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A HANDBOOK OF KERALA TIMBERS

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INTRODUCTION

Wood, in its primary form, was one of the first natural resources used extensively and because of the versatility and renewability, its usage has enlarged considerably. Its processing into secondary and tertiary forms, with rapid strides in technological sophistication, has resulted in its being of service to mankind in multitudinous ways. While demand was on a few selected species earlier, a large number of species found their way to the market and thereafter, to clearly established or improvised end uses. The improvised end uses are largely the result of practices evolved by users with little knowledge of the structural characteristics and properties. The wider acceptance of such end uses and innovative efforts to utilize lesser known species depend upon a clearer understanding of their identity, extent of availability, structure and properties. in a region or market catchment.

The structural characteristics and properties of Indian timber species have received attention since the beginning of the century and the' contributions of Gamble (1922), Kinns (1925). Pearson and Brown (1932), and Trotter (1958), have thrown considerable light on their utilization. The recent compilations by the Forest Research Institute, Dehra Dun, viz, Indian Woods (1958, 1963 and 1972) and Indian Forest Utilization (1970 and 1972) have contributed to a better understanding of the woody species of the country. The Present compilation is an attempt to collate information pertaining to woody species of Kerala, so that foresters, traders, processors as well as present and prospective users have a ready source of information on the well known, as also the lesser known timber species of the State. It is a summation of existing information gathered from published sources, supplemented by our observations. From over 300 tree species in the forests of the State, available information on among other details gross structure, properties, processing and uses of 162 species, has been proviaed. These species include those of restricted occurence with little economic value as also those cultivated extensively for industrial end uses.

Introduced species, cultivated in or outside the forests have also been included. An attempt has thus been made to cover most of the timber species-wherher well known or obscure, indigenous or exotic, widely utilized or sparingly used. The species are listed in alphabetical order (with family) for easy reference. Apart from the scientific names, each species is indexed under trade and local names, with appropriate cross references. Distributional details have been collected from Resources Survey Reports and Forest Working Plans. The Forest Types followed are in accordance with the classification of Champion and Seth (1968). The qualitative expressions used for description of the wood (explained in Appendix I) and the terminology (explained in Appendix III) essentially follow the International Association of Wood Anatomists Committee of Nomenclature (1964) and Matcalfe and Chalk (1950). A tabulated classification according to end uses is given in Appendix II. While the ISI specifications have been taken into account in the determination of uses, other sources of information and local practices have also been given due emphasis. In some instances, based on the properties, suggested or possibie uses

have also been given,

The information on anatomical structure and data on properties are not exclusively from wood samples of Kerala origin. Until intensive investigations on local samples are completed, the information provided in this handbook should generally be adequate, as gross structure and properties of a species are acceptable, although, in finer details, there may be variation not only between localities, but also within a locality and even within a tree.

It needs to be recongnized that a wealth of useful information available with the foresters, traders, processors and users, is not often disseminated and hence, liable to remain unknown. To them, we make a special request to send us material and information on Kerala timbers with them, so that the same may be considered for incorporation. More details will have to be gathered, particularly with reference to distribution, growing stock, gross morphological features and more investigations have to be undertaken to study working properties, durability etc. The Institute has already initiated several studies pertaining to the above needs. With the results thus obtained and the information furnished by actual growers, processors and users, it is expected that a more comprehensive hand book on Kerala Timbers can be brought out. The present attempt is only a begining in that direction.

INDEX OF SPECIES

I. ACACIA FERRUGINEA DC.

Mimosaceae

Local name parambai

Tree Small to medium, 9-12 m in height and about 40 cm in diameter
Bark dark brown, rough

Distribution Occasional in Southern dry mixed deciduous forest

Wood

Gross structure

Diffuse-porous

Growth rings Fairly distinct

Vessels Large to medium, few to moderately numerous, solitary or in multiples of 2, 3 or more, occasionally in clusters; often filled with gummy deposits

Parenchyma Paratracheal — vasicentric to aliform and aliform-confluent

Rays Fine, somewhat widely spaced

Properties

Colour Sapwood yellowish-white, heartwood purplish-brown to dark reddish-brown

Hardness Hard to very hard

Weight Heavy to very heavy, 995 kg/m^3 at 12% m.c.

Grain Straight to interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	1,149.9	122,800	152	557.2
Air-dry	1,538 5	145,000	130	862.5

Processing

Drying	Somewhat difficult as it is liable to develop cracks and end-splits unless proper care is taken. Kiln-seasoning offers no difficulty
Shrinkage	Green to over-dry Radial 2.3% Tangential 4.0%
Working properties	Sawing satisfactory
Natural durability and preservation	Durable
Uses	Posts; beams for building construction; agricultural implements; knees of boats; brake blocks, buffers and railway keys.

2. ACACIA NILOTICA (hinn.) Willd. ex Del. ssp. INDICA (Benth.) Brenan

[A. arabica Auct. non (Lamk.) Willd.]

Mimosaceae

Trade name	babul
Local name	karuvelam
Tree	Small, reaches to a height of 10 m and about 30 cm in diameter
	Bark dark brown or black, rough with deep narrow longitudinal fissures running spirally
Distribution	Grows naturally in the deciduous forests of Peninsular India. In Kerala occasionally grown in dry areas
Wood	
Gross structure	Diffuse porous
Growth rings	Indistinct
Vessels	Medium to small, few to moderately few, mostly solitary or in radial multtples of 2, 3 or more, occasionally in clusters; filled with dark brown gummy deposits
Parenchyma	Paratracheal — vasicentric, fine lines delimiting growth rings

Rays Moderately broad to fine, rather widely and irregularly spaced

Properties

Colour Sapwood whitish to pale yellow, heartwood pinkish-brown to reddish-brown; sapwood sharply demarcated from heartwood, lustrous

Hardness Moderately hard to hard

Weight Heavy to very heavy, 720-850 kg/m^3 at 12% m. c.

Grain Straight to interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kglcm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	775.6	97,700	130	354.1
Air-dry	894.2	112,800	104	535.8

Proceseing

Drying Green conversion and proper stacking under cover during rainy season recommended. Kiln-seasoning offers no difficulty under mild drying schedule

Shrinkage Green to overn-dry
Radial 2,6%
Tangential 6.0%

Working properties Sawing somewhat difficult after seasoning, works well with hand tools and finishes to a smooth surface and takes good polish after filling

Natural durability and preservation Confiicting results reported on Heartwood treatable but complete penetration not always obtained

Uses Mainly used in construction-work as posts, beams and rafters in buildings; bridges; agricultural implements; tool handles; tent accessories; cart building; parts of hulls of boats; sports goods; piles.

3. ACROCARPUS FRAXINIFOLIUS Wight & Arn.

Caesalpiniaceae

Trade name mundani

Local names narivenga, kurangadi

Tree Large to very large, 30-35 m in height and about 95 cm in diameter; buttressed Bark light grey, thin

Distribution West coast tropical evergreen and West coast semi-evergreen forests

Wood

Gross structure Diffuse-porous

Growth rings Distinct

Vessels Medium to small, very few to moderately few, mostly solitary or in short radial multiples or in clusters; often filled with whitish deposits

Parenchyma Paratracheal and apotracheal; vasicentric, aliform, fine lines delimiting growth rings

Rays Fine to very fine, pinkish in colour, widely and unevenly spaced

Properties

Colour Sapwood yellowish to greyish-white, heartwood light pinkish or reddish-brown

Hardness Soft to moderately hard

Weight Moderately heavy, 690 kg/m^3 at 12%m.c

Grain Straight to slightly interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	806.8	126,000	81	421.6
Air-dry	1,119.8	154,500	97	517.3

Processing

Drying — Moderately refractory; green conversion and close stacking recommended. Kiln-seasoning also suggested

Shrinkage	Green to oven-dry
Radial	3.0%
Tangential	5.2%

Working properties — Easy to saw and work. Due to resin, teeth of saw often gets clogged; finishes well, takes good polish

Natural durability and preservation — Non-durable. Heartwood only partially treatable

Uses — Mostly for poles and fence posts; building construction; tool handles; heavy backing cases, crates; tea chests; Class I general purpose plywood; flush door shutters; blockboards; core and face veneers; lorry and bus bodies.

4. ADENANTHERA PAVONINA Linn.

Mimosaceae

Trade name — redwood tree

Local name — manchadi

Tree — Medium, about 20 m in height with a clear bole of 6 m and up to 60 cm in diameter Bark greyish-brown with longitudinal fissures

Distribution — Mostly grown as avenue trees. Natural occurrence in Kerala forests doubtful

Wood

Gross structure — Diffuse-porous

Growth rings — Indistinct

Vessels — Large to medium, very few to moderately few, solitary or in radial multiples of 2, 3 or in clusters; filled with dark brown gummy deposits

Parenchyma	Paratracheal — vasicentric forming 'halo' round the vessels, occasionally connecting them
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood yellowish-grey, heartwood pinkish-brown to dark brown
Hardness	Hard
Weight	Heavy, 800 kg/m^3 at 12% m. c.
Grain	Interlocked; texture medium to coarse
Processing	
Drying	Somewhat difficult to season, as it develops cracks
Working properties	Easy to work, can be finished to a smooth surface and takes good polish
durability and preservation	Reported to be durable
Uses	Building construction; furniture; turnery; excellent firewood.

5 AEGLE MARMELOS (Linn.) Correa

Rutaceae

Trade name	bael
Local name	koovalam
Tree	Small to medium, 8-13 m in height and about 30 cm in diameter Bark greyish, corky
Distribution	Occasional in Southern dry mixed deciduous forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately numerous to numerous, solitary or in radial multiples of 2, 3 or more, often in clusters; occasionally filled with orange-yellow gum

Parenchyma Fine lines delimiting growth rings

Rays Fine, fairly close spaced

Pith flecks Often present

Gum canals Vertical gum canals often present

Properties

Colour Yellowish-white to yellowish-brown, sapwood and heartwood not distinct

Hardness Hard to very hard

Weight Heavy to very heavy, 895 kg/m^3 at 12% m.c.

Grain Straight to curly; texure fine

Streagth

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	674.7	88,100	89	351.8
Air-dry	742.2	100,200	53	495.4

Processing

Drying Green conversion followed by stacking under cover recommended

Shrinkage Green to 12% m.c.
Radial 4.47%
Tangential 8.3%

Working properties Somewhat difficult to saw and machine, takes good polish

Natural durability and preservation Non-durable

Uses Temporary construction; agricultural implements; carvings; tool handles; charcoal.

6. AGLAIA AMAMALLAYANA (Bedd.) Kosterm.

(Lansium anamallayanurn Bedd.)

Meliaceae

Local names	chinnagil, vandakamin
Tree	Medium, up to 15 m in height and about 30 cm in diameter Bark grey, smooth, very thin, lenticellate
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Very small, moderately numerous to numerous, solitary or in radial multiples of 2 or 3; often filled with white deposits
Parenchyma	Predominantly paratracheal; wavy tangential bands often connecting the vessels and also terminal bands delimiting growth rings
Rays	Fine to very fine, closely spaced
Properties	
Colour	Pale yellowish to light brown, sapwood and heartwood not distinct
Hardness	Hard to very hard
Weight	Very heavy, 970 k/m^3, air-dry
Grain	Straight; texture fine
Processing	
Drying	Except for fine radial checks, it does not show any seasoning defect
Uses	Small turney articles; tool handles; posts.

7. AGLAIA ELAEAGNOIDEA (A. Juss.) Benth.

(A. roxburghiana Miq)

Meliaceae

Trade name	aglaia
Local name	punnyava
Tree	Medium to large, 15-22 m in height and up to 65 cm in diameter
	Bark brownish-grey, smooth to somewhat rough, peelsoff in scales
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately few to moderately numerous, solitary or in radial multiples of 2 or 3; often filled with yellowish deposits
Parenchyma	Paratracheal - vasicentric to confluent wavy bands
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood light greyish-yellow to light brown, heartwood pinkish-brown to reddish-brown
Odour	When freshly cut, heartwood has a pleasant odour
Hardness	Hard to very hard
Weight	Heavy to very heavy, 730-940kg/m^3 air-dry
Grain	interlocked to curly; texture fine
Processing	
Drying	Air-seasoning recommended
Working properties	Difficultto saw, machining not satisfactory
Natural durability and preservation	Moderately durable
Uses	Construction-work; tent accessories; agricultural implements.

8. AILANTHUS TRIPHYSA (Dennst.) Alston

(A. malabarica DC.)

Simaroubaceae

Trade name	maharukh
Local names	perumaram, matti, pongiliyam
Tree	Large, about 25 m in height and 80 cm in diameter
	Bark grey, smooth in young trees and becomes rough as the tree grows old
Distribution	Sparse in West coast semi-evergreen and Southern moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Very large to large, very few to few, solitary or in radial multiples of 2, 3 or more
Parenchyma	Paratracheal – vasicentric, aliform to aliform–confluent
Rays	Broad rays widely spaced; fine rays in between the broad ones
Resin ducts	Occasionally vertical traumatic resin ducts present
Properties	
Colour	Yellowish-white, sapwood and heartwood not distinct, lustrous
Hardness	Soft
Weight	Light, 400 kg/m^3, air-dry
Grain	Straight; texture coarse
Processing	
Drying	Easy to season; to avoid stains green conversion and rapid seasoning recommended
Working properties	Easy to saw and machine, nailing good
Natural durability and preservation	Perishable. Heartwood easily treatable
Uses	Packing cases; match splints and boxes; slate frames; toys; Class III veneers, core cross bands and face veneers for boards.

9. ALBIZIA CHINENSIS (Osb.) Merr.

(A stipulata Boiv.)

Mimosaceae

Trade name siris

Local names pottavaga, pulivaha

Tree Large 20–30 m in height with a clear bole of 9 m and up to 90 cm in diameter

Bark grey, smooth with a few wrinkles and numerous cracks

Distribution Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure

Diffuse-porous

Growth rings Distinct

Vessels Large to medium, very few to moderately few, evenly distributed with a tendency to semi-ring-porous, solitary or in radial multiples of 2, 3 or more in clusters; often filled with gummy deposits

Parenchyma Paratracheal — vasicentric, interrupted lines delimiting growth rings

Rays Fine, wide to somewhat closely spaced

Properties

Colour Sapwood white or yellowish-white, heart-wood pale brown to light reddish-brown, lustrous

Hardness Soft

Weight Light, 400 kg/m^3 at 12% m.c.

