; = M. 51, 59	...	*24
Gisokgisok (<i>Hopea philippinensis</i>) see Gisok ; = M. 51, 59	...	*24
Guava or Bayābas (<i>Psidium guyava</i>) ; = M. (cult)	...	*25
Gūbas (<i>Endospermum peltatum</i>) ; = M. 434	...	*1
Guijo (<i>Shorea guiso</i>) ; = M. 53, 54	...	*24
Gumamela (<i>Hibiscus rosa-sinensis</i>) ; = M. 517 (and cult)	...	*5
Guntapāi (<i>Alangium salvifolium</i>) = Malatapāi ; larger than but = M. 286	...	*26
Guyunggūyung (<i>Cratoxylon Blancoi</i>) = Paguringon, Salinggōgon ; = M. 46	...	*10

- Hagachão (*Dipterocarpus pilosus*) see Apitong ; = M. 49, 50 ... * 9
- Hairy-leaf Molave (*Vitex pubescens*) = Molave, Kalipapamadam, Lingolingo = M. 384 ... *13
- Hambabulud (*Neonauclea reticulata*) see Alintatäu ; = M. 291, 293 and 300, 301, 302, 303, 304, 306, 307, 311 ... *26 & 27
- Himbaba-8 (*Allacanthus luzonicus*) = Malambingan ; = M. 460 esp. and 452, 455, 465 ... * 3
- Hiangilang (*Canarium odoratum*) see Dalinas ; = M. (cult and) 7-20 ... *16
- Ipil (*Intsia acuminata* and *bijuga*) ; = M. 194, 195 ... *23
- Kaburo (*Phoebe sterculioides*) see Bakän ; = M. 394, 402, 404, 410, 414, 416 ... *15
- Kalamansakat (*Terminalia Blancoi*) = Malakalumpit ; = M. 235 ... *17
- Kalipäya (*Palaquium Ahernianum*) see Alakääk ; = M. 317 ... * 9
- Kalingag (*Cinnamomum Mercadai*) = Mindanao Cinnamon ; = M. 398 ... * 9
- Kalipapa-äsu (*Vitex pentaphylla*) = Longleaf Molave, Tikoko ; = M. 768, and 768 (*bis*) ... *17
- Kalipapamadam (*Vitex celebica*) see Hairy-leaf Molave ; = M. 384. ... *13
- Kaliwas (*Kayea paniculata*) = Tandu ; = M. 47 ... *3
- Kalubkub (*Eugenia calubcob*) see Binolöan ; = M. 244-267 ... *25
- Kalumpang (*Sterculia foetida*) see Banilad ; = M. 66 ... *33
- Kalünti (*Shorea* sp. ?) see Almön ; = M. 107 ... *9
- Kamätog (*Erythrophloeum densiflorum*) ; = M. 196 ... *21
- Kamangi (*Santiria nitida*) = Pili, Pagsahingan ; = M. 112 ... * 9
- Kamuning (*Murraya exotica*) = Kuyusküyus ; = M. 542, 809 ... *33
- Kanömoi (*Diospyros multiflora*) = Malatinta, Katilmä ; = M. 327, 328, 334, 336, 341, 345 ... *17
- Kansulud (*Aglaia multifolia*) see Batukanag ; = M. 120 and 113, 127 ... *29
- Käpok (*Ceiba pentandra* or *Eriodendron anfractuosum*) ; = M. (cult and) 64 ... * 1
- Kariskis (*Albizzia lebbekoides*) see Aclé ; = M. 222 to 225 ... *23
- Kāsai (*Albizzia retusa*) see Aclé ; = M. 222 to 225 ... *23
- Katābang (*Quercus caudatifolia*) = Katilük, Kilög, Manāring, Mangasiriki, Pangnān, Ulāian ; = M. none, nearly = 1, 2, 3 ... *12
- Katilmä (*Diospyros nitida*) see Kanömoi ; = M. 327, 328, 334, 336, 341, 345 ... *17
- Katilük (*Quercus Jordanae*) see Katābang ; = M. none, nearly = 1, 2, 3, 233 ... *12
- Kāto (*Amoora Aherniana*) ; = M. 124 ... *19
- Kayātau (*Dysoxylum Turczaninowii*) see Agarü ; = M. 118 ... *26
- Kayugālu (*Sindora inermis*) = Supā ; = M. 150, 217 ... *21
- Kilög (*Quercus luzoniensis*) see Katābang ; = M. none, nearly 1, 2, 3, 233 ... *12
- Kūbi (*Artocarpus lamellosa*) see Anubing ; = M. 470 ... *14
- Kulāsi (*Lunitzera racemosa*) = but smaller than Tabāu ; = M. 674. ... *26

- Kulitöm (*Diospyros foveoreticulata*) see Änang ; = 330, 331, 339, 342 ... *27
- Kunding (*Parkia Shereseei*) see Cupäng ; = M. 228, 229, 230 ... * 8
- Kurasām (*Eugenia claviflora*) see Binolöan ; = M. 244-267 ... *25
- Kuyusküyus (*Taxotrophis ilicifolia*) see Kamuning ; = M. 809, 542. ... *33
- Lägo (*Pygeum Preslii*) see Amugän ; = M. 231 ... *19
- Lamiö (*Dracontomelum Cumingianum*) see Daö ; = M. 164 ... * 6
- Lamög (*Planchonia spectabilis*) = Töög ; = M. 271 ... *21
- Lanäte (*Wrightia laniti*) = Southern Lanäte and Batino, Malabatino ; = M. 360, 361, 362, 363 ... * 5
- Langārai (*Bruguiera parviflora*) see Bacāuan ; = M. 671 and 670 ... *34
- Langil (*Albizzia lebbek*) see Aclé ; = M. 222-225 ... *23
- Lanütan (*Bombycidendron campylosiphon*) = Vidal's Lanütan ; = M. 65 ... *11
- Lanütan—(Vidal's) (*Bombycidendron Vidalianum*) see Lanütan ; = M. 65 ... *11
- Lanütan—(White) (Various genera of ANONACEÆ) see Dalinas ; = M. 7-20 ... *16
- Lauän — (Red) (*Shorea negrosinensis*) = Malakayän, Tiāong and, except for colouring, the White Lauäns (see Almön) ; also nearly with, but not so hard nor fine-grained as, nor with the purplish-red tinge of, Tanguile ; = M. 109 ... * 9
- Lauän — (White) (*Pentacme contorta*) see Almön ; = M. 107 ... * 9
- Ligää (*Zizyphus inermis*) see Balicat ; = M. 589 ... *17
- Ligäs (*Semecarpus cuneiformis* and 11 other sp., all =) ; = M. 171 to 176 ... * 3
- Lingolingo (*Vitex Turczaninowii*) see Hairy-leaf Molave ; = M. 384. ... *13
- Lisäk (*Neonauclea Bartlingii*) see Alintatäu ; = M. 291, 293 and 300, 301, 302, 303, 304, 306, 307, 311 ... *26 & 27
- Liūsin (*Parinarium corymbosum*) = Tabontābon ; = M. 664 ... *31
- Loktöb (*Duabanga moluccana*) ; = M. 277 ... * 7
- Longleaf Molave (*Vitex longifolia*) see Kalipapa-äsu ; = M. 768, 768 (*bis*) ... *17
- Lumbäng (*Aleurites moluccana*) see Balukanäd ; = M. 431, 435, 437, 439 ... * 7
- Lumbayão (*Tarrietia javanica*) ; = M. 48, 82, 83, 84, 85 ... *22
- Macaäsim (*Eugenia Benthani*) see Binolöan ; = M. 244-267 ... *25
- Madre-cacão (*Gliricidia sepium*) see Cana-fistula ; = M. 194, 195 ... *23
- Magabüyo (*Celtis luzonica*) = Malaikmö ; = M. 443 ... *16
- Magulipāk (*Sterculia Blancoi*) see Banilad ; = M. 68, 69, if very soft 66, 70, 71 and 518, if soft. ... * 1
- Mala-anönang (*Shorea malaanonan*) see Almön ; = M. 107 ... * 9
- Malabatino (*Paralstonia clusiacea* and *platyphylla*) see Batino ; = M. 360, 361, 362, 363 ... * 5
- Malabayābas (*Tristania decorticata*) = Täba, Tiga and nearly - Mancono ; = M. 254 ... *34

- Malabog (*Parishia malabog*) see Amügis ; = M. 170 ... *21
 Malabôho (*Sterculia oblongata*) see Banilad ; } = M. 68, 69 or ... *1
 Malabonô (*Sterculia cuneata*) see Banilad ; } = M. 66, 70, 71, 518. ... *3
 Malabûlak (*Bombax malabaricum*) ; = M. 63 ... *6
 Malabunga (*Nothophoebe malabonga*) see Bakân ; = M. 394, 402, 404, 414, 416 ... *15
 Malabunôg (*Garcinia Cumingiana*) see Basûn ; = M. 34, 39 ... *21
 Malacadiô ; (*Beilschmiedia cairocan*) see Dugkâtan ; = M. 395, 397, 403, 406, 415 ... *15
 Malacatmôn (*Dillenia luzoniensis*) see Catmôn ; = M. 1, 2, 3 ... *12
 Malacmâlac (*Palaquium philippense*) see Alakâak ; = M. 317 ... *9
 Malagaitmôn (*Diospyros Curranii*) see Ârang ; = M. 330, 331, 339, 342 ... *27
 Malaikmô (*Celtis philippinensis*) see Magabûyo ; = M. 443 ... *16
 Malakalumpîng (*Sterculia luzonica*) see Banilad ; = M. 68, 69 or ... *1
 66, 70, 71, 518 ... *3
 Malakalumpit (*Terminalia calamansanai*) see Kalamansâkat ; = M. 235 ... *17
 Malakayân (*Shorea sp. ?*) see Lauân-(Red) ; = M. 109 ... *9
 Malambingan (*Allæanthus glaber*) see Himbaba-o ; = M. 460 esp., and 452, 449, 459 ... *3
 Malanangkâ (*Gymnartocarpus Woodii*) = Yellow Figs ; = M. 445, 446, 459, etc. ... *5
 Malapâho (*Mangifera monandra*) see Daô ; = M. 164 ... *6
 Malapapâya (*Polyscias nodosa*) ; = M. 284, 285, 687, 688, 689 ... *4
 Malapinggân (*Trichadenia philippinensis*), except for colouring nearly = Arânga ; = M. 29 ... *26
 Malarûhat (*Eugenia similis*) see Binolôan ; = M. 244-267 ... *25
 Malasâging (*Aglaiia diffusa*) see Batukanâg ; = M. 120 and 113, 127... *29
 Malasantôl (*Sandoricum Vidalii*) = Santôl ; = M. 115, 145 ... *10
 Malatumpûi (*Eugenia xanthophylla*) see Binolôan ; = M. 244-267 ... *25
 Malatapâi (*Alangium longiflorum* and *brachystachyum*) see Guntapâi ; = M. 286 ... *25
 Malatinta (*Diospyros maritima*) see Kanômoi ; = M. 327, 328, 334, 336, 341, 345 ... *17
 Malatumbâga (*Aglaiia Harmsiana*) see Batukanâg ; = M. 120 and 113, 127 ... *29
 Malikmik (*Palaquium cuneatum*) see Alakâak ; = M. 317 ... *9
 Malubâgo (*Hibiscus tiliaceus*) ; = M. 515 ... *5
 Malûgay (*Pometia pinnata*) ; = M. 154, 157 ... *30
 Mambô ; (*Naucllea Junghuhnii*) see Bangkâl ; = M. 290, 296, 297 and 295 ... *5 & 8
 Manangkîl (*Eugenia mananquil*) see Binolôan ; = M. 244-267 ... *25
 Manâring (*Quercus solerina*) see Katâbang ; = M. none, nearly 1, 2, 3, 233 ... *12
 Manconô (*Xanthostemon Verdugonianus*) see Malabayâbas ; = M. 254 ... *34
 Mangachapny (*Hopea acuminata* and *Foxworthyi*) see Dalingdingan-isâk ; = M. 52, 56 ... *24

- Mangasinôro (*Shorea sp. ?*) see Almôn ; = M. 107 ... *9
 Mângga or Mango (*Mangifera indica*) see Daô ; = M. 164 ... *6
 Mânggasirîki (*Quercus ovalis*) see Katâbang ; = M. none, nearly 1, 2, 3, 233 ... *12
 Manggis (*Koompassia excelsa*) ; = M. 132 ... *19
 Mangkâs (*Sideroxylon ferrugineum*) see Banokbôk ; = M. 315 ... *21
 Mango see Mângga above ... *9
 Manicnic (*Palaquium tenuipetiolatum*) see Alakâak ; = M. 317 ... *11
 Marabitâog (*Calophyllum Cumingii*) see Bitanhôl ; = M. 41, 42 ... *5
 Mârang or White Baticulin (*Litsæa Perrottetii*) see Bangûlo ; = M. 412 ... *10
 Marânggo (*Melia integrifolia*) see Calantâs ; = M. 133 ... *15
 Margapâli (*Dehaasia triandra*) see Bakân ; } = M. 394, 402, 404, 410, 414, 416 ... *25
 Margapâli-kulislâu (*Machilus philippinensis*) } see Bakân ;
 Mariig (*Eugenia glaucicalyx*) see Binolôan ; = M. 244-267 ... *29
 Mâtamatâ (*Aglaiia elæagnoides*) see Batukanâg ; = M. 120 and 113, 127 ... *15
 Matângusâ (*Litsæa euphlebia*) see Bakân ; = M. 394, 402, 404, 410, 414, 416 ... *9
 Mayâpis (*Shorea squamata*) see Almôn ; = M. 107 ... *26
 Mião (*Dysoxylum euphlebioides*) ; = M. 128 ... *9
 Mindanao Cinnamon (*Cinnamomum mindanaense*) see Kalingag ; = M. 398 ... *9
 Mindoro Pine or Tapûlau (*Pinus Merkusii*) see Benguêt Pine ; = M. none, but nearly 49, 50 ... *13
 Molâve (*Vitex parviflora*) see Hairy-leaf Molâve ; = M. 384 ... *30
 Mountain Agôho (*Casuarina Rumphiana* and other sp.) see Agôho ; = M. (cult) ... *1
 Mountain Tâpinâg (*Sterculia montana*) see Banilad ; = M. 68, 69 } 66, 70, 71, 518. } *3
 Nangkâ (*Artocarpus integrifolia*) see Antipôlo ; = M. 469 and 468... *14
 Nârig (*Vatica mangachapoi*) see Gisok ; = M. 51, 55 ... *24
 Nârra (*Pterocarpus indicus*) see Blanco's Nârra ; = M. 189 ... *29
 Nâto (*Palaquium luzoniense*) see Alakâak ; = M. 317 ... *9
 Nâto (White) (*Sideroxylon macranthum*) see Duklitan ; = M. 314 ... *6
 Oak (*Quercus* genus) see Katâbang ; = M. none, but nearly 1, 2, 3, 233 ... *12
 Pagatpat (*Sonneratia pagatpat*) ; = M. 276 } ... *14
 (roots) } ... *1
 Pagsabîngan (*Canarium villosum*) see Kamîngi ; = M. 112 ... *9
 Pagurîngon (*Cratoxylon celebicum*) see Guyunggüyung ; = M. 46... *10
 Pahûtan (*Mangifera altissima*) see Daô ; = M. 146 ... *6
 Paitân (*Eugenia costulata*) see Binolôan ; = M. 244-267 ... *25
 Pâlomaria or Bitâog (*Calophyllum inophyllum*) ; = M. 40 ... *20

Palosāpis (<i>Anisoptera thurifera</i>) see Afū ; = M. 59, 60	...	* 9
Pamitaōgen (<i>Calophyllum Whitfordii</i>) see Bitanhōl ; = M. 41, 42	...	*11
Pānao (<i>Dipterocarpus vernicifluus</i>) see Apitong ; = M. 49, 50	...	* 9
Panglong-bōien (<i>Eugenia clausa</i>) see Binolōan ; = M. 244-267	...	*25
Pangnān (<i>Quercus Bennetii</i>) see Katābang ; = M. none, but nearly 1, 2, 3	...	*12
Piagāo (<i>Xylocarpum granatum</i>) = Tabigi ; = M. 130	...	*19
Pili (<i>Canarium luzonicum</i>) see Kamīngi ; = M. 112	...	* 9
Pine-(Benguēt) (<i>Pinus insularis</i>) } see Benguēt Pine ; = M. none,		
Pine-(Mindoro) (<i>Pinus Merkusii</i>) } but nearly 49, 50	...	* 9
Pinkapinkāhan (<i>Oroxylum indicum</i>) = Tuwi ; = M. 764 and 371	...	* 7
Piris (<i>Garcinia Vidalii</i>) see Basān ; = M. 32, 33, 35, 38	...	*26, 27 & 33
Prickly Nārra (<i>Pterocarpus echinatus</i>) see Blanco's Nārra ; = M. 189	...	*29
Potōtan (<i>Bruguiera eriopetala</i>) } see Bacāuan ; = M.		
Potōtan-lalāki (<i>Bruguiera caryophylloides</i>) } 670	...	*34
Pusopūso (<i>Neolitsaea Vidalii</i>) see Bakān ; = M. 394, 402, 404, 410, 414, 416	...	*15
Pūtāt (<i>Barringtonia racemosa</i> and 3 other sp.) ; = M. 269	...	* 4
Putian (<i>Alangium Meyeri</i>) ; = M. 100	...	*17
Red Lauān (<i>Shorea negrosinensis</i>) see Lauān-(Red) ; = M. 109	...	* 9
Sablōt (<i>Litsaea glutinosa</i> , <i>luzonica</i> and <i>tayabensis</i>) see Dugkātan ; = M. 392, 395, 397, 403, 405, 406, 415	...	*15
Sācat (<i>Terminalia nitens</i>) see Dalinsi ; = M. 236 (bis), 240, 273	...	*32
Sagimsīm (<i>Eugenia brevistylis</i>) see Binolōan ; = M. 244-267	...	*25
Salakīn (<i>Aphanomyx Cumingiana</i>) see Batukanāg ; = M. 120 and 113, 127	...	*29
Salamūngi (<i>Aglaiia Turczaninowii</i>) see Batukanāg ; = M. 120 and 113, 127	...	*29
Sālēng (<i>Pinus insularis</i>) see Benguēt Pine ; = M. none, nearly 49, 50	...	* 9
Salingkūgi (<i>Albizzia saponaria</i>) see Aclē ; = M. 222-225	...	*23
Salinggōgōn (<i>Cratoxylon formosum</i>) see Guyunggūyung ; = M. 46...	...	*10
Sampālok (<i>Tamarindus indica</i>) ; = M. 203	(sap) ...	*26
	(heart) ...	*34
Santōl (<i>Sandoricum koetjape</i>) see Malasantōl ; = M. 115, 145	...	*10
Sasālīt (<i>Vitex Aherniana</i>) ; = M. 103, 376, 377, 378, 379	...	*26 & 33
Sibucāo (<i>Cesalpinia sappan</i>) ; = M. (cult)	...	*21
Southern Lanēte (<i>Wrightia calycina</i>) see Lanēte ; = M. 360, 361, 362, 363	...	* 5
Sudiāng (<i>Ctenolophon philippinensis</i>) ; = M. 531, but larger	...	*29
Supā (<i>Sindora supa</i>) see Kayugālu ; = M. 150, 217	...	*21
Tāba (<i>Tristania littoralis</i>) see Malabayābas ; = M. 254	...	*34
Tabāu (<i>Lumnitzera littorea</i>) see Kulāsi ; = M. 674, but larger	...	*26
Tabigi (<i>Xylocarpus obovatus</i>) see Piagāo ; = M. 130	...	*19
Tabontābon (<i>Parinarium laurinum</i>) see Liusin ; = M. 664	...	*31
Tagātoi (<i>Palaquium Foxworthyi</i>) see Alakūak ; = M. 317	...	* 9

Taklūnganāk (<i>Garcinia dulcis</i>) see Basān ; = M. 32, 33, 35, 38	...	*26, 27 & 33
Tālang-gūbat (<i>Diospyros Copelandii</i>) see Bolongēta ; = M. 326, 329, 333, 335, 338, 340 (sap)	...	*20 & 21
	332, 338 (heart)	*28
Talisay (<i>Terminalia catappa</i>) see Binggās ; = M. 236, 237, 238	...	*32
Talūto (<i>Pterocymbium tinctorium</i>) see Banilad ; = M. 68, 69	...	* 1
Tamayūan (<i>Strombosia philippinensis</i>) ; = M. 135, 136	...	*20
Tambalāu (<i>Knema heterophylla</i>) see Dughan ; = M. 387-391	...	* 2
Tambulian (<i>Eusideroxylon Zwageri</i>) ; = M. 220	...	*34
Tāmil (<i>Diospyros plicata</i>) see Bolongēta ; M. 326, 329, 333, 335, 338,		
	340 (sap)	*20 & 21
	332*338 (heart)	*28
Tandu (<i>Kayea</i> sp. ?) see Kaliwas ; = M. 47	...	* 3
Tangāl (<i>Ceriops tagal</i> and <i>Roxburghiana</i>) ; = M. 668	...	*21
Tanglin (<i>Adenantha intermedia</i>) ; = M. 213	...	*21
Tanguile (<i>Shorea polysperma</i>) see Lauān-(Red) ; = M. 60	...	* 9
Tapināg (<i>Sterculia crassiramea</i>) see Banilad ; = M. 68, 69	...	* 1
	66, 70, 71, 518	* 3
Tāpīlāu (<i>Pinus Merkusii</i>) see Benguēt Pine ; = M. none, nearly 49,		
	50	* 9
Terūkan (<i>Beilschmiedia glomerata</i>) see Dugkātan ; = M. 395, 397, 392, 403, 405, 406, 415	...	*15
Tiāong (<i>Shorea Teysmanniana</i>) see Lauān-(Red) ; = M. 109	...	* 9
Tiga (<i>Tristania</i> sp. ?) see Malabayābas ; = M. 254	...	*34
Tikīm (<i>Neonauclea Vidalii</i>) see Alintatāu ; = M. 291, 293 and 300, 301, 302, 303, 304, 306, 307, 311	...	* 6 & 27
Tikōko (<i>Vitex philippinensis</i>) see Kalipāpa-asu ; = M. 278, 278 (bis)	...	*17
Tināanpantāi (<i>Cyclostemon Bordeni</i>) see Banāni ; = M. 427, 428	...	*26
	425, 426, 433	*27
		*21
Tindalō (<i>Pahudia rhomboidea</i>) ; = M. 151, 216, 218	...	
Tirorān (<i>Neonauclea philippinensis</i>) see Alintatāu ; = M. 291, 293 and 300, 301, 302, 303, 304, 306, 307, 311	...	* 6 & 27
Tōog (<i>Petersianthus quadrialatus</i>) see Lamōg ; = M. 271	...	*21
Tuāi (<i>Bischofia javanica</i>) ; = M. 429	...	*12
Tucāngcālo (<i>Aglaiia Clarkii</i>) see Batukanāg ; = M. 120 and 113, 127	...	*29
Tuwi (<i>Dolichandrone spathacea</i>) see Pinkapinkāhan ; = M. 371, 804	...	* 7
Ulāian (<i>Quercus Llanosii</i>) see Katābang ; = M. none, nearly 1, 2, 3, 233	...	*12
Unik (<i>Albizzia marginata</i>) ; = M. 226	...	*10
Urung (<i>Fagraea fragrans</i>) see Basān ; = M. 32, 33, 35	...	*26
Vidal's Lanūtan (<i>Bombycidendron Vidalii</i>) see Lanūtan ; = M. 65	...	*11
White Baticulin (<i>Litsaea Perrottetii</i>) see Bangūlo ; = M. 412	...	* 5
White Lanūtan (Various genera of ANONACEÆ) see Dalinas ; = M. 7-20	...	*16

- White Lauan (*Pentacme contorta*) see Almōn ; = M. 107 ... * 9
 White Nāto (*Sideroxylon macranthum*) see Duklitan ; = M. 314 ... * 6
 Yacāl (*Hopea plagata*) see Gisol ; = M. 51, 55 ... * 24
 Yellow Baticulin (*Litsea obtusa*) see Bakān ; = M. 410, 414, 416,
 and 394, 402, 404 ... * 15

V.—COMMERCIAL CATEGORIES OF TIMBERS

I.—MOSTLY VERY SOFT SPONGY VERY LIGHT

N. * 1. Corks

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
24. <i>Cochlospermum gos-</i> <i>sypium.</i>	17	...	5	5	4	2	V	(XS) GyW.
64. <i>Bombax insigne</i> ...	21	180	4	5	4	3	V	(VS) W.
68. <i>Sterculia villosa</i> ...	19	...	5	5	4	3	IV	(VS) GyB.
69. <i>Sterculia guttata</i> ...	15	147	5	5	4	3	IV	(S) GyW.
106. <i>Ailanthus malabarica</i>	23	...	5	5	4	3	IV	(VS) W.
181. <i>Erythrina stricta</i> ...	16	...	4	4	3	3	IV	(VS) W.
182. <i>Erythrina suberosa</i> ...	19	...	4	4	3	3	IV	(VS) W.
434. <i>Givotia rottleriformis</i>	17	...	5	4	4	2	IV	(VS) W.
558. <i>Balsamodendron</i> Berryi (incl. mukul)	20	...	5	5	4	3	V	(S) PkW.
612. <i>Moringa concanensis</i> (incl. pterygo- sperma, cult., com., and rwd)	19	...	5	5	4	3	V	(VS-S) W.
627. <i>Sesbania aegyptiaca</i> ...	21	...	5	5	4	2	V	(XS) W.
746. <i>Cerbera odollam</i> ...	21	...	5	5	4	3	V	(VS) GyW.
805. <i>Excoecaria agallocha</i> (incl. crenulata and robusta)	25	...	5	5	4	2	V	(VS) W.
<i>European Species</i>								
Lombardy Poplar ...	22	303	1	5	3	3	III	(VS) W-GyB.
Horse Chestnut ...	33	...	3	5	4	4	V	(VS) YW.

Philippine Species. Banilad (incl. Kalumpāng, Malakalumpāng, Malabōho, Malabonōt, Magulipāk, Tapināg, Mountain Tapināg) (*Sterculia* = 68, 69); Dapdap (*Erythrina* = 181, 182); Gūbas (*Endospermum* = 434); Kāpok (*Ceiba* = cult. and 64); Talūto (*Pterocymbium* = 68; 69).

Under 1 ft. diameter:—MADRAS. 277 *Sonneratia acida* (roots) (see N. * 7); 628. *Eschynomene aspera*.

PHILIPPINE. Pagatpat (*Sonneratia*) (roots) (see N. * 14).

Strengths.

Tensile Strength :—Lombardy Poplar=4.6; Horse Chestnut=12.1.

Crushing Strength :—Lombardy Poplar=3.1.

Shearing Strength :— ?

Elasticity modulus :—Lombardy Poplar=763; Horse Chestnut=300; Average taken for Category=530.

Compared with Oak 100 :—Lom. Poplar H. Chestnut Category

Strength	...	50	...	26
Stiffness	...	44	18	31
Toughness	...	57	...	22

General Description. Creamy-white to very light Grey or Brown, bluing very rapidly if not quickly and thoroughly seasoned; Very soft and spongy or else loosely fibrous, grain usually straight, texture coarse, very easy to work but requiring very sharp tools especially against the grain; Seasons well except for staining; Durability V (181, 182, 434=IV), decays rapidly and frequently attacked by beetles; P=163; Wt. 15–25, Av. 20, lighter than all European woods, and only little heavier than Cork (15 lbs.); Rays mostly B (106, 612, 627=m.; 434, 558=f.; 805, L. Poplar and Horse Chestnut=ff.; 746=indistinct); Pores mostly LL—L (558, 627, 805 and L. Poplar=s.; 746 and H. Chestnut=ss.); VC.=IV.

Note on European Species. The Lombardy Poplar (a variety of the Black Poplar, *Populus nigra*) is said to come from Asia Minor, the Caucasus and Persia, and first introduced into Italy in 1749, and then into other parts of Europe; its wood is the softest, lightest and weakest of all the Poplars, and is white but tending to greyish-brown towards the centre; it is used for planking, packing-cases and other boxes, wooden shoes, window-blinds, and, when knotty, for veneer-work. The Horse Chestnut (*Æsculus hippocastanum*) probably comes from Central Asia, and was introduced into Europe about 1575; its wood is yellowish-white, and is one of the poorest that exists, and does not even work clean; it is used for box-making slats in Europe, and in Asia for water-troughs, packing-cases and other boxes, platters, cups and vases especially for holding butter. It will be seen that these are both exotic to Europe; both are very soft, and are the nearest approach to the above category.

Note on Philippine Species. *Banīlad, Talūto.* Wood very soft (some sp. soft, see N.*3), very light, whitish staining to silvery-grey or very light brown, texture rather coarse and spongy, silver-grain conspicuous, seasons well except for staining, very easy to work but requires very sharp tools to make smooth cut especially across grain; Durability very poor as regards decay, frequently attacked by beetles; Uses, cheap and temporary construction, temporary mining timbers, raft-floaters, fish-net floats, box lumber, match and match-box veneer; Prices, sold with cheapest grades of Miscellaneous lumber about P/40 (=Rs. 3½ cft). *Dapdap.* (no details); Uses, fish-net and fish-line floats, and buoy for marking fish-traps (no prices). *Gūbas.* Wood soft, light, no distinct heart, nearly white turning straw on exposure but often staining to light grey if not seasoned quickly, grain very straight, texture fairly fine smooth but not glossy, seasons very well except for staining, very easy to work; Durability IV, but not often attacked by insects; Uses, match and match-box veneer, wooden shoes, cheap umbrella-sticks; Prices, with cheap Miscellaneous lumber, P/40 (=Rs. 3½ cft.), or as match logs which bring about P/9 per c. metre (=Rs. ¼ cft.) *Kāpok.* Wood of coarser and rougher texture than Malabūlak (*Bombax*), otherwise much resembling it, very soft, very light, no heart, whitish turning grey or light brown if not rapidly seasoned, grain straight, texture coarse rough, very easy to work; except for staining seasons very well; Durability very poor; Uses, live fence posts and poles, fish-net floats; Prices, not marketed. *Pagātpat* (see 277 below).

Uses of Madras Timbers recorded. 181, 182. Planking, packing-cases, sieve-frames, household jars, lacquered boxes (retains varnish better than almost any wood), scabbards, trays, toys; (the African species, *E. caffra*, splits readily and is used principally for light shingles owing to not being liable to take fire). 434. Carving, figures, toys, imitation fruit, theatrical masks, boxes, catamarans. 627. Toys, gunpowder-charcoal. 628. Hats, toys, fishing-floats, cork-substitute. 805., General carpentering purposes, toys, bedsteads, tables, etc., posts, charcoal. 277 and *Pagātpat* roots. (These air-roots or erect root-branches attain 18 inches to 3 ft. in height, and have a soft firm even texture and so form a fine substitute for Cork; they are used for) Razor-hones, fish-net floats, cork-sole slippers, cork bottom-lining in entomological cases, thumb-tack holders, and recommended for the manufacture of tropical

sun helmets, also for life-preservers especially if some means of water-proofing them, such as dipping into paraffin, were employed.

Note on Cork. The chief characters of Cork are its specific lightness (about 15 lbs. per cft.), combined with comparative strength and durability, its compressibility, elasticity, and practical imperviousness to air and water. The limits of elasticity of metals, stones, crystals and woods are so narrow that the distance between any two neighbouring points of the substance never alters by more than a small proportion of its own amount without the substance either breaking or experiencing a permanent set; and, except in the case of steel wire, the limits of elasticity may be roughly regarded as being something between $1/1000$ and $1/100$ in respect to the linear elongation or contraction, and from $1/50$ to $1/2$ degree in respect to angular distortion. On the other hand, gelatinous substances such as India-rubber, and Cork (the latter with very imperfect elasticity, it is true), have very wide limits of elasticity. Cork is singular, among bodies seemingly homogeneous to the eye, in its remarkably easy compressibility; it is, in fact, the only seemingly homogeneous solid which shows to the unaided eye any sensible change in bulk under any practically applicable forces. A small homogeneous piece torn out of cork may, by merely pressing it between the fingers, be readily compressed to half its bulk, and a large slab of cork in a Bramah press may be compressed to one-tenth of its bulk. The leading purpose for which cork is used is for forming bungs and stoppers for bottles and other vessels containing liquids; also, above all other substances, for forming life-belts, buoys and jackets, and in the construction of life-boats and other apparatus for saving from drowning; also for hat-linings and for soles of shoes; for pommels in leather-dressing; and as a medium in architectural models. Formerly, chips and cuttings were ground up and mixed with India-rubber to form 'kamptulicon', but this preparation has been superseded by 'linoleum', prepared from a mixture of boiled linseed oil and ground cork over a canvas backing. Cork is also used in making artificial limbs. Cork is simply pith, slightly modified; it is cellular tissue composed of cubical or flattened tabular cells with no green colouring matter in them. Pith proper is the central column of the woody part of the stem usually in minute proportion, the wood forming the fibrovascular system; the cellular system of the pith perpetually retains its connection with that of the bark by means of the Pith

(or Medullary) Rays, which radiate through the wood: in the bark, however, the position and relative proportion of these two systems is reversed; the fibrovascular system is internal and occupies comparatively small space, and is known as the Liber, the Bast Layer or the Endophloeum; while the cellular system is external (except for the epidermis or skin), is much developed and comprises two layers, the smaller inner of which is known as the Cellular Envelope or Mesophloeum, and the larger outer of which is known as the Cork, Suberous Layer or Epiphloeum. Whilst the colourless Cork cells are elongated horizontally to the surface, those of the Cellular Envelope are elongated vertically to the surface, contain green colouring matter and are polyhedral in shape.

Cork of commerce is obtained from the bark of the Cork Oak (*Quercus suber*, see N.*29), which grows chiefly in the Mediterranean Region. At the end of 3-4 years, the epidermal skin of the young trees splits up and falls off, and thereafter the Cork Layer develops fast, and would, if left to itself, crack deeply, lose all homogeneity and become useless for the purposes of Cork. When, therefore, the tree attains a girth of about 8-10 inches, this rough layer—'Male Cork', as it is called,—is removed, the operation of removal being called 'Demasculation'; one or more longitudinal slits, according to the diameter of the tree, and two or more transverse circular cuts about 3 feet apart starting from the bottom of the tree, are incised in the bark. A special form of axe is employed, having a very sharp blade, and having the handle both curved and bevelled down into a wedge or blade-like shape; with this handle, the bark is most carefully opened and separated—not from the wood, but—from what is called the 'Mother Cork', that is, the point of junction between the Cork Layer and Cellular Envelope, above referred to, where are the newest formed innermost cork cells which become the parent cells for all new formation of Cork, this new formation being called 'Female Cork'. The demasculation is a delicate operation; to remove the cork, it is gently tapped on the outside, hard hitting would bruise the Mother Cork; nor must the Mother Cork be torn to form holes in it; such wounds create permanent defects in the Female Cork thereafter; demasculation is usually conducted between the middle of July and the end of August, to avoid the period of the greatest activity of the sap, the rainy weather, and the hot burning winds, the Mother cells being extremely delicate when exposed.

The Female Cork develops rapidly after the removal of the Male Cork, owing to the freedom from constriction by the external layers; the constriction of the epidermis made the Male Cork rough as it was; the Female Cork is homogeneous, supple and free from large cracks, and forms the best cork of commerce. When the Female Cork has grown to a thickness of at least 1 inch, which may be between 5 and 15 years, this is removed, and periodically removed thereafter. The cork is peeled off, in the operation of demasculation, in the form of rolled cylinders, which are either put in pits of cold water, or into vessels of boiling water, to soak; later, they are removed to a flat surface and loaded with heavy weights to flatten them; finally their surfaces are planed down, or in the case of rough coarse cracked male cork the surface is, as often seen in bungs, charred, which both closes the pores and hides the defects.

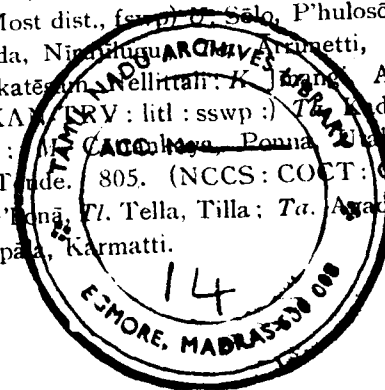
It is a question for consideration whether by demasculation treatment some of the Madras species could not be made to develop cork in a satisfactory manner; many have a thick corky bark, amongst which may be noticed *Erythrina suberosa*, *Zanthoxylum Rhetsa*, *Satinwood*, *Mundulea*, and many climbers. The two first would probably be best for trial; *Satinwood* and *Mundulea* are too slow growing, whilst climbers are not satisfactory. The two first have thick barks, one deeply fissured, the other studded with large conical prickles; in both cases, this is probably Male cork, the Female cork having no chance of development.

Again, it is probable that these Very Soft woods of the category could in themselves be used as Cork, e.g. the bottoms of entomological cases, where the wood would serve the joint purpose of box material and cork lining. Nor does there seem any reason why the wood of the stems should not be unrolled by a method of demasculation much in the same way as the cork is separated from the Mother cork, whereafter the rolled cylinders could be flattened out in precisely the same way as is Cork.

Precis of Uses (deduced from above). Planking, box-lumber, packing cases and lacquered boxes, sieve-frames, trays, scabbards, toys; raft-floaters, fish-net and fish-line floats, buoys for fish-traps; gun-powder charcoal; substitute for cork (for bungs and stoppers for bottles and jars, for life-belts buoys and jackets, for lifeboats, etc., for artificial limbs, for hat-lining, shoe-soles, for entomological cases, for leather-dressing pommels, for architectural models, and for

linoleum). In this connection, indeed, some of the species in other categories could be utilized; for instance, 269. *Barringtonia* (Cat.* 4-VS-28lbs), 63. *Bombax* (Cat.*6-VS-23lbs), 457. *Ficus* (Cat.*7-VS-27lbs), and possibly others.

Localities and Vernaculars. 24. (Most dist., dtts.) *U.* Konokopolāso, Pobosokoniāri; *Tl.* Kondagōgu, Adivibūraga; *Ta.* Kāttilavu, Kāttuppancu, Kōngilavu; *M.* Appakutaka, Pannināra, Simappanni; *K.* Arasinabūraga, Kādubūraga. 64. (WTCT: KAN-TRV: plains) *Ta.* Kāttilavu, Pāraiylavu; *M.* Kāttuppūla, Kallilavu, Pārayilavu. 68. (DKN: CNTC: MPLT: WGTS:) *Tl.* Ponaku, Nāraponaku; *Ta.* Ānainār, Vakkunār, Tanukku; *M.* Cavali, Vaku, Banninār; *K.* Bilidaili, Sāvige, Pulukusāvige. 69. WGTS: KAN-TVY: MRA: CBT:) *Ta.* Kaludaividai, Pi, Kāvalam, Tordī; *M.* Kāvalam, Pi, Kiltondi, Rāmānappū; *K.* Happusāvige, Jēnukāyitaili, Kampārike. 106. (WGTS: KAN-TVY: Anms.) *Ta.* Mattippālai, Pongiliyam; *M.* Mattippālam, Mattipponnalayam, Pātattavetti, Ponnalayam; *K.* Dūpa, Baggadadūpa, Maddidūpa, Uguludūpa. 181. (MPLT: CNTC: WFTS. 182. (NCCS: COCT: DKN: MPLT: *U.* Bonopālod'huā; *Tl.* Mullumōduga, Munimoduga; *Ta.* Murukku, Mullumurukku, Vellaikkalayānamurukku; *M.* Murikku, Kaliyānamurikku, Mulmurikku; *K.* Kādupārivāla, Mulluhongāra. 434. (Most dist., dtts.) *Tl.* Kondaponaku, Pītryponaku, Ponaku, Tellaponaku; *Ta.* Cambarittanakku, Cendanakku, Polukki, Pūdaralai, Pūttāli, Vendanakku, Vendāli; *K.* Bilitāle, Būditāle, Polike. 558. (COCT: DKN: CNTC: dtts. hedges com.) *Tl.* Guggilamu; *Ta.* Kiluvai, Mudgiluvai, Paraikiluvai; *K.* Gaccennekāya, Mulluyishane. 612. (COCT: DKN: CNTC: dtts: and cult. most dist.) *U.* Munikā, Sojobā, Sojinā; *Tl.* Mulaga, Muniga; *Ta.* Murungai; *M.* Murinna; *K.* Guggula, Mōcaka, Nugge. 627. (Most dist., cult. and rwd) *U.* Joyontri; *Tl.* Jilugu, Nallasōminta; *Ta.* Cembai, Cirragatti, Karuncembai; *M.* Cempa, Kitannu, Nellittāli; *K.* Arasinajinangi, Jinangi, Karijinangi. 628. (Most dist., fwp) *U.* Sālo, P'hulosōlo; *Tl.* Bendu, Jilugu, Jilugubenda, Ninnilugu, Arumetti, Cadaicci, Kidai, Netti; *M.* Ārukkattē, Nellittāli; *K.* Aligina, Tanakali. 746. (WTCT: KAN-TRV: litl: sswp:) *Ta.* Kāttalā, Kāttarali, Kāttumā, Udalai; *M.* Cāttamā, Ponna, Udalai; *K.* Cande, Honde, Monde, Tānde. 805. (NCCS: COCT: CNTC: WTCT: litl: sswp:) *U.* G'lonā, *Tl.* Tella, Tilla; *Ta.* Agad, Tillai, Perundillai; *M.* Katappāla, Karmatti.



II.—MOSTLY SOFT

A.—MOSTLY REDDISH, WITH INCONSPICUOUS RAYS

N. *2 Willows

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col
79. <i>Pterospermum glabrescens</i> .	31	436	4	4	4	3	IV	PkW-exp. R.
387. <i>Myristica laurifolia</i> (incl. <i>Beddomei</i>).	34	356	2	4	3	3	III	(M) YR-RB.
388. <i>Myristica malabarica</i> .	37	460	4	4	3	3	IV	(M) YB-RGy.
389. <i>Myristica magnifica</i> .	30	375	2	4	3	4	IV	YW-exp. R.
390. <i>Myristica canarica</i> ...	34	409	2	4	3	3	III	YGy-LtRB.
391. <i>Myristica attenuata</i> .	35	514	4	4	3	3	IV	LtRB.
444. <i>Trema orientalis</i> ...	27	297	4	5	4	2	IV	LtRGy.
471. <i>Salix tetrasperma</i> (incl. <i>ichnostachya</i>).	33	...	2	4	3	4	IV	Pk-RB.
European Species								
Linden, European Lime...	34	...	2	5	3	4	IV	LtPk.
White Willow	28	365	3	5	4	3	IV	PkW.
Crack Willow	28	365	5	4	4	4	V	YW-RB.ht.
Sallow	36	365	5	5	4	3	V	YR-WineR.
White Poplar, Abele	36	522	3	4	3	4	IV	W-LtR.ht.
Imported Species.								
Juniper, Pencil Cedar ...	33	...	5	2	3	...	...	Y-YR-RB. fra.
Arbor-vitæ, American	28	350	4	2	2	...	...	YW-YB-RB
White Cedar	...	...	...	...	...	...	...	...
American Bald Cypress ...	29	440	3	2	2	...	...	LtRB.
Japanese Cedar	21	...	2	2	1	...	...	YW-DkRB fra.
New Zealand Cedar	30	400	3	2	1	...	...	DkR.
African Cedar	41	...	3	3	2	...	...	RB.

Philippine Species. Anabiong (*Trema*=444); Dugān (incl. Tambalāu) (*Myristica* and *Knema*=387 to 391).

Under 1 foot diameter:—Madras. 613. *Ellipanthus Thwaitesii*. 693. *Wendlandia tinctoria* (incl. *glabrata*).

European. Glaucous Sallow (*Salix pedicellata*).

Strengths.

Tensile Strength:—Willow=12.5–14.4, Av.13.2; **White Poplar**=10.2.

Crushing Strength:—Willow=2.9–6.1, Av. 4.5; **Am. Bald Cypress**=6.0; **Am. White Cedar**=5.2.

Shearing Strength:—Am. Bald Cypress=500; **Am. White Cedar**=400.

Elasticity modulus:—Willow=557; **Linden**=615; **White Poplar**=1154; **Am. White Cedar**=910; **Am. Bald Cypress**=1290; **Average taken for Category**=904.

Compared with Oak 100:—

	Wh. Poplar	Willow	Am. Bald Cypress	Category
Strength	86	58	71	66
Stiffness	66	32	75	53
Toughness	112	102	68	82

General Description. Pinkish-grey to Reddish-brown staining unless quickly seasoned; Soft (387, 388 moderately hard), grain straight, texture fine even, very easy to work; Seasons well except for staining; Durability IV (444, Linden. W. Willow and Sallow =V; imported Conifers=II, except African Cedar III), liable to attacks of insects; P=407; Wt. 27–37, Av. 33; Rays f (444 and Linden=m; other European and Imported woods=ff); Pores m, scanty (471 and European woods=s numerous; imported Conifers=wanting); VC.=III.

Note on European Species. The Linden, or European Lime Tree (*Tilia europea*) is found scattered throughout Europe; only durable when kept quite dry under cover, it warps and cracks but little and is not very much attacked by insects; it is used for joinery, cabinet-work and fine carving, furniture and under veneer, founders' patterns, turnery, sabots and wooden shoes generally, in pianos and organs, and for papier-maché. The White Willow (*Salix alba*) is found throughout Europe, where also it is much cultivated; it is uniformly pinkish-white, and also is only durable when kept quite dry under cover; it is homogeneous, cuts easily in all directions, and warps but little, and is used for sculpture, in furniture under veneer, packing cases, cricket bats, lining of carts, and papier-maché. The Crack Willow (*Salix fragilis*) is yellowish becoming reddish or brownish towards the centre; it is seldom large enough for timber, but, when so, is used for sculpture, cart-lining, and slats. The Sallow (*Salix caprea*) is a light or yellowish-red gradually becoming vinous-red towards the centre; it does not cut so well as the White Willow, but is fissile, and is used for long thin slats, in mat-making; the Sallow is found throughout Europe, especially

Central Europe, chiefly in freshwater swamps. The White Poplar, or Abele (*Populus alba*), is found scattered in Central and Southern Europe and Algeria; it has a white or pale sapwood and a clearly defined light red heartwood; it is somewhat more durable than the others, except when grown towards the North, but can only be used under cover; it is used for rafters, rails, wheel-wrights' work, packing-cases, cigar-boxes, carving, organ-building, matches and papier-maché.

Note on Imported Species. The Juniper, or Pencil Cedar, comprises several species of the genus *Juniperus*, of which perhaps the most important are the Common Juniper (*J. communis*), and the Bermuda and Virginian Pencil Cedars (*J. bermudiana* and *virginiana*); the wood is fragrant, close and even grained, with a white or yellow sapwood and yellowish-red to red-brown heartwood; the weight varies from 29 to 47 lbs.; it is used for joinery, furniture and cabinet-making, but its most well-known use is for Cedar pencils. The American White Cedar (*Thuja sphærædalii*) is fragrant yellowish-white to yellowish-brown and is lighter than the Chinese Arbor-vitæ (*T. orientalis*), which has a reddish-brown heartwood; the weight varies from 23 to 33 lbs.; they are used for house framing, shingles and cooperage. The American Bald Cypress (*Taxodium distichum*) is valuable building material where great solidity is not required; it is fissile and used for shingles; the wood is a light reddish-brown. The Japanese Cedar (*Cryptomeria japonica*) is fragrant with a white sapwood and a dark reddish-brown heartwood; it is largely used for tea-boxes, and also for light building purposes, and joinery and furniture. New Zealand Cedar (*Libocedrus Doniana* and *Bidwilli*) is a dark red fine grained wood, used for planking and spars. African Cedar (*Callitris Whytei*), formerly known as *Widdringtonia*, is red-brown rather lighter than Havannah Cedar, used for floors, roofing and other building purposes, but will not stand exposure to the weather; it is also used in pencil-making.

Note on Philippine Species. *Anabiong* (no details given); Uses, wooden shoe-soles. *Dugñan*, *Tambulān*. Woods of *Knema* and *Myristica* practically only differ in that the latter is of a more decided red, which becomes slightly darker in seasoning if the wood is dried quickly enough to prevent staining; woods of the different species cannot be distinguished from each other; soft, light, sap indistinct, pale red or pink seasoning to light red-brown, liable to

stain badly, grain straight, texture fine even, very easy to work; except for staining seasons well with very little checking or warping; Durability IV, sap always and heart often attacked by beetles; Uses, light and temporary construction, cheap furniture, kitchen and other household utensils, cheap cigar-boxes, boxes and dry-measures, ties on logging railroads; Prices, mixed with cheapest grades of Miscellaneous lumber, P-30-40 mc. (= Rs. 2½-3¼ cft.).

Uses of Madras Timbers recorded. 387. Coffee-boxes, plumbago-casks, tea-chests, packing-cases, coffins. 388. Building. 471. Posts and planks: tried for cricket-bats but found unsuitable (too heavy, possibly 79, 389, or 444 might do better, as being nearer the weight of White Willow).

Precis of uses (deduced from above). Light construction (rafters, joists, etc.), joinery (planking, posts and rails), cabinet-work, fine carving and sculpture, cheap furniture and under veneer, founders' patterns, turnery, kitchen and other household utensils, packing-cases and boxes (cheap cigar-boxes, coffee-boxes, tea-chests, plumbago-casks, coffins, dry-measures, etc.), musical instruments (pianos and organs), cricket-bats, cart-lining, sabots and wooden shoes, salts of various kinds, temporary sleepers, pencils, papier-maché.

Localities and Vernaculars. 79. (WGTS: MBR-TVY:) *Ta.* Vattambolavu; *M.* Bāttu, Pamaram, Vattapolāku, Mūlippolāku. 387. (WGTS: KAN-TVY: CBT:). 388. (WGTS: KAN-TRV:), 389. (WGTS: KAN-TRV: scat.). 390. (WGTS: CRG-TVY), 391. (MPLT: WGTS: KAN-TRV:) (There is much confusion among the vernacular names of the species, so they are here clubbed together) *Ta.* Cādikkāy, Kāttuccādi, Palgavi, Palminigi, Cōlavēngai, Cūrappānu, Undippānu, Pānu, Kariyan; *M.* Atakkappayan, Kāttujātikkā, Pattappānu, Ponnampānu, Cōlavēnna, Sūrappayan, Untappānu, Cōrappānā, Pānu, Kariyan, Pintikkāya, Cennelli, Cōlākavullu; *K.* Jājikāyi, Kādujājikāyi, Nētrage, Kānage, Rāmapatre, Rāmanadike, Pinde, Kādupinde, Rikta. 444. (NCCS: DKN: MPLT: WGTS:) *U.* Jibono; *Tl.* Āva, Budumuru, Cēkamānu, Gadanelli, Kākamushti, Morali; *Ta.* Vendai, Kurrippalā, Mudālai, Peymunnai, Virai; *M.* Āmi, Malatontali, Ambarāti; *K.* Hōme, Bende, Kādubaja, Kiruhāle. 471. (NCCS: MPLT: WGTS: NLGS: rvs., fswp.) *U.* Bāisi, Pānijāmo; *Tl.* Etipāla, Ētipisinika, Kondagannēru; *Ta.* Āruppālai, Niruvanci, Vanci; *M.* Arali, Nirunci, Vanci, Vayisi; *K.* Niruvanji, Bāyise, Bāyike

B.—MOSTLY PINKISH, BROWNISH OR YELLOWISH WITH
CONSPICUOUS RAYS

N. #3. Alders

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
31. <i>Tamarix gallica</i> ...	44	...	5	4	3	3	IV	(M) W tgd. R.
47. <i>Eurya japonica</i> ...	45	...	5	3	3	3	IV	LtR-LtRB.
66. <i>Sterculia foetida</i> ...	23	464	2	5	3	4	IV	BW spongy.
70. <i>Sterculia colorata</i> ...	29	...	4	5	4	3	V	GyW.
71. <i>Sterculia alata</i> ...	31	613	1	4	3	3	III	YW-YGy.
105. <i>Ailanthus excelsa</i> ...	25	...	3	4	3	3	IV	YW-BGy.
171. <i>Semecarpus anacardium</i> ...	37	214	4	4	4	2	IV	GyB stk. Y.
172. <i>Semecarpus travancorica</i> ...	26	425	2	4	4	4	IV	GyW.
173. <i>Semecarpus auriculata</i> ...	25	404	3	4	4	4	IV	RGy.
174. <i>Holigarna Arnotiana</i> (incl. <i>ferruginea</i>) ...	25	343	4	4	4	3	IV	GyW-GyB.
176. <i>Holigarna Beddomei</i> (incl. <i>Grahamii</i>) ...	29	308	3	4	4	3	IV	GyW-RGy.
183. <i>Butea frondosa</i> ...	36	335	3	4	3	2	III	GyW-GyB.
243. <i>Gyrocarpus Jacquinii</i> ...	22	...	4	4	3	2	IV	GyW-GyB.
283. <i>Tetrameles nudiflora</i> ...	24	321	1	4	3	3	III	YW-YGy.
312. <i>Morinda tinctoria</i> ...	39	410	4	3	3	2	III	(M) Y exp. Or-Pk.
366. <i>Cordia myxa</i> (incl. <i>obliqua</i>) ...	34	...	5	4	3	3	IV	(M) PkY GyB.
452. <i>Ficus Benjamina</i> ...	...	...	4	4	4	2	IV	LtB-DkB.
455. <i>Ficus retusa</i> ...	...	...	4	4	4	3	IV	(M) LtRGy.
460. <i>Ficus tjakela</i> ...	30	...	4	4	4	3	IV	GyB pch. R.
465. <i>Ficus cunia</i> ...	31	...	4	4	4	4	V	(M) Lt-DkGyB.
European Species.								
Alder ...	35	492	2	5	3	3	IV	(S-M) PkW-exp. Or fading.
Tamarisk (same as above).	31	44	...	5	4	3	IV	LtPkB. (M) W tgd. R.

Philippine Species. Anōnang (*Cordia* = 366); Banilad (incl. Kalumpāng, Malakalumpāng, Malabōho, Malabonōt, Magulipāk, Tapināg, Mountain Tapināg) (*Sterculia* = 66, 70, 71, 518); Binuāng (*Ocotea* = 283); Himbaba-ō (incl. Malambingan) (*Allæanthus* = 460 esp., and 452, 455, 465); Kaliwas (incl. Tandu) (*Kayea* = 47); Ligās (*Semecarpus* 12 sp. = 171, 172, 173, 174, 176).

Under 1 foot diameter:—Madras. 510, 511. *Tamarix dioica* and *ericoides*. 518. *Sterculia populifolia*. 532. *Hiptage madablota* (incl. *parvifolia*). 579. *Celastrus paniculatus*. 588. *Ventilago madraspatana* (incl. *calyculata*). 598. *Gouania leptostachya* (incl. *microcarpa*). 599–603. *Vitis pallida* (incl. *gigantea*, Linnæi, *semicordata* and *anamallayana*). 604–606. *Leea sambucina* (incl. *robusta* and *integrifolia*). 624. *Millettia racemosa* (incl. *splendens* and *rubiginosa*). 724. *Myrsine capitellata*. 725, 726. *Embelia ribes* (incl. *viridiflora*, *adnata*, *Gardneriana*) and *robusta*. 727. *Ardisia courtallensis* (incl. *paniculata* and *missionis*). 728. *Ardisia humilis* (incl. *pauciflora* and *rhomboidea*). 729. *Ægiceras majus*.
European. Black Alder (*Rhamnus frangula*).

Strengths.

Tensile Strength:—Alder = 5.0–14.2, Av. 9.6.

Crushing Strength:—Alder = 6.8–7.2, Av. 6.9.

Shearing Strength:— ?

Elasticity modulus:—Alder = 1086–1576, Av. 1331; Minimum taken for Category 1086.

Compared with Oak 100:—Alder Category

Strength ... 80 62

Stiffness ... 78 60

Toughness ... 82 64

General Description. Large and small trees; Usually light coloured, Pinkish, Brownish or Yellowish, staining if not quickly seasoned; Soft (31, 312, 366, 455, 465, and usually Alder moderately hard), grain straight or crossed, texture coarse to fine, easy to work but often requiring sharp tools especially across the grain; Durability IV (31, 66, 70, and Alder = V; 47, 312 = III), often liable to attacks of beetles (not 47, 105, 312, 366); Seasons well except for staining; P = 384; Wt. 22–45, Av. 32; Rays conspicuous, sometimes lighter or darker coloured than adjoining tissue, mostly m (31, 66, 70, 105, 183 = B; 47 biform, m and f; 174, 176, 460, 465 = f); Pores mostly L (31, 171, 455, 465 = m; 47, 312 = s); Alternate bands of softer lighter and darker harder tissue in 66, 70, 71, 366, 452, 455, 460 and 465; VC. = III.

Note. The *Sterculias* are fetid when first cut, but lose their smell if thoroughly soaked and quickly dried. The Marking Nuts (171–176) exude on incision a grey caustic blistering juice, which

oxidizes into a black varnish; this deters woodcutters from felling the species, but can be obviated by girdling off a piece of the bark, and washing the exposed wood with carbonate of soda. The Figs (452-465) exude on incision a white rubberoid juice; their size value has been discounted owing to masses of aerial roots at their base.

Note on European Species. The Alder (*Alnus glutinosa*) is found throughout Europe near streams and in marshy ground; its wood is a pinkish-white when fresh, changing on exposure to an orange-red, and fading again to a light pinkish-brown; it is soft to moderately hard, very variable in weight and strength, and except under water or in constantly damp places, it rots rapidly and is much attacked by insects; under water it is nearly as durable as Oak; it is largely used for hydraulic works, such as water-troughs and mine-timbers, in wells, and for covering persistently damp places; seasoned and under cover, it is also used industrially or for temporary purposes, for household implements, common furniture, cooperage, sabot-making and clog-soles, cheap cigar-boxes, and occasionally for carving. The Tamarisk (*Tamarix gallica*) occurs in the South of Europe and North of Africa along the Mediterranean, chiefly; the wood is pinkish-white deepening to reddish towards the centre, it is brittle, has no durability, and cracks and warps, and is practically unused in Europe. Black Alder (*Rhamnus frangula*) with yellowish-white to pale reddish and fissile wood, is used for wooden baskets.

Note on Philippine Species. *Anōnang*. Wood soft, light, sap indistinct, yellow when quite fresh and becoming greyish-brown darkening slightly in drying, grain straight or only slightly crossed, texture fairly fine but not glossy, very easy to work; seasons?; Durability probably poor but not attacked by beetles; Uses, posts, light construction; Prices, sold amongst Miscellaneous lots about P/40 mc. (= Rs. 3½ cft.). *Banilad*. Wood of all species as far as known of fairly uniform character, soft to very soft, light to very light, heart indistinct, creamy white to very light grey or brown almost invariably staining to silvery-grey or light brown, grain straight with conspicuous silver-grain, texture coarse spongy, very easy to work but requiring very sharp tools to make smooth especially across grain; except for staining seasons very well; Durability V, very poor, frequently attacked by beetles but better if seasoned rapidly and thoroughly; Uses, cheap and temporary

construction, temporary mining timbers, box-lumber, etc., recommended for match wood; Prices, sold with cheapest grades of Miscellaneous lumber about P/40 mc. (= Rs. 3½ cft.). *Binuāng*. Wood soft, light and brittle, heart indistinct, yellowish-white drying pale yellowish-brown and resembling in appearance Loktōb (see N. * 7) though not in structure (B. having broader conspicuous rays and larger pores, L. having more conspicuous soft tissue patches round the pores), grain strongly crossed in broad belts, texture coarse and rough, extremely easy to work; stains badly if not seasoned rapidly; Durability?; Uses, cheap and temporary construction, buoys for rafts for heavier timber, box-lumber, would make a good matchbox veneer; Prices, marketed only with Miscellaneous lots of cheap Lauān (see N. * 9) about P/30-40 mc. (= Rs. 2½-3¼ cft.). *Himbaba-ō*. The two species are practically identical; wood soft to moderately hard, light to moderately heavy, sap whitish distinct, heart bright red to olive-grey towards the centre, but some logs are found all red whilst others are all grey, sometimes irregularly streaked, grain crossed in broad belts, texture rather coarse but with a glossy appearance when surfaced with sharp tools, easy to work; seasons very well; Durability probably III, sap very poor but heart rarely attacked by beetles; Uses, interior finish, doors, furniture, cabinet work, musical instruments; Prices, about P/120 mc. (= Rs. 10 cft.). (This description corresponds exactly with 460. *Ficus tjakela*). *Kaliwas*. Wood soft to moderately hard, moderately heavy, light greyish to pinkish brown, heart indistinct, general appearance like California Redwood on radial section but on tangential section a watered silk grain, grain straight, texture fine smooth; easy to work; seasons well; Durability? stains badly in log and probably not durable when exposed but not attacked by beetles; Uses? would make a very pretty easily worked interior finish and cabinet wood, and, impregnated, good ties and paving blocks; Prices, not marketed. *Ligās*. All species, as far as known, with wood of the same character; soft, light, no heart, whitish when fresh frequently staining to brownish yellowish or faintly greenish tints, grain straight, texture rather coarse, very easy to work; except for staining seasons very well; Durability IV; Uses, cheap and temporary construction, box-lumber, etc.; Prices, mixed with Miscellaneous lumber of the more ordinary kinds selling at not over P/40-50 mc. (= Rs. 3½-4 cft.).

Uses of Madras Timbers recorded. 31. Turning, lacquered work, agricultural implements. 47. Building. 66. House-building, canoes, packing-cases. 70. Ordinary, agricultural work. 105. Door-panels, planking, catamarans, spear-sheaths, fishing floats. 171-176. Seldom felled on account of the blistering juice; occasionally for house- and boat-building. 183. Good under water; common house-building, well-curbs, piles, water-scoops, planking, rough boxes. 243. Takes paint and varnish well; catamarans, boxes, toys. 283. Planking, boxes, packing-cases, tea-chests, dugout canoes. 312. Gunstocks, fancywork, wooden shoes, plates and dishes. 366. Boat-building, canoes, well-curbs, agricultural implements, gunstocks, tea-boxes. 455. Furniture.

Precis of Uses (deduced from above). Hydraulic works (incl. water troughs and scoops, well curbs, mining timbers and piles—temporary; timber for covering perpetually damp places); cheap and temporary construction; boat-building (incl. canoes and catamarans); floats (incl. rafts for heavier timber, fishing floats, etc.); joinery (incl. planking, posts, doors, and with the more highly coloured interior finish); common furniture; carving (incl. toys) and (with the finer coloured) cabinetwork; box-lumber (incl. packing-cases, tea-chests, cheap cigar-boxes, lacquer-work, wooden baskets, spear-sheaths); turnery and household implements (incl. platters and dishes); cooperage; gunstocks; musical instruments; wooden shoes; impregnated sleepers and paving blocks; match wood and box veneer.

Localities and Vernaculars. 31. (Most large rivers and litt.) *U.* J'hānu; *TL.* Ērusaru, Erracirusaru, Pakke, Palligi; *Ta.* Ārruccavukku, Ārralari, Ciruccavukku, Civappārruccavukku; *M.* J'havukam. 47. (WGTS: NLGS: high sholas) *Ta.* Ārruttuvurai, Huluni; *M.* Ārruttuvara; *K.* Hūlayane. 66. (WTCT: scat. and cult. many dist.) *TL.* Gurrapabādamu, Manciponaku, Piyyatiponaku; *Ta.* Kuduraippidukkan, Malaittingāy, Pināri; *M.* Pināri, Pottukkāvalam; *K.* B'hutaili, Gōtinakāyi, Jēnukāyitali, Kuduregōtu. 70. (NCCS-CNTC: dtts., scat.) *TL.* Kārupāyu, Kāricicce, Gudilapu, Kondatāmara, Kōdijuttu; *Ta.* Malambarutti; *M.* Malamparatti; *K.* Bilisulige, Kodokili. 71. (WTCT: KAN-TVY: com.) *Ta.* Ānaittondi, Kodaittondi; *M.* Peru, Pi, Porila, Poruttonti, Ānattondi; 105. (NCCS:—CNTC: scat.) *U.* Gorimākābbā, Mohānimbo, Yoli; *TL.* Peddamānu, Peddamandu, Reyyavēpa; *Ta.* Pi, Peruppi, Peru, Agal, Naru; *K.* Bende, Dodda, Doddabēvu, Hem, Hire.

171. (All dist., open forests) *U.* B'hollīā, B'hollātoki; *TL.* Jidi, Nallajidi, Gudova, Tummadamāmidi; *Ta.* Cēngottai, Cēran, Kālagam, Tagilimā, Viracāgi; *M.* Cēra, Cērkotta; *K.* Gēru, Karigēru, Gērkayī. 172. (MRR-TVY) *Ta.* Kāttuccēngottai, Periyaccēran, Ponnaccēran, Tēncēran; *M.* Avukaram, Malancera, Tēncēra. 173. (MBR-TVY) *Ta.* Māncārai, Vellaiccārai; *M.* Cāri; Ceruccēra. 174. (WGTS: CRG-TRV: NLGS:) *Ta.* Karuncārai, Kāttuccēran; *M.* Kāttuccēra, Cēra; *K.* Hologēru, Kādugēru, Kuttegēru. 176. (WGTS: CRG-TRV: NLGS: Anms.) *Ta.* Pālvidiniyan (?); *M.* Cēra, Valiyaccēra. 183. (Most dist., bctn.) *U.* Polāso, Kinsuko; *TL.* Mōduga, Tellamōduga, Togaramōduga; *Ta.* Murukku, Kāttumurukku, Punamurukku, Puracu, Vellaippuracu; *M.* Camata, Palācincamata, Mukkampūyam, Murikku, Palāsi, Pūppalāsi; *K.* Muttaga, Muttula, Palāsu. 243. (Most dist., dry forests) *U.* Pitulā, Sutorno; *TL.* Ponaku, Nallaponaku, Kummaraonaku, Tanuku, Mettamāmi; *Ta.* Tanakku, Kottaittanakku, Vellaittanakku, Muttaikkōngu; *K.* Bende, Kādubende, Pollika. 283. (WFTS: esp. NLGS: KAN:, and TRV:) *Ta.* Cīni, Cōlai, Piyai; *M.* Cīni, Vellaccīni, Vellappacca; *K.* Bōlu, Erimali, Kādubende. 312. (Most districts) *U.* Ācu; *TL.* Maddi, Bandamaddi, Togaru, Mogali; *Ta.* Mancanāri, Mancanunā, Nunā; *M.* Mannanāri, Karrapitalavam; *K.* Maddi, Molagu. 366. (All districts, scat.) *U.* Āmob'hoto, Bohurolo, Domolo, Kop'hokoturi; *TL.* Nakkera, Nekkara, Bankanakkerā; *Ta.* Celu, Naruvili, Viri, Viriyan, Mukkucelu; *M.* Celu, Ceruvanicki, Viri, Viriyasam; *K.* Calle, Cotte, Hādige. 452. [NCCS (Agt): WGTS: scat.] *U.* Jodi; *TL.* Kondagolugu, Kondajuvvi, Putrajuvvi; *M.* Vellāl. 455. (Most dist., scat. and cult.) *TL.* Kondapillārā, Billajuvvi, Hēmōduga, Verrijuvvi; *Ta.* Icci, Kallicci, Malaiyicci; *M.* Ittiyāl; *K.* Hīnāla, Hillāla, Kirugōli. 460. (MPLT: WGTS:) *Ta.* Kallāl, Kurugatti, Kurugu; *M.* Cakkila, Cuvannāl, Kārāl, Cōrakkōli; *K.* Basari, Kappabasari, Karibasari, Māki, Selavāla. 465. (NCCS:) *U.* Godimā; *TL.* Bommamarri, Ērubodda.

C.—MOSTLY WHITE WITH CONSPICUOUS RAYS

N. *1 Hazels

NAMES.	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
88. <i>Grewia microcos</i> ...	51	...	4	4	3	3	IV	W-Pk W.
138. <i>Apodytes Benthami-ana</i> (incl. <i>Beddomeana</i>).	...	...	4	4	4	3	IV	W-YW.
140. <i>Ilex denticulata</i> (incl. <i>malabarica</i>).	36	...	3	4	4	3	IV	W.
141. <i>Ilex Wightiana</i> ...	47	...	2	4	4	3	IV	W.
160. <i>Turpinia pomifera</i> ...	30	388	3	4	4	2	IV	W-YW.
178. <i>Spondias mangifera</i> (incl. <i>acuminata</i>).	28	453	3	5	4	4	V	W-GyW.
269. <i>Barringtonia racemosa</i>	28	302	5	5	4	3	V	(VS) W.
284. <i>Pentapanax Leschenaultii</i> .	...	...	5	4	4	4	V	W-Pk W.
285. <i>Brassaia capitata</i> ...	...	...	5	4	4	4	V	W-Pk W.
346. <i>Symplocos spicata</i> (incl. <i>kurgensis</i> , <i>Warburgi</i> , <i>macrocarpa</i> , <i>Gardneriana</i> , <i>Beddomei</i> , <i>foliosa</i> , <i>obtusata</i>).	37	...	4	4	4	3	IV	W.
569. <i>Gomphandra axillaris</i> (incl. <i>polymorpha</i>).	34	358	5	5	4	2	V	W-YW.
792. <i>Baccaurea courtallensis</i> .	41	569	5	4	3	3	IV	(M) W-YW.
<i>European Species.</i>								
Hazel	...	39	...	5	4	4	2	IV (S-M) W.

Philippine Species. Malapapaya (*Polyscias* = 284, 285, 687, 688, 689);

Pūtāt (*Barringtonia* = 269).

Under 1 foot diameter:—Madras. 579. *Mappia fortida*. 571. *Ilex Walkeri* (incl. *Gardneriana*). 687. *Aralia malabarica*. 688. *Polyscias acuminata*. 689. *Heptapleurum venulosum* (incl. *rostratum*, *racemosum*, *stellatum* and *Wallichianum*). 717. *Hamiltonia*

suaveolens. 730. *Symplocos racemosa* (incl. *oligandra*, *subglabra*, *monantha*, *anamallayana* and *microphylla*.) 740. *Azima tetracantha*. 773. *Suaeda monoica*. 810. *Ficus hispida*. 812. *Villebrunia integrifolia*.

Strengths.

Tensile Strength : —Hazel = 18.0.

Crushing Strength : — ?

Shearing Strength : — ?

Elasticity modulus : —Hazel ?; Average taken for Category (as in N.*7. Aspens) = 1144.

Compared with Oak 100 :—Hazel Category

Strength ? 67

Stiffness ? 61

Toughness ? 73

General Description. Mostly small trees (140, 141, 160, 178, capable of growing large); White or very pale, staining if not rapidly seasoned; Soft (792 moderately hard; 269 very soft), grain straight close, texture fine, easy to work; Seasons well except for staining; Durability IV (178, 269, 569 = V), liable to attacks of insects; P = 414; Wt. 28—51, Av. 36; Rays mostly biform, B-m few and also f-f numerous (269, 569 = B only, and 284, 285, 792 = m only), usually lighter or darker than adjacent tissue and always giving a pronounced silvergrain; Pores mostly s (178 = L; 88, 269 = m; 140, 141 = ss; VC. = IV).

Note on European Species. The Hazel, Filbert, or Cobnut, (*Corylus avellana*) is found throughout Europe, mostly in the form of a large shrub but occasionally in the form of a small tree; the wood is white, and being poor in both size and durability it can only be used for minor purposes, chiefly hoops and props for vines, hops, and similar plants; but when obtainable in sufficient size, having a good silvergrain, it is also used for joinery, cabinet and fancy work, sculpture and carving, turning, and other uses to which the Birch (see N.*5) is put.

Note on Philippine Species. *Malapapaya*. Wood soft, light, no heart, whitish when fresh drying pale pink or brownish but very liable to bluing if not rapidly seasoned, grain very straight, texture fine, very easy to work; except liability to stain seasons well; Durability IV; Uses, light construction, cheap boxes, light household implements, fishnet floats, matches and match-boxes; Prices,

not sawn, match logs about P/9 mc (=Rs. $\frac{3}{4}$ cft.). *Pātat*. Small trees with soft light perishable wood.

Uses of Madras Timbers recorded. 141. Building, bowls, platters, etc., a pretty cabinet wood. 284. Useful for articles of turnery. 346, 730. Useful for turning and carving, rough house-posts.

Precis of Uses (deduced from above). Joinery (incl. planking, panelling, posts and railing); cabinetwork and furniture; sculpture and carving, fancywork; turnery; household implements (incl. brushes and brooms, plates, dishes, bowls, trays, etc.); wooden shoes; match and match-box veneer.