Grain Straight to slightly interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	477.5	63,800	51	291.1

Processing	
Drying	Green conversion and proper stacking under cover recommended. Kiln-seasoning satisfactory
Working properties	Easy to saw, machining satisfactory, takes good polish provided careful filling is done
Natural durability and preservation	Non-durable. Heartwood refractory to treatment
Uses	Heavy packing cases and boxes; turnery; ballies and fence posts; decorative plywood; cabinets; flush door shutters; panelling; picture frames; blockboards.

10. ALBIZIA LEBBECK (Linn.) Benth.

Mimosaceae

Trade name	kokko
Local name	vaga
Tree	Medium to large, about 20 m in height and 65 cm in diameter
	Bark grey to dark brown, rough, irregulary cracked
Distribution	Occasional in Moist teak bearing forest; sometimes planted
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Very large to large, few, solitary or in radial multiples of 2 or 3; occasionally filled with gummy deposits
Parenchyma	Paratracheal — vasicentric to aliform
	Fine to very fine, somewhat closely spaced

Properties

Colour — Sapwood whitish or yellowish-white, heartwood brown or chocolate coloured with dark streaks, fairly lustrous

Hardness — Moderately hard to hard

Weight — Moderately heavy, 640 kg/m^3 at 12% m.c.

Grain — Straight to wavy or interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	672.1	111,700	76	358.2
Air-dry	887.2	122,700	69	534.1

Processing

Drying — Moderately refractory; green conversion and stacking under cover recommended. Kiln-seasoning possible without any difficulty

Shrinkage — Green to oven-dry
Radial 2.9%
Tangential 5.8%

Working properties — Difficult to saw, machining not satisfactory, can be worked to a fine smooth surface and takes good polish. Peels satisfactorily if soaked in hot water

Natural durability and preservation — Very durable. Heartwood only partially treatable

Uses — Class I general purpose plywood, decorative panelling; tea chests; blockboards; flush door shutters; furniture and cabinets; construction paraquet; musical instruments; mathematical and drawing instruments; tool handles; shafts of carts; lorry bodies.

11. ALBIZIA ODORATISSIMA (Linn. f.) Benth.

Mimosaceae

Trade name	kala siris
Local names	kunnivaga, nellivaga
Tree	Medium, about 20 m in height and 100 cm in diameter Bark grey with dark patches. rough, irregularly cracked
Distribution	Southern moist mixed deciduous, Southern dry mixed deciduous and West coast semi-evergreen forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Very large to large, few, solitary or in radial multiples of 2 or 3; occasionally filled with gummy deposits
Parenchyma	Paratracheal — aliform, rarely confluent
Rays	Fine to very fine, widely spaced
Properties	
Colour	Sapwood white or yellowish-white, heart wood dark brown with dark streaks fairly lustrous
Hardness	Moderately hard to hard
Weight	Moderately heavy to very heavy, 595-1010 kg/m^3 at 12% m c.
Grain	Straight to wavy or slightly interlocked: texture coarse
Streogth	

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	936.8	135,400	109	580.2
Air-dry	1,437.9	145,200	99	7875

Processing

Drying — Moderately refractory; green conversion and stacking under cover recommended

Shrinkage — Green to oven-dry

Radial	3.0%
Tangential	5.2%

Working properties — Difficult to saw, machining not salisfactory, can be brought to a fine smooth surface

Natural durability and preservation — Very durable. Heartwood very refractory to treatment

Uses — Commercial plywood, decorative plywood; furniture and cabinets; flush door shutters; building and bridge construction; tool handles; railway sleepers; mathematical and engineering instruments; shafts of carts and carriages.

12. ALBIZIA PROCERA (Roxb.) Benth.

Mimosaceae

Trade name — safed siris

Local names — karinthagara, vella vaka

Tree — Large, about 30 m in height with a clear bole of 12 m and 80 cm in diameter Bark light yellowish or greenish-white or pale grey, smooth

Distribution — Southern moist mixed deciduous and Moist teak bearing forest. Often planted as avenue trees

Woad

Gross structure — Diffuse-porous

Growth rings — Scarcely distinct:

Vessels — Very large to large, solitary or in radial multiples of 2 or 3; occasionally filled with gummy deposits

Parenchyma — Paratracheal — vasicentric to aliform

Rays — Fine to very fine, somewhat closely spaced

Properties

Colour — Sapwood pale yellowish-white, heartwood brown to dark brown

Hardness — Moderately hard to hard

Weight — Moderately heavy, 640 kg/m^3 at 120% m.c.

Grain — Straight to somewhat wavy or interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	669.7	90,200	107	341.1
Air-dry	1,023.9	10,900	150	570.1

Processing

Drying — Green conversion and stacking under cover recommended

Shrinkage — Green to oven-dry

Radial	3.10%
Tangential	6.90%

Working properties — Easy to saw and work

Natural durability and preservation — Moderately durable. Heartwood only partially treatable

Uses — Commercial plywood, flush door shutters; building construction; tool handles; railway sleepers, musical instruments; mathematical, engineering and drawing instruments; shafts of carts.

13. ALSTONIA SCHOLARIS (Linn.) R. Br.

Apocynaceae

Trade name	shaitan wood
Local name	ezhilam-pala
Tree	Medium to large, up to 30 m in height with a clear bole of 12 m and about 110 cm in diameter
	Bark greyish-brown, rough, lenticellate
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, few, occasionally solitary, mostly in radial multiples of 2, 3 or often 5; occasionally filled with tyloses, and yellowish gummy deposits
Parenchyma	Paratracheal — vasicentric and in wavy lines connecting the vessels; apotracheal — diffuse; crystals often present
Rays	Fine to very fine, closely spaced: crystals occasionally present, yellow gummy infiltration sparse
Properties	
Colour	White to yellowish-white or pale brown, often discoloured due to sap stain, sapwood and heartwood not distinct, lustrous
Hardness	Soft
Weight	Light to very light, 350-465 kg/m^3 at 12% m. c.
Grain	Straight; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kglcmz	Modulus of Elasticity kg/cmz	cm	Max. crushing stress kg/cm2
Green	361	63,100	41	196
Air-dry	466	70,400	30	273

Processing

Drying — Green conversion and soaking in water before seasoning recommended

Working properties — Easy to saw and work, finishes to a dull moderately smooth surface

Natural durability and preservalion — Non-durable

Uses — Class III. plywood and veneers; packing cases and boxes; match splints; pencil slats; wooden footwear.

14. ANACARDIUM OCCIDENTALE Linn.

Anacardiaceae

Trade name — cashew wood

Local names — kashu–mavu, parangi–mavu

Tree — Small to medium, 8-15 m in height and up to 50 cm in diameter

Bark grey, or greyish-brown, rough, moderately thick, fibrous

Distribution — Native of South America; extensively cultivated

Wood

Gross structure — Diffuse–porous

Growth rings — Indistinct

Vessels	Medium to small, few to moderately few, solitary or in radial multiples of 2-4; occasionally filled with tyloses
Parenchyma	Paratracheal - vasicectricto aliform
Rays	Fine, pinkish, closely spaced
Properties	
Colour	Pale grey to brownish-grey, sapwood and heartwood usually indistinct
Hardness	Soft
Weight	Light, 425 kg/m^3 at 12% m.c.
Grain	Straight to somewhat interlocked; texture coarse
Processing	
Working properties	Not difficult to saw and work, nail holding capacity good
Natural durability and preservation	Perishable
Uses	Low quality furniture; fibreboards; block-boards; packing cases; charcoal.

15. ANOGEISSUS LATIFOLIA (DC.) Wall. ex Guill. & Perr.

Combretaceae

Trade name	axlewood
Local names	mazhukanjiram,vetla-nava
Tree	Large, up to 30 m in height with a clear bole of 15 m and about 60 cm in diameter Bark greenish or greyish-white, smooth, exfoliating in irregular thin scales
Distribution	Southern moist mixed deciduous, South-ern dry mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	indistinct

Vessels Small, moderately numerous to numerous, solitary or in radial multiples of 2,3or often more in slightly oblique or tangential groups

Parenchyma Paratracheal — vasicentric to aliform, often confluent connecting the vessels

Rays Very fine, closely spaced

Gum canals Traumatic, often in short or long tangential rows

Properties

Colour Sapwood grey to pale yellowish-brown, heartwood purplish-brown

Hardness Hard to very hard

Weight Heavy to very heavy, 785-1105 kg/m^3 at 12% mc.

Grain Slightly interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max, crushing stress kg/cm^2
Green	896.6	122,100	145	403.0
Air-dry	1,101.1	134,400	130	525.5

Processing

Drying Difficult to season as it develops splits and cracks; green conversion in rainy season followed by stacking under cover recommended. Kiin-seasoning difficult due to surface cracking

Shrinkage — Green to oven-dry
Radial 4.2%
Tangential 7.2%

Working properties Difficult to saw, but can be machined and finishes to a smooth surface

Natural durability and preservation	Non-durable. Heartwood very refractory to treatment
Uses	Tool handles; agricultural implements; railway sleepers; clubs, gymnastic rings, jumping and vaulting stands; carts and carriages; picker arms in textile mills; cross arms and ballies; excellent charcoal.

16. ANTHOCEPHALUS CHINENSIS (Lank.) Rich. ex Walp.

[A. cadamba (Roxb.) Miq.]

Rubiaceae

Trade name	kadam
Local names	cadamb, attu-teak
Tree	Medium to large, 15-25 m in height with a clear bole of 9 m and about 60 cm in diameter
	Bark dark grey, with longitudinal fissures; peels off in thin scales
Distribution	West coast semi-evergreen forest
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large to very small, moderately numerous to numerous, mostly solitary or in radial multiples of 2, 3 or 4
Parenchyma	Paratracheal — scanty; apotracheal — diffuse
Rays	Very fine, closely spaced
Properties	
Colour	White with yellowish tinge to creamy white or yellowish-grey, sapwood and heartwood not distinct
Hardness	Soft

Weight Light to moderately heavy, 385-640 kg/m^3 at 12% m.c.

Grain Straight; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/m^2	cm	Max. crushing stress kg/cm^2
10% m.c.	884.1	95,200	—	541.1

Processing

Drying Conversion soon after felling and stacking between stickers under cover recommended

Working properties Sawing and working not difficult

Natural durability and Preservation perishable. Heartwood easily treatable

Uses Furniture; tea chests; building construction; Class III veneers for plywood; match splints; pencil slats; turnery.

17. APHANAMIXIS POLYSTACHYA (Wall.) Parker

[Amoora rohituka (Roxb.) Wight *&* Arn.]

Meliaceae

Trade name pitraj

Local name chemmaram

Tree Medium to large, 18-25 m in height with a clear bole of 5-8 m and up to 80 cm in diameter

Bark greyish-brown to dark brown, rough, exfoliating in circular flakes

Distribution West coast tropical evergreen forest

Wood

Gross structure

Diffuse-porous

Growth rings — Indistinct

Vessels — Medium, few to moderately few, solitary or in radial multiples of 2-4; often filled with dark gummy deposits

Parenchyma — Apotracheal — straight to wavy bands; paratracheal — vasicentric

Rays — Fine to very fine, closely spaced

Pith flecks — Occasionally present

Properties

Colour — Sapwood yellowish with a pinkish tinge, heartwood reddish-brown, lustrous when freshly cut

Hardness — Moderately hard

Weight — Moderately heavy, 705 kg/m^3 at 12% m c.

Grain — Straight to slightly interlocked; texture meidum

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	733.7	103,562	94	356.7
Air-dry	965.8	113,475	89	531.2

Processing

Drying — Air-seasoning gives good results

Shrinkage — Green to oven-dry

Radial 3.3%

Tangential 8.3 %

Working properties — Sawing and machining satisfactory

Natural durability and preservation — Very durable

Uses — Furniture and cabinets; doors and windows; Class I plywood and veneers; tea chests.

18. ARTOCARPUS GOMEZIANUS Wall. ex Trecul ssp. ZEYLANICUS Jarrett

(A. lakoocha non Roxb.)

Moraceae

Trade name lakooch

Local name thitti-pilavu

Tree Medium, 12-20 m in height and about 65 cm in diameter

Bark greyish-brown or brownish-black, peels off in small, thin flakes

Distribution Southern moist mixed deciduous and West coast semi-evergreen forests

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Very large to large, moderately few, mostly solitary or in radial multiples of 2 or 3; often filled with chalky deposits

Parenchyma Paratracheal — vasicentric

Rays Moderately broad to fine, fairly wide spaced

Properties

Colour Sapwood whitish to greyish–white, heart-wood light yellowish-white to golden brown, lustrous when first exposed

Hardness Moderately hard

Weight Moderately heavy, 640 kg/m^3 at 12%m.c.

Grain Straight or interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	499	61,400	160	210
Air-dry	808	76,400	122	368

Processing	
Drying	Seasons without difficulty, if converted soon after felling
Working properties	Difficult to saw and work when dry, finishes to a smooth surface, does not take polish satisfactorily
Natural durability and preservation	Very durable
Uses	Building construction: as beams, posts, rafters, door, window frames and scantlings; blockboards; boat oars, dugouts; railway sleepers; furniture and cabinets.

19. ARTOCARPUS HETEROPHYLLUS Lamk.

(A. integrifolia Linn.)

Moraceae

Trade names	jack, kathal
Local name	pilavu
Tree	Medium to large, 18-25 m in height, and up to 120 cm in diameter Bark blackish, mottled with black and green, rough with warty excrescences
Distribution	West coast tropical evergreen and Southern hill-top tropical evergreen forests; widely cultivated
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Very large to large, few, mostly solitary or in radial multiples of 2 or 3; often filled with tyloses or chalky deposits
Parenchyma	Paratracheal — vasicentric to aliform
Rays	Moderately broad to fine, fairly wide spaced

Properties

Colour — Sapwood greyish or pale yellow, heartwood yellow to yellowish-brown or pinkish-brown, lustrous when first exposed

Hardness — Moderately hard

Weight — Moderately heavy, 595 kg/m^3 at 12% m.c.

Grain — Straight to interlocked; texture medium

Strength

Condition	Static Bendlng		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	633	82,300	73	338
Air-dry	806	100,700	64	496

Processing

Drying — Seasons well when open stacked after conversion

Working properties — Easy to saw and work, can be brought to a smooth finish and takes good polish

Natural durability and preservation — Very durable

Uses — Multi-purpose constructional timber; furniture and cabinets; carvings and turnery; Class II plywood and veneers; marine plywood; blockboards; musical, mathematical, engineering and drawing instruments; lorry and bus bodies; brushware.