Localities and Varietals. 88. (WGTS: KAN-TVY) *Ta.* Kadambu, Vicālam; *M.* Kottakka; *K.* Ab'hrāngu, Biliyab'hrāngu, Majjigesoppu. 138. (WFTS: KAN-TVY: NLGS: Anms.) Names not known. 140. (WGTS: CRG-TRV: NLGS: MYS: Anms., Pnis.) 141. (WGTS: NLGS-TRV: Anms., Pnis.) *Ta.* Velludai; *K.* Hurulu. 160. (WFTS: NLGS-TRV: Anms., Pnis.) *Ta.* Kanali, Pambavetti, Cānda; *M.* Kāttambālam, Palukku, Cānda; *K.* Nīla. 178. (NCCS: MPLT: DKN: BEL: WGTS: KAN: MBR: CBT: scat.) *U.* Āmboto; *Tl.* Adavimāmidi, Kondamāmidi; *Ta.* Ambalam, Kāttumā, Pulimā, Māmbulicci; *M.* Āmpalam, Ampālam, Kāttāmpalam, Pulimāvu; *K.* Amate, Marahunise, Kādambate. 269. (WTCT: litl., sswp) *Ta.* Camuttirakkadambu, Camuttirappalam; *M.* Samstaravati, Samudrāccam, Samudrappū; *K.* Samudrap'hala, Kempuganigalu. 346. (NCCS-Agt: WFTS: esp. NLGS:) 347. (CRG: NLGS) 348. (TVY: TRV) 349. (WGTS: NLGS-TRV: Anms.) 350. (CDP: CRG: KAN:) 351. (NLGS:) 352. (NLGS: Anms.) *Tl.* Lodduga, Sābaramu, Sāpara, Penjrapoda; *Ta.* Kam-balivetti, Paralai; *M.* Nānnal, Pāccōtti, Malaparala; *K.* Loddi. Balaloddi, Būdigane, Sankani. 569. (WCTS: KAN-TRV: NLGS: Anms., Pnis.) *Ta.* Cundali, Kambuli. 792. WFTS: KAN-TVY: Anms.) *Ta.* Pūvai; *M.* Mūttakaippū, Mūttaturi, Nannil, Tippū; *K.* Kōlikukke.

II.—MOSTLY SOFT

D.—MOSTLY WHITE OR PALE WITH INCONSPICUOUS RAYS

N. *5. Birches

NAMES	w.	p.	s.	u.	u.	u.	vc.	(H) and Col.
22. <i>Crataeva religiosa</i> ... 40	...	...	5	4	4	2	IV	(M) YW-LtBW
62. <i>Kydia calycina</i> ... 38	...	...	4	4	3	2	IV	CreW-GW.
87. <i>Grewia laevigata</i> ... 36	...	...	5	4	3	2	IV	(S-M) W.
89. <i>Elaeocarpus ganit</i> 28	...	...	4	4	3	4	IV	W-GyW.
rus.								
90. <i>Elaeocarpus serratus</i> 32	508	...	4	4	3	3	IV	GyW.
91. <i>Elaeocarpus lancea</i> 41	...	...	4	4	3	4	IV	LtBW.
folius.								
93. <i>Elaeocarpus amoen</i> ...	...	...	4	4	3	3	IV	W.
us.								
97. <i>Elaeocarpus ferrugi</i> ...	...	...	4	4	3	3	IV	W.
neus.								
144. <i>Microtropis rami</i> ...	...	...	4	4	4	3	IV	W-YW.
flora.								
290. <i>Sarcocephalus mis</i> 36	430	...	4	3	3	3	IV	(S-M) YGy.
sionis.								
296. <i>Hymenodictyon ex</i> 31	447	...	4	3	3	2	III	W-BGy.
celsum.								
297. <i>Hymenodictyon obo</i> 28	...	...	4	3	3	4	IV	W-BGy.
vatum.								
358. <i>Salvadora persica</i> ... 42	...	...	4	3	3	4	IV	W.
360. <i>Tabernaemontana di</i> ...	...	...	4	4	3	3	IV	(M) YW.
chotoma.								
361. <i>Tabernaemontana</i> 35	391	...	4	4	3	3	IV	(M) W-GyW.
Heyneana.								
362. <i>Wrightia tinctoria</i> ... 46	...	...	4	4	3	2	IV	(M) IvoryW.
363. <i>Wrightia tomentosa</i> 39	457	...	4	4	3	2	IV	(M) W.
412. <i>Litsaea polyantha</i> ... 38	...	...	4	3	4	4	IV	CreW-OIGy.
445. <i>Sireblus asper</i> ... 41	58	...	4	4	3	2	IV	(M) W.
446. <i>Ficus gibbosa</i> ... 39	443	...	4	4	4	2	IV	(S-M) GyW.
449. <i>Ficus tomentosa</i> ... 41	...	...	4	4	4	2	IV	(M) W.
459. <i>Ficus Arnotiana</i> ...	...	...	4	4	4	2	IV	W.
749. <i>Holarrhena ahtidy</i> 40	501	...	5	4	3	2	IV	W.
senterica.								
European Species.								
Birch ...	44	580	4	4	3	2	IV	(S-M) W.
Elder ...	39	...	5	4	4	3	V	(M) YW.

Philippine Species. Bangkāl (incl. Mambōg) (*Nauclea* = 290, 296, 297); Bangūlo (incl. Mārang or White Baticulin) (*Litsaea* = 412); Batino (incl. Malabatino) (*Alstonia* and *Paralstonia* = 360,

361, 362, 363, 749); Gapasgāpas (Cumingia=62); Gumamela (Hibiscus=517 and cult); Lanēte (incl. Southern Lanēte) (Wrightia=360, 361, 362, 363, 749); Malanangkā (Gymnartocarpus = 445, 446, 449, 465); Malubāgo (Hibiscus=515).

Under 1 foot diameter:—**Madras.** 473. *Uvaria narum*. 478. *Unona viridiflora*. 502. *Capparis horrida*. 503. *Alsodeia zeylanica*. 508. *Polygala arillata*. 515-517. *Hibiscus tiliaceus* (incl. *canescens* and *collinus*). 537. *Zanthoxylum tetraspermum*. 538. *Toddalia aculeata*. 578. *Microtropis Wallichiana* (incl. *latifolia*, *densiflora*, *microcarpa* and *ovalifolia*). 607. *Allophylus cobbe*. 615. *Crotalaria barbata* (incl. *formosa*). 616-620. *Crotalaria lanata* (incl. *semperflorens*, *obtecta*, *fulva* and *pulcherrima*). 634. *Dalbergia congesta* (incl. *rubiginosa*, *coromandeliana*, *rostrata* and *Gardneriana*). 639. *Derris scandens*. 647. *Mezoneuron cucullatum*. 648. *Pterolobium indicum*. 649. *Wagatea spicata*. 660, 661. *Acacia concinna* and *intsia*. 675, 676. *Combretum decandrum* (incl. *acuminatum*, *ovalifolium* and *extensum*). 677. *Quisqualis malabarica*. 695. *Mussaenda frondosa*. 732, 733. *Jasminum arborescens* and *cordifolium*. 741. *Chilocarpus atroviridis*. 743. *Carissa macrophylla*. 744. *Rauwolfia densiflora*. 747. *Thevetia neriifolia*. 748. *Ellertonia Rheedii*. 750. *Vallaris Heyneana*. 751. *Beaumontia Jerdoniana*. 752. *Chonemorpha macrophylla*. 753. *Aganosma caryophyllata* and *cymosa*. 754. *Anodendron paniculatum*. 756. *Dregea volubilis*. 758. *Fagraea obovata* and *zeylanica*. 770. *Symphorema involucratum* and *polyandrum*.

Strengths.

Tensile Strength:—Birch=6.1-15.0, Av. 10.6; Elder=10.0-15.0, Av. 12.5.

Crushing Strength:—Birch = 3.3-6.4, Av. 4.9; Elder=7.5-10.0, Av. 8.8.

Shearing Strength:— ?

Elasticity modulus:—Birch=1418-1645, Av. 1521; Minimum taken for Category=1418.

Compared with Oak 100:—	Birch	Category
Strength	93	80
Stiffness	89	83
Toughness	97	77

General Description. Mostly moderate sized trees; White or Pale coloured, staining if not rapidly seasoned; Soft (87, 290, 446,

and Birch soft to moderately hard; 22, 360, 361, 362, 363, 445, 449 and Elder moderately hard), grain usually straight but sometimes slightly crossed, texture from fairly fine to very fine, easy to work; Seasons well except for staining; Durability IV (290, 296, 297, 358, 412=III), not usually (except the Figs—445, 446, 449, 459—) attacked by insects; P=496; Wt. 28-46, Av. 36; Rays not conspicuous m-f (62=B-f; 91, 144, 362, 363=ff); Pores usually m (90, 446, 449=L-m; 89, 91, 144, 358, 445, 749=s; 361, 362, 363=ss); VC.=III.

Note on European Species. The Birch (*Betula alba*) is found throughout Europe and Central Asia, chiefly on sandy soils with a moist substratum or even in swamps in the plains and lower hills; the wood is white, sometimes tinged yellowish or pink; it decays very rapidly and completely under atmospheric conditions, and is not used for construction, but largely for joinery, wheelwrightery, turning, cabinetwork (especially rootwood or excrescences on the boles), furniture, wood-carving, sabots and clogs, ladders, hoops, bobbins, brushes and brooms, shoe-pegs, etc. The Elder (*Sambucus nigra*) grows throughout Europe, North Africa and elsewhere as a small tree, and usually contains a comparatively large volume of pith; the wood is very pale yellow or yellowish-white, very difficult to dry properly and with a great tendency to warp and split, and is only durable under cover; it is used for small turned articles and fancyware (such as combs, etc.), skewers and shoe-pegs.

Note on Philippine Species. *Bangkāl.* The majority of the woods of this family are whitish or yellow to red and of a very smooth texture, they have numerous fine pith rays and small pores, soft tissue inconspicuous, and ill-defined or no growth rings; the wood of *Bangkāl* is soft, light to moderately heavy, grain sometimes quite straight sometimes slightly crossed, texture fairly fine with a greasy or waxy feeling, very easy to work; seasons well; Durability III but rarely attacked by beetles; Uses, house-posts, framing, siding, ceiling, etc., carved ornamental work in churches, bearings of cart-axles where wheels are fixed on the axle, boats, furniture, cabinetwork, sculpture; Prices, now rarely in the market, but has brought as high as P/90 mc. (=Rs. 6½ cft.). *Bangūlo.* Excluding Tambulian (see N. *34) and Kalingag (see N. *9), a number of other species of this family can first be divided roughly in two groups, the White Baticulins and the Yellow Baticulins; the White Baticulin seems to be derived only from *Litsæa Perrottetii* and a

few other species of the same genus; the Yellow Baticulin is furnished by several species of *Litsæa*, *Dehaasia*, *Machilus*, *Neolitsæa*, *Nothophœbe* and *Phœbe*; besides these, there is another type, the *Malacadiôs* group, rather harder and darker coloured, furnished by several species of *Cryptocarya*, *Beilschmiedia*, and a few *Litsæas*; the wood of the White Baticulin group is soft, light, heart indistinct, creamy-white but easily staining if not rapidly seasoned, grain somewhat crossed, texture rather coarse but taking a smooth somewhat glossy surface under sharp tools, very easy to work; except for staining seasons very well; Durability III, occasionally attacked by insects; Uses, carving and sculpture, panelling for doors, carriages, wardrobes and altars, ceiling and sheathing, musical instruments, cabinetwork, pyrography; Prices, sold with the White *Lauâns* (see N. *9) at about P/30-60 mc. (=Rs. 2½-5 cft.). *Batino*. Wood of *Malabatino* in all respects similar to *Batino*, and would pass as such in the market, hard, heavy, heart none, pale yellowish-white sometimes pink tinged, grain straight, texture fine even, disagreeable odor, easy to work; Durability II, not attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, furniture and cabinetwork, household implements, ties; Prices, formerly up to P/180 mc. (=Rs. 15 cft.), but no recent sales except second class ties from P/1¼-1½ (=Rs. 3½-4½) each. *Lanête*. Wood of all species practically identical in general appearance and structure; a great number of large shrubs and small trees belonging to the genera *Alyxia*, *Kickxia*, *Kopsia*, *Lepiniopsis*, *Rauwolfia*, *Tabernæmontana*, and *Voacanga*, furnish woods which are similar to *Lanête*, and some of which are occasionally cut and sold as *Lanête*, and for which if seasoned without staining they are perfectly good substitutes; wood soft to moderately hard, light, creamy-white or sometimes with a rosy tint or streaks, no heart, grain generally straight but sometimes crossed and wavy, texture very fine, very easy to work; Durability probably not great when exposed but not attacked by insects; Uses, sculpture and carving (next to Baticulin the most sought for wood for sacred images, altars, carved jewel boxes, etc.), household implements, musical instruments (necks, heads, trimmings), picture frames, pyrography panels; Prices, short bolts ranging from P/20-50 mc. (=Rs. 1¼-4 cft.), as it rarely comes into Manila as saw timber, but clear unstained fairly wide (say up to 1 ft. wide) boards can bring P/300 mc. (=Rs. 25 cft.) or more. *Gapasgāpas*. Wood more creamywhite

and a finer texture than *Malabūlak* (see N. *6), and a fair substitute for *Lanête*; soft to moderately hard, moderately heavy, pure creamywhite but liable to stain if seasoned in log, no heart, grain straight or slightly crossed, texture fine smooth, easy to work; seasons with but little warping or checking; Durability under severe conditions probably poor but not attacked by beetles; Uses, temporary construction, planks, and if seasoned carefully an excellent substitute for *Lanête*; Prices, not marketed. *Gumamela* and *Malubāgo*. Somewhat similar in appearance to *Lanūtan* (see N. *11), but much softer and lighter; Uses, fish-net floats, cheap scabbards, household implements; Prices, not marketed. *Malunangkā*. Wood very much like that of many species of *Ficus*, yellowish-white almost always staining to bluish-grey unless very carefully seasoned, perishable, no heart; Uses, ?; Prices, mixed with cheap Miscellaneous lumber P/30-40 mc. (=Rs. 2½-3½ cft.).

Uses of Madras Timbers recorded. 22. Turnery, boxes, drums, models. 62. Building, ploughs, oars, carving. 91, 97. Building. 296. Cabinet-making, palanquins, blackboards and school-slates, tea-boxes, agricultural implements, gunstocks, grain-measures, scabbards, toys. 362, 363. Turning, carving, bowls, plates, combs. 412. Agricultural implements. 445. Cartwheels.

Precis of Uses (deduced from above). Light and temporary construction; joinery (incl. houseposts, planking, framing, siding, ceiling, wainscotting, flooring, door panels); wheelwrightery (incl. carriage and palanquin panels); boatbuilding (oars); cabinetwork and furniture (incl. wardrobe panels); woodcarving sculpture and fancyware (incl. ornamental work in churches, altars, sacred images, jewel-boxes, picture-frames, pyrography panels, combs, models, toys); turning (incl. bobbins, gun-stocks); Desk supplies (incl. blackboards and school-slates); household implements (incl. brushes and brooms, bowls, plates, skewers); agricultural implements (incl. ladders, ploughs, cart-axle bearings); box lumber (incl. common boxes, tea-chests, grain-measures, cheap scabbards); musical instruments (incl. heads, necks, trimming of guitars, etc., drums); hoops; floats for fish-nets.

Localities and Vernaculars. 22. (Most dist., often rvrs.) U. Boryno; TL. Magalingamu, Peddamagalingamu, Ulimidi, Usiki, Bilvaramu, Marēdu. Ta. Māvilingai, Nirumāliyam, Mālāram, Villuvam; M. Kili, Nirumāliyam, Niravila; K. Bilpatre, Tudemadirengi, Hoddelenage, Nerajani, Neravele, Vittasi, Māvilinga.

62. (Most dist., except atts) *U.* Kopāsyā, B'hārimo; *TL.* Pōtari, Kondapōtari, Peddakunji, Pandiki, Erukatada; *Ta.* Vendai; *M.* Velukku, Venta; *K.* Belagu, Bende, Kādubende, Kolibende, Nāyibende. 87. (Most dist., scat.) *U.* Kūlokāt'hi; *TL.* Allipayaru, Kotirike, Potirike; *Ta.* Naraittai, Pirunnu, Tavunnu, Uduppai; *K.* Jāvanigala, Kargelē, Murige. 89. (KAN) *K.* Rudrāksham. 90. (WGTS: NLGS: KAN-TRV) *Ta.* Ulungārai, Uruttirādcam; *M.* Āvil, Kārumāvu, Nallakkāra, Perunkāra, Valiyakkāra; *K.* Bigada, Gudderenge. 91. (KAN) *K.* Bigada, Gudderenge. 93. (WFTS: KAN: MBR: Anms.) *Ta.* Nagari, Narul; *M.* Barali; *K.* Gurumani, Maratugurumani. 97. (NLGS: TRV: Anms. Pnis.) (no names known). 144. (NLGS: Anms., Pnis.) 290. (WTCT: KAN-TRV: rvrs) *Ta.* Ārruvanci; *M.* Pulamannal, Ārruvanni; *K.* Ānāvu, Holehalasu. 296 (Most dist.), 297. (MPLT: WGTS: scat.) *U.* Bod'hikā, G'hono, Mundiōholo, Rongobod'hika; *TL.* Bandāru, Cēdippa, Duvvudippe, Manuvubillu; *Ta.* Malaittanakku, Ilaimērgāy, Nāykkadambu, Peruncōli, Vellaikkadambu; *M.* Ittiyila, Malankalli, Nicakkatampa, Peruntōli, Vāllari, Vellakkatampa; *K.* Battaga, Dōli, Gandle. 358. (COCT: DKN: CNTC: scat.) *U.* Kotungo, Toboto; *TL.* Gōne, Kārugōgu, Peddavaragōgu, Varagōgu; *Ta.* Cirugalarvā, Cittuvilā, Perungōli, Perungōni, Ugā; *K.* Gōni. 360, 361. (WGTS: KAN-TVY) *Ta.* Kandalaippālai, Kāttalari, Pālai; *M.* Pāla, Kunnampāla, Utulam; *K.* Madarasa. 362. (Most dist., dtts) *U.* Dud'hokryā, Kryā; *TL.* Ankudu, Cittankudu, Pālabaranki, Pālavārēni, Pālunili, Rēpāla, Tedlapāla; *Ta.* Irumbālai, Kumbambālai, Nilambālai, Pālai, Veppālai; *M.* Ayyappāla, Irumpāla, Kotakkappāla, Pāla; *K.* Beppāle, Hāle, Hallunovu, Halugale, Kādunili, Kudasige. 363. (Most dist) *U.* Kudelo, Dud'hokryā, Pāhukryā; *TL.* Kolamuk'hi, Pāla, Peddapāla, Puttucheyavalaru, Tedlapāla; *Ta.* Conaivedbālai, Pālai, Tondambālai, Vedbālai; *M.* Mayilappāla, Nattappāla, Nilampāla. 412. (NCCS:) *U.* Kulyā, Kukkuoc'hodiyā, Māyāc'hodiyā; *TL.* Meda, Nāra, Naramāmidī. 445. (All dist., scat.) *U.* Sāhādā; *TL.* Barinika, Kukkabēdi, Pakki, Sitanike; *Ta.* Kurripirāy, Kurrippilā, Pacunā, Pirāy; *M.* Paruva, Tintapparuva; *K.* Mitāla, Ponalige, Timli, Mitle. 446. (All dist., scat.) *U.* Korotosāni; *TL.* Kappa, Karāsa, Pindi, Kondajuvvi, Tellabarinika; *Ta.* Itti, Kallitti, Kattitti, Iradagam, Iratti, Kuruvēru; *M.* Itti, Kallitti, Kuruvāl, Attimīrāl; *K.* Goddumitle, Kajjigōli. 449. (All dist., scat.) *TL.* Kaljuvvi, Kālatti, Kondakalajuvvi, Kondamarri, Pittamarri; *Ta.* Kalatti; *Karbādi*; *M.* Kallāl;

K. Kādugōni, Kallāla, Kallatti. 459. (All dist., dry forests) *U.* Plok'hyo; *TL.* Kondarāvi, Kallarāvi; *Ta.* Kāgōli, Kōdiyaracu, Kallaracu; *M.* Āmakanniyam, Kallarayāl; *K.* Bettadarali, Kādarase, Kādasvatt'ha, Kallarase. 749. (NCCS: DKN: MPLT: CNTC: WGTS:) *U.* Indrojōbo, Kryā, Pittākryā, Potrokryā; *TL.* Cēdu-kodise, Kākakodise, Kodisepāla, Pālakodise, Kolamuk'hi, Kutajamu, Manupāla; *Ta.* Arularaci, Erukkalaippālai, Kacappuveppālai, Kudacappālai, Kudugappālai; *M.* Kaippakkotakappāla, Kutakappāla Pālappatta, Panippāla, Venpāla; *K.* Hāle, Hirekodasige, Kōdasige Kodamurike, Kodanji.

N. *6. White Deals—continued

II.—MOSTLY SOFT

D.—MOSTLY WHITE OR PALE, WITHOUT CONSPICUOUS RAYS

N. * 6. White Deals

NAMES.	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
63. Bombax malabaricum	23	630	1	4	3	2	III	(VS) W-GyW.
92. Elaeocarpus oblongus	...	...	3	4	3	3	IV	... W.
94. Elaeocarpus tuberculatus (incl. aristatus).	33	460	2	4	3	3	III	(M) W-LtB.ctr.
98. Elaeocarpus Munroni.	...	...	3	4	3	3	IV	(M) W-YW.
148. Kurrimia bipartita (incl. paniculata).	40	505	3	4	4	3	IV	(M) W-LtGyB.
159. Harpullia cupanioides.	45	530	2	4	4	3	IV	... W.
164. Maugifera indica	42	589	2	4	2	3	III	(S.yg-H. old) YW-GyB.ctr.
234. Blepharistemma corymbosum.	44	574	3	3	3	3	III	(M) GyY.
291. Anthocephalus cadamba.	40	598	3	3	2	3	III	... YW-GyY.
292. Adina cordifolia	45	616	1	3	2	2	II	(M) Y.
293. Stephegyne parvifolia (incl. tubulosa)	44	620	3	3	2	2	III	(M) LtPkB.
314. Chrysophyllum Roxburghii.	37	628	3	4	3	3	IV	... W-GyW.
359. Alstonia scholaris	31	563	2	4	3	2	III	... W.
436. Trewia nudiflora (incl. polycarpa)	29	...	2	4	3	3	IV	... W.
447. Ficus bengalensis	36	600	2	4	3	2	III	(M) GyW.
448. Ficus mysorensis	...	...	3	4	4	3	IV	(M) YW-Y.
451. Ficus altissima (incl. Beddomei, Talboti).	...	...	2	4	4	3	IV	(S-M) W.
456. Ficus nervosa (incl. Trimeni)	...	...	2	4	4	3	IV	... W-exp.Y.
458. Ficus religiosa	36	521	3	4	3	2	III	(M) GyW.
461. Ficus tsiela	34	...	3	4	4	2	IV	... GyW.
462. Ficus infectoria	34	...	2	4	4	3	IV	(M) GyW.
466. Ficus glomerata	30	573	3	4	4	3	IV	... GyW-BGy.
467. Antiaris toxicaria	24	...	1	4	4	3	III	... W-YW.
472. Podocarpus latifolia	32	588	3	3	3	4	IV	(M) GyW.
European Species								
Spruce—British	34	465	3	4	2	1	III	W-YW.
—Scandinavian	30	686	...	...	...	...	...	...
Silver Fir	32	515	1	4	2	2	II	W-W tgdRB.
Cembro Pine	29	...	2	4	3	3	III	W-PkW.

NAMES.	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
Imported Species								
American White, or Weymouth, Pine.	25	...	...	...	...	...	...	(S) W.
gr. Europe	25	...	...	...	...	...	...	(M) W.
gr. America	38	534	...	...	...	...	...	... W.
American Spruce Pine	29	555	...	...	...	...	...	... LtY.
American Yellow Pine	32	534	...	...	...	...	...	... W.
American White Spruce	28	570	...	...	...	...	...	... W-YW.
Hemlock Spruce of America	24	...	...	...	...	...	...	... W-YW-BW.
Oregon Pine, or Douglas Fir.	32	440	...	...	...	...	...	... LtYB silky.
Cowrie (Kauri) Pine (N. Zealand).	36	582	...	...	...	...	...	... LtY.
Moreton Bay Pine (Australia).	45	...	...	...	...	...	...	... W.
Huon Pine (N. Zealand).	40	...	...	...	...	...	...	... LtY-B
N. Zealand Red or Rimu Pine.	40	...	...	...	...	...	...	... W-LtY.
N. Zealand White Pine	30	620	...	...	...	...	...	... LtY.
Yellowwood of the Cape.	40	...	...	...	...	...	...	...

Philippine Species. Alintatāu (incl. Calamansānay, Hambahādud, Lisāk, Tikim, Tiḡorōn) (Neonauclea = 291, 293); Almāciga (Agathis = 472); Daō (incl. Lamiō) (Dracontomelum = 164); Manggā (incl. Malapāho and Pahūtan = 164); Ditā (Alstonia = 359); Duklitau (incl. White Nāto) (Sideroxylon = 314); Malabūlak (Bombax = 63).

Under 1 foot diameter—(None).

Strengths.

Tensile Strength:—Spruce, British = 7.0-8.0, Av. 7.5; Scandinavian = 12.0-18.0, Av. 15.0; Silver Fir = 10.1; American White Pine = 11.8; American White Spruce = 8.0-10.0, Av. 9.0; Cowrie Pine = 4.5.

Crushing Strength:—Spruce, British = 4.2; Scandinavian = 5.8; Silver Fir = 6.5; American White Pine = 6.0; American Yellow Pine = 5.3; Oregon Pine = 5.7; Hemlock = 5.4; Cowrie = 7.8.

Shearing Strength:—American White Pine = 430; American White Spruce = 420-470, Av. 445; Hemlock = 490-540, Av. 515.

Elasticity Modulus:—Spruce, British=1393, Scandinavian=1804; Silver Fir=1583; American White Pine=1571; American Yellow Pine=1600; American Spruce Pine=1640; Oregon Pine=1680; 292. Adina=1461 (taken for Category).

Compared with Oak 100:—

	Spruce		Silver Am.		Wh.	Am.	Spr.	Oregon	Cowrie	Category
	Br.	Sc.	Am.	Wh.	Fir	Pine	Pine	Pine	Pine	
Strength	70	104	86	83	99	89	71	92	93	
Stiffness	81	104	72	93	95	95	98	116	95	
Toughness	60	104	112	74	103	95	52	74	95	

General Description. Large trees; Wood White or Pale, staining if not rapidly seasoned; Soft (94, 98, 148, 234, 292, 293, 447, 448, 458, 462, 472 moderately hard; 451, 461 soft to moderately hard; 164 soft when young and hard when old; 63 very soft), fairly elastic, grain usually straight but sometimes crossed or curly, texture usually fairly fine, alternating bands of harder darker and lighter softer tissue in 4+7 to 467 (the Figs) inclusive, and transverse bands or wavy lines in 148, 164, 314, 359 and 436; Seasons well except for staining, (292, 293 require careful stacking to prevent warping); Durability IV, often attacked by beetles (234, 291, 292, 293, 472=III and little attacked; Figs—447 to 467—and 63 durable under water); P=570; Wt, 23—45, Av. 36; Rays usually f—ff (63=B—f; 458, 462, 466, 467=m; 94, 472=ff); Pores usually m—s, (63, 466=LL; 164, 447, 451, 456, 458, 461, 462, 467=L; 472 wanting); VC.=II.

Note. A white milky rubberoid or guttaperchoid juice exudes from 314, 359, 447, 448, 451, 456, 458, 461, 462, 466, 467 on incision; the size class of the Figs has been discounted on account of the mass of aerial roots at their base.

Note on European Species. The Spruce of Europe (*Picea excelsa*) occurs throughout the greater part of Europe especially in the Northern portion, and is very largely planted; the wood is white, or when of inferior quality has a slight reddish tinge; it varies exceedingly in quality, very soft spongy or brashy when grown in low or marshy localities and of the poorest durability (such as in this country would be considered a thoroughly useless wood), whereas when grown on high hills it is moderately hard resinous with narrow growth rings and except when exposed to atmospheric agency is durable; the British Spruce is representative of the common poor quality, the Scandinavian and Alpine quality is the scarcer best quality; it always contains resin ducts,

and is slightly scented; the best quality is used for beams, joists, rafters, etc., in civil constructions, for telegraph posts, for masts and planking for mercantile marine and freshwater boats, in joinery especially for planks, boards, laths, etc., and for cabinet-making, for cooperage and medium grade shingles as splitwood, for ladders, for packing-cases and boxes, and the poorer qualities in large quantities for the last item and wooden baskets, for toys, for paper pulp, for cheap pencils, and for matches; the wood with the very narrow growth rings is the most valuable for sounding boards for musical instruments, and fetches very high prices therefor. The Silver Fir (*Abies pectinata*) is found on the hills of Central and Southern Europe; it is not so abundant, but grows to a much larger size; the wood is white or slightly tinged with yellow or brown, and has no resin ducts; it does not vary so much in quality as the Spruce, never as good as the very best nor as poor as the very inferior Spruce; it is very elastic, but even the best quality (grown at moderate altitudes) is not durable under atmospheric alternations, but it lasts very well under water; it is therefore largely used for hydraulic constructions, and also for all the other purposes of Spruce, except that of musical sounding boards.

The Cembro Pine (*Pinus cembra*) grows on the High Alps and Carpathians; the wood is white or slightly reddish towards the centre; it is scarcely resinous, and is lacking in elasticity, has very poor durability, loses half its weight in drying and warps considerably; it is used for sculpture, fine joinery, woodcarving, cabinet-making, shingles and toys.

Note on Imported Species. The American White Spruce (*Picea alba*) is white, elastic and strong, but rather coarse grained; it is not durable when exposed to the weather; it is used for building especially flooring, for small masts and spars, for medium grade shingles as splitwood, whilst the roots and trunk bases are worked into knees for canal boats, barges, etc. The strongest, most elastic and most durable wood comes from elevated regions with a dry soil, and of such the best material for sounding boards is derived; the logs for this are first quartered and then sawn as near as may be vertically to the lines of growth. The Hemlock (*Tsuga canadensis*) often attains immense size; the wood is coarse but strong, only durable under atmospheric conditions when the grain is placed vertical; it is used largely in the form of planks and scantlings for building purposes and bridges, as boards for fences, for

roofing, and for the siding of barns; young, it is used for sleepers, but not durable. The Douglas Fir, or Oregon Pine, (*Pseudotsuga Douglasii*) grows to an enormous size, up to 300 ft. high and 20 ft. diameter, and exceedingly densely together; the wood varies considerably in strength and texture; it is very largely used for masts and spars. The American White Pine, or Weymouth Pine, (*Pinus strobus*), grown in America and Canada is very different from that grown in Europe; the wood is white, very straight grained and free from knots, durable in dry climates but rots at once in damp; it makes excellent masts, beams and scantlings for house and bridge building, and especially planking and mouldings for joinery; but in Europe it is inferior to the poorest Spruce, and is only used for wooden baskets, slats, toys, common pencils, matches and paper pulp. The Yellow Pine (*Pinus variabilis* and *mitis*) of America and Canada has a light yellow wood, fine grained moderately resinous and strong, rather more durable than the White Pine, except the sapwood which rots at once; it is used for masts and yards of larger ships, and for framework in building. The American Spruce Pine (*Pinus glabra*) is found in the southern states of America; the wood very much resembles the American Spruce. The Cowrie (or Kauri) Pine of New Zealand (*Agathis australis*) grows to a large size; the wood is a light yellowish-brown with a silky lustre, close even and fine grained, and contains a considerable quantity of resin, and is durable under atmospheric conditions; it is largely used for masts and spars and for joinery purposes, but it is liable to buckle and expand in inside mouldings. Moreton Bay Pine (*Araucaria Cunninghamii*) of Queensland yields spars from 80-100 feet long; the wood is tough, straight grained, but not so durable as the Yellow Pine; it is excellent for joinery, and has a peculiar figure which resembles drops of rain; it is much employed for flooring, and being fissile for shingles. The Huon Pine (*Dacrydium Franklinii*) of Tasmania is closer grained and more durable than the White Pine of America, and has an aromatic smell; it is used for similar purposes. The New Zealand White Pine (*Podocarpus dacrydioides*) is straight grained soft and flexible, shrinks and warps very little; it decays rapidly exposed to damp, but is excellent for interior joiners' work especially flooring boards, for which, when properly seasoned it is deemed superior to best Baltic deal. The New Zealand Red Pine, or Rimu (*Podocarpus cupressinum*) varies in colour from light

yellow to brown; it is used for joiners work like White Pine, but is not so well adapted as it shrinks more, but it is better, and principally used, for house framing and carpentry. The Yellowwood of the Cape (*Podocarpus elongatus*) is of the same type; it is light yellow, and the grain is said to resemble Lancewood; it warps considerably and will not stand exposure to the weather; but is extensively used for building purposes.

Note on Philippine Species. *Alintatāu*. (See note on Bangkāl —N. * 5.) Wood hard, heavy, heart indistinct, pale yellowish or pinkish, drying paler than when fresh cut, grain slightly crossed in narrow belts, texture dense fine glossy, rather difficult to work; seasons with little checking, but liable to warp if not carefully stacked; Durability II rarely attacked by insects; Uses, posts, beams, joists, rafters and all other structural timber; bridge and wharf building; favorite for flooring and window sills; turned and shaped tool handles, planestocks, etc.; recommended for bobbins, shuttles, etc.; sometimes cut with miscellaneous lots of ties; Prices, P/160-180 mc. (= Rs. 13½-15 cft.). *Almāciga*. Wood moderately hard flexible and tough but not resilient, moderately heavy, heart indistinct, pale yellow or faintly tinged with pink or brown, grain very straight, texture very fine and smooth, very easy to work; Durability uncertain under severe conditions but excellent in dry situations, rarely attacked by beetles but not termite-proof; Uses, not well known, but recommended for carving, pyrography panels, sounding-boards for musical instruments, lumber-scale sticks, meter sticks, draftsmen's triangles and curves, etc.; Prices, only sold with Miscellaneous lumber about P/40 mc. (= Rs. 3½ cft.). *Daō*; *Manggā*. Wood moderately hard, moderately heavy, sap very large with pale yellow brownish or greyish tinge distinct, heart brown or greyish (Malapāho nearly white, Pahūtan dark brown with alternating dark and light bands), grain straight or wavy and curly, texture fairly fine, easy to work and takes a fine finish; sap liable to stain if not rapidly seasoned, and liable to warp if not carefully stacked, but otherwise seasons well; Durability III not liable to attacks of insects if seasoned carefully, but poor exposed to the weather; Uses, posts above stumps, beams, joists, rafters, door panels, flooring, sheathing, ceiling, interior finish, furniture and cabinetwork, dugout canoes, cheap clothes chests, musical instruments; from buttress roots solid cart-wheels, wash-bowls and table-tops are made; Prices, mixed with miscellaneous lumber at

P/40-50 mc. (= Rs. 3½-4 cft.). *Dita*. Wood much softer than Batino (see N. * 5); soft, light, no heart, whitish bluing rapidly if not quickly seasoned, taste bitter, grain usually straight and even but sometimes twisted and curly, texture fairly fine but variable, very easy to work; but cross-section only smoothed with a very sharp tool; except for bluing seasons well; Durability IV, but not attacked by insects; Uses, light construction, ceilings, drawing-boards, musical instruments, molds or forms for basket-weaving, light household implements such as wooden wash-bowls, wooden shoe-soles, match-wood; Prices, no sales recorded, supply limited and not cut for Manila market. *Duklitan*. Wood much paler and softer than Banokbök (see N. * 21); soft to moderately hard, light to moderately heavy, no heart, creamy-white but bluing badly if not rapidly seasoned, grain very straight, texture fine and dense, very easy to work; except for bluing seasons very well; Durability poor and sometimes wormy when cut, but sawn and seasoned wood rarely attacked by borers; Uses, locally for cheap and temporary construction, household implements, small carved and turned articles, often used instead of Lanête (see N. * 5), for which it is a good and easily worked substitute, cheap bolo and knife handles, wooden shoe-soles, excellent for pyrography panels; Prices, in lots of cheap miscellaneous lumber about P/40 mc. (= Rs. 3½ cft.), but perfectly clear unstained boards about 1 foot wide might command a higher price—up to P/300 mc. (= Rs. 25 cft.)—as Lanête substitute. *Malabûlak*. Wood very soft elastic, light, whitish when newly cut but staining greyish-brown if seasoned in log, no heart, grain even and straight, texture fairly smooth finer than Kâpok (see N. * 1) but not so fine (nor so creamy white) as Gapas-gâpas (see N. * 5), very easy to work; Durability very poor, but lasts well in sea water; Uses, light household implements, fishnet floats; Prices, scarce and not marketed.

Uses of Madras Timbers recorded. 63. Lining of wells, planking, packing-cases, tea-boxes, coffins, scabbards; toys, fishing-floats, 92 and 94. Building. 148. Tea-chests, packing-cases, furniture backs. 164. Door and window frames, planking, packing-cases, tea and coffee boxes, opium and indigo boxes, canoes and masula-boats. 234. Fissile, but little used. 291. Beams and rafters; good joiners' wood, tea-boxes. 292. Building purposes and construction, house carpentry, planking, furniture, chests, opium boxes, agricultural implements, gunstocks, turned and carved articles

(combs, platters, spoons, etc.), dugout canoes. 293. Building, cabinet-making, furniture, agricultural implements, gunstocks, turned and carved articles (combs, platters, spoons). 314. Fissile; building, shingles, tea-chests and Kerosine oil cases (at Cochin). 359. Beams, planking, furniture, packing-cases, trunks, boxes, coffins, blackboard, sheaths and scabbards, turnery. 436. Carved images, drums, agricultural implements. 447. Well curbs, door panels, furniture, cart-yokes. 458. Packing-cases. 466. Well frames.

Precis of Uses (deduced from above). Construction (incl. beams, joists, rafters and all other framing); Bridge and wharf building; télégraph poles; boat building (incl. masts and spars, knees, planking for masula and canal boats and barges, dugout canoes and catamarans); hydraulic works (incl. piles, well curbs, frames and linings); temporary or impregnated sleepers; joinery excellent (incl. planking, boarding, laths and slats, flooring, ceiling, siding, sheathing, interior finish, mouldings, posts, door and window sills and panels); cabinet work and furniture (incl. furniture backs, and single-piece table-tops from buttress stems and roots); sculpture wood-carving and fancyware excellent (incl. pyrography panels, toys, combs, etc.); cooperage and box-lumber good (incl. packing-cases, common boxes, cheap clothes-chests and trunks, tea, coffee, opium, indigo and kerosine-oil cases and boxes, coffins, wooden baskets, scabbards and sheaths, shingles, etc.); household implements (incl. washbowls—large from buttresses, and small—, platters, spoons, wooden shoe-soles, etc.); agricultural implements (incl. ladders, fencing-boards, cart-yokes, solid wheels from buttresses, etc.); turnery (incl. tool handles, bobbins, shuttles, plane-stocks, basket-weaving forms, etc.); musical instruments (incl. sounding-boards, drums, etc.); desk requisites (incl. drawing-boards, blackboards, draftsman's triangles and curves, lumber sticks, yard measures, etc.); cheap pencils; floats for fish-nets and fish-lines; match sticks and boxes; paper pulp.

Localities and Vernaculars. 63. (All dist., decid. forests) *U*. Buro, Simulî, Sâlmolî; *Tl*. Bûraga, Mundlabûraga; *Ta*. Ilavu, Mullilavu, Pûlai, Kôngu; *M*. Pûla, Ilavu; *K*. Bûraga, Kempubûraga, Mullubûraga, Elava. 92. (WFTS: KAN-TRV: NLGS: Anms.) *Ta*. Kattûkkârai; *M*. Kattakkâra, Malankâra; *UK*. Bikki, Hennalatade. 94. (WGTS: CRG-TRV: MYS: NLGS:) *Ta*. Uruttirâdcam, Pagumbal, Nâvâti, Pulândi; *M*. Totayam, Ammakaram, Kotuvâsi; *K*. Dandele, Rudrâksha. 98. (WGTS: NLGS:

CRG-TRV:) *Ta.* Milaicciriyā; *M.* Punkāra; *K.* Kalbikki, Nāribikki. 148. (CBT: TRV: TVY: Anms.) *Ta.* Kadappilā, Perungarandam. 159. (WFTS: KAN-TVY:) *Ta.* Neykottai; *M.* Pūkkolli, Cirrilamatukku. 164. (NCCS: DKN: WGTS: ravs., scat.) *U.* Āmbo; *Tl.* Māmidi; *Ta.* Mā; *M.* Mānnā, Māvu; *K.* Māvu. 234. (WGTS: CRG-TRV:) *M.* Nirkkurunta. 291. (WTCT: rvs.; elsewhere scarce and cult.) *U.* Kodombo, Kodomo, Holiptiyā; *Tl.* Kadambamu, Mogulukadimi, Nipamu; *Ta.* Kadambu, Vellaikkadambu, Kadappai; *M.* Ārrut-tēkku, Katampa, Kāttuccakka; *K.* Kadambe, Bale. 292. (Most dist.) *U.* Holondo, Kelikodombo; *Tl.* Bandāru, Dāduga, Kamba, Paccabōtruga, Paccaganapa; *Ta.* Kadambai, Mancadgadambai; *M.* Bimbu, Katampa, Mannakkatampa, Pitampu; *K.* Ānāvu, Arasinategē, Doddakadaga, Heretēge, Paccenike. 293. (Most districts) *U.* Mundāmundi; *Tl.* Bōtruga, Bottaganapa, Bottakadapa, Nirukadimi; *Ta.* Cinnakkadambu, Nirkkadambu, Pāttakkadambu; *M.* Nirkkatampa, Sirakkatampa, Malantampa; *K.* Hedū, Kadamba, Nāyikadamba, Nirkadamba, Sannakadamba. 314. (WFTS: KAN-TRV: Anms.) *Ta.* Karbālai, Kāttiluppai; *M.* Ātta, Pāla, Pālicukka, Pāliccakka; *K.* Hāle. 359. (WFTS: abdt.; NCCS: rare) *U.* C'hotinā, Kumbāro, Soptoporni; *Tl.* Ēdākulapāla, Ēdākulaponna, Ēdākularati, Pālagaruda; *Ta.* Pālai, Ēlilaippālai, Maranalari; *M.* Pāla, Daivappāla, Ēlilampāla, Kotappāla, Mangalappāla; *K.* Ēlelehāle, Hāle, Jantrahāle, Koduhāle, Mudihāle. 436. (Most dist., rvs., scat.) *U.* Mondā, Pit'hāliya; *Tl.* Ēruponaku; *Ta.* Ārraracu, Āruppūvaracu, Cannattuvarai, Kānci, Nāykkumil; *M.* Pongati, Kānci, Kāttukkumil, Malankumil, Pāmarakkumil; *K.* Kādūkānci, Kādūkēre, Kādūkumbala, Kānci. 447. (All districts, scat. and cult.) *U.* Boro, Botō; *Tl.* Marri; *Ta.* Āl, Pērāl; *M.* Āl, Pērāl; *K.* Āla, Gōli. 448. (MPLT: WGTS: scat.) *Ta.* Kallāl; *M.* Kōli, Ānakkōli, Kāttāl, Āla; *K.* Gōli, Gōni, Atakkagōli, Biligōli, Habbugōli, Kōttegōli. 451. (WGTS: MBR-TVY:) *Ta.* Pudālam, Kallatti, Kallitti, Itti; *M.* Ānakkōli, Ānakkoyāli, Tavittāl, Valiyakkōli, Vellakkōli; 456. (NCCS-Agt: WGTS: KAN-TRV). *Tl.* Vonjar; *Ta.* Nīrāl; *M.* Iccam, Ceriyaccūta; *K.* Hebbasari. 458. (All districts, scat. and cult.) *U.* Usto, Oswott'ho; *Tl.* Rāvi, Rāgi, Asvatt'hamu, Bod'hi; *Ta.* Aracu, Arayāl, Acuyatt'ham; *M.* Arasu, Arayāl, Asvatt'ham; Calādalam; *K.* Arāse, Arali, Asvatt'ha, Basari, Rāgi. 461. (All districts, scat. and cult.) *U.* Jori; *Tl.* Juvvi, Peddajuvvi,

Pittajuvvi; *Ta.* Cēlaikkallicci, Icci, Kallicci, Cirrāl. 462. (WGTS: and cult.) *U.* Pākodo, Ryshorconā; *Tl.* Jati, Juvvi, Badijuvvi; *Ta.* Cuvī, Kallāl, Kurugatti, Kurugu; *M.* Billukkōli, Bākni, Cak-kila, Cuvannāl, Itti, Jatti; *K.* Basari, Basarigōli, Karibasari, Kabbasari, Juvvi. 466. (All districts, scat.) *U.* Dimiri, Dumuro; *Tl.* Atti, Mēdi, Paidi; *Ta.* Atti, Ārā, Kōli; *M.* Atti, Attiyāl; *K.* Atti. 467. (WGTS: CRG-TRV: Anms.) *Ta.* Arandali, Ali, Nettāvil, Maravūri; *M.* Arayānnili, Ārannili, Nettāvil; *K.* Ajanapatte, Aranyapatte, Bairi, Jajjuri. 472. (CBT: TRV: TVY: scat.) *Ta.* Narumbili; *M.* Karuntumpi.

Note.—It will be noticed that there are a large number of moderately hard timbers in this category, which is a transition between soft and moderately hard; the better qualities of European White Deals are moderately hard, and are chiefly used for construction, the inferior soft qualities are used for industrial purposes and joinery under cover; this category is therefore conformable with the European White Deals.

H. MOSTLY SOFT

D.—MOSTLY WHITE OR PALE, WITHOUT CONSPICUOUS RAYS

N. * 7. *Aspens*

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
28. <i>Hydnocarpus Wightiana</i> .	33	464	3	4	4	2	III	GyW.
30. <i>Asteriastigma macrocarpum</i> .	36	456	4	4	4	3	IV	GyW.
277. <i>Sonneratia acida</i> ...	36	...	4	4	4	3	IV	GyW.
287. <i>Mastixia arborea</i> ...	31	452	3	4	4	3	IV	GyY-GnGy.
288. <i>Mastixia pentandra</i> .	27	331	3	4	4	3	IV	W shining.
371. <i>Dolichandrone Rheedii</i> .	35	...	4	4	4	3	IV	W.
417. <i>Euphorbia anti-quorum</i> (incl. <i>tirucalli</i> and <i>tortilis</i>)	30	...	5	5	4	2	V	(S-M) W-GyW.
431. <i>Daphniphyllum glaucescens</i> .	40	...	4	4	4	3	IV	GyW.
435. <i>Ostodes zeylanica</i> ...	32	421	4	4	4	3	IV	W
437. <i>Mallotus albus</i> ...	25	...	4	4	4	3	IV	W.
439. <i>Cleidion javanicum</i> .	34	452	3	4	4	3	IV	GyW.
440. <i>Macaranga indica</i> (incl. <i>Roxburghii</i>)	25	403	4	4	4	2	IV	GyW-BW.
441. <i>Sapium insigne</i> ...	27	...	4	4	4	4	V	W-GyW, spongy
457. <i>Ficus Rumphii</i> ...	27	...	5	5	4	3	IV	(VS) W. spongy
463. <i>Ficus callosa</i> ...	30	...	4	4	4	3	IV	GyW-BW.
464. <i>Fiens asperrima</i> ...	23	245	4	5	4	3	V	GyW.
European Species.								
Aspen and Black Poplar	26	315	1	4	3	4	III	W-BW.
Common or Grey Poplar	33	327	3	4	3	4	IV	W.
Canada Poplar	26	...	3	4	3	4	IV	W-PkWctr.

Philippine Species. Balukanād (incl. Lumbāng) (Aleurites = 431, 435, 437, 439); Binunga (*Macaranga* = 440); Loktōb (*Duabanga* = 277); Pinkapinkāhan (incl. Tuwi) (*Oroxylum* and *Dolichandrone* = 764 and 371).

Under 1 foot diameter. Madras. 552. *Samadera indica*. 565, 566. *Olex scandens* and *Wightiana*. 567. *Erythralum popul-*

folium. 568. *Cansjera Rheedii*. 684. *Medinilla Beddomei* and *malabarica*. 723. *Maesa indica*. 763. *Solanum verbascifolium* (incl. *giganteum* and *pubescens*). 764. *Oroxylum indicum*. 804. *Sapium indicum*.

Strengths—

Tensile Strength :—Aspen = 10.2; Poplar = 4.6-6.2, Av. 5.4.

Crushing Strength :—Poplar = 3.1-5.1, Av. 4.1.

Shearing Strength :— ?

Elasticity modulus :—Aspen = 1530; Poplar = 736-777, Av. 757;

Average taken for Category = 1144.

Compared with Oak 100 :— Aspen Poplar Category

Strength 51 53 65

Stiffness 60 44 61

Toughness 29 64 69

General Description. Mostly moderate sized trees; Wood white or pale, staining if not rapidly seasoned; Soft (417 soft to moderately hard; 457 very soft), grain straight or somewhat crossed or wavy, texture rather coarse to fairly fine, very easy to work; Seasons well except for staining; Durability IV (417, 457, 464 = V), often attacked by beetles unless thoroughly seasoned; P = 403; Wt. 23-40, Av. 31; Rays f-f, (439, 463, 464 = m, indistinct or scanty); Pores mostly s (437, 440, 441, 463, 464 = L-m; 439, 457 = m; 435 = m-ss; 431 = ss); VC. = III. NOTE.—A white milky rubberoid or guttaperchoid juice exudes from 417, 441, 457, 463, 464 on incision, from the two last sometimes yellowish; in the pith of 440 is a red resin which is apt to stain the wood if not carefully soaked.

Note on European Species. The Aspen (*Populus tremula*) occurs scattered throughout Europe and the Northern part of Asia as far as Japan; it seldom attains 2 ft. in diameter; the wood is white, little or not tinted towards the centre; it is not durable except when kept quite dry; it is but little used except for the manufacture of matches and of paper pulp, of which last it gives the best and whitest known. The Black Poplar (*Populus nigra*) is a much larger tree, often growing to 2-3 ft. diameter (and has been known up to 12 ft. diameter); it is found scattered in Central and Southern Europe, and throughout West and N. Asia as far as Afghanistan; the wood is white tending to become brownish towards the centre; it is not durable except under cover and when kept perfectly dry;

it is used for planking, packing-cases, wooden shoes, window-blinds, matches and paper pulp, and for common pencils. The Common, or Grey, Poplar (*Populus canescens*) is considered by some as a variety of the White Poplar, by others as a hybrid between that and the Aspen, and is usually found associated with them on the banks of streams; it is heavier and stronger than the Aspen and Black Poplar, but neither so heavy nor so strong as the White Poplar; it makes very good flooring, is used for packing-cases, butchers' trays, carving. The Canada Poplar (*Populus canadensis*)—called Cottonwood in Canada and the United States, owing to the cottony seed—is cultivated in Europe; it grows to a large tree, 100 ft. high and 3 ft. diameter; has a white wood tending to pinkish-white in the centre, no more durable than the others; it is used for joinery, box-making, small carpentry.

Note on Philippine Species. *Balukanāt*. Wood soft, light, white staining grey or light brown if not rapidly seasoned, grain straight, texture rather coarse, very easy to work; except for staining seasons very well; Durability IV, not often attacked by insects; Uses, match and match-box veneer, wooden shoes, sticks of cheap umbrellas; Prices, marketed with cheap Miscellaneous lumber about P/40 mc. (=Rs. $3\frac{1}{2}$ c.ft.), or as match logs about P/9 mc. (=Rs. $\frac{3}{4}$ c.ft.) *Binunga*. The species are practically identical; soft and light, whitish or light coloured, of fairly straight and even grain; Uses, after Tuwi the most commonly used wood in the Philippines for wooden shoe-soles or clogs. *Loktōb*. Resembles Binuāng (see N. * 3) in appearance but not in structure; soft, light, brittle, yellowish-white drying pale yellowish-brown, grain strongly crossed in broad belts, texture coarse and rough, extremely easy to work; Durability poor, but not often attacked by beetles; Uses, light or temporary construction, dugout canoes, floaters for rafts and fish-net floats; Prices, sold with the cheapest Miscellaneous lumber about P/40 mc. (=Rs. $3\frac{1}{2}$ c.ft.), or less. *Pinkapinkahan and Tuwī*. Wood practically identical; soft, light, no heart, pale yellowish or brownish-white, grain somewhat wavy, texture fine, very easy to work; except liability to stain, seasons very well; Durability IV; not attacked by beetles; Uses, handles of kitchen and other household implements and of cheap bolos, wooden shoe-soles (see Binunga above), matches and match-boxes; Prices, only marketed as bolts 8-10 inches diameter for wooden shoes and match-boxes about P/9 mc. (=Rs. $\frac{3}{4}$ c.ft.).

Uses of Madras Timbers recorded. 277. Models. 435. 'Used for ordinary work in Ceylon'. 439. Building. 440. Temporary huts, cabinetwork, tea-boxes.

Precis of Uses (deduced from above). Light and temporary construction; joinery (incl. planking, flooring, window-blinds); dugout canoes; floats for rafts and fish-nets; carving; household implements (incl. handles of kitchen and other utensils and of cheap knives and cheap umbrellas, wooden shoe-soles); box-lumber (incl. packing-cases, tea-chests, butchers' trays); matches and match-boxes; cheap pencils; paper-pulp.

Localities and Vernaculars. 28. (WTCT: KAN-TRV: Anms.) *Ta.* Maravattai, Nīradimuttu, Nīrvetti; *M.* Nīralam, Nīrvetti, Maravetti, Vetti; *K.* Garudap'hala, B'hūtabi, Nīradivittulu, Surānte. 30. (TVY: TRV: MYS:) *Ta.* Vellaināngu; *M.* Aileyam, Vellanāngu; *K.* Doddasurante. 277. (WTCT: KAN-TRV: litl., sswp.) *Ta.* Kinnai; *M.* Tirala, Vilātti; *K.* Kandeale. 287. (WFTS: esp. NLGS: and CBT:) 288. (WFTS: KAN-TRV:) *Ta.* Veiliccai. 371. (WTCT: MBR: TRV:) *Ta.* Ārrukkombudi, Kanbillai, Peruppūmbādri, Virbādri; *M.* Nīrpponnālyam. 417. (Most dry districts; much cult., hedges.) *U.* Siju, Dokāhānsiju, Lōhāsiju, Lonkā-siju; *Tl.* Jemmudu, Bontajemmudu, Bommajemmudu, Bara-mājemmu, Mūppakkajemmudu, Kattimandu, Kancijemmudu, Kādujemmudu; *Ta.* Kalli, Cadurakkalli, Cudācci, Tiruvargalli, Tirugukkalli, Āttāngalli, Valangalli, Mandāngalli, Kombukkalli; *M.* Kalli, Caturakkalli, Katakkalli, Tirukkalli, Kōlkalli; *K.* Kalli, Bontegalli, Caturagalli, Jadegalli, Mundugalli, Dārēgalli, Mandagalli, Bottugalli, Kōdukalli, Kōlugalli. 431. (WFTS: esp. NLGS: Anms., Pnis.) *Ta.* Colluvan; *K.* Nīrjappe, Nīrkakke. 435. (WFTS: KAN-TRV: Anms., Pnis.) *K.* Sotige. 437. (WGTS: KAN-TRV: com.) *Ta.* Mulluppolavu; *M.* Kuttali, Kāttukkurukkutti, Kāttuk-kumil, Payamparal; *K.* Uppila, Kukkuṭi, Tambittu. 439. (WFTS: KAN-TRV: NLGS: Anms.) *Ta.* Vellarai; *M.* Īyalari; *K.* Niya. 440. (Many districts scat., but WGTS: com.) *U.* Podmopornnī; *Tl.* Boddi, Puttatāmara, Kondatāmara, Kondajāp'hara, Pulicinculamu; *Ta.* Kandubārangi, Pottudāmarai, Vattadāmarai, Vattikkanni, Vattittutti, Pimugam; *M.* Pattattāmara, Pattavanni, Vattattāmara, Uppila; *K.* Uppalige, Bettadāvare, Kancupparānti. 441. (WGTS: scat.) *Ta.* Karuppuccūlai; *K.* Kannupade. 457. (NCCS-Agt: NLGS:) *K.* Bettarāgi, Kādarali. 463. (MPLT: CNTC: WGTS:) *Ta.* Kōliyāl; *M.* Valiyaccūta; Nāccūta,

Neyappuram; K. Niratti, Takadugōli. 464. (NCCS-Agt: MPLT :
WGTS :) U. Korotosāno; Tl. Karasāna, Karakabodda, Siribodda;
Ta. Imbarattān, Malandiniyatti; M. Olapparūm, Tērekam;
K. Garagasayele, Garagatti.

III.—MOSTLY MODERATELY HARD

A.—MOSTLY REDDISH

N. * 8. Cherries

NAMES	W	P.	S.	D.	U.	A.	VC.	(H) and Col.
166. <i>Buchanania latifolia</i> .	43	452	4	4	2	2	III	PkW-LtRB.
167. <i>Buchanania angustifolia</i> .	43	...	4	4	2	3	IV	PkW-LtRB.
168. <i>Buchanania lanceolata</i> .	...	...	4	4	2	3	IV	PkW-LtRB.
204. <i>Humboldtia Brunonis</i> .	...	...	4	4	3	3	IV	LtPbB.
205. <i>Humboldtia Vahlia</i> .	37	442	4	4	3	3	IV	LtPbB.
206. <i>Humboldtia decurrens</i> .	43	716	4	4	3	4	IV	PkB-DkRctr.
207. <i>Bauhinia racemosa</i> .	47	443	5	3	3	2	IV	PkW-B-DkBctr.
208. <i>Bauhinia malabarica</i> .	47	563	4	3	3	2	III	DkRB-Ppl Bctr.
210. <i>Bauhinia purpurea</i> .	46	...	5	3	3	3	IV	PkW-DkRB.
211. <i>Bauhinia variegata</i> .	44	...	5	4	3	3	IV	PkW-B-DkBctr.
228. <i>Pithecolobium umbellatum</i> .	48	...	4	4	4	3	IV	YW-YB.
229. <i>Pithecolobium biginum</i> .	22	...	4	4	3	3	IV (S)	YW-LtYB.
230. <i>Pithecolobium subcoriaceum</i> (incl. <i>anamallayanum</i>).	31	...	4	4	3	3	IV (S)	YW-LtYB.
295. <i>Nauclea purpurea</i> .	45	...	4	3	3	4	IV	LtR.
<i>European Species</i>								
Cherry	42	...	4	5	2	3	IV	YW-LtRB.
<i>Imported Species.</i>								
American Cherry ...	31	...	...	...	...	...	...	YW-LtRB.
<i>Philippine Species.</i>								
Banūyo	40	333	...	...	...	...	...	YW-LtYB-PkB-Coffee
Cupāng	23	200	...	...	...	...	(S)	YW-LtYB.

Balinghāsāy (*Buchanania* = 166, 167, 168); Bangkāl (incl. *Mambōg*) (*Nauclea* = 295); Banūyo (*Wallaceodendron* = 205, 211); Cupāng (incl. *Kundīng*) (*Parkia* = 228, 229, 230).

Under 1 foot diameter: -**Madras.** 644-646. *Caesalpinia sepia* (incl. *nuga*, *mimosoides*, and *digyna*). 663. *Pithecolobium geminatum*. 673. *Calycopteris floribunda*. 772. *Pisonia aculeata*.

Strengths.

Tensile Strength :— ?

Crushing Strength :—Americian Cherry=6.5 ; Banuyo=4.2 ;
Cupang=3.6.

Shearing Strength :—Banuyo=596.

Elasticity modulus :—Cherry=678 ; Banuyo=1070 ; Cupang=779 ; Average adopted for Category=925.

Compared with Oak 100 :—				Cherry	Banuyo	Cupang	Category
Strength	...	...	...	?	53	32	84
Stiffness	...	...	...	40	62	46	54
Toughness	...	...	...	?	45	22	131

General Description. Mostly small to moderate sized trees ; Wood pinkish or yellowish-white to reddish-brown or yellowish-brown towards the centre and there sometimes dark, heart not always distinct but irregularly coloured ; Moderately hard (229, 230=soft), grain straight or slightly crossed, texture fairly fine, easy to work ; Seasons well (except for staining of 229, 230 and sap of rest unless rapidly seasoned) ; Durability IV (207, 208, 210, 295=III), sap often perishable but heart seldom attacked by insects ; P=521 ; Wt. 22-48, Av. 42 ; Rays mostly f-f (229=fff ; Cherry m-f) ; Pores L scanty (207, 210, Cupang=m ; 295, Cherry and Banuyo=s) ; VC.=III.

Note on European Species. The Cherry (*Prunus cerasus*) occurs scattered throughout the greater part of Europe and North Africa ; this is the variety (*avium*) with the sweet fruit, the variety (*cerasus*) with the sour fruit being indigenous in Western Asia but cultivated also in Europe ; the wood is whitish in the sapwood and light reddish-brown in the heart, veined and shining, it can be deepened to a Mahogany red by soaking in lime-water or water acidulated with nitric acid ; it rots quickly under atmospheric influences ; it is used for joinery, cabinetwork and furniture (especially chairs and settees), for turning, for musical (wind) instruments, for toys, and by cartwrights, and also when young for hoops, and for the stems and bowls of tobacco-pipes, its almond scent being appreciated in that respect ; branches are also employed for walking-sticks. The American Cherry (*Prunus serotina*) is also used for cabinetwork, and in America it is considered almost equal to Mahogany, which it in some degree resembles when darkened by age.

Note on Philippine Species. *Balinghās*. Wood of all species (six) is practically identical ; soft to moderately hard, moderately

heavy, sap large white tinged with pink and not always distinct from the pink to light reddish-brown heart, grain straight sometimes with small knots, texture rather fine and even, easily worked ; seasons well ; Durability IV, sap often attacked by beetles ; Uses, light construction, flooring, interior finish, houseposts above stumps, joists, rafters, furniture, household implements, musical instruments (necks), cheap cigar boxes, common boxes, dry-measures ; Prices, P/40-60 mc. (=Rs. 3½-5 cft.), usually mixed with Miscellaneous lumber, sometimes sold for Amūgis (see N.* 21), but lighter coloured and less dense. *Bangkal*. (see N.* 5) ; wood soft to moderately hard, light to moderately heavy, sap pale yellow distinct or gradually merging into yellow or orange heart, grain sometimes quite straight, sometimes slightly crossed, texture fairly fine, greasy or waxy feeling, very easy to work ; seasons well ; Durability III, but rarely attacked by beetles ; Uses, houseposts, framing, siding, ceiling, carved ornamental work in churches, boats, furniture, cabinet-work, sculpture ; Prices, now rarely seen in Manila market, but has brought as high as P/90 mc. (=Rs. 6½ cft). *Banūyo*. Wood moderately hard, moderately heavy, sap distinct whitish, heart light golden-brown to light coffee-colour sometimes lightly reddish tinged, grain usually straight but sometimes slightly crossed curly or wavy, texture fine glossy, easy to work ; Durability III, heart rarely attacked by beetles ; Uses, all sorts of interior finish, doors, windows, shell-screens, furniture and cabinetwork, carriage-panels, carved picture frames, musical instruments, ships' cabins ; Prices, F/140-210 mc. (=Rs. 11½-17½ cft). *Cupang*. Wood of both species identical ; soft, light, sap whitish rapidly bluing if not quickly seasoned and usually large distinct, heart pale brown, grain straight or slightly crossed, texture looking coarse but taking a smooth finish under sharp tools, very easy to work ; except for bluing seasons well ; Durability IV, sap perishable but heart rarely attacked by beetles ; Uses, cheap siding, wooden shoes, wooden washbowls and other kitchen and household utensils ; Prices sold with soft Miscellaneous lumber at P/40-50 mc. (=Rs. 3½-4 cft).

Uses of Madras Timbers recorded. 166. Window-frames, doors, tables, bullock-yokes, bedsteads, boxes. 208. Houseposts, cross-pieces of harrows. 211. Agricultural implements.

Precis of Uses (deduced from above). Light construction (incl. joists, rafters) ; joinery (incl. planking, flooring, interior finish,

siding, ceiling, doors, windows, shell-screens, posts); boat-building (incl. planking, cabin panels); cabinetwork and furniture (incl. chairs and settees, tables, bedsteads); sculpture, carving and fancy ware (incl. ornamental work for churches, picture frames, toys); wheelwrightery (incl. carriage panels, bullock-yokes, hoops); musical instruments (wind-instruments, necks of guitars, etc.); box-lumber (incl. common boxes, cheap cigar boxes, dry measures); household implements (incl. kitchen implements, washbowls, wooden-shoes); tobacco pipe bowls and stems; walking sticks; agricultural implements (incl. crosspieces of harrows).

Localities and Vernaculars. 166. (Most districts, dry forests) *U.* Cāro; *Tl.* Cāra, Cāramāmidi, Jvaramāmidi, Mōralli; *Ta.* Āymā, Cārai, Kāttumā, Mudaimā, Mōralai; *M.* Kālamāvu, Mural, Nuruvi; *K.* Kolegēru, Kolemāvu, Morale, Morave, Murukāli. 167. (DKN: southwards, dry forests) *Tl.* Cāra, Mōralli, Induba; *Ta.* Kalmā, Kāttumā, Mudaimā, Pulimā; *M.* Malamāvu. 168. (NCCS: CNTC: MBR-TVY) *Tl.* Pandijāruga; *Ta.* Miricudā; *M.* Malamāvu. 204. (CRG-MBR: NLGS) (names not known). 205. (MBR-TVY: NLGS:) *Ta.* Ārruvanci; *M.* Kūrappunnu, Kūrati. 206. (TVY: TRV:) *Ta.* Kuntāni; *M.* Nānōli, Malantotappū. 207. (Most districts, dry forests) *U.* Omborodā; *Tl.* Āre, Manciyāre, Paccāre, Adaīyāre; *Ta.* Ārai, Ārikka, Āttai, Cīrāccā, Callagi; *M.* Mandāram, Kotappuli; *K.* Āra, Āralumandāra, Ārise, Ayata, Kittārisa. 208. (Most districts) *U.* Gohonoborodā; *Tl.* Āre, Pullāre, Pullagoddukūra, Pulladanda; *Ta.* Malaiyātti, Puliyātti, Vattātti; *M.* Ārāmpuli, Mīnpuli, Kokkavāli, Ponnā; *K.* Basavanapādu, Cappara, Kogile, Mandāra. 210. (NCCS: MPLT: WFTS:) and 211. (NCCS: DKN: MPLT: WFTS: scat.) Borodā, Debokānjoro, Koconāro; *Tl.* Bōdanta, Devakāncanamu, Kāncanamu, Mandāra; *Ta.* Cegap-pumandārai, Mandārai, Cemmandārai, Periyavātti, Vellaippūvātti; *M.* Cuvannamandāram, Kovidāram; *K.* Kancivāla, Kempukancivāla, Bilikancivāla, Mandāra, Kempumandāra. 228. (KSN: CNTC: scat.) *Tl.* Celangi; *Ta.* Iluvai. 229. (WGTS: KAN-TVY: com.) *Ta.* Kalaipākkū; *M.* Konacatti, Koranjati, Kānnatti, Attapparanta, Kalpākkū, Kāttukkonna, Muttakkoluppan; Kādukonde. 230 (MBR-TVY: Anms., Pnis.) *Ta.* Malaivāgai; *M.* Urimpukkunni, Urimpukkonna. 295. (NCCS: WGTS: scat.) *Tl.* Begada; *Ta.* Nīrkka-dambu; *M.* Kāttuccakka.

III.—MOSTLY MODERATELY HARD

A.—MOSTLY REDDISH

N. * 9 Red Deals

NAMES.	w.	p.	s.	d.	u.	a.	vc.	(H) and Col.
49. <i>Dipterocarpus indicus</i> .	46	695	1	3	1	3	II	(H) DkGyR.
50. <i>Dipterocarpus Bourdillonii</i> .	42	572	1	3	1	4	II	RB-DkRctr.
59. <i>Vateria indica</i> ...	37	415	2	3	1	2	II	PkGy-PkB pch.R.
60. <i>Balanocarpus utilis</i> (incl. <i>erosa</i>).	...	...	2	3	1	4	III	(H) DkR.
107. <i>Boswellia serrata</i> ...	36	...	4	4	3	2	IV	W-LtRB-DkGnB.
109. <i>Balsamodendron caudatum</i> .	33	...	4	4	3	2	IV	PkW-LtRB.
112. <i>Canarium strictum</i> .	37	523	2	4	2	3	III	PkW-LtRB.
317. <i>Dichopsis elliptica</i> ...	42	472	1	4	2	3	III	PkW-RB.
398. <i>Cinnamomum zeylanicum</i> (incl. <i>sulphuratum</i> , <i>Wightii</i> and <i>macrocarpum</i>).	39	509	3	2	2	3	III	PkW-LtRB-LtB.
European Species.								
Mountain Pine	33	...	4	4	2	3	IV	(S) W-LtRB.
Scotch Fir	31	448	2	4	2	1	II	(S) W-YW (practically no heart.)
Red Deal	See Sals N. *24	35	661	4	3	1	II	(M-H) PkW-RB.
		34	578	2	2	1	I	(M-H) PkW-PkR.
		38	608	4	2	1	III	(M-H) PkW-PkR.
Larch	32	443	3	3	2	2	III	(S) YW-PkB
Imported Species.								
Red Pine of Canada and America.	37	483	...	...	...	...	...	(S) PkW-PkR.
California Redwood	28	508	...	...	...	...	...	(S) RB.
Totara Pine of New Zealand.	40	570	...	...	...	...	...	LtRB.
Miro Pine of New Zealand.	46	...	...	...	...	...	...	LtB-DkR.
Black, or Matai, Pine of New Zealand.	40	610	...	...	...	...	...	LtB-DkR.
Philippine Species.								
White Lauan	28	542	...	...	...	...	...	(S-M) W-LtGyB-LtR.
Almon	33	459	...	...	...	...	...	(S) YW-LtR (fading).
Red Lauan	30	394	...	...	...	...	...	(S-M) RW-R-DkRB.
Tanguile	36	482	...	...	...	...	...	(M) GyB-R-DkPplB.
Palosapis	35	376	...	...	...	...	...	(M) YW-PkR pchPk.
Apitong	54	646	...	...	...	...	...	(M-H) GyB-GyR-RB.

Afū (incl. Dāgang and Palosāpis) (Anisoptera = 59, 60); Alakāak (incl. Dulītan, Kalipāya, Malacmālac, Malikmik, Manic-nīc, Nāto, Tagātoi) (Palaquium = 317); Banīti (= Alakāak, etc.) (Bassia = 317); Almōn (incl. Danlīg, Kalūnti, Mala-anōnang, Mangasinōro, Mayāpis) (Shorea = 107); Baglīcan (= Almōn, etc.) (Parashorea = 107); White Lauān (= Almōn, etc.) (Pentacme = 107); Apitong (incl. Hagachāc, Pānao) (Dipterocarpus = 49, 50); Benguēt Pine or Sāleng (incl. Mindoro Pine or Tapūlau) (Pinus = none but nearly 49, 50); Kalīngag (incl. Mindanao Cinnamon) (Cinnamomum = 398); Kamīngi (Santiria = Pīli, etc. = 112) Pīli (incl. Pagsahingan) (Canarium = 112); Red Lauān (incl. Malakayān, Tiāong) (Shorea = 109); Amamanīt (= Red Lauān, etc.) (Eucalyptus = 109); Tanguile (Shorea = 60).

Under 1 foot diameter. (None).

Strengths.

Tensile Strength:—British Scotch Fir = 5.0-10.0, Av. 7.5; Plains Larch = 6.0; Red Pine = 12.0-14.0, Av. 13.0; Nato = 12.4; Palosapis = 13.0; Apitong = 13.0.

Crushing Strength:—Plains Larch = 3.2; Red Pine = 5.4-7.5, Av. 6.4; White Lauan = 6.2; Almon = 4.5; Red Lauan = 3.9; Tanguile = 5.2; Palosapis = 3.5; Apitong = 7.3. Across the grain:—White Lauan = 645; Tanguile = 800; Apitong = 730.

Shearing Strength:—Scotch Fir = 500; White Lauan = 557; Almon = 508; Red Lauan = 502; Tanguile = 647; Palosapis = 473; Apitong = 730.

Elasticity modulus:—British Scotch Fir = 845-951, Av. 898; Plains Larch = 1074; Red Pine = 1168; California Redwood = 1320; White Lauan = 1653; Almon = 1377; Red Lauan = 1201; Tanguile = 1232; Palosapis = 1133; Apitong = 2144; Average adopted for Category = 1457.

Compared with Oak 100:	British Sc. Fir	Plains Larch	Red Pine	Calif. Redwd.	Philip. woods	Category
Strength	61	71	78	81	78	84
Stiffness	49	63	68	77	102	68
Toughness	76	80	89	85	60	98

General Description. Mostly large trees, resinous or balsamic; Wood pinkish-white to light or dark reddish-brown, sapwood distinct or merging into heart; Moderately hard (49, 60 = hard), fairly to very elastic, grain straight to much crossed, texture fine to rather coarse, resin ducts present in 49, 50, 59, 60 often arranged

in conspicuous narrow lines (concentric) which give the appearance of growth rings which latter are rarely distinct except in the first years of growth, usually easy to work; Seasons well generally, but liable to stain if not quickly dried, and to warp if not carefully stacked; Durability III (39 = II; 107, 109, 112, 317 = IV), not liable to attacks of beetles except 107, 109, 112; P = 525; Wt. 33-46, Av. 41; Rays f-f (50, 59 biform, B-m few and f numerous; 107, 109 = m white); Pores mostly L-m (109 = s few); VC = II. *Note.*—All these trees contain, like the Pines and Conifers generally, a resinous juice; 49, 50, 59, 60, 112 Copal or Dammer; 107, 109 Olibanoid balsamic; 317 white guttaperchoid; and 398 Camphoraceous.