20. ARTOCARPUS HIRSUTUS Lamk.

Moraceae

Trade name aini

Local names anjili, anyani

Tree Large to very large, 25–45 m in height with a clear bole of 10–20 m and up to 130 cm in diameter

Bark dark brown, smooth

Distribution West coast tropical evergreen, West coast semi-evergreen and Southern secondary moist mixed deciduous forests

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Very large to large, few, solitary or in radial muitiples of 2 or 3; often filled with tyloses or white chalky deposits

Parenchyma Paratracheal — vasicentric to aliform

Rays Moderately broad to fine, fairly wide spaced

Properties

Colour Sapwood greyish or yellowish-white, heartwood golden yellow to yellowish-brown, lustrous when first exposed

Hardness Moderately hard

Weight Moderately heavy, 595 kg/m^3 at 12% m.c.

Grain Straight to interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression Parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	752	104,500	76	414
Air-dry	969	122,400	58	616

Processing

Drying	Air-and klin-seasoning offer no difficulty Shrinkage Green to oven-dry Radial 3.4% Tangential 5.3%
rking properties	Easy to saw and machine when green; turns well to a good shining surface; takes lasting polish
Natural durability and preservation	Durable
Uses	Boat and shipbuilding; vehicle bodies; beams, rafters, window, door frames and ceiling boards; furniture and cabinets; turnery; piles; flush door shutters; Class I plywood and veneers; marine plywood; blockboards; tool handles; fence posts; textile mill accessories; cooperage; hurdles for sports; mathematical, engineering and drawing instruments; brushware; carts and carriages.

21. ATALANTIA MONOPHYLLA (Roxb.) DC.

Rutaceae

Local names	mala-narakam, kattu-narakam
Tree	Small, 6 - 9 m in height and 20 - 25 cm in diameter Bark grey to dark brown, smooth
Distribution	Southern dry mixed deciduous forest
Wood	
Gross structure	Diffuse - porous
Growth rings	Distinct
Vessels	Small to very small, numerous to very numerous, solitary or in radial multiples of 2- 5 or more in clusters; often filled with yellowish or brownish gum - like deposits

Parenchyma — Apotracheal — diffuse, concentric bands delimiting growth rings

Rays — Fine to very fine, closely spaced

Gum canals — Often present

Pith flecks — Occasionally present

Properties

Colour — Yellow to yellowish-brown, sapwood and heartwood not distinct, lustrous

Hardness — Very hard

Weight — Very heavy, 895 kg/m^3 at 12% m.c.

Grain — Fairly straight to slightly twisted; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/crn^2
Green	833.9	103,100	58	451.9
Air-dry	1,158.8	136,700		612.7

Processing

Drying — Refractory to seasoning

Shrinkage — Green to 12% m.c.
Radial 5.1%
Tangential 8.6%

Working properties — Easy to saw, machining satisfactory, takes good polish

Natural durability and preservation — Durable

Uses — Turnery and carvings; mathematical instruments; penholders; camp furniture.

22. AZADIRACHTA INDICA A. Juss.

Meliaceae

Trade name	neem
Local names	arya-veppu, veppu
Tree	Medium to large, 15-20 m in height with a clear bole of 7 m and about 50 cm in diameter Bark greyish to dark grey with tubercles
Distribution	Naturally found in deciduous forests of Peninsular India. In Kerala, planted mostly in homesteads
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Medium, few to moderately few, solitary or in radial multiples of 2 or 3, often in clusters; filled with brownish gum
Parenchyma	Apotracheal — irregularly placed tangential and continuous bands delimiting growth rings; paratracheal — vasicentric, also in tangential lines connecting vessels
Rays	Fine to moderately broad, somewhat widely spaced
Gum canals	Often present in tangential bands
Properties	
Colour	Sapwood yellowish-grey to yellowish-brown, heartwood reddish brown, lustrous
Odour	Freshly cut wood has characteristic odour
Hardness	Hard to very hard
Weight	Heavy, 835 kg/m^3 at 12%
Grain	interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	728.7	85,200	124	400.0
Air-dry	913.9	98,600	104	480.8

Processing

Drying — Green conversion followed by open stacking under cover recommended

Shrinkage — Green to oven-dry
Radial 4.5%
Tangential 6.2%

Working properties — Sawing and machining fairly good, gives fair finish

Natural durability and preservation — Durable

Uses — Carvings and toys; agricultural implements; tool handles; boards and panels; furniture.

23. BARRINGTONIA ACUTANGULA (Linn.) Gaertn.

Barringtoniaceae

Local — nir-pezhu, attu-pezhu

Tree — Medium, 10-15 m in height and up to 50 cm in diameter

Bark dark brown, rough

Distribution — Southern moist mixed deciduous and West coast tropical evergreen forests; mostly along the banks of rivers and streams

Wood

Gross structure

Diffuse-porous

Growth rings	Indistinct
Vessels	Small to medium, moderately numerous, solitary or in radial multiples of 2-4
Parenchyma	Apotracheal — diffuse, fine tangential tines; paratracheal — vasicentric and aliform
Rays	Broad to very broad, closely spaced
Properties	
Colour	Sapwood light pinkish, heartwood reddish-grey sapwood and heartwood not very distinct, lustrous
Hardness	Soft
Weight	Light to moderately heavy, 580 kg/m^3 at 12% m.c.
Grain	Straight; texture medium to fine
Drying	Quarter sawing and proper stacking recommended
Working properties	No difficulty in sawing and machining
Natural durability and preservation	Moderately durable
Uses	Packing cases and boxes; furniture; carts.

24. BERRYA CORDIFOLIA (Willd.) Burret

(B. ***ammonilla*** Roxb.)

Tiliaceae

Trade name	trincomalee wood
Tree	Medium to large, 18-25 m in height with a clear bole of 9-11 m and about 80 cm in diameter
	Bark brownish-grey with longitudinal fissures

Distribution Native of Sri Lanka, occasionally grown as avenue trees

Wood

Gross structure

Diffuse - porous

Growth rings Scarcely distinct

Vessels Medium to moderately small, moderately numerous, solitary or in radial multiples of 2-5, occasionally in small clusters; plugged with tyloses

Parenchyma Paratracheal — vasicentric and aliform, with occasional broad confluent bands

Rays Fine to very fine, storied

Properties

Colour Sapwood whitish to greyish brown, heartwood reddish to chocolate brown with dark streaks

Hardness Very hard

Weight Heavy to very heavy, 960 kg/m^3 at 12% m.c.

Grain Slightly interlocked;texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	945.2	133,700	150	449.1
Air–dry	1,193.8	147,200	145	563.7

Processing

Drying Seasons fairly well

Shrinkage — Green to 12% m.c

Radial	5.5%
Tangential	9.5%

Working properties Difficult to saw, machining satisfactory, works to a fine finish and takes good polish

Natural durability and preservation	Very durable. Easily treatable
Uses	Building construction; boat building; carriages and carts; lorry bodies; agricultural implements; tool handles; turnery; bentwood articles; bobbins; cooperage.

25. BISCHOFIA JAVANICA BI.

Euphorbiaceae

Trade names	bishopwood, uriam
Local names	cholavenga, nira, thrippu
Tree	Medium tq large, 15–25 m in height and up to 110 cm in diameter Bark dark grey with a brownish tinge, exfoliating in angular scales
Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	
Diffuse-porous	
Growth rings	Indistinct
Vessels	Large to medium, moderately few to moderately numerous, occasionally solitary or mostly in radial multiples of 2 or 3, rarely in double rows; often filled with reddish-brown gum
Parenchyma	Paratracheal — scanty
Rays	Moderately broad and fine, the latter interspersed in between the broader ones; filled with dark brown deposits and crystals
Properties	
Colour	Sapwood light creamy to reddish-brown, heartwood reddish-brown to chocolate-brown
Hardness	Moderately hard

Weight Moderately heavy, 740 kg/m^3 at 12% m.c.

Grain Straight to irregularly interlocked; texture coarse

Strength

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	**490**	88,400	**58**	**237**
Air-dry	**882**	**113,100**	**76**	**533**

Processing

Drying Seasons fairly well although liable to warping. Kiln-seasoning gives satisfactory results

Working properties Saws easily when green and works to a smooth surface

Natural durability and preservation Non-durable. Heartwood very refractory to treatment

Uses Beams in buildings; tea chests; packing cases and boxes; pencil slats; carrom boards; carvings; poles and posts.

26. BOMBAX CEIBA Linn.

[Salmalia malabarica (DC.) Schott. & Endl.]

Bombacaceae

Trade name semul"

Local names mullilavu, poola

* ***Bombax insigne*** **Wall, Occasionally found in Southern moist mixed deciduous forest; also included in this trade name.** wood **characteristics, properties and uses are similar to *B. ceiba*.**

Tree

Large to very large, 25-40 m in height with a clear bole of 15-25 m and up to 150 cm in diameter; buttressed

Bark grey, covered with conical prickles when young, deeply cracked when old, outer bark fleshy and soft, inner fibrous

Distribution

West coast semi-evergreen, Southern moist mixed deciduous arid Moist teak bearing forests

Wood

Gross structure

Diffuse-porous

Growth rings

Scarcely distinct

Vessels

Very large to large, scanty, mostly solitary or in radial multiples of 2 or 3

Parenchyma

Predominanrly apotracheal — fine interrupted tangential lines forming reticulum with rays

Rays

Fine to very broad, widely spaced, forming conspicuous flecks on radial surface

Properties

Colour

Creamy white to pale yellowish-brown or greyish-brown, sapwood and heartwood not distinct, often lustrous

Hardness

Very soft to soft

Weight

Very light to light, 365 kg/rn^3 at 12%m.c.

Grain

Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	582	5 1,043	53
Air-dry	428	59,500	48

Condition	Compression Parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	144	181	57,652	26
Air-dry	188	242	65,296	29

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	39	49	21	26
Air-dry	40	55	25	35

Processing

Drying — Very easy to season; quick conversion and open stacking under cover recommended

Shrinkage	Green to oven-dry
Radial	2.3%
Tangential	5.1%

Working properties — Easy to saw; peels and glues well

Natural durability and preservation — Perishable. Heartwood easily treatable

Uses — Class III plywood and veneers; packing cases and boxes; match splints and boxes; shipbuilding; fishing floats; cooperage; toys; pencil slats.

27. BRIDELIA SQUAMOSA (Lamk.) Gehrm.

(B. retusa Spreng.)

Euphorbiacene

Trade name	kasi
Local name	mullu-venga
Tree	Small to medium, 8-18 m in height and up to 65 cm in diameter Bark greyish-brown, rough with many cracks, exfoliating in irregular flakes
Distribution	Mostly in Southern moist mixed deciduous, West coast semi-evergreen and Moist teak bearing forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Distinct
Vessels	Medium to small, few to moderately few, mostly solitary or in radial multiples of 2-4; tyloses present
Parenchyma	Paratracheal — scanty
Rays	Fine to moderately broad, fairly close spaced, forming silvery radial flecks; filled with dark coloured deposits and crystals
Properties	
Colour	Sapwood greyish-white to grey, heart-wood olive-brown
Hardness	Moderately hard
Weight	Heavy, 785 kg/m^3 at 12%
Grain	Shallowly or deeply interlocked; texture madium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	**580**	**94,200**	**86**	**282**
Air-dry	**759**	**108,300**	**89**	**422**

Processing

Drying — Green conversion and stacking under cover recommended

Working properties — No difficulty in sawing and machining and works to a fairly smooth surface

Natural durability and preservation — Moderately durable

Uses — Rafters, post and floor boards in building: agricultural implements; tool handles; carts and carriages.

28. BUCHANANIA AXILLARIS (Desr.) Ramam.

***(B. angustifolia* Roxb.)**

Anacardiaceae

Local names — kula-mavu, mala-mavu

Tree — Medium, up to 15 m in height and about 30 cm in diameter

Bark dark brown, rough with irregular cracks

Distribution — Southern moist-mixed deciduous forest

Wood

Gross structure

Diffuse-porous

Growth rings	Indistinct
Vessels	Large, very few to moderately few, solitary or in radial multiples of 2 or **3;** frequently filled with tyloses
Parenchyma	Paratracheal — scanty, vasicentric; brownish
Rays	Brownish; broad, widely spaced; fine, closely spaced among the broad ones
Gum canals	Horizontal, occasionally seen in broad rays
Properties	
Colour	Greyish-white to greyish-brown, sapwood and heartwood not distinct
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 605 kg/m^3 at 12% m.c.
Grain	Straight to somewhat interlocked; texture coarse
Processing	
Drying	Quick conversion and open stacking under cover recommended
Working properties	Easy to saw, machining satisfactory
Natoral durability and preservation	Non-durable
Uses	Packing cases; temporary construction; light furniture; toys.

29. BUCHANANIA LANZAN Spreng.

(B. ***latifolia*** Roxb.)

Anacardiaceae

Local name	moongapezhu
Tree	Medium, about 18 m in height and 40 cm in diameter
	Bark dark grey or nearly black, rough. fissured into small plates

Distribution Southern moist mixed deciduous and Moist teak bearing forests; sparse in Laterite thorn forest

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Large, very few to moderately few; solitary, or in radial multiples of 2 or 3; frequently filled with tyloses

Parenchyma Paratracheal — scanty and vasicentric

Rays Brownish; broad, widely spaced; fine, closely spaced among the former

Gum canals Horizontal, occasionally present

Properties

Colour Greyish-white or brown, sapwood and heartwood not distinct

Hardness Soft to moderately hard

Weight Light, 500 kg/m^3 at 12% m.c.

Grain Straight to somewhat interlocked; texture even and coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	321.9	57,500	41	150.5
Air-dry	522.0	80,300	—	293.9

Processing

Drying Quick conversion and open stacking under cover recommended

Shrinkage Green to oven-dry

Radial 4.1%

Tangential 7.3%

Working properties	Easy to saw and machining satisfactory
Natural durability and preservation	Non-durable
Uses	Match splints; packing cases; domestic appliances; temporary construction.

30. BUTEA MONOSPERMA (Lamk.) Taub.

(B. *frondosa* Roxb.)

Papilionaceae

Trade names	flame of the forest, palas
Local names	plas, chamatha
Tree	Medium, 12-15 m in height and about 40 cm in diameter Bark grey, exfoliating in irregular pieces
Distribution	Southern dry mixed deciduous and Laterite thorn forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Very large to very small, few to very few, mostly solitary or in radial multiples of 2 or 3
Parenchyma	Abundant; paratracheal — broad tangential wavy or straight bands alternating with fime tracts
Rays	Broad to very broad, widely spaced
Properties	
Colour	Creamy white to pale yellowish-brown, sapwood and heartwood not distinct
Hardness	Soft to moderately hard
Weight	Light, 515 kg/m^3 at 12%
Grain	Straight to somewhat interlocked; texture coarse

Strcngth

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	257.8	31,400	53	121.2
Air-dry	364.3	43,000	23	227.1

Processing

Drying — Green conversion and open stacking under cover recommended

Shrinkage — Green to oven-dry

Radial	3.4%
Tangential	8.6%

Working properties — Easy to saw and work, difficult to peel

Natural durability and preservation — Perishable

Uses — Water scoops and well curbs; low quality furniture.