Note on European Species. The timbers of these Conifers are exceedingly variable in quality. Taking, to start with, the Scotch Fir (*Pinus sylvestris*)—otherwise known as Scotch Pine, Red Deal, Memel Red Deal and Riga Red Deal or jointly Baltic Red Deal, Norway Red Deal and Swedish Red Deal or jointly Scandinavian Red Deal,—occurs throughout the whole of Europe and Northern Asia especially Siberia; it has a white or yellowish-tinged sapwood, which is very inferior but very abundant, so much so that it practically forms the whole wood in young trees (sometimes up to 80 years of age), also in trees grown in damp compact soils, also in those grown south of about 55 degrees North latitude; it is chiefly this material which forms a large proportion of the stock of commerce, and especially that recognized as the British type; it is soft, and wanting in durability, being perishable when exposed to the air or moisture, and can therefore be only used under cover and when kept quite dry. The heartwood varies also; grown north of about 65 degrees North latitude, which is the Scandinavian type, it is but slightly lignified, slightly resinous, very homogeneous and easy to work, is moderately hard and pink red or reddish-brown; on the other hand, grown between the parallels of 55 and 65 degrees North latitude it forms the Baltic type, it is fully lignified, very elastic, full of turpentine which makes it very durable, hard, and has much the same colouring as the Scandinavian type, and is difficult to work. The Baltic and Scandinavian types are therefore quite a different category of timber to that of the British type, and will be discussed under N. *24. The British Red Deal is chiefly used for construction under cover in the form of beams, joists, rafters, studding, and other forms of framing, in

joinery for flooring, ceiling, wainscoting, door and window frames and panelling, etc.; for ladders; for packing-cases and other box-lumber; for carving and toys; for poles and saplings used in agricultural purposes; for household implements; for matches and for paper pulp. The Mountain Pine (*Pinus montana*) occurs in Central Europe on mountains above an elevation of 7,000 feet; it has a poor white sapwood, which is little used, and a fissile light reddish-brown heartwood, rather of the Scandinavian Red Deal type but softer, which is used for construction work especially military buildings, for carpentry, industrial work, wood-carving and turnery. The Larch (*Larix europaea*) occurs chiefly in Central Europe, the best quality being found on mountains over 3,000 feet elevation; it is also much planted; it has a yellowish or reddish-white sapwood, which is highly developed when grown on the plains and the lower hills, and which is poor and put to the same uses as the British type of Scotch Fir. Grown naturally on hills above 3,000 feet, it is a very different timber, and there the heartwood is the part mostly developed; this is resinous, very elastic, hard, very durable, is considered as good as the best Oak or as the very best Scotch Fir of the Baltic type; this, also, will be considered in Category N. *24.

Note on Imported Species. The Red Pine of Canada and America (*Pinus rubra* and *resinosa*) is soft to moderately hard, of a light reddish tinge, fine grain and close texture, coarser than the White Pine, easily worked; it is largely used in boat-building for spars and planking, in bridge construction and framing in house-building; it is not so durable as Baltic Red Deal. The Totara Pine of New Zealand (*Podocarpus totara*) is a large tree, usually attaining a height of 80 feet and a diameter of $3\frac{1}{2}$ feet; the wood is fissile, reddish, does not warp much, but is brittle and apt to shrink if not well seasoned; it is apt to decay in the heart; it is principally used for joinery, especially for flooring, and for shingles. The Miro Pine (*Podocarpus ferruginea*) is brownish-coloured, and is not durable when exposed to the weather; but it is useful for interior carpenters' and joiners' work. The Black Pine (*Podocarpus spicata*) close-resembles the Miro but is more durable, and is used where strength and solidity are required.

Note on Philippine Species. *Afri* (incl. *Dāgang* and *Palosāpis*). Wood of all species is practically identical in structure and general appearance, and is known as *Palosāpis* in the market; moderately

hard, moderately heavy, sap distinct whitish staining when drying, heart rose-red quickly fading to yellowish with rose-red streaks and blotches, grain somewhat crossed, texture rather coarse, easy to work; seasons without much checking but liable to warp if not carefully piled; Durability III when exposed to weather, poor in the ground, except the inferior sap rarely attacked by beetles; Uses, posts above stumps, beams, joists, rafters, floors, doors, sheathing, ceiling, wagon-beds, furniture, dugout canoes, boats, barges, rice-mortars, backs and bases of harps and smaller musical instruments, dashboards and other parts of carretelas and carromatas (c.f. *jutkas* and *ekkas*); all cheap and temporary construction, boxes and packing-cases; Prices, P/50 mc. (= Rs. 4 cft.) and upwards; the best grades often sold as *Mangachapūy* (see N. *24) to which it is not quite equal. *Alakāak* (*Nāto*; incl. *Baniti*). *Baniti* is sold as *Nāto*; wood of all species, except for slight differences in colour weight and hardness, is practically identical, and in the Manila market is known as *Nāto*; soft to moderately hard, light to moderately heavy, sap pale red distinct, heart light red to dull red-brown, grain straight, texture fine smooth, very easy to work; Durability IV, but very rarely attacked by beetles; Uses, all the various uses of the *Lauāns* (see below) with which it is mixed by the larger operators, a favourite for cheap cigar-boxes, also for bottoms and sides of drawers, shelves, and backs of sideboards, dressers, wardrobes, etc.; Prices, mixed with *Lauāns* and other soft Miscellaneous red woods, P/30-60 mc. (= Rs. $2\frac{1}{2}$ -5 cft.). *Almōn* and *Amamanit* (see *Lauān* below). *Apitong* (incl. *Hagachāc* and *Pānao*). Wood of all species is practically identical as far as structure goes, whilst in weight hardness and colour the difference between various species seems no greater than between individuals of the same species in different regions; it is not quite so good nor so smooth as *Guijo* (see N. *24); moderately hard to hard, moderately heavy to heavy, stiff and strong, sap indistinct greyish or brownish staining badly in drying, heart light ashy-red to reddish or dark-brown, grain fairly straight or somewhat crossed, texture rather coarse and rough, resinous and more difficult to saw than other allied less resinous woods but otherwise not difficult to work; does not check badly, but liable to warp if not seasoned carefully; Durability III, not commonly attacked by beetles but occasionally by dry-rot; Uses, posts above stumps, beams, joists, rafters, flooring, bridge and wharf-construction except piles,

wagon-beds, ship-planking, barges and lighters, ties, paving-blocks, mine-timbers (impregnated), cheap and medium grade furniture, one of the most generally used construction woods in the Islands; Prices, P/35-90 (mostly 60-70) mc. (=Rs. 5-6 cft.). *Benguët Pine*. Wood soft to moderately hard, moderately heavy to very heavy (the resinous heart being much heavier than the sapwood), sap pale yellow merging gradually into the rich orange-brown heart which is completely impregnated with resin (especially in the Mindoro Pine), grain straight or slightly crossed, texture fine and smooth, easy to work except for gumming tools; seasons well; Durability II, sap not very good but heart rarely attacked by insects even by termites; Uses, as it grows in localities where practically no other timber exists, it is there put to every use, but is little used where other timbers can be obtained; Prices, about P/70 mc. (=Rs. 6 cft.). *Kalingag*. Wood soft to moderately hard, light to moderately heavy, sap large light brown or pink, heart irregular in outline very irregularly mottled with dark brown or blackish streaks, strongly scented, easy to work; warps badly unless carefully seasoned; Durability II at least, never attacked by beetles though rapidly destroyed by termites; Uses, locally for beams, flooring, etc., household implements, carved articles, excellent material for lining wardrobes, moth-proof chests, etc.; Prices, not marketed, scarce but well-known. *Kamīngi* (incl. Pili and Pagsahingan). Kamīngi is very similar in all respects to Pili, but rather tougher and more difficult to work; the structure of all species of *Canarium* is practically identical; wood moderately hard, moderately heavy, sap small whitish drying grey indistinct, heart pale reddish-brown, grain straight, texture fine dense glossy, rather easy (Kamīngi more difficult) to work; seasons well; Durability IV, subject to attacks of shot-hole borers; Uses, cheap construction, posts said to last fifteen years if portion in ground charred, cheap furniture, box-lumber, treated ties and paving blocks; Prices, marketed only with Miscellaneous lumber about P/50-60 mc. (=Rs. 4-5 cft.). *Lauān* (incl. Aimōn, Danlig, Kalūnti, Mala-anōnang, Mangasinōro, Mayāpis, Bagtican and White Lauān proper, all as White Lauāns; and Red Lauān proper, Malakayān, Tiāong and Amamanit, all as Red Lauāns). Wood of Amamanit in general appearance like a light bright Red Lauān, and sold only mixed with that; wood soft to moderately hard, light to moderately heavy, sap fairly distinct yellowish-white often staining slightly in

drying, heart from pale straw (White Lauāns) through all shades of pale red to dark reddish-brown (Red Lauāns), grain usually much crossed, texture rather coarse, works very easily; seasons well checking and warping but little but sometimes staining unless care is taken; Durability IV, liable to attacks of beetles; Uses, siding, sheathing, ceiling, floors, doors, interior finish, concrete forms, dugouts, lighters, barges, boxes, furniture, general cheap and temporary construction; Prices, P/30-80 mc. (=Rs. 2½-6 cft.). *Tanguile*. It bears about the same relation to Red Lauān that Guijo (see N. *24) does to Apitong, i.e. it has a smoother cleaner look and takes a glossier finish owing to its elements being smaller and more sharply defined; it is the finest grained and hardest of the Lauān class, and has a pale purplish tinge in contradistinction to the pale to dark brick-red colour of the Red Lauāns; seasons well, but may warp if not carefully stacked; Durability III; Uses, all the uses of Red Lauān, but preferred to the other Lauāns for fine work on account of its greater hardness and density, and, excepting sapwood, somewhat greater freedom from attacks of beetles; Prices, the best selected stock is exported, while the remainder is sold with Miscellaneous lumber; has been quoted during 1915 at P/60-75 mc. (=Rs. 5-6½ cft.), except for selected export grades.

Uses of Madras Timbers recorded. 49. Reepers. 50. Dugout canoes. 59. Canoes, coffins, masts of native vessels, shelves, doors, tea-chests, cordite-boxes, packing-cases, ceilings. 107. Masts, furniture. 317. Building, rafters, planking, shingles (being fissile), furniture, boxes, packing-cases.

Precis of Uses (deduced from above). Cheap and temporary construction (incl. beams, joists, rafters, etc.); joinery (incl. plank-ing, boarding, laths and reepers, flooring, ceiling, siding, sheathing and wainscoting, interior finish, doors); boat-building (incl. barges and lighters, boats and canoes, dugouts, masts and spars, ship-planking); treated sleepers and paving blocks, hydraulic works (incl. impregnated mine timbers, poles if base charred); cabinet-making and furniture (incl. medium and cheap grades, wardrobe lining, moth-proof chests, bottoms and sides of drawers, shelves and backs of sideboards dressers and wardrobes); box-lumber (incl. packing-cases, tea-chests, cordite-boxes, cigar-boxes, common boxes, coffins); cooperage (including cask-staves, shingles, etc.); wheel-wrightery (incl. wagon-beds, dash-boards and other parts of light

vehicles); turnery; wood-carving (incl. toys); household implements (incl. rice-pounders); concrete forms; matches; paper pulp.

Localities and Vernaculars. 49. (WGTS: KAN-TRV:) *Ta.* Enney, Vellāyini; *M.* Kalpayan, Kakka, Nili, Vellāyini, Varanku; *K.* Banasampa, Callenne, Enne, Ganduyenne, Maradenne, D'hūma, Vālivara. 50. (WGTS: KAN-TRV: scat) *M.* Kārānnili, Caratānnili, Pālapayan; *K.* D'hūma. 59. (WGTS: KAN-TRV: abot). *Ta.* Kundurukkam, Vellaikkundurukkam, Kungiliyam, Vellaikkungiliyam, Tūbam; *M.* Payan, Perumpayan, Vellappayan, Telli, Kunturukkam. 60. (TVY: TRV:) *Ta.* Karungōngu. 107. (Most districts, dry forests) *U.* Lōbān; *Tl.* Anduga, Guggilāmu, Tellaguggilāmu; *Ta.* Kungiliyam, Vellaikkungiliyam, Parangiccāmarāni, Valugam; *M.* Kunturukkam, Vellakkunturukkam, Mukkundam, Pālankam; *K.* Dūpa, Guggula, Gugguladūpa. 109. (KSN-SLM: CNTC: dry forests) *Tl.* Kondamāmidī, Kondarāgi, Mettamāmidī, Pullamāmidī; *Ta.* Kiluvai, Cengiluvai, Malangiluvai, Malaikkiluvai, Karppūrakkiluvai, Paccaikkiluvai; *K.* Bettamāvu, Kalmāvu, Kondamāvu, Hasuvāra. 112. (WFTS: CRG-TVY: MRA: MYS: Anms.) *Ta.* Kundurukkam, Karungundurukkam, Kungiliyam, Karungungiliyam, Karuppukungiliyam, Tūbam; *M.* Payan, Pantappayan, Pantam, Kungiliyam, Karuttukkungiliyam; *K.* Hālemaddu, Karedūpa, Mandadūpa, Pāndu, Rāladūpa. 317. (WFTS: CRG-TVY: com.; MPLT:) *Ta.* Pālvadindān, Pālai, Pāccōrrippālai; *M.* Pāli, Cōlapāli, Cōmpāla, Pāccontippāla, Kaippāla; *K.* Pālucotte. 398. (WFTS: esp. KAN: MBR: NLGS: Anms: Pnis.) *Ta.* Karuvā, Kāttukkaruvā, Ilavangam; *M.* Karuppu, Kāttukkaruppu, Ilavangam; *K.* Dālcini, Lavangam, Adividālcini, Adivilavangam.

III.—MOSTLY MODERATELY HARD

A.—MOSTLY REDDISH.

N. *10. Red Cedars.

NAMES.	w.	p.	s.	d.	u.	a.	vc.	(H) and Col.
46. <i>Ternstroemia japonica</i> .	45	...	4	3	2	4	IV	RB.
67. <i>Sterculia urens</i> ...	41	...	3	5	4	2	IV	(S) PkB-RB mot.
108. <i>Garuga pinnata</i> ...	40	...	4	3	2	2	III	PkW-RB-Cop. R.
115. <i>Melia composita</i> ...	27	391	3	3	2	3	III	(S) PkW LtPkR.
133. <i>Cedrela toona</i> (incl. microcarpa).	35	465	1	2	1	2	I	(S) BrkR-RB fgt.
145. <i>Lophopetalum Wightianum</i> .	29	467	2	3	2	2	II	PkW-RGy.
151. <i>Meliosma Wightii</i> ...	36	370	4	4	2	4	IV	(S) DkRB.
162. <i>Meliosma simplicifolia</i> .	32	370	4	4	2	4	IV	LtRB.
163. <i>Meliosma Arnottiana</i> .	23	325	4	4	2	4	IV	(S) DkRB.
215. <i>Acrocarpus fraxinifolius</i> .	39	...	1	3	2	2	II	PkW-PkR fgt.
226. <i>Albizzia stipulata</i> ...	35	568	3	3	2	3	III	(S) PkW-exp. PkB.
313. <i>Rhododendron arboreum</i> .	40	...	5	4	3	3	IV	(S-M) PkW-exp. RB.
Imported Species.								
West Indian Red Cedar:	36	404	...	...	...	...	...	(S) LtR-DkR.
Cuba.								
Bermuda ...	47	610	...	...	...	...	...	LtR-DkR.
Philippine Species.								
Calantas ...	34	499	...	...	...	...	...	(S) LtR-DkR.
Malasantol ...	36	604	...	...	...	...	...	(S) PkW-LtPkR.

Bōgo (*Garuga* = 108); Calantās (incl. Marānggo) (*Toona* and *Melia* = 133); Guyunggūyung (incl. Paguringon, Salinggōgon) (*Kayea* = 46); Malasantōl (incl. Santōl) (*Sandoricum* = 115, 145); Unik (*Albizzia* = 226).

Under 1 foot diameter:—Madras. 590. *Zizyphus oenoplia*. 592. *Zizyphus rugosa*. 596. *Sageretia oppositifolia* and *hamosa*. 662. *Acacia pennata*. 669. *Kandelia Rheedii*. 720. *Vaccinium neilgherrense* and *Leschenaultii*. 722. *Gaultheria fragrantissima*. **European.** Tree Heath, or Briar-pipe wood (*Erica arborea*). Azalea (*Rhododendron ferrugineum* and *hirsutum*).

Strengths.

Tensile strength :—West Indian Red Cedar (Average) = 5.0 ;

133. Cedrela (Toon) = 5.0.

Crushing Strength :—West Indian Red Cedar = 5.7 ; Calantas =

4.4 ; Malasantol = 6.6 ; 115. Melia = 3.0.

Shearing Strength :—Calantas = 526 ; Malasantol = 720 ; 115.

Melia = 478.

Elasticity Modulus :—West Indian Red Cedar, Cuba = 290 ;

Bermuda = 486 ; Calantas = 1255 ; Malasantol = 1754 ; 115.

Melia = 739 ; 133. Toon = 1784 ; Average taken for Category = 1261.

Compared with Oak 100 :—

	Malasantol	Calantas	Cuba Red* Cedar	Bermuda* Cedar	115 Melia	133 Toon	Category
Strength	94	80	65	98	60	75	68
Stiffness	103	73	17	27	43	104	74
Toughness	85	89	254	318	84	54	64

General Description. Large and small trees ; Wood usually pinkish-white when fresh becoming slightly to far darker and usually dark reddish-brown ; Moderately hard, (313 soft to moderately hard ; 67, 115, 133, 161, 163, 226 soft), sometimes cedar-scented, grain generally straight, texture fine, easy to work ; Seasons well, but sometimes liable to internal cracking if seasoned in log ; Durability III, 133 = (II ; 161, 162, 163, 313 = IV ; 67 = V), not liable (sap of 108, and 161, 162, 163, 67 entirely liable) to be attacked by beetles, (133 when living sometimes attacked by borer) ; P = 422 ; Wt. 23-41, Av. 35 ; Rays usually conspicuous and often darker or lighter than adjacent tissue, mostly m (46, 313 biform, m few and f many ; 115, 145, 226 = f) ; Pores mostly L (215 = LL ; 161, 162, 163 = m ; 46 = s ; 313 = ss-sss) ; VC. = I.

Note on European Species. The Tree Heath, or Briar Pipe Wood (*Erica arborea*) is found in the Mediterranean region, whilst the Azaleas (*Rhododendron*) are found on the High European mountains ; the wood is identical ; and the root and stump wood is used for the manufacture of 'Bruyère' or 'Briar' pipes for smoking. The West Indian Red Cedar (*Cedrela odorata*) occurs chiefly in the West Indies, and also in Honduras, and attains 80 ft. in height and 5 ft. diameter ; the wood is reddish, somewhat resembling

* **Note.**—There seems something wrong about these figures (although all such figures are collected from Tredgold and other high authorities) ; West Indian Red Cedar is a brittle wood ; these figures make it exceptionally tough.

Pencil Cedar (*Juniperus*) both in colour and odour ; it is soft, porous and brittle, but very durable ; it is used for framing in housebuilding (beams, joists, rafters, etc.), for joinery (planking, ceiling, wainscotting, also shingles), for cabinetmaking and furniture (especially when it has a curly grain), for carving and fancyware and, especially, for high grade cigar-boxes.

Note on Philippine Species. *Bōgo*. Wood of the different species of *Garuga* is identical, and when not too streaky it looks exactly like *Amūgis* (see N. *21), but is not so hard ; moderately hard, heavy, sapwood large whitish staining dirty grey in drying distinct, heart coppery-red sometimes with blackish streaks, grain generally straight, texture rather fine smooth, easy to work ; Durability of heart fair, sapwood much liable to attacks of beetles ; Uses, interior finish, cabinetwork, furniture ; Prices, supply limited and not marketed. *Calantās*. Wood of *Marānggo* on the average slightly harder and heavier than, otherwise identical with, *Calantās*, which latter is practically identical with the Indian Toon and Spanish Cedar (*Cedrela odorata*) ; wood soft, light, sap pale red distinct, heart light to very dark red and most frequently of the colour of the average Spanish Cedar, grain generally straight, texture fine or moderately coarse smooth, very easy to work ; seasons well except that thick planks are liable to internal checking if not carefully seasoned ; strong and lasting (fugitive in *Marānggo*) odor of Spanish Cedar ; Durability II, heart practically never attacked by insects when seasoned, but living trees sometimes attacked by borers ; Uses, the only wood used in Manila for high-grade cigar-boxes and also for piano-cases, a favourite for dugout canoes, sheathing and ceiling, carving and sculpture, paddles and light oars, automobile mudguards, wardrobes, clothes chests, boats and small launches, ships' cabin finish ; Prices, P/140-160 mc. (=Rs. 11½-15 cft.). *Guyunggūyung*. Wood moderately hard, moderately heavy, sap merging into heart, pale pinkish or reddish-brown darkening towards centre, grain straight with a narrow ribbon of lighter and darker colour on the quarter-sawn—and a 'watered-silk' grain on the flat-sawn—face, texture fine dense smooth, fairly easy to work ; seasons well ; Durability III, not attacked by beetles ; Uses, locally for posts, beams, agricultural implements, etc., and if impregnated would make good ties and paving blocks ; the wood of all species is practically identical in mechanical properties, structure and colour ; Prices, rarely brought to the Manila

market except occasionally with Miscellaneous lumber. *Malasantōl*. Wood practically identical with Santōl, and fit for the same uses; soft, light, pale red sometimes tinged with pink or violet darker towards the centre, faintly scented, grain straight, texture fine and smooth, very easy to work; seasons well; Durability III, rarely attacked by beetles; Uses, carving and sculpture—next to Baticulīn (see N. *5 and 15) and Lanēte (see N. *5) the favourite, especially for sacred images—hatmakers blocks, houseposts and light framing, ceilings, furniture, cabinetwork, household implements; Prices, rarely marketed, but sculptors buy short bolts at not more than P/10-15 mc. (—Rs. $\frac{3}{4}$ -1 $\frac{1}{4}$ cft.). *Unik*. Wood soft to very soft, light, sap whitish not distinct, heart pale clear pinkish or reddish-brown, grain almost perfectly straight, texture fairly fine homogeneous smooth glossy, very easy to work; seasons well; Durability probably at least III, heart rarely attacked by beetles; Uses, sheathing and ceiling, bancas, shipping cases for cigarettes, very good for canoes and light boats, Prices, marketed only with Miscellaneous soft lumber at P/40-50 mc. (—Rs. 3 $\frac{1}{2}$ -4 cft.).

Uses of Madras Timbers Recorded. 46. Building, rafters, doors, etc. 67. Guitars, toys. 108. Cabinetwork, furniture. 115. Building, ceiling, boat-outriggers, furniture, boxes. 133. Buildings, furniture and cabinetwork, door panels, carving, boxes, tea-boxes, cigar-boxes. 145. Building, rafters, planking, packing-cases. 161, 162, 163. Rafters. 215. Fissile; Building, furniture, shingles, tea-boxes. 226. Building, cabinet-work, furniture, cartwheel naves, tea-boxes, cattle-bells. 313. Posts, gunstocks, knife-handles, plates and dishes.

Precis of Uses (deduced from above). Construction (incl. beams, joists, rafters, house posts, light framing); joinery (incl. posts, planking, door frames and panels, flooring, ceiling, sheathing and wainscotting, interior finish, also shingles); wheel-wrightery (incl. carriage bodies, panels, automobile mudguards, naves of wheels); boat building (incl. small launches, boats, canoes, paddles and light oars, ships' cabin finish, dugouts and outriggers); musical instruments (incl. piano cases and all internal parts except the mechanism, guitars, cattle-bells); box-lumber (incl. clothes chests, cigar-boxes of highest grade, tea-chests, shipping cases for cigarettes, packing-cases, ordinary boxes); turnery (incl. gunstocks, hat-makers' blocks); household implements (incl. plates, dishes, knife-handles, etc.); briar pipes (for smoking).

Localities and Vernaculars. 46. (WFTS: esp. NLGS) *K.* Kemuni. 67. (Most districts, dry forests) *U.* Gūdālo; *TL.* Ponaku, Erraponaku, Tanuku, Tapasi; *Ta.* Cendālai, Cendanakku, Cigaputtanakku, Tanakku; *M.* Tonti; *K.* B'hūtaili, Kempudaili, Punise. 108. (Most districts, dry forests) *U.* Hāndulomohi, Mohi, Nibrymohi, Sompotri, Sorupotri; *TL.* Garuga, Garudu, Kondavēpa; *Ta.* Arunelli, Enneykkārai, Karuvēmbu, Karavilangan, Vilangam, Malaiyudi; *M.* Karavēmpu, Kariyan, Kāttukkalinjam; *K.* Gadde, Biligadde, Nelligadde, Aranelli, Doddadumpli. 115. (GJM: KNL: MPLT: WGTS: scat.) *U.* Mohālimbo, Potonolimbo; *TL.* Munnatikāraka; *Ta.* Malaivēmbu, Turukkavēmbu; *M.* Malavēppu, Kattampālam, Conakil; *K.* Bettabēvu, Bēvu, Hebbēvu, Kādubēvu, Turakabēvu. 133. (NCCS-Agt: SAC-MRA: CRG: TVY: MPLT: scat) *U.* Mohālimbo; *TL.* Gāli, Nandi; *T.* Āyil, Candanavēmbu, Cevvagil, Cūli, Madagirvēmbu, Māli, Tevadāram, Tūnu, Vedivēmbu; *M.* Akil, Conakil, Arana, Devatāram, Vedivēmbu, Tunnam, Kac'ham; *K.* Dēvadāri, Gand'hagarige, Garige, Kalingi, Kalkalingi. 145. (KAN-TVY: NLGS: Anms. Pnis.) *Ta.* Venbalagai, Vengottai; *M.* Kāruka, Vellapollam, Venkut'ham, Venkatavu; *K.* Bōralapāle. 161, 162, 163. (WGTS: CRG-TVY: NLGS: Anms.) *Ta.* Cembavu, Kallavi, Kuccavir, Kadiri, Tagari; *M.* Kallavi, Kuccavir, Kattukiluvu; *K.* Mette, Tode, Kancemogge, Holemogge, Masavala. 215. (MPLT: WGTS: CRG-TVY: NLGS: Anms.) *Ta.* Kurangam, Malaikkōn, Malaikkonrai, Cegappuyagil; *M.* Kurannan, Kurannāti, Malakkonna; *K.* Belangi, Havalige, Kalingi, Kalkalingi. 226. (NCCS-Agt: WFTS:) *U.* Gūdānāudiā, Reyī; *TL.* Cinduga, Kondaciguru, Kondadirisanamu; *Ta.* Cilai, Cilaivāgai, Karrurincil, Pilivāgai; *M.* Vāka, Mottuvāka, Pottuvāka; *K.* Bāge, Bettabāge, Hottubāge, Kalbāge, Kottapāli. 313. (WGTS: NLGS TRV: Anms., Pnis., hills over 6000 ft.) *Ta.* Alingi; *M.* Kāttuppūvaracu; *K.* Bili, Pū.

III.—MOSTLY MODERATELY HARD

A.—MOSTLY REDDISH

N. *11 Chestnuts.

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
41. Calophyllum tomentosum (elatum).	38	586	1	2	1	2	I	RPk-RB.
42. Calophyllum Wightianum.	43	582	3	2	1	3	II	R-RB.
65. Cullenia excelsa ...	36	508	1	3	3	2	II	(S-M) Pk-RB.
74. Pterospermum suberifolium.	43	595	4	3	2	3	III	LtR.
75. Pterospermum diversifolium (incl. obtusifolium).	44	...	4	3	2	4	III	PkB-LtPplB.
76. Pterospermum rubiginosum.	42	840	3	2	1	3	II	(H) LtPk-DkPk.
77. Pterospermum reticulatum.	43	603	3	3	1	3	III	LtRB stk. DkB.
78. Pterospermum Heyneanum.	45	...	4	2	1	3	III	(H) LtR.
274. Lagerstrœmia lanceolata.	44	625	2	2	1	2	II	GyPk-PkR-RB.
275. Lagerstrœmia flos-Régina.	40	642	3	2	1	3	II	(H) PkGy-LtPkB.
European Species								
Chestnut { South Europe	40	416	1	4	1	3	II	(H) YW-YB-YRB.
{ America and	31	...	...	...	...	...	...	(M) YW-YB-YRB.
Carob, or African Locust Bean.	51	...	...	...	...	...	...	(H) YW-PkR.
Philippine Species.								
Batitanan	...	59	538	...	...	...	...	(H) BW-LtOlGy-DkB.

Banabā (incl. Batitanan) (Lagerstrœmia = 274, 275); Bayök (incl. Bayokbayōkan, Kulatīngan) (Pterospermum = 74, 75, 77); Bitanhōl (incl. Marabitāog, Pamitaōgen) (Calophyllum = 41, 42); Lanūtan (incl. Vidal's Lanūtan) (Bombycidendron = 65).

Under 1 foot diameter. Madras. 586. Gymnosporia montana. 813. Debregeasia velutina.

Strengths.

Tensile Strength:—Chestnut = 10.5-13.3, Av. 11.9; 41. Calophyllum (Poon) = 8.0-14.7, Av. 11.4; 42. Calophyllum (Wight's Poon) = 15.8; 275. Lagerstrœmia (Water Venteak) = 13.0-15.0, Av. 14.0.

Crushing Strength:—American Chestnut = 5.0; Batitanan (= 275) = 9.3; 275. Water Venteak = 6.0; 74. Pterospermum = 4.3.

Shearing Strength:—American Chestnut = 690; Batitanan = 859; 275. W. Venteak = 852; 74. Pterospermum = 963.

Elasticity modulus:—Chestnut = 1148; 41. Poon = 1512-1690, Av. 1601; 74. Pterospermum = 963; 274. Lagerstrœmia (Common Venteak) = 1623; 275. Water Venteak = 1219; Batitanan = 1655; Average adopted for Category = 1352.

Compared with Oak 100:—Chestnut. Batitanan. Poon. Venteak. Category.
Spar. Common Water. gory.

Strength	...	89	87	94	101	103	102
Stiffness	...	67	97	94	95	71	79
Toughness	...	118	79	94	108	150	132

General Description. Large and moderate sized trees; Wood more or less pinkish at first and developing later a more or less pronounced brown tint from pale pink brown to red brown, sometimes fading and sometimes deepening on drying; Moderately hard (76, 78, 275, Chestnut of the South and Carob all hard; 65 = soft to moderately hard); considerably elastic, usually fissile, but tough and difficult to split otherwise, grain sometimes straight, sometimes crossed or wavy, texture fine smooth, usually easy to work (275 rather difficult); Seasons well but liable to split at ends, so that logs and freshly trimmed ends of lumber should be painted to prevent splitting; Durability II, (65, 74, 75, 77, = III) rarely attacked by insects (275 little attacked even by termites or teredo); P = 630; Wt. 38-45, Av. 42; Rays f-f; Pores usually L or L.L.-ss (all sizes), (75, 76 = m; 65, 74, 77, 78 = s); VC. = 1.

Note on European Species. The Chestnut (Castanea vesca) occurs wild (or long centuries naturalized) and much planted throughout Europe, Asia Minor and W. Asia, and also in America; the sapwood is scanty of a yellowish-white, and the heartwood brown of varying tints from pale tawny to deep reddish fawn brown; it is hard, elastic, strong, readily fissile, but grown towards the North and in America it is not so heavy nor so close-grained

nor so fissile but more brittle; it is fairly durable under alternations of the atmosphere but not eminently so, it is more durable underground, and distinctly durable under cover and when kept dry; the trees, though growing to great size, usually tend to rot at the heart, and very large dimension timber can rarely be obtained; it is used, but not largely, for construction, more so for joinery and interior finish, for cabinet-making and furniture, but especially for cask-staves and cask-hoops, and also for shingles, when grown in the south but in the north it is too porous for other than dry-goods barrels; it is also largely used for agricultural purposes (incl. vine-props, hop-poles, fences and park-palings, hurdles, etc.), and wheelwrightery (chiefly spokes and felloes). The Carob, Algaroba, or African Locust Bean (*Ceratonia siliqua*) occurs in South Europe and North Africa along the Mediterranean and in Asia Minor; the sapwood is copious, and of a yellowish-white with a heartwood of bright pink to rosy-red often veined with darker streaks; it is hard and fissile, but has no durability under the influence of humidity; it is largely used for joinery, for cabinet-work, and for wheelwrightery, but its principal use is as splitwood for cask-staves, etc.

Note on Philippine Species. *Banabā*. In general appearance and structure *Banabā* (see Venteak 274) is identical with, but rather softer pinker and easier to work than, *Batitanan* (see Venteak 275); wood moderately hard to hard, heavy, ashy-rose to reddish-brown (*Batitanan* is light or dark greyish-brown), sap paler distinct or gradually merging into the heart, grain straight or sometimes waved and resembling Ash-wood in being partly narrow and open and partly broad and dense, texture fine dense smooth, fairly easy (or, *Batitanan*, rather difficult) to work; seasons with little warping, but liable to split badly at the ends, so that logs and freshly trimmed ends of sawn lumber should be painted to prevent splitting; Durability I, rarely attacked even by termites or teredo; Uses, ship wharf and bridge-building (including salt-water piles), ties, paving blocks, sills, posts, beams, joists, rafters, flooring, interior finish, furniture and cabinetwork; Prices P/180-200 mc. (= Rs. 15-16½ cft.). *Bayōk*. Wood of all species as far as known identical in general appearance and structure, easily mistaken for *Lanūtan* from its colour texture and presence of ripple-marks; moderately hard and rather tough, moderately heavy to heavy, sap indistinct from, but paler than, the purplish or reddish-brown fading to light

brown, heart, grain straight or slightly crossed, texture fine smooth, easy to work; seasons well; Durability IV, but rarely attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, sheathing, ceiling, furniture and cabinetwork, household implements, combs, and impregnated would make good ties and paving blocks; Prices, mixed with medium-grade lumber selling about P/50 mc. (= Rs. 4 cft.) and upwards. *Bitanhōl*. Though varying considerably in colour hardness and weight and texture, the structure of all species is very similar, *Bitāog* or *Pālomaria* (see N. *20) is thus harder heavier and usually darker than, but *Marabitāog* and *Pamitaōgen* are practically identical with, *Bitanhōl*; wood moderately hard, moderately heavy, sap pale red distinct, heart light red to reddish-brown, grain distinctly crossed, texture fine glossy, rather tough and difficult to split, except for difficulty of surfacing cross-grain in radial sections easy to work; seasons very well; Durability III, but heart rarely attacked by insects; Uses, masts and spars, bridge-ship and boat-building, frames or beds of carriages and other vehicles, posts, beams, joists, rafters, flooring, cabinetwork (for which from its beauty of grain and colour it deserves more attention from cabinet-makers), hubs and shafts; Prices, P/100 mc. (= Rs. 8½ cft.), but often substituted for *Bitāog* (or *Pālomaria*) and bringing P/125-175 mc. (= Rs. 10½-14½ cft.) *Lanūtan*. Wood moderately hard flexible and tough, moderately heavy to heavy, sap yellowish-white usually distinct, heart light to dark purple fading to dull purplish-brown, grain straight or slightly crossed, texture fine smooth, fairly easy to work; seasons well; Durability III, but rarely attacked by beetles; Uses, posts, beams, joists, rafters, of small houses, carriage shafts, single-trees, ax and similar tool-handles, gunstocks, backs and sides of musical instruments (guitars, mandolins, etc.), cabinetwork; Prices, shafts roughed out and bent P/3½ (= Rs. 10½) per pair, bolts of 10 ft. length and 1 ft. diameter at P/5-8 (= Rs. 15-24) each.

Uses of Madras Timbers recorded. 41. Ship-building, bridge-building, constructions, shingles, dugout canoes. 42. Engineering purposes, house-building, furniture. 65. Building, planking, boxes. 75. Building. 76. Building, houses and boats. 77. Boats. 78. Rafters, shoulder-poles. 274. Building, rafters, planking generally, good shingles, ship-building, furniture, good coffee cases. 275. Building, posts, beams, rafters, planking, ship and boat building, hulls of canoes, fittings paddles and oars of boats, next in demand

after Teak for light and heavy cheeks of gun-carriages, spirit casks, cabinetmaking.

Precis of Uses (*deduced from above*). Constructions, carpentry (including ground-posts, beams, joists, rafters); joinery (incl. posts, planking, flooring, ceiling, siding, sheathing and wainscoting, interior finish); ship-building (incl. masts and spars, boat-building, canoe hulls and dugouts, oars and paddles); wharf and bridge-building (incl. saltwater piles, sleepers and paving blocks impregnated or not); cooperage (incl. staves and hoops of casks, oil and dry-goods barrels, and shingles); wheelwrightery (incl. frames and beds of carriages and other vehicles, shafts of carriages, singletrees, light and heavy cheeks of guncarriages); cabinetwork, furniture and fancyware (incl. combs); musical instruments (incl. backs and sides of guitars, mandolins, etc.); turnery (incl. axe and similar tool handles, gunstocks, etc.); agricultural implements (incl. hop-poles, vine-props, palings, hurdles, etc.); household implements (incl. shoulder-poles); box-lumber (incl. coffee-cases).

Localities and Vernaculars. 41. (WGTS: CRG-TVY: Anms., Pnis.) *Ta.* Pinnai, Kāttuppinai, Pungu; *M.* Punna, Kāttuppunna, Cōlappunna, Malappunna, Kumpu, Viri, Karunguttiyam; *K.* Srihonne, Holehonne, Bobbe, Kūve. 42. (WTCT) *Ta.* Cirubinnai, Analveri; *M.* Āruppunna, Ceruppunna, Mannappunna, Purappunna; *K.* Kalhonne, Kalponne, Kaiponne, Bobbi. 65. (WGTS: CRG-TVY: NLGS: Anms.) *Ta.* Ānaippalā, Malaikkoncil, Pālāvu, Vedbalā, Kārānai; *M.* Cempayira, Elancakka, Vellirumpakam, Kārāni, Kārānnili. 74. (NEL: CDP: NAC: SAC:) *Tl.* Nārudu, Tada; *Ta.* Cembolavu, Cirilaippolavu, Tadai, Vennangu. 75. (TVY: TRV) *Ta.* Mulippolavu; *M.* Mulippolāku. 76. (WGTS: MBR-TVY: Anms.) *Ta.* Cirilaippolavu, Karundōrbolavu; *M.* Cittālapolāku, Malantotali, Totali, Talavāri, Ponarika. 77. WGTS: MBR-TVY) Mūlarbolavu, Polavu, Tōrbolavu; *M.* Malavuram, Palakayunam, Tōlpuli, Nāyunnu. 78. (NCCS: com.) *U.* Bailo; *Tl.* Lōluga, Nōlika, Duḍḍika, Maccakanda; *Ta.* Polavu. 274. (MPLT: CNTC: WGTS:) *Ta.* Vendēkku, Venveyila, Kaccaikkatti; *M.* Ventekku, Vellilāvu, Vendan, Vengulam, Cennāli; *K.* Bendēku, Aunnate, Belaunnate, Nandi, Bilinandi, Tavaunnate. 275. (KAN: TRV: rvs.) *Ta.* Pūmarudu, Kadali, Kadalimugai, Kadalippū; *M.* Nīrvēṭēkku, Pūvalavēṭēkku, Nīrmarutu, Manimarutu, Cemmarutu; *K.* Nīrbendēku, Vāribendēku, Calla, Holecalla, Maruvācalla, Holematti.

III.—MOSTLY MODERATELY HARD

A.—MOSTLY REDDISH

N. *12. Oaks

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
1. <i>Dillenia indica</i> ...	44	721	4	2	1	3	III	LtR-R.
2. <i>Dillenia bracteata</i> ...	...	...	4	2	1	4	III	LtR-R.
3. <i>Dillenia pentagyna</i> ...	50	751	3	2	1	2	III	RGy-RB.
233. <i>Carallia integerrima</i>	47	699	3	3	1	3	III	(H) Or-R-RB.
270. <i>Barringtonia</i> acu- tangua.	43	609	4	3	2	2	III	PkW-LtRB.
418. <i>Bridelia retusa</i> ...	54	655	4	3	2	2	III	YGy-DkOIB.
419. <i>Phyllanthus emblica</i> ...	50	645	4	3	2	1	III	(H) Pk-R-DkR.
420. <i>Glochidion arboreum</i> 53 (incl. <i>Hohenackeri</i> , <i>neilgherrense</i> and <i>Heyneanum</i>).	...	...	5	3	3	3	IV	LtR-DkR.
429. <i>Bischofia javanica</i> ...	44	681	1	3	1	3	II	LtR-DkClAR.
<i>European Species</i>								
Oak (generally) ...	46	621	1	2	1	2	I	(MH) GyYB-RYB.
Peduncled Oak ...	48	592	1	2	1	2	I	(H) RYB.
Sessile Oak ...	45	650	1	3	1	2	II	(M) GyYB.
<i>Imported Species</i>								
Amer. and Canadian White Oak.	54	572	...	...	...	...	...	(H) RB-B.
Australian Silk, or Silver Oak.	42	...	...	...	...	...	...	(H) YW-LtRB.

Philippine Species. Anislāg (*Securinea*=420); Bacāuan-gūbat (*Carallia*=233); Bōtong (*Barringtonia*=270); Catmōn (incl. *Catmōn-calabāu*, *Malacatmōn*) (*Dillenia*=1, 2, 3); Katābang (incl. *Katilūk*, *Kilōg*, *Manāring*, *Manggasiriki*, *Pangnān*, *Ulāian*) (*Quercus*=none truly, but nearly 1, 2, 3, 233, etc.); Tuāi (*Bischofia*=429).

Under 1 foot diameter:—Madras. 563. *Chaillatia gelonioides*. 784. *Glochidion littorale* (incl. *multiloculare*, *lancifolium*, *fagifolium*, *ellipticum* and *velutinum*). 788. *Antidesma ghæsembilla* and *bunius*. 789. *Antidesma diandrum* (incl. *zeylanicum* and *menasu*). 802. *Homonoia riparia*.

Strengths.

Tensile Strength:—Peduncled Oak = 10.0–19.0, Av. 14.5; Sessile Oak = 12.6; American White Oak = 5.1–10.2, Av. 7.7.

Crushing Strength:—Peduncled Oak = 6.5–10.0, Av. 8.2; Sessile Oak = 6.5–7.7, Av. 7.1; American White Oak = 6.6; 233. Carallia = 10.4; Across the grain:—American White Oak = 2000.

Shearing Strength:—Peduncled Oak = 700; Sessile Oak = ? American White Oak = 780; 233. Carallia = 1075.

Elasticity modulus:—Type Oak = 1710; Peduncled Oak = 1649–1714, Av. 1681; Sessile Oak = 1471–1988, Av. 1740; American White Oak = 1920–1959, Av. 1940; 233. Carallia = 1257 (taken as average for the Category, but probably higher).

Compared with Oak 100:—Sessile Oak. Amer. Wh. Oak. Carallia. Category.

Strength	...	...	109	92	113	108
Stiffness	..	...	90	113	73	73
Toughness	...	...	133	75	175	163

General Description. Large and moderate sized trees; with the exception of their colouring (418 and 563 have normally, and the others especially 3, 233, 270 and 419 not unfrequently fade into, the tawny and fawn browns of the Oak), these species correspond very approximately with the Oaks in strength, durability, weight and their conspicuous silver grain which furnishes the well-known curly wavy mottling; Wood usually more or less pinkish-white at first developing into various tints of light or dark red or light or dark reddish-brown (418 and 563 always yellowish, and 233, 273, 419 sometimes more or less orange); Moderately hard (233, 419—hard), grain straight or somewhat crossed to very twisted and curly, with a very conspicuous silvergrain on radial section sometimes forming a most capricious pattern of waves and curls, texture often looking coarse sometimes fine always dense, usually easy to work though sometimes difficult to saw; Seasons well with little warping and cracking if carefully undertaken and properly stacked (429 requires special care in this respect); Durability III, (1 2, 3 = II), usually very durable under water and mostly so underground (in which cases some turn jet-black), not attacked by beetles; P = 670; Wt. 44–54, Av. 48; Rays mostly biform, BB-B and also f-ff (3, 418, 420 m and f-ff) giving a conspicuous silvergrain; Pores mostly m-ss of different sizes (233, 429 = L-m; Oak = LL-ss; 270 = s); VC. = II.

Note on European Species. The Oak occurs throughout the whole of Europe, Asia Minor, the Caucasus and the Urals; now considered one species (*Quercus robur*), it was formerly classed as two, the Peduncled Oak (*Q. pedunculata*) and the Sessile Oak (*Q. sessiliflora*), and Brandis says: 'Foresters, particularly in France and Germany, have no difficulty in keeping them apart'; on the other hand, Mathieu says: 'Normally speaking, the Peduncled Oak is grown chiefly as Standards over Coppice in fertile soil in the plains, and is more fibrous, rougher, more knotty, stronger, darker, and more suitable for construction than the Sessile Oak, which is chiefly grown in High Forest on low hills and plateaux, and is straighter fibred, softer, more fissile, rather lighter coloured, and which is more suitable for split wood and industrial purposes; but these qualities are less intrinsic in the species themselves than due to the different conditions under which they are grown'. He also says: 'Oak does not occupy the first rank in any of its individual qualities which characterize its timber; thus, it is not the heaviest, nor the hardest, nor the most elastic, nor even the strongest; nevertheless it unites all these qualities to such a degree, it has also such durability whether in the air or under water, and again it can acquire such great dimensions, that undoubtedly it is the most valuable at least of European woods, if not of those of the whole world'. The woodh as a large sapwood of a pale yellowish-white, which is rapidly attacked by insects in dry, and by fungi in damp, localities; the heartwood varies from moderately hard and a tawny (greyish-yellowish) brown to hard and a fawn (reddish-yellowish) brown, chiefly agreeing with the varieties Sessile and Peduncled, respectively; the Peduncled Oak has a durability II when grown in the open in a mild climate and on a moist, but not wet, soil, otherwise III; the Sessile Oak has a durability of II when used solely in dry places, but IV when exposed to damp, and taken generally III; bearing in mind what has been said above in respect of Peduncled Oak being most suitable for construction work and Sessile for split wood and industrial work, the Oak is by far the best timber for naval, civil, hydraulic and military construction in the form of girders, beams, scantlings, piles, shores, bed-plates for motors and all the wooden parts of machinery that demand strength and durability, sleepers, etc.; cabinetwork demands a large proportion of it cut to show off its beautiful silvergrain; joinery uses it for flooring, wainscotting, doors, window sills;

cooperage consumes large quantities of it in the form of staves and bungs, mill-wheel boarding, shingles, hurdles, palings, sieve-frames; it is further used for poles, vinestakes and other props, trenails, laths and trellises, and thousands of other objects which are constructed of it.

Note on Imported Species. The White Oak of America and Canada (*Quercus alba*) derives its name from the colour of its bark, and occurs from Canada southward to the Gulf, and westward to beyond the Missouri, but comes to greatest perfection in the Middle States, in the deep strong moderately damp soil; the wood has a slightly reddish tinge, and, although not as heavy and compact as the common English Oak, it is strong solid and durable, and found excellent for heavy timber-work, and for all kinds of structures requiring durability and strength. It is extensively used for staves, agricultural implements, carriage and car-building, cabinet-ware, fencing, and various farm purposes, and is a favourite wood in ship-building. Like the European Oaks, the quality of the wood differs according to the nature of the soil in which it has grown. Australian Silk, or Silver, Oak (*Grevillea robusta*) occurs in Queensland and New South Wales, and has a hard pinkish-white to light reddish-brown somewhat brittle wood; the rays are broad and very broad, and show a most beautiful silver-grain; it does well for panelling, parquet floors, and wainscoting, cabinetwork and furniture.

Note on Philippine Species. *Bacāuan-gūbat*. Wood moderately hard, moderately heavy, sap pale red not very distinct, heart light red to light reddish-brown, grain very straight with very conspicuous silvergrain, texture appearing rather coarse but fairly dense, easy to work; seasons with little checking or warping; Durability III, probably not high under severe conditions but not attacked by beetles; Uses, locally for posts and structural timber, a very pretty easily worked cabinet and furniture wood, musical instruments; Prices, not known in Manila market except found occasionally in lots of mixed Miscellaneous woods. *Anislāg*. Wood moderately hard, moderately heavy, sap small indistinct, heart reddish-brown with darker streaks, grain straight, texture fine dense smooth, easy to work; liable to warp somewhat if not carefully piled, otherwise seasons well; Durability at least III, not attacked by beetles; Uses, houseposts, joists, rafters, agricultural implements, tool-handles; Prices, not marketed except with Miscellaneous lumber. *Bōtong*.

Wood soft to moderately hard, light, sap pale distinct, heart pale reddish-brown sometimes with darker streaks, grain somewhat crossed, texture fairly fine and smooth but not glossy, easy to work; seasons well; Durability III, not commonly attacked by beetles; Uses, locally for posts and beams, and household and agricultural implements, a pretty cabinet wood, and impregnated would make good ties or paving blocks; Prices, though found on almost all beaches nowhere abundant and not marketed. *Catmōn*. Excepting for a wide range of colour, from a light brick-red to a very dark reddish-brown, the wood of all species is practically identical in general appearance as well as in structure, and is known in the Manila market as Catmōn; wood hard, heavy, sap pale red not distinct, heart light brick-red to dark reddish-brown, grain very twisted and curly making it very difficult to split and the silvergrain of pith-rays on radial section very conspicuous forming a most capricious pattern of dark curls and waves, texture looking coarse but dense, difficult to saw but not otherwise difficult to work; seasons well checking and warping but little; Durability II, not attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, sheathing, ceiling, furniture, cabinetwork (and on account of its unusual flake grain it should be much more used for this, and would make a beautiful veneer), musical instruments, impregnated paving blocks and mining timbers; Prices, P/100-120 mc. (=Rs. 8½-10 cft.). *Katābang*. Though varying somewhat in colour and texture, the wood of the Oaks is practically of one type: moderately hard, heavy, to very heavy, sap pale yellow-brown hardly distinct, heart light to dark brown, grain straight with an extremely broad and showy silvergrain on quarter-sawn face and forming straight long brown lines on slash-sawn face, texture fine smooth and dense; seasons well if carefully stacked but otherwise is liable to split and warp considerably; Durability probably III, not attacked by beetles; Uses, posts, beams, joists, rafters, flooring, tool-handles, probably if treated would make superior railroad ties and paving blocks; Prices, rarely marketed except in small quantities with Miscellaneous lumber, though small lots of good boards may bring as high as P/120-150 mc. (=10-12½ cft.). *Tuāi*. Structure of Anislāg, but colour of Lamōg and Tōog (see N. *21), but not so hard; wood moderately hard, heavy, sap cream-colour to reddish-brown not very distinct, heart reddish-brown with a purplish tinge, odour of vinegar especially when fresh, grain straight or somewhat

crossed, texture coarse dull rough, easy to work; checks and warps badly if not carefully seasoned and stacked; Durability excellent underground, otherwise III; Uses, posts above stumps, beams, joists, rafters, flooring, foundation piling, recommended for treated ties and paving blocks, and mining timber; Prices, sold with heavier Miscellaneous lumber P/50-70 mc. (-Rs. 4-6 cft.), but often wrongly sold with Bansalāgin and Bētis (see N. *31), i. e. P/150-200 mc. (-Rs. 12½-16½ cft.).

Uses of Madras Timbers recorded. 1 (Very durable under water, and turns black), House-building, ship-building, gunstocks, helvcs. 3. (Durable under water, and under ground), House-construction, ship-construction, cabinetwork, ricemills. 233. (Fissile), cabinet-work, furniture, fittings, planking. 270. (Durable under water), Cabinet-work, furniture, boat-building, well-work, carts, rice-pounders. 418. (Good under water and under ground), house-building, sleepers, carts, agricultural implements. 419. (Good under water, wood mottled brown, red and yellow, and with its broad rays resembles Carallia), Building, poles, furniture, well-curbs, turning, gunstocks, agricultural implements. 420. Cabinet work, turning. 429. (Almost imperishable in muddy ground and under water), Bridges and other works of construction, building especially planking, specially suited for piles and sleepers, furniture.

Precis of Uses (deduced from above). All major civil, military, naval and hydraulic construction; bridge-building (incl. piles, beams, planking, sleepers and paving-blocks); hydraulic works (incl. piles, mine-timbers, mill-wheel boarding, well-work); carpentry (incl. poles, piles, posts, beams, joists, rafters, shores); joinery (incl. planking, flooring, ceiling, sheathing and wainscotting, siding, doors, windowsills); ship-building (incl. keels, knees, ribs, planking for decks and hulls, treenails, cabin wainscotting and other finish); factory work (incl. bedplates for motors, all wooden parts requiring strength and durability, rice-mills and pounders); cooperage (incl. staves, bungs, shingles, sieve-frames); wheelwrightery (incl. carriage and cart-building); cabinet work and furniture (should be much more used on account of the peculiar flake grain, and would make beautiful veneer); musical instruments; turnery (incl. helvcs and handles of axes and other tools and instruments, gunstocks); agricultural implements (incl. ploughing apparatus, hoppoles or vine-props and similar supports, hurdles, palings, trellises); household implements.

Localities and Vernaculars. 1. (WFTS: KAN: MBR: Anms., scat.; NCCS-Agt: rare) *U.* Cālotā, Ōū; *TL.* Kalinga, Peddaka-linga, Uvva; *Ta.* Akku, Ugākkāy, Uvāttēkku; *M.* Punna, Vālapunna, Cālitā; *K.* Kanigala, Bettakanigala, Neyitāku. 2. (CDP: NAC: CPT: CBT: MYS: scat. or rare) *TL.* Cirutēku, Kallatēku; *Ta.* Cōlikkāy, Karrēkku; *K.* Bettadakanigalu. 3. (NCCS: KNL: WGTS: com.) *U.* Rāi; *TL.* Pārudu, Pārutākulu, Ravadana, Cinnakalinga; *Ta.* Kallicilaikkāy, Nāyttēkku, Pinnai; *M.* Punna, Kotappunna, Pattippunna; *K.* Kanigala, Kādukanigala, Kōlatēgu. 233. (WGTS: esp. CRG: KAN:) *TL.* Kāralli; *Ta.* Andimiriyā, Valluttal; *M.* Valakkanna, Vankana; *K.* Andimargal, Andimuriyasa, Andipunāru. 270. (Most districts, rvrs., fswp) *U.* Hinjolo, Nij'hirā; *TL.* Kadamu, Kanapakanigi; *Ta.* Cengadambu, Kadambu, Perungadappai, Āram; *M.* Attampu, Ceriyasamistaravati, Āruppēra, Nīrppēra; *K.* Holekāuva, Nīrgānigalu, Nīrdaddal. 418. (Most districts) *U.* Kosi; *TL.* Annemu, Bontavēgisa, Duriyamaddi, Kōdāri, Koramaddi, Poramānu; *Ta.* Acavai, Ādamarudu, Ciruvēngai, Kōmanci, Mulvēngai; *M.* Calaru, Kōmanci, Mullukayani, Mulluvēnna; *K.* Asana, Gōjji, Koyyāmunji, Mullubēnga Mulluhonne, Nāsinage, Siruhonne. 419. (All districts, dtts., abdt.) *U.* Onolā; *TL.* Usirika, Nelli, Āmalakamu; *Ta.* Nelli, Āmalagam; *M.* Nelli, Āmalakam; *K.* Nelli, Āmalaka, Cattu, Dadi. 420. (WGTS: KAN: TRV:), 421. (NLGS: TRV: T.V.Y.:), 422. (NLGS), 423. (NCCS:) *TL.* Endrika, Lajoda, Ragoda; *Ta.* Ānikkāy; *M.* Kulucān; *K.* Nīrjani, Ānikāyi, Banavara. 429. (Most districts, rvrs. or mts) *U.* Dīngiri; *TL.* Nalupumushti, Panta; *Ta.* Madagirvēmbu, Māccadayan, Tondi; *M.* Nīra, Tirippu, Nannal; *K.* Nigurulle, Nile, Gōparinigurulle.

III.—MOSTLY MODERATELY HARD

B.—MOSTLY YELLOWISH OR BROWNISH

N. * 13 Teaks

NAMES	W	P	S	D	U	A	VC	(H) and Col.
4. <i>Michelia champaca</i> .	36	555	2	1	1	4	II	(S) YW-LtOIB satiny.
5. <i>Michelia nilagirica</i> ...	38	...	3	1	1	3	II	YW-OIB glossy.
380. <i>Callicarpa arborea</i> ...	33	...	4	2	2	3	III	(H) YW-LtBW.
381. <i>Tectona grandis</i> ...	45	661	1	1	1	2	I	YW-DkYB fgt.
382. <i>Premna tomentosa</i> ..	60	...	4	2	2	3	III	YW-YB fgt.
383. <i>Gmelina arborea</i> ...	33	493	3	1	1	2	II	(S) YW-PkW-GyW glos.
384. <i>Vitex altissima</i> (incl. alata and pubescens)	55	734	1	1	1	3	I	(H) YGy-YB-YRB-OIB.
<i>European Species</i>								(None)
<i>Philippine Species</i>								
Molave ...	48	488	...	...	...	...	...	(H) YGy-LtYB.

Hairy-leaf Molāve (incl. Molāve, Kalipāpamādam, Lingolingo) (Vitex = 384).

Under 1 foot diameter:—**Madras**. 683. *Melastoma malabathricum*. 765. *Callicarpa lanata*. 766, 767. *Premna integrifolia* (incl. *corymbosa*, *coriacea*, *villosa*, *Wightiana*) and *latifolia*. 769. *Clerodendron infortunatum* and *phlomidoides*. 775. *Elæagnus latifolia*.

Strengths

Tensile strength:—381. Teak = 12.9–15.0, Av. 14.0.

Crushing strength:—4. *Michelia* = 3.5; 384. *Vitex* = 7.0; Molāve = 8.3; Across the grain:—Molave = 2,300.

Shearing Strength:—4. *Michelia* = 753; 384. *Vitex* = 1004; Molāve = 914.

Elasticity modulus:—4. *Michelia* = 1125; 381. Teak = 950–2160, Av. (of four experiments) 1724; 384. *Vitex* = 1822; Molāve = 1614; Average taken for Category = 1571.

Compared with Oak 100:—*Michelia* Teak Vitex Molāve Category

Strength ...	...	90	107	115	78	98
Stiffness ...	...	66	101	106	94	92
Toughness ...	...	123	113	125	65	104

General Description. Large and moderate sized trees; Wood yellowish-white to centre light or dark olive-brown or dark yellowish brown (380, 383 pale); Moderately hard (4,383 = soft; 380, 384 = hard), stiff but often inclined to be brittle and uncertain in transverse strength, grain sometimes straight and sometimes very curly and wavy, texture fine dense very smooth or glossy under sharp tools, easy to work; seasons very well as a rule, but the harder species liable to develop internal cracks unless very carefully seasoned; Durability I (380, 382 = II), usually excellent under water and under ground, not attacked by beetles and not much by termites (384 only very slowly by teredo); P = 612; Wt. 33–60, Av. 43; Rays mostly m-f (381 = B-m; 380, biform, B and f); Pores mostly m-s (383 = L-m; 380, 381 = L-s); VC. = I.

Note on Philippine Species. *Hairy-leaf Molāve*. The structure of all the species of the genus is very similar, though there are wide variations in hardness and durability, ranging them into three groups:—(1) Sasālit (see N. * 26), very hard and very durable, superior to Molāve for all uses requiring very great transverse strength; (2) Molāve, hard and equally durable, but somewhat more brittle in long lengths; (3) Kalipāpa-āsu (see N. * 17), wood with much the appearance of Molāve, but much lighter and softer, and less durable under severe conditions. The wood of Molāve and Hairy-leaf Molāve is identical and put to precisely the same uses; Kalipāpamādam seems to be a fairly hard grade of Molāve, whilst Lingolingo has the general appearance of Molāve, but often lighter and softer, and though sometimes cut and brought to market for Molāve it brings lower prices; wood hard stiff but brittle, heavy, sap scarcely distinct, heart pale straw to light brown sometimes with greenish tints, grain sometimes straight or but little crossed sometimes very wavy or curly, texture dense fine and very smooth under sharp tools, easy to work (perhaps the easiest of all Philippine woods of equal hardness and density); seasons with very little warping, but liable to develop large irregular checks (so much so that, in tests of 4 × 4 inch by 6 ft. beams, the average modulus of rupture of seasoned beams was about 20% lower than that of unseasoned ones); Durability I, rarely attacked even by

termites and very slowly by teredo; Uses, piles, posts, ties, paving blocks, ship bridge and wharf-building, foundation sills, window sills, windows and doors, flooring, stairs including risers and treads balusters and handrails, siding, sheathing, all kinds of interior finish, all kinds of structural parts except long beams, furniture and cabinet-work, sculpture and carving, wooden type and woodcut engraving, tool-handles and planestocks and other wooden tool parts, pestles and mortars and other house-hold implements, framing of hemp-presses, sugar-mills, etc., cog-wheels and inserted cogs, agricultural implements, yokes; Prices, P/180-250 mc. (=Rs. 15-21 cft).

Uses of Madras Timbers recorded. 4. (Very durable, a log stored in Calcutta for forty-two years on being cut found perfectly sound; very durable in ground): house-building especially piles and posts also planking and door-panels (a palace in Coorg built entirely of it), carriage-building, furniture, carving, sacred beads and necklaces, drums. 5. (Very durable, and lasts well underground); house-building, beams and rafters, railway sleepers. 380. (Wood very like 383, takes beautiful polish); cabinetwork, carving, furniture. 381. (Compared with Sal and Sissoo it is brittle; beams found in Vizianagar-Hampi still sound though 400 years old or more; also durable under water and under ground, probably due to the essential oil; like Chestnut, often unsound at centre, due to large pith that insects can bore; does not resist teredo well); major construction of all kinds, bridge wharf ship and house-building, decking of ships and backing of iron-clads, railway carriages and sleepers (latter not so satisfactory as Sal and other timbers), cabinetwork and furniture, sculpture and carving, beams, joists, rafters, flooring, ceiling, panelling, doors and window, shingles, carriage- and cart-building (framing, spokes and felloes); in fact, every conceivable purpose. 382. (Takes beautiful polish); cabinetwork, carving and fancyware, turning, weavers' shuttles and bobbins. 383. (Very durable, lasts well under and alternately in and out of water, and in brackish water, better than Teak; does not appreciably shrink and thus specially suitable for sounding-boards, etc.; less brittle than Teak, thin slats not breaking under action of nails and tacks; takes paint, lacquer and varnish admirably); house-building especially posts, planking, panelling, door-panels, blinds and venetians, boat-building especially decking, cabin-panelling and interior finish, hydraulic works especially well-work

and sluice-gates even in brackish water, furniture and cabinetwork (show-cases in Calcutta Museum are made of it), carriage-building and palanquins, musical instruments especially organ-pipes, sounding-boards and drums, sculpture, carving and fancyware especially picture-frames, box lumber especially tea-chests and packing cases, bullock-yokes, wooden shoes. 384. (Especially good under water; see Molāvē); building, construction of carts, wooden bells.

Precis of Uses (deduced from above). Major construction of all kinds: ship-building (including backing of ironclads, decking and planking of all kinds, cabin-work); wharf bridge building (incl. piles, posts, foundation-sills, paving-blocks and sleepers); house-building, carpentry (incl. beams, rafters, joists, studs, poles, piles, etc.), joinery (incl. flooring, ceiling, panelling, sheathing and wainscoting, siding, door and window sills, frames, panels, shutters, blinds and venetians, stairs with treads, risers, balusters and handrails, shingles); cabinetwork and furniture; sculpture, carving and fancyware (incl. scabbards, picture-frames and other ornamental work); hydraulic-work (incl. piles, foundation-sills, well-work, lock and sluice-gates for brackish and fresh water); factory work (incl. framing of hemp-presses and sugar-mills, cogwheels and inserted cogs, etc.); turnery (incl. tool-handles, weavers' shuttles, bobbins, plane-stocks and other tool parts); wheelwrightery (incl. cart and carriage-framing, carriage- and palanquin panelling, yokes, spokes and felloes, the wood-work—framing, panelling and interior finish—of railway carriages); musical instruments (incl. sounding-boards, organ-pipes, wooden-bells, and probably flutes and other wind instruments); wooden type and wood-cut engraving; household implements (incl. mortars and pestles, and other articles); agricultural implements; box-lumber (incl. clothes chests, tea-chests, packing-cases, ornamental and ordinary boxes of all kinds); wooden shoes.

Localities and Vernaculars. 4. (NCCS-Agt: WFTS: scat.) U. Compā, Compoko; *Tl.* Campakamu, Cāmpēyamu; *Ta.* Canbagam; *M.* Campakam; *K.* Campaka, Sampige. 5. (MPLT: WFTS: esp. NLGS: Pnis) *Ta.* Cambagam, Kāttuccanbagam, Nilagiriccanbagam; *K.* Sampige, Bilisampige, Doddasampige, 380. (NCCS: esp. GJM: VZM-Agt:) U. Bornnopotrī, Subornborodo, Sānogomb'hārī, D'hāugomb'hārī. 381. (GDV: southwards; WGTS: fairly abdt.) *Tl.* Tēku; *Ta.* Tēkku; *M.* Tēkku; *K.* Tēga. 382. Most districts scat. or com.) U. Sumont'hi,

Kotusumont'hi; *Tl.* Kampugummudu, Naguru, Namuru, Nāruva; *Ta.* Kolikkattaittēkku, Pināri, Podaganāri; *M.* Kāttuttēkka, Kolikkāttuttēkka; *K.* Īcu, Madike, Nārele, Pite, Tavadike. 383. (Most districts, scat.) *U.* Gomb'hāri, B'hodroporni, Kāsmori; *Tl.* Gummudu, Peddagummudu, Callagummudu, Gummudutēku; *Ta.* Kumil, Perungumil, Umittēkku; *M.* Kumil; *K.* Kumule, Kūle, Kumbudi, Baccānige, Sripāru. 384. (Most districts, scat.; NCCS: TVY: com.) *U.* Codāigodi, Tiloko, Moyūriā, D'holāsik'hā; *Tl.* Nemaliyadugu, Mayūramu, Būsi, Rātangi; *Ta.* Māyilai, Mayiladi, Kāttumāyilai, Kāttunocci; *M.* Māyila, Māyilila, Māyilati, Kāttumāyila, Ārrumāyila; *K.* Naviladi, Māyūrōlu, Doddalakki, Kādunekki, Sompukēpala, Pordele.

III.—MOSTLY MODERATELY HARD

B.—MOSTLY YELLOWISH OR BROWNISH

N. *14 Jacks

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
276. <i>Sonneratia apetala</i> ...	39	...	5	2	2	3	III	GyB-ChocB RB.
468. <i>Artocarpus hirsuta</i> ...	36	644	1	2	1	2	I	YW YB.
469. <i>Artocarpus integri-</i> <i>folia.</i>	40	686	3	2	1	3	II	LtY-BtY-OrY.
470. <i>Artocarpus Lakoo-</i> <i>cha.</i>	40	577	2	2	1	3	II	(H) Y-DkB.
<i>European Species</i>								
(Exotic).								
White Mulberry	...	42	640	3	2	2	4	III (H) LtY-OrB.
Black Mulberry	...	46	...	2	3	2	4	III (H) LtY-OrB.

Philippine Species. Antipōlo (incl. Nangkā) (*Artocarpus* = 468, 469); Anubīng (incl. Kūbi) (*Artocarpus* = 470); Pagatpat (*Sonneratia* = 276).

Under 1 foot diameter:—**Madras.** 811. *Cudrania javanensis*.

Strengths.

Tensile Strength:—Mulberry = 12.5–15.0, Av. 14.0; 468. Wild Jack = 13.0–15.0, Av. 14.0.

Crushing Strength:—469. Jack = 7.6.

Shearing Strength:—469. Jack = 672.

Elasticity modulus:—469. Jack = 995–1810, Av. 1402 (taken as average for Category).

Compared with Oak 100:—Mulberry Jack Category

Strength ... 103 110 104

Stiffness ... ? 82 82

Toughness ... ? 148 132

General Description. Large trees (276 small); exuding on incision (not 276) a white milky rubberoid juice; Wood yellowish white to bright yellow (469), yellowish-brown (468), dark brown (470), or chocolate-brown (276) centre; Moderately hard, (470 = hard),

grain straight or somewhat crossed, texture somewhat coarse and rough to fairly dense and fine, somewhat difficult, or not, to work, but (468, 469, 470) dulling tools rapidly from resin-content; Seasons well but (468, 469, 470) liable to warp if not carefully stacked, and (276) liable to crack internally if seasoned in log or heavy planks; Durability II, not attacked by beetles (except perishable sapwood of 468, 469, 470) and but little by termites, 276 resists teredo very well; P = 636; Wt. 36-40, Av. 39; Rays m-f; Pores usually L (276 = s); VC. = I.

Note on European Species. The original habitat of the Mulberry (both species) is not known, but believed to be China; they are both cultivated in Europe and Western and Central Asia; except that the Black Mulberry is a somewhat larger tree with slightly heavier wood, the timber is identical, has a pale yellow sapwood merging into an orange or reddish-brown heartwood; it is very similar in structure to the False Acacia (see N. 26) and in general properties, but has a far better colouring; it is durable but apt to shrink in drying unless carefully seasoned; it is scarce in Europe, but where available much esteemed; it is used for coopers' work, wheelwrights' work, treenails for naval work, turnery and vineprops.

Note on Philippine Species. *Antipōlo*. Woods of this genus fall rather distinctively into a softer and a harder class, which are known in commerce respectively as Antipōlo and Anubing, otherwise they resemble each other fairly closely; of the former the wood is soft to moderately hard, light, sap perishable whitish, heart light yellow turning yellowish-brown, grain straight or somewhat crossed, texture rather coarse and rough or (Nangka) denser and smooth, not difficult to work but dulls tools rapidly; seasons well; Durability III, heart not attacked by beetles; Uses, posts, beams, joists, rafters, shipbuilding, ceiling, sheathing, doors, musical instruments, furniture and cabinetwork, inlaying, sawframes and tool-handles; Prices, generally sold with cheap Miscellaneous lumber about P/40-50 mc. (= Rs. 3½-4 cft.). *Anubing*. Similar to Antipōlo in structure and colouring but turning a darker brown, and harder and heavier (Kābi not quite so hard nor heavy as Anubing), grain somewhat crossed, texture dense but rough, difficult to work dulling tools rapidly; checks little but liable to warp if not seasoned carefully; Durability I, rarely attacked even by termites; Uses, piling, ship-wharf- and bridge-building, poles, beams, joists,

rafters, mine-timbers, ties, paving blocks; Prices, P/180-185 mc. (= Rs. 15-15½ cft.). *Pagatpat*. Wood moderately hard, moderately heavy to heavy, sap greyish-brown, heart light brown to dark chocolate or in old trees almost black, grain straight or very slightly crossed, texture fine very homogeneous smooth but not glossy, distinct salt taste and especially when fresh a fishy or swampy smell, easy to work; boards season fairly well, but logs and heavy planking liable to check internally; rusts out small nails or screws from salt content; Durability II, even sap rarely attacked by insects, and heart said to resist teredo very well; Uses, piles, posts, poles, ties, paving blocks, ship bridge- and wharf- building, general strong construction, doors, siding, sheathing, ceiling, flooring, all kinds of interior finish, ship-planking and decking, furniture and cabinetwork, musical instruments; Prices, P/50-95 mc. (= Rs. 4-8 cft.).

Uses of Madras Timbers recorded. 276. Parts of boats, planking, furniture, boxes. 468. Shipbuilding, planks, oars, boats, housebuilding, flooring and panelling, furniture. 469. Building, boatbuilding, carpentry, cabinetwork and furniture, marquetry, turning, brushbacks. 470. (Resists teredo); houseposts, beams, rafters, piles in saltwater, canoes, furniture, sugar-mills.

Precis of Uses (deduced from above). General construction; bridge- and wharf- building (incl. piles for salt and fresh water, poles and posts, beams, planking, sleepers and paving blocks); housebuilding, carpentry (incl. beams, joists, rafters, poles and posts), joinery (including posts, flooring, ceiling, panelling, sheathing and siding, all kinds of interior finish); ship-building (incl. planking and decking, oars, treenails, boats and canoes); cabinet-making and furniture (incl. inlaying); cooperage, wheelwrightery, turnery (incl. saw-frames, tool-handles, brushbacks, etc.), musical instruments, sugar-mills, box-lumber (incl. clothes chests, ordinary boxes, etc.).

Localities and Vernaculars. 276. (COCT: GDV-SAC: litt., sswp.) *Tl.* Kalinga; *Ta.* Maraimā. 468. (WFPS: KAN-TVY: SLM-MRA:) *Ta.* Āyini, Āncali, Kāttuppalā; *M.* Ānnili, Āyini, Āyinippilāvu; *K.* Hebhalasu. 469. (KAN-TVY: NLGS: Anms; and cult. NCCS:) *U.* Ponoso; *Tl.* Panasa; *Ta.* Pilā, Palā, Palācu; *M.* Pilāvu, Cakka (fruit); *K.* Halasu, Panasa. 470. (CRG-TRV:) *Ta.* Ilagucam, Cōlaippakku, Irappalā; *M.* Pulincakka; *K.* Otehuli, Vātehuli.

III.—MOSTLY MODERATELY HARD

B.—MOSTLY YELLOWISH OR BROWNISH

N. * 15. Camphors

NAMES.	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
392. Cryptocarya Wightiana (incl. Stocksii).	44	666	4	1	2	4	III	LtYB-DkGnB.
394. Apollonias Arnottii	...	...	4	2	2	4	III	LtYB-YB.
395. Beilschmiedia fagifolia (incl. Wightii).	42	615	1	1	1	4	II	YGy-DkYB. ctr.
397. Beilschmiedia Bourdillonii (incl. oppositifolia).	51	...	3	1	1	4	III	(M-H) LtYB-YB.
402. Machilus macrantha.	35	408	3	2	2	3	III	LtPkY-OrB.
403. Phoebe lanceolata	51	...	4	1	1	4	III	(H) YW-OB.
404. Phoebe paniculata	48	...	3	2	2	4	III	YW-YB.
405. Alseodaphne semicarpifolia.	55	586	3	1	1	2	II	YW-DkYB.
406. Actinodaphne campanulata (incl. lanata, madraspatana and Hookeri).	54	907	4	1	1	3	III	YW-LtOB stkdB.
410. Litsaea sebifera (incl. tomentosa)	47	...	4	2	2	3	III	YW-LtYB shining.
414. Litsaea glabrata (incl. Stocksii).	32	535	4	2	2	4	III	YW-LtOB shining.
415. Litsaea Wightiana (incl. oleoides and coriacea).	46	...	4	1	1	3	III	(H) YW-YB shining.
416. Litsaea zeylanica	...	...	4	2	2	2	III	YW-LtYB.
European Species (Exotics).								
Cedar of Lebanon (Europe grown).	44	376	1	2	1	4	II	YW-LtYB.
(Deodar of India)	34	440	...	...	...	...	...	YW-LtYB.
Cypress	39	...	4	2	2	3	III	YW-YB.

Philippine Species. Bakān (incl. Baticulīn, Matāngusā, Pusopūso) (Litsaea and Neolitsaea = 410, 414, 416), practically identical with Kabūro (incl. Malabunga) Phœbe and Nothophœbe = 404), Margapāli (Dehaasia = 394), and Margapāli-kulislāu (Machilus = 402); Dugkātan (Cryptocarya = 392), practically identical with

Malacadiōs (incl. Terūkan) (Beilschmiedia = 395, 397), and Sablōt (Litsaea = 415), and with these may also be classed 403, 405, and 406.

Under 1 foot diameter:—**Madras.** 776 Santalum album.

Strengths.

Tensile Strength:—Cedar = 5.0–11.4, Av. 8.2; Cypress = 6.0; Malacadios = 14.8.

Crushing Strength:—Cedar 5.7–5.9, Av. 5.8; 405. Alseodaphne = 5.7.

Shearing Strength:—405. Alseodaphne = 927.

Elasticity modulus:—Cedar = 486; 405. Alseodaphne = 1020 (taken for Category).

Compared with Oak 100:—Cedar 405. Als. Category

Strength ... 62 94 100

Stiffness ... 28 60 60

Toughness ... 106 147 167

General Description. Mostly moderate sized trees, imbued with a camphoraceous (or, the European Conifers, with a cedary-turpentinous) essential oil; Wood pale yellow to golden or olive-brown; Moderately hard (403, 415 = hard; 397 = moderately hard to hard), grain usually straight, texture fine with a smooth waxy feel taking usually a glossy cut under sharp tools, easy to work; Seasons well except for liability to stain if not quickly dried; Durability I-II, even sap rarely attacked by insects; P = 620; Wt. 32–55, Av. 46; Rays f (406, 410 = m; 395 = ff); Pores m-s (Cedar and Cypress wanting); VC. = II.

Note on European Species. The Cedar of Lebanon (Cedrus Libani) occurs in Asia Minor, and, if we include the Deodar, extends to N. Baluchistan, Afghanistan and the N.-W. Himalayas; it is cultivated in Europe on a limited scale; it has a white sapwood and a yellowish-brown heartwood, scented but without resin-ducts; it is strong and elastic, but has a stiffness only a little more than a quarter that of Oak; in its own habitat it is very durable and an excellent timber, but as grown in Europe it is inferior, and consequently but little used; in N. India it is extensively used for house- and bridge- building, chiefly as beams and door and window frames, but it is brittle and does not take paint and varnish well; it is also largely used for boats, and especially for railway sleepers; it is very durable, beams in some old mosques being over 400 years

old, and boats of it last 40 years. The Cypress, of which there are several species, the most important grown in Europe being the Evergreen Cypress (*Cupressus sempervirens*), occurs in Persia to Asia Minor and Crete, and is cultivated in Europe; the wood is whitish to pale yellow-brown, scented, very durable especially under water; it works easily, and is much esteemed for carpentry, insect-proof trunks and boxes, and it makes very good vine-props; it was in olden times used for coffins in Egypt.

Note on Philippine Species. Excluding Tambulian (see N. *34), and Kalingag (see N. *9), and the White Baticulins (see Bangūlo, N. *5), as stated in connexion with the last named the remaining species of the family of the Lauraceae can be divided into two groups: firstly, the *Yellow Baticulins* (incl. Bakān, Baticulīn, Matāngusā, Pusopūso, Kabūro, Malabunga, Margapāli, and Margapāli-kulislāu):—Of these the wood is soft to moderately hard, light, sap hardly distinct from the heart, which is pale yellow to a bright golden-yellow darkening on exposure and aromatically scented, grain straight, texture fine with a smooth waxy feel and taking a glossy cut under sharp tools, very easy to work; seasons well; Durability II, even sap rarely attacked by insects; Uses, carving and sculpture especially of sacred images (best of all the Philippine woods for this purpose), panelling for doors, altars, wardrobes and carriages, ceiling and sheathing, musical instruments, cabinetwork, pyrography panels; Prices, no regular supply of sawn lumber in the Manila market, mostly obtained in log about P/18-20 cm. (—Rs. 1½ cft.). Secondly, the *Malacadiōs* group (incl. Dugkātān, Malacadiōs, Terūkan and Sablōt):—Wood moderately hard, moderately heavy, sap pale golden-yellow distinct, heart darker yellow shading into golden brown or (Dugkātān) dark greenish-brown, grain straight or slightly crossed, texture fine glossy or (Dugkātān) smooth, more or less aromatically scented, easy to work; seasons well; Durability I-II, even sap rarely attacked by insects; Uses, bridge-wharf- and ship-building, poles, ties, beams, joists, rafters, posts, sills, window-sills, floors, ceiling, sheathing, siding, oars and paddles, carving and cabinetwork, household implements; Prices, rather scarce and rarely cut, about P/120 mc. (—Rs. 10 cft.).

Uses of Madras Species recorded. 395. Building. 405. (Resists teredo); building, boat-construction. 415. Rafters.

Precis of Uses (deduced from above). Bridge- and wharf-building (incl. poles, posts, foundation-sills, beams and sleepers);

house-construction, carpentry (incl. poles, posts, foundation-sills, beams, joists, rafters), joinery (incl. floors, ceiling, siding, sheathing, posts, door and window sills and panelling); ship-building; cabinetwork and furniture (incl. wardrobe panels, veneer for fine cabinetwork especially small chests and tables); box-lumber (incl. insect-proof trunks, boxes and coffins); carving and sculpture (incl. sacred images and altars, pyrography panels); wheelwrightery (carriage-panels); musical instruments; agricultural implements (incl. vine-props and similar supports); household implements; lead pencil slats.

Localities and Vernaculars. 392. (WFTS: KAN-TVY: NLGS: Anms., scat.) *Ta.* Pālai; *M.* Katamāmpāri. 394. (WGTS: MBR-TVY: scat.) *M.* Centanam. 395. (NCCS-Agt: WGTS: KAN-TVY: Anms., scat.) *K.* Kamate. 397. (TRV: Svys., scat.) *M.* Muralkutti. 402. (NCCS: MPLT: WGTS:) *Ta.* Ānaikkuru, Kollimā, Mūlai; *M.* Kulirmāvu, Kollimāvu, Urāvu, Ānakkuru; *K.* Cittutantre, Gūlimāvu, Krūramāvu, Nīrkukku. 403. (MBR-TVY: Anms., scat.) (No names known). 404. (MPLT: NLGS: Anms., scat.) *Ta.* Cudalam; *K.* Krūramāvu, Kumāri. 405. (NCCS: KAN-TVY: MPLT:) *Tl.* Naramāmidi; *Ta.* Kanaippirandai, Pudai; *M.* Vāttu; *K.* Karuvadi, Nēralutare. 406. (TVY), 407. (NLGS: Wnd.), 408. (CDP: NAC: WGTS: esp. NLGS:), 409. (NCCS: KAN-TRV:) *U.* Jādāmbō; *Tl.* Kovangutti; *Ta.* Puttadāli, Tāli; *M.* Puttamvīlāvila, Iyōli, Munkāli, Malavirinni, Neyārum, Pūvaca; *K.* Nitte. 410. (NCCS: MPLT: WGTS: scat.) *U.* Jādāmbō; *Tl.* Naramāmidi, Nāra, Meda, Kanujunālike, Naranālike, Katuvukamma; *Ta.* Ama, Elāmbiragi, Pippinbattai. 414. (NLGS: KAN: TRV: TVY: MRA: scat.) *M.* Unkakkanni, Karuvāttu. 415. (NLGS: KAN-TRV: TVY:) *Ta.* Panrittāli; *M.* Maravettittāli; *K.* Kanci. 416. (NCCS-Agt: WFTS: fairly com.) *U.* Pohorāpotri; *Tl.* Ākupatrikamu, Bododo, Buroyida; *Ta.* Cenbagappālai, Cirubancattai, Malligaiccanbagappālai, Pancattai; *M.* Varanam; *K.* Beluri.

III.—MOSTLY MODERATELY HARD

C.—MOSTLY WHITE OR PALE

N. *16. Ashes

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
7. Polyalthia coffeoides (incl. fragrans).	40	567	3	3	2	3	III	(MH) YW.
9. Polyalthia cerasoides.	50	...	4	3	2	2	III	YW-LtOIB
10. Popowia Beddomeana.	...	...	4	3	2	3	III	YW.
11. Mitrephora Heyneana (incl. grandiflora).	60	1189	4	3	2	3	III	(H) YW-LtY.
13. Xylopia parviflora	42	725	4	3	2	3	III	(M H) W-YW.
14. Miliusa velutina	48	840	4	3	2	3	III	YW-Y-YB.
15. accopetalum tomentosum.	41	...	4	3	2	4	III	Y-OIB.
16. Alphonsea lutea (incl. zeylanica and madraspatana).	...	...	4	3	2	4	IV	YW.
19. Orophea erythrocarpa.	...	...	4	3	2	4	IV	YW.
20. Sagera laurina (incl. Dalzellii).	48	788	4	3	2	4	IV	(H) LtY-OrY.
424. Putranjiva Roxburghii.	49	...	4	3	3	2	III	W-YW.
443. Celtis tetrandra	39	800	3	3	2	2	III	YW-YGy.
<i>European Species</i>								
Ash	52	721	3	3	2	3	III	W-Pk-W-YW prearily W-GnW-YGy (identical with 443, see Gamble and Schneider).
Nettle-tree. Hackberry or Lotus of Greek Authors.	44	800	3	3	2	3	III	
<i>Imported Species</i>								
Hickory (Average)	51	852	...	...	...	...	...	(MH) GylP-YB.
Pignut Hickory	58	1009	...	...	...	...	...	
Shellbark or Shagbark Hickory	56	888	...	...	...	...	...	
Mockernut Hickory	53	850	...	...	...	...	...	
Pecannut	48	850	...	...	...	...	...	
Bitternut	46	837	...	...	...	...	...	
Nutmeg	47	694	...	...	...	...	...	
Water	46	837	...	...	...	...	...	

Philippine Species. White Lanutan (name applied generally to the genera Alphonsea, Goniiothalamus, Mitrephora, Orophea, Phæanthus, Polyalthia, Popowia, Saccopetalum, Xylopia, and others of the Family ANONACEÆ; and including Dalinas (Cyathocalyx=474); Ilangilang (Canangium=cult. only).

Magabuyo (incl. Malaikmō) (Celtis=443).

Under 1 foot diameter:—**MADRAS.** 474. Cyathocalyx zeylanicus. 475. Artabotrys odoratissimus. 476, 477. Unona pannosa and discolor. 479. Polyalthia suberosa. 480. Phæanthus malabaricus. 481-483. Goniiothalamus Thwaitesii (incl. cardiopetalus and Wightii). 484. Anona squamosa and reticulata (cult. and rwd.). 485-487. Miliusa indica (incl. nilagirica and Wightiana). 488-490. Orophea uniflora (incl. Thomsoni and zeylanica). 519. Helicteres isora.

Strengths.

Tensile Strength:—Ash=9.6-19.6, Av. 14.1.

Crushing Strength:—Ash=8.7-9.4, Av. 9.0; Hickory (Average)=9.5; Pignut H.=10.9; Shellbark H.=9.5; Mockernut H.=10.1; Pecannut H.=9.1; Bitternut H.=9.6; Nutmeg H.=8.8; Water H.=8.4. Across the grain:—Hickory=3100.

Shearing Strength:—Hickory, Pignut=1200; Shellbark=1100; Mockernut=1100; Pecannut=1200; Bitternut=1000; Nutmeg=1100; Water=1000.

Elasticity modulus:—Ash=1526-1640, Av. 1583; Hickory (Average)=2327; (Pig=2730, Shell=2390, Mocker=2320, Pecan=2530, Bitter=2280, Nutmeg=1940, Water=2080); 9. Polyalthia=2045 (taken as average for Category).

Compared with Oak 100:—Ash Nettle Av. Hickory Category
Strength ... 119 127 137 132
Stiffness ... 89 ? 136 119
Toughness ... 160 ? 138 146

General Description. Mostly moderate sized to small trees; Wood white or pale yellowish or brownish white; Moderately hard (11, 20=hard; 7, 13 and Hickory moderately hard to hard), grain straight, texture rather fine, very easy to work; Except for staining if not dried quickly seasons well; Durability III, not very durable in contact with the ground or exposed to the weather, but not commonly attacked by insects; P=818; Wt. 39-60, Av. 46; Rays m-f (9=B-m; Ash=ff); except 443, Nettle-tree,

Ash and Hickory, with ladderlike transverse bars between the rays which are characteristic; Pores m-s (13, 20, 443 and Hickory = L-m; Ash and Nettle = LL-ss); VC. = II.

Note on European Species. The Ash (*Fraxinus excelsa*) occurs scattered throughout the whole of Europe, Western Asia and North Africa; it has a white, pinkish-white or pale yellowish-white wood sometimes tinged with brown towards the centre, and with a pearly silky or satiny lustre, unctuous to the touch, and tenacious and elastic; it is liable to decay if exposed to alternations of dry and moisture, but is fairly durable under cover and is little liable to be worm-eaten; it is used for all purposes where elasticity and toughness are required; wheelwrightery (incl. coach and cart-shafts, beams and spokes), oars and sculls and rudders of boats, cooperage (including cask-hoops, hurdles, etc.), joinery, light construction under cover, turnery (incl. tool and whip-handles, lance-shafts, fishing-rods, gymnastic apparatus, etc.), cabinetwork. The Nettle-tree (*Celtis australis*) occurs in the Mediterranean region of the South of Europe and North Africa, and in Western and Central Asia; it has a white, greenish-white or yellowish-grey wood, with a durability slightly superior to that of Ash; it is highly esteemed in the south of France, where it is called the Micocoulier, and were it only as abundant as Ash in Europe it would undoubtedly be preferred to it, except for cabinetwork; Mathieu says: 'It has all the qualities of Ash but to a much higher degree, with the exception of its satiny lustre; and it is essentially an industrial wood, particularly esteemed for all purposes where suppleness and tenacity are demanded'; this is noteworthy because, whereas both Gamble and Schneider show that the timbers of all species of the genus are practically identical, the Indian tree has practically never been used as a real substitute in this country for Ash; it is considered a first class wood for oars and sculls, for marine treenails, for whip-handles, forks, gunstocks, hoops, props, and excellent for wheelwrights, turners, sculptors, musical (wind) instrument makers, joiners, etc.

Note on Imported Species. The Hickories (*Carya*), which are nearly related to the Walnut (*Juglans regia*—see N. *23), occur only in North America, and consist of several species, of which the chief are the Pignut Hickory (*C. porcina*), the Shellbark or Shagbark Hickory (*C. alba*), the Mockernut Hickory (*C. tomentosa*), the Pecan Hickory (*C. olivæformis*), the Bitternut (*C. amara*), the

Nutmeg Hickory (*C. ?*), and the Water Hickory (*C. aquatica*); they are mostly large trees growing 80–100 ft. high and 2–3 ft. diameter; they have a hard or moderately hard wood which is very elastic and tough, but does not bear exposure to the weather and is very liable to attacks of insects; it is used very largely where toughness and elasticity are required, and for that purpose it is perhaps the best wood that exists; barrel-hoops, press-screws, axe and other tool handles, handspikes, fishing-rods, shafts and poles of carriages, and is also largely used for furniture and cabinetwork, especially bentwood furniture.

Note on Philippine Species. *White Lanūtans.* The name of White Lanūtans is applied generally to various species of the Anonaceæ family, as they are very much alike in general character, being soft to moderately hard (Dalinas hard), light to moderately heavy, flexible and tough, sap usually indistinct (distinct in Dalinas and pale yellow with a purplish-brown heart) whitish pale yellow or light brown staining easily in drying, grain straight, texture rather fine with the conspicuous ladderlike pattern in cross-section characteristic of the family, works very easily; except for staining seasons very well; Durability III, but apparently not attacked by insects; Uses, houseposts and other light structural parts, household implements, cabinetwork, scabbards, canes; Prices, sold with cheap Miscellaneous lumber about P/40–50 mc. (=Rs. 3½–4 cft.). *Magabūyo.* Wood of all the species is practically identical; moderately hard to hard, tough and somewhat difficult to split, moderately heavy, sap indistinct, light yellowish-grey with darker streaks towards the centre, grain somewhat crossed, texture variable either looking coarse but dense or fine and glossy, fairly easy to work; seasons well; Durability III, not commonly attacked by insects; Uses, cheap furniture, box-lumber, etc., but not properly known in the Manila market; Prices, sold with cheap Miscellaneous stuff a little better than cheap Lauāns (see N. *9) and other softer woods, about P/50 mc. (=Rs. 4 cft.).

Uses of Madras Timbers recorded. 7–20. (Wood of all species is very similar, elastic and tough, strong and durable); house-building, small beams and rafters, carpentry, boat building, masts and spars, carriage shafts, cart poles, yokes, barrels, agricultural implements, harrows, spearshafts, shoulderpoles, walking sticks. 424. (Elastic, durable); turning, handles of tools. 443. (of similar character, and similar uses to *C. australis*); canoes, planking.

Precis of Uses (*deduced from above*). Light interior construction, carpentry (incl. small beams, joists, rafters, posts), joinery (incl. planking, posts and rails); shipbuilding (incl. masts and spars, oars and sculls, rudders, planking, canoes, treenails); cooperage (incl. cask-hoops, barrels); wheelwrightery (incl. shafts and beams for coaches, carriages and carts, spokes and felloes); turnery (incl. lance and spearshafts, whip-handles, fishing-rods, walking sticks, tool-handles, gymnastic apparatus, shoulderpoles); agricultural implements (incl. harrows, forks, hurdles, props); cabinetwork and furniture (cheaper); sculpture; musical wind-instruments; stamping hammers; household implements; box-lumber (incl. scabbards).

Localities and Vernaculars. 7. (WGTS: MBR: TRV: MYS: Anms.) *Ta.* Nedunārai, Acuvattai, Pūludai; *M.* Netunār, Villal, Kākkannāral, Pulluri, Cēla, Kōdānci; *K.* Gāuri. 9. (Most districts, dtts.) *U.* Nobinisworo; *Tl.* Cilukadudduga, Cittidudduga. Dudduga, Gutti; *Ta.* Kōdigilai, Nagutalilai, Nettanāratti, Nūlilai; *K.* Habbe, Sannaheccāra. 10. (TVY: TRV:) (No names known). 11. (KAN: TRV: TVY: Pnis) (No names known). 13. (WGTS: KAN-TRV:) *Ta.* Karboruttal, Cāndu; *M.* Kalluppottan, Sāntu; *K.* Ulli. 14. (Most districts, mts., scat.) *U.* Gontip'holāto; *Tl.* Nalladudduga, Peddacilukadudduga; *M.* Kānakkāita, Villuni; *K.* Ance. 15. (Most districts, scat.) *U.* Gontip'holāto, Pātomosuno; *Tl.* Buddaduduga, Buddacilukadudduga, Gādidelotta; *Ta.* Periyuvāy; *K.* Heccāra, Kaladri. 16. (NCCS: GTR: rvs., scat.), 17. (TVY: TRV: scat.), 18. (MYS: CDP: NAC: scat.) *Tl.* Cirudduga, Mogili, Muvvi. 19. (WGTS: Anms., scat.) (No names known). 20. (KAN: MYS: MBR: TRV: Anms., scat.) *Ta.* Nedunāttu; *M.* Kānakkāita; *K.* Sāgare. 424. (Most districts, esp. ravs.) *U.* B'holokōli, Pohuncomā; *Tl.* Putrajīvika, Kuduru-jivi, Mahāputrajivi; *Ta.* Karuppilai, Pongōlam, Vicaranai; *M.* Ponkōlam; *K.* Putrajiva, Menasinakāle. 443. (Most districts above 2000 ft.) *U.* Korāyi; *Tl.* Jabjābal; *Ta.* Āda, Kōna, Tavudi; *M.* Karukka; *K.* Aduva, Garuke.

C.—MOSTLY WHITE OR PALE

N. 17. *Sycamores*

NAMES	w.	p.	s.	d.	u.	a.	vc.	(H) and Col.
23. <i>Capparis grandis</i> ...	46	...	5	3	3	3	IV	W-GyW-YW.
99. <i>Evodia Roxburghiana</i> ...	38	368	4	3	3	3	IV	W.
100. <i>Zanthoxylum Rhetsa</i> ...	40	...	3	3	3	3	III	GyY.
142. <i>Euonymus indicus</i> (incl. <i>dichotomus</i>)...	48	...	4	3	3	4	IV	W-YW.
190. <i>Pongamia glabra</i> ...	44	686	4	4	3	2	IV	YW-BY.
191. <i>Ormosia travancorica</i> (sap ?) ...	41	...	3	4	3	3	IV	W (? Or hrt).
235. <i>Terminalia belerica</i> ...	46	549	2	4	2	1	III	YGy.
327. <i>Diospyros montana</i> ...	47	...	4	2	2	3	III	GyW-YW-BW.
328. <i>Diospyros embryopteris</i> (sap)...	45	...	4	2	2	3	III	LtBGy.
334. <i>Diospyros sylvatica</i> ...	50	...	4	2	2	2	III	GyW-stk.
336. <i>Diospyros chloroxylon</i> ...	45	603	4	2	2	2	III	GyY.
341. <i>Diospyros nilagrica</i> ...	45	605	4	2	2	3	III	YB.
345. <i>Diospyros paniculata</i> ...	46	445	4	2	2	3	III	(S) W-DkGy.-stk.
355. <i>Liociera intermedia</i> (incl. <i>leprocarpa</i>)...	...	...	4	3	3	3	IV	W.
369. <i>Ehretia laevis</i> (incl. <i>aspera</i> , <i>ovalifolia</i> and <i>Wightiana</i>)...	37	...	5	3	3	2	IV	GyW-BW.
372. <i>Dolichandrone crispata</i> ...	44	...	4	3	3	2	III	YW-LtYB.
373. <i>Dolichandrone falcata</i> (incl. <i>Lawii</i>)...	46	...	5	3	3	2	IV	(H) W shining.
375. <i>Dolichandrone arcuata</i> ...	48	...	5	3	3	4	IV	W.
589. <i>Zizyphus trinervia</i> ...	42	474	5	4	3	3	IV	(H) YW-LtOIB.
718. <i>Vernonia arborea</i> (incl. <i>travancorica</i>)...	41	391	5	3	3	3	IV	LtYB.
<i>European Species.</i>								
Sycamore ...	41	491	1	4	2	3	III	W.
<i>Philippine Species.</i>								
Balacat (same as 589 above).	42	474	...	...	...	...	...	YW-LtOIB.

Bāhai (sap) (*Ormosia*—191); Balācat (incl. *Duklāp*, *Ligāa*) (*Zizyphus*—589); Banaibānai (*Radermachera*—372, 373, 375); Kalamansākat (incl. *Malakalumpit*) (*Terminalia*—235); Kalipāpāasu

(incl. Longleaf Molāve, Tikōko) (Vitex = 768, 768 bis); Kanōmoi (incl. Malatinta, Katilmā) (Diospyros = 327, 328, 334, 336, 341, 345); Putian (Alangium = 100).

Under 1 foot diameter:—**EUROPEAN.** Sumac (*Rhus cotinus*). Spindle (*Euonymus europæus*). **MADRAS.** 505-507. *Pittosporum tetraspermum* (incl. *neilgherrense* and *floribundum*). 536. *Zanthoxylum alatum*. 539. *Acronychia laurifolia*. 551. *Atalantia missionis*. 553. *Balanites Roxburghii*. 556. *Ochna Wightiana*. 573. *Euonymus crenulatus* (incl. *paniculatus*, *serratifolius* and *angulatus*). 594. *Rhamnus Wightii*. 608, 609. *Sapindus erectus* and *bifolius*. 686. *Casearia graveolens* (incl. *tomentosa*, *rubescens* and *wynaadensis*). 694. *Hedyotis stylosa* and *swertioides*. 713. *Psychotria congesta* (incl. *Thwaitesii*, *macrocarpa*, *elongata*, *bisulcata*, *anamallayana*). 714. *Psychotria sarmentosa*. 716. *Saprosma indicum* (incl. *fragrans*, *ceylanicum* and *corymbosum*). 719. *Microglossa zeylanica*. 731. *Jasminum pubescens*. 757. *Buddleia asiatica*. 768. *Vitex negundo* and *trifolia*. 768. (*bis*). *Vitex leucoxylon*. 771. *Colebrookia oppositifolia*. 794. *Croton oblongifolius*. 799. *Agrostistachys longifolius* and *indicus*. 800. *Mallotus muricatus* (incl. *Beddomei* and *rhamnifolius*).

Strengths.

Tensile Strength :—Sycamore = 9.6.

Crushing Strength :—Sycamore = 7.1; Balacat (= 589. *Zizyphus*) = 5.5.

Shearing Strength :—Balacat = 692.

Elasticity modulus :—Sycamore = 1036; Balacat = 1271;

Average taken for Category = 1154.

Compared with Oak 100 :—Sycamore			Category
Strength	...	81	83
Stiffness	...	59	68
Toughness	...	111	101

General Description. Mostly moderate sized trees; Wood white or pale yellowish or brownish; Moderately hard (373, 589 = hard; 345 = soft), grain straight or slightly crossed sometimes wavy, texture fine to rather coarse or looking coarse but working smooth, easy to work; Seasons well but liable to stain if not quickly dried; Durability III (190, 191, 235 and Sycamore = IV), not usually (190, 191, 235 liable to be) attacked by insects; P = 515; Wt. 37-50, Av. 44; Rays f-f (23 and Sycamore = m);

often of different tint to rest of tissue and giving fair silvergrain; Pores m-s (23 = L-s; 345 = L-m); VC. = III.

Note on European Species. The Sycamore (*Acer pseudoplatanus*) occurs scattered throughout Europe and Western Asia, and is often cultivated; the wood is white without lustre, and is less compact and less hard than the Maple (see N. * 27) which otherwise it considerably resembles; it decays rapidly under atmospheric variations, but is little apt to warp and crack, nor is it usually attacked by insects; it is therefore used for industrial purposes by joiners for planking and flooring, by machinery makers for parts requiring a common tough wood (such as jig-rollers), by wheelwrights for naves of wheels, by turners for common tool and whip handles, by gunmakers for gunstocks, by musical instrument makers for wind instruments, and by sabot makers. The Spindle tree (*Euonymus europæus*) is a small tree of 20 feet high, or more commonly a large shrub, which occurs scattered, mostly in hedges, throughout Europe; the wood is pale yellow and very homogeneous; it is used for inlaying and turning (especially for spindles, skewers, shoe-pegs and toothpicks), and is sometimes used as a substitute for Boxwood (see N. * 33) owing to its homogeneity colour and fineness of grain although much less hard and much less heavy (43 lbs). The Sumac (*Rhus cotinus*) is a bushy shrub scattered about Southern Europe; it has small white sapwood and a yellow heart tinged with red and veined with brown having a satiny lustre and taking a fine polish; it is used for fancyware.

Note on Philippine Species. *Bāhai*. Wood hard, moderately heavy, sapwood very large whitish, heart orange-red darkening somewhat with age, grain frequently wavy and curly, texture rather coarse in appearance but dense and glossy, general appearance very like Tindalō (see N. * 21), fairly easy to work; seasons well; Durability III, heart not attacked by beetles; Uses, houseposts, beams, joists, rafters, interior finish, furniture, cabinetwork (the soft tissue forms patterns like a 'mackerel sky'); Prices, often wrongly substituted for Tindalō—P/170-240 mc. (= Rs. 14-20 cft.)—but otherwise much lower in price, and often mixed when sawn with mixed Miscellaneous lumber. **Note.**—Bourdillon's description would appear to refer merely to the copious sapwood. *Balācat*. Wood moderately hard to hard, moderately heavy, sap hardly distinct from heart, pale yellowish white rarely reddish-tinged, grain slightly crossed sometimes rather wavy, texture rather fine and smooth, easy to

work; seasons well; Durability IV, often attacked by shot-hole borers; Uses, cheap or temporary construction, ordinary furniture, flooring, agricultural implements, household implements, wooden shoes; Prices, when sold alone good boards and dimension stuff for house-construction bring P/60-65 mc. (= Rs. 5-5½ cft). *Banaibānai*. Wood of all species as far as known is identical; light, pale yellowish- or pinkish-white drying to very light brown, no heart, grain straight and even texture rather fine, very easy to work; seasons?; Durability?, probably poor when exposed, but not attacked by beetles; Uses, sculpture and carving for which it is a substitute for Baticulin (see N. *15), a very pretty cabinetwood for all light work, used locally for rice-mortars and other household implements; Prices, not marketed except occasionally with cheap Miscellaneous lumber at about P/40 mc. (= Rs. 3½ cft). *Kalamansākut*. Wood moderately hard, moderately heavy, whitish when fresh turning greyish-yellow, heart indistinct, grain often curly or wavy, texture looking coarse but smooth, easy to work; seasons?; Durability IV, often attacked by shot-hole beetles; Uses, cheap and temporary construction, cheap furniture, treated ties and paving blocks; Prices, sold only with cheap Miscellaneous lumber P/30-50 mc. (= Rs. 2½-4 cft.). *Kalipāpa-āsu*. (see Hairy-leaf Molāve, N. *13); Uses, locally for interior structural timber, flooring, etc.; Prices, supply limited and does not come into the markets. *Kanōmoi*. Though varying widely in the relative proportion and the colouring of the sapwood and heartwood, all the woods of the family are practically indistinguishable as regards their structure; wood hard to very hard, heavy to very heavy, sap tough and flexible small to very large whitish, yellowish or red generally sharply distinguished from heart, which is brittle and black with rosy, yellowish, brownish or ashy streaks or sometimes quite black; whether or not a given species produces black heart depends largely on the size attained, but evidently also on other conditions, as there is a wide variation in the relative amounts of sap and heart in individuals of the same species; may be roughly divided into four groups according to the character of the sap:—(1) *Camagōn* group, sap pinkish or pale red, heart largish sometimes nearly dead black, sometimes mottled and streaked; (2) sapwood with a distinct yellow tint becoming light yellowish brown in drying, heart good commercial camagōn but streaks if present also yellowish brown; (3) *Ata-āta* group, sap almost white turning

yellowish in seasoning heart small or defective but jet-black when present; (4) *Malatinta* group, sap almost always white but changing shortly after felling to an even bluish grey as if stained with dilute ink, heart defective or small but black if present; grain generally very straight, texture fine smooth and very dense especially in the heart, difficult to work but takes a beautiful surface under sharp tools; difficult to season well, logs almost invariably checking in several directions from the heart outwards, while sawn lumber must be stacked carefully and weighted to prevent warping; Durability of heart I, of sap II, but even the latter practically never attacked by beetles though not termite-proof; Uses, small trees with no heart used locally for posts, beams, joists, rafters, window-sills, parts of agricultural implements, and skids for lumbering; sapwood, which is almost as hard as the heart and very much tougher, excellent material for T-squares and other drawing instruments, shuttles, bobbins, spindles, golf-club heads and shafts, axe pick and hammer handles; heart scabbards, canes, hilts, tool-handles, gunstocks, saw-frames, a favorite for musical instruments especially finger boards and keys of guitars, furniture, cabinetwork, inlaying, paperweights, inkstands and similar desk supplies; Prices, logs sell in Manila at P/30-70 mc. (= Rs. 3¼-8 cft.), and select small lots of sound heart at P 300 (= Rs. 900) per M. board feet and upward. [Note. For (1) group, sap see N. *20 and 21, heart N. *28; for (2) group, sap see N. *27, heart N. *28; for (3) group see N. *28; for 4 group N. *17. *Puttan*. Of coarser texture than Guntapāi and Malatapāi (see N. *26), and in appearance and structure resembles Banāui and Malapīnggan (also see N. *26) but neither so hard nor so durable; wood moderately hard, moderately heavy to heavy, no heart, dull yellowish-white subject to bluing if not seasoned quickly, pith rays rather coarse and conspicuous, texture rather coarse, works easily; except for staining seasons well; Durability III; Uses, little used but recommended for foundation piling; Prices, not marketed, would sell with cheap Miscellaneous lumber about P/30-50 mc. (= Rs. 2½-4 cft.).

Uses of Madras Timbers recorded. 23. (Durable); small buildings, agricultural implements. 142. (Compact close and even grained); wood-engraving, substitute for boxwood. 190. (Not durable and attacked by insects, but better if seasoned in water): temporary buildings, oil-mills, solid cartwheels. 191. (Attacked by insects when young, little known or used). 235. (Not durable, liable to be attacked by insects, steeping in water makes it more durable);

housebuilding especially rafters and planking, canoes and dugouts, plough-shafts, coffee boxes, grain measures. 327. Good furniture wood. 328. Building. 369, 372, 373. Buildings, Agricultural implements.

Precis of Uses (*deduced from above*). Temporary or cheap construction; carpentry (under cover, incl. beams, joists, rafters, houseposts), joinery (incl. planking, flooring, interior finish); furniture and cabinetwork; sculpture, carving, fancy ware (incl. inlaying, wood-engraving, soft substitute for boxwood); desk supplies (incl. T-squares and other mathematical instruments); wheelwrightery (incl. naves, solid cartwheels); oil-mills; turnery (incl. axe pick hammer and other tool handles, common whip handles, rollers, bobbins, shuttles, spindles, golf heads and shafts, gunstocks); agricultural implements (incl. plough-shafts); household implements (incl. rice-mortars and similar articles, wooden shoes and sabots); musical wind instruments; box-lumber (incl. coffee-boxes, grain measures); canoes and dugouts; treated sleepers and paving blocks.

Localities and Vernaculars. 23. (DKN: CNTC: dtts.) *Tl.* Rēgutti, Duduppi, Nalluppi, Gudi, Āridonda; *Ta.* Turattu, Vellaiturattu, Nākkulincan; *K.* Tottle, Tottulla, Rēvapi. 99. (WGTS: esp. NLGS: Pnis.) *M.* Kanila, Kāttuccempakam; *K.* Tambita. 100. (NCCS-Agt: WGTS: WTCT: KAN-TVY: Anms.) *Tl.* Raccamānu, Morapu; *Ta.* Iraccāi; *M.* Karimurikku, Mullilam; *K.* Aremādulu, Aremāpala, Jimmi; Sesele, Kāvati. 142. (NCCS-Agt: CRG: NLGS: WFTS: KAN-TRV: Anms.) *Tl.* Nallakā-kidi; *Ta.* Malaikkurattai, Vini. 190. (All districts, rvrs.) *U.* Koronjo; *Tl.* Kānuga, Kāgu; *Ta.* Pungu, Nīrppungu; *M.* Mināri, Punnu, Unnu; *K.* Honge, Batti, Huligili, Karanja, Pungu, Kurundi. 191. (WGTS: KAN-TVY) *Ta.* Kunri, Malaimancādi; *M.* Kunni, Malamannāti. 235. (Most districts, dry forests, abdt.) *U.* Bāhādā; *Tl.* Tāndra, Tādi; *Ta.* Tānri; *M.* Tānni; *K.* Tāri, Sāndi. 327. (Most districts, scat.) *U.* Koshāk'hōli, B'hodrikā, Gōurokoshāyo; *Tl.* Eddayagāta, Gātugāta, Muccitumiki, Kākavulimidi, Nallavulimidi, Makuna, Pālbungi; *Ta.* Vakkanai, Velvakkanai, Vakkanāttan, Vellittuvarai; *M.* Bāli; *K.* Jagalagante, Balkūniki, Kādubālekāyi, Vankana. 328. (NCCS: rvrs.; WTCT: rvrs., sswp.) *Tl.* Tummiki, Etitummiki, Nīrtummiki, Muttiyatummiki, Elosu, Gābu; *Ta.* Paniccai, Tumbi, Tuvarai, Kavikkattai, Kāttatti, Pattuppalam; *M.* Panicci, Vananci; *K.* Olletupare, Holetupare, Kākutupare, Tupare, Antina, Banda. 334. (NCCS:

DKN: WGTS:) *U.* K'hālijyā, Mod'hurok'hālijyā; *Tl.* Gāta, Gāda, Gādalūti, Nallagāta, Nallakākamushti, Verrigāta; *K.* Akkasarali, Bilisarali, Kākasarali. 336. (NCCS: COCT: DKN:) *U.* Koshāyo, Ondodi; *Tl.* Ulinda, Peddavulinda, Peddavulimidi, Tellavulimidi; *Ta.* Vakkanai, Karuvakkanai, Periyavulinci. 341. (WGTS: KAN: TRV: NLGS:) *Ta.* Karu. 345. (WGTS: KAN-TRV: Wnd., Anms.) *Ta.* Karunduvarai; *M.* Kari, Kari-vella, Ilakkatta, Vellabāla. 355. (Most districts, scat.) *U.* Esu-muko; *Tl.* Satapāla, Verripogada, Cēdanērēdu, Kurumā, Udadam; *Ta.* Kalidalai; *K.* Kunda. 369. (Most districts, scat.) *U.* Guā-cipo, Mosryniā; *Tl.* Bukkedī Ādabukkedī, Pōtubukkedī, Būri, Peddabūrimēli, Peddapiccka, Tellapisuni, Pāladantamu, Tellajihvi; *Ta.* Pattaiviracu, Kuruviracu; *M.* Cavanti; *K.* Adake, Karadake, Hallippe, Kapura, Pagakina. 372. (DKN: MPLT: CNTC: com.) *Tl.* Oddi, Nīruvoddī, Vankanīroddī; *Ta.* Pārudi, Kombādīri, Pūmbādīri, Vattalappū; *K.* Udure, Beludure, Nirudure. 373. (Most districts, bctn.), 374. (DKN:) *U.* Mrygosingo; *Tl.* Oddi, Cittuvoddī, Cittinīruvoddī, Āruvoddī; *Ta.* Kadalātti, Kaliyāccā, Pacalatti, Udi, Kāttuvarucam; *M.* Nīrpponālyam; *K.* Udure, Mududavudure. 375. (NLGS: CBT; MBR: Pgt: scat.) *Ta.* Īrappālai, Pēcalātti; *K.* Kādunīrudure. 589. (MPLT: CNTC: NLGS; MBR: TRV:) *Tl.* Kākupāla; *Ta.* Kadikkai, Karukkattān, Karukavācci, Karukavāli; *K.* Cuccipāli. 718. (WFTS: NLGS: TRV: TVY: Anms., Pnis., high sholas) *Ta.* Cutti, Karandai; *M.* Īrankatira, Kirana, Katavāri, Tēmpū; *K.* Durge.

D.—ANOMALOUS STRUCTURE

N. *18. Bast-Rings

NAMES	WT	HARDNS	COLOUR	RAYs	PORES
187. <i>Dalbergia paniculata</i> ...	43	S-M	W-YW	f	m
386. <i>Avicennia officinalis</i> ...	52	M-H	YW-LtPplB	f	L-s
492. <i>Cocculus laurifolius</i> ...	41	S-M	GyW-YW	BiformBB&m	m-s
493. <i>Tiliacora racemosa</i> ...	...	S	GyB	BB	L-m
496. <i>Niebuhria linearis</i> ...	48	M	W	f	s
497. <i>Maerua arenaria</i> ...	...	M	W	f	s
498. <i>Cadaba trifoliata</i> ...	50	M	W	f	s
587. <i>Salacia prinoidea</i> (incl. oblonga, reticulata, macrosperma and fruticosa).	...	S	LtB	f	LL
625. <i>Millettia auriculata</i> ...	...	S. altM	W	obscure	L
632. <i>Spatholobus Roxburghii</i>	...	S. altM	DkB	obscure	LL
633. <i>Butea superba</i> ...	...	S. altH	DkB	obscure	LL-s
638. <i>Dalbergia spinosa</i> (incl. monosperma)	...	S. ctrH	BW-ctr.DkR	ff	m
640. <i>Dalbergia uliginosa</i> ...	...	S-M	B	m	L
652. <i>Bauhinia Vahlia</i> (incl. phoenicea and anguina.)	...	S-M	B	obscure	LL
655. <i>Entada scandens</i> ...	...	S-M	DkB	obscure	LL
734. <i>Jasminum breviloebum</i> ...	...	S	W	ff	ss
755. <i>Gymnema hirsutum</i> ...	...	S	W	obscure	m
761. <i>Erycibe paniculata</i> ...	...	S	W	ff	LL
762. <i>Argyrea speciosa</i> and others.	...	S	GyW	B	L
814. <i>Gnetum scandens</i> ...	...	S. altH	YB	obscure	L
<i>European Species. (None)</i>					

Philippine Species. *Api-āpi* (*Avicennia* = 386).

Under 1 foot diameter:—**Madras.** All likely to be serviceable included in the list given above.

Tensile, Crushing and Shearing Strength, and Elasticity modulus unknown, and not required for the purposes indicated.

General Description. Mostly very large climbers and a few small trees, having an anomalous structure rendering them unsuitable for the normal uses of timber; Wood of various colours, white,

yellowish, various shades of brown or dark red, often variously mottled streaked veined or marbled; Mostly moderately hard on the average, but usually in alternating concentric layers of soft to moderately hard or moderately hard to hard, and with narrow to fairly broad wavy concentric rings—not always perfectly continuous—of bast separating the wood rings, and often also radial lines of bast which form the wood into wedges, the bast often being of a different colour to the wood tissue, grain usually very curly wavy or crossed, texture usually seeming very coarse but mostly working smooth under sharp tools, very hard to saw by reason of the crossed and twisted bast fibres clogging the teeth of the saw and generally somewhat difficult to work, a fact which would appeal to an artistic cabinet-maker who appreciates the difficulties of working excrescences of boles and irregularities of root-stocks in order to form 'Bird's-eye' material; Liable to split along the lines of bast if not quickly sawn up and carefully dried, and to warp in thin slats if not carefully weighted till dry owing to the more or less spiral lines of fibres; Durability IV, serviceable only under cover and kept free from alternations of dry and moisture, but not ordinarily attacked by beetles; P (of 386 only) = 600 (does not apply); Wt. 41-52, Av. 47; Rays (see table); Pores (see table); VC. = IV.

Note on Philippine Species. *Api-āpi*. Wood hard brittle but difficult to split, heavy, sap distinct whitish drying grey or light brown, heart purplish-grey, grain conspicuous from alternate bands of hard and soft tissue somewhat crossed and often wavy irregularly making it attractive for cabinetwork, texture of hard tissue extremely fine and dense and of soft somewhat coarser, not difficult to work; except that the sap is liable to stain if not dried very quickly, seasons well; Durability poor, but not attacked by beetles; Uses, locally, for a rice-mortars, recommended for cabinetwork and creosoted paving blocks; Prices, not marketed for timber.

Uses of Madras Timbers recorded. *None.*

Precis of Uses (deduced from above). Cabinetwork and fancyware.

The bulk of the above species are what are recorded as 'gigantic and most noxious climbers'; from a Forest point of view they are pernicious as they tend to overwhelm and destroy the very best species, and consequently large sums are spent annually on their destruction, for, as has been stated above, no use whatever has so far been found for them; they are the rank weeds of the forest. Nevertheless, some of them at least, if not the majority of them,

are very beautiful woods if properly cut up and seasoned; the *Gnetum scandens*, for instance, has all the beauty of the very finest cabinet Oak combined largely with that of the olive; some of the dark brown woods with their very large pores combined with their anomalous structure make them very attractive, whilst the paler woods sometimes with very broad rays, sometimes with fine close texture combined with the relieving of the monotony by the bast tissue, are by no means to be despised as small material for cabinetwork and fancyware.

Localities and Vernaculars. 187. (All districts, dry open forests. com.) *U.* D'hōbi; *Tl.* Paccāre, Pacaru, Poralasāpara, Tellapacaru, Poralapaccāre; *Ta.* Paccalai, Nāyvelangu, Vellangam, Velvariyaṅgam; *M.* Pāiyāṅgani, Vattantōli; *K.* Belaga, Hasarugōni, Paccāri. 386. (NCCS: COCT: CNTC: WTCT: litl., sswp.) *Tl.* Mada; *Ta.* Madaippattai, Uppukkurri, Uppattam, Kandal; *M.* Ūri, Ūrppam; *K.* Uppati. 492. (NCCS: rare; WFTS: sholas, scat.) (No names known). 493. (NCCS: WTCT:) *U.* Koliciti; *Tl.* Kappatige, Nallatige, Nāgamushini, Tigemushidi, Verricitramūlamu; *M.* Vallikkānniram; *K.* Kuri. 496. (COCT: DKN: CNTC:) *Tl.* Cinnanevili, Nemaliyadugu, Gadapulusu; *Ta.* Alandal, Cengattāri, Mayil, Mayiladikkurundu. 497. (COCT: DKN: CNTC: i *Tl.* B'hūchakramu, Morinika, Puttatige; *Ta.* Mulmurandai. 498. (COCT: NEL-TVY: DKN: CNTC): *Tl.* Kōdikālu, Nallagāra, Peddacikonadi. 587. (Most districts, scat.) *U.* Jomokuli, Ullāno; *Tl.* Nerani; *Ta.* Cundan, Karukkuvai. 625. (NCCS: MBR:) *U.* Kissi, Māccomāribāro, Rek'hāhālo; *Tl.* Kondatangēdutige, Sindugaboddi, Nedibunda; *M.* Vallimuritāli. 632. (NCCS: DKN: KNL: MPLT: WFTS: com.) *U.* K'hontopolāso, Noipolāso, Timāno; *Tl.* Nāyivāda, Piccikatamba; *Ta.* Ānaippiccān, Pillāccāvalli, Kallavudu; *M.* Attampu; *K.* Mukkataballi. 633. (NCCS: COCT: DKN: *U.*) Noipolāso, Polāsonoi; *Tl.* Mōdugatige; Tigemōduga, Tivvamōduga; *K.* Muttuginaballi. 638. (COCT: WTCT: litl. sswp) *Tl.* Cillanki; *M.* Vallivitti; *K.* Ballibite. 640. (COCT: CNTC: WTCT: litl., sswp) *Tl.* Nallatige, Tigekrānuga. 652. (NCCS: com; DKN: MPLT: WFTS:) Siāli, Pairmal, Nāgobolli; *Tl.* Addatige, Madapu; *Ta.* Mandāraiylai; *M.* Mottanvalli, Mandāranāgavalli, Nāgambuvalli; *K.* Anepādu, Hepparige, Kambihū, Kempayataballi. 655. (NCCS: KNL: WGTS:) *U.* Giridi; *Tl.* Gilatige, Peddamadupu, Tikātivva; *Ta.* Cillu, Irikki; *M.* Ānattata, Ānakkatla, Kakkavalli, Makkanka,

Paranta, Perunkakkavalli, Vattaval'i; *K.* Hallekāviballi, Pallebūru. 734. (WFTS: esp. NLGS: Pnis.) *Ta.* Malligai; *M.* Mallika; *K.* Mallige; (all generic, specific names not known). 755 (NLGS): (Names not known). 761. (NCCS: MPLT: WGTS:) *U.* Bodolombomāno, Kātoporāk'hiā, Mād'hobī; *Tl.* Puttapālatige; *M.* Irimpiyatāli; *K.* Ankōle, Krymig'hna. 762 (Most districts) *U.* Brydd'hoiāreko, Moncā; *Tl.* Candrapoda, Kokkita, Tivvakokkita, Pālasamudra, Samudrapacca, Samudrapāla; *Ta.* Camut-tiraccōgi, Camuttirappaccai, Camuttirappālai, Peymunnai; *M.* Samudrappacca, Samudrappāla, Samudrastōkam, Samudrayōgam; *K.* Samudraballi, Samudrahālaballi, Samudrasōge. 814. (NCCS: esp. Agt: MPLT: WGTS:) *U.* Lolori; *Tl.* Apajūttili, Kalol, Luliti; *M.* Ūla; *K.* Navurukatte.

IV.—MOSTLY HARD

A. MOSTLY REDDISH

N. *19. *Mahoganies*

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
111. <i>Bursera serrata</i> ...	42	...	3	3	2	3	III	LtB-R.
114. <i>Azadirachta indica</i> ...	48	642	4	2	1	2	II	YW-R-RB
116. <i>Dysoxylum binectariferum</i> (incl. <i>Beddomei</i> , <i>purpureum</i>).	46	494	2	3	2	3	III	RGy-R-RB
124. <i>Amoora Rohituka</i> (?) (incl. <i>canarana</i> and <i>Lawii</i>).	41	792	4	2	2	3	III	R-DkClR. (?M; ? Red Cedars).
130. <i>Carapa obovata</i> ...	44	526	4	2	2	4	III	PkW-LtR.
132. <i>Chukrassia tabularis</i> ...	48	614	1	3	2	3	II	YB-RB satiny
201. <i>Hardwickia pinnata</i> ...	46	640	1	3	2	3	II	(M) LtR-DkR-RB.
231. <i>Pygeum Wightianum</i> (incl. <i>Gardneri</i>).	43	622	3	2	2	3	III	R-RB scented of prussic acid.
320. <i>Bassia malabarica</i> ...	47	471	5	3	3	3	IV	DkR.
<i>European Species</i>								
Peach ...	46	...	5	4	3	4	V	(M-H) YW-ChesRB.mot.
<i>Imported Species.</i>								
Mahogany (Average) ...	43	536	...	...	...	...	...	RB
Mexico or Spanish	53	425	...	...	...	...	...	
West Indian, Cuba, Jamaica.	52	546	...	...	...	...	...	
Honduras	35	637	...	...	...	...	...	
Animé, or West Indian Locust.	43	765	...	...	...	...	...	

Philippine Species. Amugān (incl. Lāgo) (*Pygeum* = 231); Batēte (*Kingiodendron* = 201); Kāto (*Amoora* = 124); Manggīs (*Koompassia* = 132); Piāgao (incl. Tabīgi) (*Xylocarpum* or *Carapa* = 130).

Under 1 foot diameter:—MADRAS. 595. *Scutia indica*.

Strengths.

Tensile Strength:—Mahogany, Spanish = 7.6-8.0, Av. 7.8; Honduras = 11.5; 114. *Azadirachta* (Neem) = 6.9. Anime = 7.5;

Crushing Strength:—Mahogany, Spanish = 8.2; Honduras = 8.0; 114. Neem = 6.7.

Shearing Strength:—114. Neem = 1326.

Elasticity Modulus:—Mahogany, Spanish = 1256; Honduras = 1593; Average = 1424; 114. Neem = 1109-1252, Average (of four experiments) = 1187 (taken for Category).

Compared with Oak 100:—Mahogany Neem Category

Strength 86 103 94

Stiffness 83 69 69

Toughness 89 153 128

General Description. Large and moderate sized trees, usually somewhat resinous (201 oily-balsamic); Wood of various shades of red and red-brown; Hard (201 = moderately hard, and see note to 124), grain straight or sometimes finely curly or wavy, texture usually fine and smooth or glossy, generally easy to work; Seasons well, but often requires careful piling to prevent warping; Durability II-III, rarely attacked by beetles; P = 587; Wt. 41-48, Av. 45; Rays m-f, usually of different tint to adjacent tissue giving a good silvergrain; Pores mostly L-m (124, 130 = m-s; 111 = s); VC. = II. *Note*.—Closely allied to the Red Cedar *10, but harder and stronger; 124. *Amoora canarana* and *Lawii* are not well known, and it is uncertain whether they shall be classed as Red Cedar or Mahogany; see Kāto, in the Philippine timbers, below.

Note on European Species. The Peach (*Prunus persica*) is a small tree of Central Asia from Persia to China, and cultivated in Europe; the wood is yellowish-white with a small chestnut- or reddish-brown heart, moderately hard to hard, not durable except under cover; it is used for cabinetwork and inlaying, as the whitish rays give a good silvergrain, and it takes polish well.

Note on Imported Species. The Mahogany (*Swietenia Mahagoni* and *macrophylla*) occurs in Central America, notably Honduras, the West Indian Islands and Mexico; the wood is usually reddish-brown of different shades and various degrees of brightness, but sometimes yellowish-brown, often veined and mottled; in a dry state it is very durable, but does not last long when exposed to the weather; it would make excellent timber for floors, roofs, etc., but on account of its costliness it is chiefly confined to doors, sometimes for window-frames and sashes, but especially it is in demand for furniture and cabinetwork; it is also extensively

used in the framing of machinery for cotton mills, as it shrinks very little and is supposed to warp and twist less than any other wood.

The Animē, or West Indian Locust, tree (*Hymenaea courbaril*) is a very large tree of the West Indies, Central America and Brazil; with a hard tough reddish-brown wood, very like Mahogany in all respects, and at the same time very like 201, *Hardwickia* and the Philippine Batēte being replete, as they are, with a balsamic resin or Copaiba; it is used for building, cabinetwork and furniture.

Note on Philippine Species. *Amugān*. As far as known, the character of all species is the same; wood moderately hard, moderately heavy, sap indistinct from the reddish-brown heart with narrow concentric lines of dark tissue, grain often curly or wavy and often crossed, texture fairly fine glossy, easy to work; seasons well; Durability III, rarely attacked by beetles; Uses, locally for posts, framing, etc., practically unknown in the Manila market, but recommended for a most useful cabinetwood; Prices, sold with Miscellaneous lumber about P/50 mc. (—Rs. 4 cft.). *Batēte*. Wood soft to moderately hard, moderately heavy, sap indistinct pale red to dull brown, heart light to dark reddish-brown with blackish streaks due to oil which stains all surfaces, grain fairly straight, texture fine smooth but not glossy, fairly easily worked; checks very little, but warps badly if not carefully seasoned; Durability III, heart rarely attacked by insects other than termites which destroy it rapidly; Uses, posts above stumps, beams, joists, rafters, flooring, doors, sheathing, other interior finish, furniture, treated ties and paving blocks; Prices, P/100-125 mc. (—Rs. 8½-10½ cft.). *Kāto*. As far as known, the wood of other species is softer and lighter and the trees do not grow as large; wood hard, heavy, sap light dull red distinct, heart deep dull wine-red, grain straight, texture fairly fine, not difficult to work; seasons well, at least in small dimensions; Durability II, even sap not attacked by beetles; Uses, posts, beams, joists, rafters, flooring, doors, windows, interior trim, furniture and cabinetwork, bridge-wharf and other heavy construction timber, ties, turned and shaped tool-handles; Prices, rare and not marketed. *Manggis*. Resembles, but has not the oil-content of, and is harder than, Batēte; wood hard brittle, heavy, sap whitish distinct, heart rich reddish-brown often with conspicuous broad lighter and darker belts, easy to

work; Durability probably III at least; Uses, unknown but would make a beautiful interior finish, cabinet, and furniture wood; Prices, unknown in Manila market, worth P/150 mc. (—Rs. 12½ cft.). *Piāgao*. Practically the only difference between these two species is the colour; the 'African Mahogany' belongs to the same genus; wood moderately hard, moderately heavy, sap whitish distinct, heart light red (Tabīgi) to deep wine-red (Piāgao), grain straight or slightly crossed, texture fine glossy, works easily; seasons very well, shrinking little and warping or checking hardly at all; Durability II, rarely attacked by beetles; Uses, poles, ties, posts, beams, joists, rafters, doors, flooring, all interior finish, high-grade furniture and cabinetwork, among the best and most beautiful cabinetwoods in the Islands; Prices, rarely marketed except with better grades of Red Lauān (see N. *9) about P/60-80 mc. (—Rs. 5-6½ cft., but it should bring better prices than the best Lauāns, especially for export.

Uses of Madras Timbers recorded. 111. (Takes fine polish); furniture. 114. (Resembles Mahogany, takes fine polish; durable and not attacked by insects); construction, shipbuilding, furniture (keeps off moths and other insects), carving and sculpture, cartbuilding (wheels), agricultural implements. 116. (Faintly scented, excellent timber but not used). 124. (Good timber and takes fine polish, but is little used); building, canoes. 130. (Stands brackish water better than Sal; strong but brittle and liable to warp; cf. Tabīgi, which is this species!); building, furniture, spokes of wheels, handles of tools. 132. (Cedar-scented, very durable, has lasted for hundreds of years in the Palace of the Kandyan Kings); building, cabinetwork, furniture, cigar-boxes. 201. ('Malabar Mahogany'); building especially planking, furniture. 231. (Durable, contains prussic acid); not used. Might be tried for pipes (see Mahaleb Cherry N. *21).

Precis of Uses (deduced from above). Construction; carpentry (incl. beams, joists, rafters, poles and posts), joinery (incl. planking, flooring, ceiling, sheathing and wainscotting, interior finish, doors, windows frames and panels); mill-work (framing in cotton-mills); bridge- and wharf- building (incl. piles, poles, posts, beams, sleepers and paving blocks treated or otherwise); ship-building (incl. planking and decking, cabin-finish, canoes); cabinetwork and furniture (high-grade); sculpture and carving; wheelwrightery (incl. wheel naves and spokes, carriage panelling); turnery (tool

handles, tobacco pipes); agricultural implements; box-lumber (high-grade cigar-boxes).

Localities and Vernaculars. 111. (NCCS:KNL:) *U.* Mohi, Sorupotrimohi, Onderu; *Tl.* Būsi, Karakabūsi, Errabūsi, Manutikaraka, Cittirekka. 114. (Most districts, plains) *Tl.* Vēmu (Vēpa); *Ta.* Vēmbu, Vēppu; *M.* Vēppu; *K.* Bēvu, Bēmu, Ollebēvu. 116. (WFTS:KAN-TVY:CBT:MRA:scat.) *Ta.* Aguniyagil, Cembil; *M.* Akil, Kārakil, Pūvalakil; *K.* Agilu, Kādugand'ha. 124. (WGTS:KAN-TVY:Anms. scat.) *Ta.* Pēyccanbagam. Cem, Curilaiccuvaram, Vangul, Cevvanai, Erumaikkonrai; *M.* Cem, Kārakil, Madarasada; *K.* Mullunuttuga, Tottile. 130. (COCT:WTCT:scat.) *Tl.* Adivipucca; *Ta.* Conmundiri, Kandalangāy; 132. (SAC:—TVY:and MYS:CRG:—TRV:scat.) *Ta.* Agil, Āyil, Celvangāci, Kādamūlai, Madagirvēmbu, Vēdvēmbu, Pallirukki, Tēvaganni; *M.* Akil, Cuvannakil, Malavēppu; *K.* Davala, Gand'hamalar, Huruli. 201. (WGTS:KAN:—TVY:) *Ta.* Kolavu, Enneykkolavu, Kudaippālai, Madancāmbārāni; *M.* Curuli, Cuvannappayan, Kulāyu, Uram; *K.* Enne, Hennuyenne. 231. (WFTS:NLGS:—TVY:Anms., Pnis., Svys., scat.) *Ta.* Attanāri, Calangullumā, Palāngādai, Kongai, Kāttukkongai, Kullumā, Nadilai; *M.* Cettari, Nākkampakam, Irattiyan, Muttukkonka; *K.* Nadele, Kullumāvu. 320. (KAN:—TRV:Anms., rvs) *Ta.* Ārriluppai, Vanci; *M.* Ārririppa; *K.* Nānele, Hulinānele.

IV.—MOSTLY HARD

A.—MOSTLY REDDISH

N. *20. Pears

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
43. <i>Calophyllum</i> ino- phyllum.	46	540	4	2	1	4	III	RB DkRB.
61. (<i>bis</i>). <i>Thespesia</i> populnea.	49	691	4	3	2	4	IV	DkR.
135. <i>Strombosia</i> ceylanica.	...	...	3	2	2	4	III	YB-DkRB.
136. <i>Anacolosia</i> densiflora.	44	630	3	2	2	3	III	(M-H) LtRB.
281. <i>Homalium</i> zeylani- cum.	48	777	3	1	1	3	II	GyR-R-ctr. DkR.
289. <i>Viburnum</i> acumi- natum.	49	...	5	3	3	3	IV	LtR.
326. <i>Diospyros</i> pruriens.	...	...	4	2	3	3	III	YW-R-expo.
329. <i>Diospyros</i> toposia	...	...	4	2	2	4	III	R-RB.
335. <i>Diospyros</i> microphyl- la.	49	643	3	2	2	3	III	RGy.
430. <i>Aporosa</i> Lindleyana.	42	515	4	3	3	2	IV	Pk-PkB.
438. <i>Mallotus</i> philippinen- sis	47	361	4	3	3	2	III	GyR-LtR.
<i>European Species.</i>								
Pear	48	509	3	4	2	3	III	PkR-YR.
Mountain Ash, or Rowan.	46	...	4	3	2	2	III	Pk-YW-ctr. RB.

Philippine Species. Arānga (*Homalium* = 281, see also N.*30); Banālo (*Thespesia* = 61-*bis*); Bitāog or Pālomaria (*Calophyllum* = 40); Bolongēta (sap) (incl. Camagōn, Tālang-gūbat, Tāmil) (*Diospyros* = 326, 329, 335); Tamayūan (*Strombosia* = 135, 136, 138).

Under 1 foot diameter:—**Madras.** 504. *Flacourtia sepiaria*. 512. *Hypericum mysorense* and *Hookerianum*. 657. *Mimosa rubicaulis* (incl. *hamata* and *polyancistra*). 691. *Viburnum hebanthum* and *erubescens*.

European. Buckthorn (*Rhamnus catharticus*).

Strengths.

Tensile Strength:—Pear = 9.8.

Crushing Strength:—40. *Calophyllum* = 5.7; 61. (*bis*). *Thespesia* (Portia) = 6.3.

Shearing Strength :—40. Calophyllum = 859 ; 61 (*bis*). Portia = 927.

Elasticity modulus :—Pear = 813 ; 40. Calophyllum = 1471 ; 61 (*bis*). Portia = 1013 ; Average taken for Category = 1242.

Compared with Oak 100 :—Pear Calophyllum Portia Category

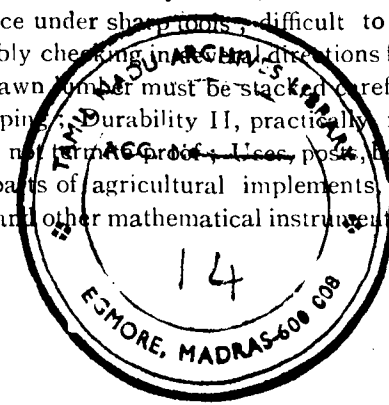
Strength	...	82	87	111	96
Stiffness	...	47	86	60	73
Toughness	...	141	88	205	127

General Description. Mostly moderate sized trees ; Wood either distinctly reddish, or, if reddish-brown, finer grained and with finer rays and smaller pores than the Mahoganies, with which it, agrees fairly in weight ; Hard, (136—moderately hard), grain straight or crossed sometimes curly and wavy, texture fine smooth, fairly easy to work ; Seasons well generally, but often liable to warp if not carefully stacked, and also liable to crack internally in logs or large planks ; Durability II, (281—I, 61-*bis*, 289, 430, 438 =III), not usually attacked by beetles ; P = 593 ; Wt. 42-49, Av. 47, and like the Mahoganies all under 50 ; Rays f-ff, (40, 281 =fff) ; Pores mostly s-ss, (305 = L, but very scanty ; 40, 61-*bis*, 136, 281, 430 = m, but usually scanty) ; VC. = II.

Note on European Species. The Pear (*Pyrus communis*) occurs scattered throughout the greater part of Europe, where also it is considerably cultivated, and also through Western and Central Asia as far as North China ; the wood is a nearly uniform pinkish-red or yellowish-red, hard, compact, very homogeneous, only durable under cover and is liable to warp or crack, but works easily and is capable of taking a fine polish ; it is highly esteemed for wood-engraving, and is in great demand by sculptors, cabinetmakers, turners, and makers of musical instruments and especially of mathematical instruments (T-squares, triangles, curves, scales, etc.) ; figury wood is especially prized for veneer in cabinetwork. The Mountain Ash, or Rowan, (*Pyrus aucuparia*) occurs throughout Europe chiefly on hilly ground, and in Northern Asia ; the wood is a pinkish or yellowish white which deepens towards the centre into a reddish-brown with a satiny lustre ; and, like the Pear, it is hard and tough, homogeneous, and takes a fine polish ; it is only durable under cover, however it warps but little ; it is much in demand for wheelwrightery, for turning (especially for tool handles), and for parts of machinery subject to friction. The Buckthorn (*Rhamnus*

catharticus) is a small tree, or more commonly a shrub growing about ten feet high, which occurs throughout Europe. North Africa, and Siberia ; the wood is pinkish-white passing to a light red towards the centre, with a lustre like straw ; it is used for turning, and small articles of cabinetwork.

Note on Philippine Species. *Arānga*. General appearance, mechanical properties and structure of all species are very much alike except for certain variations in colour and density, which seem partly due to local conditions and not to specific differences ; wood hard to very hard, heavy, sap distinct from or merging gradually into heart, yellowish pinkish or pale red or a small heart of red or chocolate-brown, grain straight or slightly crossed, texture very fine dense and smooth, hard to saw but not difficult to shape or surface ; seasons fairly well, checking and warping very little ; Durability I, rarely attacked by termites and very slowly by teredo ; Uses, piling, ship- wharf- and bridge- building, posts, sills, poles, ties, paving blocks, floors, interior finish, sash, furniture, cabinetwork ; Prices P/110-180 mc. (= Rs. 9-15 cft.). *Banāto*. The smooth red heartwood is highly prized by musical instrument makers, but is very scarce in Manila. *Bitāog* or *Pālomaria*. (See Bitanhöl, N.*11) ; wood harder, heavier and usually darker than Bitanhöl, grain generally very curly or wavy and crossed making it very hard to split and also difficult to surface, but except for this difficulty of surfacing not hard to work ; seasons well ; Durability II, very rarely attacked by insects ; Uses, posts or stumps, doors, flooring, sheathing and ceiling, ships' knees and ribs, hubs, fine furniture and cabinetwork, musical instruments (necks and heads) ; Prices, scarce but brings P/125-170 mc. (= Rs. 10½-14 cft.) ; cart- and other vehicle- makers pay for bolts 1½ ft. long by 1 ft. diameter (just enough for a pair of cart-hubs) P/2½ (= Rs. 7½) per bolt. *Bolongāta*. (See Kanōmoi, N.*17, the Camagōn group) ; wood hard, heavy, with pinkish or pale red sapwood, grain generally very straight, texture fine smooth and very dense, difficult to work but takes at beautiful surface under sharp tools ; difficult to season well, logs almost invariably checking in all directions from the heart outwards, while sawn timber must be stacked carefully and weighted to prevent warping ; Durability II, practically never attacked by beetles though not termite-proof ; Uses, posts, beams, joists, rafters, window-sills, parts of agricultural implements, excellent material for T-squares and other mathematical instruments, shuttles, bobbins,



spindles, golf-club heads and shafts, ax pick and hammer handles : Prices, logs sell in Manila at P/30-70 mc. (=Rs. 3½-8 cft.). *Tamayhan*. Wood hard but brittle, heavy, sap whitish not durable distinct, heart pink to dark red-brown, grain straight or slightly crossed, texture very fine dense smooth, easy to work : taking smooth silky surface under a sharp plane ; seasons with little warping, but liable to internal checking in logs or large pieces : Durability II at least, rarely attacked by beetles ; Uses, poles, piles, posts, beams, joists, rafters, studs, mine-timbers, ax chisel and similar tool handles, canes, flooring, window-sills, furniture and cabinetwork ; Prices, no established price, but occasional lots of boards and dimension stuff would bring at least P/100 mc. (=Rs. 8½ cft.) ; ties P/1¼-1½ (=Rs. 3¾-4½) each.

Uses of Madras Timbers recorded. 40. Shipbuilding, masts and spars, railway sleepers, machinery, beautiful wood for cabinetwork. 61 (*bis*). Cart and carriage-making, spokes, furniture, boats, gunstocks. 281. (Very strong, not attacked by insects, inclined to split in seasoning) ; building. 289. (Mathieu says the wood of the genus resembles that of the Pear, especially in colour and in fineness of grain) ; not used. 335. Walking sticks from young trees.

Precis of Uses (deduced from above). Construction ; carpentry (incl. posts and stumps, beams, joists, rafters, studs) ; joinery (incl. posts, flooring, ceiling, sheathing and wainscotting, doors, window-sills and sashes, interior finish) ; bridge- and wharf- building (incl. piles, poles, foundation sills, beams, paving blocks and sleepers) ; hydraulic works (incl. piles, foundation sills, mining timbers) ; ship-building (incl. knees and ribs, masts and spars for small vessels, boats) ; wheel-wrightery (incl. hubs and spokes) ; machinery (incl. all parts subjects to friction) ; cabinetwork (high-grade, including veneer) ; sculpture and carving (incl. inlaying, wood carving, etc.) ; turnery (incl. tool handles such as axe, pick, hammer, chisel, etc., shuttles, spindles, bobbins, gunstocks, golf-club heads and shafts, walking-sticks ; musical instruments : agricultural implements ; desk supplies (incl. mathematical instruments such as T-squares, triangles, curves, scales).

Localities and Vernaculars. 40. (WTCT: litl.; cult. NCCS: etc.) *U.* Punnāngo ; *Tl.* Ponna ; *Ta.* Pinnai, Punnai, Punnāgam ; *M.* Punna, Ponnakam ; *K.* Honne, Hūhonne, Namēru, Sūrahonne. 61. *bis.* (cult. and rwd. com. ECT: COCT: CNTC: WTCT: *U.*

Gunjāusto, Porosopippoli ; *Tl.* Gangarāvi, Gangarēni ; *Ta.* Pūvaracu, Pūpparutti ; *M.* Pūvarasu, Pūpparutti, Cilānti, Kallāl ; *K.* Bangāli, Bugari, Gandarali, Hūvarasu, Arasu, Jōgi, Jōgiyarale. 835. (WGTS: KAN-TRV: scat.) (names not known). 836. (TVY: TRV: Anms.) *Ta.* Kalmānikki, Kalpottan, Kāttuvekkāli ; *M.* Kalmānikkam, Kaiyati, Malankāra, Kānyan, Nettamatukku, Kānamatukku. 288. (NAC: WFTS: KAN-TVY:) *Ta.* Kalviracu ; *M.* Mantalamuk'hi ; *K.* Kal 289. (NCCS-Agt: MPLT: WFTS: KAN-TRV:) *Ta.* Konargāram ; *K.* Hēlusunde. 326. (WGTS: KAN-TVY: Anms.) (names not known). 329. (TVY: TRV:) *Ta.* Cinnattuvarai, Malligaittuvarai ; *M.* Kāttutuvara, Tuvarakkari, Ilaccivicca, Cōrakkari. 430. (WFTS: esp. com. CRG-KAN:) *Ta.* Vittil, Kottili ; *M.* Eccil, Vetti, Vittil, Kottili ; *K.* Sarali. 438. (Most districts, ravs., degn.) *U.* Sindūrogundi, Bosontogundi, Kunkumo ; *Tl.* Kunkumu, Sinduragundi, Vasant'hagand'hamu ; *Ta.* Kabilapodi, Kurangumancanārri ; *M.* Kappila, Mannana, Pīponnakam, Kurukkutti ; *K.* Kapile, Kunkuma, Punnāga.