31. CALOPHYLLUM ELATUM Bedd.

(C. *tomentosum* Sensu T. And.)

Guttiferae

Trade name — poon

Local names — kattu-punna, punnapa

Tree — Very large, about 35 m in height with a clear bole of 20 m and up to 150 crn in diameter

Bark yellowish brown, thick, with very long, wavy vertical fissures

Distribution — West coast tropical evergreen, Southern hill-top tropical evergreen and West coast semi-evergreen forests

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Large to medium, few, mostly solitary, arranged in radial or oblique chains; often filled with deposits and tyloses

Parenchyma Apotracheal — narrow tangential discontinuous bands

Rays Very fine, closely spaced

Properties

Colour Sapwood pinkish and heartwood reddish-brown with dark streaks

Hardness Moderately hard

Weight Moderately heavy, 655 kg/m^3 at 12% m.c.

Grain Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	672.2	97,700	74	345.1
Air-dry	921.O	120,200	51	571.9

Processing

Drying Air-seasoning not difficult. Kiln-seasoning fairly easy

Shrinkage	Green to oven-dry
Radial	4.9%
Tangential	6.6%

Working properties Easy to work, finishes well, takes good polish

Natural durability and preservation Moderately durable. Heartwood refractory to treatment

Uses Class I plywood; tea chests; low quality furniture; blockboards; packing cases and boxes; poles and cross arms; boat and shipbuilding; ceiling boards and rafters.

32. CALOPHYLLUM INOPHYLLUM Linn.

Guttiferae

Trade name poon

Local names punna, pinna

Tree Medium, 15–18 m in height and 65 cm or more in diameter

Bark brownish-black with shallow irregular fissures

Distribution Coastal areas and along river banks in restricted localities

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Large to medium, few, exclusively solitary, appear as radial or oblique chains; occasionally filled with tyloses and gummy deposits

Parenchyma Apotracheal — narrow tangential bands

Rays Fine to very fine, distinct as numerous closely spaced lines

Properties

Colour Sapwood pinkish and heartwood reddish-brown with dark lustrous streaks

Hardness Moderately hard

Weight Moderately heavy, 705 kg/m^3 at 12% m.c.

Grain Interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Air–dry	765.6	70,300		519.6

Processing	
Drying	Seasons well but liable to develop short surface cracks if sufficient care is not taken in stacking. Kiln-seasoning possible
Working properties	Saws without difficulty and works to a fine finish, takes good polish
Natural durability and preservation	Non-durable
Uses	Building construction; flush door shutters Class I plywood; tea chests; furniture; panelling; shipbuilding; cooperage.

33. CANARIUM STRICTUM Roxb.

Burseraceae

Trade name	white dhup
Local names	kundrikam, panta-payin, thelli-payin
Tree	Large to very large, 20-30 m in height and about 50 cm in diameter Bark pale-grey, rough
Distribution	West coast tropical evergreen, Southern secondary moist deciduous and Southern hill-top evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium. moderately few to few, solitary or in radial multiples of 2, 3 or more; often filled with tyloses and yellowish deposits
Parenchyma	Indistinct; paratracheal — scanty
Rays	Moderately broad, rather widely spaced
Properties	
Colour	Creamy-white to yellowish-gray; sapwood and heartwood not distinct, lustrous
Hardness	Moderately hard

Weight Moderalely heavy, 655 kg/m^3 at 12%m c.

Grain Interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression Parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	666.6	118,600	79	324.7
Air-dry	949.3	137,000	89	548.2

Processing

Drying Vertical stacking recommended for air-seasoning. Kiln-seasoning gives better results

Shrinkage Green to 12% m.c.
Radial 4.8%
Tangential 7.4%

Working properties Easy *to* saw and machine

Natural durability and preservation Perishable

Uses Flush door shutters; Class II plywood; furniture; panelling; blockboards; light packing cases; match splints; pencil slats.

34. CARALLIA BRACHIATA (Lour.) Merr.

(C. *integerrima* DC.)

(C. *lucida* Roxb.)

Rhizophoraceae

Trade name carallia

Local names vallabham, varangu

Tree Medium to large, 18-25 m in height and about 65 cm in diameter

Bark dark grey, lenticellate

Distribution West coast semi-evergreen and Myristica swamp forests

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Medium, few to moderately few, solitary, short radial multiples, oblique and/or in tangential groups of 2–4; often filled with tyloses

Parenchyma Paratracheal — vasicentric or aliform to confluent, forming ladder like pattern with rays

Rays Very broad, widely spaced; very fine, closely spaced between the broad rays. Silvery radial flecks conspicuous

Properties

Colour Sapwood pale yellow, heartwood reddish-yellow to reddish-brown

Hardness Moderately hard

Weight Moderately heavy to heavy, 690-755 kg/m^3 at 12% m. c.

Grain Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	919.1	126,000	112	455.2
Air-dry	1,199.4	141,400	97	567.2

Processing

Drying Green conversion during wet weather followed by slow drying recommended. Kiln-seasoning gives moderate results.

Shrinkage Green to oven-dry
Radial 2.6%
Tangential 8.8%

Working properties	Easy to saw and work, but difficult to plane to a smooth surface
Natural durability and preservation	Fairly durable for interior work, perishable in exposed conditions
Uses	Panelling and ornamental work in building construction; general purpose Class II plywood and veneers; blockboards; low quality furniture; brushware.

35. CAREYA ARBOREA Roxb.

Barringtoniaceae

Trade name	kumbi
Local name	pezhu
Tree	Small to medium, 8-15 m in height and about 30 cm in diameter Bark dark grey, with shallow cracks, exfoliating in narrow flakes
Distribution	Southern moist mixed deciduous, Moist teak bearing and Laterite thorn forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium, moderately numerous, mostly solitary or in radial multiples of 2–4; mostly filled with tyloses
Parenchyma	Predominantly apotracheal — continuous tangential bands forming reticulum with rays
Rays	Fine, closely spaced
Properties	
Colour	Sapwood pale reddish-white, heartwood light to dark brownish-red
Hardness	Moderately hard

Weight Very heavy, 955 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Msx. crushing stress kg/cm^2
Green	657	83,700	62	306
Air-dry	1,048	4,900	76	605

Processing

Drying Very difficult. Kiln-seasoning can be tried

Working properties Sawing difficult, but machines fairly well, finishes to a smooth shiny surface and takes good polish

Natural durability and preservation Very durable

Uses Building construction; tool handles; poles and posts; planks for boats and oars.

36. CASSIA FISTULA Linn.

Caesalpiniaceae

Trade name rajbrikh

Local name kani-konna

Tree Small to medium, 8-15 m in height and about 40 cm in diameter

Bark greenish-grey, smooth when young and rough when old, exfoliating in hard scales

Distribution Southern dry mixed deciduous, Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure Diffuse-porous

Growth rings Fairly distinct

Vessels Large, medium and small, few to moderately few, solitary or in radial multiples of 2, 3 or rarely more; often filled with yellowish-white deposits

Parenchyma Abundant; paratracheal-vasicentric, often aliform to aliform-confluent and fine lines delimiting growth rings

Rays Fine to very fine, closely spaced

Properties

Colour Sapwood greyish-white to light yellowish-brown, heartwood yellowish-red to brick red or reddish-brown

Hardness Very hard

Weight Heavy to very heavy, 835 kg/m^3 at 12% m.c.

Grain Straight to slightly interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	960.7	118,000	119	491.7
Air-dry	1,306.5	161,300	117	673.7

Processing

Drying Refractory to seasonings; as it developes cracks, splits, and warps, green conversion and stacking under cover recommended

Shrinkage Green to oven-dry
Radial 5.2 %
Tangential 7.6%

Working properties Difficult to saw, machining not satisfactory

Natural durability and preservation	Very durable
Uses	Locally for building construction; plough-handles; wheels and shafts of carts; turnery; tool handles; charcoal.

37. CASSIA SIAMEA Lamk.

Caesalpiniaceae

Local names	thagara, manja-konna
Tree	Medium, 10-18 m in height and up to 45 cm in diameter Bark grey smooth, slightly fissured
Distribution	Native of South East Asia; planted as avenue trees
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large, medium and small, few to moderately few, mostly solitary or in radial multiples; often filled with yellowish-brown deposits
Parenchyma	Abundant; paratracheal – wavy, more or less continuous bands enclosing vessels
Rays	Fine to very fine, closely spaced
Properties	
CoIour	Sapwood yeilowish-white to greyish-brown, heartwood dark brown to black with lighter streaks, lustrous
Hardness	Moderately hard to hard
Weight	Heavy to very heavy, 815 kg/m^3 at 12% m. c.
	Slightly interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	709.4	105,000	91	433.5
Air-dry	866.3	116,500	79	712.3

Processing

Drying Season well

Shrinkage Green to oven-dry

Radial 5.2%

Tangential 7.6%

Working properties Not difficult to work with tools, finishes to a fairly smooth surface and takes good polish

Natural durability and preservation Very durable

Uses General construction; inlay of furniture; tool handles; walking sticks.

38. CASUARINA EQUISETIFOLIA J. R. & G. Forst.

Casuarinaceae

Trade name casuarina

Local names chula-maram, kattadi

Tree Large, up to 30 m in height and about 40 cm in diameter

Bark brown, rough, fibrous, peels off in vertical strips

Distribution Native of Andamans and South East Asia cultivated extansively

Wood

Gross

Diffuse-porous

Growth rings Indistinct

Vessels Medium to small, mostly solitary, rarely in two, arranged diagonally; often filled with gummy deposits

Parenchyma Apotracheal -. diffuse, short to continuous bands, one or two cells wide

Rays Fine to very fine, fairly close spaced

Properties

Colour Sapwood pale brown, heartwood dark reddish-brown

Hardness Hard to very hard

Weight Heavy to very heavy, 975 kg/m^3 at 12% m. c.

Grain Straight; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression Parallel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	732	114,400	124	327

Processing

Drying Refractory to seasoning; due to severe deep splits, green conversion followed by close stacking under cover recommended

Working properties Difficult to saw and work, but takes fine polish

Natural durability and preservation Non-durable in exposed conditions and in contact with ground, moderately durable under cover and in contact with water. Heartwood only partially treatable.

Uses Poles and beams for temporary construction; fuel wood.

39. CEIBA PENTANDRA (Linn.) Gaertn.

(Eriodendron anfractuosum DC)

Bombacaeeae

Trade name	kapok
Local names	panji-ilavu, panya
Tree	Medium to large, 15–25 m in height with a clear bole of 12 m and about 50 cm in diameter
	Bark greyish-brown, green when young
Distribution	Native of Tropical America and Africa; often grown in homesteads and in plantations
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to moderately large, very few to few, mostly solitary or in radial multiples of two or more; usuallv filled with tyloses
Parenchyma	Predominantly apotracheal — fairlydistinct, showing poorly developed reticulum and also concentric bands delimiting growth rings
Rays	Fine to moderately broad, rather widely spaced, showing flecks on radial surface
Properties	
Colour	Greyish-white or greyish-brown, sapwood and heartwood not distinct, somewhat lustrous
Hardness	Very soft to soft
Weight	Very light to light, 210 kg/m^3, air-dry
Grain	Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	136.0	23,000	18	61

Processing

Drying — Quick conversion and air- or kiln-seasoning gives satisfactory results

Working properties — Easy to work

Natural durability and preservation — Non-durable

Uses — Catamarams; match splints and boxes; light packing cases.

40. CHLOROXYLON SWIETENIA DC.

Rutaceae

Trade name — satinwood

Local name — vari-maram

Tree — Medium, about 15 m in height and up to 50 cm in diameter

Bark rough, yellowish, corky

Distribution — Southern dry mixed deciduous forest in Central Kerala

Wood

Gross structure

Diffuse-porous

Growth rings — Distinct

Vessels — Small to very small, numerous to very numerous, solitary or in radial multiples of 2-6 or more, rarely in clusters; filled with yellowish or brownish deposits

Parenchyma — Apotracheal — diffuse, initial concentric bands

Rays — Fine, closely spaced

Gum canals — Vertical, occasionally present

Properties

Colour — Creamy yellow to golden yellow with satin lusture, sapwood and heartwood not distinct

Hardness — Hard to very hard

Weight — Heavy to very heavy, 960 kg/m^3 at 12% m c.

Grain — Straight to interlocked; texture. fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	865.5	115,400	99	478.9
Air-dry	1,272.3	151,900	86	794.5

Processing

Drying — Conversion and seasoning during rainy season recommended. Kiln-seasoning possible with little degradation

Shrinkage Green to 12% m.c.
Radial 5.1%
Tangential 6.5%

Working properties — Difficult to saw, machining not satisfactory

Natural durability and preservation — Non-durable. (Reported to be very durable — Pearson Brown, 1932)

Uses — Bridge and building construction; ploughs; axles; cabinets and furniture; turnery; interior decorative work; mathematical instruments.

41. CHUKRASIA TABULARIS A. Juss.

Meliaceae

Trade name	chickrassy
Local name	mallei–vepu
Tree	Large, up to 25 m in height and about 80 cm in diameter Bark dark brown, deeply cracked
Distribution	Sporadic in West coast semi–evergreen and Southern moist mixed deciduous forests

Wood

Gross structure

Diffuse–porous

Growth rings — Distinct

Vessels — Small, moderately few to moderately numerous, solitary or in radial multiples of 2 or 3; filled with orange coloured deposits

Parenchyma — Abundant; brown to reddish-brown; paratracheal vasicentric, concentric lines delimiting growth rings

Rays — Light reddish–brown; fine to very fine, fairly close spaced

Gum canals — Vertical, traumatic gum canals often present

Properties

Colour — Sapwood greyish or yellowish–white and heartwood yellowish-brown to dark brown, lustrous

Hardness — Moderately hard

Weight — Moderately heavy, 675 kg/m^3 at 12% m.c.

Grain — Straight to interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm²	Modulus of Elasticity kg/cm²	cm	Max. crushing stress kg/cm²
Green	589.6	83,500	71	284.5
Air-dry	866.1	113,100	94	508.6

Processing

Drying — Moderately refractory to air-seasoning. Kiln-seasoning not difficult

Shrinkage — Green to 12% m.c,
Radial 3.9%
Tangential 6.0%

Working properties — Sawing not difficult, machines fairly well, can be brought to a fine finish and takes an excellent polish. Peels well

Natural durability and preservation — Non-durable. Heartwood partially treatable

uses — Beams and posts for construction; Class I plywood; decorative plywood; panelling; marine plywood; cabinets and furniture; turnery and toys; dobby barrels and bobbins in textile mills.