N. *21. Plums—continued

IV.—MOSTLY HARD

A.—MOSTLY REDDISH

N. *21. Plums

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
25. <i>Scolopia crenata</i> ...	...	...	4	2	2	3	III	RB.
26. <i>Flacourtia cataphracta</i> ...	54	811	4	2	2	3	III	OrR-R.
27. <i>Flacourtia Ramontchi</i> ...	52	...	5	2	2	2	III	R-RB.
34. <i>Garcinia echinocarpa</i> ...	53	955	2	2	1	3	II	BtRB-DkR.
39. <i>Ochrocarpus longi folius</i> ...	50	546	3	2	1	4	III	DkR.
150. <i>Zizyphus jujuba</i> ...	50	533	4	3	2	2	III	PkR-RB.
151. <i>Zizyphus xylopyra</i> (incl. <i>horrida</i>) ...	52	800	5	3	2	2	III	YB.OrB-RB.
170. <i>Odina wodier</i> ...	57	565	3	3	2	2	III	(M-H) LtR-RB-CopR.
196. <i>Cynometra ramiflora</i> (incl. <i>Beddomei</i> , <i>travancorica</i> and <i>Bourdillonii</i> — <i>Halmendora</i> of Ceylon).	57	762	3	2	1	4	III	R.
209. <i>Bauhinia retusa</i> ...	58	...	4	3	3	3	IV	R-DkRBk ctr.
213. <i>Adenanthera pavonia</i> ...	56	902	4	2	1	4	III	PkR RB.
216. <i>Acacia planifrons</i> ...	...	...	5	3	2	3	IV	PkW-R.hrt.
217. <i>Acacia arabica</i> ...	54	880	3	2	2	1	II	PkR-RB mot.
218. <i>Acacia leucophloea</i> ...	55	861	4	3	2	2	III	YW-BkR-RB.
271. <i>Careya arborea</i> ...	53	688	5	2	2	2	III	(M) PkW-RB-ClaR
298. <i>Wendlandia Notonia</i> (incl. <i>angustifolia</i>) ...	53	...	4	3	2	3	III	(M-H) DkRB.
315. <i>Sideroxylum tomentosum</i> ...	56	...	4	2	2	3	III	(M-H) LtYB.
316. <i>Isonandra lanceolata</i> (incl. <i>anfractuosa</i> , <i>villosa</i> , <i>Candolleana</i> and <i>Perrottetiana</i>) ...	53	...	5	2	3	3	IV	LtRB.
333. <i>Diospyros assimilis</i> (sap) ...	70	940	2	2	1	3	II	PkGk.
338. <i>Diospyros melanoxylon</i> (sap) (incl. <i>tomentosa</i> and <i>tupru</i>) ...	63	1021	3	2	1	2	II	Pk-RB.
340. <i>Diospyros Candolleana</i> ...	56	...	4	2	2	3	III	PkR-R.

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
<i>Caesalpinia sappan</i> (cult. only; Sibucan of Philippines).	53	1520	...	...	...	...	...	YW-OrR-YR.
<i>European Species</i>								
Plum	52	...	4	3	2	4	IV	RB vnd. Crim & Vi.
Apple	52	520	5	4	2	3	IV	R-ctr.RB.
Torminal	52	...	4	3	2	3	III	PkR-ctr RkB.
Evergreen Buckthorn	61	...	4	3	3	3	IV	LtYB-DkChesRB.
Almond	65	...	5	3	2	3	IV	YW-DkChesRB.
<i>Philippine Species</i>								
Supa	58	728	...	...	...	...	...	YPk-DkBrzB.
Tindalo	57	622	...	...	...	...	...	YW-Or DkRstBk.
Amugis	56	670	...	...	...	...	...	R-CopR.

Amugis (incl. Malabog) (Koordersiodendron and Parishia=170); Bāhai (Ormosia=191, heart? see N. *17); Bolongēta (incl. Camagōn, Tālung-gūbat, Tāmīl) (Diospyros=333-sap, 338-sap, 340); Banokbōk (incl. Mangkā) (Sideroxylum=315); Kamāog (Erythrophloeum=196); Kayagālu (incl. Supā) (Sindora=150, 217); Lamōg (incl. Tōog) (Planchonia and Petersianthus—under Terminalia=196); Malabunōg (Garcinia, red type, =34, 39); Tangāl (Ceriops=668); Tanglīn (Adenanthera=668); Tindalō (Pahudia=151, 216, 218).

Under 1 foot diameter:—MADRAS. 564. *Ximenia americana*. 597. *Colubrina asiatica* and *travancorica*. 611. *Rhus mysorensis* and *parviflora*. 658. *Acacia eburnea*. 665. *Photinia Lindleyana* and *Notoniana*. 668. *Ceriops Candolleana* and *Roxburghiana*. 692. *Wendlandia exserta*. 735. *Nyctanthes arbor-tristis*. 777. *Osyris arborea*. 778. *Scleropyrum Wallichianum*. 779. *Bridelia montana*. 781. *Cleistanthus collinus* (incl. *malabaricus* and *patulus*). 785. *Flueggia microcarpa* and *leucopyrus*. 786. *Breynia rhamnoides*.

EUROPEAN. African Mahogany of the French (*Zizyphus vulgaris*). Terebinth Mastic (*Pistacia terebinthus*). Chios Mastic (*Pistacia lentiscus*). Mahaleb Cherry (*Prunus mahaleb*). Bugwood,

or Blood Cornel (*Cornus sanguinea*). Strawberry tree (*Arbutus unedo*).

Strengths.

Tensile Strength:—Plum=11.8 14.0, Av. 12.9; Apple=19.5; Supa=11.8; Tindalo=10.5.

Crushing Strength:—Plum=8.2-10.5, Av. 9.3; Apple=6.5-7.1, Av. 6.8; 150. Zizyphus (Jujube)=6.2; Supa=8.7; Tindalo=7.7; Amugis=4.9; Across the grain:—Supa=1920.

Shearing Strength:—150. Jujube=1013; Supa=898-1200, Av. 1049; Tindalo=1004; Amugis=824.

Elasticity modulus:—Plum and Apple=1000; 150. Jujube=956; 196. Cynometra=1530; Supa=1863; Tindalo=1570; Amugis=1760; Average taken for Category=1536.

Compared with Oak 100:

	Plum and Apple	Supa	Tindalo	Amugis	Jujube	Cynometra	Category
Strength ...	84	117	100	108	87	123	127
Stiffness ...	58	109	92	103	56	90	90
Toughness...	122	125	100	113	133	168	180

General Description. Mostly moderate sized trees; Wood various shades of red to reddish-brown, closely allied to both Mahoganies and Pears, but in all cases heavier and over 50 lbs.; Hard (271=moderately hard; 170, 297, 315=moderately hard to hard), grain sometimes straight sometimes crossed wavy or curly, texture usually fine and dense or if appearing coarse taking smooth surface under sharp tools, easy or rather difficult to work; Seasons well generally but requiring considerable attention in carrying it out, whether from liability of sap to stain demanding rapidity of drying, or tendency to warp and exacting careful stacking and sometimes weighting, or liability to crack internally if seasoned in log or large pieces; Durability II (150, 151, 170, 216, 218, 297=III), sap in these cases liable, in the others not, nor heart, to be attacked by beetles; P=790; Wt. 50-70, Av. 55, thus much heavier than Mahoganies and Pears; Rays m-f (209, 213, 315, 333, 338=ff); Soft tissue often forming alternate bands, or continuous parallel, or broken sometimes wavy, lines; Pores usually m-s (209, 216, 217, 271, 338=L-m); VC.=II.

Note on European Species. The Plum (*Prunus communis*) is a very variable species with several varieties, of which the shrubby Sloe or Blackthorn (*var. spinosa*) is wild and abundant especially

in hedges in Europe, the Bullace (*var. insititia*) a small tree is also wild but not nearly so common, the Plum proper (*var. domestica*) and Mirabelle (*var. divaricata*) probably belong to Macedonia, the Caucasus and North Persia but have been cultivated in Europe from very early ages; the wood is reddish-brown veined and shaded with crimson and purple or violet, which colours are brightened by treatment with limewater; it is hard and finegrained, fairly durable if not exposed to atmospheric alternations, and it has a fair silvergrain; it is used for turning, small fine cabinetwork and inlaying. The Apple (*Pyrus malus*) occurs wild in Greece, Asia Minor to Persia, and to a small degree in other parts of Europe and Central Asia, but it is cultivated to a considerable degree in Europe; the wood is very nearly identical with that of the Pear, except that it is heavier, and the colouring is not so uniform being red passing to reddish-brown towards the centre; it is somewhat more liable to crack and warp than the Pear, but is otherwise similar in properties; it is therefore used, but to a less degree, like the Pear for wood-engraving, sculpture, cabinetmaking, turning, musical instruments, mathematical instruments, etc. The Torminal, or Wild Service (*Pyrus torminalis*) occurs chiefly in the plains or on low hills scattered throughout Europe and temperate Asia; it, again, with the exception of its weight and colour—which is a pinkish-red darkening and often flushed with a blackish-brown towards the centre—very closely resembles the wood of the Pear, hard tenacious and very homogeneous, shrinking little in drying, working well and taking a good polish; it is hardly large enough nor durable enough for construction, but it is largely used by wood-engravers, turners, mechanics for parts of machines subject to friction, and makers of musical and mathematical instruments. The Almond (*Prunus amygdalus*) is a small tree occurring in Syria, Caucasus and Turkestan, cultivated in Europe but more especially in Persia and Afghanistan; it has a scanty white sapwood and a deep chestnut-red-brown heartwood, veined and with white mottling from the rays giving a good silvergrain; it is hard and fairly durable, taking a good polish, but is very liable to crack and warp; it is used for cabinetwork and inlaying. The Evergreen Buckthorn, or Alatern, (*Rhamnus alaternus*) is a small tree of the South of Europe and North Africa; the wood is yellowish white in the sapwood and from a light Oak-brown to a deep chestnut-red-brown in the heartwood; it is hard but brittle, very homogeneous, only durable under

cover, and shrinks a good deal in drying; it is used for turning, small cabinetwork and inlaying. The African Mahogany of the French (*Zizyphus vulgaris*--see Piāgao of the Philippines N. *19) is a small tree of Syria and Central Asia to the Himalayas, cultivated along the Mediterranean region of Europe and North Africa; it has a very large yellowish-white sapwood and a uniformly red heartwood, which is hard compact very homogeneous and capable of taking a very fine polish; it is used in cabinetmaking as a substitute for Mahogany. The Terebinth and Chios Mastics (*Pistacia terebinthus* and *lentiscus*) are two small trees or large shrubs of the Mediterranean region of South Europe and North Africa; they have a yellowish-white sapwood and a heartwood in the larger Terebinth of a chestnut-reddish-brown and in the smaller Chios of a satiny salmon-orange; they are both hard compact with a fair silvergrain and capable of taking a good polish; they are used for cabinetwork and inlaying, sculpture, fancyware, and turning. The Mahaleb Cherry occurs in Central and Southern Europe and Western Asia as a small tree; the wood is scented, pinkish-white to light red, hard homogeneous fine grained capable of taking a fine polish; it is used for turning, small cabinetwork and fancyware including snuff-boxes and tobacco-pipes. The Bugwood or Blood-Cornel (*Cornus sanguinea*) is a common shrub of Europe and Siberia with a hard elastic tough close grained reddish-white wood; it is used for basket-frames, tool-handles, small pieces of machinery, ladder-rungs, fork-handles, and walking-sticks. The Strawberry Tree, or *Arbutus* (*Arbutus unedo*), also grows along the Mediterranean in the South of Europe and North Africa as a small tree; the wood is red, hard, brittle, heavy, short-fibred, of poor durability and very liable to warp, but is easy to work and takes a good polish; it is used for turning, small cabinetwork and inlaying, and fancyware and toys.

Note on Philippine Species. *Amūgis*. The whole structure of Malābog is similar to Amūgis, but lighter in colour and slightly coarser; when not too streaky Bōgo (see N. *10) looks exactly like Amūgis; wood moderately hard to hard, moderately heavy to heavy, sap distinct pale dull red, or whitish generally staining to a mottled greyish-brown on drying, heart light reddish-brown to dull coppery-red, grain generally straight sometimes with short regular waves, texture fine, easy to work taking a smooth glossy finish; liable to warp in seasoning if not carefully stacked; Durability II, heart

rarely attacked by insects; Uses, beams, joists, rafters, flooring, interior finish, carriage bodies, furniture and cabinetwork; Malābog locally for dugout canoes; Prices, Malabog only comes into the market with Miscellaneous lumber selling at P/40 mc. (—Rs. 3½ cft.), Amugis P/130–150 mc. (—Rs. 11–12½ cft.). *Bāhai*. Wood hard, moderately heavy, sap very large whitish, heart orange-red darkening somewhat with age, grain frequently wavy and curly, texture rather coarse in appearance but dense and glossy, general appearance very like Tindalō (see below), fairly easy to work; seasons well; Durability III, heart not attacked by beetles; Uses, houseposts, beams, joists, rafters, interior finish, furniture, cabinetwork (the soft tissue forms patterns like a 'mackerel sky'); Prices, often wrongly substituted for Tindalō, but otherwise much lower in price, and often mixed when sawn with mixed Miscellaneous lumber. *Banokbōk* (see Duklitan, N. *6). Although the woods of this genus are generally lumped together under the name of 'White Nāto', they vary considerably in hardness as well as somewhat in structure, the wood of Banokbōk is practically identical with that of Mangkā, whilst that of White Nāto is practically identical with that of Duklitan; wood hard, heavy, distinctly yellow, heart indistinct, grain straight, texture dense and smooth, not difficult to work; seasons well but somewhat liable to split at ends if not painted; Durability? Uses, cabinetwork, carved and turned articles; Prices, scarce and not known in the markets, would sell with the cheaper Miscellaneous lumber about P/50–60 mc. (—Rs. 4–5 cft.). *Bolongtā*. (see N. *20, and Kanōmoi, N. *17; Camagōn group); wood hard, heavy, with pinkish or pale red sapwood, grain generally very straight, texture fine smooth and very dense, difficult to work but takes a beautiful surface under sharp tools; difficult to season well, logs almost invariably checking in several directions from the heart outwards, while sawn lumber must be stacked carefully and weighted to prevent warping; Durability II, practically never attacked by beetles though not termite-proof; Uses, posts, beams, joists, rafters, window-sills, parts of agricultural implements, excellent material for T-squares and other mathematical instruments, shuttles, bobbins, spindles, golf-club heads and shafts, ax pick and hammer handles; Prices, logs sell in Manila at P/30–70 mc. (—Rs. 3½–8 cft.). *Kamātog*. Wood moderately hard, moderately heavy, sap whitish but drying reddish-brown perishable sometimes distinct sometimes merging

gradually into the bright red heart, grain distinctly crossed in bands, texture rather coarse, in color and grain resembling Tindalō, but of somewhat softer coarser texture, easy to work; does not check much but liable to warp if not carefully seasoned; Durability III, heart rarely attacked by beetles; Uses, posts above stumps, beams, joists, rafters, floors, ceiling and sheathing, furniture and cabinetwork; Prices, P/90-125 mc. (=Rs. 8½-10½ cft.). *Kayagālu*. Wood hard, heavy, sap pinkish somewhat perishable distinct, heart yellow to pinkish-red and turning bronze, grain somewhat crossed, texture very fine dense and smooth, rather difficult to work; seasons slowly but with very little checking or warping; Durability II, very rarely attacked by beetles; Uses, formerly used for general construction for beams, joists, rafters, etc., and in bridge-wharf and ship-building, but now too highly valued for interior finish, furniture and cabinetwork, and especially flooring, also excellent wood for finely turned and shaped tool-handles, rulers, and other desk supplies; Prices, P/120 mc. (=Rs. 10 cft.). *Lamōg*. Wood moderately hard or hard, moderately heavy, sap whitish to pale greyish-brown distinct, heart deep reddish-brown (resembling Tuāi—see N. *12—but harder), grain fairly straight or somewhat crossed, texture fairly fine or (Tōog) coarse, fairly easy to work taking glossy surface under a sharp tool; liable to warp and check if not carefully seasoned, especially in large pieces; Durability II, even sap very rarely attacked by beetles; Uses, beams, joists, rafters, posts above stumps, flooring, interior finish, sheathing, ceiling, furniture and cabinetwork; Prices, sometimes fraudulently substituted for Bansalāgin and Bētis (see N. *31), usually with medium-grade Miscellaneous lots P/70-120 mc. (=Rs. 6-10 cft.). *Malabunōg*. Except for coloring, the woods of the different species of *Garcinia* are fairly uniform in general appearance and structure; Urung (see N. *26) resembles the Yellow *Garcinias*; wood hard, heavy to very heavy, sap very variable in thickness yellow, and some trees all yellow (Basān, Pīris, Taklānganāk—and Urung—see N. *26), sometimes merging gradually into (Binūkau, Gatāsan,—see N. *26) and sometimes sharply distinct from (Bunōg, see N. *30—Malabunōg, N. *21) the deep reddish-brown heart, grain straight, texture fine dense glossy, hard to saw but not otherwise difficult to work; seasons without warping but liable to split unless ends painted; Durability II at least, not attacked by beetles, the red varieties have especially

a good reputation for posts; Uses, poles, posts, ties, paving-blocks, beams, joists, rafters, flooring, piling; Prices, much used locally for house-construction, but rare in Manila market, and no fixed price. *Sibucāo*. Wood practically identical with Brazilwood, Braziletto, and Pernambuco-wood of South America; hard, very heavy, orange-red, fine and dense; Uses, treenails, canes, scabbards, small cabinetwork, inlaying. *Tangāl*. Wood very hard, very heavy, sap small indistinct, heart orange-red changing on exposure to reddish-brown, grain straight, texture very fine and dense taking a smooth almost polished surface under sharp tools, not difficult to work except for its hardness; (Note.—Gamble considers this merely hard, as against *Rhizophora* and *Bruguiera* very hard, see N. *34); seasons without checking badly but somewhat liable to warp; Uses, locally as beams and rafters (round) of small houses, posts, treenails, wedges, etc.; Prices, scarce and small, and so not often seen as sawn timber, but much the same as Bacāuan, i.e. P/100-120 mc. (=Rs. 8½-10 cft.). *Tanglīn*. Wood hard, heavy, sap yellowish or pinkish distinct, heart yellow in young trees and yellowish- or reddish-brown in old ones turning on exposure to rich chocolate-brown, grain straight or somewhat crossed, texture fairly fine glossy, general appearance much like Ipil (see N. *23); seasons well; Durability II, heart very rarely attacked by beetles; Uses, posts, beams, rafters, joists, flooring, inside finish, wheels and beds of bull-carts, good untreated and excellent treated ties and paving blocks; Prices, except as an attempted substitute for Ipil, rarely marketed. *Tindalō*. Wood hard, heavy, sap white perishable distinct, heart saffron or pale orange turning to a deep rich red sometimes with irregular blackish streaks, grain straight or slightly crossed, texture fine dense smooth taking a glossy cut under sharp tools, saws smoothly and not difficult to shape or surface; seasons well, perhaps less subject to checking and warping than any other wellknown Philippine cabinetwood; Durability II, rarely attacked even by termites, but not very durable in ground or exposed to teredo; Uses, one of the very finest cabinetwoods, all kinds of high-grade construction except posts set in the ground, interior finish, floors, doors, window-sills, windows, a favourite for stair treads and rails, musical instruments, tool handles, sawframes, etc.; Prices, P/170-240 mc. (=Rs. 14-20 cft.). **Uses of Madras Timbers recorded.** 25. (A first class wood, very dense, hard to cut and saw, warps in planking; not used).

26. (Takes a fine polish; not used). 27. (Durable, not attacked by insects, does not warp); scantlings of small buildings, agricultural implements especially ploughs, cart-building. 34. (Timber valuable, fissile); shingles. 150. (Durable and tough); buildings, well-curbs and Persian-wheels, oil-crushers, cabinetwork, agricultural implements, saddle-trees, bedstead legs, tent-pegs, sandals. 151. (Durable, easily worked); scantlings of small buildings, agricultural implements especially ploughs, cart-building. 170. (Sapwood copious, perishable and attacked by insects and blues rapidly, heart durable difficult to season planes smoothly and polishes well); cabinetwork very good, furniture, wheelspokes, oil-presses and rice-pounders, cattle-yokes, spear-shafts, scabbards. 196. (Very strong, very durable, cracks and splits when exposed); housebuilding especially posts, cart-building. 213. Housebuilding, cabinetwork. 216. Agricultural implements. 217. (Tough and very durable if water-seasoned); building especially rafters, ship and boat-building especially kneed timbers, railway sleepers, well-curbs, sugar-rice and oil-presses, naves, spokes and felloes of wheels, agricultural implements especially plough-shares, mallets, axe handles, tentpegs. 218. (Sapwood large perishable attacked by insects, heart durable strong tough, seasons well takes fine polish; not used). 271. (Sap large whitish, heart strong flexible, durable stands well under water, rather difficult to season, apt to split, but takes a fine polish); housebuilding, posts and planking, well-curbs, cart-framing, cabinetmaking and furniture resembling Mahogany, gunstocks, framing of sepoys' drums. 298. (Wood good and strong); small buildings. 315. (Wood esteemed, fibrous, but liable to split); buildings, beams (splits too much for planks), carpenters' planes, good for turning. 316. (Useful timber); door-panels. 333. Building. 338. Building, carriage-shafts, shoulder-poles.

Precis of Uses (deduced from above). Construction, carpentry (incl. posts, beams, rafters, joists), joinery (incl. flooring, ceiling, sheathing and wainscotting, door and window framing sills and panels, interior finish, posts and rails, stair treads, general planking, shingles); hydraulic works (incl. piles, well-curbs, water-wheels); wharf and bridge-building (incl. piles, poles, posts, sleepers and paving blocks treated and untreated); ship-building (incl. kneed timbers, treenails, wedges, boats and dugout canoes); wheelwrightery (incl. carriage bodies and shafts, beds of carts, cattle

yokes, naves, spokes and felloes of wheels); cabinetwork and furniture (high-grade incl. inlaying); sculpture, carving and fancyware (incl. wood-engraving, snuff-boxes, toys); turning (incl. handles of tools, such as axe, pick, hammers and chisels, fork-handles, plane-stocks and gunstocks, mallets, shuttles, spindles, bobbins, saddle-trees, ladder-rungs, tobacco-pipes, golf-club heads and shafts, walking sticks); machinery (incl. parts subject to friction, oil-crushers, sugar- and rice-presses); agricultural implements (incl. ploughs); household implements (incl. rice-pounders, shoulder-poles, sandals); musical instruments (incl. drum-frames); desk supplies (incl. mathematical instruments, such as T-squares, triangles, curves, etc., rulers and other articles); box-lumber (incl. basket-frames, scabbards); tent-pegs.

Localities and Vernaculars. 25. (NCCS-Agt: WFTS: NLGS: Svys.) *Ta.* Kōdali, Tarunai; *M.* Caralu; *K.* Jabbale, Doddajabbale, Atakkajabbale, Kokkara, Heccaralu. 26. (NCCS-Agt: WGTS: MPLT:) *Tl.* Talisapatramu, Kūragāyi; *Ta.* Caralu, Tālicam, Vayangārai; *M.* Tālisam, Kānci, Vāyakkattam, Caralanka; *K.* Tālisapatri, Cancali, Goraji, Kirinelli. 27. (Most districts, dtts.) *U.* Bonico, Potuābonico; *Tl.* Kānarēgu, Bontakānarēgu, Nakkanarēgu, Nakkanērēdu; *Ta.* Cottaikkalā, Maluk-kārai; *K.* Gajalu, Hettarimullu, Mullutari, Nāyibēla. 34. (TVY: TRV: com.) *Ta.* Madul; *M.* Pūra. 39. (WGTS: esp. NLGS:; MYS: scat.) *Ta.* Curabunnai, Curabunnāgam; *M.* Surampunna; *K.* Gād'havūnate, Ūnate, Punya, Punnāga, Suragi. 150. (Most districts, dtts.) *U.* Bodokōli, Kōli, Bodori; *Tl.* Rēgu; *Ta.* Ilandai; *M.* Lanta; *K.* Elaci, Bore. 151. (Most districts, dtts.) *U.* Goto; *Tl.* Gotti, Rēgotti; *Ta.* Kottai, Kottaiyilandai; *M.* Kotta, Cottukkotta; *K.* Gotte, Cottenmullu, Doddacotte, Kodaci. 170. (Most districts, com.) *U.* Mohi, Gongoromohi; *Tl.* Gumpena; *Ta.* Odi, Ānaikkārai; *M.* Kariyan, Ānakkariyan; *K.* Udi. 196. (WTCT: KAN: MBR: litt., sswp.), 197. (TVY: TRV:). 198. (KAN: MBR:). 199. (WFTS: MBR: TRV: NLGS: Anms., scat.) *Ta.* Irudbū, Nāyppudukkan, Mukkānci; *M.* Irippa; *K.* Kanaga. 209. (NCCS:) *Tl.* Āre, Godduyāre, Goddukūra. 213. (NCCS: rare, but cult.; MPLT: KAN: MBR: scat. or rare). *U.* Cokākāinco; *Tl.* Bandigurivenda, Ēnugaguruginji; *Ta.* Ānaikkunrimani, Mancāli; *M.* Cem, Mancāli; *K.* Mancatti, Manjāti. 216. (SAC-TVY:) *Ta.* Kudaivēl, Kudai, Udai; *K.* Odajāli. 217. (Most districts, abdt. on bctn.) *U.*

Bābulo; *Tl.* Nallatumma; *Ta.* Karuvēlam; *M.* Karuvēlakam; *K.* Karijāli. 218. (Most districts, open forests). *U.* Guāriā; *Tl.* Tellatumma; *Ta.* Velvēlam; *M.* Velvēlakam; *K.* Bilibēla, Nāyibēla, Toppalu. 271. (Most districts, open forests). *U.* Kumb'hi; *Tl.* Kumb'hi, Dudippa, Gādava, Buddabūrija; *Ta.* Āymā, Kalkumbi; *M.* Ālam, Pēlu, Pīlu; *K.* Ālagavvele, Gavvabannu, Gavvele, Doddāla, Daddal. 298. (KAN-TVY: MBLT:) *Tl.* Konkupuccu, Tellapuccu; *Ta.* Vellaittāl, Kadambam; *M.* Tuvāra, Pūvu; *K.* Bettadakammagaggara, Candukāra, Koyini, Nīrpare. 315. (NCCS-Agt: WFTS: esp. NLGS: Anms., Pnis.) *U.* Kontābohulo, Gudyā; *Tl.* Bejjuven; *Ta.* Mulmagil, Pālai; *K.* Hāle, Kumpāle, Hudugolla, Kalmaḍ'hu. 316. (MPLT: CDP: WFTS: NLGS: CRG-TRV: Anms.) *Tl.* Kondayippa, Peddayippa; *Ta.* Iluppai, Nāttiluppai; *M.* Irippa; *K.* Ippe, Sannayippe, Hūli. 333. (WGTS: KAN-TRV:) *Ta.* Tāli, Karundāli, Karungāli, Kākkāyttāli, Marā, Māy, Narai; *M.* Karu, Mishtumpi, Vayasi; *K.* Bāle, Kari, Mallali. 338. (Most districts, open forests, dtts.) *U.* Kendu; *Tl.* Tumiki, Tūki, Tunki, Mancitumiki, Nallatumiki, Pasarugāta; *Ta.* Tumbi, Karundumbi, Kari; *M.* Karu; *K.* Bāle, Bilāra, Tupare, Tumare. 340. (NCCS-Agt: WFTS: KAN-TRV: NLGS:). *U.* Koduāmoriyo; *Tl.* Tadār; *Ta.* Karikkattai; *M.* Kari; *K.* Kari.

IV.—MOSTLY HARD

A.—MOSTLY REDDISH

N. *22. Yews

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
48. <i>Gordonia obtusa</i> ...	42	533	3	3	1	3	III	PkW-DkRB.
82. <i>Grewia excelsa</i> ...	43	...	4	3	2	3	III	Y-OrB.
83. <i>Grewia salvifolia</i> ...	45	...	4	3	2	4	IV	Y-OrB.
84. <i>Grewia orbiculata</i> ...	45	...	5	3	2	2	III	Y-OrB.
85. <i>Grewia tiliaefolia</i> ...	45	631	4	3	2	2	III	Y-OrB.
147. <i>Pleurostylia Wightii</i> ...	51	608	5	3	3	2	IV	(M) YR-LtR.
149. <i>Elæodendron glaucum</i> (Evgn forest form) ...	51	572	5	3	3	2	III	PkW-LtRB.
353. <i>Schrebera swietenioides</i> ...	57	...	3	3	2	4	III	OlGy-PplB. ctr.
356. <i>Olea glandulifera</i> ...	56	...	3	3	1	4	III	PkW-RGy.
357. <i>Olea dioica</i> ...	49	581	3	3	1	3	III	BW-LtRB.
520. <i>Eriolæna Candollei</i> (incl. <i>Stocksii</i> , <i>Hookeriana</i> and <i>quinelocularis</i>) ...	52	1030	5	3	2	3	IV	YW-LtR-BrkR. often stk. Or.
685. <i>Woodfordia floribunda</i> ...	55	730	5	3	2	3	IV	RW.
707. <i>Ixora parviflora</i> (incl. <i>brachiata</i> , <i>polyantha</i> , <i>Notoniana</i> , <i>elongata</i> and <i>nigricans</i>) ...	57	717	5	3	2	2	III	LtRY-RB.
European Species.								
Yew ...	45	444	3	2	2	3	III	YW-OrR-RB.
Laburnum ...	47	...	5	3	2	4	V	YW-YB.mot. Bk&Gn.
Philippine Species.								
Lumbayao ...	42	633	...	...	...	...	...	RW-LtR-RB.

Lumbayao (*Tarrietia*=48, 82, 83, 84, 85).

Under 1 foot diameter:—**MADRAS.** 523. *Leptonychia moacurroides*. 526. *Grewia populifolia*. 527. *Grewia abutilifolia*. 554. 555. *Ochna squarrosa* and *Gamblei*. 557. *Gomphia angustifolia*. 560. *Cipadessa fruticosa*.

Strengths

Tensile Strength:—Yew=8.0; Laburnum=10.4.

Crushing Strength:—147. Pleurostyliā = 6.2; Lumbayao = 6.4.

Shearing Strength:—147. Pleurostyliā = 7.45; Lumbayao = 8.27.

Elasticity modulus:—(Yew, Laburnum, not available); 85. Grewia = 1577; 147. Pleurostyliā = 1475; Average taken for Category 1526; Lumbayao = 1570.

Compared with Oak 100:—Yew				Lumbayao	Grewia	Pleurostyliā	Category
Strength	...	...	...	71	102	102	109
Stiffness	...	...	...	?	92	92	89
Toughness	...	...	...	?	113	113	125

General Description. Mostly small to moderate sized trees; Wood all shades of red, from orange to dark red-brown, occasionally with an olive-brown tint in place of reddish; Hard, (147 = moderately hard), strong tough and fairly elastic, grain usually somewhat crossed making it difficult to split, texture usually fine sometimes somewhat open but taking a smooth glossy surface under sharp tools, easy to work; Seasons well but somewhat liable to split at ends if not painted, and to warp if not carefully stacked; Durability III, heart very rarely attacked by beetles; P = 675; Wt. 42-57, Av. 46; Rays generally f-f, (520 = m-f and white); Pores generally s, (82, 85, 356, 357, Laburnum = m; 147 = ss; Yew wanting); VC. = II.

Note on European Species. The Yew (*Taxus baccata*) occurs throughout Europe, North Africa, and from Asia Minor through Northern India to Japan as a large tree; the wood is yellowish-white orange to chestnut-red-brown, and is one of those called elastic, rather one of the toughest and most compact that exists; it is scented and resinous, but contains no resin-ducts; it is very durable, seasons well but very slowly, and works and polishes beautifully; it is also fissile; it is used for sculpture and carving, excellent for cabinetwork, turnery of all kinds, it is celebrated for making bows, and it is suitable for all purposes where elasticity and toughness are demanded, such as whip-handles, shoulderpoles, shafts, etc.; it forms most durable palings and fencing, and also flood-gates of mill-ponds and streams; stained black, it makes a good substitute for Ebony. The Laburnum (*Laburnum anagyroides*, or *Cytisus laburnum*) occurs as a small tree in the mountains of the East of France, South of Germany, and Switzerland; the wood is yellowish

white in the small sapwood and yellowish brown mottled with greenish and black tints in the heartwood; shining; it is hard, very tough and elastic, durable, works well and takes a fine polish; it is so small and uncommon that it can only be used for comparatively minor purposes; it is used for cabinetwork, and is much in demand for turning; stained black, it, also, makes a good substitute for Ebony.

Note on Philippine Species. *Lumbayao*. Very closely resembles the Australian Crow's-foot Elm (*Tarrietia argyrodendron*) and in color and texture the Columbian Mahogany (*Cariniana pyriformis*); wood moderately hard to hard, moderately heavy to heavy, flexible and tough, sap pale red merging gradually into a heart of reddish-brown or usually about the color of Cigar-box Cedar, grain somewhat crossed, texture somewhat open but taking a smooth glossy surface under sharp tools; seasons well except for being somewhat liable to split at ends; Durability III, heart very rarely attacked by beetles; Uses, flooring, doors, interior finish, furniture and cabinetwork, boat ribs and planking, excellent cooperage (slack), recommended for trial for steamed bent-work; Prices, P/65-100 mc. (= Rs. 5½-8¼ cft.).

Uses of Madras Timbers recorded. 48. (Very elastic, even and close grained, easy to work but warps if not well seasoned); building, beams, rafters, planks, doors. 82, 83, 84. Building, rafters, shoulder-poles. 85. (Elastic, fibrous, durable, contracts and expands in dry and wet, valuable where strength and elasticity are required, works easily); building, cart- and carriage-shafts, oars, masts, axe and tool handles, shoulder-poles, golf-clubs, walking-sticks, bows. 147. (A very pretty wood; combs. 149. (Tough, close and even grained, a pretty wood beautifully curled and flaked, durable, seasons well, but requires careful treatment as thin planks are liable to warp, works easily and takes fine polish); small buildings, cabinetwork, picture frames, combs, spear-handles. 353. (Very closegrained something like Box, elastic, durable, seasons well without warping or splitting, easy to work); Weavers' looms, turning, combs. 356. (Close, compact, durable and not attacked by insects, capable of taking a high polish); construction, carpentry, turnery, agricultural implements. 357. (An excellent strong valuable timber; not used). 520. (Tough and strong, often handsomely marked); cart-building, ploughs, gunstocks, paddles, rice-pounders. 707. (Does not readily split); building, furniture, turning, engraving.

Precis of Uses (*deduced from above*). Construction, small carpentry (incl. small beams, joists, rafters), joinery (incl. planking, flooring, doors, interior finish); hydraulic works (incl. flood-gates for streams and mill-ponds); ship-building (incl. small masts, oars, paddles, boat-ribs and planking); wheel-wrightery (incl. cart- and carriage-shafts); machinery (incl. weavers' looms); sculpture, carving and fancyware (incl. engraving, picture-frames, combs); cabinet-work and furniture (incl. steamed bent-work); cooperage (slack-barrels); turnery (incl. spear-handles and other shafts, whipstocks, axe and tool handles, golf-clubs, bows, shoulder-poles, walking-sticks); gunstocks, agricultural implements (incl. ploughs, fencing and palings); household implements (incl. rice-pounders, shoulder-poles); stained black, substitute for Ebony.

Localities and Vernaculars. 48. (WFTS: esp. NLGS: and Wnd). *Ta.* Miyilai; *M.* Alāngi, Ola; *K.* Nāgatti. 82. (NCCS: DKN:) *U.* Homolopoto, Kūlo; *Tl.* Cipuru, Mancicipuru, Ped-dacipuru. 83. (GTR: CNTC:) *U.* D'hātoki, Kūlo; *Tl.* Kondacipuru, Mancikōlupu, Nārabudama, Tavatike, Kāda; *Ta.* Cavatalunnu, Nārōduppai; *K.* Ūdippa. 84. (Most districts, dry tracts) *Tl.* Jāna, Nūlitada; *Ta.* Uduppai, Neyccitti, Valukkunnu; *K.* Jāne, Karijāne. 85. (Most districts) *U.* D'hāmono; *Tl.* Jāna, Tada, Inuputada, Erratada, Nūlitada; *Ta.* Cadacci, Unnu; *M.* Catacci; *K.* Tadacali, Tada, Buttele. Kanapadi. 147. (most districts, dtts., open forests) *Tl.* Kunticinta, Kāralli, Pāiri; *Ta.* Pāiri, Cirubāiri; 149. (As a small tree, most districts, dtts.; as a large tree, evergreen forests of the WFTS: NLGS: Anms.) *U.* Mok'hā, Pisitondoro; *Tl.* Nirija, Nerisi, Kanniru; *Ta.* Īrgōli, Kiri, Karukkuvā, Karuvāli, Kannirai; *M.* Kanuniruka; *K.* Kannira, Mukkarite. 353. (Most districts, dtts., scat.) *U.* G'hontiā, Nemibulā; *Tl.* Bullakāyi, Makkavēpa, Magalinga, Mukkidi; *Ta.* Magalingam; *K.* Gante, Maggante, Kalgante, Bulā. 356. (NCCS-Agt: WFTS: scat.) *Tl.* Lodājang; *K.* Kunde. 357. (WFTS: KAN-TRV: SLM:) *Ta.* Idalai, Manidalai, Paravanidalai; *M.* Etala, Valiyavetala, Karivetala; *K.* Edala, Mahōdale, Hakkāsarali, Sāranuke, Pārujambu, Naravele. 520. (Most districts, dtts., open forests) *U.* Pontuā, Bonohāndi; *Tl.* Botuku, Nārabotuku, Kutikibotuku; *Ta.* Uduppai, Cidaiyuduppai, Pēruduppai, Erumāmutti, Puliccevandī, Nāyunnu, Vattunnu; *M.* Vetinār; *K.* Dandiyāse, Kadegī, Gōmajjige, Kattale. 685. (NCCS: com.; most districts, scat., dtts.) *U.* D'hātuko, D'hā-

tubip'hulo, D'hobo, Horibādi, Pātālabeluri; *Tl.* D'hātaki, D'hātupushpika, Gaddapisiniki, Godāri, Jāji, Reyyamānu, Sirinji, Kerani; *Ta.* Velakkai; *M.* Tātiri; *K.* Are, Bēlā. 707. (Most districts, degn. or sholas) *U.* Kryā, Kilākryā, Telokryā; *Tl.* Korivi, Koringi, Korivipāla, Mabbukorivi, Puttapāla, Teddapāla; *Ta.* Culundu, Karunculundu, Kōrān, Korivi, Kalirumbilai, Paccaikkōrān, Vellaikkōrān, Macāgani, Ūdappū; *M.* Irumbarippi; *K.* Goravi, Hennugoravi, Kānsuragi, Suragi, Korice, Adayāla.

B.—MOSTLY YELLOWISH TO BROWNISH

N. * 23. Walnuts

NAMES	w.	P.	S.	D.	U.	V.	VC.	(H) and Col.
194. <i>Cassia siamea</i> ...	53	840	4	2	2	2	III	YW-DkB stk. Bk.
195. <i>Cassia timoriensis</i> ...	57	594	5	2	2	4	IV	YW-DkB stk. Bk.
222. <i>Albizzia lebbek</i> ...	49	819	4	2	1	3	III	YW-DkB stk. LtDk.
223. <i>Albizzia Thompsoni</i> ...	47	...	4	2	1	4	III	YW-DkB stk. LtDk.
224. <i>Albizzia odoratissima</i> ...	51	754	4	2	1	2	II	YW-DkB stk. Dk.
225. <i>Albizzia procera</i> ...	46	744	4	2	1	3	III	(M-H) YW-LkB stk. LtDk.
<i>European Species</i>								
Walnut ...	44	487	1	3	1	4	III	(M) GyB- mot. BkR.
<i>Imported Species.</i>								
American Black Walnut...	46	...	...	...	...	...	...	(M) DkB stk. Bk.
<i>Philippine Species.</i>								
Acle ...	46	409	...	...	...	...	...	YW-B-DkB.
Ipil ...	57	552	...	...	...	...	...	YW-GyY-LtOr-DkRstk. Bk.

Acle (incl. *Aclengpā-an*?, *Kariskīs*, *Kā-sai*, *Langil*, *Salingkūgi*) (*Albizzia* = 222, 223, 224, 225); *Cana-fistula* (*Cassia* = 194, 195); *Ipil* (*Intsia* = 194, 195).

Under 1 foot diameter:—**MADRAS**. 621. *Crotalaria laburni*. folia. 650. *Cassia glauca*. 651. *Bauhinia tomentosa*.

Strengths.

Tensile Strength:—Walnut = 7.8–8.8, Av. 8.2; Acle = 10.7; Ipil = 12.7.

Crushing Strength:—Walnut = 6.0–7.2, Av. 6.6; Black Walnut = 5.6; Acle = 5.1; Ipil = 6.5; 224. *Albizzia* = 9.4; Across the grain:—Black Walnut = 1500; Ipil = 1920.

Shearing Strength:—Acle = 686; Ipil = 948; 224. *Albizzia* = 1283.

Elasticity modulus:—Walnut = 837; Acle = 880; Ipil = 1383; 222. *Albizzia* = 1801; 224. *Albizzia* = 1736; Average taken for Category = 1768.

Compared with Oak 100:—	Walnut	Acle	Ipil	222. <i>Albizzia</i>	224. <i>Albizzia</i>	Category
Strength ...	78	66	89	132	121	121
Stiffness ...	49	52	81	105	102	103
Toughness ...	125	81	98	165	143	142

General Description. Mostly moderate sized trees; Wood mostly dark brown mottled with lighter or darker, sometimes black, streaks; Hard (Walnut and American Walnut = moderately hard; 225 = moderately hard to hard), grain straight crossed or curly, texture fairly fine, fairly easy to work; Seasons well; Durability II, sap perishable, otherwise practically never attacked by beetles; F = 750; Wt. 46–53, Av. 50; Rays f; Pores L–m; Soft tissue in continuous parallel concentric and wavy lines forming alternate layers of lighter softer and harder darker tissue; VC. = II. (See note in *32).

Note on European Species. The Walnut (*Juglans regia*) is said by some to occur from Asia Minor across Asia to the N.-W. Himalayas, others doubt its occurrence in the wild state over so extensive an area, but it is cultivated in Europe and largely in Persia, Baluchistan and Afghanistan; the wood is grey deepening to brown towards the centre, veined and flushed with black and red tints; it is moderately hard, fairly durable but does not bear exposure to the atmosphere or moisture; it is said to be too flexible for beams; it seasons well, shrinking very little, but does not work so easily as Mahogany; it is highly valued for cabinet work and furniture for wood-carving, inlaying and fancyware, it is also used for joinery, for carriage panels, for turning, for gunstocks (the principal wood used), and it is one of the most used veneers in cabinetmaking and high-grade furniture.

Note on Imported Species. The American Black Walnut (*Juglans nigra*) differs very slightly from the ordinary Walnut; it is slightly heavier, and blacker in tint, but otherwise it appears identical, and is used for precisely the same purposes.

Note on Philippine Species. *Aclē*. Except *Unik* (see N. *10), all the species of *Albizzia* have very similar wood in general appearance, varying somewhat in structure; hard, moderately heavy, sap large whitish perishable, heart light to dark Walnut-brown in bands, grain straight or crossed and curly, texture fairly fine, fairly easy to work; seasons well; Durability I, except perishable sap practically never attacked by beetles; Uses, ties, sills, general construction, all classes of high-grade interior finish, furniture and

cabinetwork; Prices, P/160-250 mc. (=Rs. 13½-21 cft). *Cana-fistula*. Wood moderately hard to hard, moderately heavy to heavy, sap whitish drying light brown perishable distinct, heart bright yellow when fresh turning yellowish-brown to dark brown, grain generally distinctly crossed, texture looking coarse but dense and taking a smooth surface under sharp tools, fairly easy to work; seasons well; Durability II, sap perishable but heart rarely attacked by beetles; Uses, posts, ties, beams, joists, rafters, flooring, interior finish, dugout canoes, furniture and cabinetwork; Prices, scarce and not marketed, but well and favourably known wherever it occurs. *Īpil*. Tanglin (see N. *21) is sometimes sold for Īpil, which it resembles in general appearance, but it has a pink sap and a different structure, and is not so durable; wood hard to very hard, heavy to very heavy, sap whitish distinct, heart yellowish when fresh to deep brown on exposure with black spots from exuding oil, grain straight or somewhat crossed, texture fine dense taking a glossy cut under sharp tools, hard to saw but not difficult to surface; does not warp much, but in large sizes is liable to check badly if not properly seasoned; Durability I, except as regards teredo; Uses, all high-class general construction, posts, beams, joists, rafters, electric poles, sills, ties, paving blocks, ship-wharf- and- bridge- construction except salt-water piling, furniture and cabinetwork, hubs, spokes, tongues and cart-beds, necks and heads of musical instruments, tool handles, harrow-teeth and other parts of agricultural implements; Prices, P/150 200 mc. (=Rs. 12½-16½ cft).

Uses of Madras Timbers recorded. 194. (Yellowish brown beautifully mottled with black, durable, works easily with smooth surface and takes fine polish); furniture, inlaying, mallets, tool handles, walking sticks. 195. (Wood identical with last in colouring and structure); building, furniture. 222. (Tough, sapwood large not durable, not liable to warp and crack, seasons well, works freely, takes fine polish); building especially houseposts, boat-building, furniture, well curbs, sugar- and oil- mills, pestles and mortars, wheelwork especially naves and spokes, fancyware, picture frames. 223. (Hitherto confused with the other species). 224, 225. (Structure and uses similar to 222; sapwood is the largest in 225, which is also the least hard of the four, then comes 222, then 223, and 224 is the hardest of the four.)

Precis of Uses (deduced from above). Construction (all high-grade); carpentry (incl. foundation sills, piles, poles, posts, beams,

joists, rafters), joinery (planking, flooring, posts and rails, all high-grade interior finish); bridge- and wharf- building (incl. foundation sills, piles except saltwater, all high-grade woodwork, sleepers and paving blocks); hydraulic works (incl. piles, foundation sills, well curbs); ship-building (incl. planking, ribs, cabin-finish, and other parts, dugout canoes); cabinetwork and furniture (high-grade and veneer); sculpture, carving and fancyware (incl. inlaying, picture frames); wheelwrightery (incl. hubs and naves, spokes, tongues and cartbeds, carriage panelling); turning (incl. mallets and similar tools, tool handles, walking sticks); musical instruments (heads and necks); agricultural implements (incl. harrow-teeth and other parts); household implements (incl. pestles and mortars); factory machinery (incl. sugar- and oil- mills).

Localities and Vernaculars. 194. (MRA: TVY: but much planted and run wild so that it has become common in many districts) U. Simokāsundiri; TL. Simatangēdu; Ta. Cīmaiāvirai, Konrai, Karungonrai, Mancadgonrai, Pirambukkonrai; M. Mannakkonna; K. Hiretangedi, Simatangedi. 195. (WFTS: esp. NLGS: scat.) (no names known). 222. (Most districts, dtts., cult. and much rwd.) TL. Dirisanamu; Ta. Vāgai, Perumvāgai, Adukkavāgai, Kāttuvāgai; M. Vāka, Kāttuvāka; K. Bāge, Doddabāge, Hombāge, Sirisa, Doddasirisa. 223. (GJM: CDP: and elsewhere scat.), 224. (Most districts com.) U. Sirisi, Bonosirisi; TL. Cinduga, Bandicinduga, Telasu; Ta. Vāgai, Karuvāgai, Cilaiyuncal, Kaḷit-turincil; M. Vāka, Karuvāka, Pulivāka, Karintakara, Kunni; K. Kādubāge, Ēnubāge, Bettasujjalū, Bilivara. 225. (Most districts, scat., mostly rvrs. or mts.) TL. Dirisanamu, Kondadirisanamu, Telladirisanamu, Ganaru, Tellacinduga; Ta. Vāgai, Nallavāgai, Velvāgai, Cālaiyuncil; M. Vāka, Kutamvāka, Vellavāka, Cālavāka; K. Bāge, Sālabāge, Sālayudi, Belatu, Cikul.

IV.—MOSTLY HARD

B.—MOSTLY YELLOWISH OR BROWNISH

N. *24 Sals

Names	W.	P.	S.	D.	U.	A.	VC	(H) and Col.
51. <i>Vatica Roxburghiana</i> ... 60	762	1	1	1	3	I		YW-Y-expo. DkYB-RYB.
52. <i>Shorea talura</i> ... 56	896	4	2	1	3	III		YWY YB-GyB.
53. <i>Shorea robusta</i> ... 55	814	2	3	1	3	II		YWLtB-expo. DkB-RB
54. <i>Shorea tumbagaia</i> ... 67	892	2	3	1	3	II		(VH) YW-LtB-expo. DkB-RB.
55. <i>Hopea parviflora</i> (incl. <i>glabra</i> and <i>racopiloea</i>) ... 65	829	1	1	1	3	I		YW-Y-expo. DkYB.
56. <i>Hopea Wightiana</i> ... 54	...	1	2	1	3	II		YW-YGy-expo. LtB.
European Species								
Larch (of the Mountains) ... 38	608	4	2	1	3	III		(M-H) PkW-Pk-R.
Scotch Fir { Scandinavia- 35	661	4	3	1	1	II		(M-H) PkW-RB.
or Red Deal { Baltic. ... 34	578	2	2	1	1	I		(M H) PkW-Lk-R.
Corsican, (Austrian) Pine ... 44	...	1	2	2	2	II		PkW-PkR-RB.
Muntine, (Star or Cluster) Pine ... 40	...	2	2	1	3	II		PkW-LtR-DkRB.
Stone, (Italian) Pine ... 41	...	1	2	1	2	I		PkW-LtR-DkRB.
Imported Species								
Hackmatack, American Larch ... 44	628	...	...	...	...	...		(M-H) PkW-R-RB.
Pitch Pine ... 41	495	...	...	...	...	...		PkW-R-RB.
Philippine Species								
Guijo ... 54	842	...	...	...	...	...		LtGyB-LtB-B-RYB.
Mangachapuy ... 48	788	...	...	...	...	...		GyY-B.
Yacal ... 62	872	...	...	...	...	...		YW YB-DkYB.

Dalingdinganisak (incl. Mangachapuy) (*Hopea* 52, 56); Gisok (incl. Gisokgisok, Nārig, Yacal) (*Shorea*, *Hopea*, *Vatica* and *Hopea*—51, 55); Guijo (*Shorea*—53, 54).

Under 1 foot diameter:—(None).

Strengths.

Tensile Strength:—Larch of the Mountains=3.0; Red Deal, Baltic=9.5, Scandinavian=10.0–14.3, Av. 12.2; Pitch Pine=7.3–10.3, Av. 8.8; Yacal=16.7; Mangachapuy=20.6; 53. *Shorea* (Sal)=11.5.

Crushing Strength:—Larch of the Mountains=5.5; Red Deal Baltic=5.4; Pitch Pine=7.0; Guijo=7.9; Mangachapuy=7.7; Yacal=9.2; 53. Sal=8.5; 51. *Vatica*=5.9. Across the grain:—Guijo=1250; Yacal=2275.

Shearing Strength:—Guijo=900–915; Yacal=2275.

Elasticity modulus:—Larch of the Mountains=1363; Red Deal, Baltic=1942, Scandinavian=1516–1687, Av. 1602; Pitch Pine=1240; Guijo=2158; Mangachapuy=1755; Yacal=2583; 51. *Vatica*=1871; 53. Sal=1080–2564, Av. (3 expts) 1930; Average taken for Category=2049.

Compared with Oak 100:—	Larch	Red Deal	Pitch	Yacal	Vat-	Sal	Cate-
		Bltc. Scnd.	Pine		ica		gory
Strength ...	98	93	107	80	140	121	131
Stiffness ...	80	114	94	73	142	109	112
Toughness ...	120	76	122	88	131	134	153

General Description. Mostly large resinous trees; Wood mostly yellowish-brown, light or dark, sometimes with a red tinge especially in young trees, sap usually distinct and inferior; Hard, (54=very hard; Larch and Red Deal moderately hard to hard), grain straight or much crossed, texture fine to very fine, resin ducts present often arranged in conspicuous narrow concentric lines which give the appearance of growth rings but the latter are seldom distinct except in the first years of growth, (in the European and imported Conifers the resin ducts are irregularly distributed and vertical in the wood cells but horizontal in the rays), easy or difficult to work or to surface; Seasons sometimes well, sometimes drying very slowly and liable to warp if not very carefully stacked, and even at times to split if due precautions are not taken; Durability I–III, heart not attacked by beetles, but none proof from teredo; P=812; Wt. 54–67, Av. 60; Rays m-f; Pores m-s, (53, 54=L-m; in Conifers wanting); VC.—I.

Note on European Species. The description of the Scotch Fir or Red Deal (*Pinus sylvestris*) and Larch (*Larix europaea*) has been given in N.*9. (Red Deals); it remains merely to give the uses thereof, both being employed in the same manner, the best Red Deal

being considered one of the most valuable for the uses indicated, but the best Mountain Larch being considered superior even to that : Baltic Deal and Larch for high-grade construction of all descriptions, piles, poles, posts, beams, joists, rafters ; for bridge and wharf construction ; for hydraulic works (incl. piles, foundation sills, mining timbers and shores, conduit-pipes) ; railway sleepers and paving blocks ; telegraph poles ; the most esteemed of all for masts and spars : Scandinavian Deal and Larch for high-grade joinery (incl. planking, flooring, wainscoting, ceiling, interior finish, shingles) ; high-grade cabinetwork and furniture ; decking side-planking and framing for ships ; staves for casks. The Corsican, or Austrian, Pine (*Pinus laricio*) occurs throughout the south of Europe from Spain to, and into, Asia Minor, including the islands of the Mediterranean ; it has a large whitish sapwood and a rosy-red to red-brown heart, with numerous resin ducts filled with turpentine, that often make the wood translucent like horn ; the wood is hard but brittle from excessive resin, durable but wanting in elasticity ; it shrinks in drying, and is very difficult to work ; it is more used for hydraulic works (piles, poles, posts, foundation sills, mine timbers, well-work) and earth-work (especially sleepers) than for carpentry and joinery ; it serves for side-plates and planking in arsenals. The Maritime Pine, also called the Star-Pine or Cluster Pine, (*Pinus maritima*, or *Pinus pinaster*) occurs in the Mediterranean region of Europe and North Africa, and has been extensively planted in the 'Landes' on the west coast of France ; it has a whitish sapwood and a light red to red-brown heart with numerous large longitudinal resin ducts ; it is hard and durable, and, contrary to the effect on most Pines, is more durable if tapped for resin ; it is used for secondary purposes in naval construction, carpentry, sleepers, telegraph poles, piles, vine-props, tops and bottoms of double casks, slats for packing cases. The Stone Pine, or Italian Pine (*Pinus pinea*) also occurs throughout the Mediterranean region from Portugal to, and into, Asia Minor ; the wood resembles, and is very difficult to distinguish from, that of the Maritime Pine, but the resin ducts are less numerous and it is less resinous ; it is used for first class carpentry, excellent joinery and for masts and side-planking in ship-building.

Note on Imported Species. The Hackmatack, Tamarack, or American Larch (*Larix americana*) is, to all intents, identical with the European Larch, except that it is rather heavier and stronger

and very durable ; it grows in Canada and the Northern states of America in swamps. The Pitch Pine (*Pinus rigida*) also comes from Canada and America, being most abundant along the Atlantic coast ; the colour is redder than the Scotch Pine ; it is heavy, elastic and durable becoming, however, brittle when old or very dry ; the wood feels sticky, and it is difficult to plane ; it has sometimes been used for the masts of small vessels, but is not much used in commerce.

Note on Philippine Species. *Guijo*. Closely allied to, and in general appearance and structure extremely similar to, the Indian Sal (*Shorea robusta*) ; all elements are smaller and more sharply defined, and the cross-section has generally a cleaner look and takes a glossier finish, than in the Apitongs (see N.*9) ; it is generally redder than, more cross-grained and more difficult to shape and finish than, the Mangachapūys, and it is redder than, and not so durable as, the Yacāls ; but whilst these are general characteristics, it is difficult to draw a hard and fast line between them, for instance, *Hopea Foxworthyi*—classified as a Mangachapūy—is probably heavier than any material heretofore tested ; wood moderately hard to hard, moderately heavy to heavy, tough and difficult to split, sap small greyish-brown indistinct, heart ashy-brown to brown sometimes reddish-tinged, grain distinctly crossed, texture fine, not hard to saw but rather difficult to shape and surface ; dries slowly and is very liable to split and warp if not seasoned carefully ; Durability III ; Uses, posts above stumps, beams, joists, rafters, flooring, windows, doors, siding, sheathing, ceiling ; ships' keels, planking, decking, etc. ; bridge and wharf construction except saltwater piles ; furniture ; vehicle parts such as cart and wagon beds, and probably the most widely used wood in the Islands for this purpose, carriage floors, backs and dashboards, hubs, spokes, felloes, poles, shafts, reaches, hounds, etc. ; recommended for treated ties and paving blocks ; Prices, P/45-100 mc. (—Rs. 3½-8½ cft.). *Mangachapūy and Dalingdinganisāk*. Very similar to the Yacāls, but straighter grained, not so hard nor durable nor so dark coloured when fresh ; also very closely similar to Guijo, but straighter grained and a clearer brown and not reddish ; also resembling the Palosāpis (see N.*9), but harder heavier browner more durable and finer textured with straighter grain ; wood hard, heavy to very heavy (*H. Foxworthyi* probably heavier than any material heretofore tested), sap distinct lighter—both fresh and seasoned—than the heart, which is

pale straw rapidly turning clear brown and often with dark streaks, grain straight or only slightly crossed, texture fine to very fine, easy to work ; seasons well neither checking nor warping much ; Durability III at least ; Uses, posts, beams, joists, rafters, flooring, ceiling, sheathing ; doors, moldings ; masts and spars, ship planking and decking ; pestle shafts in rice-mills ; carriage panels ; furniture, cabinetwork ; carpenters' sawframes, broom rake and hoe handles ; Prices, P/60—150 mc. (=Rs. 5-22½ cft.). *Yacāl, Gīsoḥ, etc.* *Yacāl* includes, as a commercial name, the several species of *Shorea* and of *Vatica* which furnish almost identical woods with that group of *Hopeas* that passes under that name ; more durable and less red than *Guījo*, and more durable and more crossgrained than *Manga-chapūy* ; wood hard to very hard, tough but very stiff, heavy, sap pale yellow staining to a dirty grey distinct, heart pale yellow to yellowish brown rapidly darkening and often with blackish streaks, grain generally sharply crossed making radial splitting difficult, texture fine and dense, translucent like yellow horn, difficult to work but saws with a very clean surface ; does not check badly but liable to warp if not seasoned carefully ; Durability I except for teredo ; Uses, all high grade construction except saltwater piling ; posts, beams, joists, rafters ; bridges and wharfs ; ship framing and decks ; vehicle hubs, spokes, felloes, axles, poles and trees ; flooring ; ax peavy canthook handles, capstan bars, levers of all kinds, tool handles ; cabinetwork ; railway ties and paving blocks ; Prices, P/60-120 mc. (=Rs. 5-10 cft.).

Uses of Madras Timbers recorded. 51. (A first rate wood though little known) ; the best wood for underground purposes. 52. (Wood resembles that of *Hopea* rather than that of *Sal* or *Thamba*) : housebuilding, doors, panels. 53. (Wood strong and tough, cross-grained with the fibres appearing interlaced, superior to *Teak* in transverse strength, durable but not so as *Teak*, lasts an immense time underground and under water, sapwood not durable, difficult to season, requires to dry very slowly and after seasoning is apt to split and warp with change of dry and wet, warps in plank, not easily worked) ; engineering construction, gun-carriage manufacture, housebuilding (beams, door and window-posts), almost unequalled for sleepers, shipbuilding and river boats, bodies of carts, agricultural implements especially ploughshares. 54. (Harder than *Sal*, but similar in structure and much smoother) ; housebuilding, posts, rafters, door-frames, plough-handles. 55. (For construction superior

to and more durable than *Teak*) ; house- and bridge- building, beams and rafters, sleepers, gun-carriage building, dugouts. 56. (A valuable timber, said to be the best of the timbers in Tinnevely ; no uses given).

Precis of Uses (deduced from above). Construction of all kinds (high-grade, except saltwater piling) ; Carpentry (piles, poles, posts, beams, joists, rafters), joinery (incl. planking, flooring, ceiling, sheathing and wainscoting, siding, door and window sills and panelling, moulding, all interior finish) ; bridge- and wharf- building (incl. foundation sills and all parts except saltwater piling, shores, telegraph poles, sleepers and paving blocks) ; shipbuilding (incl. masts and spars, keels, framing, decking and side-planking) ; hydraulic works (incl. conduits, well-work, foundation sills, piles, mining timbers) ; wheelwrightery (incl. cart- and wagon- beds, carriage floors, backs, dashboards panels, hubs, spokes, felloes, axles, poles, shafts, trees, reaches, hounds ; gun-carriage building) ; cooperage (incl. cask staves, tops and bottoms) ; cabinetwork and furniture ; factory machinery (incl. pestle-shafts of oil-mills) ; turning (incl. broom rake and hoe handles, axe peavy, canthook and all tool handles, capstan bars, all kinds of levers, carpenters' sawframes).

Localities and Vernaculars. 51. (WGTS : KAN-TRV) *Ta.* Tūbam ; *M.* Atakkappayan, Ceruppayan, Kalluppayan, Vellippayan ; *K.* Dūpa, Gugguladūpa, Uguludūpa. 52. (CDP : NAC : SAC : SLM : CBT ; MRA) : *Tl.* Jālāri, Jāri ; *Ta.* Cālāri, Tālāri, Tālūrai ; *M.* Jāla ; *K.* Jāla, Jālaranda. 53. (NCCS : GJM : VZM-Agt : and Palkonda) *U.* Sāluā, Sodingi (only young trees) ; *Tl.* Sāluvā, Guggilamu. 54. (CDP : NAC) : *Tl.* Tamba ; *Ta.* Tanbai, Tanbugai, Karudanbai. 55. (WGTS : KAN-TVY : rvrs : mts) : *Ta.* Irumbagam, Kōngu, Vellaikkōngu, Karaikkōngu, Karūngōngu, Neduvārgōngu ; *M.* Urippu, Irimpakam, Kampakam, Pōngu, Ilappōngu, Kolalu, Nākkampakam, Netuvālpōnku ; *K.* Bōvu, Bōvige, Kiralabōvige, Tirupu, Niragālu, Malehegge. 56. (WGTS : KAN-TVY : mts) *Ta.* Kōngu ; *M.* Vellurippu, Ilappōngu ; *K.* Kalbōvu, Hiri-bōvige, Bilibōvu, Hegge, Unni, Kar.

IV.—MOSTLY HARD
B.—MOSTLY YELLOWISH OR BROWNISH
N. *25 Elms

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
242. <i>Anogeissus acuminata</i> .	...	880	2	3	2	3	III	(M) YGy.
244. <i>Eugenia Munronii</i> ...	41	...	4	2	2	3	III	B.
244. (bis). <i>Eugenia mundagam</i> .	...	675	4	2	2	3	III	GyB-PkR.
245. <i>Eugenia aquea</i> ...	...	...	5	2	2	4	IV	B.
246. <i>Eugenia Beddomei</i> ...	...	...	4	2	2	4	III	B.
247. <i>Eugenia hemispherica</i> ...	...	...	2	2	1	3	II	B.
248. <i>Eugenia cylindrica</i> ...	...	...	4	2	2	4	III	B.
250. <i>Eugenia Arnottiana</i> .	56	594	2	2	1	3	II	YB-OrB.
251. <i>Eugenia Wightiana</i> .	...	...	4	2	2	3	III	B.
252. <i>Eugenia zeylanica</i> ...	...	...	5	2	2	3	III	B.
253. <i>Eugenia montana</i> ...	44	489	4	2	2	3	III	(M) LtB pch.Y
255. <i>Eugenia corymbosa</i> (caryophyllaea).	49	...	5	2	2	3	III	LtB.
256. <i>Eugenia utilis</i> ...	...	...	3	2	1	4	III	RB.
257. <i>Eugenia revoluta</i> ...	...	...	4	2	2	4	III	B.
258. <i>Eugenia myhendrae</i> .	...	...	4	3	2	4	III	B.
259. <i>Eugenia Neesiana</i> ...	...	...	4	2	2	4	III	B.
260. <i>Eugenia calophyllifolia</i> .	45	...	4	2	2	4	III	RB.
261. <i>Eugenia rubicunda</i> .	39	...	4	2	2	3	III	(M) RB.
262. <i>Eugenia malabarica</i> .	...	...	4	2	2	3	III	B.
263. <i>Eugenia alternifolia</i> .	58	...	3	2	1	3	II	DkRB.
264. <i>Eugenia operculata</i> .	47	...	2	2	1	3	II	B-RGy.
265. <i>Eugenia Stocksii</i> ...	...	...	3	2	1	4	III	B.
266. <i>Eugenia jambolana</i> .	47	585	3	2	1	2	II	(M-H) RGy-RB.
267. <i>Eugenia floccosa</i> ...	...	...	4	2	2	3	III	B.
442. <i>Holoptelea integrifolia</i> .	40	...	3	3	2	3	III	(M) LtYGy.
444. (bis). <i>Gironniera reticulata</i> .	50	...	4	2	2	4	III	(H-VH) RB.
European Species.								
Elm	46	509	1	2	1	2	I	YW-OrB-RB.
Wych Elm	48	480	1	4	2	2	II	(M) YW-LtB-B.
Imported Species.								
American White Elm	35	650	...	...	...	...	...	YW-OrB-RB.
Canada Rock Elm	45	800	...	...	...	...	...	YW-OrB-RB.
American Slippery Elm	...	...	...	...	...	...	...	B-DkRB.
American Cork Elm	...	...	...	...	...	...	...	YW-B.
Australian Blue Gum	60	725	...	...	...	...	...	YB-LtRB.
Do. as grown on the Nilgiris.	47	534	...	...	...	...	...	Gy-B.
Australian Jarrah	63	500	...	...	...	...	...	DkR-RB.
Australian Stringy Bark	48	467	...	...	...	...	...	Gy-LtR.
Philippine Species								
Macaasim	55	613	...	...	...	...	...	GyB.

Bayābas, or Guava (*Psidium* — cult.); Binolōan (incl. Duhāt, Kalubkūb, Kurāsām, Macaāsīm, Malarūhat, Malatampūi, Manangkil, Mariīg, Paitān, Panglongböien, Sagirnsīm) (*Eugenia* — 244 to 267 above.)

Under 1 foot diameter:—**Madras**. 679. *Eugenia Heyneana*. 680. *Eugenia jossinia*. 681. *Eugenia codyensis* and *calcadensis*. 682. *Eugenia Rottleriana*.

European. Myrtle (*Myrtus communis*).

Strengths.

Tensile Strength:—Elm. — 9.7–14.0, Av. 11.8; Macaasim — 11.4.

Crushing Strength:—Elm — 10.3; Blue Gum — 6.7; Stringy Bark — 6.7; Jarrah — 7.0; Macaasim — 6.9.

Shearing Strength:—Macaasim — 916.

Elasticity modulus:—Elm=816–1657, Av. 1334; Wych Elm — 1235; Jarrah — 1157; Stringy Bark — 1769; Macaasim — 1825 (taken for Category).

Compared with Oak 100:—

	Elm	Wych Elm	Jarrah	Str. Bk.	Macaasim	Category
Strength ...	82	77	80	75	99	101
Stiffness ...	78	72	68	103	106	106
Toughness ...	86	82	94	55	93	96

General Description. Mostly large to moderate sized trees; Wood mostly of a rather light brown or reddish-brown sometimes with a yellowish or greenish tinge; Hard (242, 253, 261, 442 and Wych Elm moderately hard), grain crossed often wavy, texture fine and even but dull, not difficult to work but dulls tools rather quickly and often blackens them; Rather difficult to season; Durability II (242, 442. — III; Wych Elm — IV), even sap rarely attacked by beetles; P = 639; Wt. 39–50, Av. 47; Rays f–ff (250 = m and f); Pores m–s, (261 = L–m); VC. — II. *Note.* Except 242, 442 and 444 (bis), imbued with an aromatic essential oil.

Note on European Species. The Elm (*Ulmus campestris*) occurs as a large tree in Central and Southern Europe and from Syria through North Asia to North China, and has been planted and run wild in Great Britain; the wood is yellowish-white in the sapwood and orange to red-brown in the heart; the sap is perishable but the heart is tough and elastic, non-fissile, durable especially in damp

places, such as caves, galleries, mines; it is slow to dry and is apt to shrink, warp and crack; it is excellent for piles, planking for wet foundations, well-work and mine timbers, waterworks, pumps and water-conduits; it is also used for naves and felloes of wheels and for gun-carriage building, in the construction of machinery, for the keels and gunwales of ships, in turnery, for the shells of tackle-blocks, and for coffins. The Wych Elm (*Ulmus montana*) occurs in Northern Europe, and to some extent in Central Europe, also in North-Eastern Asia and Japan but not in Siberia; the wood is much lighter coloured than the Elm, generally of a light brown without the reddish tinge, and is usually considered much inferior in quality and durability, but in the Harz mountains of Germany it fetches a higher price than Oak; it is, where used, employed in the same way as the common Elm. The Myrtle (*Myrtus communis*) is a shrub of the Mediterranean region, with a greyish-pink wood, like Pear, used for fancywork, inlaying, and turning.

Note 0.1 Imported Species. The White Elm or Common American Elm is in America considered just as good as the European Elm, very tough, strong and flexible, but in Europe it is not considered so good as the European species; it is much used for hoops, carriage- and wagon- making, cheese-boxes, and bent-work generally, and is considered excellent in carpentry, but apt to shrink and warp when sawn into boards: the Rock Elm is only a variety of the American Elm (*Ulmus americana*), and is particularly prized for hubs of wheels, for which purpose the trees are cut in winter, the logs arranged in cross-piles for two months, then cut into blocks the ends of which are dipped into melted lard and rosin to prevent them from cracking, and then left under shelter till dry. The Slippery or Red Elm (*Ulmus fulva*) is also considered durable in America, but inferior in Europe; and the Cork Elm (*Ulmus racemosa*) is 'harder, stronger and more durable than the preceding species' in America, whilst in Europe it is described as a 'timber very liable to shrink, and soon becomes shaky when exposed to sun and wind; when kept in a dry confined place, it will sometimes become so perished as to resemble cork'; it is, however, used in the Royal Dockyards of England as a substitute for White Oak for boat-building for which it is well adapted. The Australian Blue Gum (*Eucalyptus globulus*) has a yellow or light reddish wood, hard and compact, but difficult to work, and liable to shrink split and warp considerably in seasoning; it is used for carpenters' work

generally, for the spokes of wheels, etc.; the wood grown in the Nilgiris is not nearly so good as that grown in Australia. The Jarrah, or Australian Mahogany (*Eucalyptus marginata*) is darker in colour than the Blue Gum, and approaches that of Mahogany; it is hard, heavy, close in texture, and very durable in both salt and fresh water, and resists the attack of both sea-worms and white ants; it is used especially for ship-building, jetties (employed in the whaling jetty at Freemantle, it was found as sound after sixteen years as when first used), for telegraph posts, railway sleepers, and almost every purpose where a strong wood is required. The Stringy Bark (*Eucalyptus obliqua* and others) has a pale brown wood, hard, heavy, strong, close and straight in grain; it shrinks considerably in, and is difficult to work after, drying, (as is the case with most species of the genus), it should therefore be cut up, and even planed, as far as practicable, while green, which is frequently performed where the tree is felled; in this way it works up well for the various purposes to which it is applied, such as beams, joists, planking and flooring.

Note 0.1 Philippine Species. *Binolōan, Macaāsīm, etc.* Although there is considerable variation of colour and texture, the woods of the larger species found in the markets are fairly uniform in general appearance and structure, and known under the names of Macaāsīm and Malarūhat; wood moderately hard to hard, moderately heavy to heavy, sap greyish or pale brown fairly distinct, heart generally greyish brown often with reddish, yellowish or greenish tinge, acid-smelling and blackening tools, grain crossed and often wavy, texture fine even but dull, not difficult to work but dulls tools rather rapidly; rather difficult to season; Durability II, even sap rarely attacked by beetles: Uses, ship- bridge- and wharf- building, piles, posts, ties, beams, joists, rafters, studs, flooring, window-sills, doors, siding, furniture, cabinetwork, agricultural implements, tool handles, rice-mortars and other household implements, musical instruments (heavy parts, such as harpbases, guitar-necks); Prices, good boards, and dimension stuff bring P/120-160 mc. (—Rs. 10-13½ c.ft.). *Bayābas, or Guava.* Wood hard and tough, heavy (52 lbs.) sap pale brown merging gradually into the darker heart, grain straight or slightly crossed sometimes wavy, texture very fine and smooth, fairly easy to work taking a very smooth surface under sharp tools; liable to warp in seasoning; Durability III; Uses, household and agricultural implements, ax and other tool handles,

treenails, pestles, piston-rings for water cylinders of small feed pumps, posts of small houses, fence-posts and stakes, yokes, boot-lasts; Prices, not marketed as saw timber.

Uses of Madras Timbers recorded. 242. (Strong and durable except will not stand alternations of wet and dry, cracks and warps—or not, according to Beddome—in seasoning, hard to work but gives smooth surface and takes fine polish); Building, interior work. 244 to 267. (Although it is more or less generally recognized that the wood of this genus is, as recorded for the Philippines, fairly uniform, practically nothing is recorded except what follows). 250, 254, 260, 263. (Wood excellent); building; 253. (Timber good); building, planking; 264. (Not so good as 266, but useful); building, agricultural implements; 266. (A good timber, durable, especially underground—sleepers laid and taken up five years later found untouched by white ants, and in fairly good condition,—and resists the action of water well; it must be recognized that this is the most wide-spread species, and therefore its qualities most understood); buildings, posts, beams, rafters, sleepers, agricultural implements, rice-mortars, carts, well-work (almost indestructible for curbs and steps), boats and canoes. 442. (Strong, coarsely fibrous but close-grained, durability uncertain, sap attacked by beetles, takes fine polish); building, carving, good material for carts. 444 (*bis*). (Hard, heavy, valuable for engineering); housebuilding, rafters, planks.