42. CINNAMOMUM VERUM J. S. Presl

(C. *zeylanicum*

Lauraceae

Trade name — cinnamon

Local names — vayana, karuva, elavangam

Tree — Small to medium, 8–18 m in height and about 50 cm in diameter

Bark reddish-brown, soft, with numerous small warts

Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, moderately numerous to numerous, mostly solitary or in radial multiples of 2-4; occasionally in double rows or clusters; often filled with tyloses
Parenchyma	Paratracheal — vasicentric
Rays	Fine, fairly close spaced, forming silvery radial flecks
Pith flecks	Often present
Properties	
Colour	Light greyish-brown with a faint olive tinge to yellowish-brown. Sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Moderately heavy, 575 kg/m^3 at 12% m. c,
Grain	Straight to somewhat wavy; texture medium to coarse
Processing	
Drying	Green conversion recommended
Working properties	Somewhat difficult to work the seasoned wood. Does not finish to a smooth surface
Natural durability and preservation	Non-durable
Uses	Packing cases; could be used for block-boards.

43. COCOS NUCIFERA Linn.

Palmae

Trade name coconut palm

Local name thengu

Tree A tall palm reaches to a height of about 20 m and is approximately 25 cm in diameter

Bark smooth with prominent annulate leaf scars

Distribution Cultivated extensively

Wood

Gross structure The unbranched cylindrical stem consists of parenchymatous sclerotic ground tissue with numerous fibro-vascular bundles which are widely scattered in the central region and densely distributed in the peripheral zone. Vessels are large. Cells containing silica are abundant in the ground tissue

Properties

Colour Red towards periphery and reddish-brown towards centre

Hardness Outer portion very hard and inner soft

Grain Interlocked; texture medium to fine

Weight (Peripheral) Very heavy, 946 kg/m^3 (green); 761 kg/m^3 (Kiln-dry)

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cma	Modulus of Elasticity	cm
Green	460	73,400	41
Air-dry	666	93,800	65

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	249	380	120,700	68
Kiln-dry	293	502	146,900	94

Condition	Shear parallel to grain	Tension perpendicular to grain
	Shearing stress kg/cm^2	Tensile stress kg/cm^2
Green	66.9	19.7
Kiln-dry	80.9	16.4

Processing

Drying

Sizes up to 50 mm thick can be air-dried under cover. Can be successfully dried in a solar kiln. Slick weighting is advised to minimise possible drying distortions. For better economy in solar kiln-drying preliminary air-drying to about 60% moisture content would be advisable

Working properties

Sawing difficult Teeth gets blunted after a few cuts. The use of tungsten carbide-tipped saws (or stellite-tipped or inlaid teeth) would overcome basic sawing problems but can increase problems of saw maintenance. Can be brought to a srnooth surface and takes good polish

Natural durability and preservation

Perishable when exposed *to* weather or in ground contact; preservative treatment essential. Debarking extremely difficult but it is necessary for treatment by conventional method. Wood must be partially air-dried under cover before treatment. Provided the outer zones are well dried, a good retention and distribution can be

achieved with creosote by hot and cold process and copper chrome-arsenate by vacuum/pressure. Pressure sap displacement is an attractive method for treating freshly-felled, unbarked logs and it appears possible to achieve a satisfactory retention and distribution of waterborne preservative by this system

Uses Rafters, poles, posts and other constructional items; tool handles; walking sticks; wooden bowls and vases; fancy work and curio items; saw dust can be used in the manufacture of cement based building bricks; can be used in decorative furniture.

44. CORDIA DICHOTOMA

(C. *myxa* non Linn)

Boraginaceae

Local name viri

Tree Medium, about 12 m in height and up to 40 cm in diameter

Bark grey or brown, rough with shallow, longitudinal furrows

Distribution Occasional in Moist teak bearing and Southern dry mixed deciduous forests

Wood

Gross structure

Semi-ring-porous

Growth rings Distinct

Vessels Very large to large, few, mostly solitary or occasionally in radial or oblique multiples of two or more in clusters

Parenchyma Predominantly apotracheal — tangential bands alternating with fine fibre tracts

Rays Moderately broad, fairly close spaced

Properties	
Colour	Yellow to olive-grey and greyish-brown on exposure. Sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Light, 525 kg/m 3at 12% m.c.
Grain	Straight to shallowly interlocked; texture coarse
Processing	
Drying	Reported to season well
Working properties	Easy to saw, works to a smooth finish and takes good polish
Natural durability and preservation	Moderately durable
Uses	Class III plywood; building construction; packing cases and boxes; low quality furniture.

45, CULLENIA EXARILLATA Robyns

(C. *excelsa Wight)*

Bombacaceae

Trade	karani
Local names	mullen-pali, mullen-chakka, vedipila
Tree	Medium to large, 18-30 m in height with a clear bole up to 15 m and about 95 cm in diameter; often buttressed Bark greyish–white, smooth, thick
Distribution	West coast tropical evergreen and Southern hill-top tropical evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct

Vessels Large to medium, very few to moderately few, mostly solitary or in radial multiples of 2, 3 rarely 4 or more; occasionally filled with reddish-brown deposits

Parenchyma Light brown, mostly apotracheal — diffuse, fine concentric often interrupted lines, forming reticulum with rays

Rays Very fine to moderately broad, forming reddish-brown flecks on the radial surface, somewhat closely spaced

Properties

Colour Gray to brown with pinkish tinge. Sapwood and heartwood not distinct, lustrous when freshly cut

Hardness Moderately hard

Weight Light to moderately heavy, 510-625 kg/m^3 at 12% m.c.

Grain Straight ; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	736.8	124,300	74	361.2
Air-dry	1,061.8	145,800	89	571.1

Processing

Drying Kiln-seasoning gives good results. Green conversion and open stacking also satisfactory

Shrinkage — Green to oven-dry

Radial	4.3%
Tangential	6.9%

Working Sawing and peeling satisfactory, machining good

Natural durability and preservation Perishable in exposed conditions, fairly dutable under cover. Heartwood treatable but complete penetration not always obtained

Uses	Flush door shutters; Class II plywood; blockboards; furniture; tool handles; textile mill accessories.

46. DALBERGIA LANCEOLARIA Linn. f.

Papilionaceae

Local name	vella-veetti
Tree	Medium, 15–20 m in height and about 50 cm in diameter Bark grey, smooth, flakes off in round scales
Distribution	Southern moist mixed deciduous forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large, medium and small, few, solitaryar in radial multiples of 2, 3 or 4
Parenchyma	Apotracheal — diffuse, diffuse-in-aggregate
Rays	Fine to very fine, closely spaced
Properties	
Colour	Yellowish or greyish-white to brown, sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Moderately heavy to heavy, 620–770 kg/m^3, air-dry
Grain	Straight to interlocked; texture medium to coarse
Processing	
Drying	Liable to develop heart-shake; green conversion recommended. Not difficult to season

Working properties	Not difficult to saw and work
Natural durability and preservation	Non-durable
Uses	Light packing cases; carts and carriages; temporary construction.

47. DALBERGIA LATIFOLIA Roxb.

Papilionaceae

Trade name	rosewood
Local name	veeti
Tree	Medium to large, 15-30 m in height and up to 130 cm in diameter Bark grey with cracks, peels off in thin flakes
Distribution	West coast semi-evergreen, Moist teak bearing and Southern secondary moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous, rarely with a tendency to semi-ring-porous
Growth rings	Scarcely distinct
Vessels	Large to small, few to moderately numerous, solitary or often in short radial multiples; occasionally filled with gummy deposits
Parenchyma	Paratracheal — aliform to confluent and banded, also fine or interrupted lines delimiting growth rings
Rays	Fine to very fine, visible only under lens, numerous, closely spaced
Properties	
Colour	Sapwood pale yellowish-white with pinkish tinge and heartwood purplish-brown with black or red streaks, colour uniform

Grain Straight to shallowly interlocked; texture medium

Hardness Hard

Weight Heavy, 815 kg/m^3 at 12% m.c.

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	845	92,700	114
Air-dry	943	101,700	112

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	242	418	105,700	113
Air-dry	292	486	105,300	127

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	104	108	72	78
Air-dry	99	156	33	36

Working properties Works comparatively easy with hand and machine, can be brought to a fine finish and takes good polish. Peels and slices well and very thin veneers can be obtained

Processing

Drying — Offers no difficulty in seasoning, if carefully stacked under cover. Can be kiln-seasoned without difficulty

Shrinkage	Green to oven-dry
Radial	2.3%
Tangential	5.6%

Natural durability and preservation — Very durabie, sapwood perishable but readily treatable with complete penetration

Uses — One of the best known Indian timber for high class furniture and cabinets; construction of buildings; flush door shutters; Class l plywood; decorative plywood; aircraft plywood; marine plywood for face veneers; tool handles; artificial limbs and rehabilitation aids; textile mill accessories; chess pieces, discus and carrom draughts; musical instruments; engineering instruments: bentwood articles; handicrafts.

48. DALBERGIA PANICULATA Roxb.

Papilionaceae

Local names — painganni, pachila-maram

Tree — Medium to large, 15-20 m in height and up to 50 cm in diameter

Bark whitish-grey, smooth, thin

Distribution — Southern dry mixed deciduous forest

Wood

Gross structure

Diffuse-porous

Growth rings — Scarcely distinct

Vessels — Medium to small, moderately few to few, solitary or in radial multiples of 2 or 3

Parenchyma — Abundant; predominantly paratracheal — aliform-confluent, bands and fine lines delimiting growth rings

Rays	Fine to very fine, closely spaced
Included phloem	Distinct
Properties	
Colour	Yellowish or greyish-white to brown, sapwood and heartwood not distinct
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 510-735 kg, m^3, air-dry
Grain	Straight; texture medium to coarse
Natural durability and preservation	Non-durable
Uses	Timber falls to pieces when sawn, due to separation in the region of included phloem and is therefore of little use.

49. DALBERGIA SISSOIDES* Grah. ex Wight & Arn.

Papilionaceae

Trade name	malabar blackwood
Local name	veeti
Tree	Medium to large, 15–25 m in height and up to 100 cm in diameter Bark pale brown
Distribution	West coast semi evergreen, Moist teak bearing and Southern moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to small, few to moderately few, often unevenly distributed, solitary or in short radial multiples; occasionally filled with white or dark gummy deposits

* In trade not distinguished from ***Dalbergia latifolia*** Roxb.

Parenchyma — Abundant; paratracheal — vasicentric to aliform, aliform-confluent forming wavy irregular [ines; apotracheal — diffuse or diffuse-in-aggregates

Rays — Fine to very fine, closely spaced

Properties

Colour — Sapwood yellowish-white, heartwood light purplish-brown to deep purple with dark brown streaks, without tint of red as in *D. latifolia*

Hardness — Hard

Weight — Heavy to very heavy, 770 kg/m^3 at 12% m.c.

Grain — Straight to shallowly interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	727.7	73,500	132	325.9
Air-dry	832.7	99,500	107	452.1

Processing

Drying — Green conversion and stacking under cover recommended. Kiln-seasoning offers no difficulty

Shrinkage	Green to oven dry
Radial	3 1%
Tangential	6.1%

Working properties — Works comparatively easy with hand and machine, can be brought to a fine finish and takes good polish. Peels and slices well and very thin veneers can be obtained

Natural durability and preservation — Very durable

Uses High class furniture and cabinets; Class I plywood for general purpose; ornamental and decorative plywood; aircraft and marine plywood; blockboards; construction-work, especially for doors; panelling, heavy duty striking tools of quality; cutlery handles; musical instruments; boat and shipbuilding; textile mill accessories; carrom draughts, clubs and chess pieces; mathematical engineering and drawing instruments; shoe-lasts,

50. DILLENIA INDICA Linn.

Dilleniaceae

Trade name dillenia

Local name syalita

Tree Medium to large, 15-25 m in height with a clear bole of 6 m and about 60 cm in diameter

Bark reddish-brown, smooth, peels off in small flakes

Distribution West coast tropical evergreen forest in North Kerala

Wood

Gross structure

Diffuse-porous

Growth rings Fairly distinct

Vessels Large to medium, moderately few to moderately numerous, mostly solitary, occasionally in tangential or oblique pairs; sometimes filled with tyloses and white deposits

Parenchyma Apotracheal -- diffuse, usually indistinct, sometimes appear as white dots

Rays Broad to moderately broad, widely spaced; fine to very fine, closely spaced among the broad rays

Properties

Colour Sapwood yellowish-brown, heartwood light brown

Hardness Moderately hard

Weight Moderately heavy, 640 kg/m^3 at 12% m.c.

Grain Twisted to interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Cornpression parellel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max crushing stress kg/cm^2
Green	602.6	36,100	71	292
Air-dry	947 9	11.950	79	438

Processing

Drying Moderately refractory to air-seasoning Kiln-seasoning easy

Shrinkage Green to oven-dry
Radial 3.2%
Tangential 8.7%

Working properties Easy to saw when green. Difficult to work with seasoned wood, does not take fine polish. Can be peeled after boiling in water

Natural durability and preservation Non-durable. Heartwood refractory to treatment

Uses General construction-work, after treatment; flush door shutters; Class I plywood; tea chests; furniture; blockboards; tool handles.

51. DILLENIA PENTAGYNA Roxb.

Dilleniaceae

Trade name dillenia

Local names malampunna, vazha-punna

Tree Medium, 15–20 m in height and 50-80 cm in diameter

Bark greyish–brown, smooth, peels *off* in thick round flakes

Distribution Southern moist mixed deciduous, Moist teak bearing and Southern secondary moist mixed deciduous forests

Wood

Gross structure

Diffuse-porous

Growth rings Fairly distinct

Vessels Large to medium, moderately numerous, solitary or in tangential and oblique pairs; occasionally filled with tyloses and deposits

Parenchyma Aporracheal — diffuse, usually indistinct, sometimes appear as white dots

Rays Broad to moderately broad, widely spaced; fine to very fine, closely spaced among the broad rays

Properties

Colour Sapwood yellowish-brown, heartwood reddish-brown with greyish tinge

Hardness Moderately hard

Weight Moderately heavy, 625 kg/m^3 at 12% m.c.