Precis of Uses (deduced from above). (Excellent under water, good below ground, requires working up green and very careful seasoning for scantlings, boards and planking, and uses above ground to prevent warping, and, if these precautions are taken, a very good timber); construction; carpentry (incl. piles, poles, posts, beams, rafters, joists, studs), joinery (planking, flooring, siding, doors, window-sills); hydraulic works (incl. piles for salt and fresh-water, wet foundations, well work, mine timbers, waterworks, pumps and water cylinders, conduits and pipes); shipbuilding (incl. keels and gunwales, boats and canoes); bridge and wharf building (incl. piles for salt and fresh water, beams and other parts, telegraph posts, sleepers and paving blocks); wheelwrightery (incl. hubs and naves, spokes and felloes, gun-carriage building, cart beds and other parts); machinery (incl. bedplates, parts underground and under water or requiring tough wood); furniture and cabinetwork; agricultural implements; household implements (incl. rice-mortars and pestles and other utensils); turnery (incl. tackle-block-shells,

tool handles); musical instruments (incl. heavy parts such as harp bases, guitar necks, etc.); box lumber (coffins).

Localities and Vernaculars. 242. (NCCS : GJM : GDV :) *U.* Pānsi; *Tl.* Pācimānu. 244 to 267. The generic name is very loosely applied to almost all species; this is :— *U.* Jāmo; *Tl.* Nēredu; *Ta.* Nāval, Nāgai; *M.* Nāral, Nēral, Cēmpa; *K.* Nēralu, Nāge; and beyond this no other names are known for 245, 246, 248, 251, 257, 258, 259, 260 and 265. 244. (WGTS : KAN-TVY : NLGS) *Ta.* Aiva, Ilambili; *M.* Möttu. 244. (*bis*). (TVY : TRV :) *Ta.* Kāttuccāmbal; *M.* Kāttuccēmpa, Muntakam. 245. TVY : TRV :) 246. (CBT : Anms.). 247. (WGTS : CRG : com.—TRV : Anms.) Vellaināval; *M.* Payannāral, Vellannāral, Vennāral, Nāral; *K.* Bananērale, Mattanērale, Makkinērale, Nāyinēralu. 248. (TVY :). 250. (WGTS : esp. NLGS : Anms., Pnis.) *Ta.* Nāval, Nāgai, Cirunāgai; *M.* Āiri; *K.* Nāge. 251. (NLGS : KAN-TRV : MRA :). 252. (WGTS : KAN-TVY : rvs.) *Ta.* Murungi, Pūvalā; *M.* Pūvalā, Veluttannāral; *K.* Guddenērale, Kunnērale, Jōgi-parandu. 253. (WGTS : esp. NLGS : TRV :) *M.* Poriyila; *K.* Payannērale, Pūnāge. 255. (WGTS : WTCT : NLGS : KAN-TRV : rvs. and lit.) *Ta.* Malaināval; *M.* Kilakannāral; *K.* Kempukuntāle, Kuntāle, Kuntunēralu, Nēralukuntālu. 256. (KAN :) *K.* Hennērale. 257. (NLGS :). 258. (TVY : TRY :). 259. (TVY : TRV :). 260. (NLGS :). 261. (WGTS : KAN-TRV :) *Ta.* Cirunāval; *M.* Nāral. 262. (KAN : MBR : Anms., rvs., fswp.) *M.* Ceriannāral, Nāttuccēmpa; *K.* Cikkanērale, Nērale, Kuntunērale. 263. (KNL : CDP : NAC : CPT : SLM :) *Tl.* Mōvi, Mancimōvi; *Ta.* Mōvi, Oranāval, Cōranāval, Tidbērā. 264. (NCCS : esp. GJM : WFTS :) *U.* Monisiājāmo; *M.* Nāral. 265. (KAN : MBR :). 266. (Most districts, com., esp. rvs.) *U.* Jāmo; *Tl.* Nēredu, Nēredu; *Ta.* Nāgai, Nāval, Kottaināval, Kottaināgai; *M.* Nāka, Nāral, Perinnāral; *K.* Nērale, Nēralu, Nāyinērale, Jambunērale. 267. (MPLT : TRV : TVY : Anms., Pnis). *K.* Simpinērale. 442. (Most districts, dtts., scat). *U.* D'hārāngo; *Tl.* Navili, Peddnavili, Tapasi; *Ta.* Āyā, Vellāyā, Avali, Tabaci; *M.* Avil, Aval; *K.* Kaladri, Tapasi, Rāhubija, Nilavahi. 244 (*bis*). (WGTS : KAN-TVY : rare) (names not known).

IV.—MOSTLY HARD

C.—MOSTLY WHITE OR PALE

N. *26 White Cedars.

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
29. <i>Hydnocarpus alpina</i>	40	...	3	3	2	3	III	LtB stk.Dk.
32. <i>Garcinia indica</i> (incl. <i>Wightii</i>).	57	713	3	2	1	3	II	YW.
33. <i>Garcinia cambogia</i> ...	50	608	3	2	1	3	II	YW sometimes pch.R.
35. <i>Garcinia morella</i> ...	50	772	4	2	2	3	III	(H-VH) GyY mot.
36. <i>Garcinia travancorica</i> .	52	535	4	2	2	4	III	(H-VH) Y-BtOrB.
37. <i>Garcinia xanthochymus</i> .	57	...	4	2	2	3	III	(H-VH) YW-DkGyB.
103. <i>Feronia elephantum</i> .	50	634	4	3	2	3	III	YW.
118. <i>Dysoxylum malabaricum</i> .	48	992	1	2	1	3	II	YW-LtOrY-pch. Or
128. <i>Heynea trijuga</i> ...	54	...	5	3	2	2	III	(M) LtYW.
186. <i>Dalbergia lanceolaria</i>	44	718	4	3	2	3	III	YW.
286. <i>Alangium Lamarckii</i> .	50	...	5	2	2	2	III	LtY-OIB.
376. <i>Stereospermum cheilonoides</i> .	47	703	4	3	2	2	III	YW-OrB-pch.B.
377. <i>Stereospermum suaveolens</i> .	46	...	4	3	2	3	III	YB-mot.stk.DkB.
427. <i>Cyclostemon macrophyllus</i> .	52	...	3	3	2	3	III	YB.
428. <i>Cyclostemon malabaricus</i> .	54	...	4	3	2	4	IV	YW-LtYB.
<i>European Species.</i>								
False Acacia, American Locust	48	711	3	2	2	3	III	Y-GyY-YB.
Aleppo Pine	43	...	2	2	2	2	II	W-YGyB.
<i>Imported Species.</i>								
Guiana White Cedar	44	895	...	...	...	...	...	YW.
Jamaica Boxwood	43	689	...	...	...	...	...	YW-LtYB.
<i>Philippine Species.</i>								
Sasalit	63	632	...	...	...	...	...	(H-VH) YW-OrY-DkYB.

Agāru (incl. Kayātau) (*Dysoxylum*=118); Banāui (incl. Batobatō, Butongmanūk, Tinānpantāi) (*Cyclostemon*=427, 428); Basān (incl. Pīris, Taklānganāk) (*Garcinia*=32, 33, 35, 36, 37);

Guntapāi (incl. Malatapāi) (*Alangium*=286); Kulāsi (incl. Tabāu) (*Lumnitzera*=674); Malapinggān (*Trichadenia*=29); Miāo (*Dysoxylum*=128); Sasalit (*Vitex*=103, 376, 377); Urung (identical with Basān, etc.) (*Fagraea*=32, 33).

Under 1 foot diameter:—**Madras.** 622. *Indigofera pulchella*. 626. *Mundulea suberosa*. 674. *Lumnitzera racemosa*. 660. *Cordia monoica* (incl. *Rothii* and *Perrottetii*).

Strengths.

Tensile Strength:—False Acacia=11. 3-20. 6, Av. 16.0; Jamaica Boxwood=20. 0; Sasalit=15.6.

Crushing Strength:—False Acacia=7.5; Sasalit=9.1. Across the grain:—False Acacia=2.60.

Shearing Strength:—False Acacia=1180; Sasalit=1176.

Elasticity modulus:—False Acacia=1646-1794, Av. 1720; Guiana White Cedar=1870; Sasalit=1837; 108. Wood Apple=1930 (taken as Average for Category).

Compared with Oak 100—

	False Acacia	Guiana W. Cedar	Sasalit	108 Wood Apple	Category
Strength ...	114	144	102	102	114
Stiffness ...	106	109	107	113	113
Toughness ...	123	190	97	91	115

General Descriptions. Mostly large trees; Wood mostly pale yellowish-white often with a light tint of orange or brown; Hard, (35, 36, 37, hard to very hard; 128 moderately hard), grain usually straight sometimes slightly wavy, texture fine smooth dense, easy to work; Seasons well with very little warping, but liable to split or crack internally sometimes if precautions are not taken; Durability II-III, seldom attacked by beetles; P=709; Wt. 40-57, Av. 50; Rays m-f, (186-f), sometimes white; Pores usually m, (35, 189, 376-L=m; 36, 128, 286=s; 33=s-s); VC.=II.

Note. The Gamboges (32-37) exude on incision a yellowish or yellowish-white gum resin.

Note on European Species. The False Acacia, or American Locust (*Robinia pseudacacia*) is an American species which has been introduced into, and fairly considerably cultivated in, Europe; it has a small whitish sapwood and a yellow or greenish-yellow shining heartwood; it is hard, and very tough and elastic, as durable as Oak, and works well and polishes well; it is seldom obtainable large enough for construction, but it is a first class

wood for spokes in wheelwrightery, and is preferred above all others for vine and other props, for hoops, and for treenails; and is considered excellent for furniture, joinery, turnery (especially tool handles), and other purposes. The Aleppo Pine (*Pinus hal-epensis*) occurs in South Europe along the Mediterranean from Portugal eastwards, in North Africa, and into Asia Minor, Syria and Arabia, and forms extensive pure forests; the wood is white darkening irregularly towards the centre to a tawny yellow-brown, and contains large resin ducts filled with resin; it is hard and durable, but is considered a wood of medium quality only; it is used for small carpentry, common joinery, in construction as piles, Railway sleepers, boat-planking, but especially for packing cases and barrels for dry goods.

Note on Imported Species. The White Cedar of Guiana (*Iceia altissima*) is a very large tree occurring in the forests of Guiana and Venezuela (North of South America); the wood is white or pale yellowish-white, scented like Cedar, very durable, and very easily worked; it is used for house-building, especially interior fittings, for cabinet work and furniture (especially bookcases), for chests and clothes trunks (the essential oil keeping off insects), and for canoes. The Jamaica Boxwood* (*Tecoma pentaphylla*), which is almost identical with the West Indian White wood (*Tecoma leucoxydon*), occurs in the tropical parts of America; the wood is a yellowish-white sometimes with an orange or brownish tint; it is hard and durable, and is employed for housebuilding, shipbuilding, and for the bows of the natives.

Note on Philippine Species. *Agāru*. Very similar in general appearance and mechanical properties to Satinwood (*Chloroxylon swietenia*) but not so hard, and differing slightly from Miāo (see below); wood hard, moderately heavy, sap light yellowish white fairly distinct but irregular, heart light yellow when fresh gradually shading towards the outer edge of each growth ring into orange or light yellowish brown, grain commonly wavy giving 'changeable silk' effects, texture fine smooth dense, somewhat scented, works easily; seasons well; Durability II at least, even sap rarely attacked by beetles; Uses, posts, beams, joists, rafters, ties, flooring, windows, window-sills, doors, furniture, cabinetwork, tool handles, would make excellent moth-proof chests; Prices, only sold as ties

* Not to be confused with *Brya Ebenus*,—see p. 61—which is also occasionally called Jamaica Box wood.

at P/1½-1¾ (=Rs. 4½-5½) each. *Banāui*. The wood of all species is practically identical; hard, heavy, heart rare and irregular, creamy-yellow when fresh seasoning to greys or light brown curiously mottled in brown greenish-black or black like streaky *Diospyros*, grain very straight, texture dense fine and very smooth, not hard to saw and for a hard wood easy to shape and finish; seasons, badly in log, staining considerably and splitting very deeply at the ends, but if sawn while fresh and carefully stacked seasons with little staining and checking; Durability III, but not attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, interior finish, moldings, furniture and cabinetwork, rice-mortars and pestles, turnery, would make an excellent paving block if treated; Prices, generally sold with Miscellaneous lumber, but good boards for flooring, etc., sell as high as P/ 900 mc. (=Rs. 7½ cft.) or over. *Basān* (see Malabunōg, N.*21). *Urung* resembles the Yellow Garcinias; wood hard, heavy, sap yellow (and in these species not passing, or gradually merging, into a red brown heart), grain straight, texture fine dense glossy, hard to saw but otherwise not difficult to work; seasons without warping but liable to split if not painted; Durability II at least, not attacked by beetles; Uses, poles, posts, ties, paving blocks, beams, joists, rafters, flooring, piling; Prices, much used locally for house construction, but rare in Manila market and has no fixed price, *Guntapāi*. Resembles Pagatpat (see N.*14) in colour and texture but is finer glossier and harder; wood hard, moderately heavy; sap large bright yellow distinct, heart coffee-brown, texture fine very even glossy, works easily taking very smooth surface under sharp tools; seasons well; Durability II, even sap rarely attacked by insects; Uses, carving, cabinetwork, furniture, canes, scabbards; locally for small houseposts; Prices, supply limited and not marketed. *Tabāu*. Identical with, but much larger than *Kulāsi*; wood moderately hard to hard, heavy, heart indistinct, pale brown, grain straight, texture fine dense and smooth taking a silky finish under a sharp plane, when fresh faintly rose-scented, easy to work; seasons well; Durability I; Uses, piles, poles and houseposts, ties, paving blocks, bridges and wharfs, general strong construction, ship planking and decks, handles, cabinetwork; Prices, not known in Manila, brought only with Miscellaneous lumber, but ties sold at P/1½-1¾ (=Rs. 4½-5½) each. *Malapinggān*. Identical in appearance and structure with Aranga (see N.*20), but paler in colour;

wood hard, heavy, sap merging gradually into heart yellowish to light brown, grain straight or slightly crossed, texture fine dense very smooth, hard to saw but not difficult to shape or surface; seasons with little warping but liable to check if not carefully seasoned; Durability II, not attacked by beetles; Uses, posts, beams, joists, rafters, flooring, interior finish; Prices, sold with Miscellaneous stuff about P. 75 mc. (=Rs. 6½ cft.). *Miāo*. Wood lighter coloured than, and not so durable as, but otherwise resembling, *Agāru* and *Kayātau*; hard, moderately heavy, heart indistinct almost white when fresh turning yellowish, grain straight or somewhat crossed, texture fine, nasty-smelling, easy to work; seasons well; Durability III or better; Uses, house construction, carved and turned articles, cabinetwork; Prices, scarce and not marketed, worth for small lots up to about P/125 mc. (=10½ cft.). *Sasāltt*. (see N.^o13); wood harder, more durable and of greater transverse strength than *Molāve*, Hairy-leaf *Molāve*, *Kalipāpamādam* and *Lingolingo*; very hard strong and stiff but easy to split, very heavy, sap yellowish fairly distinct, heart light amber to dark yellowish brown, grain generally very straight, texture extremely dense and fine taking a glossy surface under sharp tools, not difficult to work except for its hardness; seasons well except for splitting at ends; Durability I, even sap rarely attacked by insects, and heart scarcely by teredo; Uses, piles, posts, bridges and wharfs, ties, foundation sills, tool handles and other tool parts practically all uses to which *Molāve* is put and also those which require greater transverse strength than *Molāve*; Prices, P. 225-250 mc. (=Rs. 19-21 c.ft.).

Uses of Madras Timbers recorded. 29. (A fair wood, fissile); beams, rafters, packing cases. 33. Common furniture. 37. (Timber valuable, strong and good, but not used). 103. (Strong, close even and fine grained, durable but sap often eaten by beetles); house-building, naves of wheels, oil-crushers, agricultural implements, well adapted for ornamental carving. 118. (Wood very strong, scented, liable to warp unless kept moist); housebuilding, furniture, oil casks. 186. (Strong, compact); building. 286. (Usually small, but wood very good if found of large enough size, seasons well and cuts easily); oilmills, pestles, useful for inlaying and carving, cattle-bells. 376. (Wood elastic, close and even grained, durable, easy to work, takes a fine polish); building, very good for furniture, canoes, tea-boxes. 377. (Wood similar to the last but a little redder, strong, durable, much esteemed); building.

Precis of Uses (*deduced from above*). Construction; carpentry (incl. posts, beams, joists, rafters), joinery (incl. planking, flooring, windows, widow-sills, posts and rails, interior finish, mouldings); bridge- and wharf- building (incl. piles, sleepers and treated paving blocks); ship building (incl. planking and decking, boats and canoes, treenails); cabinetwork and furniture (incl. carving and fancyware insect-proof book-cases, scabbards and walking sticks); wheel-wrightery (incl. naves and hubs, spokes); machinery (incl. oil-crushers); turnery (especially tool-handles, also bows); box-lumber (incl. moth-proof chests and trunks, barrels for dry-goods, oil-casks, tea-boxes, packing cases); household implements (incl. rice-pestles and mortars); agricultural implements (incl. vine- and other props); musical instruments (incl. cattle-bells).

Localities and Vernaculars. 29. (WGTS: esp. NLGS:) *Ta.* Ārūccancalai, Vattai, Malaivattai; *K.* Maratattu, Surante, Sannasurante. 32. (WGTS: CRG-TRV: Wnd. com:) *Ta.* Pulimarangai; *M.* Kāttuppuli, Punampuli, Pulimaranka, Kulavāla; *K.* Murginahuli, Punarapuli. 33. (WGTS: WTCT: NLGS-TVY:) *Ta.* Korukkāyppuli; *M.* Kotukkāppuli, Kutampuli, Punnargam, Punnaru, Cikiri, Korugan; *K.* Aradala, Arasinapulige, Esali, Ōtekāyi, Hila, Mandapuli. 35. (WTCT: KAN-TRV: scat.) *Ta.* Cōlaippuli, Irēvalcinni, Makki; *M.* Makki, Kurukkampuli, Pinarppuli, Pulincakka, Valokam, Cikiri; *K.* Aradala, Arasinagurce, Dēvanahuli, Jārigehuli. 36. (TVY: TRV: scat.) *M.* Malam-bungu. 37. (NCCS-Agt: WGTS: CRG: NLGS:) *Tl.* Cikati-mrānu, Ivurumāmidi, Lollorimānu, Tamālamu; *Ta.* Malaippuli, Malaippacca, Paccalai, Kulavi, Tabincam, Tamālam; *M.* Anavaya; *K.* Dēvajārige, Gurce, Hirekanigu, Nēralemāvu, Vāte. 103. (Most districts, open forests) *U.* Koit'ho; *Tl.* Velaga, Kapitt'hamu; *Ta.* Vilā, Velliōttiram; *M.* Vilannu, Vilāvu; *K.* Bēla, Belala. 118. (WGTS: CRG-TVY: Anms.) *Ta.* Vellaigil; *M.* Vellakil, Pūrippā; *K.* Bilibudlige, Bilidēvadāri. 128. (NCCS-Agt: MPLT: NLGS: WGTS:) *Ta.* Cendarai, Karaivilangu, Karai; *M.* Kari-toranam, Kurukkāti, Conakil; *K.* Kora, Linabira. 186. (Most districts, scat.) *U.* Dodilo; *Tl.* Errapaccāri, Kondapaccāri, Nāgu-lapaccāri, Peddasāpara, Vellāri; *Ta.* Erigai, Kalvellangu, Nalvellangu; *M.* Mannavitti, Pulari; *K.* Bettahasarugōni, Manjalabite. 286. (All districts, esp. bctn, tank-bunds, rvrs., fswp.; abdt. as shrub) *U.* Ānkulo, Bāg'honokiyā, Dolānku, Konkonōlo; *Tl.* Ūduga, Nallūduga, Ankōlamu, Nallankōlamu; *Ta.* Alincil, Adigōlam,

Angōlam, Karikkōlam; *M. Alinnil*, Ankōlam, Kārānkōlam, Vallit.
tonti; *K. Ankōla*, Ankōleda, Kallumāvu, Guddadagōni. 376.
(Most districts, deciduous forests), 377. (Most districts, deciduous
forests, scat.) *U. Pātoli*; *TI. Kaligottu*, Goddalipulusu, Mogavēpa,
Tagada, Vivi; *Ta. Pādiri*, Pāḷalam, Ponbādiri, Pūmbādiri; *M.*
Kariyāyi, Karinkara, Pātiri, Pūppātiri; *K. Hādiri*, Hūde, Hūlave,
Karivudure, Malevudure, Kariguddadu, Puruli, Tagada. 427.
(WGTS: CRG-TRV: Anms.), 428. (TVY: TRV: scat.) (names
not known).

IV.—MOSTLY HARD

C.—MOSTLY WHITE OR PALE

N. *27. Malletwoods

NAMES	w.	p.	s.	d.	u.	a.	vc.	(H) and Col.
38. <i>Garcinia spicata</i> ...	60	942	3	2	1	4	III	YW.
104. <i>Aegle marmelos</i> ...	56	...	4	3	2	3	III	YW.
153. <i>Hemiglyosa canescens</i> .	54	...	4	3	1	3	III	W.
156. <i>Sapindus trifolius</i> ..	64	704	4	3	2	3	III	BtLtY-OrB.
177. <i>Nothopegia Colebrookiana</i> .	62	...	4	3	3	3	IV	PkY satiny.
203. <i>Tamarindus indica</i> (sap).	60	614	1	2	2	2	II	YW.
214. <i>Prosopis spicigera</i> (sap).	59	...	4	3	2	2	III	LtYB.
241. <i>Anogeissus latifolia</i> (sap).	56	752	3	3	1	2	II	YW.
248. <i>Eugenia laeta</i> ...	56	759	4	2	3	4	IV	LtBGy.
268. <i>Eugenia bracteata</i> ...	...	...	5	2	3	4	IV	YW.
268. (bis). <i>Eugenia Mooniana</i> .	...	...	4	2	3	3	III	YW.
278. <i>Casearia esculenta</i> ...	54	...	4	3	3	2	III	W satiny.
279. <i>Homalium nepalense</i>	53	...	4	3	3	3	IV	W shining.
300. <i>Randia Gardneri</i> ...	55	...	4	3	3	4	IV	LtYB.
301. <i>Randia Candolleana</i>	60	...	5	2	3	3	IV	LtB.
302. <i>Gardenia latifolia</i> ...	51	...	5	2	2	2	III	LtYB.
303. <i>Gardenia turgida</i> ...	56	...	4	2	3	2	III	W-LtPplW.
304. <i>Diplospora apiocarpa</i> (incl. <i>sphaerocarpa</i>).	...	...	4	2	3	4	IV	W.
306. <i>Canthium pergracile</i> .	50	870	4	2	2	4	III	LtGyB.
307. <i>Canthium didymum</i> (incl. <i>umbellatum</i> , <i>neilgherrense</i> and <i>ficiforme</i>).	53	...	4	2	2	2	III	W-LtBW.
311. <i>Canthium travancoricum</i> .	...	...	4	2	2	4	III	LtGyB.
324. <i>Maba buxifolia</i> (sap).	58	...	5	2	2	2	III	W-GyW.
330. <i>Diospyros foliolosa</i> ..	...	...	4	2	2	4	III	YW.
331. <i>Diospyros ovalifolia</i>	...	...	5	2	1	3	III	PkW-LtBW
332. <i>Diospyros ebum</i> (sap).	70	720	2	2	2	3	II	YW-YGY
337. <i>Diospyros oocarpa</i> ..	45	...	5	2	1	4	III	LtGyB.
339. <i>Diospyros insignis</i> ...	...	...	4	2	1	4	III	W expo. Gy
342. <i>Diospyros affinis</i> ...	...	...	4	2	2	4	III	YW.
344. <i>Diospyros Bourdillonii</i> (sap).	54	785	3	2	1	3	III	(H-VH) YGy.
364. <i>Strychnos nux-vomica</i> .	65	813	2	3	2	2	II	W-expo. YGy mot. W.

N. * 27. Malletwoods - continued

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
365. <i>Strychnos potatorum</i> .	58	840	4	3	2	3	III	W-expo. YGy mot W.
425. <i>Hemicyclia venusta</i> .	51	726	4	3	1	3	III	YW-DkGy.
426. <i>Hemicyclia Wightii</i> (incl. <i>elata</i> and <i>travancorica</i>).	56	527	3	2	3	3	III	YW-GyW.
433. <i>Croton malabaricus</i> .	...	...	4	3	1	3	III	W-ctr. LtB.
European Species								
Beech ...	46	588	1	4	2	2	II	(M-H) W-LtPkr
Plane Tree	...	...	...	...	...	...	...	...
{ grown in	45	...	...	...	...	...	...	...
{ Europe	...	...	...	...	...	...	...	...
{ Average	40	587	1	4	2	4	III	(M-H) LtB-B mot.
{ American	35	...	...	...	...	...	...	...
Hornbeam ...	53	600	4	4	2	3	IV	W.
Holly ...	53	...	4	3	2	3	IV	W-mot. Gy.
White Service ...	53	...	4	4	2	3	IV	W-ctr. Pkr, old.
Maple ...	44	565	2	4	2	3	III	W.
Norway Maple	43	...	1	4	2	3	III	W-PkW
Imported Species								
American Maple	35	...	...	...	...	...	...	W-PkW

Philippine Species. *Anang* (incl. *Ata-ata*, *Kulitöm*, *Malagaitmön*) (*Diospyros*—330, 331, 339, 342); *Sampalok* (sap) (*Tamarindus*—203); also see *Alintatäu* (N. * 6 for 300, 301, 302, 303, 304, 306, 307, 311); *Arānga* and *Malapinggan* (N. * 20 and 26 for 278, 279); *Banāui* (N. * 26 for 425, 426, 433); and *Basān* (N. * 26 for 38).

Under 1 foot diameter:—Madras. 494, 495. *Berberis nepalensis* and *aristata*. 499. *Capparis divaricata*. 501. *Capparis sepiaria*. 509. *Xanthophyllum flavescens*. 530. *Hugonia mystax*. 534. *Melicope indica*. 540. *Glycosmis pentaphylla*. 543. *Murraya Koenigii*. 544. *Clausena indica* and *Willdenovii*. 547. *Limonia alata*. 548. *Luvunga eleutherandra*. 549. *Paramignya monophylla* and *armata*. 577. *Glyptopetalum zeylanicum* and *grandiflorum*. 580–585. *Gymnosporia emarginata* (incl. *ovata*, *Rothiana*, *Heyneana*, *Royleana* and *Wallichiana*). 629. *Desmodium umbellatum*. 630. *Desmodium cephalotes*. 631. *Desmodium pulchellum*. 637. *Dalbergia volubilis* (incl. *sympathetica* and *tamarindifolia*). 641. *Sophora glauca* (incl. *Wightii* and *interrupta*). 642. *Calpurnia*

aurea. 643. *Catesalpinia bonduc* and *bonducella*. 690. *Viburnum coriaceum*. 696, 697. *Webera corymbosa* (incl. *monosperma* and *lucens*). 698. *Byrsophyllum tetrandrum*. 699. *Randia uliginosa*. 700. *Randia dumetorum*. 701–703. *Randia malabarica* (incl. *densiflora* and *rugulosa*). 704. *Gardenia gummifera* and *lucida*. 705. *Octotropis travancorica*. 706. *Canthium parviflorum* (incl. *Rheedii* and *angustifolium*). 712. *Pavetta indica* (incl. *hispidula* and *breviflora*). 715. *Lasianthus venulosus* and *Blumianus*. 736. *Linociera Wightii* and *purpurea*. 737. *Olea polygama*. 738. *Ligustrum neilgherrense* (incl. *Walkeri*, *Roxburghii*, *Perrottetii* and *Decaisnei*) (*satiny*). 742. *Carissa carandas* (incl. *spinarum* and *paucinervia*). 759. *Strychnos colubrina* (incl. *Dalzellii*, *Rheedii*, *Bourdillonii*, *Beddomei* and *cinnamomifolia*). 774. *Lasiosiphon eriocephalus*. 780. *Bridelia tomentosa*. 782, 783. *Phyllanthus polyphyllus* and *indicus*. 793. *Croton scabiosus*. 795, 796. *Croton caudatus* (incl. *aromaticus*, *Klotzschianus* and *Gibsonianus*). 797. *Blachia umbellata* (incl. *reflexa*, *calycina* and *denudata*). 798. *Dimorphocalyx glabellus* and *Lawianus*. 801. *Mallotus repandus*. 803. *Gelonium lanceolatum* and *multiflorum*.

European. *Barberry* (*Berberis vulgaris*). *Hawthorn* (*Crataegus monogynum*).

Strengths.

Tensile Strength:—Beech=11.5–22.C, Av. 16.8; Plane=10.9–11.7, Av. 11.3; Hornbeam=20.2; Maple=10.6–17.4, Av. 14.0.

Crushing Strength:—Beech=7.7–9.4, Av. 8.6; Hornbeam=4.6; American Maple=6.1.

Shearing Strength:— ?

Elasticity modulus:—Beech=1316–1394, Av. 1355; Plane=1343; Hornbeam=1544; Maple=1453; 203. *Tamarind*=2050; 241. *Anogeissus*=1702 (taken as average for Category).

Compared with Oak 100:—

	Beech and Plane	Hornbeam	Maple	Tamarind	Category and Anogeissus.
Strength	95	96	91	99	121
Stiffness	77	90	85	120	100
Toughness	119	104	97	82	146

General Description. Mostly moderate sized trees; Wood white or yellowish- to brownish-white; Hard (Beech and Plane moderately hard to hard), very tough (just such as is wanted for making mallets, whence the name), grain usually straight

sometimes slightly crossed, texture fine dense and smooth or glossy, rather difficult to work but takes fine surface under sharp tools; Seasons badly as a rule in log or large pieces, and requires careful stacking and often weighting to prevent warping †; Durability II-III (Beech, Plane, Hornbeam, White Service and the Maples IV), not usually (European species mostly liable to be) attacked by beetles; P=754; Wt. 50-70, Av. 56; Rays f-fl, (364, 365, Beech, Plane and Hornbeam biform, B-m few and f numerous; in 364 and 365 white); Pores usually s-ss, (364, 365 two classes, L few and s many; 337, 433-L-m: 38, 152, 156, 203, 214, 324-m but scanty); VC.=II. NOTE. Closely resembling the White Cedars (N. *26), but either heavier, or finer textured with finer rays and smaller pores; serving the purposes of the European woods, but much more durable and a better class generally and, except for colour, much resembling N * 21 Plums.

Note on European Species. The Beech (*Fagus sylvatica*) occurs throughout the better part of Europe except the far North, and stretches into Asia as far as the Caucasus; the wood is white when freshly cut, turning yellowish on exposure and a light pinkish-brown on drying; it is moderately hard to hard, wanting in suppleness, very liable to attacks of insects, and will not stand exposure to alternations of damp and dry, but lasts well under water or in places perpetually wet; it warps and cracks easily, works easily but will not take polish well; it is solely used for industrial purposes, by wheelwrights for spokes, by joiners, by furniture makers especially for bent work and for carpenters' benches, by coopers for slack barrels, by turners for tool-handles, brushes, gunstocks, horse-collars, etc., by sabot-makers for wooden shoes to an extensive degree, for agricultural implements, and for packing cases. The Plane Tree (*Platanus orientalis* and *occidentalis*) occurs in Greece, Macedonia, Armenia and North Persia, and in North America, and is cultivated throughout Europe; the wood is almost identical with that of the Beech, except that it is a shade browner and is rather less subject to decay in damp places; it is used in precisely the same way as Beech. The Hornbeam (*Carpinus betulus*) occurs in Central and Eastern Europe, and penetrates Asia as far as the Caspian Sea; the wood is uniformly white with wavy growth rings; it is hard,

homogeneous, compact, tough, often with interlaced fibres, of very poor durability, and difficult to work; it is also used solely for industrial purposes, its hardness, toughness, weight, and homogeneity, making it useful for parts of machinery subject to friction such as cog-wheel teeth, cams, etc., for turnery such as tool-handles, plane-boxes, shoemakers' lasts, and pegs, and for agricultural implements. The White Service (*Pyrus aria*) occurs scattered throughout the hilly forests of the greater part of Europe, in Northern Africa, in Western Asia and through Siberia, Persia, Afghanistan to the Himalayas; the wood is uniformly white, except that in old age it becomes a pink tinged with brown towards the centre; except for colouring, it is almost identical with the Torminal and Apple (see N. *21) and very little different from the Mountain Ash and Pear (see N. *20); hard, tough, non-fissile, very homogeneous, durable only under cover, works easily and takes a good polish; it is used for parts of machinery subject to friction, for tool handles, and, like the Hornbeam, wherever hardness, toughness, homogeneity, and weight are demanded. The Holly (*Ilex aquifolium*) occurs, and is much cultivated also as it makes a most excellent hedging; with its rigid evergreen prickly leaves, throughout the greater part of Europe, the Caucasus and Western Asia, chiefly in mountainous regions and mostly in the form of a large shrub though sometimes growing to a moderate-sized tree; the wood is uniformly white except in so far as it is mottled with silvery-greyish rays which give a good silver grain, and when deteriorating it goes brownish towards the centre; it is hard, tough, compact and very homogeneous, fairly durable (but on account of its size is never used except for industrial purposes) and not liable to be worm-eaten, and it cracks and warps but little; it is chiefly used for cabinetwork especially in relief, carving and inlaying, turning especially tool handles and walking sticks, and, like Hornbeam and White Service, for cog-wheel teeth and such parts of machinery; it polishes well, and stains black well and is then used as a substitute for Ebony. The Maple (*Acer campestre*) occurs throughout Europe and Western Asia, as a moderate-sized tree; the wood is uniformly white, or faintly tinged with pink or yellow, or when old with brown towards the centre; and has a satiny lustre and a fair silver grain; it resembles Sycamore (see N.*17), but is finer, harder and with a lustre that the Sycamore does not possess, hard, very tenacious and tough, very homogeneous and compact, it decays rapidly under

† For seasoning short bolts, see remarks on the American Elm in * 25, Imported Species, page 230.

atmospheric variations but is little liable to be worm-eaten or to warp or crack; it works easily and takes a good polish; it is not used for construction but is in great demand for industrial purposes; it is used for joinery especially flooring, cabinetwork and furniture for solid or veneered work, sculpture carving and fancyware, wheel-wrightery especially naves, spokes and felloes but also panelling of all descriptions, turnery especially tool handles and ornamental whipstocks, churns, gunstocks, and musical wind-instruments; 'Bird's-eye Maple', from knotty and excrescence wood, forms a most valuable cabinetwood. The Norway Maple (*Acer platanoides*) occurs in North-eastern and Middle Europe, and Asia Minor as far as The Caucasus; it resembles the Common Maple but has a pink tinge and is never so pure a white as the Maple, and is more liable to attacks of insects; it is used for the same purposes. The American Maple (*Acer saccharinum*) resembles the Norway Maple, but is rather lighter in weight. The Barberry (*Berberis vulgaris*) is shrub with a hard yellow wood used in inlaying and carving. The Hawthorn (May or Whitethorn) (*Crataegus monogynum*) is a large shrub or small tree with a hard white or pinkish-white wood, very similar to White Service, used for turning and pieces of machinery subject to friction.

Note on Philippine Species. *Alintatāu*. (See Bangkāl, N. *5); wood hard, heavy, heart indistinct, pale yellowish or pinkish, drying paler than when fresh cut, grain slightly crossed in narrow belts, texture dense fine glossy, rather difficult to work; seasons with little checking, but liable to warp if not carefully stacked; Durability II, rarely attacked by insects; Uses, when large enough posts, beams, joists, rafters, and all other structural timber, including bridge- and wharf- building; favourite for flooring and window-sills; turned and shaped tool-handles, plane-stocks, etc.; recommended for bobbins, shuttles, and other articles of turnery; Prices, P/160-180 mc. (=Rs. 13½-15 cft.). *Arānga, Malapinggān*. The latter is identical in appearance and structure to the former, but paler in colour; wood, hard, heavy, sap merging gradually into the heart, yellowish to light brown, grain straight or slightly crossed, texture fine dense very smooth, hard to saw but not difficult to work; seasons with little warping but liable to check if not carefully seasoned; Durability II, not attacked by beetles; Uses, when large enough posts, beams, joists, rafters; flooring, interior finish; Prices, sold with Miscellaneous stuff about P/75 mc. (=

Rs. 6½ cft.). *Banāui*. Wood of all species is practically identical; hard, heavy, heart rare and irregular, creamy-yellow when fresh cut seasoning to grey of light brown, and often curiously mottled in brown greenish-black or black, grain very straight, texture dense fine and very smooth, not hard to saw and for a hard wood easy to shape and finish; seasons badly in log, staining considerably and splitting deeply at ends, but if sawn when fresh and carefully stacked seasons with little staining or checking; Uses, when large enough posts above stumps, beams, joists, rafters, flooring interior finish, moldings; furniture and cabinetwork; rice mortars and pestles; turnery; would make excellent paving blocks if treated; Prices, generally sold with Miscellaneous lumber, but good boards for flooring, etc., sell as high as P/100 mc. (=Rs. 7½ cft.), or over. *Basān* (see Malabunog, N. *21); *Urung* resembles the Yellow Garcinias; wood hard, heavy, sap yellow (and in these species not passing, or gradually merging, into a red-brown heart), grain straight, texture dense fine glossy, hard to saw but not otherwise difficult to work; seasons without warping but liable to split if not painted; Durability II at least, not attacked by beetles; Uses, poles, posts, ties, paving blocks, beams, joists, rafters, flooring, piling; Prices, much used locally for house construction, but rare in Manila market and has no fixed price. *Ānang* (see Kanōmoi, (3) Ata-āta group, N. *17); wood hard to very hard, heavy to very heavy, heart defective or very small, sap white turning yellowish in seasoning, grain straight, texture fine smooth very dense, difficult to work but takes fine surface under sharp tools; difficult to season in logs which almost invariably check from the heart outwards, whilst sawn lumber must be stacked carefully and weighted to prevent warping; Durability II, never attacked by beetles, but not termite-proof; Uses, posts, beams, joists, rafters, window-sills; agricultural implements; T-squares and other mathematical instruments; shuttles, spindles, bobbins, golf-club heads and shafts, ax pick and hammer handles; Prices, logs sell in Manila at P/30-70 mc. (=Rs. 3¼-8 cft.). *Sampālok*. Wood hard tough and difficult to split, sap very large whitish distinct, grain crossed in narrow belts, texture fine dense smooth, difficult to work; apt to blue very readily in seasoning; Durability of sap III, but not attacked by beetles; Uses, locally for household and agricultural implements, small pieces of furniture, wooden tools, tool handles, etc.; Prices, only used locally and not brought to market.

Uses of Madras Timbers recorded. 104. (Compact even and close grained, esteemed for strength and toughness); Construction, naves and other parts of carts, oil and sugar-mill pestles, agricultural implements, drums. 153. (Durable, close and fine grained, easy to work); engraving, turning, combs, recommended as a substitute for Boxwood. 156. (Not durable and cracks if exposed—Bed.; very durable and valued where strength, hardness and durability are required—Bs.; tough, close and prettily grained, seasons well and takes polish); building especially doorframes and houseposts, cart-construction various parts, agricultural implements especially ploughs and teeth of harrows, oil- rice- and sugar- crushers, screws, rollers, pestles and mortars. 177. (Strong, but scattered in many forests, so not used). 203. (Sapwood not clearly defined, the dark so-called heart projecting into the hard yellow wood with radiating ramifications, the outermost wood not durable and apt to be eaten by insects unless waterseasoned, central portion durable, heart purplish very durable, difficult to work but polishes well); naves and other parts of wheels, oil-presses, sugarcane-crushers, rice-pestles, mallets including croquet-mallet heads and balls, planes, tent-pegs, furniture, excellent for turning. 214. (Straight and close grained, hard and durable, superior to Teak in strength,—Bed.; tough, easy to work, but not durable, liable to dry-rot and to be attacked by insects, —Bs., Gbl.); buildings, cart-wheels, agricultural implements, good for well-curbs, occasionally for furniture. 241. (Very tough and very superior for sustaining cross strain, sapwood not durable if left exposed to the weather, warps and splits in seasoning); housebuilding, shipbuilding, carthbuilding especially for poles and axles for which it is one of the best, moderate only for sleepers, good for furniture, also for axe- and other tool handles, and for agricultural implements, and excellent for poles for carrying loads. 248, 268, 268 (*bis*). (Wood close grained, durable, becoming black if buried in mud); walking sticks. 278, 279. (Wood strong and elastic, durable, apt to split in seasoning, does not warp, works smoothly, but not used). 301. (Wood even and close grained and has the character of Boxwood, but not used). 302. (Wood close and fine grained, durable, easy to work); engraving, recommended as substitute for Boxwood, turning, combs. 303. (A good wood, close grained and even closer in the drier tracts, splits and cracks in seasoning); not used, but recommended as a substitute for Boxwood, for coarser engraving.

and for tool handles. 307. (Wood close and even grained, somewhat resembles Boxwood and is called 'Ceylon Boxwood'); agricultural implements. 330. Butcherblocks. 332. Sapwood for building and other purposes. 364, 365. (Wood close grained, durable, bitter and not attacked by white-ants, takes good polish); building, plough-shares, posts, cart-wheels, fancy cabinetwork. 425. [Wood close grained, cracks a good deal, not durable (?)-]; houseposts, walking sticks. 426. (Strong, close grained with the texture of Boxwood); building. 433. (Close and even grained seasons well; not used).

Precis of uses (deduced from above). House-bridge and- wharf-construction, when large enough (incl. posts, poles, piles, foundation sills, sleepers and pavingblocks especially if treated); carpentry (beams, joists, rafters, posts), joinery especially (incl. planking, flooring, stair-cases, posts and handrails, window-sills, interior finish, mouldings); furniture and cabinetwork (incl. solid and veneered, bentwood work); sculpture and carving (incl. inlaying, wood-engraving, fancyware such as combs, etc.); turnery (incl. axe, pick hammer and other tool handles, mallets plane-boxes and other shaped tools, shuttles and spindles, bobbins, whip-handles, gun-stocks, horse-collars, shoemakers' lasts and pegs, screws, rollers, croquet-mallet heads and balls, golf-club heads and shafts, brushes, churns, walking-sticks); machinery (parts subject to friction such as cogwheel teeth, cams, etc., oil- sugar- and rice- mills); butchers' blocks; wheelwrightery (incl. naves, spokes, felloes, axles, poles of carts, panelling of carriages); agricultural implements (especially ploughs and harrow teeth); household implements (incl. rice mortars and pestles, shoulder-poles, sabots); cooperage (slack barrels); box-lumber (packing-cases); musical instruments (wind instruments, drums); desk-supplies (T-squares and other mathematical instruments); well-curbs; tent-pegs; substitute for Box-wood, and, stained black, for Ebony.

Localities and Vernaculars. 38. (NEL: CPT: Sriharikot: WGTS: scat.) *Tl.* Pidata; *Ta.* Cōlaikkodukkāppuli, Kōgottai, Mancalnāngu; *K.* Kādujārige. 104. (Most districts, dtts., scat.) *U.* Belo; *Tl.* Mārēdu, Māredu, Bilvamu; *Ta.* Villuvam, Kūvilam, Māvilangai; *M.* Vilvam, Kūvilam, Māvilāvu; *K.* Bilva, Bilvapatre, Bellapatre, Kumbala. 153. (Most districts, degn., scat.) *U.* G'hontiākusumo, Pānikusumo; *Tl.* Ekkudubūsi, Boddamāmidi, Murumāmidi, Korivi; *Ta.* Karadippungu, Neykkottān,

Tolukkottān, Puvandi, Vekulā; *K.* Kadupe, Kalluhette. 156. (Most districts, esp. betn.) *U.* Mukṭāmonji; *TL.* Kunkudu, Kūkudu; *Ta.* Pūcikkottai, Manippungu, Nittavanci, Neykkottān, Ponnangottai; *M.* Cavakkāya, Paccakkotta, Ponnankotta, Pulinci, Urvanci, Arishtam; *K.* Antarali, Antavāla, Arishta, Burugukāyi, Kūgate, Runde, Talemarudu, Nurekāyi. 177. (NCCS: MPLT: WFTS: scat.) *TL.* Nallalli; *M.* Macaru. 203. (Most districts, esp. dtts. and DKN:) *U.* Koinā; *TL.* Cinta; *Ta.* Puli; *M.* Puli; *K.* Hunise, Punke. 214. (Most districts, dtts., betn.) *U.* K'hodiro; *Somī*; *TL.* Jammi; *Ta.* Parambai, Vanni, Cami; *M.* Parambu, Vanni; *K.* Banni. 241. (Most districts, deciduous forest) *U.* D'hoū; *TL.* Cīrimānu, Sirikana, Velama; *Ta.* Vellaināgai, Vekkāli, Namai, Vellainamai; *M.* Vellanāvu, Malakkānniram, Marukkānniram; *K.* Bejjalu, Dindalu, Dindiga, Tirapu. 248. (WGTS: KAN-TVY:) *M.* Kāttuccampakam; *K.* Maddale. 268. (TRV: CBT: Anms., as tree: NCCS: COCT: CNTC degn., as shrub) *U.* Mod'hurojotti, Sogoropotonā; *TL.* Aramanda, Gārimottu, Gorgumudi, Kuntinēredu, Rodda; *Ta.* Vengalaikkāyā, Kāyā, Pikkonci. 268 (bis). (WFTS: KAN-TVY: NLGS: Anms.) (Names not known). 278. (NEL: KNL: BEL-Rmdg: WTCT:) *TL.* Kondajunguru; *Ta.* Kākkaippilai, Kilar, Kōttagōvai, Vencanduvar; *M.* Cerukkannan, Malanpāvatta, Pannimurangam, Vellakkannan; *K.* Doldahānice, Hillehānice. 279. (NCCS-Agt: Mhgi: Jprs: Rpas:) *U.* Kidākuntu; *TL.* Balbāli, Cēdu. 300. (TVY: TRV:) *Ta.* Padārappan. 301. (DKN: MPLT: CNTC:) *TL.* Kudamanga, Peddamanga; *Ta.* Malakkārai; *K.* Mahāgāre, Malakuva. 302. (Most districts, dtts. open forests) *U.* Bodogurudu, Dāntiā, Kurukutu, Kōtorāngo; *TL.* Bikki, Adavibikki, Kondabikki, Peddabikki, Kokkita, Kondakokkita, Rātikokkita, Kāringuva, Peddakāringuva; *Ta.* Kambil, Perungambil; *K.* Bikke, Adivibikke, Kalkambi. 303. (Most districts, dtts.) *U.* Bomoniā, Dārobokryco, Gūrnā; *TL.* Kokkita, Mullukokkita, Tellakokkita, Tuddumanga, Verribikki; *Ta.* Malangārai, Nancundam; *M.* Malankāra; *K.* Magge, Bongeri. 304. (WFTS: NLGS-TVY: Anms., scat.) *M.* Kāttuppancāru. 306. (TVY: TRV:) *M.* Ānakuppi, Palaka. 307. (Most districts, degn., and WFTS: sholas.) *U.* Dālosingi, Gujorāni, Pryt'hugujorāni, Tōlā; *TL.* Balasu, Nallabalasu, Nakkena, Nīrali; *Ta.* Imburuttān, Nakkanai, Nallamandanam, Nalluvugai; *M.* Nallamandanam, Nānnūl; *K.*

Ellele, Oppe, Oppele, Gandekakkōrā. 311. (TRV: TVY:) (Names not known). 324. (Most districts, degn.) *U.* Gourok'hōli, Pitonu; *TL.* Cinnavulinji, Erravūti, Ūti, Kārūti, Nallamūdi, Pisinika, Nallapisinika, Pittapisinika; *Ta.* Irumbili, Kuruvinci, Kāttutuvarai, Vicaram; *K.* Piccane, Simbalike, Karugāne, Kari. 330. (MRA: TVY: TRV:) *Ta.* Vellaittuvarai, Pūlivellaittuvarai. 331. (WFTS: CRG-TVC: NLGS: Anms.: KNL-Nlms.) *TL.* Kukkatummiki; *Ta.* Vedikkanuru. 332. (DKN: rare; NEL: CPT: CNTC: WGTS:) *TL.* Nallūti, Nallavāludu; *Ta.* Tāli, Karundāli, Karungāli, Narai, Kākkāyttāli, Māy, Marā; *M.* Karu, Mishtumpi, Vayasi; *K.* Bāle, Kari, Mallali. 337. (WGTS: KAN-TRV:) *Ta.* Vellaikkarungāli. 339. (CBT-TRV: Anms.) *Ta.* Pottuttuvarai. 342. (TVY: TRV:) *Ta.* Vankkanai. 344. (WGTS: MBR-TVY: Anms.) *Ta.* Karuncattiyam, Karunduvarai; *M.* Kari, Kotal, Terika. 364. (Most districts, degn., mtts., rvrs.) *U.* Korā; *TL.* Musidi, Mushti; *Ta.* Etti, Kānciram; *M.* Kānniram; *K.* Kāsara, Kāsāraka, Itti, Kānjira, Hemmushti, Kāyeru. 365. (Most districts, dtts.) *U.* Kotoko; *TL.* Cilla, Induga, Indupu; *Ta.* Tērrā, Tērrāngottai; *M.* Tērrā, Tērrāmparalkānniram; *K.* Cillā, Kataka, Anduga, Calibija. 425. (TVY: TRV:) *Ta.* Pattakkanni, Vellalambu; *M.* Vellakkatavu, Vellakkāri. 426. (WGTS: NLGS-TRV: Anms.) *M.* Bālā; *K.* Sampuhannu, Ahilapu. 433. (WGTS: esp. MBR-TRV:) *Ta.* Tavattappolavu; *M.* Koluvāsi, Pamparam, Tēnātal, Ānakuru.

III.—MOSTLY VERY HARD

A.—MOSTLY WITH BLACK HEART

N. *28 Ebonies

NAMES	W.	P.	S.	D.	U. A.	VC.	(H) and Col.
324. <i>Maba buxifolia</i> (heart) (incl. nigrescens).	58	...	5	1	2	II	hrt jetBk.
328. <i>Diospyros embryopteris</i> (heart).	45	...	4	2	2	III	(H) hrt irregularBk
332. <i>Diospyros ebenum</i> (heart) (incl. assimilis).	70	1160	2	1	1	II	hrt jetBk.
337. <i>Diospyros oocarpa</i> (heart)	45	...	5	2	1	III	(H) hrt irreg. PplBk and stk. GyB.
338. <i>Diospyros melanoxylon</i> (heart) (incl. tomentosa and turrul).	63	1021	3	1	1	II	hrt irreg. Bk sometimes stk. Ppl.
344. <i>Diospyros Bourdillon</i> (heart).	54	785	3	2	1	III	hrt smallBk irreg. ringed. Bk.
Imported Species							
Jamaica Ebony, or Cocus-wood.	75	1583	...	...	...	...	GnB-GnBk.
Calamander-wood	...	57	751	...	...	...	GyB ringed. Bk.

Philippine Species. Batulināu or Ebony (*Maba*—324); Bolongēta (incl. Camagōn, Tāmīl, Tālang-gūbat) (*Diospyros*—338); Camarines Bolongēta (*Diospyros*—332).

Under 1 foot diameter :—(None).

Strengths.

Tensile Strength :— ?

Crushing Strength :—Ebony—19.0; Jamaica Ebony—13.0-18.1, Av. 15.6.

Shearing Strength : ?

Elasticity modulus : ?

Compared with Oak :—

	Jamaica Ebony	Calamander	332. Ebony	338. Ebony	Category
Strength	...	254	121	187	164
Stiffness	...	?	?	?	?
Toughness	...	?	?	?	?

General Description. Mostly large to moderate sized trees; Wood with (whitish, yellowish or reddish sapwood,—considered elsewhere,—and a) black heart sometimes tinged with brown or purple, and sometimes streaked or ringed with lighter or darker colouring; Very hard, (328, 337 hard), brittle as compared with the sapwood which is always very tough, grain generally very straight, texture fine smooth and very dense, difficult to work but takes a beautiful surface under sharp tools; Difficult to season logs almost invariably cracking from the heart outwards, while sawn material must be stacked carefully and weighted to prevent warping, but once thoroughly dried it becomes very stable; Durability I, (328, 337, 344—II), practically never attacked by beetles; P—989; Wt. 45–70, Av. 56; Rays f-f; Pores m-s, (337, 338 sometimes also a few L; VC. = II).

Note on Imported Species. The Jamaica Ebony, or Cocus-wood, (sometimes also called Green Ebony, or Jamaica Boxwood) (*Brya ebenus*) is a small tree of the West Indies with long slender tough branches; the wood is of a dark greenish-brown to greenish-black, very hard, very heavy, and very tough; it takes a good polish; it is used for small cabinetwork and fancyware, but especially for turnery, tool- whip- and knife- handles being largely made from it, and also the police constables batons in London. The Calamander-wood (*Diospyros quæsitæ*) is a large tree of Ceylon, but now scarce; the wood is greyish-black variegated with broad or narrow belts of black; it is used for making the finest kinds of ornamental work in cabinet-making.

Note on Philippine Species. *Batulināu*, or Ebony. It is often confused with the various species of *Diospyros*; sapwood whitish, often staining to a dull light grey in seasoning, heartwood jet-black, if streaky the streaks are always whitish or greyish and never yellow red or brown, very hard but brittle, very dense, and apparently heavier than all but the very blackest and densest heart wood of the Camagons. *Bolongēta* and *Camarines Bolongēta* (see Kanōmoi, N.*17 groups (1) Camagōn, and (2) Bolongēta of the

Camarines); wood hard to very hard, heavy to very heavy, sapwood pinkish or pale red in the Camagōn group, or a distinct yellow becoming a yellowish-brown in drying in the Camarines Holongēta group, heart brittle black with rosy yellowish brownish or ashy streaks or sometimes quite black, grain usually very straight, texture fine smooth and very dense, difficult to work but takes a most beautiful finish under sharp tools; seasons with much difficulty, logs almost invariably checking from the heart outwards in several directions, while sawn lumber must be carefully stacked and weighted to prevent warping; Durability of heart 1, practically never attacked by beetles; Uses, scabbards, canes, hilts, tool-handles, gunstocks, saw-frames, a favourite for musical instruments especially finger-boards and keys of guitars, furniture, cabinetwork, inlaying, paper-weights, inkstands and similar desk-supplies; Prices, select small lots of sound heartwood at P/300 mc. (—Rs. 900) per M. board feet, and upward.

Uses of Madras Timbers recorded. 332. (Heartwood jet black, very hard, close and even grained, stands high polish;) turnery, cabinetwork, keys of pianos, rulers, backs of brushes, chopsticks in China, carved stands for vases and images. 337. (Is like Calamander-wood or Zebra-wood, and can be used like it); cabinet-making. 338. (Heartwood black but irregular, hard to very hard;) carved walking-sticks, picture frames, combs, and other fancyware.

Precis of uses (deduced from above). Cabinetwork and furniture, sculpture carving and fancyware (incl. picture-frames carved walking sticks, combs, carved stands for presentation cups and vases, carved scabbards and hilts brush-backs,) inlaying; turnery (incl. tool- knife- whip- and other handles, constables' batons, gunstocks, saw-frames); musical instruments (especially piano-keys and guitar keys); desk-supplies (incl. rulers, paper-weights, inkstands).

Localities and Vernaculars. 324. (Most districts, degn., and rvrs.) *U.* Gouruk'hōli, Pītonu; *TL.* Cinnavulinji, Errūti, Ūti, Kārūti, Nallamūdi, Pişinika, Nallapisinika, Pittapisinika; *Ta.* Irumbili, Kuruvinci, Kāttuttuvarai, Vicaram; *K.* Piccane, Simbalike, Karugāne, Kari. 328. (NCCS: rvrs.; WTCT: rvrs. and sswp.) *U.* Kendu, D'husārokendu; *TL.* Tummiki, Ētitummiki, Nirutummiki, Muttiyatummiki, Elōsu, Gābu; *Ta.* Paniccai, Tumbi, Tuvurai, Kavikkattai, Kāttatti, Pattuppalam; *M.* Panicci, Vananci; *K.*

Olletupare, Holetupare, Kākutupare, Tupare, Antina, Banda. 332. (DKN: rare; NEL: CPT: CNTC: WGTS:) *TL.* Nallūti, Nallavālu; *Ta.* Tāli, Karundāli, Karungāli, Narai, Kākkāyttāli, Marā, Māy; *M.* Karu, Mishtumpi, Vayasi; *K.* Bāle, Kari, Mallali. 337. (WGTS: KAN-TRV:) *Ta.* Vellaikkarungāli. 338. (Most districts, dtts.) *U.* Kendu; *TL.* Tummiki, Tūki, Tuniki, Nallatummiki, Pasarugāta; *Ta.* Tumbi, Karundumbi, Karai; *M.* Karu; *K.* Bāle, Bīlāra, Tupare, Tumare. 344. (WGTS: MBR-TVY: Anms.) *Ta.* Karuncattiyam, Karunduvurai; *M.* Kari, Kotal, Terika.

V.—MOSTLY VERY HARD

B.—MOSTLY REDDISH

N. *29. Rosewoods

NAMES.	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
113. <i>Filicium decipiens</i> ...	64	902	2	1	1	1	I	(XII) BtR-BldR stk DkR-Bk.
120. <i>Aglaia Roxburghiana</i> (incl. <i>Majae</i> , <i>minutiflora</i> and <i>travancorica</i>).	58	978	2	2	1	3	II	(H-VII) PkR-BtR-CopR-DkRB.
127. <i>Walsura piscidia</i> ...	60	947	3	2	1	4	III	
165. <i>Gluta travancorica</i> ...	53	734	1	2	1	3	II	DkR-DkRB stk. Bk. Pk-BtR CopR-KB andstk. Or. Crim R. and Bk.
180. <i>Ougeinia dalbergioides</i> .	56	835	3	2	1	3	II	(H) LtB-DkB mot. Gn. Y. and R.
184. <i>Dalbergia latifolia</i> ...	55	902	1	2	1	2	I	DkPl lined and stk. Crim and Bk.
185. <i>Dalbergia sissooides</i> ...	52	720	3	2	1	3	II	(XII) BPpl lined and stk. Pl and B.
189. <i>Pterocarpus marsupium</i> .	55	718	2	2	1	2	II	YB-DkYRB stk. DkB and RB.
European Species								
Service ...	55	...	2	3	2	3	IV	RB.
Montpelier Maple ...	58	...	5	4	2	4	V	PkW-PkR.
Cork Oak ...	57	...	1	3	2	3	II	(XH) GyB mot. YGy. B.
Holm Oak ...	65	...	3	2	1	2	II	(XH) LtR-DkRB-DkYB mot.
Imported Species								
South American Rosewood.	...	...	...	...	...	...	...	PkR-PplR lined and stk. Vi and DkPl.
African Rosewood	...	...	...	...	...	...	...	Pk BtR and stk. B and Bk.
North Indian Rosewood, Sissoo.	48	796	...	...	...	...	...	LtB-DkB lined and stk. Lt-DkB and Bk.
Burmese Rosewood, Padouk.	65	1150	...	...	...	...	...	(H) PkGy-DkBrkR.
Andaman Rosewood, Andaman Padouk.	48	827	...	...	...	...	...	(M) PkGy-BtR stk Bk and B.
Philippine Species								
Philippine Rosewood, Narra (said to be Burmese Padouk).	42	420	...	...	...	...	...	(M-H) All shades YW-Y. YB-DkB-PkY-PkR-BtR-RB-BldR.

Batukanāg (incl. Bayanti, Bulōg, Gisihan, Kansulud, Malatum-bāga, Malasāging, Matamatā, Salamūngi, Tucāngcālo) (*Aglaia* = 120); Salakin (identical with Batukanāg, etc.) (*Aphanomyxis* = 113, 120, 127); Nārā (incl. Blanco's Nārā, Prickly Nārā = 189); Sudiāng (*Ctenolophon* = 531).

Under 1 foot diameter: —**Madras**. 531. *Erythroxylum monogynum* and *lanceolatum*. (VH. DkRB-Choc.B, scented, 62 lbs).

Strengths.

Tensile Strength: —Sissoo = 12.0.

Crushing Strength: —Narra = 6.7.

Shearing Strength: —Narra = 678.

Elasticity modulus: —Narra = 1510; Sissoo = 1518-1642, Av. 1565; 184. *Dalbergia* = 1694; 189. *Pterocarpus* = 1537; Average taken for Category = 1615.

		Compared with Oak 100:—		Narra	Sissoo	184. Dalbergia	189. Pterocarpus	Category
Strength	...	...	68	128		145	116	136
Stiffness	...	...	88	91		99	90	94
Toughness	...	...	53	180		213	160	197

General Description. Mostly large resinous trees; Wood mostly reddish in various shades, but sometimes brownish, variously mottled, lined, streaked or shaded, giving a large scope of colour; Very hard (113, 185, Cork Oak and Holm Oak extremely hard; 180, Padouk hard; Narra moderately hard to hard; Andaman Padouk moderately hard), grain straight wavy or crossed, texture fine dense taking a very smooth surface under sharp tools, easy or rather difficult to work; Seasons well usually; Durability usually II (113 = I; service and Cork Oak = III; Montpelier Maple = IV), not attacked (except M. Maple) by beetles; Rays mostly f-f (Cork Oak = BB and brown; Holm Oak = BBB; these very broad rays giving the mottling that arises from the different coloured tissues in the Indian Rosewoods); Pores L-m (Cork Oak = LL-ss; 113, 120, 127, Service, Montpelier Maple and Holm Oak = s-ss); VC = I.

Note on European Species. The European species are none of them ordinarily recognized as 'Rosewoods', but they are the nearest approach amongst the European woods, in respect of their hardness, colouring and utilization. The Service (*Pyrus sorbus*) occurs in Southern Europe and part of Central Europe and also in Western Asia; the wood is reddish-brown or brownish-red, very hard, one of the most homogeneous and compact of the European

woods; it is durable, but is always used under cover; it is greatly in demand by cabinet-makers, sculptors, wood-engravers, mechanics and turners, and gunsmiths; it is a first-class wood for making tools for joinery and cabinetwork such as large jointer and common planes; high prices are paid for it, and the demand is greater than the supply. The Montpellier Maple (*Acer monspessulanus*) is a small tree occurring in Central and Southern Europe, Algeria (North Africa), and Syria and Armenia in Asia Minor; the wood is pinkish-white to pinkish-red, very hard but not durable; it is used for joinery, cabinetwork and turning. The Cork Oak (*Quercus suber*) is usually a moderate sized tree, sometimes however growing very large, which occurs in the Mediterranean region mostly in the South-West of Europe from Spain to Dalmatia through France, Italy, Sicily and Corsica; the wood is greyish-brown mottled with yellowish-grey, brown and red-brown and has a conspicuous silver-grain of very broad rays; it is extremely hard, compact but not so homogeneous or fine grained as Holm Oak, durable but decays under alternations of wet and dry, and is apt to split badly in seasoning; it is used for inferior scantlings in marine construction, but much more for joinery and machine construction, and to a certain extent for cabinetwork. The Holm Oak (*Quercus ilex*) occurs as a moderate sized tree along the whole Mediterranean region in South Europe and North Africa into Asia Minor, then there is a gap and it recurs in Northern India and Afghanistan; the wood is light red to dark reddish-brown or dark yellowish-brown, mottled with extremely broad rays; it is extremely hard and compact and very homogeneous, very durable, but is liable to warp and crack in seasoning unless it is soaked in water for some time; it receives and retains a polish like marble; it forms a superb planking for cabinet-making, but requires special tools for cutting it; it is also used largely for tool handles, and for agricultural implements.

Note on Imported Species. The South American Rosewood is the produce of various trees of different species and genera, all of which go by the name of 'Jacaranda' in Brazil; the principal of all is *Dalbergia nigra*, the timber of which is pinkish-red to purplish-red lined and streaked with dark purple and violet, and—what distinguishes it from the Indian Rosewoods—with a characteristic agreeable perfume and having black lines of resinous matter; two or three other species of *Dalbergia* (formerly separated

as *Triptolomæa*) and of *Machærium* (chiefly *M. firmum*, *M. in-corrupibile* and *M. legale*) are also exported as Rosewood, but the wood of the last genus is not considered up to the standard of the other; it is perhaps the timber par excellence, shared only with Mahogany and Walnut, for the highest class of cabinetwork and furniture in Europe. The African Rosewood (*Pterocarpus erinaceus*) which occurs in Western Tropical Africa, and which has a pink to a bright red, streaked with brown and black, wood. There has been considerable confusion about the Burmese and Andaman Rosewoods, or Padouks; classed originally as *Pterocarpus indicus*, it was found later that the Burmese comprised, in large part at least, *Pterocarpus macrocarpus*, and the Andamanese was *Pterocarpus dalbergioides*; it would hardly seem as if the matter were yet satisfactorily settled, for the figures given for Burmese Padouk are those taken from Gamble under *Pterocarpus indicus*, which is also the Philippine Narra, where the figures are so vastly different; the wood of the Andaman timber is said to be normally of a bright red colour, often streaked with black, and fading to much the same colour as Teak; that of both *indicus* and *macrocarpus*, according to Gamble, a dark brick-red colour, and the former, according to Schneider, every shade from straw-yellow to dark-brown and from salmon-pink to dark blood-red. The uses of all the *Pterocarpus* given in this category are practically identical.

Note on Philippine Species. *Batukanāg* and *Salakin*. Except for a rather wide range of colour and variation in hardness, the woods of the larger trees of this genus are very uniform in appearance and structure, so that a description of the genus will give the principal characters of any species; *Salakin* is probably confused in the market with the *Aglaias*, and put to the same uses, for which from its beauty of colour and texture, hardness and resistance to insects, it is equally good; wood hard to very hard, heavy to very heavy, sap pink or pale red not very distinct from the pale red to deep coppery-red heart, grain often crossed and sometimes wavy, texture fine dense taking a very smooth surface under sharp tools, aromatically scented and exuding resin, rather difficult to work, the curly grain requiring a very sharp fine-set plane to surface it well; Durability II at least, sap rarely attacked by beetles, and heart even by termites; Uses, bridge- and wharf- building; favourites locally for house-building, posts, beams, joists, rafters, windows and sills, flooring, sheathing, ceiling; fine furniture and cabinet-work,

and would make beautiful strong moth-proof chests; Prices, rarely comes into the market except in occasional very small lots, though well known locally for their strength and durability. *Narra*. The three species are indistinguishable except by botanical characters; wood moderately hard to hard, moderately heavy, sap whitish perishable distinct, heart the most variable in colour of all well-known Philippine woods, from pale straw-colour through all possible shades of salmon, pink, and red to deep blood-red, and occasionally dull brown without any red tint, and, as far as known, the commercial classification of 'Red', 'Yellow', and 'White' is applicable only after the tree is felled and sawn; grain somewhat crossed frequently very wavy and curly, texture rather fine with fine uniform ripple-marks on tangential section (characteristically distinguishing it from *Tindalo*), faintly scented, easy to work; seasons well, checking and warping hardly at all; Durability II, very rarely attacked even by termites; Uses, by far the most widely known high-grade interior-finish furniture and cabinet wood in the Philippines; household implements; tool handles, saw-frames, try-squares, yard and meter sticks, rulers, dry-measures, musical instruments, carriage and automobile panels and dashboards, plain and carved jewel and clothes chests, canes, scabbards, carved picture-frames, railway ties (occasionally found in mixed lots), singlepiece round table-tops from buttress-roots; Prices, P/200 (for lighter coloured) to P/300 (for prime red) mc. (= Rs. 16½-27 cft.). *Sudiang*. (Tree up to 2 feet diameter, therefore larger than 531); wood hard to very hard, heavy to very heavy, sap pinkish-brown, heart darker and with almost black mottlings and streaks, contains much oil or resin and scented, grain straight, texture fine dense but rough, difficult to work; seems to season well; Durability I; Uses, piles, poles, posts, beams, joists, rafters, window-sills and windows, doors, floors; bridge- and wharf- building, paving blocks; furniture and cabinetwork; agricultural implements; tool handles, canes, treenails; Prices, not marketed, but worth as much as *Ipil*, i.e. P/150-200 mc. (= Rs. 12½-16½ cft.).

Uses of Madras Timbers recorded. 113. (An excellent wood but little known, red, extremely hard, close grained with a long fibre, smooth, often knotted); valuable for building, cabinetwork, furniture and carving. 120. (Wood bright red, dark-red or red-pink, fragrant, very strong, very hard, close grained smooth with a long fibre, fissile); excellent for building, spokes and felloes of

wheels, axe-handles. 127. (Wood dark red to dark brown much streaked with black, sapwood reddish-brown, very hard, fine and close grained, said to be used by natives for various purposes). 165. (Wood bright coppery- to dark- red, mottled and streaked with orange and pale to dark crimson sometimes nearly black, with satiny or coppery lustre, very hard and close grained, very durable, seasons very well, works and polishes admirably, certainly one of the finest and most beautiful woods in India); most valuable for furniture and inlaying. 180. (Wood light to dark brown with green yellow or red tints and mottled, hard, close grained, strong tough and durable, seasons well, works easily and takes a most beautiful polish; the pillars of the palace of the Maharajah of Sindhia at Oojein were of this wood); excellent for cabinet work and furniture, carriage- and cart- building especially shafts, poles and naves of wheels, agricultural implements especially ploughs. 184. (Wood dark purple with lake-red to black longitudinal lines and streaks, very hard, very strong fibrous close and fine grained, durable, seasons well, works easily and takes fine polish); principally and emphatically for cabinetwork and furniture, excellent, but too valuable, for large construction works and sleepers, sculpture and carving, turning, spokes and felloes of gun-carriages, boat-building especially kneed timbers, agricultural implements especially ploughs, knife- (especially Nepalese kukris) and tool- handles. 185. (Wood purplish-brown with longitudinal lines and streaks of purple and brown, much resembling the last (184) but always with a browner or redder tinge, extremely hard, very strong fibrous and close grained though sometimes coarse grained, durable, seasons well, fairly easy to work but not so easy as last; uses similar to last, with which till recently it has been considered identical). 189. (Wood yellowish, reddish, or brown, with darker streaks, very hard, close grained, strong, durable and weathers very well but is attacked by teredo, seasons well, not very easily worked but takes fine polish, apt to give out a yellow stain when damp); building, and as highly prized as Teak except for Hindu houses, especially posts, beams, planking, door and window frames and panelling, one of the best for venetians and weather-boards; excellent for cabinetwork and furniture, except where yellow staining liable to be objectionable; boat-building; cart-building, especially spokes and felloes, and temple-cars; railway sleepers and panelling; cotton-gins; agricultural implements.

Precis of Uses (deduced from above). Par excellence for cabinet-work, furniture, sculpture, carving, inlaying and fancyware (incl. high-grade furniture, ornamental chests, jewel-boxes and other boxes, carved scabbards and walking sticks, wood-engraving, single-piece tabletops from buttress-roots, etc.); major construction (except that it is so valuable for cabinetwork), bridge- and wharf-building (incl. piles, posts, poles, beams, planking, sleepers and paving blocks); carpentry (incl. poles, posts, beams, joists, rafters), joinery (incl. planking, flooring, ceiling, wainscoting and sheathing, interior finish, weather-boarding, door and window frames, panelling and venetians; railway panelling); ship-building (incl. kneed timbers, planking and decking, cabin-finish, treenails); wheel-wrightery (incl. poles, shafts, naves, spokes, felloes, carriage and automobile panelling and dash-boards; gun-carriage spokes and felloes); machinery (incl. cotton-gins, and parts subject to friction); turnery (incl. tool- and knife- handles, wooden tools, plane-boxes, sawframes, gunstocks, walking-sticks); agricultural implements (especially plough-shares); household implements; desk appliances (incl. mathematical instruments, try-squares, yard measures and other measuring sticks, rulers).

Localities and Vernaculars. 113. (WGTS: MBR-TVY: NLGS: Anms.) *Ta.* Ārralāngal, Attāidāli, Kāttuppūvaracu, Nīngal, Nīrkāngu; *M.* Irumbāga, Nīrōli, Nīrvāli, Vālmuriccal. 120. (NCCS: Agt: WGTS: KAN-TVY: MYS: Anms.) *U.* Priyongo; *Tl.* Erranduga, Kondanduga; *Ta.* Cokkalai, Kannikkombu, Kāragil; *M.* Bāyināvu, Punyāvu, Cempuli, Nīrmuli; *K.* Tottilakāyi. 127. (NCCS: MBR-TVY: scat.) *Tl.* Erravāludu, Vallarasi, Vālarasi, Vālavadi; *Ta.* Cattuvakku, Malaivirāli, Vālacura; *M.* Pērilāppiccu. 165. (TVY: TRV: com.) *Ta.* Cengurangī, Cengurāni, Cencandanam; *M.* Totappi. 180. (NCCS-esp. GJM: and Agt:; KNL-Nlms: MPLT: WGTS:) *U.* Bānd'hono; *Tl.* Bandanēgi, Adavicikkudu, Neimmi; *Ta.* Narivēngai; *M.* Maḷavēnna, Nēmi; *K.* Bettahonne, Malehonne, Nāyihonne. 184. (Most districts, better forests) *U.* Sisuā; *Tl.* Cittēgi, Jittēgi, Irugudu; *Ta.* Ītti, Karundōrviral, Nūkkū, Tōdagatti; *M.* Ītti, Cōlavitti, Kāritti, Ulmalavitti, Vitti; *K.* Bīte, Ibadi, Tōdagatti. 185. (WFTS: NLGS-TVY: MRA: outer hills) *Ta.* Iruvadi, Tōdagatti; *M.* Irupputtu, Ītti, Puramalavitti; *K.* Bīte. 189. (Most districts, better forests) *U.* Piyāsālo; *Tl.* Vēgisa, Yēgi, Vēngi; *Ta.* Vēngai; *M.* Vēnna; *K.* Honne, Ollehonne, Bēnga.