Grain Interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	591.5	75,700	56	285.0
Air-dry	803.3	95,500	74	514.6

Processing

Drying	Moderately refractory to air-seasoning. Kiln-seasoning not difficult
	Shrinkage — Green to oven-dry: Radial 3.0%; Tangential 7.5%
Working properties	Easy to saw when green, does not give a smooth finish
Natural durability and preservation	Perishable. Heartwood refractory to treatment
Uses	Building construction; Class I plywood; tea chests; furniture and cabinets; charcoal (due to high calorific value).

52. DIOSPYROS EBENUM Koenig

Ebenaceae

Trade name	ebony
Local name	karimaram
Tree	Small *to* medium, occasionally attains a height of 20 m and about 40 cm in diameter
	Bark dark grey with longitudinal fissures
Distribution	Sporadic in West coast semi-evergreen forest
wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Small, few to moderately few, solitary or in radial multiples of 2 or 3; filled with brownish–black or black gum
Parenchyma	Apotracheal — fine undulating tangential lines
Rays	Very fine, closely spaced

Properties

Colour	Sapwood light yellowish-grey to grey, heartwood jet-black
Hardness	Very hard
Weight	Very heavy, 1150 kg/m^3 at 12% m.c.
Grain	Straight to somewhat irregularly wavy; texture fine
Processing	
Drying	Liable to develop long, fine, deep cracks if cut to wide sections; green conversion to small size and stacking under cover recommended
Working properties	Not difficult to saw and work can be finished to a fine shiny smooth surface and takes good polish
Natural durability and preservation	Durable. Refractory to treatment
Uses	Cutlery handles; dobby lags and pegs in textile mills; mathematical, engineering and drawing instruments; walking sticks; swagger slicks; handicrafts and carvings.

53. DIPTEROCARPUS BOURDILLONI Brandis

Dipterocarpaceae

Trade name	gurjan
Local names	karanjili, charatta anjili
Tree	Very large, up to 45 m in height and about 120 cm in diameter Bark greyish-brown, smooth
Distribution	West coast tropical evergreen forest in Central and South Kerala
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct

Vessels Large to medium, few lo moderately nurn-erous, mostly solitary; often filled with tyloses

Parenchyma Apotracheai - diffuse lo very short tang-ential lines; paratracheal — vasicentric, fairly conspicuous around resin ducts

Rays Moderately broad to fine, widely spaced; siicious deposits present

Resin ducts Vertical ducts occasionally present

Properties

Colour Sapwood whitish to pale yellowish-brown, heartwood pale red to reddish-brown

Hardness Moderately hard

Weight Moderateiy heavy, 705 kg/m^3 at 12% m.c.

Grain Straight lo interiocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallei to grain
	Modulus of Rupture kg/cm^2	Modulus Of Elasticity kg/cm^2	cm	Max crushing stress kg/cm^2
Green	678	127,100	74	312
Air-dry	1,051	156,200	89	581

Processing

Drying Air-seasoning easy. Kiln-seasoning diff-icult

Shrinkage Green to oven-drv
Radial 4.5%
Tangentia l 9.6%

Working properties Easy to saw and machine, finishes to a smooth surface. Screw and nail holding capacity satisfactory. Peels w e l l

Natural durability and preservation Fairly durable. Readily treatable

Uses Building and bridge construction; Class I plywood for general purposes; poles and cross arms; railway sleepers; boat and shipbuilding; carts and carriages.

54. DIPTEROCARPUS INDICUS Bedd

Dipterocarpaceae

Trade name	gurjan
Local names	kalpayin, vella-ayini
Tree	Very large, up to 37 m in height with a clear bole of 15–20 m and about 120 cm in diameter Bark pale, smooth, deeply cracked when old
Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium, few to moderately numerous, mostly solitary; occasionally filled with tyloses and reddish-brown resin
Parenchyma	Paratracheal — vasicentric; apotracheal — diffuse-in-aggregate as short lines in between rays, abundant around resin ducts
Rays	Few, moderately broad to fino, fairly close spaced, with reddish brown contents
Resin ducts	Vertical vesin ducts common, in short tangential rows of 2-6 or often solitary; occasionally filled with white deposits
Properties	
Colour	Sapwood greyish-white to pale brownish-white, heartwood greyish to reddish-brown, sapwood arid heartwood not well demarcated
Hardness	Moderately hard to hard
Weight	Moderately heavy Io heavy, 705-900 kg/m^3 at 12%m.c.
Grain	Fairly straight to somewhat interlocked or irregular; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	789	162,900	71	411
Air-dry	1,245	201,400	112	725

Processing

Drying — Moderately easy to air-seasoning. Kiln-seasoning difficult

Shrinkage — Green to oven-dry
Radial 6.0%
Tangential 11.4%

Working properties — Easy to work with machine and hand tools, does not turn to a smooth surface. Peels well. Shows an attractive grain when quarter sawn. Screw and nail holding capacity satisfactory

Natural durability and preservation — Moderately durable. Heartwood treatable but complete penetration not always obtained

Uses — Construction purposes like beams, ceiling, floor boards; bridge construction; Class I plywood and veneers; poles and cross-arms; railway sleepers; boat and shipbuilding; cart and carriages.

55. DYSOXYLUM BINECTARIFERUM (Roxb.) Hook.f, ex Bedd.

Meliaceae

Local names — akil, karagil

Tree — Medium, up to 15 m in height and about 30 cm in diameter

Bark grey with wrinkles, often peels off in papery flakes

Distribution	West coast semi-evergreen forest in North and Central Keraia
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately few, solitary or in radial multiples of 2–4; frequently filled with yellowish-brown deposits
Parenchyma	Abundant; paratracheal -- wavy bands alternating with fibre tracts concentric lines delimiting growth rings and also aliform confluent
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood pale greyish-yellow, heartwood pink or reddish-grey
Hardness	Moderately hard
Weight	Moderately heavy, *700* kg/m^3 air-dry
Grain	Straight to broadly interlocked; texture moderately fine
Processing	
Drying	Air- and kiln-seasoning not difficult, green conversion and immediate seasoning preferred
Working properties	Easy to saw, machining not difficult, can be brought to a fairly smooth surface and takes good polish
Natural durability and preservation	Moderately durable
Uses	Furniture and cabinets; plywood; mathematical, engineering and drawing instruments; vats and casks.

56. DYSOXYLUM FICIFORME (Wight) Gamble

(D. purpureum Bourd)

Meliaceae

Local name	karakil
Tree	Large, reaches to a height of 30 m and up to 100 cm in diameter Bark pale grey, smooth
Distribution	West coast tropical evergreen forest, mostly confined to South Kerala
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately few, solitary or in radial multiples of 2–4; frequently filled with yellowish-brown deposits
Parenchyma	Abundant; paratracheal — wavy bands and also aliform to aliform-confluent
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood greyish-yellow, heartwood pink or reddish-grey
Hardness	Hard
Weight	Moderately heavy to heavy, 730 kg/m^3 at 12%
Grain	Straight to broadly interlocked; texture medium to fine
Processing	
Drying	Air and kiln-seasoning not difficult
Working properties	Easy to saw and work with machine, can be brought to a fairly good finish
Natural durability and preservation	Durable
Uses	Furniture; turnery and carvings; cigar boxes.

57. DYSOXYLUM MALABARICUM Bedd. ex Hiern

Meliaceae

Trade name white cedar

Local names vella-agil, akil

Tree Very large, up to 35 m in height and 60-90 cm in diameter

Bark grey with white warts

Distribution West coast tropical evergreen and Southern hill-top tropical evergreen forests

Wood

Gross structure

Diffuse-porous

Growth rings Distinct

Vessels Small, moderately numerous, solitary or in radial multiples of 2 or 3; usually filled with yellowish-brown deposits

Parenchyma Paratracheal — vasicentric, forming a thin sheath around vessels and in bands delimiting growth rings

Rays Fine, numerous and closely spaced

Properties

Colour Sapwood whitish or greyish-yellow, heartwood yellow to golden yellow or yellowish-brown

Hardness Moderately hard

Weight Moderately heavy,720 kg/m^3 at 12% m.c.

Grain Straight to somewhat interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	661.2	109,200	104	318.8
Air-dry	1,81.6	141,300	107	620.5

Processing

Drying — Easy to season. Green conversion and quick stacking recommended

Shrinkage	Green to oven-dry
Radial	4.7%
Tangential	8.1%

Working properties — Easy to saw and machine, takes good polish

Natural durability and **preservation** — Very durable

Uses — Building construction; decorative panelling; aircraft plywood; furniture and cabinets; tool handles; artificial limbs and rehabilitation aids; textile mill accessories; coorperage; chess pieces; mathematical and engineering instruments.

58. ELAEOCARPUS RECURVATUS Corner

[E. ferrugineus (Wt.) Steud.]

Elaeocarpaceae

Local name — chola-rudraksham

Tree — Medium, about 15 m in height and 30–40 cm in diameter

Distribution — Confined to the Southern hill-top tropical evergreen forest

Wood

Gross structure — Diffuse-porous

Growth rings — Scarcely distinct

Vessels — Medium to small, moderately few to numerous, solitary or in radial multiples of 2–4 or more, up to 7; often sparsely filled with tyloses

Parenchyma — Fairly distinct, paratracheal — fine, more or less continuous lines delimiting growth rings

Rays	Medium to fine, widely spaced: very fine, closely spaced
Pith flecks	Often present
Properties	
Colour	Sapwood greyish–white, heartwood yellowish to pale brownish-grey, somewhat lustrous
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 550 kg/m^3, air-dry
Grain	Straight to somewhat wavy; texture medium to fine
Processing	
Drying	Not difficult to season, but liable to end-cracks; green conversion and open stacking under cover recommended
Working properties	Easy to saw and work
Natural durability and preservation	Non–durable
Uses	Packing cases and boxes; plywood; match splints.

59. ELAEOCAFQPUSTUBERCULATUS Roxb.

Elaeocarpaceae

Trade name	rudrak
Local names	rudraksham, kara
Tree	Large, up to 25 m in height and about 65 cm in diameter; buttressed
	Bark dark coloured, mottled, yellowish inside
Distribution	West coast tropical evergreen and West coast semi–evergreen forests
Wood	
Gross structure	
	Diffuse–porous

Growth rings Scarcely distinct

Vessels Medium to small, moderately few to numerous, solitary or in radial multiples of 2–4; often filled with tyloses

Parenchyma Indistinct

Rays Moderately broad to fine, widely spaced; very fine, closely spaced among broad rays

Properties

Colour Sapwood white, heartwood light greyish-brown to light brown, lustrous

Hardness Soft

Weight Light, 465 kg/m^3 at 12% m.c.

Grain Interiocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	483.7	87,400	58	253.0
Air-dry	656.9	98,600	50	381.1

Processing

Drying Not difficult to season, green conversion and open stacking under cover recommended. Kiln-seasoning not difficult

Shrinkage	Green to 12% m.c.
Radial	3.1%
Tangential	6.1%

Working properties Easy to saw. Peels well; gluing satisfactory

Natural durability and preservation Non-durable in exposed conditions, fairly durable under cover

Uses Building construction; packing cases; plywood; match splints; pencil slats.

60. EMBLICA OFFICINALIS Gaertn.

(Phyllanthus emblica Linn.)

Euphorbiaceae

Trade name	amla
Local name	nelli
Tree	Small to medlum, 8-18 m in height and 38–50 cm in diameter
	Bark light grey, thin, exfoliating in small thin irregular flakes
Distribution	Southern moist mixed deciduous, Southern dry mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, moderately few, solitary or in radial multiples of 2 or **3,** often in clusters; usually filled with reddish-brown deposits
Parenchyma	Indistinct
Rays	Moderately broad to broad, closely spaced, radial flecks distinct
Properties	
Colour	Reddish, often with purplish tinge, sapwood and heartwood not distinct
Hardness	Hard
Weight	Heavy, 785 kg/m^3 at 12% m.c.
Grain	Irregularly interlocked to wavy; texture coarse
Processing	
Drying	Somewhat difficult; green conversion and stacking during or after rainy season recommended
Working properties	Easy saw and planes to a fairly smooth surface
Natural durability and preservation	Moderately durable, very durable under water
Uses	Minor construction-work; well curbs.

61. ERYTHRINA STRICTA Roxb.

Papilionaceae

Trade name	coral tree
Local names	murukku, mullu-murukku
Tree	Medium, 12-18 m in height and up to 65 cm in diameter
	Bark yellowish or greenish-grey, corky, with pale green prickles on young trees
Distribution	Southern moist mixed deciduous forest
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Very large to small, few to very few, solitary or in radial multiples of 2 or 3
Parenchyma	Abundant, paratracheal — straight or wavy broad tangential bands alternating with fibre tracts
Rays	Broad to very broad, widely spaced
Properties	
Colour	Creamy white to greyish-white, sapwood and heartwood not distinct
Hardness	Soft
Weight	Very light to light, 240-470 kg/m^3, air-dry
Grain	Straight; texture very coarse
Processing	
Drying	Air-seasoning easy; green conversion and open stacking in piles recommended
Working properties	Easy to work but does not give good finish
Natural durability and preservation	Perishable
Uses	Lacquer boxes; picture frames; toys; domestic appliances; insulator boards; match splints.

62. ERYTHROXYLUM MONOGYNUM Roxb.

Erythroxylaceae

Trade name	bastard sandal
Local name	vella-devadharam
Tree	Small, up to 8 m in height and about 15 cm in diameter
	Bark dark brown, rough
Distribution	Southern dry mixed deciduous and Laterite thorn forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Small to very small, moderately numerous to numerous, solitary or in radial multiples of 2 or 3, occasionally up to 6, mostly in radial or oblique clusters; often filled with tyloses
Parenchyma	Apotracheal — diffuse, usually indistinct
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood creamy white or pale brown and heartwood reddish-brown
Odour	Heartwood with pleasant odour
Hardness	Very hard
Weight	Heavy to very heavy, 1000 kg/m^3, air-dry
Grain	Interlocked; texture fine to very fine
Processing	
Working properties	Easy to work and takes good polish
Uses	Posts and poles; agricultural implements; turnery articles. Oil extracted from wood is used in preserving country boats.

63. EUCALYPTUS GRANDIS Hill ex Maid.

Myrtaceae

Trade names	rose gum, flooded gum
Local names	eucalyptus, eucali
Tree	Large, about 30 m in height and 40–50 crn in diameter Bark whitish or ash coloured, smooth
Distribution	Native of Australia, extensiveiy raised in plantations
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct or scarcely distinct
Vessels	Large to medium moderately few; mostly solitary, sometimes in oblique alignment; tyloses sparse to abundant kino-like deposits sparse of absent
Parenchyma	Sparse to abundant apotracheal — diffuse; crystals sometimes present kino like deposits moderatley abundant to absent
Rays	Fine closeiy spaced; kino-like deposits abundant
Properties	
Colour	Sapwood pinkish, heartwood pinkish brown to reddish-brown
Hardness	Moderately hard to hard
Weight	Moderately heavy to heavy, 740 kg/m^3 air-dry
Processing	
Drying	Seasoning difficult; liable to warp and crack
Working properties	Easy to saw and work
Natural durability and preservation	Non-durable
Uses	Mainly for pulping; suitable for packing cases and boxes; crates, beams, columns, poles and posts.

64. EUCALYPTUS TERETICORNIS Sm.

Myrtaceae

Trade names mysore gum, eucalyptus hybrid

Local names eucalyptus, eucali

Tree Large, about 25 m in height and 40 cm in diameter

Bark whitish or ash coloured, smooth

Distribution Native of Australia, extensiveiy raised in plantations

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Medium, moderately numerous, mostly solitary; rarely in radial or oblique chains; tyloses abundant; kino-like deposits sparse to moderately abundant

Parenchyma Moderately abundant to abundant; apotracheal — diffuse; kino-like deposits sparse to abundant

Rays Fine, closely spaced; kino-like deposits abundant

Properties

Colour Sapwood light or pale red, heartwood reddish-brown

Hardness Hard to very hard

Weight Heavy to very heavy, 980 kg/m^3, air-dry

Grain Straight; texture medium

Strength

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	510	60,000	107	291
Air-dry	866	100,800	74	513

Processing	
Drying	Seasoning difficult, liable to warp and crack
	Shrinkage — Green to oven-dry: Radial 6.3%, Tangential 9.6%
Working properties	Easy to saw and work. Nail holding capacity good
Natural durability and preservation	Moderately durable under cover
Uses	Mainly for pulping; suitable for packing cases and boxes; beams, columns, poles and posts.

65. EUODIA LUNU-ANKENDA (Gaertn.) Merr

(E. roxburghiana Benth.)

Rutaceae

Trade name	kambli
Local names	kanala, kambili
Tree	Medium, about 15 m in height and 40 cm in diameter
	Bark grey, smooth, lenticeliate
Distribution	West coast tropical evergreen, West coast semi-evergreen and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Medium to small, moderately numerous, solitary or in radial multiples of 2-4 or more, rarely in clusters; often filled with yellowish deposits
Parenchyma	Paratracheal — aliform to aliform-confluent
Rays	Fine, closely spaced

Properties	
Colour	Yeilowish-white, sapwood and heartwood not distinct, lustrous
Hardness	Soft
Weight	Light, 450 kg/ms, air-dry
Grain	Straight; texture fine
Processing	
Drying	Easy to season
Working properties	Difficult to work but finishes well and takes good polish
Natural durability and preservatioa	Perishable
Uses	Match splints and boxes; packing cases and boxes.

66. FILICIUM DECIPIENS Thw.

Sapindaceae

Local name	niroli
Tree	Medium to large, 18-25m in height and up to 90 cm in diameter Batk reddish-qrey to blackish-brown, rough
Distribution	Sporadic in West coast tropicai evergreen and West coast semi-evergrten forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Usually srnall, numerous to moderately numerous, mostly in radial muliiples of 2-4, occasional[y solitary; often plugged with whitish or reddish-brown gummy deposits
Parenchyma	Paratracheal — Vasicentric, in fine usually interrupted lines often delimiting growth rinsg

Rays	Very fine, rather closeiy spaced
Properties	
Colour	Sapwood greyish–white with a pale pinkish tinge, heartwood reddish-brown
Hardness	Very hard
Weight	*Very* heavy, 830 kg/m^3 at 12% m.c.
Grain	Straight; texture fine
Processing	
Drying	Quick conversion and close piling under cover recommended
Working properties	Sawing not difficult, machining easy, can be brought to a good finish
Natural durability and preservation	Moderately durable
Uses	Bearns and posts in construction; tool handles; agricultural implements; low quality furniture; cart and carriages.

67. FIRMIANA COLORATA (Roxb) R. Br.

(Sterculia colorata Roxb)

Sterculisceae

Local name	malamparathi
Tree	Medium 10- 2O m in height, with a clear bole of 6-9 m and *30-50* cm in diameter Bark whitish–grey, fairly smooth fibrous
Distribution	Sparingly found in West coast semi-evergreen and Southern moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium, few to moderately numerous, mostly solitary or in radia- multiples of 2, 3 or in clusters

Parenchyma	Broad wavy or fairly straight tangential bands
Rays	Broad to moderately broad and fine, widely spaced, forming conspicuous flecks on radial surface
Gum canals	Occasionally present, traumatic, arranged in long tangential bands
Properties	
Coiour	Greyish or pale yellowish-white to light greyish-brown, sapwood and heartwood not distinct, somewhat lustrous
Hardness	Moderately hard
Weight	Moderately heavy, 590 kg/m^3 at 12% m.c
Grain	Straight; texture-coarse
Natural durability and preservation	Perishable
Uses	Packing cases and boxes; match boxes

68. GARUGA PINNATA Roxb.

Burseraceae

Trade name	garuga
Local names	annakara, kattu-nelli
Tree	Medium to large, 12–25 m in height, with a clear bole of 5–10 m and 30-60 cm in diameter
	Bark pale grey or brown, peels off in small flakes
Distribution	Southern moist mixed deciduous, Moist leak bearing and Southern dry mixed deciduous forests
Wood	
Gross structure	Diffuse–porous
Growth rings	Indistinct

Vessels — Large to medium, moderately few, solitary or in radial multiples of 2–4 or more; heartwood vessels filled with tyloses and deposits

Parenchyma — Paratracheal — scanty, usually indistinct

Rays — Moderately broad, somewhat widely spaced

Gum canals — Horizontal

Properties

Colour — Sapwood whitish to grey often with sap stain, heartwood reddish-brown

Hardness — Moderately soft to moderately hard

Weight — Light to moderately heavy, 465-790 kg/m^3 at 12% m.c.

Grain — Straight to interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	583.4	55,800	81	288.8
Air-dry	694.8	87,300	58	353.8

Processing

Drying — Green conversion and stacking under cover recommended

Shrinkage — Green to 127; m.c.
Radial 3.5%
Tangential 5.3%

Working properties — Easy to saw, machining good

Natural durability and preservation — Perishable. Heartwood very refractory to treatment

Uses — Temporary construction; Class III plywood; packing cases and boxes; tea chests; cross arms; low quality furniture.

69. GLUTA TRAVANCORICA Bedd.

Anacardiaceae

Trade name	gluta
Local names	thenmavu, thodappei
Tree	Very large, up to 35 m in height and 65-120 cm in diameter Bark pinkish-grey, smooth
Distribution	Confined to the West coast tropical evergreen and Southern hill-top tropical evergreen forests in South Kerala
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium, very few to moderately few, solitary or in radial multiples of 2 or 3; frequently filled with tyloses
Parenchyma	Fairly abundant; apotracheal – in long tangential bands; paratracheal scanty; brownish in colour
Rays	Brownish; very fine to fine, closely spaced, occasionally moderately broad rays present at intervals
Gum canals	Horizontal in the rays, often traumatic vertical canals present in tangential rows
Properties	
Colour	Sapwood pale grey with pinkish or yellowish tinge, heartwood reddish-brown or dark red
Hardness	Hard to very hard
Weight	Moderately heavy, 720 kg/m^3 at 12%
Grain	Interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	677.1	127,300	74	361.2
Air-dry	945 8	148,500	81	557 3

Processing

Drying — Green conversion and stacking under cover recommended

Working properties — Somewhat difficult to saw, machining gives fine finish; takes excellent polish

Natural durability and preservation — Durable

Uses — Building construction; cabinets and furniture; decorative interior joinery; turnery articles and carvings; tool handles.

70. GMELINA ARBOREA Roxb.

Verbenaceae

Trade name — garnari

Local name — kumbil

Tree — Medium, 15-20 m in height and 40-65 cm in diameter

Bark whitish-grey, corky, lenticellate, exfoliating in thin flakes

Distribution — Sporadic in Southern moist mixed deciduous, Moist teak bearing and Southern secondary moist mixed deciduous forests

Wood

Gross structure — Diffuse-porous to

Growth rings — Scarcely distinct

Vessels — Large to medium, few to moderately numerous, mostly solitary and in short radial multiples of 2 or 3; tyloses abundant

Parenchyma — Mostly paratracheal — vasicentric and also in terminal bands delimiting growth rings

Rays — Broad to moderately broad, few, rather widely spaced

Properties

Colour — Creamy white to pale yellowish-grey or buff turning to yellowish-brown on exposure, sapwood and heartwood not distinct

Hardness — Soft to moderately herd

Weight — Light to moderately heavy, 415-610 kg/m^3 at 12% m.c.

Grain — Straight to wavy; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	492	70,200	76
Air-dry	543	77,400	43

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm$_2$	Max. crushing stress kg, cm	Modulus of Elasticity kg/cmz	Compressive stress at elastic limit kg/cm
Green	181	227	75,200	73
Air-dry	162	251	76,200	43

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	77	77	38	37
Air-dry	75	68	43	51

Processing

Drying	Easy to air-seasoning. Kiln-seasoning offers no difficulty
Working properties	Easy to saw, works to a fairly smooth finish and takes good polish. Usually very uniform in colour and except for occasional roe-mottling which gives the wood a silvery sheen. Being very steady after seasoning, it is considered as a first class work-. shop wood
Natural durability and preservation	Durable
Uses	Building construction; shipbuilding; Class I plywood for general purpose; furniture and cabinets; tool handles; artifical limbs and rehabilitation aids; textile mill accessories; cooperage;.carrom draughts, tennis and badminton rackets; brushware; musical instruments; shoe-lasts; pencil slats.

71. GREVILLEA ROBUSTA A. Cunn. ex R. Br.

Proteaceae

Trade name	silver oak
Local name	silver oak
Tree	Medium to large, 18-25 m in height and about 65 cm in diameter Bark rough, with vertical fissures
Distribution	Native of Australia, grown in tea and coffee estates as shade trees and in homesteads
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large to medium, moderately numerous, mostly in tangential clusters; filled with deposits

Parenchyma — Paratracheal — vasicentric and aliform to aliform-confluent

Rays — Broad to very broad, widely spaced; occasionally fine rays present in between the broad rays. Silvery radial flecks present

Properties

Colour — Sapwood greyish-white, heartwood light reddish-brown

Hardness — Hard

Weight — Moderately heavy, 640 kg/m^3 at 12% m.c.

Grain — Straight; texture coarse but uniform

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	**396**	**49,000**	**46**
Kiln-dry	**633**	**83,000**	**51**

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	**121**	**216**	**49,000**	**44**
Kiln-dry	**207**	**389**	**71,000**	**82**

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	**73**	**72**	63	**74**
Kiln-dry	82	**98**	**61**	**56**

Working properties	Easy to work with tools but difficult to bring to a good finish
Natural durability and preservation	Perishable. Treatable
Uses	Panelling in building construction; flush door shutters; Class III general purpose plywood; decorative plywood; block-boards; packing cases and boxes; mathe-matical, engineering and drawing instru-ments; bobbins; rehabilitation aids.

72. GREWIA TILIIFOLIA Vahl

Tiliaceae

Trade name	dhaman
Local names	chadachi, unnam
Tree	Medium, up to 20 m in height, with a clear bole of 8 m and about 65 cm in diameter
	Bark grey to blackish-brown, rough, fibrous, peels off in thin flakes
Distribution	Southern moist mixed deciduous, Moist teak bearing and West coast semi-ever-green forests
Wood	
Gross structure	Diffuse-porous to semi-ring-porous
Growth rings	Distinct
Vessels	Medium to small, moderately few to moderately numerous, solitary or in radial multiples of 2, 3, occasionally in clusters of 3-5; filled with tyloses or chalky deposits
Parenchyma	Paratracheal — vasicentric; apotracheal-diffuse and also in tangential lines
Rays	Moderately broad fine, widely spaced; very fine, closely spaced, with a tendency of storeyed arrangement

Properties

Colour Sapwood light greyish-brown, heartwood reddish-brown with dark streaks

Hardness Moderately hard

Weight Heavy, 785 kg/m^3 at 12% m.c.

Grain Fairly straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	912.9	148,200	91	480.3
Air-dry	1,301.9	163,900	124	701.2

Processing

Drying Moderately refractory, liable to surface cracking and end splitting; conversion soon after felling and stacking under cover recommended

Shrinkage Green to 12% m.c.
Radial 4.1%
Tangential 7.9%

Working properties Easy to saw and machine, can be brought to a smooth finish and takes good polish

Natural durability and preservation Moderately durable. Heartwood refractory to treatment

Uses Agricultural implements; tool handles; constructional purposes like door and window frames: furniture; poles, ballies, cross arms and fence posts; railway sleepers; tent accessories; boat and shipbuilding; badminton rackets, clubs, balancing bench. hurdles, cricket stumps and bails; lorry and bus bodies; brushware; cart and carriages.

73. GYMNACRANTHERA CANARICA (King) Warb.

(Myristica canarica King)

Myristicaceae

Local name	unda-payin
Tree	Very large, about 35 m in height and 60 cm in diameter
	Bark brown, smooth
Distribution	Myristica swamp and West coast tropical evergreen forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small moderately few to few, occasionally soiitary or mostly in radial multiples of 2 or 3, often in double rows; filled with tyloses and gummy deposits
Parenchyma	Apotracheal — as tangential bands
Rays	Fine, closely spaced
Properties	
Colour	Pinkish or pale red to light reddish-brown, sapwood and heartwood not distinct, lustrous
Hardness	Soft
Weight	Light, 530 kg/m^3 at 12%
Grain	Straight to wavy; texture medium to coarse
Processing	
Drying	Green conversion and stacking under cover recommended
Working properties	Easy to saw and work, finishes to a smooth surface
Natural durability and preservation	Non-durable
Uses	Superior quality boxes and packing cases. Can be tried for plywood.

74. HALDINA CORDIFOLIA (Roxb.) Ridsd.

*[Adina **cordifolia*** (Roxb) Hook, **f.** ex Brandis]

Rubiaceae

Trade name haldu

Local name manja-kadambu

Tree Medium to very large, 15–35 m in height and up to 110 cm in diameter; often buttressed

Bark grey, soft, thick, exfoliating in small irregular flakes

Distribution Southern moist mixed deciduous, Moist teak bearing and West coast semi-evergreen forests

Wood

Gross structure Diffuse-porous

Growth rings Indistinct

Vessels Small to very small, moderately numerous to numerous, mostly solitary or in radial multiples of 2 or 3

Parenchyma Extremely sparse paratracheal — scanty; apotracheal relatively abundant-diffuse and diffuse-in-aggregate

Rays Fine, closely spaced

Properties

Colour Sapwood yellowish-white, heartwood yellow or yellowish-brown

Hardness Moderately hard

Weight Moderately heavy, 695 kg/m^3 at 12% m,c.