V.—MOSTLY VERY HARD

B.—MOSTLY REDDISH

N. *30. Lancewoods

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
44. <i>Poeciloneuron</i> indi- cum (incl. pauci- florum) ...	60	928	3	2	1	3	II	R-DkR-DkRB-BkR.
73. <i>Heritiera</i> papilo ...	57	...	3	1	1	3	II	R-DkR.
81. <i>Berrya</i> ammonilla ...	54	818	3	2	1	4	III	PkB-DkR.
154. <i>Erioglossum</i> edule ...	...	...	4	1	2	4	III	(H) PkB-Choc. RB.
157. <i>Nephelium</i> longana ...	58	1061	4	1	2	2	II	(H) PkR-RB.
158. <i>Nephelium</i> stipula- ceum ...	60	968	4	1	2	3	II	PkW-BtRB.
192. <i>Cassia</i> fistula ...	61	827	4	2	2	2	III	YW-YR-DkBrkR.
193. <i>Cassia</i> marginata ...	61	798	4	2	2	3	III	PkY-LtPkB.
227. <i>Albizzia</i> amara ...	62	1284	4	1	1	2	II	YW-DkB-DkPplB.
241. <i>Anogeissus</i> latifolia ...	62	925	3	2	1	2	II	YW-LkB-DkPplB.
280. <i>Homalium</i> tomento- sum ...	59	927	3	1	2	4	II	PkY-PkB.YB-Choc. RB.
Imported Species								
Lancewood (Guiana) ...	52	964	...	...	...	...	...	Y-I kB.
Cape Lancewood, Assegai Wood.	56	...	...	...	...	...	...	LtR.
Philippine Species.								
Malugay ...	48	776	...	...	...	...	...	LtR.
Aranga ...	64	996	...	...	...	...	...	Y-Pk-LtR-Choc. RB.
Agoho (Casuarina) ...	58	814	...	...	...	...	...	LtBW-LtRB-DkRB.

Agōho (incl. Mountain Agōho) (Casuarina = cult. only); Alupāg (incl. Alupāgamō, Bulāla) (Euphoria, Litchi, Nephelium = 158); Arānga (Homalium = 280); Bunōg (Garcinia = 44); Malūgay (Pometia = 154, 157).

Under 1 foot diameter:—Madras. 678. *Rhodomyrtus tomentosa*.

European. Cornel, or Dogwood (*Cornus mas*).

Strength.

Tensile Strength:—Lancewood = 23.4; Casuarina (Agōho) = 21.9.

Precis of Uses (deduced from above). Par excellence for cabinet-work, furniture, sculpture, carving, inlaying and fancyware (incl. high-grade furniture, ornamental chests, jewel-boxes and other boxes, carved scabbards and walking sticks, wood-engraving, single-piece tabletops from buttress-roots, etc.); major construction (except that it is so valuable for cabinetwork), bridge- and wharf-building (incl. piles, posts, poles, beams, planking, sleepers and paving blocks); carpentry (incl. poles, posts, beams, joists, rafters), joinery (incl. planking, flooring, ceiling, wainscoting and sheathing, interior finish, weather-boarding, door and window frames, panelling and venetians; railway panelling); ship-building (incl. kneed timbers, planking and decking, cabin-finish, treenails); wheel-wrightery (incl. poles, shafts, naves, spokes, felloes, carriage and automobile panelling and dash-boards; gun-carriage spokes and felloes); machinery (incl. cotton-gins, and parts subject to friction); turnery (incl. tool- and knife- handles, wooden tools, plane-boxes, sawframes, gunstocks, walking-sticks); agricultural implements (especially plough-shares); household implements; desk appliances (incl. mathematical instruments, try-squares, yard measures and other measuring sticks, rulers).

Localities and Vernaculars. 113. (WGTS: MBR-TVY: NLGS: Anms.) *Ta.* Ārralangal, Attaidāli, Kāttuppūvaracu, Ningal, Nirk-kāngu; *M.* Irumbāga, Nīrōli, Nīrvāli, Vālmuriccal. 120. (NCCS: Agt: WGTS: KAN-TVY: MYS: Anms.) *U.* Priyongo; *Tl.* Erranduga, Kondanduga; *Ta.* Cokkalai, Kannikkombu, Kāragil; *M.* Bāyināvu, Punyāvu, Cempuli, Nīrmuli; *K.* Tottlakāyi. 127. (NCCS: MBR-TVY: scat.) *Tl.* Erravāludu, Vallarasi, Vālarasi, Vālavadi; *Ta.* Cattuvakku, Malaivirāli, Vālacura; *M.* Pēril-lāppiccu. 165. (TVY: TRV: com.) *Ta.* Cengurangi, Cengurāni, Cencandanam; *M.* Totappi. 180. (NCCS-esp. GJM: and Agt:; KNL-Nlms: MPLT: WGTS:) *U.* Bānd'hono; *Tl.* Bandanēgi, Adavicikkudu, Nemmi; *Ta.* Narivēngai; *M.* Maḷavēnna, Nēmi; *K.* Bettahonne, Malehonne, Nāyihonne. 184. (Most districts, better forests) *U.* Sisūā; *Tl.* Cittēgi, Jittēgi, Irugudu; *Ta.* Ītti, Karundōrviral, Nūkkū, Tōdagatti; *M.* Ītti, Cōlavitti, Kāritti, Ulmalavitti, Vitti; *K.* Bīte, Ibadi, Tōdagatti. 185. (WFTS: NLGS-TVY: MRA: outer hills) *Ta.* Iruvadi, Tōdagatti; *M.* Īrupputtu, Ītti, Puramalavitti; *K.* Bīte. 189. (Most districts, better forests) *U.* Piyāsālo; *Tl.* Vēgisa, Yēgi, Vēngi; *Ta.* Vēngai; *M.* Vēnna; *K.* Honne, Ollehonne, Bēnga.

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154. <i>Erioglossum</i> edule ...	...	...	4	1	2	4	III	(H) PkB-Choc. RB.
157. <i>Nephelium</i> longana.	58	1061	4	1	2	2	II	(H) PkR-RB.
158. <i>Nephelium</i> stipula- ceum.	60	968	4	1	2	3	II	PkW-BtRB.
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193. <i>Cassia</i> marginata ...	61	798	4	2	2	3	III	PkY-LtPkB.
227. <i>Albizzia</i> amara ...	62	1284	4	1	1	2	II	YW-DkB-DkPplB.
241. <i>Anogeissus</i> latifolia.	62	925	3	2	1	2	II	YW-LkR-DkPplB.
280. <i>Homalium</i> tomento- sum.	59	927	3	1	2	4	II	PkY-PkB.YB-Choc. RB.
Imported Species								
Lancewood (Guiana) ...	52	964	...	...	...	...	...	Y-l kR.
Cape Lancewood, Assegai Wood.	56	...	...	...	...	...	...	LtR.
Philippine Species.								
Malugay ...	48	776	...	...	...	...	...	LtR.
Aranga ...	64	996	...	...	...	...	...	Y-Pk-LtR-Choc. RB.
Agoho (Casuarina) ...	58	814	...	...	...	...	...	LtBW-LtRB-DkRB.

Agōho (incl. Mountain Agōho) (Casuarina—cult. only); Alupāg (incl. Alupāgamō, Bulāla) (Euphoria, Litchi, Nephelium=158); Arānga (Homalium=280); Bunōg (Garcinia=44); Malūgay (Pometia=154, 157).

Under 1 foot diameter:—Madras. 678. *Rhodomyrtus* tomentosa.

European. Cornel, or Dogwood (*Cornus mas*).

Strength.

Tensile Strength:—Lancewood=23.4; Casuarina (Agōho)=21.9.

Crushing Strength :—Arānga =12.4 ; Malūgay =8.1 ; Casuarina =7.4 ; 81. Berrya =7.7.

Shearing Strength :—Arānga =1038 ; Malūgay =980 ; Casuarina = ? 81. Berrya =830.

Elasticity modulus :—Arānga =2419 ; Malūgay =1788 ; Casuarina =1970 ; 81. Berrya =1296-1689, Av. 1493 ; 241. Anogeissus =1702-2065, Av. 1884 ; Average taken for Category =1911.

Compared with Oak 100 :—Arānga							
		Malū-	Casua-	Ber-	Ano-	Cate-	
Strength	...	160	gay	rina	rya	geissus	gory
Stiffness	...	142	125	131	132	149	151
Toughness	...	187	105	115	87	110	112
			150	200	202	204	

General Description. Mostly moderate sized trees ; Wood usually from pinkish-brown through all shades of red to the deepest red or red-brown (Lancewood and the sapwood of some species yellowish) ; Very hard (154, 157 merely hard), eminently tough, elastic, grain usually straight sometimes slightly crossed and with a regular wave, texture fine dense smooth, often rather difficult to work but taking a fine surface ; Seasons well usually (44 difficult to season in log, but seasons well if sawn up green) ; Durability I-II, rarely attacked by beetles except occasionally the sapwood ; P=948 ; Wt. 54-62, Av. 59 ; Rays f-f (73, 81-m) ; Pores m (192, 193-L-m ; 157, 241, 280, Guiana and Cape Lancewoods and Arānga-s ; Malūgay m-s) ; VC.=II.

Note on Imported and European Species. The Lancewood of Guiana, the West Indies and Brazil appears to be derived from at least two different medium sized trees of the family Anonaceæ (*Orophea virgata* and *Duguetia quitarensis*) ; like most of this family (see N.*16—Ashes) the wood is pale coloured from yellowish to pinkish-brown, and very elastic ; it is mostly used by coach-builders for shafts, poles, etc., requiring an elastic wood, and tough at the same time. The Cape Lancewood, or Assegai wood, (*Curtisia faginea*) is of light red colour with a grain like ordinary Lancewood, very tough and elastic, it is used for wheel spokes, shafts, wagon rails, for shafts for assegais or javelins, and for turners' work. The Cornel or Dogwood (*Cornus mas*) is a large shrub or small tree growing throughout Europe and North Asia, with reddish-white wood, one of the hardest, toughest and most homogeneous of European woods ; it is used for tool and fork handles, for small parts of machines, for ladder rungs, for hoops, for skewers, for

walking sticks, and also for poles and props for vines and other crops.

Note on Philippine Species. *Agōho*. The species of this genus seem to have the same structure and general properties ; wood very hard, heavy to very heavy, sap pale brown gradually merging into, or distinct from, the light to dark red-brown heart with irregular dark and light belts, grain straight but with very regular short waves, texture fairly fine, difficult to work and surface but tough and working smooth ; Durability at least II, even sap rarely attacked by insects ; Uses, piling, ties, paving blocks, poles, house-posts, bridge- and wharf- construction, beams, joists, rafters, window-sills, handles ; Prices, about P/100 mc. (—Rs. 8½ cft.), but not now on the Manila market. *Alupāg*. Wood of *Alupāgamō* and *Bulāla* practically identical with *Alupāg* ; very hard, very heavy, sap gradually merging from pale reddish into light coppery-red or dark-reddish-brown heart, grain slightly crossed and often wavy, texture fine dense and very smooth, difficult to work but taking a fine surface under sharp tools ; seasons well ; Durability I, very rarely attacked by insects ; Uses, posts and sills, beams, joists, rafters, flooring, burrs in native rice-mills, teeth of cogwheels, in primitive sugar-mills, presses, etc., bearings, wooden anchors, combs, treenails, harrow teeth and other parts of agricultural implements ; Prices P/100-150 mc. (—Rs. 8½-12½ cft.). *Arānga*. The general appearance, mechanical properties and structure of all species are very much alike, except for certain variations in colour and density, which seem partly due to local conditions and not to specific differences (see N.*20, and Malapīnggan N.*26) ; wood hard to very hard, heavy, sap distinct from or merging into the heart, yellowish pinkish or pale red or small heart of red or chocolate-brown, grain straight or slightly crossed, texture very fine dense and smooth, hard to saw but not difficult to shape or surface ; seasons fairly well checking and warping but little ; Durability I, rarely attacked by termites and but slowly by teredo ; Uses, piling, ship- wharf- and bridge- building, posts, sills, poles, ties, paving blocks, floors, interior finish, sash, furniture and cabinetwork ; Prices, P/110-180 mc. (=Rs. 9-15 cft.). *Bunōg* (see Basān, N.*26, 27 ; Malabunōg, N.*21) ; wood very hard, heavy to very heavy, sap yellow distinct from the reddish-brown heart, grain straight, texture fine dense glossy, hard to saw but not otherwise difficult to work ; seasons without warping but liable to split at

ends; Durability II at least, these red varieties have especially a good reputation for posts; Uses, poles, posts, ties, paving blocks, beams, joists, rafters, flooring, piling; Prices, much used locally for house construction, but rare in Manila market, hence no fixed price. *Malāgay*. Although varying in mechanical properties and general appearance, the wood has several features in common with the structure of *Alupāg*, *Alupāgamō* and *Bulāla*; moderately hard to hard, flexible and tough, moderately heavy, sap scarcely distinct, pale reddish deepening towards the centre to light red or dark reddish-brown, grain somewhat crossed often with a regular wave, texture fine smooth, fairly easy to work; seasons well; Durability III, sap attacked by beetles but clear heart usually untouched; Uses, posts above stumps, beams, joists, rafters, flooring, sheathing, ceiling, other interior finish, boat-building, masts and spars, ax pick rack and hoe handles, levers, capstan bars, peavies, etc., minor tool handles, furniture and cabinet work, recommended for trial for tight cooperage and gymnastic apparatus; Prices, P/100-120 mc. (=Rs. 6½-10 cft.).

Uses of Madras Timbers recorded. 44. (Valuable dark red timber, very hard); rice-pounders, very suitable in appearance for sleepers and paving blocks. 73. (Very hard, close grained, strong tough durable); building, houseposts, rafters, bridge-piles, boats, cart-poles, agricultural implements. 81. ('Ceylon Lancewood,' one of the best woods in Ceylon, tough and flexible, close grained, very durable but liable to split); boat-building, axles, poles and shafts of carts and carriages, ploughs and other agricultural implements. 154. (Strong and durable); house-building. 157, 158. (Wood red, hard to very hard, durable, takes fine polish, little used); good for furniture. 192. (Wood with copious sapwood liable to be attacked by insects if not well seasoned, heart brick-red to red-brown, very strong, tough, elastic, rather coarsely fibrous but close grained, very durable, apt to crack and to splinter, works easily and takes fine polish); house-building especially posts, boat-spars, cart-axes, agricultural implements especially ploughs, bed-plates for machinery, rice-pounders, bows. 193. (Wood deep rose-pink becoming reddish-brown, very hard, close grained, durable, works easily and takes good polish); well adapted for turnery, naves of wheels, handles of instruments. 227. (Wood with large sap, heart purplish-brown with alternate light and dark bands and beautifully mottled, superior to Teak and Sal in transverse strength and direct cohesive power,

strong and tough, fibrous and close grained, very durable, usually cut merely for fuel); buildings, beams, etc., construction of carts and ploughs, beautiful wood for cabinetwork. 241. (Wood yellowish-grey with small irregular purplish-brown heart, very strong, very tough, very superior for sustaining cross-strain, very durable if properly seasoned, but sap decays rapidly if left exposed in the forest to the weather when it is soon attacked by white-ants and insects, warps and splits in seasoning); house-building ship-building, cart-building being one of the best for poles and axles, excellent for poles for carrying loads, good for furniture, also for axe and tool handles, and agricultural implements, only moderate for sleepers. 280. ('Moulmain Lance Wood' wood brown to very dark red-brown, very close grained, durable, splits in seasoning, takes very fine polish); furniture, teeth of harrows.

Precis of uses (deduced from above). Major construction; bridge- and wharf- building (incl. piles, poles, sills, sleepers, paving blocks); ship-building (incl. masts and spars, oars, rudders, wooden anchors, treenails); carpentry (incl. poles and posts, beams, joists, rafters), joinery (incl. floors, ceiling, sheathing and wainscoting, doors, window-sills, sash, interior finish, posts and rails); machinery (incl. bed-plates, burrs and cogs in rice-mills and sugar-mills, presses); wheel-wrightery (incl. shafts, poles, axles, naves, spokes and felloes, of carriages and carts); furniture and cabinetwork: turnery (incl. handles of tools, such as axe, pick, rake, fork, hoe; levers of all sorts, capstan bars, peavies; ladder-rungs; bows and lance or javelin shafts; gymnastic apparatus); cooperage (staves, etc., for tight cooperage, hoops); agricultural implements (especially ploughs and harrow teeth); household implements (incl. rice-pounders, shoulder-poles); all uses requiring toughness and elasticity.

Localities and Vernaculars. 44. WGTS: KAN-TVY: rvrs.) *Ta.* Pūdangōli; *M.* Pūtankalli, Vayila, Pulivayila; *K.* Balige, Karbalāyi. 73. (WGTS: MBR-TVY: sholas) *Ta.* Cāundarigai, Cavandalaiyunnu, Cōlaivendēkku. 81. (MBR-TRV: rare) *Ta.* Cavandalai, Tirukkōnamalai; *M.* Kolla. 154. (NCCS: SLM: scat.) *U.* B'homuniā, Muktimāyā; *Tl.* Ishikarāsi, Tavati, Undurungu; *Ta.* Kōrali, Manippungu. 157. (WFTS: KAN-TVY: MYS: Anms., com.) *Ta.* Pūvam, Kāttuppūvam, Varattarbūvam; *M.* Pūvan, Malappūvan, Cempūvan, Porippūvan, Mullai; *K.* Kānakantali, Malahākuta. 158. (WFTS: MBR: TRV: Anms., com.) *Ta.* Kānamayilai; *M.* Pūvan, Kalpūvan, Kānamaylia, Pāyivirimuli. 192

(Most districts, dry forests) *U. Sunāri*; *Tl. Rēla*; *Ta. Konrai*, Carakkonrai; *M. Konna*; *K. Kakke*, Konde. 193. (SAC-TVY:) *Tl. Simarēla*; *Ta. Cengonrai*, Cimaikkonrai, Civappukkonrai, Kāttukkonrai; *M. Kāttukkonna*. 227. (Most districts, dtts.) *Tl. Cigarū*, Cīkarēni, Nallarēgu, Nallangi; *Ta. Turincil*, Uncil, Ucil; *M. Cūlivāka*; *K. Sujjalu*, Tuggali, Belukambi. 241. (Most districts, deciduous dry forests) *U. D'hoū*; *Tl. Cirimānu*, Sirikana, Velama; *Ta. Vellaināgai*, Vekkāli, Namai, Vellainamai; *M. Vellanāvu*, Malakkānniram, Marukkānniram; *K. Bejjalu*, Dindalu, Dindiga, Tirapu. 280. (NCCS : GJM :) (Name not known.)

V.—MOSTLY VERY HARD

B.—MOSTLY REDDISH

N. *31. Greenhearts

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
72. <i>Heritiera littoralis</i> ...	65	903	4	1	1	3	II	LtRB-DkRB-Choc. RB.
318. <i>Bassia latifolia</i> ...	62	687	2	1	1	2	I	PkR-DkRB.
319. <i>Bassia longifolia</i> ...	61	737	3	2	1	3	III	(M-H) PkR-DkRB.
321. <i>Mimusops elengi</i> ...	62	632	3	1	1	3	II	LtR-DkR-DkRB.
322. <i>Mimusops Roxburghiana</i> .	62	834	3	1	1	3	II	LtR-DkR-DkRB.
323. <i>Mimusops hexandra</i> .	67	998	4	1	1	2	II	LtR-DkCl. R-PplBk.
664. <i>Parinarium indicum</i> (incl. <i>travancoricum</i>).	49	803	5	3	1	3	III	(M-H) PkR-expo. PkW-LtR.
<i>Imported Species.</i>								
Greenheart ...	64	1217	...	...	...	...	...	Y-DkB.
<i>Philippine Species.</i>								
Dungon (same as 72) ...	60	951	...	...	...	...	...	see 72 above.
Bansalagin (same as 321) ...	62	804	...	...	...	...	...	see 321 above.
Bētis ...	55	603	...	...	...	...	...	LtR-DkRB.
Liūsin ...	53	633	...	...	...	...	...	LtR-often stk. DkR.

Bansalāgin (incl. Duyokdūyok) (*Mimusops* = 321, 322, 323); Bētis (*Bassia* = 318, 319); Dūngon (incl. Dūngonlāte) (*Heritiera* and *Tarrietia* = 72); Liūsin (incl. Tabontābon) (*Parinarium* = 664).

Under 1 foot diameter :—(None).

Strengths.

Tensile Strength :—Liūsin = 14.7.

Crushing Strength :—Greenheart = 10.8-12.4, Av. 11.6; 72. *Heritiera* (Dūngon) = 6.6-9.4, Av. 8.0; Bētis = 6.4; 321. *Mimusops* (Bansalāgin) = 8.6; Liūsin = 5.2; Across the grain :—Dūngon = 2100.

Shearing Strength:—Dūngon (72) = 1253-1275, Av. 1264; Bansalāgin (321) = 1098; Bētis = 1168; Liūsin = 886.

Elasticity modulus:—Greenheart = 1200; Dūngon (72) = 1651-2209, Av. 1930; Bansalāgin (321) = 2311; Bētis = 1593; Liūsin = 1896; 318. Bassia = 1490; Average taken for Category = 1932.

Compared with Oak 100:—

	Greenheart	Dūngon (72)	Bētis	Bassia (318)	Bansalāgin (321)	Liūsin	Category
Strength	... 196	150	97	110	130	102	133
Stiffness	... 70	113	93	87	135	111	113
Toughness	... 549	199	101	140	125	94	156

General Description. Large or moderate sized trees; Wood mostly of darker shades of red or red-brown (664 paler, Greenheart yellow to dark brown); Very hard (319, 664, moderately hard to hard); very tough and elastic or flexible, grain straight or crossed sometimes very wavy and curly, texture fine dense and smooth or glossy, usually difficult to work and dulling tools; Seasons as a rule with much difficulty, logs and large pieces liable to split badly, and sawn lumber requiring to be carefully piled and weighted to prevent warping; Durability I (319-II; 664-III), the great feature being that all resist the teredo well (the great feature of Greenheart); P=828; Wt. 49-65, Av. 61; Rays f-f (72-m); Pores m-s. (72, 664=L-m); VC=I.

Note on Imported Species. The Greenheart (*Nectandra Rodiaei*) is a large tree of British Guiana; the wood is from yellow to dark brown, hard, heavy, close grained, and very durable, and its greatest property lies in its resistance to the teredo, as well as the white-ant; owing to this property it ranks among the first class timbers for planking vessels, wharves, piles, and all structures under water; it is however very liable to split, and in sawing it has to be bound with chains to prevent its splintering.

Note on Philippine Species. *Bansalāgin*, *Bētis*. Wood of Duyokdūyok appears to be identical with Bansalāgin except that it seems to be as a rule lighter in colour; the wood is much the same as in, but all elements finer and cross-section (like all other surfaces) glossier when cut with a sharp tool than in, Bētis; hard to very hard, heavy to very heavy, sap distinct pale red, heart deep rich red to red-brown, grain straight or, in Bētis, slightly crossed, texture dense smooth and (not in Bētis) glossy under sharp tools, hard to saw but not otherwise difficult to work; liable to split badly

if not carefully seasoned, large timbers especially liable to check internally, but seasons well in boards; Durability I, sap somewhat inferior but heart not attacked by termites even and very slowly by teredo; Uses, Wharf-bridge- and ship-construction, posts, foundation sills, turned and shaped tool handles, ties, paving blocks, and Bansalāgin is an especial favourite for ships' wheels, marine spikes, fine tool handles, and all objects where both for looks and for wearing properties a dense fine wood is required; Prices, P/150-200 mc. (=Rs. 12½-16½ cft.). *Dūngon*. The wood of Dūngonlāte is practically indistinguishable from Dūngon, and is put to the same uses; very hard, very tough and flexible but not resilient, heavy, sap pale reddish-brown distinct in mature trees, heart dark reddish-brown to chocolate-brown, odor of old leather, grain crossed and sometimes curly, texture fine dense smooth but not glossy, difficult to work both because of its hardness and also because it dulls tools badly; seasons with difficulty, logs and large timbers liable to split deeply in seasoning, boards less liable to split but must be piled carefully and loaded to prevent warping; Durability I, sap rapidly attacked by both insects and fungi, but heart rarely attacked even by termites and very slowly by teredo; Uses, piling, posts, foundation sills, ties, paving blocks, bridge-wharf- and ship-building, beams, joists, rafters, hubs, spokes, felloes, axles, capstan bars, other levers, ax-pick- and other tool-handles, mallets and other wooden tools, recommended for bent work (steamed) where strength and durability are required; Prices, P/150-220 mc. (=Rs. 12½-18½ cft.). *Liūsin*. Wood of all species is practically identical; hard, heavy, sap indistinct, pale red sometimes concentrically banded (these are not annual rings), faint acid odor, grain straight or slightly crossed often with a characteristic wave, texture dense fine, very difficult to work owing to dulling tools rapidly; seasons without much checking, but warps considerably; Durability in contact with ground or exposed to weather poor, but one of the best woods known for resisting teredo, and very rarely attacked by insects; Uses, salt-water piling (tops given as soon as possible a thorough coating of paint or hot tar), impregnated ties and paving blocks, posts above stumps, and general framing under cover, keels, etc., splendid flooring except difficulty in planing; Prices, P/100-140 mc. (=Rs. 8½-11½ cft.).

Uses of Madras Timbers recorded. 72. (Very hard, close grained, strong, tough and durable); building, houseposts, rafters, bridge-piles,

boats, cart-poles, agricultural implements. 318. (Strong, close and even grained, tough, durable but sap attacked by whiteants, seasons well, not easily worked); building, door-panels and frames, country boats, sleepers, furniture, naves of wheels, but only little used being especially kept for spirit from the flowers. 319. (Wood very flexible, straight-grained, durable and scarcely inferior to Teak in that respect); building and houseposts, bridges, ship-building, keels, planking below the waterline, treenails, furniture, cart-building where strength is required. 321. (Strong, close and even grained, durable, of good colour and quality, takes a good polish, one of the best woods in the dry Carnatic evergreen forests, as is 323, and these two may be said to be the best woods of the laterite hills of Nellore and similar adjoining districts); house-building, cabinet-work, carts especially shafts, rice-pounders, furniture. 322. (Strong, rather coarse grained, durable, easily worked); house-building, gunstocks. 323. (See 321; strong, tough, close and even grained, very durable especially under saltwater, piles in two cases being found sound after 100 and 135 years); house-building especially posts and decorative fittings, oil-presses, sugar-mills, furniture, excellent for turning, tool-handles, etc. 664. Close and even grained; no other remarks on quality or uses).

Precis of Uses (*deduced from above*). Resists teredo for many years, and, in this connection, see also 276. *Sonneratia* -N. * 9, 274, 275. *Lagerstroemia* -N. * 11, 384. *Vitex* -N. * 13, 280, 281. *Homalium* -N. * 20 and 30, 674. *Lumnitzera* -N. * 26, 113. *Filicium* and 120. *Aglaia* and 127. *Walsura* -N. * 29, and 220. *Acacia* and 254. *Eugenia* and 667. *Rhizophora* and 670, 671. *Bruguiera* -N. * 34; Wharf- and bridge- construction (incl. piles, posts, foundation sills, beams, sleepers, paving blocks); ship-building (incl. keels, planking below the waterline, capstans, ships' wheels, marline spikes, treenails); house-building, carpentry (incl. posts, poles, beams, rafters, joists), joinery (incl. flooring, door frames and panels); machinery (incl. oil-presses, sugar-mills); wheel-wrightery (incl. hubs, spokes, fellos, axles, shafts, steamed bent-wood work); cabinetwork and furniture; turnery (incl. fine tool handles, axe-pick- and other handles, mallets and other wooden tools, levers of all kinds, gunstocks); household implements (incl. rice-pounders); agricultural implements.

Localities and Vernaculars. 72. (CNTC: WTCT: litl., sswp.) *Ta.* Conmundiri, Kannādiylai; *M.* Mukuram, Nākam. 318.

(NCCS: DKN: MPLT: CNTC: deciduous forests) *U.* Mohulo; *Tl.* Ippa; *Ta.* Iluppai, Kāttiluppai; *M.* Irippa, Kāttirippa, Pū, Pūvuma; *K.* Ippe, Doddippe, Hālippe. 319. (WFTS: KAN-TVY: MYS-SLM:) *Ta.* Iluppai, Nātiluppai; *M.* Irippa; *K.* Ippe, Sannayippe, Hūli. 321. (Most districts, rvrs., scat.) *U.* Bokulo, Boūlo, K'hyiri; *Tl.* Pogada, Vakulamu, Nemmi, Nunni; *Ta.* Magil, Ilanci, Vagulam; *M.* Ilanni, Bakulam; *K.* Renje, Pagada. 322. (NLGS: Aums: WFTS: scat.), 323. (NCCS: MPLT: COCT-CNTC: degn.) *U.* K'hyiri, Rājono; *Tl.* Pāla, Mancipāla, Nemmi, Nunni; *Ta.* Kanuppālai, Karumbālai, Pālai, Ulakkaippālai, Cukkīlam; *M.* Pāla; *K.* Renje, Kalhāle, Bakula. 664. (NLGS-TVY: esp. Wnd., sholas) (Names not known).

V.—MOSTLY VERY HARD

C.—MOSTLY BROWNISH OR YELLOWISH.

N. * 32. Turkey Oaks

NAMES	w.	P.	S.	D.	U.	A.	VC.	(H) and Col.
236. <i>Terminalia chebula</i> (incl. <i>pallida</i>)	61	1020	4	3	1	3	III	YB-GnB-ctr. DkPpl.
236. (<i>bis</i>). <i>Terminalia travancorensis</i> .	51	1012	3	3	2	4	III	Y-LtB.
237. <i>Terminalia arjuna</i>	55	813	1	3	1	3	II	PkW-PkB stk. DkB.
238. <i>Terminalia tomentosa</i> .	60	768	2	3	1	2	II	(H-VH) PkYB mot. B.Bk.
240. <i>Terminalia paniculata</i> .	54	652	3	3	2	2	III	YW-GyB-LtB mot. DkB.
273. <i>Lagerstroemia parviflora</i> .	52	612	3	3	1	2	II	YW-YB-GyB-YRB.
<i>European Species</i>								
Turkey Oak...	58	...	3	3	1	3	III	YB-PkB veined. DkB.
<i>Imported Species</i>								
African Oak, Turtosa	60	954	...	...	...	...	...	DkY-GyB.
Johore Teak	66	1213	...	...	...	...	...	LtB-DkB.
West Indian Broadleaf	48	...	...	...	...	...	...	GyB-LtB mot. DkB.
<i>Philippine Species</i>								
Sacat...	43	636	...	...	...	...	...	YW-DkY-YB.
Calumpit	...	...	...	...	...	...	...	YW-LtB-LtRB.

Calumpit (incl. Binggās, Talisay) (*Terminalia* = 236, 237, 238);
 Sacat (incl. Dalinsī, Talisay-gubat) (*Terminalia* = 236-*bis*, 240,
 273).

Under 1 foot diameter. (None).

Strengths.

Tensile Strength :—African Oak = 21.0 ; Calumpit = 10.4.

Crushing Strength :—African Oak = 9.3 ; Broadleaf = 7.5.
 Sacat = 7.1.

Shearing Strength :—Sacat = 850.

Elasticity modulus :—African Oak = 1726 ; Johore Teak = 2167 ; Sacat = 1886 ; 236. *Terminalia* = 1436 ; 238. *Terminalia* = 1858 ; Average taken for Category = 1727.

Compared with Oak 100 :—	African Oak	Johore Teak	Sacat	236. <i>Ter-</i> <i>minalia</i>	238. <i>Ter-</i> <i>minalia</i>	Cate- gory
Strength	154	195	102	197	124	131
Stiffness	101	127	110	84	109	101
Toughness	234	300	95	162	141	200

General Description. Large to moderate sized trees ; Wood various shades of yellow and brown, often beautifully mottled with lighter and darker shades of brown and reddish purplish or blackish brown ; Very hard (238 hard to very hard), very tough, grain straight to crossed wavy or curly, texture rather coarse to fine and smooth, usually easy to work ; Seasons well ; Durability III, uncertain even in different trees in the same species, sometimes very durable (considerably above the figure given), at other times only moderately so, heart not attacked by beetles, but sap poor ; P = 818, very variable (236 from 825 to 1230, and 238 from 615 to 1010) ; Wt. 51-61, Av. 56 ; Rays f,ff, numerous (Turkey Oak and African Oak = m, very numerous and brown) ; Pores L-m (Turkey Oak LL-s ; 236, 236-*bis* = m-s ; African Oak and Johore Teak = s) ; VC. = II. *Note.*—Sometimes 238 is called 'Walnut', with which in beauty of colouring it agrees very well when nicely finished ; but it is much heavier, harder and stronger, and from these qualities it approximates far more closely the 'Turkey Oak', of which it is a very fine-coloured class, as are also some of the others.

Note on European Species. The Turkey Oak (*Quercus cerris*) occurs in Southern and South-Central Europe, being cultivated in other parts of Europe, and extends to Asia Minor and North Syria ; the sapwood is yellowish-white and very liable to attacks of insects, the heartwood is a deep fawn-yellow tinted with pink and veined with dark brown from the rays which, though not nearly so broad as in Common Oak, are very numerous ; it is very hard, very fibrous, nearly non-fissile, durable, but only when not exposed to damp and atmospheric changes, apt to split in drying ; when it grows in mixture with Common Oak, it is preferred to the latter species ; it is used largely in naval construction, in carpentry, and also for vine-props.

Note on Imported Species. The African Oak, African Teak, or Turtosa (*Oldfieldia africana*) is neither an Oak nor a Teak, properly speaking, being an Euphorbiaceous tree, imported in considerable

quantities into England from Sierra Leone, where it grows to a large tree; the wood is rather dark yellow to greyish-brown, very hard, dense but brittle, the sapwood is perishable, and the heartwood is somewhat liable to borer and does not resist teredo; it splits much internally in seasoning, and in plank is liable to warp unless carefully seasoned, and it absorbs moisture which on drying out renders it again liable to split; it is nevertheless used much in ship-building, especially for beams, keelsons, waterways, and shelf-pieces, but especially in steamboats as it will stand great heat in the wake of fires provided there is a free current of air, for it decays rapidly in confined situations. The Johore Teak (believed to be *Tectona Hamiltoniana*) is much harder and heavier than the ordinary Teak, and is of a light to dark brown colour, close grained; it is said to be well adapted for permanent sleepers on railways, beams, piles, and engineering purposes generally; piles in a comparatively good state of preservation exist on the site of the old town of Johore, which has been abandoned upwards of 100 years. The Broad-leaf, or Almond tree, of Jamaica (*Terminalia latifolia*) is a large tree, much resembling the Persian Almond of this country (*Terminalia catappa*—the Talisay of the Philippines); it is imported into England, where the wood is used for beams and scantlings, boards, shingles and staves.

Note on Philippine Species. *Calumpit, Talisay, Binggās.* Woods of this genus appear to fall into three groups, although the line between them is not markedly fixed; first, is the Talisay group, the most durable and richest coloured; next is the Sācat group, not quite so durable nor so finely coloured; lastly the Kalamansākat, group (see N.* 17), much less durable, rather coarse, and dull coloured (1) wood moderately hard to hard, moderately heavy to heavy, sap in young trees whitish large, in old trees hardly distinct from the heart, which is from light to dark brown or reddish- or purplish-brown with irregular darker and lighter belts, streaks or mottlings, grain straight (Binggā-) to crossed wavy or curly (Talisay), texture fine smooth (Binggās) to rather coarse (Talisay), easy to work; seasons well; Durability III at least, even sap not attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, sheathing, ceiling, furniture, cabinet-work; Prices, P/80-100 mc. (=Rs. 6½-8½ cft.). (2) *Sācat, Dalinsī, Talisay-gūbat.* Wood moderately hard to hard, moderately heavy, sap yellowish to light yellowish-brown not very distinct, heart yellowish- reddish- or dark- brown,

grain straight or somewhat crossed and curly, texture coarse (Talisay-gūbat) or fairly fine and smooth (Sācat) or glossy (Dalinsī), easy or not difficult to work; seasons well; Durability III, not attacked by beetles; Uses, posts above stumps, beams, joists, rafters, flooring, sheathing, furniture, cabinetwork; Prices, P/80-100 mc. (=Rs. 6½-8½ cft.).

Uses of Madras Timbers recorded. 236. (Strong but variable, fairly durable but uncertain sometimes lasting excellently and at others developing dryrot, close but cross grained, difficult to work but takes fine polish); house-building, beams, rafters, railway sleepers (uncertain), ship- and boat- building, excellent for furniture and cabinetwork, carts and agricultural implements; not much felled, being mostly kept for Myrobalans. 236 (bi-). (Little known, has the appearance of good sound timber, but not used). 237. (Brown variegated with darker coloured streaks, very hard, apt to split in seasoning, not easy to work); house-building, boat building, carts and agricultural implements. 238. (Wood dark brown beautifully variegated with streaks of darker colour, hard, strong, fibrous, elastic, durability uncertain, grain coarse and curly, does not season readily, apt to warp and crack); house-building, boat-building, furniture, cart-wheels, rice-poun lers, and, not very good, sleepers. 240. (The timber is good but not equal to the last, 238; it is improved by being kept under water); building and especially good for planking, packing-cases and boxes, agricultural implements. 273. (Wood yellowish- greyish- or reddish- brown darker towards centre and mottled, elastic, tough, of great strength, straight fibred, fairly durable, seasons well, works freely and takes good polish); building, posts, beams, rafters, door and window-frames, boat-building, cart- and carriage- shafts, railway sleepers, ploughs and other agricultural implements, tool handles.

Precis of Uses (Deduced from above). House-building, carpentry (incl. beams, joists, rafters), joinery good (incl. planking, flooring, sheathing, wain-scotting, posts and rails, stair-cases, door and window frames); ship-building (incl. beams, keelsons, waterways, shelf pieces, fire-backing, knees); cabinetwork and furniture (high class); wheelwrightery (incl. carriage- and cart- shafts, poles, naves, spokes and felloes); box-lumber (extra strong packing-cases and other boxes); agricultural implements (incl. vine- and similar props, ploughs, etc.); household implements (incl. rice-pounders); railway sleepers (uncertain, better treated).

Localities and Vernaculars. 236. (Most districts, open deciduous forests; 239. CDP: NEL: CPT:) *U.* Horidā; *Tl.* Karaka, Nallakarakā, Tellakarakā, Velamakarakā; *Ta.* Kadukkāy, Vellaikkadukkāy; *M.* Kātukkā; *K.* Arala, Harada. 236-bis. (TVY: TRV: sholas, scat.) *Ta.* Cūlamarudu, Murugānci, Pēykkadukkāy; *M.* Kāttukkatukkā, Pēkkatukkā, Sūlamarutu. 237. (Most districts, rvs., scat.) *U.* Orjuno; *Tl.* Tellamaddi, Erumaddi; *Ta.* Marudu, Vellaimarudu, Ārrumarudu; *M.* Marutu, Vellamarutu; *K.* Bilimatti, Holematti, Nirmatti, Toramatti. 238. (Most districts, esp. clay soils) *U.* Sāhājo, Kolasāhājo; *Tl.* Maddi, Nallamaddi, Inumaddi; *Ta.* Marudu, Karumarudu, Karuppumarudu, Kalimarudu; *M.* Marutu, Karimarutu; *K.* Matti, Karimatti, Hebhuluve, Banupu. 240. (CNTC: WGTS:) *Tl.* Nimiri, Pūlamaddi; *Ta.* Puluvaivarudu, Puluva, Pūmarudu, Venmarudu, Ilaikkadukkāy; *M.* Pullamarutu, Vemmarutu (wrongly also Vellamarutu, see 237); *K.* Huluve, Honagalu, Maruve. 273. (Most districts, except WTCT:) *U.* Sid'hā; *Tl.* Cennangi, Cinnangi; *Ta.* Cinnanci, Kaccaikkattai; *K.* Cennangi, Cinnangi.

V.—MOSTLY VERY HARD

D.—MOSTLY WHITE OR PALE

N. * 33. *Olives*

NAMES	W.	P.	S.	D.	U.	A.	VC.	(H) and Col.
35. <i>Garcinia morella</i> ...	50	772	4	2	2	3	III	(H-VH) GyY mot.
36. <i>Garcinia travancorica</i> ...	52	535	4	2	2	4	III	(H-VH) Y-BtOrB.
37. <i>Garcinia xanthochy-nus</i> ...	57	...	4	2	2	3	III	(H-VH) YW-DkGyB.
123. <i>Lansium anamallayanum</i> ...	62	1041	4	2	1	3	III	YW-stk. Y satiny.
134. <i>Chloroxylon swietenia</i> ...	60	1000	3	1	1	2	II	CreamyY-Oly satiny.
152. <i>Hemigyroa deficiens</i> ...	53	928	4	2	1	3	III	(XH) LtGyW.
272. <i>Memecylon edule</i> and other sp. ...	59	851	4	2	3	2	III	W-LtGyB.
354. <i>Linociera malabarica</i> ...	65	...	4	2	3	3	III	CreamyW-YW satiny.
368. <i>Cordia McLeodii</i> (and <i>fulvosa</i>) ...	52	...	4	2	2	3	III	YW-LtB veined DkB.
378. <i>Stereospermum xylocarpum</i> ...	43	785	4	2	2	3	III	YW-OrB.
379. <i>Pajanelia Rheedii</i> ...	53	...	3	2	2	4	III	YW-OrB.
807. <i>Celtis cinnamomea</i> ...	59	706	5	2	2	4	III	(XH) W-LtB. ctr.
<i>European Species</i>								
Olive ...	60	...	3	2	1	3	II	(VH-XH) YW-DkB cloud-ed mot. and stk. Bk.
Box ...	59	750	4	2	2	4	III	(H-VH) YW ctr. YB.
<i>Imported Species</i>								
Bastard Box of New South Wales.	69	1746	...	...	...	...	...	YW-LtB.
Sneezewood of the Cape	53	...	...	...	...	...	...	CreamyY-Oly satiny.

Philippine Species. Basān (incl. Piris, Taklāngarāk, Binūkau, Gatā-an) (*Garcinia* = 35, 36, 37); Bālu (*Cordia* = 368); Kamūning (Murraya = 542) identical with Kuyuskūyus (*Taxotrophis* = 809); Sasā it (*Vitex* = 378, 379).

Under 1 foot diameter:—Madras. 500. *Capparis aphylla*. 535. *Zanthoxylum ovalifolium*. 542. *Murraya exotica*. 546. *Limonia acidissima*. 550. *Atalantia monophylla* (incl. *racemosa* and *zeylanica*). 593. *Rhamnus virgatus*. 666. *Cotoneaster buxifolia*. 745. *Hunteria corymbosa*. 787. *Hemicyclia sepiaria*. 808. *Celtis Wightii*. 809. *Plecospermum spinosum*.

610. *Dodonaea viscosa*, of the next Category, might also come here.]

Strengths.

Tensile Strength :—Box = 15.5.

Crushing Strength :—Box = 10.3.

Shearing Strength :— ?

Elasticity modulus :—Box = 1856 ; Bastard Box = 1170 ; 134, Chloroxylon (Satinwood) = 1566-2246, Av. 1906 (taken as average for Category).

Compared with Oak 100 :—

	Box	Bastard Box	134. Satinwood	Category
Strength ...	128	281	161	133
Stiffness ...	103	68	112	112
Toughness ...	152	1132	231	158

General Description. Mostly moderate sized trees ; Wood white or yellowish-white usually passing to some darker shade of orange- or brownish- yellow towards the centre. Very hard (152, 807 — extremely hard ; 35, 36, 37, — hard to very hard), very tough and elastic, grain usually straight sometimes slightly crossed, texture fine dense smooth or glossy or satiny, rather difficult to work but takes a very fine surface under sharp tools ; Seasons badly as a rule in log or large pieces (but see note on Boxwood below), and planks usually require careful stacking and weighting to prevent warping ; Durability II (134 — I), not attacked as a rule by beetles ; P = 827 ; Wt. 43-63, Av. 55 ; Rays f-fff (368 — m-f, and white) ; Pores s (Box, 123, 134, 535, 542, 550, 593, 666 — ss-sss ; 37, 368, 378 — m ; 809 — L-s ; 35, 379 — L) ; VC. = II. *Note.*—Just as in the Mahoganies, Pears and Plums there is a transition from one category into the others, so in the case of the White Cedars (N. *26), Malletwoods (N. *27) and Olives (N. *33) is there a similar transition ; the White Cedars are usually the larger trees, lighter in weight, the Malletwoods and Olives are the smaller trees heavier in weight, and the Olives are usually harder than the Malletwoods ; as a substitute for Box, correctly speaking it is essential that the pores should be very or extremely small, but for many of the uses to which Boxwood is applied, this factor is not essential, hardness and great toughness being then the requisites.

Note on European Species. There is some doubt as to the true habitat of the Olive (*Olea europæa*) ; it was probably originally a

moderate sized tree of Syria and Western Asia, introduced on the one hand into Europe and North Africa where all along the Mediterranean region it is not only extensively cultivated but also has become quite naturalized and run wild, and, on the other hand, introduced into Persia ; at the same time, there is another species (*Olea cuspidata*) that occurs in Baluchistan, Afghanistan and Northern India, so very similar that some persons consider it the same species, and the distinctions are not very much greater between the cultivated, and the wild forms, of the true Olive ; the tree occasionally grows to a very large girth but not tall, normally however it is a small tree or large shrub ; the wood is of a pale yellow (sapwood) passing to a yellowish- (or occasionally a dark) brown often clouded, veined and mottled with blackish brown markings, very hard to extremely hard, and one of the most compact and homogeneous woods that exists, very durable, works well and takes a beautiful polish ; it is very highly esteemed for cabinetwork, inlaying, sculpture and carving, and fancyware, and is excellent for turning. The Box (*Buxus sempervirens*) occurs in Central and South Europe, West and North Asia to China and Japan ; it grows exceedingly slowly to a moderate sized tree, but is seldom more than small tree or shrub, the more so as the demand in the world is greater than the supply and practically all larger material is exhausted ; the wood is usually yellowish-white, occasionally greyish-white, sometimes passing to a yellowish-brown towards the centre, but there is no distinct heartwood ; hard to very hard, very dense and very homogeneous, very durable, it cuts very cleanly and takes a beautiful polish ; it is apt to crack, and to be knotty, concerning which see below ; as regards its uses, it is absolutely precious for engravers, turners, fancyware makers and makers of instruments of all kind (mathematical, musical, such as flutes, shuttles and spindles, measures, etc.). The following note, extracted from Gamble's *Manual of Timbers*, is of great interest, by no means the least instructive portion being that in connexion with the collection and seasoning, which should largely be borne in mind in connexion with all hard to extremely hard woods. The value of Boxwood at Bombay of suitable texture for the English market, of which latter we can judge from a few sample pieces, will depend principally upon the quality. Wood from 2-4 inches in diameter is required to be free from splits or cracks, otherwise, however free from knots and straight and round it may be, the value would not exceed £1

to £2 per ton, whilst if free from splits and round and straight, and with

not exceeding 1 knot per foot length	the value	£10 per ton
exceeding 1 and not 2 per foot length	probably	£7/10 "
exceeding 2 and not 3 per foot length	would be	£5 "

All knots or holes are counted as such however small. Wood 4 inches in diameter and upwards is preferred with one split rather than sound or with more than one split, any splits after the first reducing the value on account of the additional waste in working the same: the value of round and straight, and with 1 split, averaging:—

Diameter, averaging per foot length:—

	One knot	Two knots	Three knots
4"-5" ...	£6	£4/10	£3
5"-6" ...	£9	£6	£3
6" and upwards ...	£12	£9	£4/10

If the splits are twisted more than 1 inch to the foot if small, 2 inches if medium, and 3 inches if large, all to the foot length, the value is reduced one-half. The above values will, of course, vary with the supply and demand for the various sizes and qualities.

The most suitable texture of wood will be found growing upon the sides of mountains. If grown on the plains, the growth is usually too quick, and consequently the grain is too coarse; the wood of the best texture being of slow growth and very fine in the grain. It should be cut down in the winter, and, if possible, stored up at once in airy wooden sheds well protected from the sun and rain, and not have too much air through the sides of the shed, more especially for wood under 4 inches in diameter. The Boxwood must not be piled upon the ground, but be well skidded under, so as to be kept quite free from the effects of any damp in the soil. After the trees are felled, the longer they are left exposed, the more danger is there of the wood splitting more than is absolutely necessary during the seasoning before shipment to this country. If shipped green, there is great danger of the wood sweating and becoming mildewed during transit, which causes the wood afterwards to dry light and of a defective colour, and in fact renders it of little value for commercial purposes. There is no occasion to strip the bark off, or to put cow-dung, or anything else, upon the ends of the pieces to prevent their splitting. Boxwood is the nearest approach to Ivory of any known wood, and will therefore probably increase in value, as it, as well as Ivory, becomes scarcer. It is now used

very considerably in manufacturing concerns, but, on account of its gradual advance in price, during the past few years cheaper woods are, in some instances, being substituted. Small wood under 4 inches is used principally by flax spinners for rollers, and by turners for various purposes, rollers for rink skates, etc.; and if free from splits is of equal value with the larger wood. It is imported here as small as 1½ inches diameter, but the most useful sizes are from 2½ to 3½, and would therefore, we suppose, be from 15 to 30 or 40 years in growing, whilst larger wood would require 50 years and upwards at least, perhaps, we ought to say, 100 years and upwards. It is used principally for shuttles for weaving silk, linen and cotton, and also for rule-making and wood-engraving. *Punch*, *The Illustrated London News*, *The Graphic*, and all first class pictorial papers use large quantities of Boxwood.

In the above, note (1) felling at the coolest part of the year, and this in the cool climate of N. India, so as to reduce initial evaporation of this very hard wood to a minimum; (2) immediate storage under cover, and off the ground; (3) reduction of excess of breeze though the sides of the shed, to reduce initial evaporation; (4) mildew setting in, if shipped before seasoning, even in this very hard wood; (5) that, although Americans use malted lard and rosin into which they dip ends of hard woods to prevent cracking, see page 232, even this is unnecessary if very great care is taken; but in this case one split is not altogether objectionable.

Note on Imported Species. The Bastard Box of New South Wales (*Eucalyptus bicolor*) is a large shrub, and is only mentioned here as a curiosity on account of its deficiency in elasticity, with a stupendous toughness and very great transverse strength. The Sneezewood of the Cape (*Ptaeroxylon utile*) is a large tree very closely allied to 152, and has a wood resembling 134. Satinwood, very durable and useful, and almost imperishable underground; it is used for railway sleepers, piles, foundation sills, for door and sash sills, and similar work; it is curious in being very full of a resin resembling guaiacum, which causes it to burn like 'Candle-wood'.

Note on Philippine Species. *Balu*. Wood hard, moderately heavy, sap small greyish-brown distinct, heart light to dark brown with darker belts, cedar-scented, grain sometimes wavy, texture fairly fine, not difficult to work and takes good finish; Uses, musical instruments, small cabinetwork, scabbards; Prices, scarce and not marketed, except rarely in short logs for musical instrument makers. *Basān* (see Malabunōg, N. * 21). Wood hard to

very hard, heavy to very heavy, sap very variable in thickness yellow (some trees all yellow—Basān, Pīris, Taklānganāk—or merging gradually into a reddish-brown heart—Binūkau, Gatāsan), grain straight, texture fine dense glossy, hard to saw but not otherwise difficult to work; seasons without warping but liable to split; Durability II at least, not attacked by beetles; Uses, poles, posts, ties, paving blocks, beams, joists, rafters, flooring, piling; Prices, much used locally for house construction, but rare in Manila market and no fixed price. *Kamūning, Kuyus-kūyus*. Wood very hard, very heavy, sap light yellow very similar to Boxwood, heart irregular darker yellow to brown mottled and streaked with brown green and black reminding one of Olive-wood, grain straight or slightly crossed, texture extremely fine and dense glossy, hard to saw but not difficult to surface and taking a glossy finish under sharp tools; seasons very slowly but without much warping and splitting; Durability II at least, even sap and even from small trees rarely attacked by beetles; Uses, cabinetwork, inlaying, carved and turned articles, a favourite for canes and fine bolo hilts, tool handles, musical instruments and inlaying flutes and billiard cues, paper-weights, paper-knives and other desk supplies, wood-type and wood-cuts, probably good for bobbins and shuttles; Prices, not marketed on account of small size and scarcity. *Sasālīt* (see N. * 26); wood very hard, strong and stiff but easy to split, very heavy, sap yellowish fairly distinct, heart light amber to dark yellowish-brown, grain generally very straight, texture extremely dense and fine taking a glossy surface under sharp tools, not difficult to work except for its hardness; seasons well except for splitting at ends; Durability I, even sap rarely attacked by insects and heart scarcely by teredo; Uses, piles, posts, bridges and wharfs, ties, foundation sills, tool handles, other tool parts, all kinds of structural work, joinery, furniture and cabinetwork, sculpture and carving, wood-type and wood-cut engraving, etc.; Prices, P/180-250 mc. (=Rs. 15-21 cft.).

Uses of Madras Timbers recorded. 35, 36, 37. (Wood strong and good, but not used). 123. (Wood pale yellowish-white, scented somewhat of Sandal, smooth straight and even grained, excellent wood but small in size and not used). 134. Wood yellow-tawny often mottled and feathered with satiny lustre, close-grained and resembles Boxwood, very durable and stands well under water, liable to warp and split if not seasoned in shade, polishes beauti-

fully); excellent for cabinet and ornamental work but not suitable for engraving, furniture, backs of brushes, picture frames, ploughs, axle-trees, oil-presses, gun-carriage work. 152. (Wood extremely hard and cross-grained, pale yellow tinged with grey; no uses given, but the Buckingham Mills, Madras, found it one of the best woods they had ever come across for shuttles and other similar uses of Boxwood). 272. (Wood very hard, close fine and even grained, tough, should be used as a substitute for Boxwood); houseposts, walking sticks. 354. (Wood creamy- or yellowish-white, with satiny lustre, very hard, close grained and very like Boxwood; not used). 368. (Wood light brown with darker mottling, very hard, tough elastic, seasons well and works easily); furniture, picture frames and other ornamental work, excellent fishing rods, agricultural tools. 378. (Wood orange-brown, very hard, elastic, tough, close grained, takes good polish, deserves to be better known); cabinetwork, cart-poles and shafts. 379. (Wood orange-brown, very hard, elastic, close grained but somewhat coarsely fibrous, a fine wood which deserves to be better known); canoes and dugouts. 807. (Wood dull white with a darker patch towards the centre, extremely hard, with a disgusting odour when first cut or when wetted after drying, close grained; not used).

Precis of Uses (deduced from above). When large enough, Construction; carpentry (incl. posts, beams, joists, rafters), joinery (incl. planking, flooring, ceiling, sheathing and wainscoting, interior finish, posts and rails, stair-cases, door and window frames); cabinetwork and furniture (high class); sculpture, carving and fancyware (incl. inlaying, engraving, wooden type and wood-cuts, ornamental walking sticks and knife handles, picture frames, etc.); especially good for turnery (incl. rollers, shuttles, croquet balls and mallet heads, golf-club shafts and heads, tool handles of all descriptions, wooden tools, such as mallets and planes, gunstocks, fishing rods and walking sticks); wheelwrightery (incl. shafts, poles, naves); machinery (incl. parts subject to friction, cogs, cams, oil-sugar- and rice-mills); musical instruments (wind-instruments); agricultural implements (especially ploughs and harrow teeth); household implements (incl. rice-pounders).

Localities and Vernaculars. 35. (WTCT: KAN-TRY: scat.) *Ta.* Cōlaippuli, Irēvalcinni, Makki; *M.* Makki, Kurukkampuli, Pinarppuli, Pulincakka, Valokam, Cikiri; *K.* Aradala, Arasinagurce, Dēvanahuli, Jārigēhuli. 36. (TVY: TRV: scat.) *M.* Malambungu.

37. (NCCS-Agt: WGTS: CRG: NLGS.) *Tl.* Cikatimrānu, Ivurumāmidī, Lollorimānu, Tamālamu, *Ta.* Malaippuli, Malaippacca, Paccalai, Kulavi, Tabincam, Tamālam; *M.* Ānavaya; *K.* Dēvajārige, Gurce, Hirekanigu, Nēralemāvu, Vāte. 123. (WGTS: MBR-TVY: NLGS: Anms.) *Ta.* Candanavirai, Tēvatāli; *M.* Cerubāyināvu, Vantakkani, Tēvatāli. 134. (Most districts, deciduous forests, dtts.) *U.* B'heru; *Tl.* Billu, Billudu; *Ta.* Karumboradcu, Kudavuboradcu, Poradcu, Van, Mudirai, Vicaram; *K.* Bittulla, Hurihuli, Masula. 152. (CHN-TVY: Anms.) *Ta.* Pūvam, Kāttuppūvam. 272. (Most districts, degn., rvs., and sholas) *U.* Nīroso, Bonohorono; *Tl.* Alli, Kukkalli, Uddatalli; *Ta.* Kācā, Kāyā, Perungācā, Cīrugācā; *M.* Kālcavu, Kanila, Pūvandetti, Pūvanciti, Ārukkanila; *K.* Ollekodi, Gandukēpala, Ūdidalle, Alle, Neymāru. 354. (NEL: CDP: CPT: KAN-TRV:) *Tl.* Pūnagamu, Pūnicce; *Ta.* Parumbalu, Kalidalai; *M.* Kāttetala, Kalletala; *K.* Hariyage, Mahōdale, Ma-yisāle. 368. (Most districts, scat.) *U.* Bohurolo, B'hoto; *Tl.* Botuku, Feddabotuku, Peddabattava; *Ta.* Palandēkku, Perunaruvili; *K.* Bilicalle, Calle, Doddacalle, Hiricalle, Hinacalle, Gāvudi, Mod'hasi. 378. (MPLT: CNTC: WGTS: scat.) *Ta.* Vedanguranai, Kadalātti, Mānkombu, Pādirimilaidai; *M.* Pātiri, Vetankāruna; *K.* Ambalahūde, Hūde, Hūlave, Kānanakombu. 379. (WGTS: KAN-TRV: CBT: scat.) *Ta.* Acci, Arāndal, Pālaiyudaicci, Pana, Pūdabudbam, Vangam; *M.* Aralānd'ha, Ārantal, Pāyāni, Payyān-nali, Veluttappātiri; *K.* Alangi, Ānemungu, Bāgi, Dundukara, Mekkada, Tandayalaka. 807. (WGTS: KAN-TRV: Anms., scat.) *Ta.* Pināri; *M.* Pūtan, Pūtanonnatu.

VI.—MOSTLY EXTREMELY HARD

N. *34. *Lignum-Vitæ*

NAMES	w.	p.	s.	d.	u.	a.	vc.	(H) and Col.
43. <i>Mesua ferrea</i> ...	70	1010	1	1	1	3	I	DkR.
131. <i>Soymida febrifuga</i> ...	74	961	3	1	1	2	II	DkRB satiny.
155. <i>Schleichera trijuga</i> ...	66	834	1	1	1	2	I	(VH-XH) LtRB
188. <i>Pterocarpus santa-</i> <i>linus.</i>	74	975	4	1	1	3	II	OrR-DkCl.R-BkR.
200. <i>Hardwickia binata</i> ...	78	942	2	1	1	2	I	DkR-PplBk stk.Bk
203. <i>Tamarindus indica</i> (heart).	81	850	4	2	2	2	III	DkPplB.
212. <i>Xylia dolabriformis</i> ...	59	952	1	2	1	2	I	DkB-DkRB.
214. <i>Prosopis spicigera</i> (heart).	72	981	5	2	2	2	III	(VH) DkPplB-BkB.
219. <i>Acacia suma</i> ...	76	801	4	1	1	3	II	(VH) DkB.
220. <i>Acacia catechu</i> and <i>sundra.</i>	66	847	3	1	1	2	II	LtYR-DkYR-DkRB
221. <i>Acacia ferruginea</i> ...	68	798	4	1	1	3	III	YW-DkOI3.
254. <i>Eugenia Gardneri</i> ...	68	865	2	2	1	3	II	(VH) DkRB Y.patches.
Note. The size of 203, 214 are discounted from the smallness of heartwood.								
<i>Imported Species.</i>								
<i>Lignum-vitæ</i> ...	78	890	...	...	...	...	...	Y-GnB-DkOIB.
Australian Ironbark ...	64	1000	...	...	...	...	...	DkR.
Tewart of West Australia.	70	730	...	...	...	...	...	YR-LtR.
<i>Philippine Species.</i>								
Tambulian, Billian or	60	1038	...	...	...	...	...	YB-DkB
Borneo Ironwood.								

Alupāg (incl. Alupāgamō, Bulāla) (*Euphoria*, *Litchi*, *Nephelium* = 155); Bacāuan (incl. Bacāuan-babāe) (*Rhizophora* = 667) practically identical with Busāin (incl. Potōtan, Potōtan-lalāki, Langā-rai) (*Bruguiera* = 670, 671); Malabayābas (incl. Tāba, Tīga) (*Tristania* = 254) practically identical with Manconō (*Xanthostemon*); Sampālok (*Tamarindus* = 203); Tambulian (*Eusideroxylon* = 220).

Under 1 foot diameter:—Madras. 610. *Dodonaea viscosa* (BW-DkB mot. Bk, 77 lbs). 656. *Dichrostachys cinerea* (R stk. Bk, 80

lbs). 659. *Acacia latronum* (LtB-RB, 69 lbs). 667. *Rhizophora conjugata* and *mucronata* (LtR-DkR, 63 lbs). 670, 671. *Bruguiera gymnorhiza* (incl. *eripetala*, *caryophylloides*) and *parviflora* (R, 54 lbs).

Strengths.

Tensile Strength :—131. *Soymida* = 15.0 ; 212. *Xylia* = 16.0.

Crushing Strength :—*Lignum-vitæ* = 8.6-10.0, Av. 9.3 ; *Tambulian* = 11.3 ; *Ironbark* = 9.9 ; *Tewart* = 10.0.

Shearing Strength : ?

Elasticity modulus :—*Tambulian* = 2384 ; *Ironbark* = 1000 ; 43. *Mesua* = 2592-3171, Av. 2881 ; 203. *Tamarind* = 2050 ; 212. *Xylia* = 1793-2065, Av. 1929 ; 220. *Catechu* = 2322 ; Average taken for Category = 2298.

Compared with Oak 100 :

	Tambulian	Mesua	Tamarind	Xylia	Catechu	Ironbark	Catechu	Lignum-vitæ
Strength ...	167	161	137	153	136	161	145	140
Stiffness ...	133	168	120	112	135	59	134	?
Toughness...	211	154	156	163	137	427	157	?

General Description. Mostly large trees, often containing resin ; Wood usually red often very dark or a dark shade of brown ; Extremely hard (214, 219, 254, 659, — very hard ; 155 — very hard or extremely hard), very strong, very elastic and very tough, grain straight or crossed and sometimes twisted, texture fine dense and smooth to glossy, usually hard to work but taking a very smooth surface under sharp tools ; Seasons well sometimes, but as a rule logs and large pieces very liable to crack badly, sawn material seasoning well but often requiring careful stacking and weighting to prevent warping ; Durability I-II, very rarely attacked by insects ; P = 896 ; Rays f-ff (131, 220, 221 = m ; 43 = fff ; *Lignum-vitæ* = m-f) ; Pores m-s (212, 220 = L-m ; 254 = ss) ; VC = I.

Note on Imported Species. The *Lignum-vitæ* tree (*Guaiacum officinale*) occurs in the West Indies and the north coast of South America ; the wood is yellowish or greenish-brown to a dark olive-brown, extremely hard and tough with cross-grained fibres ; owing to its hardness and toughness under friction it wears so very smooth that it has both the appearance and feel of having been oiled, which, however, may partly be due to the fact that the wood contains a resin which can be observed by boiling chips when the resin floats on the water ; it is extensively used for pulley-blocks, and also for

rulers, skittle-balls, and other purposes where hardness is required and weight is no objection. The Australian *Ironbark* (*Eucalyptus siderophloia* and *leucoxylon*) is a large tree ; the wood is dark red, very dense and heavy, strong and durable, straight in the grain but extremely difficult to work ; the tree is generally sound, but liable to both heart and star shakes, and so is not usually very solid about the centre ; the timber cannot be employed with advantage except in stout planks or large scantlings. The *Tewart* is a variety of the *White Gum* (*Eucalyptus viminalis*) found principally in West Australia ; the wood has a colour resembling that of *Blue Gum*, heavy, strong, sound and durable, the grain is rather crooked and twisted which makes it difficult both to split and work ; it is much valued where great strength is required and weight would not be an objection.

Note on Philippine Species. *Alupāg*. Wood of *Alupāgamō* and *Bulāla* practically identical with that of *Alupāg* ; very hard, very heavy, sap gradually merging from pale reddish into light coppery-red or dark reddish-brown heart, grain slightly crossed and often wavy, texture fine dense very smooth, difficult to work but taking fine surface under sharp tools ; seasons well ; Durability I, very rarely attacked by insects ; Uses, posts and sills, beams, joists, rafters, flooring, burrs in native rice-mills, teeth of cogwheels in primitive sugar-mills, presses, etc., bearings, wooden anchors, combs, treenails, harrow-teeth, other parts of agricultural implements ; Prices, P/100-150 mc. (= Rs. 8½-12½ cft). *Bacāuan*, *Busāin*. *Busāin*, *Potōtan*, *Potōtan-lalāki* and *Langārai* are four species of a genus with practically identical wood, the last named the crookedest and shortest of the four ; the *Bacāuans* are practically identical with the *Potōtans* in structure, but slightly harder and heavier ; wood hard to very hard, heavy to very heavy, sap distinct from or merging into the orange reddish-brown or dull red heart, grain straight, texture fine and dense, hard to saw but not otherwise difficult to work ; logs check badly in seasoning but, sawn lumber seasons without much checking and warping if properly stacked under roof ; Durability III or better, especially *Bacāuans*, sap not so good but heart lasts very well in wet situations, is rarely attacked by insects, and resists teredo for 7-8 years ; Uses, saltwater and foundation piling, mine-timbers, house-posts, furniture and cabinet work, properly sawn and carefully seasoned would make excellent flooring ; Prices, little marketed except as firewood, occasional lots sold

with Miscellaneous lumber from P/70 mc. (—Rs. 6 cft.) and upwards, and small quantities of medium and small dimension stuff separately at P/100-120 mc. (—Rs. 8½-10 cft.). *Malabayābas*. Wood of all species practically identical; in colour, hardness, weight and texture *Malabayābas* rather closely resembles *Mancono*, which is called 'Philippine Lignum-vitæ', and 'Philippine Ironwood'; wood very hard, very heavy, sap light brown or reddish gradually merging or (*Mancono*) distinct, heart dark or yellowish-brown turning bronze or nearly black, grain crossed and (*Mancono*) frequently twisted or curly, texture fine dense glossy—*Mancono* without oil or polish can be burnished almost like metal,—hard to work but not difficult to surface nor specially dulling tools; large logs have often several radial heart-cracks, and fresh-sawn pieces check superficially but not deeply, if not carefully seasoned, also needs to be piled carefully to prevent warping: Durability I, or at least II, even sap very rarely attacked by insects, and *Mancono* scarcely by teredo: Uses, piles, posts, bridge- and wharf- construction, beams, joists, rafters, window-sills, ties, tool-handles, wooden tools, cabinetwork, bowl-balls, dumb-bells, pulleys, sheaves, bearings, saw-guide blocks, etc., paperweights and other desk novelties; Prices, with mixed lots of hard and heavy construction timbers at P/70-130 mc. (—Rs. 6-11 cft.). *Tambutan*; known as 'Billian' or 'Borneo Ironwood'; wood very hard, very heavy, sap small not very distinct, heart yellowish-brown turning very dark brown, grain straight, texture fine somewhat glossy, for a very hard wood not difficult to work; shrinks, warps and checks very little; Durability I, even sap not attacked by insects; Uses, excellent piles and posts, ties, bridge- wharf- and ship- construction, all sorts of high-grade construction, ax and other tool handles, axles, shafts, hubs, spokes and felloes, flooring and stairs, window-sills, cabinetwork; Prices, not marketed, but worth as much as *Ipil*, i. e. P/150-200 mc. (—Rs. 12½-16½ cft.).

Uses of Madras Timbers recorded. 43. (Wood dark red or reddish-brown, extremely hard, disliked for felling as it turns the axe edge, also difficult to saw, very strong, very durable, lasts well under ground); splendid engineering construction timber, bridges, sleepers, house-building, carpentry, machinery, gunstocks, tool-handles, recommended for paving blocks. 131. (Wood bright red when fresh to dull dark red-brown with satiny lustre, extremely hard, very strong, very durable including under water or under ground or in

damp masonry walls, apt to crack in seasoning, easily worked and planed); construction work (but considered sacred by Hindus, and used by them only as temple pillars and not in houses), excellent piles and sleepers, good clamps in masonry walls, well-work, beautiful cabinet and furniture wood, piano cases, tables, carving, plough shares, pestles, oil-pounders. 155. (Wood light reddish-brown, very hard to extremely hard, one of our most valuable timbers especially esteemed where strength, hardness and durability are required, close grained, very durable, seasons well and takes fine polish); building, especially good for oil rice and sugar crushers, pestles and mortars, rollers, screws, cart-building especially wheels, agricultural implements especially teeth of harrows and ploughs. 188. (Wood orange on being freshly cut and turning from claret-red to almost black, extremely hard, close and even grained, very durable, easy to work and takes fine polish); building especially house posts often carved and ornamented, cabinetwork, carving and sculpture, joinery, furniture, boxes, picture-frames. 200. (Wood dark red often tinged with purple and streaked with black, extremely hard, very strong and very durable, close but cross grained, liable to split but does not warp, takes fine polish); general construction, bridges, house-building especially posts often carved and ornamented, recommended for sleepers, cabinetwork and furniture, carving and sculpture, ploughshares, pestles, oil and rice pounders. 203. (Heartwood.) (Dark purplish-brown irregular in outline and comparatively small, extremely hard, highly prized, very durable, very difficult to work but takes a fine polish); naves of wheels, mallets, planes, rice-pounders, oil and sugar mills, excellent wood for turning, cabinetwork and furniture, croquet mallet-heads and balls. 212. (Wood often twisted knotty or internally cracked, dark brown, dark red or dark reddish-brown, extremely hard, strong fibrous and close grained, as durable as Teak and lasts well underground and under water excepting sap which is attacked by insects, difficult to cut, liable to crack if exposed, not easy to work, planes with an unctuous surface, gives out reddish stain when damp); large constructions, excellent piles, bridge-building especially posts, piles and beams, telegraph-posts, excellent railway sleepers and paving blocks, house-building especially posts, piles, beams, joists and rafters, boat-building especially knees and boat-anchors, cart-building especially naves of wheels, tool handles, agricultural implements especially ploughs, tent pegs. 214. (Heartwood), Purplish-brown, very hard, durable and superior

to Teak in strength, tough, easy to work); buildings, cart-wheels, good well-curbs, agricultural implements, occasionally for furniture. 219. (Wood dark brown, very hard, durable and not attacked by white-ants, works smoothly and takes a good polish); house-building, construction of carts, ploughs, pestles, drinking cups. 220. (Wood from yellowish-white sap to light or dark red, heart, very hard, fibrous and close grained, more durable than Teak and not attacked by either white-ants or teredo, seasons well and takes fine polish); house-construction especially posts and pillars, bridges, railway sleepers, oil- and sugar- crushers, rice-pounders, agricultural implements especially ploughs, wheelwrights' work, cotton rollers, bows, spear and sword handles. 221. (Wood from yellowish-white sap to olive- or reddish- brown heart, extremely hard, and generally closely resembling the last, 220); building, carts, agricultural implements. 254. (Wood dark reddish-brown often with bright yellow patches, very hard, strong, serviceable, but rather coarse); beams in house building.

Precis of Uses (*deduced from above*). Conspicuous for extreme hardness and great toughness and strength, thus wearing little but very smooth under friction and capable of withstanding shocks; in this connexion, see also 113. *Filicium* and 185. *Dalbergia*—N.*29, and 152. *Hemigyroa* and 807. *Celtis*—N.*33; all major construction; bridge- and wharf- building (incl. piles, poles, posts, foundation sills, beams, sleepers, paving blocks, telegraph poles); hydraulic works (incl. well-work, mine-timbers); ship-building (incl. beams, kneed timbers, treenails, wooden anchors); house-building, carpentry (incl. in both fresh and salt water, posts, poles, beams, joists, rafters), joinery (incl. planking, flooring, stairs, posts and rails, door and window sills); wheelwrightery (incl. axles, shafts, hubs and naves, spokes and felloes); cabinetwork and furniture (beautiful woods, excellent for veneer, piano cases, tables, etc.); sculpture carving and fancyware (incl. carved house posts and panelling, picture frames, and other ornamental work); machinery (bearings, saw-guide blocks, pulleys and sheaves, burrs screws and cogwheel teeth in oil-, sugar- and rice- mills, presses, rollers, and all parts subject to friction and shocks); excellent for turnery (axe and other tool handles, mallets, planes and other wooden tools, dumb-bells, bowl balls, croquet mallet-heads and balls, skittle balls and ninepins, rink skate rollers, police batons, bows, spear and sword handles); agricultural implements (especially ploughshares and harrow teeth);

household implements (incl. pestles and mortars); desk appliances (such as rulers and paperweights).

Localities and Vernaculars. 43. (WFTS: esp. NLGS: & Anms., evergreen forest) *Ta.* Nāngu, Nāgappū, Nāgēcuram, Curuli; *M.* Vaināvu, Nānga, Nāgaccampakam, Curuli; *K.* Nāgakēsara, Nāgā-sampige, Kēsara, Atta. 131. (Most districts except WTCT:) *U.* Sonhān; *Tl.* Sōmi, Sōmiti; *Ta.* Cūmi, Cōmbu, Cem, Curakkalli, Vanda; *K.* Svāmi, Kalgarige. 155. (Most districts, com.) *U.* Kusumo; *Tl.* Būsi, Cāgalaposuku, Posuku, Kodālipulusu, Madakapululu, Pulisari; *Ta.* Pūvam, Cākattai, Koncivanci, Mirugukkottai, Mudgottān; *M.* Pūvan, Cāna; *K.* Sāgade, Hākuta, Hulimaya. 188. (KNL: CDP: NAC: CPT:) *Tl.* Candanam, Erracandanam, Raktacandanam; *Ta.* Candanam, Cencandanam, Civappuccandanam; *K.* Kempugand'ha, Raktacandana. 203. (Most districts, esp. dtts. & DKN:) *U.* Koinā, Tentuli; *Tl.* Cinta; *Ta.* Puli; *M.* Puli; *K.* Hunise, Punke. 212. (GDV: SLM: SAC: WFTS: CRG-TVY: Anms.) *Tl.* Kondatangedu, Tangedumānu, Erracennangi; *Ta.* Irūl, Iruvēl; *M.* Irūl, Irimpullam, Pānnal, Pānkali; *K.* Tiruve, Sivve, Takku, Arasutakku, Bettadāvarike, Hommāvarike, Jambe. 214. (Most districts, dtts., bctn) *U.* K'hodiro, Sōmi; *Tl.* Jammi; *Ta.* Parambai, Vanni, Cami; *M.* Parampu, Vanni; *K.* Banni. 219. (MPLT: CNTC:) *Ta.* Cēlai, Cilai, Cēlaiyuncai, Cilaiyuncai; *M.* Venkarinnāli; *K.* Bilijāli, Cēlaiyudi, Sami. 220. (Most districts, dtts.) *U.* K'hoiro; *Tl.* Nallacandra, Candra; *Ta.* Karungāli, Cengarungāli, Kadiram; *M.* Karinnāli, Cenkarinnāli, Kadiram; *K.* Kaggali, Kempuk'hairapujāli, Saradu, Tera, K'hadira. 221. (Most districts, dtts., scat.) *U.* K'hoiro; *Tl.* Vannicandra, Vellicandra; *Ta.* Vanni, Pēykarungāli, Cīmaivelvēl; *M.* Vanni, *K.* Banni. 234. (WGTS: KAN-TRV: Anms.) *Ta.* Nirnāval; *M.* Malannēral, Cen-nēral, Karunnēral; *K.* Bilitirupu.

VI. ALPHABETICAL UTILIZATION LIST

VS. W=(1. Corks); **S.-R**=(2. Willows); **PkYBsg**=(3. Alders); **Wsg**=(4. Hazels); **W**=(5. Birches, 6. White Deals, 7. Aspens); **M.-R**=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); **YB**=(13. Teaks, 14. Jacks, 15. Camphors); **W**=(16. Ashes, 17. Sycamores); **Anom**=(18. Bast-rings); **H.-R**=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); **YB**=(23. Walnuts, 24. Sals, 25. Elms); **W**=(26. White Cedars, 27. Malletwoods); **VB.-Bk**=(28. Ebonies); **R**=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); **YB**=(32. Turkey Oaks); **W**=(33. Olives); **KH.-RYB**=(34. Lignum-vitæ).

[NOTE.—The above is an abbreviated Synopsis of the Categories. Instead of specifying a special timber for any given purpose,—and usually several will answer the same purpose—it is better to specify a category of timbers. But, as different persons require different qualities, a series of Categories is given from which a selection can be made. Mostly, the higher the number of the category, the stronger, but at the same time the more costly, is the timber.]

Aeroplane Timber (see *Vehicles*).

Agricultural Machinery and Implements.

For Framework requiring considerable transverse strength as well as durability:—Categories N. *9, 11, 14, 15 (Harder), 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 33, 34.

For parts subject to severe wear:—Categories N. *5, 6 (Harder), 12, 13, 17, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 33, 34.

For Levers, Connecting-rods, Long Handles, all rather long and slender working parts requiring straight-grained fairly tough and springy rather than very strong and very durable woods:—Categories N. *6, 9, 11, 16, 22, 24, 26, 27, 30, 31, 33.

Hurdles, Palings, Trellises, etc.:—Categories N. *6, 11, 12, 16, 22.

Crop supports (such as Hop-poles, Vine-props):—N. *11, 12, 16, 25, 26, 32.

Ploughs, Harrows, etc.:—N. *8, 12, 16, 17, 20, 21, 22, 23, 27, 30, 32, 33, 34.

Altars (see *Sculpture and Carving*).

Athletic Goods (see *Sporting Goods*).

Automobiles (see *Vehicles*).

Backing of Mirror and Picture Frames (see *Veneers*).

Balusters (see *Stairs*).

Bank Fixtures (see *Fixtures*).

Bars—Horizontal, Parallel, Trapeze (see *Sporting Goods*).

Barges (see *Ship-building*).

Barrels (see *Cooperage*).

Batons—Constables (see *Clubs*).

Beams (see *Bridge-building and House-construction*).

Bearings.

Includes Bushings, Brake-shoes for vehicles, Winches, Cogs and Cog-wheels, Pulleys, Saw-guide Blocks, Sheaves, etc., requiring hard, very hard or extremely hard and tough wood:—Categories N. *13, 24, 25, 26, 27, 29, 30, 31, 33, 34.

Bed-Plates for Machinery.

Requiring hard to extremely hard and durable wood:—Categories N. *12, 13, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34.

Bells (see *Musical Instruments*).

Bentwood Articles.

Not very much is known on this subject; in Europe the Conifers, corresponding chiefly to Categories N. *6 and 9, are used; in the Philippines vehicle shafts are bent by steaming in a crude chest, or by boiling them in a tank kept hot by live steam from species in Categories N. *11, 24, 30, and 31, with good results; besides these the following Categories are also recommended for trial:—Categories N. *20, 21, 22, 25, 26, 27, 30, 31, 34. Beechwood, corresponding to Category N. *27 above included, is also used for the purpose in Europe. The wood should be tough.

Billiard Cues and Tables (see *Sporting Goods*).

Black-Boards (see *Draftsmen's Implements*).

Blinds (see *House-construction*).

Boats (see *Ship-building*).

Bobblis, Shuttles, Spindles, Spools.

Either tough smooth-wearing woods:—Categories N. *6 (Harder), 13 (Harder), 17, 20, 21, 22, 26, 27, 31, 33, 34; or else light soft woods requiring smooth texture but no great strength for spools and the cheaper for cotton-reels:—Categories N. *1, 4, 5, 6 (Softer), 7, 8, 9, 10, 13 (Softer).

Bolsters (see *Vehicles*).

Book-cases (see *Furniture*).

VS. W=(1. Corks); S.-R=(2. Willows); PkYl3sg=(3. Alders); Wsg=(4. Hazels); W=(5. Birches, 6. White Deals, 7. Aspens); M.-R=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); YB=(13. Teaks, 14. Jacks, 15. Camphors); W=(16. Ashes, 17. Sycamores); Anom=(18. Bast-rings); H.-R=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); YB=(23. Walnuts, 24. Sals, 25. Elms); W=(26. White Cedars, 27. Malletwoods); VH.-Bk=(28. Ebonies); R=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); YB=(32. Turkey Oaks); W=(33. Olives); XH.-RYB=(34. Lignum-vita).

Boot and Shoe Findings.

Lasts, requiring hard or moderately hard close-grained wood:—Categories N. *5, 6 (Harder), 10, 11, 13, 15, 16, 20, 21, 23, 25, 26, 27, 33; of these, 25 is (especially Guava and Eugenia) considered about the best in the Philippines, in Europe they are mostly made of Beech, corresponding to 27.

Wooden Shoe-soles, generally white or light coloured, rather soft and light and of a fairly straight and even grain:—Categories 2, 3, 4, 5, 6, 7, 8, 10, 13, 17, 21; in Europe clogs and sabots are generally made of Linden, Birch and Beech, the last corresponding to 27.

Cork-soles, are made of Cork substitutes, Category N. *1.

Bowls, Dishes, Platters and Trays (see *Household Implements*).

Bowling Balls (see *Sporting Goods*).

Bows (see *Sporting Goods*).

Boxes.

(1) *Butchers' Trays* in Europe are mostly made of Common Poplar and might be made from Categories N. *1, 4, 5, 6, 7, soft whitish woods.

(2) *Cigar Boxes* of the higher grade from Categories N. *10, and 19, especially the softer and Cedar-scented woods; the cheaper grades are made from Categories N. *2, 3, 8, 9, and lower grade woods of 10.

(3) *Clothes Chests* are made from almost every type of wood, plain or highly ornamented; for common and cheap chests Categories 2, 3, 4, 5, 6, 7, 8 and 9 are employed; for better and superior, Categories 10, 11, 12, 13, 14, 15, 19, 20, 21, 23, 24 (Higher grade), 25, 26, 27, 28, 29, 30, 31, 32, 33 and 34.

(4) *Coffee boxes*: for wood actually used for making these, see details in Categories N. *1, 11, 17; see Packing cases.

(5) *Coffins* are either of very cheap material pertaining to Categories N. *2, 3, 6, 9; or wood lasting well underground belonging to Categories N. *12, 15, 24 and 25.

(6) *Crates and Package-boxes* are made of cheap light soft woods, which are often cut up by veneer-machines (see Veneers); Categories N. *1, 2, 3, 4, 5, 6, 7.

(7) *Dry Measures*; the smaller are made in the Philippines from any cheap soft wood, corresponding to Categories N. *1, 2, 3, 4, 5, 6, 7, 8, or 9 (Softer), and in Europe chiefly from Birch and Hazel; the larger ones in Europe are mostly made from Oak, Chestnut, Ash, and occasionally Yew, and in the Philippines from Dipterocarps and Pterocarps, corresponding between them to Categories 9 (Harder), 12, 13, 16, 22, 24, 29.

(8) *Jewel-boxes* (see *Sculpture*).

(9) *Lacquer-work Boxes* are chiefly made from Categories N. *1 and 3.

(10) *Packing Cases*, the cheaper from all except brashy woods of Categories N. *2, 3, 4, 5, 6, 7, 8 and 9, whilst the better and stronger are formed from Categories N. *9 (Better classes), 11, 13, 14, 16, 17, 22, 24, 26, 27, 32.

(11) *Scabbards and Sheaths*, of the common kind and not the ornamental class which would come under Sculpture and Carving, are made from Categories N. *1, 3, 5, 6, 16.

(12) *Sieve frames* much resemble Dry Measures, and are made chiefly from light more or less elastic or tough woods, Categories N. *1, 4, 5, 6, 12, 16, 22.

(13) *Tea chests*; for wood actually used for making these, see details in Categories N. *2, 3, 5, 6, 7, 9, 10, 13; see Packing cases.

(14) *Wooden baskets* in Europe are made from Black Alder and Blood Cornel, and might be prepared from Categories N. *3, 20 and 21.

Boxwood Substitutes.

Categories N. *15, 17, 26, 27, 33; being homogeneous close-grained woods, the two first being softer and of the nature of Spindlewood, which is used in Europe for such purposes; (see also *Printers' Materials*, *Engraving Blocks*).

Brake-beams (see *Vehicles*).

Brake-shoes (see *Bearings*).

Bridge- and Wharf- Building.

(1) *Piles*—(Saltwater). Categories N. *13, 14, 15 (Harder), 20, 25, 26, 27, 29, 30, 31, 33, 34.

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(2) *Piles—(Freshwater).* Categories 10, 11, 12, 13, 14, 15 (Harder), 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 34.

(3) *Piles—(Submerged foundations)*; all kinds straight enough and strong enough to stand driving.

(4) *Beams and floors.* Where considerable to great durability is required, Categories N. *10, 11, 12, 13, 14, 15 (Harder), 19, 20, 21, 23, 24, 25, Higher grade of 26 and 27, 29, 30, 34; but if durability is not of so much consequence, or where the wood is to be creosoted or thoroughly painted or tarred with hot tar, or where frequent traffic makes the mechanical destruction more rapid than decay, Categories N. *6, 9, 11, 12, 22, Lower grade of 26 and 27, or 32.

Broom- and Brush- Handles (see *Handles*).

Brush-backs (see *Novelties*).

Buckets (see *Cooperage*).

Bungs (Cork) (see *Buoys*).

Bungs (Hardwood) (see *Cooperage*).

Buoys and Floats.

(1) *Floaters for Rafts* for bringing heavier timbers down the rivers and canals; almost any of those in Categories N. *1, 2, 2, 4, 5, 6, 7 will serve the purpose, and some of them will often fetch a price in the market which will pay their cost of extraction.

(2) *Floats* for Fish-lines, Fish-nets, and for marking Fish-traps; Category N. *1 is the best, but most of the species in Categories N. *2, 3, 4, 5, 6 and 7 are sometimes used.

(3) *Cork substitutes.* Besides being used for Fish-line floats, Cork is also used for (a) Bungs and Stoppers of jars and bottles, (b) in the construction of Life-boats, Life-buoys, belts, waistcoats and preservers generally, (c) for artificial limbs, (d) for architectural models, (e) in the preparation of linoleum; and (f) for lining the bottoms of entomological cases, the insides of hats and of leather-

dressing pommels, and small slabs for thumb-tack mounts; in some cases Category N. *1 has been utilized in such purposes, probably it could be extended to a much greater degree, and possibly some of Categories N. *2, 3, 4, 5, 6 and 7 could also similarly be employed. In the case of utilizing Sonneratia Cork for life-preservers, Schneider suggests that some means to waterproof the material, such as dipping in paraffin, should be adopted.

Bushings (see *Bearings*).

Butcher-blocks.

The best wood for this purpose is said to be Vitex (Category N. *13), whilst Parinarium (Category N. *31) is also said to be good; the wood should be white or pale coloured, hard and tough, and light coloured woods of Categories N. *20, 21, 24, 25, 26, 27 and 30 should answer the purpose.

Butchers' trays (see *Boxes*).

Cabinet-work (see *Furniture*).

Canes, Umbrella-handles, Whipstocks.

For the cheap grades, Categories N. *4, 5, 6, 7.

For the better grades, Categories N. *11, 13, 14, 15, 16, 17, 20, 21, 22, 26 and 27.

For the best grades, often highly ornamented and carved, Categories N. *23, 28, 29, 30, 31, 33 and 34.

Probably for Whipstocks, Categories N. *16, 22 and 30 are the most elastic and consequently most suitable.

Cant-hooks, Capstan-bars (see *Levers*).

Carpentry (see *House-construction*).

Carriage and Cart Building (see *Vehicles*).

Cars (Electric and Railway).

Heavy structural parts, framing, flooring, roofing and siding, Categories N. *12, 13, 14, 23, 24, 29.

Interior finish, Categories N. *6 (Harder), 9 (Finer coloured), 13, 15, 17, 19, 20, 21, 23, 24 (Higher grade), 29.

Carving (see *Sculpture*).

Casings (see *House-construction*).

Casks—Spirit and Oil (see *Cooperage*).

Cattle Bells (see *Musical Instruments*).

Ceilings (see *House-construction*).

Cement Barrels (see *Cooperage*).

VS. W=(1. Corks); **S.-R.**=(2. Willows); **PkYBsg.**=(3. Alders); **Wsg.**=(4. Hazels); **W.**=(5. Birches, 6. White Deals, 7. Aspens); **M.-R.**=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); **YB.**=(13. Teaks, 14. Jacks, 15. Camphors); **W.**=(16. Ashes, 17. Sycamores); **Anom.**=(18. Bast-rings); **H.-R.**=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); **YB.**=(23. Walnuts, 24. Sals, 25. Elms); **W.**=(26. White Cedars, 27. Malletwoods); **VH.-Bk.**=(28. Ebonies); **R.**=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); **YB.**=(32. Turkey Oaks); **W.**=(33. Olives); **XH.-RYB.**=(34. Lignum-vite).

Churns.

In Europe these are made of Sycamore or Maple, pale tough moderately hard to hard woods; Categories N. *15, 17, 26, 27.

Cigar Boxes (see *Boxes*).

Clothes Chests (see *Boxes*).

Clubs—Golf, and Indian (see *Sporting Goods*).

Clubs—Police.

The batons of the London Constabulary are made of West Indian Ebony or Cocus wood (Category 34), whilst in America and elsewhere Blackwood and Ebony have been used (Category 29 and 34); these are said to be dangerously hard and heavy; Schneider suggests the sapwood of various Ebonies (*Diospyros*) as being lighter, tougher and more resilient, and (see *Ebony-substitutes*) capable of being stained black and looking precisely like Ebony; including all these, the Categories recommended for this purpose are:—N. *6 (Harder), 9, 11, 12, 20, 21, 22, 23, 24, 25, 26, 27 and, harder and therefore more dangerous, 28, 29, 30, 33, 34.

Coffee Boxes (see *Boxes*).

Coffins (see *Boxes*).

Cogs (see *Bearings*).

Combs (see *Novelties*).

Concrete Forms.

For large pieces of work, where considerable quantities of lumber of uniform sizes are necessary, Category N. *9.

For smaller jobs, cheap miscellaneous lumber of all the softer kinds, Categories N. *1, 2, 3, 4, 5, 6, 7.

Construction (see *Bridge-building, House-construction, Hydraulic works, Poles, Posts, Ship-building, Ties and Mine-timber*).

Cooperage.

(1) *Buckets, Pails, Small tubs.* Often made from packing-cases of European and American Coniferous lumber; the following categories can be used:—N. *5, 6, 7, 13, 16, 22, 24.

(2) *Large Vats* for use in distilleries and by wholesale liquor and alcohol dealers, Categories N. *9, 24, 30.

(3) *Heading and staves* for ordinary barrels, Categories N. *11, 12, 14, 16, 30.

(4) *Oil Casks*, Categories N. *11, 14, 16, 26.

(5) *Cement barrels, Plumbago casks, Dry-goods barrels generally.* Categories N. *2, 3, 4, 5, 6, 9, and, better, 11, 14, 16, 22, 26, 27, 30.

(6) *Hoops*, Categories N. *5, 10, 11, 16, 22, 30.

(7) *Hardwood bungs*, Categories N. *12, 24; probably many others could be used.

Cork Soles (see *Boot-findings*).

Cork substitutes and Corkwoods (see *Buoys*).

Cotton Reels (see *Bobbins*).

Counters (see *Fixtures*).

Crates (see *Boxes and Veneers*).

Cricket Bats (see *Sporting Goods*).

Crop supports (see *Agricultural Machinery*).

Croquet sets (see *Sporting Goods*).

Curves (see *Draftsmen's Implements*).

Dishes (see *Household Implements*).

Doors (see *House-construction*).

Dowels (see *Mouldings and Stickerwork*).

Draftsmen's Implements.

(1) *T-squares, Triangles, Rulers, Curves*, etc. Categories N. *6 (Harder), 11, 14, 15, 16, 17, 20, 21, 24 (Higher grade), 26, 27, 29, 30, 31 (Higher grade), 33, 34.

(2) *Drawing-boards, Black-boards, School Slate frames*, Categories N. *4, 5, 6 (Soft), 7, 9 (Softer), 10.

(3) *Triangular and Flat Scales*, Categories N. *14, 16, 17, 26, 27, 33.

(4) *Yard Measures and Lumberers' Scale Sticks*, Categories N. *6, 16, 24, 29.

Drums (see *Musical Instruments*).

Dry Goods Barrels (see *Cooperage*).

Dry Measures (see *Boxes*).

Dumb-bells (see *Sporting Goods*).

Ebony Substitutes.

In Europe, the Yew and the Holly stained black are used as substitutes for Ebony, and occasionally the Pear and the Apple

VS. W = (1. Corks); **S.-R** = (2. Willows); **PkYBsg** = (3. Alders); **Wsg** = (4. Hazels); **W** = (5. Birches, 6. White Deals, 7. Aspens); **M.-R** = (8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); **YB** = (13. Teaks, 14. Jacks, 15. Camphors); **W** = (16. Ashes, 17. Sycamores); **Anom** = (18. Bast-rings); **H.-R** = (19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); **YB** = (23. Walnuts, 24. Sals, 25. Elms); **W** = (26. White Cedars, 27. Malletwoods); **VH.-Bk** = (28. Ebonies); **R** = (29. Rosewoods, 30. Lancewoods, 31. Green hearts); **YB** = (32. Turkey Oaks); **W** = (33. Olivers); **XH.-RYB** = (34. Lignum vitae).

and cognate woods (Service, White and Torminal Services, Mountain Ash, etc.); in the Philippines, it is found that by staining the sapwood of the various Ebonies (Diospyros) not only is there a good substitute but a better material to work upon as it is tougher and not so brittle nor so hard, and consequently the work is in reality finer; the same applies practically to all the woods contained in Categories N. *17, 20, 21, 22, 27, and 30. In addition to these, there are certain species which by being long submerged in water or buried in mud become jet-black in colour, such are Dillenia and Barringtonia in Category N. *12; Eugenia in N. *27; whilst Michelia, N. *13, becomes blue-black in contact with steel.

Electrotype and Engraving Blocks (see *Printers' Materials*).

Fancyware (see *Sculpture*).

Farm Implements (see *Agricultural Machinery, Handles, Vehicles*).

Felloes (see *Vehicles*).

Fence Poles (see *Poles*).

Fencing (see *Agricultural Machinery*).

Fishing Rods (see *Sporting Goods*).

Fixtures—Bank, Office, Drug-stores, etc.

(1) *Furniture and Interior Finish, High-grade work.* For counters, Show-cases and backing of show-cases Shelves, Panelling, Mouldings and various ornamental applications, Tables, Chairs and Stools, the following are the most in demand:—Categories N. *8, 10, 11, 13, 14, 15, 17, 19, 20, 21, 23, 26, 27, 29, 30, 32 (Rich colours), 33, 34.

(2) For Medium-grade work, Categories N. *3, 4, 5, 6 (Better qualities and usually the purest whites), 9 (Richest reds), 17, 22, 24, 25, 32 (other than richest colours).

(3) For cheapest grade and fixtures of all sorts, Categories N. *1, 2, 3, 4, 5, 6, 7 and 9.

Floats (see *Buoys*).

Foundation Sills (see *House-construction*).

Founders' Patterns (see *Sculpture*).

Frames—Mirror and Picture (see *Mouldings*).

Furniture and Cabinetwork (see also *Fixtures and Veneer*).

(1) *Durable and Handsome woods.* So many elements—durability, strength, grain, colour, price, etc.—enter in the choice of woods for furniture and cabinetwork, that it is difficult to make a really useful classification, but the mode in which the Categories have been arranged helps in this direction to a considerable extent, and, for the matter of that, in all branches of utilization; here, the arrangement is adopted of three grades only. These woods are used solid, or as veneer, or as inlaying materials; for tables, chairs, side-boards, cupboards, book-cases, wardrobes, turned and carved table-legs, pedestals and pillars, panelling, moulding and ornamental bordering, and a variety of other uses; Categories N. *5 and 6 (especially the pure white or harder tinted grades), 8, 9 (Richer reds), 10, 11, 12, 13, 14, 15, 18 (for small work), 19, 20, 21, 22, 23, 24, 25 and 26 (Higher grades), 28, 29, 30, 31, 32 (Richer colours), 33, 34.

(2) *Woods of Medium price*, of good or fair quality, common to abundant, but not so highly esteemed as lacking in high qualities of colour and grain, but largely used or capable of being used for backs or bottoms, shelves, linings, or for commoner use, or stained or varnished; Categories N. *4, 5, 6, 8, 9, and lower grades of 11, 12, 17, 21, 24, 26, 27 and all of 25.

(3) *Cheap woods*, soft and easily worked, used for the most ordinary kind of furniture, or used or capable of being used under veneer for the highest class of furniture as is the case in Europe and America; Categories N. *1, 2, 3, 4, 5, 6, 7, 9, and lower grades of 8, 10, 11, 12, 13, 16, 17.

(4) *For moth-proof cabinets*, wardrobes, bookshelves, etc., Categories N. *15 and 29 to 34 are especially suitable.

(5) *One-piece Table-tops* made out of the buttress wood of certain species are a feature of Philippine furniture work that might well be imitated in India: The table-tops are round or rectangular, mostly of Pterocarpus, occasionally of Shorea and Hopea (our Dipterocarpus, Vateria, Vatica and Hopea would serve here), Pahudia (cf. Hardwickia), Heritiera and Tarrietia. These, as well as large trees of softer species, especially Dracontomelum (cf. Mangifera), Parkia (cf. Albizzia stipulata), Alstonia, Palaquium (Dichopsis), Sideroxylon (Chrysophyllum), and others are used for

Corks); S.-R=(2. Willows); PkYBsg=(3. Alders); Wsg=(4. Hazels); W=(5. Birches, 6. White Deals, 7. Aspens); M.-R=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); YB=(13. Teaks, 14. Jacks, 15. Camphors); W=(16. Ashes, 17. Sycamores); Anom=(18. Hastings); H.-R=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); YB=(23. Walnuts, 24. Sals, 25. Elms); W=(26. White Cedars, 27. Malletwoods); VH.-Hk=(28. Ebonies); R=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); YB=(32. Turkey Oaks); W=(33. Olives); XH.-RYB=(34. Lognum-vita).

'bateas' or huge shallow bowls and washtubs. In connexion with the first item, attention may be drawn to our species of the following genera (this being a question of size, it cannot be dealt with in categories):—Acrocarpus, Adina, Aglaia, Artocarpus, Cedrela, Chukrassia, Cullenia, Dalbergia, Dipterocarpus, Dysoxylum, Eugenia (Gardner), Filicium, Gluta, Hopea, Mesua, Michelia, Pterocarpus, Schleicheria, Soyimida, Tamarindus, Tectona, Vateria, Vatica, Vitex, Xylia, and of course there are also many other large species but not quite equal to these. In connexion with the second item:—Albizia (stipulata), Alstonia, Antiaris, Bombax, Chrysophyllum, Dichopsis, Elavocarpus, Mangifera, Myristica, Salix, Sterculia, Tetrameles. On somewhat similar lines, in former days solid one-piece cart-wheels were used in India chiefly from species in Categories N. *17 and 27; these have almost entirely died out, but it is a matter for consideration whether solid wheels of larger size and broader rim from some of the above species might not be adopted for carting huge timbers in such localities where carting is necessary rather than water or rail traffic.

Golf Clubs (see *Sporting Goods*).

Gymnasium Apparatus (see *Sporting Goods*).

Gun-Carriage Timber (see *Vehicles*).

Gun Stocks (see *Sporting Goods*).

Handles (see also *Levers* and *Wooden Tools*).

(1) *Handles for adzes, axes, hammers, hatchets, and mallets*:—wood hard to very or even extremely hard, tough and somewhat elastic and springy, difficult to split:—Categories N. *11, 12, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 30, 33, 34.

(2) *Handles for mattocks, mauls, picks, etc.*:—similar to above.

(3) *Handles for brooms, brushes, mops, rakes, hoes, etc.*:—wood usually much softer, not too heavy, straight grained and

fairly tough; Categories N. *4, 5, 6, 7, 8, 9, 11, 16, and stronger 22, 24, 30.

(4) *Handles for choppers, knives, wrenches, surgical and other professional instruments (also butt-plates for braces and drills, hollow-handles, etc.*:—Categories N. *6 (Harder), 10, 11, 12, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34.

(5) *Handles for Chisels* require a wood that is hard, tough and especially difficult to split; if provided with a ring at the butt, practically any wood in the above list will make a good chisel handle; for a plain chisel handle; Categories N. *11, 12, 20, 21, 22, 24, 27, 30, 34 are the best.

Hand-Rails (see *Stair-work*).

Hand-Spikes (see *Levers*).

Hat-Blocks—

The type of wood required is one that is soft, light, easy to work, not liable to crack, nor be attacked by mould nor insects; Categories N. *2, 4, 5, 7 taking precautions in connexion with the last proviso, and still better N. *10 (Softer), 15 (Softer).

Hoops (see *Cooperage*).

House Construction (see also *Poles, Posts, Stair-work*, and, for Interior Finish, *Fixtures*)—

(1) *Foundation Sills, Posts, and Stumps*:—Categories N. *11 (Harder), 12, 13, 14, 15 (Harder), 20, 21, 23, 24 (Higher grade), 25, 26 (Higher grade), 27 (Higher grade), 29, 30, 31 (excluding Parinarium), 33, 34.

(2) *Posts above Stumps*:—Categories N. *4, 5, 6, 8, 9, 10, 11, 12, 14, 16, 17, 19, 20, 21, 24, 26 and 27 (all lower grade), 31 (Parinarium), 32, 34 (Bruguiera).

(3) *Beams, Joists, Rafters, Studding, etc.*—

(a) Where considerable strength and especially durability are required, the woods for Sills and Posts, see (1) above;

(b) Where the situations are thoroughly protected from the weather and at a sufficient distance from the ground, the woods for Posts above stumps, see (2) above;

(c) For light or temporary work:—Categories N. *1, 2, 3, 4, 5, 6, 7, or, better, 8, 9, 16, 17.

VS. W=(1. Corks); **S.-R.**=(2. Willows); **PkYBsg.**=(3. Alders); **Wsg.**=(4. Hazels); **W.**=(5. Birches, 6. White Deals, 7. Aspens); **M.-R.**=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); **YB.**=(13. Teaks, 14. Jacks, 15. Camphors); **W.**=(16. Ashes, 17. Sycamores); **Anom.**=(18. Bast-rings); **H.-R.**=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); **YB.**=(23. Walnuts, 24. Sals, 25. Elms); **W.**=(26. White Cedars, 27. Malletwoods); **VH.-Bk.**=(28. Ebonies); **R.**=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); **YB.**=(32. Turkey Oaks); **W.**=(33. Olives); **XH.-RYB.**=(34. Lignum-vitæ).

(4) *Flooring*—

(a) For high-grade work, requiring durability, beauty of colour and grain, and capable of taking and retaining fine finish:—Categories N. *6 (Harder), 11 and 12 (Higher grades), 13, 14, 15 (Harder), 19, 20, 21, 23, 24, 26 and 27 (Higher grades), 29, 30, 32 (Higher grades), 33;

(b) For cheaper work:—Categories N. *3, 4, 5, 6 (Softer), 7, 8, and, better, 8, Lower grades of 10, 11, 12, 13, 15, 16, 17, 22, 25, Lower grades of 24, 26, 27, 32 and 34 (Bruguiera),

(c) For floors subject to heavy and rough usage:—Categories N. *9, 12, 20, 21, 24, 25, 31, 34.

(5) Siding, or weatherboarding outside walls, eavesboards, walls of wooden houses exposed to weather, etc.:—

(a) Where exposed to weather or near the ground and unpainted:—Categories N. *6 and 11 (Harder), 12, 13, 15 (Harder), 20, 21, 23, 25, Higher grades of 24, 26, 27 and 30, 29, 31, 34.

(b) Where protected or well painted:—Categories N. *4, 5, 6, 8, 9, 10, Lower grades of 11, 12, 13 and 15, 16, 17, 22, Lower grades of 24, 26, 27, 30, 32.

(6) *Sheathing and Wainscotting, Panelling and Ceiling*; for this purpose, the chief requisites of a good wood are beauty of grain, freedom from attacks of borers, and also comparatively light soft woods are preferred especially when a large part of the preparation is handwork.

(a) Better-grade Ceiling, etc.:—Categories N. *8, 10, 11, 12, 13, 14, 15, 16, 17.

(b) Common Ceiling, etc.:—Categories N. *3, 4, 5, 6, 7, 9 (Lighter).

(c) *High-grade Sheathing, Wainscotting and Panelling*:—Categories N. *11, 12, 13, 14, 15, 19, 20, 21, 23, 26, 29, 33.

(7) *Window-sills*; Categories 6 (Hard), 10, 11, 12, 13, 14, 15, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 34. For cheaper work, N. *8, 9, Lower grades of 24.

(8) *Window-framing*; Categories N. *10, 13, 15, 19, 24 (Higher grade), 26, 27, 29.

(9) *Blinds, Shutters and Venetians*:—

(a) Better class:—Categories N. *12, 13, 14, 20, 21, 26, 29, 31.

(b) Inferior class:—Categories N. *6 (Harder), 8, 17, 24, 25.

(10) *Doors*:—Categories N. *12, 13, 14, 15, 19, 20, 21, 22, 23, 25, 26, 29, 32, 34. Cheaper, N. *6, 9, 10, 17, 24 and 27 (Lower grade).

(11) *Shingles*:—Categories N. *6, 9, 10, 11, 12, 13.

Household Implements.

(1) *Bowls, Dishes and Platters, Trays*; Categories 3, 4, 5, 6, 7, 8, 9, 10* 13, 14, 15, 17, 18, 21, 29.

In the Philippines, from the huge shallow wash-tubs (bateas—see Furniture—) down to the various round or flat bottomed dishes used in the houses, the majority are made from buttresses of large trees, the chief species employed being *Pterocarpus*, *Pahudia*, *Parkia*, *Dracontomelum*, various *Dipterocarps*, *Palaquium*, *Sideroxylon* and *Alstonia*.

(2) *Ladles and Spoons*:—Categories N. *4, 5, 6, 13, 17, 33.

(3) *Mortars and Pestles*; these demand hardness, durability and comparative ease of working:—Categories N. *6 (Harder), 8, 9, 11, 12, 13, 17, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34.

(4) *Ricemills*; in the Philippines domestic ricemills for blanching or polishing rice, which are easily worked, are in common use; they consist of a framework of common soft woods (Categories N. *1, 2, 3, 4, 5, 6, 7) and bamboo, with one special part, 'the burrs', made of narrow strips of hard wood (Categories N. *30 and 34) set in a cement on the surface of a disk, so as to form a pattern like that of the burrs of a millstone.

(5) *Shoulder-poles or Kavadis*; these require a tough elastic wood:—Categories N. *11, 16, 20, 21, 22, 26, 27, 30.

(6) *Skewers*; these are made of pale coloured tough woods of the Categories N. *4, 5, 20, 21, 22, 26, 27, 30.

VS. W=(1. Corks); S. R=(2. Willows); PkYBsg=(3. Alders); Wsg=(4. Hazels); W=(5. Birches, 6. White Deals, 7. Aspens); M.-R=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); YB=(13. Teaks, 14. Jacks, 15. Camphors); W=(16. Ashes, 17. Sycamores); Anom=(18. Bast-rings); H.-R=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); YB=(23. Walnuts, 24. Sals, 25. Elms); W=(26. White Cedars, 27. Malletwoods); VH.-Bk=(28. Ebonies); R=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); YB=(32. Turkey Oaks); W=(33. Olives); XH.-RYB=(34. Lignum-vitæ).

Hubs (see *Vehicles*).

Hurdles (see *Agricultural Machinery*).

Hydraulic Works (see also *Bridge-building* for Piles, and *House-construction* for Foundation-sills)—

(1) *Water troughs and scoops, Well curbs and framing, Timber for covering perpetually damp places*:—Categories N. *3, 6, 12, 13, 20, 21, 23, 24, 25, 27, 31.

(2) *Water-mill wheels*:—Categories N. *12, 13, 20, 21, 22, 23, 25.

Indian Clubs (see *Sporting Goods*).

Inlaying (see *Sculpture*).

Interior Finish (see *Fixtures*).

Jewel Boxes (see *Sculpture*).

Joinery (see *House-construction*).

Joists (see *House-construction*).

Kitchen ware (see *Household Implements*).

Knees (see *Ship-building*).

Knife Handles (see *Handles*).

Lacquer Boxes (see *Boxes*).

Ladders—

Very few ladders are made in the Tropics, where Bamboo is almost universally available, (and might well be properly seasoned and sent to Europe for the purpose).

(1) For *sides*, the wood should be light but tough and elastic:—Categories N. *5, 6, 9, 11, 16, 24. In Europe, half poles of Spruce or Scotch Pine are almost exclusively used.

(2) For *rungs*, strong wood is required, and, if exposed to the weather, should ordinarily be painted:—Categories N. *11, 12, 13, 20, 21, 22, 23, 24, 25, 26, 27, 30, 31, 34. In Europe the Cornel and Blood Cornel are largely used.

Ladies (see *Household Implements*).

Lance Shafts (see *Sporting Goods*).

Lasts (see *Boot-findings*).

Levers.

Under this head may be conveniently grouped Cant-hooks, Peavies, Capstan-bars, Hand-spikes, and similar large and heavy tools or handles requiring hard and tough woods:—Categories N. *11, 13, 16, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 33, 34.

Life Boats and Preservers (see *Buoys*).

Lighters (see *Ship-building*).

Linoleum (see *Buoys*).

Machinery (see *Agricultural Machinery, Bearings, Bedplates for machinery*).

Masts (see *Ship-building*).

Matches (see also *Veneer*).

Matches require a soft but tough and straight grained wood; as there is a prejudice against coloured woods, though there is no conceivable reason why coloured woods should not be employed, a white or pale coloured wood is advisable:—Categories N. *1, 4, 5, 6, 7 and pale coloured species of 3, 9 and (Cullenia only) 11.

Measures (see *Boxes and Draftsmen's Implements*).

Mine Timbers (see *Ties and Mine Timbers*).

Mirror-Backs -- Hand (see *Novelties*).

Mirror Backing (see *Veneers*).

Mirror Frames (see *Mouldings*).

Models (see *Buoys*).

Mortars (see *Household Implements*).

Mouldings and Sticker-work.

Very little in the way of Mouldings is undertaken in tropical countries—

- (1) For *Interior finish*, the same woods are naturally employed as for the remaining inside finish (see *Fixtures*).
- (2) *Picture and Mirror Frames* (see *Sculpture*).
- (3) *Dowels* for doors, windows and furniture are made of woods tough and difficult to split; Categories N. *20, 21, 22, 23, 24, 25, 26, 27.
- (4) *Rolling Porch and Window Screens* are made of soft light wood, in strips about $\frac{1}{2} \times \frac{1}{4}$ inch, tied together and heavily painted, the cords by which they are tied being

VS. W=(1. Corks); S.-R=(2 Willows); PkYBsg=(3. Alders); Wsg=(4. Hazels); W=(5. Birches, 6. White Deals, 7. Aspens); M.-R=(8. Cherries, 9. Red Deals, 10. Red Cedars, 11. Chestnuts, 12. Oaks); YB=(13. Teaks, 14. Jacks, 15. Camphors); W=(16. Ashes, 17. Sycamores); Anom=(18. Bast-rings); H.-R=(19. Mahoganies, 20. Pears, 21. Plums, 22. Yews); YB=(23. Walnuts, 24. Sals, 25. Elms); W=(26. White Cedars, 27. Malletwoods); VV.-Bk=(28. Ebonies); R=(29. Rosewoods, 30. Lancewoods, 31. Green-hearts); YB=(32. Turkey Oaks); W=(33. Olives); XH.-RYB=(34. Lignum-vitæ).

Painted as well as the wood; Categories N. * 1, 2, 3, 4, 5, 6, 7, 9, and 10 (Softer).

Mud Guards (see *Vehicles*).

Musical Instruments

- (1) *Guitars, Mandolins, Bandurias, etc.*—
 - (a) Backs and sides:—Categories N. * 5, 6, 8, 10, 11, 12, 14, 15, 20, 21, 23, 26, 27, 29, 33.
 - (b) Sounding boards:—Categories N. * 6, but usually old box-lumber of European or American Coniferous trees.
 - (c) Necks:—Categories N. * 5, 8, 9, 10, 19, 20, 21, 25.
 - (d) Heads:—Categories N. * 5, 8, 9, 10, 19, 20, 21.
 - (e) Finger boards:—Categories N. * 6, 17, 20, 21, 23, 26, 27, 28, 31, 34.
 - (g) Keys, Tail-pieces:—Categories N. * 28, 29, 34; and see Ebony substitutes.
 - (h) Trimmings:—Categories N. * 5, 20, 21, 26, 27, 28, 29.
 - (i) Interior reinforcement:—Categories N. * 4, 5, 6, or more usually Coniferous box-lumber for cross-battens, whilst strips of rattan are glued along the joints.
- (2) *Harp*—
 - (a) Base, usually a solid block shaped of Categories N. * 9 (Hard) or 25.
 - (b) Back and sides of body:—Categories N. * 8, 9, 14.
 - (c) Sounding board:—Coniferous box lumber (see Sounding Boards at end).
 - (d) Pillar:—Categories N. * 9 (Hard), 29.
 - (e) Wrist-plate:—Categories N. * 21, 29, 39, 34.

Note.—The above are taken from material actually used in the Philippines.

(3) *Piano cases*; in the Philippines *Cedrela* (*10) was used both for the outside, for the sounding-board, and for all inside fittings exclusive of the metal mechanism; for piano cases proper, not only in the Philippines, but in America and Europe, or recommended both in the Philippines and India:—Categories N. * 8, 9, 10, 11 (Higher grade), 14, 19, 20, 21, 22, 23, 27, 29, 30, 33, 34.

(4) *Drums*; Categories N. * 5, 6, 21, 27.

(5) *Cattle bells*:—10, 13, 26.

(6) *Organ pipes*:—Category N. * 13 (*Gmelina*).

(7) *Sounding boards*; in Europe, the only wood used is the very best dense mountain (exceedingly slow) grown Spruce with very narrow annual increments; this wood is non-porous and very homogeneous and moderately hard; the hardness is not of much consequence, but the homogeneity, freedom from warping, and normally the reduction of pores to a minimum is necessary for the perfect transmission of sound waves; nevertheless, *Gmelina* (*13) and *Cedrela* (*10) have been found good material for sounding boards, and in both cases the pores are large to medium; it is probable that all woods that do well for wind-instruments (see below), drums, or even cattle-bells, would form good woods also for sounding boards also, and woods for sounding boards fetched in Europe, as long ago as the late seventies, prices up to 500 francs per cubic metre (about Rs. 8½–8¾ per cubic foot):—Categories N. * 5, 6, 8, 13, 15, 17, 26, 27, and perhaps 33.

(8) *Wind Instruments*, such as flutes, flageolets, etc.:—Categories N. * 8, 13, 17, 27, 33.

Newels (see *Stair-work*).

Ninepins (see *Sporting Goods*).

Novelties—

(1) *Desk Supplies*, such as Paper-weights, Inkstands, Pen and Pin Trays, etc., for which chiefly hard heavy dense woods of striking colour are in demand:—Categories N. * 6 (Harder), 12, 13, 14, 15, 17, but more especially 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 33, 34.

(2) *Mirror and Brush Backs*, and similar toilet articles, principally Ebony (*28) and Ebony substitutes (*17, 20, 21, 22, 27 and 30 stained black), but the woods of the Desk Supplies would also make, and sometimes do make, fine material.

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(3) *Combs*:—Categories N. * 4, 5, 6, 11, 20, 21, 22, 28, 30, 34.

(4) *Toothpicks*:—Categories N. * 4, 5, 6, 15, 17, 25.

(5) *Tobacco-pipe bowl and stems*; in Europe, the principal woods used for tobacco pipes are Cherry and Mahaleb Cherry, Tree Heath (called in French *Bruyère*, and corrupted into English as 'Briar'), and the Australian 'Myall'. For the 'Briar', *Rhododendron*, *Vaccinium*, *Gaultheria*, and perhaps *Ternstroemia*, especially the root-wood of all (Category N. *10), should answer very well. As regards the 'Myall' (*Acacia homalophylla*) perhaps others of the Category N. *21 might do, but it is doubtful whether they would have the violet scent, which is characteristic of the Myall; possibly *Alsodeia* (Category N. *5), which has violet scented wood, *Hugonia* (*27) with violet scented roots, or *Erythroxylon* with a characteristic scent (*29) might suit. As regards the softer Cherry perhaps Category N. *8 might do for common purposes, but the characteristic Cherry scent in both that and the harder Mahaleb Cherry would probably be obtainable from *Pygeum* in Category N. *19.

Oars (see *Ship-building*).

Oil Casks (see *Cooperage*).

Oil Mills (see *Agricultural Machinery, Bearings, Household Implements*).

Opium Cases (see *Boxes—Packing-cases*).

Package Boxes (see *Boxes and Veneers*).

Packing Cases (see *Boxes*).

Paddles (see *Ship-building*).

Palls (see *Cooperage*).

Palings (see *Agricultural Machinery and Posts*).

Panelling (see *House-construction*).

Paper Pulp and Papier-Maché.

The best and whitest paper-pulp in Europe is made from the Aspen, but the bulk is prepared from the brashy type of Spruce;

the following are in use, as indicated by Cross, Bevan and Sindall in their *Wood pulp and its uses*, pp. 89, 133;—American Basswood (*Tilia americana*) and White Poplar, Category N. * 2; Yellow and White Birch, Category N. * 5; Common Spruce, White Spruce, Black Spruce, European Silver Fir, Indian Fir, Balsam Fir of America, Hemlock of Canada and America, White Pine, Category N. * 6; Aspen and Black Poplar, Category N. * 7; Larch and Tamarack, Black Pine of Austria, Pitch Pine or Swamp Pine (*Pinus palustris*), Category N. * 9; and Soft Maple, Category N. * 17. Papier-maché is made chiefly from Linden, White Willow and White Poplar, all of Category N. * 2.

Paving Blocks—

(1) *Untreated*:—Categories N. * 11, 12, 13, 14, 20, 21, 23, 25, Higher grades of 24, 26 and 27, 30, 31, 34.

(2) *Treated*:—Categories N. * 9 (Softer, only where traffic not severe; Harder, under all conditions), 12, Lower grades of 24, 26 and 27, 22, *Parinarium* in 31, and *Rhizophora* in 34.

Peavies (see *Levers*).

Pencil Slats—

The best 'Cedar' Pencils are not of Cedar wood but of various kinds of Juniper, which also goes by the name of 'Pencil Cedar'; nor has it anything to do with Red Cedar, except perhaps in scent and to a certain extent in colour, but the Red Cedar is far too porous for pencil making, for, for that purpose a soft straight and fine grained wood as free from pores (the Conifers are characteristic in being quite devoid of pores) as possible or with the pores small to very small; the Juniper also has a Cedar scent, and, if this can also be obtained, so much the better. That neither the brown or red-brown colour, on the one hand, nor the scent, on the other, is essential, is evident that a very large proportion of the pencils used in India, commonly known as 'Bazaar Pencils', are white and scentless, their sole recommendations being that they will make a black mark and that they are cheap to such a degree that practically the poorest can buy; these are ordinarily made of White Deal, or occasionally of Aspen, Poplars, and so forth; but here again the wood is soft, straight grained and without, or with very small, pores. The Categories that might answer this purpose are:—N. * 2, 6 (for cheap), 7 (for cheap), and 15 (Softer), the last being about the nearest approach in grain, scent and colour (except perhaps the

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Cinnamons of Category N.*9) to the Pencil Cedar, of the indigenous species of this Presidency.

Pestles (see *Household Implements*).

Picture Frames (see *Sculpture*).

Piling (see *Bridge-building*).

Platters (see *Household Implements*).

Plumbago Casks (see *Cooperage*).

Poles—Carriage (see *Vehicles*).

Poles—Telegraph, Telephone, and Trolley.

(See also *Posts*—Creosoted).

Categories N.*11 (Lagerstroemia only), 14, 20, 21, 23, 24, 25, 26, 27 and 30 (Higher grade), 29, 33, 34.

Poles—Vaulting (see *Sporting Goods*).

Police Clubs (see *Clubs*).

Posts—House (see *House-construction*).

Posts—Fence—

(1) Not creosoted :—Categories N.*10, 11 (Harder), 12, 14, 15 (Harder) 19, 20, 21, 23, 24 (Higher grade), 25, 26, 27, 29, 30, 31, 33, 34.

(2) Creosoted Telegraph Poles and Fence Posts :—Categories N.* 2, 3, 6, 8, 9, 10, 11 (Softer), 16, 17, 19 (Softer), 22, 24 (Lower grade), 31 (Parinarium), 32.

Printers' Materials—

(1) *Engraving Blocks*; hard to very hard, very fine and close grained, and homogeneous :—Categories N.*13 (Vitex), Lighter colours in 20 and 21, 24 (Vatica), 26, 27, 33.

(2) *Wooden Type*; as the process of engraving is much simpler, light colour is not so necessary as for fine engravings, so :—Categories N.* 13, 20, 21, 22, 24, 26, 27, 30, 31, 33, 34.

(3) *Electrotype*; for electrotype blocks, a wood is required that is not liable to shrink, swell or warp when thoroughly seasoned,

soft enough to take small nails easily, but not liable to crack or sliver round the edges :—Categories N.* 3, 5, 6, 8, 9, 10, 11 (Softer), 14 (Sonneratia), 15, 21, 24 (Hopea softer), 26, 30 (Softer).

(4) *Quoins*; require wood smooth, hard, tough and difficult to split :—Categories N.* 20, 21, 22, 24 (Hopea), 26, 27, 29, 30, 34.

Pulleys (see *Bearings*).

Pyrography—

For this, the chief requirements are homogeneous texture and even light colour :—Categories N.* 1 (Givotia), 5, 6, 15, 17, 26.

Quoins (see *Printers' Materials*).

Rafters (see *House-construction*).

Reaches (see *Vehicles*).

Rice Mills (see *Agricultural Machinery, Bearings, Household Implements*).

Rollers—

(1) *Softwood* :—Categories N.* 4, 5, 7, 8.

(2) *Hardwood* :—Categories N.* 15, 16, 17, 20, 21, 22, 26, 27, 30, 31, 33, 34.

Roller Skates (see *Sporting Goods*).

Rolling Screens (see *Mouldings and Stickerwork*).

Rulers (see *Draftsmen's Implements*).

Saw-Guide Blocks (see *Bearings*).

Scabbards and Sheaths (see *Boxes*).

Scales (see *Draftsmen's Implements*).

Screws—

Hard to extremely hard tough wood not likely to split nor sliver at edges :—Categories N.* 20, 21, 22, 24 (Higher grade), 26, 27, 30, 31, 33, 34.

Sculpture, Carving and Inlaying.

(1) *Sculpture of Images*—

(a) Soft to moderately hard, and mostly pale colour—Categories N.* 4, 5, 6, 10, 13, 15, 17;

(b) Hard, and mostly rich coloured, including statues to be set permanently out of doors :—Categories N.* 13, 19, 20, 21, 23.

(c) Pedestals and platforms on which statues are carried in processions.—Categories N.* 6 (Harder), 8, 19, 20, 23, 29.

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(d) Stationary pedestals where weight is no objection :—
Categories N.* 13, 19, 23, 29, 33.

(e) Mouldings, carved ornaments, raised plain or carved panels, etc., the same woods are used.

(2) *Ornamental Church Fixtures*, such as altars and other ornamental or ornamented fixtures, carved and turned ornaments, etc.

(a) Where strength is essential, or where subjected to wear—Categories N.* 10, 13, 19, 20, 21, 23, 29.

(b) Where strength is not essential :—Categories N.* 4, 5, 8, 19, 15.

(c) For benches and for posts and handrails of partition railings in churches, articles subject to much handling and wear, often more or less ornamented with carvings :—Categories N.* 13, 21, 23, 26, 29, 33.

(3) *Chests and Jewel-boxes*, often ornamented with a flat design executed by the method of chip-carving :—Categories N.* 4, 5, 13, 19, 20, 21, 22, 26, 28, 29.

(4) *Picture frames* :—Categories N.* 4, 5, 6, 8, 10, 11, 13, 17, 19, 20, 21, 22, 23, 26, 27, 28, 29, 33.

(5) *Carved Panels, Pillars, Finials, Feet*, etc., for furniture, for harps, and other articles, also carved letters and ornaments for show-cases, etc., similar woods are employed, and many others, depending on the caprice of the owner of the work.

(6) *Inlaying* of small tables, cabinets, china closets, desks, wardrobes, etc. :—

Categories N.* 4, 5, 13, 14, 15, 17, 26, 27, 33... Whitish or Yellowish ;

10, 19, 20, 21, 22, 29 ... Red

8, 14, 23 ... Brown

28, and Ebony substitutes ... Black.

(7) *Fancyware* :—Categories N.* 4, 5, 6, 19, 21, 23, 26, 33.

(8) *Toys* :—Categories N.* 1, 3, 4, 5, 6, 7, 8, 17, 21.

(9) *Founders' Patterns* ; either a soft, or hard to extremely hard, but always a homogeneous, close and even grained, wood :—Categories N.* 2, 4, 5, 13, 15, 20, 21, 26, 27, 30, 31, 33, 34.

Shafts—Cart and Carriage (see *Vehicles*).

Shafts—Machinery (see *Agricultural Machinery*).

Shades—Porch and Window (see *Mouldings and Stickerwork*).

Sheathing and Wainscoting (see *House-construction*).

Sheaths (see *Boxes*).

Sheaves (see *Bearings*).

Shelves (see *Fixtures*).

Ship Building

(1) *Cabin-work* :—

(a) Highest grade :—Categories N.* 8, 10, 11, 12, 13, 14, 19, 21, 23, 29, 30.

(b) Cheaper grade :—Categories N.* 9, 22, 24.

(c) Cheapest work :—Categories N.* 2, 3, 4, 5, 6, 7, 8.

(2) *Keels* :—Categories N.* 11, 12, 13, 14, 20, 21, 23, 24, 27, 31, 34.

(3) *Knees and Ribs* either of natural crooks or sawn out of planks ; if the latter, sawn out approximately along the curvature of the grain :—Categories N.* 12, 13, 15, 20, 21, 22, 23, 24, 29, 32, 34.

(4) *Masts and Spars* :—Categories N.* 6, 9, 11, 16, 20, 22, 24, 30.

(5) *Planking* :—Cheaper, Categories N.* 6 and 9 ; More expensive and best work, Categories N.* 11, 12, 13, 14, 15, 19, 22, 23, 24, 26, 31, 32, 34.

(6) *Treenails* :—Categories N.* 11, 12, 14, 16, 21, 24, 26, 27, 29, 30, 31, 33, 34.

(7) *Ships' Wheels* :—Categories N.* 31, 34.

(8) *Dugouts and Catamarans* :—Categories N.* 3, 5, 6, 7, 8, 9, 10, 11, 14, 17, 20, 21, 22.

(9) *Boats and Canoes* :—Categories N.* 6, 9, 10, 11, 14, 16, 19, 20, 21, 26.

(10) *Barges Lighters and Scows* :—Categories N.* 6, 9, 24.

(11) *Oars and Paddles and Rudders* :—Categories N.* 5, 6, 9, 10, 11, 13, 14, 16, 22, 24, 30.

(12) *Backing of Ironclads* :—Category N.* 13.

Shoe Lasts (see *Boot-findings*).

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Shoe Soles (see *Boot findings*).

Shoulder Poles (see *Household Implements*).

Show Cases (see *Fixtures*).

Shutters (see *House-construction*).

Shuttles (see *Bobbins*).

Slates (see *Draftsmen's Implements*).

Sleepers (see *Ties and Mine Timbers*).

Siding or Outer Walling (see *House construction*).

Sieve Frames (see *Boxes*).

Sills (see *House-construction*).

Single-Piece Table Tops, Wash Tubs and Cart-Wheels (see *Furniture*).

Singletrees (see *Vehicles*).

Skewers (see *Household Implements*).

Skittles (see *Sporting Goods*).

Spars (see *Ship-building*).

Spears and Lance Shafts (see *Sporting Goods*).

Spindles (see *Bobbins*).

Spokes (see *Vehicles*).

Spools (see *Bobbins*).

Spoons (see *Household Implements*).

Sporting and Athletic Goods

(1) *Bars; Horizontal, Parallel, Trapeze, etc.*:—Categories N.* 11, 16, 20, 21, 22, 24, 25, 26, 27, 30, 31, 34; tough, smooth, springy or somewhat elastic woods.

(2) *Billiard Cues*:—Shafts, Categories N.* 6, 9, 11, 14, 16, 20, 21, 22, 24, 26, 27, 30; Butts, Categories, N.* 12, 21, (for lighter shafts), 21, 28, 29, 31, 32, 34, (for heavier shafts).

(3) *Billiard Table*:—Categories N.* 9, 19, 20, 21, 29.

(4) *Bowling Alleys*; hard, tough, fine grained, Light coloured woods:—Categories N.* 20 and 21 (lighter colours), 24 (Hopea), 26, 27, 30.

(5) *Bowling Balls*, Very hard to extremely hard, tough and difficult to split:—Category N.* 34.

(6) *Bows*; tough and elastic woods:—Categories N.* 16, 22, 30, 34.

(7) *Cricket Bats*:—Salix (*2) has been tried, not quite successfully, too heavy: 27. Trema (*2), 269. Barringtonia (*4), 296, 297. Hymenodictyon (*5), 436. Trewia, (N.*6), 287, 288. Mastixia (*7), and 115. Melia, 145. Lophopetalum, and 163. Meliosma (*10) might be tried.

(8) *Croquet sets*, requiring combined weight hardness and toughness:—Categories N.* 20, 21, 22, 24 (Hopea), 26, 27, 29, 30, 31, 33, 34, bearing in mind the facts, (a) the heavier the better, (b) sometimes pale coloured woods are preferred, Boxwood being the typical wood of which these goods are usually prepared in Europe.

(9) *Dumbbells*, requiring hard to extremely hard, rather heavy to very heavy according to personal preference, woods capable of taking a fine polish:—Categories N.* 13, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31, 33, 34.

(10) *Fishing Rods*, as for Bows, hard tough and elastic woods are required:—Categories N.* 16, 22, 30, 33, 34. In the Philippines, Palm wood is found as suitable as any.

(11) Golf Clubs

(a) Heads; in America, the sapwood of the Ebonies (Diospyros, various species) has been found as good as any wood, but other woods heavy tough and difficult to split are also serviceable:—Categories N.* 17, 20, 21, 22, 24, 26, 27, 30, 33, 34.

(b) Shafts; in the Philippines, Palm wood again is recommended provided it is not too heavy; much the same type is required as for Bows and Fishing rods, but toughness is rather preferable to actual elasticity, and the wood should be somewhat lighter; Categories N.* 11, 16, 17, 20, 22, also, but rather heavy, 30, 33, 34.

(12) *Gun Stocks*; Walnut is the wood par excellence used in Europe for this purpose, and the woods of Category N.* 23 have almost the exact colouring which is a quality considerably esteemed, but for the most part they are heavier and in this way

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correspond more nearly to the Hickory (a closely related genus) which is sometimes used in America for the purpose (* 16); other species recommended in the Philippines, or reported to have been used in India, are Categories:—**N.* 2** (Harder Myristicas), 3 (Morinda), 5 (Hymenodictyon), 8, 9, 10, 11, 12, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 29, 30, 31, 33, 34.

(13) *Indian Clubs*; for this purpose, lighter woods are generally used than for dumbbells, otherwise the properties are much the same;

(a) Lighter Clubs, Categories **N.* 8, 9, 10, 11, 14, 15.**

(b) Heavier Clubs, Categories **N.* 19, 21, 22, 24, 26, 27, 29.**

(14) *Roller Skate Wheels*, practically the same woods as are required for Bearings:—Categories **N.* 24, 25, 26, 27, 29, 30, 31, 33, 34.**

(15) *Ninepins, Tenpins, Skittle Balls*; Categories **N.* 9, 21, 22, 34.**

(16) *Lance and Spear Shafts*:—Categories **N.* 16, 22, 30, 33, 34.**

(17) *Vaulting Poles*; Lighter woods of the same class as the last:—Categories **N.* 6, 16, 22**; but bamboos (solid) are probably the best material.

Stair Work

(1) *Balusters and Handrails*—

(a) Superior work, Categories **N.* 11, 13, 14, 19, 20, 21, 23, 24, 26, 27, 29, 30, 32, 33, 34.**

(b) Medium grade work, Categories **N.* 6** (Harder), 9 (Harder), 8, 16, 17.

(c) Cheaper work, Categories **N.* 2, 4, 5, 6** (Softer), 9 (Softer).

(2) *Risers and Treads*:—Categories **N.* 13, 20, 21, 22**, for best work, and **N.* 6, 9, 12, 17, 25**, for medium grade and cheaper work.

(3) *Panelling and other Trim* is naturally made, as a rule, of the same woods as the surrounding Interior Finish (see Fixtures).

Staves (see *Cooperage*).

Sugar Mills (see *Agricultural Machinery, Bearings, Household Implements*).

Sword Handles (see *Handles—Knife Handles*).

Tables and Chairs (see *Fixtures, Furniture*).

Tea Chests (see *Boxes*).

Telegraph and Telephone Poles (see *Poles, Posts—Creosoted*).

Tenpins (see *Sporting Goods*).

Tent Pegs

Categories **N.* 20, 21, 27, 31, 34.**

Triangles, T-Squares (see *Draftsmen's Implements*).

Ties and Mine Timbers

(1) *First Class Railway ties*, as accepted in the Philippines:—Categories **N.* 11, 13** (Vitex), 14, 15 (Harder), 19, 20, 21, 23, 24, 26, 27, 29, 30, 31, 33, 34.

(2) *Second Class Railway ties*, (Ditto.):—Categories **N.* 6** (Harder), 10, 11, 12, 14 (Sonneratia), 21, 25, 27, 30, 32.

(3) *Impregnated ties*; a very large number of other species would make excellent ties, if creosoted; as impregnation is effected with best results when large quantities of wood are treated and not mixed lots of various species, those woods available in large uniform lots with a continuous supply would be best for this purpose; this should be borne in mind in dealing with Categories **N.* 2, 6, 9, 17, 32, 34** (Rhizophors).

Tobacco Boxes (see *Boxes*).

Tobacco Pipes (see *Novelties*).

Tongues (see *Vehicles*).

Tool Handles (see *Handles*).

Tools Wooden (see *Wooden Tools*).

Toothpicks (see *Novelties*).

Toys (see *Sculpture*).

Trays (see *Household Implements*).

Trellises (see *Agricultural Machinery*).

Trolley Poles (see *Poles*).

Tubs (see *Cooperage, Furniture*).

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Turnery (see *Bearings, Handles, Household Implements, Rollers, Sporting Goods*).

Type (see *Printers' Material*).

Umbrella Handles (see *Canes*).

Vats (see *Cooperage*).

Vehicles

(1) *Hubs or Naves* :—Categories N. *10, 11, 12, 17, 19, 20, 21, 22, 23, 24, 25, 29, 30, 31, 32, 34.

(2) *Axles* :—Categories N. *12, 16, 23, 24, 26, 27, 30, 31, 34.

(3) *Spokes and Felloes* :—Categories N. *9, 12, 13, 16, 19, 20, 21, 23, 24, 25, 29, 30, 31, 32, 34.

(4) *Solid Cartwheels* :—Categories N. *17, 27.

(5) *Shafts* :—Categories N. *11, 12, 16, 20, 21, 22, 24, 26, 27, 30, 31, 32, 34. Ash, Hickory and Lancewood are most used in Europe.

(6) *Poles* :—Categories N. *11, 16, 23, 24, 26, 27, 29, 32, 34.

(7) *Single trees* :—Categories N. *11, 16, 24, 26, 27, 34.

(8) *Cart Yokes* :—Categories N. *8, 13, 20, 21, 22.

(9) *Beds and Frames* :—Categories N. *9, 10, 11, 12, 13, 21, 23, 24, 25.

(10) *Framework of Automobile and Carriage Bodies* :—Categories N. *21, 23, 24, 31, 34.

(11) *Framework of Aeroplanes* : hitherto the wood of 41. Calophyllum (Cat. N. *11), a comparatively light wood, but very strong tough and elastic with regard to its weight, has been found most suitable; 65. Cullenia, lighter but not quite so strong transversely, and 76. Pterospermum, rather heavier but transversely much stronger, both of the same category, might also be tried; it might also be seen whether, after being *thoroughly and properly seasoned*, some of the Figs (e.g. Banyan Wt. 36, P=600, see *6) Canarium (Wt. 37, P=523, see *9), and Celtis (Wt. 39, P=800)

would not also be useful but they should be heavily varnished or painted to preserve them from the weather.

(12) *Floors of Carriages, Jutkas, etc.* :—Categories N. *20, 21, 22, 23, 24, 25, 26, 27.

(13) *Panelling and Cart-lining* ;

(a) Medium and High grade :—Categories N. *10, 13, 17, 23, 24, 26, 27, 29.

(b) Cheap grade :—Categories N. *1, 2, 3, 4, 5, 6, 7, 8, 9 (Softer).

(14) *Dashboards* ;

(a) High grade :—Categories N. *11, 12, 13, 14, 19, 20, 21, 23, 29.

(b) Cheaper grade :—Categories N. *8, 9, 16, 17, 24, 25, 27, 32.

(c) Mud-guards of Carriages and Automobiles :—the best material is 133. Cedrela, but other good material is to be found in Categories N. *10, 16, 19, 20, 26.

(15) *Gun-carriage Building* :—Categories N. *11, 24, 25, 29, 31, 34.

(16) *Railway Carriages and Trucks* (see *Cars*).

Veneers—

There is no veneer industry, as such, in either India or the Philippines; the Philippine Match Factory uses rotary veneer cutters for making both boxes and match sticks, but that is the only veneer machinery in the Islands. Most of the material for Picture and Mirror Frames is sawn in local sawmills from logs or flitches to about 1/8 inch thickness for backing. Musical Instrument makers saw even thinner stuff by hand, whereas machine sawn veneer would serve this purpose, but rotary cut veneer could not, of course, be used by them on account of the distortion and loosening of the fibres to which the process subjects the wood. Heavy veneers might be cut for drawer bottoms, partitions, and interior panelling in desks and other furniture. Light crates, fruit packages and baskets, wooden dishes and similar articles (also common pencil slats), can be made of cheap veneers.

(1) For *High-grade Ornamental* work, the following are recommended as veneer :—Categories N. *3 (460. Ficus), 4 and 5 (Pure or Creamy Whites), 6 (Harder), 8, 10, 11, 12, 13, 14, 15, 19, 20, 21, 23, 26, 28, 29, 30, 32, 33, 34.

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(2) *Heavy veneers for drawer bottoms, etc.*:—Categories N. *6 and 9.

(3) *Cheap veneers, for Picture and Mirror frame backing, crates, baskets, wooden dishes, etc.*:—Categories N. *1, 2, 3, 4, 5, 6, 7, 8, 9.

Venetians (see *House-construction*).

Walnscooting (see *House-construction*).

Walking Sticks (see *Canes*).

Wash-Tubs (see *Cooperage, Furniture*).

Wharf Building (see *Bridge-building*).

Wheels—Solid or One-piece (see *Furniture*).

Wheelwrightery (see *Vehicles*).

Whip Stocks (see *Canes*).

Windows (see *House-construction*).

Window sills (see *House-construction*).

Wooden Baskets (see *Boxes, Veneers*).

Wooden Shoe Soles (see *Boot-findings*).

Wooden Tools—

(1) *Plane-stocks*:—Categories N. *6 (Harder), 11, 13 (Vitex), 20, 21, 24 (Vatica), 26, 27, 29, 30, 31, 33, 34.

(2) *Saw-frames*:—Categories N. *24, 29, 31, 34.

(3) *Hand-saws*; the handle of hand-saws in Europe are usually of Beech; Categories N. *20, 21, 26, 27 would suit this purpose.

(4) *Try-squares* (stock and blade), *Straight-edges, Gauges*, etc.:—Categories N. *20, 21, 22, 24 (Hopea), 26, 27, 30, 31.

(5) *Mallets*:—Categories N. *20, 21, 22, 23, 26, 27, 30, 31, 33, 34.

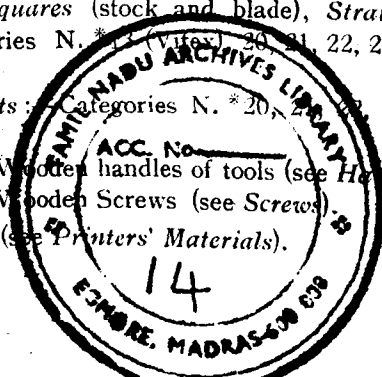
For Wooden handles of tools (see *Handles*).

For Wooden Screws (see *Screws*).

Wooden Type (see *Printers' Materials*).

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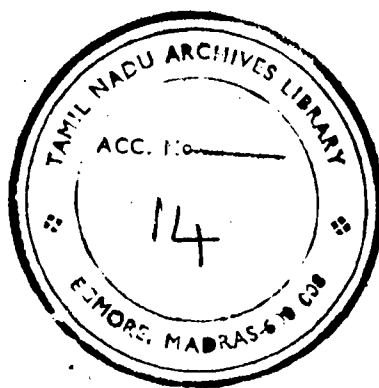
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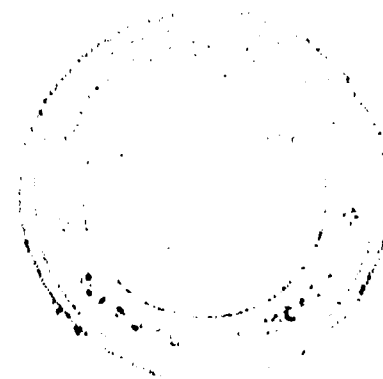
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JB954-211
N11



MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

URTICACEÆ

Villebrunlia	
812. integrifolia (t. 20 × 4")	* 4
Debregeasia	
813. velutina (t. 20 × 4")	* 11

EUROPEAN—(None)

PLATANACEÆ

EUROPEAN—

Platanus (Plane Tree)

orientalis (Plane Tree, Platane d'Orient of the French) (E) (110' × 10')	* 27
occidentalis (American Plane Tree, Buttonwood, Platane d'Occident of the French) (E) (100' × 6')	* 27

JUGLANDACEÆ

EUROPEAN—

Juglans (Walnut)

regia (Common Walnut, Noyer of the French) (E) 130' × 5')	* 23
nigra (American Black Walnut) (I)	* 23

Carya (Hickory)

glabra (Pignut Hickory) (I)	* 16
alba (Shell-bark Hickory, Shag-bark Hickory) (I)	* 16
tomentosa (Mockernut Hickory) (I)	* 16
olivæformis (Pecannut Hickory) (I)	* 16
amara (Bitternut Hickory) (I)	* 16
(?) (Nutmeg Hickory) (I)	* 16
aquatica (Water Hickory) (I)	* 16

CASUARINACEÆ

Casuarina—Beef wood, She Oak
(equisetifolia, extensively planted, see) * 30

EUROPEAN—(None)

Casuarina (23)
equisetifolia (Agôho) * 30
Rumphiana (Mountain Agôho) * 30

BETULACEÆ

EUROPEAN—

Betula alba (Birch, Bouleau of the French) (N) (75' × 2')	* 5
Alnus glutinosa (Alder, Aune of the French) (N) (100' × 3')	* 3
Carpinus betulus (Hornbeam, Charme of the French) (N) (60' × 1½')	* 27
Corylus avellana (Hazel, Cob-nut, Nut Tree, Noisetier of the French) (N) (t. or SH)	* 4

MADRAS		PHILIPPINE
Large trees over 1 foot diameter	Small material under 1 foot diameter	(Diameters in feet given in brackets)

FAGACEÆ

EUROPEAN—

Quercus (Oak, Chêne of the French)

robur (Common Oak) (N) (175' × 20')	* 12
(a) pedunculata (Peduncled Oak, Black Oak, Chêne pédonculé of the French)	
(b) sessiliflora (Sessile Oak, White Oak, Chêne rouvre of the French)	
cerris (Turkey Oak, Chêne chevelu of the French) (N) (75' × 2½')	* 32
ilex (Holm Oak, Evergreen Oak, Chêne yeuse of the French) (N) (50' × 3')	* 29
suber (Cork Oak, Chêne liège of the French) (N) (40' × 5')	* 29
alba (American and Canadian White Oak) (I)	* 12
Castanea vesca (Chestnut, Châtaigner of the French) (N) (100' × 10')	* 11

SALICACEÆ

Salix (Willow)

471. tetrasperma and
ichnostachya IV * 2

EUROPEAN—

Salix

alba (White Willow, Saule blanc of the French) (N) (75' × 3')	* 2
fragilis (Crack Willow, Saule fragile of the French) (N) (40' × 1')	* 2
caprea (Sallow, Goat Willow, Saule marceau of the French) (N) (35' × 1')	* 2
pedicellata (Glaucous Sallow, Saule pédicellé of the French) (N) (SH)	* 2
Populus (Poplar)	
tremula (Aspen, Peuplier tremble of the French) (N) (100' × 1½')	* 7
nigra (Black Poplar, Peuplier noir of the French) (E) (110' × 12')	* 7
(b) pyramidalis (Lombardy Poplar, Peuplier d'Italie of the French) (E) (110' × 12')	* 1
alba (White Poplar, Abele, Peuplier blanc of the French) (N) (100' × 3')	* 2
canescens (Common Poplar, Grey Poplar, Peuplier grisaille of the French) (N) (70' × 2')	* 7
canadensis (Canada Poplar, Peuplier de Canada of the French) (E) (100' × 3')	* 7

GNETACEÆ

Gnetum

814. scandens (CL) * 18

EUROPEAN—(None)

CONIFERÆ

(Note.—Sometimes divided into Taxaceæ and Pinaceæ.)

Podocarpus

472. latifolia IV * 6

Agathis (6')

alba (Almāciga)	* 6
Pinus (4'–4½')	
insularis (Sālang or Benguēt Pine)	* 9
Merkusii (Tapōlau or Mindoro Pine)	* 9