Grain Fairly straight to somewhat interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Moduius of Elasticity kg/cm^2	cm
Green	657	89,290	79
Air-dry	735	101,600	66

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	217	320	95,760	55
Air-dry	228	421	110,240	87

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	75	89	41	46
Air-dry	82	94	25	44

Processing

Drying

Green conversion and open stacking under cover recommended. Kiln-seasoning offers no difficulty

Shrinkage Green to 14.6% m.c.
Radial 3.4%
Tangential 6.8%

Working properties

Sawing not difficult, machining satisfactory, works fairly easy giving good finish

Natural durability preservation

Non-durable. Heartwood easily treatable

Uses

Class I plywood; tea chests; furniture and cabinets; blockboards; tool handles; bobbins; cricket stumps and bails; musical instruments; mathematical, engineering and drawing instruments; brushware; bentwood articles and toys; shoe-lasts; battery separators.

75. HERITIERA PAPIPLIO Bedd.

Sterculiaceae

Trade name	sundri
Local name	chokla-maram
Tree	Small to medium, 7–12 m in height and about 30 cm in diameter Bark grey or greyish-white with shallow longitudinal fissures
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, few to moderately few, mostly solitary or in radial multiples of 2 3 or more; often filled with gummy deposits
Parenchyma	Visible under lens as fine, tangential, interrupted lines forming a reticulum with rays and delimiting growth rings, sometimes diffuse
Rays	Fine, closely spaced
Gum canals	Traumatic gum canals present in short tangential rows associated with parenchyma
Properties	
Colour	Sapwood pale pinkish-brown, heartwood reddish-brown with purple streaks
Hardness	Hard to very hard
Weight	Heavy to very heavy, 830 kg/m^3 at 12%
Grain	Straight to somewhat interlocked; texture medium
Processing	
Drying	With great care kiln-seasoning possible
Working properties	Difficult to saw but machines well to a smooth surface and takes good polish

Natoral durability and preservation	Non-durable. Refractory to treatment
Uses	Temporary construction-work; poles and posts; musical instruments; mathematical, engineering and drawing instruments; agricultural implements.

76. HEVEA BRASILIENSIS (HBK.) Muell. Arg.

Euphorbiaceae

Trade name	rubber wood
Local name	rubber wood
Tree	Large, tip to 30 m in height and 40-70 cm in diameter
	Bark greyish-black, smooth
Distribution	Native of South America, raised extensively in plantations
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Medium to small, moderately numerous to few, solitary or in radial multiples of 2, rarely 3 or 4; occasionally with tyloses and white to chalky deposits
Parenchyma	Abundant; apotracheal — diffuse, fine tangentiai wavy lines and also in more or less continuous fine lines delimiting growth rings; paratracheal — vasicentric
Rays	Fine, somewhat closely spaced
Properties	
Colour	Yellowish-white when freshly cut, brownish or creamy on exposure, sapwood and heartwood not distinct
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 525-610 kg/m^3 at 12%

Grain	Slraight; texture medium
Processing	
Drying	Seasons easily and quickly without much degradation. During air-seasoning liable to end-splitting, while in kiln-seasoning there is tendency to warp
Shrinkage	Green to 12%m.c. Radial 1.2% Tangential 1.8%
Working properties	Easy to saw and works well with hand tools and machines. Nail holding capacity good
Natural durability and preservation	Perishable, sap stains common. Moderate to treatment
Uses	Packing cases and boxes; fibreboards; particleboards; match splints and boxes; low quality furniture.

77. HOLIGARNA ARNOTTIANA Hook. f.

Anacardiaceae

Local name	cheru
Tree	Medium; 12-20 m in height with a clear bole of 5-8 m and 30-50 cm in diameter Bark ash coloured or grey, rather smooth
Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to small, very few to moderately few, solitary or in radial multiples of 2, 3 or more, occasionally in clusters; often filled with tyloses
Parencbyma	Paratracheal — scanty

Rays	Brownish; broad, irregularly spaced; fine, indistinct, closely, spaced
Pith flecks	Occasionally present
Properties	
Colour	Greyish–brown, sapwood and heartwood not distinct
Hardness	Soft
Weight	Light, 430 kg/m^3 at 12% m.c.
Grain	Straight; texture rather coarse
Processing	
Drying	Easy to season; green conversion and open stacking under cover recommended
Working properties	Easy to saw, finishes to a fairly smooth surface
Natural durability and preservation	Non-durable. Heartwood easily treatable
Uses	Plywood; light packing cases and boxes; match splints; pencil slats.

78. HOLIGARNA GRAHAMII (Wight) Kurz

Anacardiaceae

Local names	valiyacheru, anacheru
Tree	Medium, about 15 m in height and up to 50 cm in diameter Bark grey, lenticellate, smooth
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse–porous
Growth rings	Indistinct
Vessels	Large to small, very few to moderately few solitary or in radial multiples of 2, 3 or more, often in clusters; filled with
Parenchyma	Paratracheal — scanty

Rays	Broad to moderately broad, widely spaced; fine, closely spaced in between the broad rays
Properties	
Colour	Greyish-brown, sapwood and heartwood not distinct
Hardness	Soft
Weight	Light, 480 kg/m3 at 12% m.c.
Grain	Straight; texture coarse
Processing	
Working properties	Easy to saw and work
Natural durability and preservation	Perishable
Uses	Packing cases and boxes; match splints,

79 HOLOPTELIA IMTEGRIFOLIA (Roxb.) Planch.

Ulmaceae

Trade names	Indian elm, kanju
Local name	aval
Tree	Medium to large, 15-25 m in height and up to 80 cm in diameter Bark whitish-grey, thin, exfoliating in irregular flakes
Distribution	West coast semi-evergreen and occasionally in Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately numerous, solitary or in short radial multiples of 2 or 3, rarely more; often filled with chalky deposits

Parenchyma — Paratracheal — aliform to aliform-confluent

Rays — Moderately broad to fine, somewhat closely spaced

Properties

Colour — Light yellow or yellowish-grey, sapwood and heartwood not distinct, somewhat lustrous

Hardness — Moderately hard

Weight — Moderately heavy, 595 kg/m^3 at 12% m. c.

Grain — Somewhat interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	598	74,600	94	270
Air-dry	719	91,500	66	411

Processing

Drying — Seasons well. Kiln-seasoning offers no difficulty

Working properties — Easy to saw and work, turns to a fine smooth surface and takes good polish

Natural durability and preservation — Non-durable. Heartwood treatable but complete penetration not always obtained

Uses — General construction; bobbins and cotton reels in textile mills; general purpose Class I plywood; tea chests; decorative plywood; furniture and cabinets; blockboards; tool handles; agricultural implements; bentwood artilcles and toys.

80. HOPEA GLABRA Wight & Arn.

(H. wightiana var. ***glabra*** Bedd.)

Dipterocarpaceae

Trade name	hopea
Local names	ilapongu, puzha-pongu
Tree	Medium to large, 18-25 m in height with a clear bole of *6* m and about 60 cm in diameter; often buttressed Bark blackish-brown, peels off in thin flakes, leaving irregular markings
Distribution	Sporadic in West coast semi-evergreen and West coast tropical evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Very small, numerous, solitary or in radial multiples of 2-5 or in oblique grouping; partly filled with tyloses and brownish-yellow deposits
Parenchyma	Apotracheal — diffuse-in-aggregate, paratracheal — vasicentric to aliform, short or long tangential bands embedding resin ducts
Rays	Moderately broad to fine, closely spaced: brownish-yellow granules and crystals often present
Resin ducts	Vertical, distinct under lens as tangential lines, irregularly spaced; whitish-yellow deposits present
Properties	
Colour	Light greyish or creamy brown often with dark streaks, sapwood and heartwood not distinct, lustrous when freshly cut
Hardness	Hard to very hard
Weight	Heavy to very heavy, 1,075 kg/m^3 at 12%
Grain	Interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	1,067.3	147,900	124	581.4
Air-dry	1,263.7	160,700	180	710.5

Processing

Drying — Green conversion and stacking under cover recommended

Shrinkage — Green to oven-dry
Radial 4.3%
Tangential 8.7%

Working properties — Difficult to saw,machining not satisfactory, takes good polish

Natural durability aod preservation — Durable to very durable. Very refractory to treatment

Uses — Building and bridge construction; posts and poles; rice pounders.

81. HOPEA PARVIFLORA Bedd.

Dipterocarpaceae

Trade name — hopea

Local names — Kambagam, tharnbagam, irumbagam

Tree — Large to very large, 25-40 m in height with a clear bole of 10-20 m and up to 130 cm in diameter; often buttressed

Bark light brown, mottled with white, smooth in young trees, changes to rusty brown and rough as the tree grows old

Distribution — West coast tropical evergreen, Southern hill-top tropical evergreen, West coast semi-evergreen and West coast secondary evergreen *Dipterocarp* forests

Wood

Gross structure

	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately numerous, solitary or in radial multiples of 2–5 or in oblique grouping; often filled with tyloses and occasionally lemon yellow deposits
Parenchyma	Predominently apotracheal — diffuse-in-aggregate; paratracheal — vasicentric, inconspicuously confluent, tangential bands embedding resin ducts
Rays	Moderately broad to fine
Resin ducts	Vertical, small to very small, distinct under lens, connate in uniseriate rows; filled with whitish-yellow deposits

Properties

	Yellowish-brown to reddish-brown when first exposed, on ageing to dark reddish-brown with white lines at intervals, sap-wood and heartwood not distinct
Hardness	Hard to very hard
Weight	Heavy to very heavy, 930 kg/m^3 at 12%m c.
Grain	Broad, shallowly interlocked; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	927.8	130,300	94	528.9
Air-dry	1,353.7	145,100	127	692.9

Processing

Drying — Liable to surface cracks and splits; green conversion and stacking under cover recommended. Kiln-seasoning possible without degradation

Shrinkage	Green to oven-dry
Radial	3.8%
Tangential	8.1%

Working properties — Difficult to saw and work gives a good finish and takes fine polish. Peeling extremely difficult

Natural durability and preservation — Very durable. Heartwood very refractory to treatment

Uses — Beams, rafters and trusses in building construction; planks for shipbuilding; tool handles; poles and posts; railway sleepers; cart and carriages.

82. HOPEA PONGA (Dennst.) Mabberley

(H. wightiana Wall.)

Dipterocarpaceae

Trade name — hopea

Local name — ilapongu

Tree — Medium, 10–18 m in height and about 50 cm in diameter

Bark brown, mottled with white, exfoliating in thin flakes in old trees

Distribution — West coast tropical evergreen and West coast semi-evergreen forests

wood

Gross structure

Diffuse-porous

Growth rings — Fairly distinct

Vessels — Medium to small, moderately numerous, solitary or in radial multiples of 2-5 or in oblique groups; often filled with tyloses

Parenchyma	Abundant; paratracheal — vasicentric, confluent tangential bands connecting resin ducts
Rays	Moderately broad to fine, fairly close spaced; crystals numerous
Resin ducts	Irregularly scattered; often with whitish-yellow deposits
Properties	
Colour	Yellowish-brown to brownish-red, sapwood and heartwood scarcely distinct
Hardness	Hard to very hard
Weight	Heavy to very heavy, 920 kg/m^3 at 12% m.c.
Grain	Somewhat interlocked; texture fine
Processing	
Drying	Green conversion and stacking under cover recommended
Working properties	Rather difficult to saw and work
Natural durability and	Moderately durable. Very refractory to tieatment
Uses	Beams and rafters in bridge and building construction; poles, ballies and fence posts; railway sleepers.

83. HOPEA UTILIS (Bedd.) Bole

(Balanocarpus utilis Bedd.)

Dipterocarpaceae

Trade name	kongu
Local name	karan-kongu
Tree	Large, 25–30 m in height with a clear bole of 15–20 m and 60-100 cm in diameter
	Bark dark brown, often with greyish patches

Distribution Restricted localities in West coast semi-evergreen forest

Wood

Gross structure

Diffuse-porous

Growth rings Fairly distinct

Vessels Very small, visible only under lens, numerous, arranged in short radial or oblique chains, often in a zig-zag fashion, rarely solitary; tyloses abundant, with occasional yellow to orange-brown deposits

Parenchyma Abundant; apotracheal — occasionally diffuse and often in fine concentric lines; paratracheal - relatively sparse, vasicentric to aliforrn

Rays Fine, distinct under lens, closely spaced; orange brown deposits and crystals abundant

Resin ducts In concentric uniseriate or short tangential lines; often fiiled with yellowish-white deposits, clearly visible when moistened

Properties

Sapwood light olive brown and heartwood yellowish-brown often turning reddish-brown with age, somewhat lustrous

Hardness Very hard

Weight Very heavy, 995 kg/m^3 at 12% m.c

Grain Shallowly interlocked; texture fine to very fine

Strength

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	1,254.7	169,200	135	656.6
Air-dry	1,510.7	187,200		755.1

Processing

Drying — Difficult to season, liable to surface cracks; green conversion and close stacking under cover recommended

Shrinkage — Green to oven-dry

Radial	4.8%
Tangential	8.2%

Working properties — Difficult to saw and to plane to a smooth surface

Natural durability and preservation — Moderately durable. Very refractory to treatment

Uses — Building construction; railway sleepers; poles, cross arms, ballies and fence posts; planks; cart wheels.

84. HUMBOLDTIA DECURRENS Bedd. ex Oliver

Caesalpiniaceae

Local names — kunthani, malamthodappu

Tree — Medium, about 15 m in height and 30 cm in diameter

Bark bluish-green, smooth

Distribution — West coast tropical evergreen forest in South Kerala

Wood

Gross structure — Diffuse-porous

Growth rings — Indistinct

Vessels — Medium to small, few to moderately few, solitary or in radial multiples of 2, 3 or rarely in clusters; often filled with yellowish-brown gummy deposits

Parenchyma — Paratracheal — aliform to fluent

Rays — Fine to very fine, closely spaced

Properties

Colour	Sapwood light brown, heartwood dark purple
Hardness	Moderately hard to hard
Weight	Light to moderately heavy, 530–710 kg/m^3 air–dry
Grain	Straight to slightly interlocked; texture medium to coarse
Uses	Boxes and crates.

85. HYDNOCARPUS ALPINA Wight

Flacourtiaceae

Local names	mala-marotti, kattu-marotti
Tree	Small to medium, 8-18 m in height and up to 50 cm in diameter Bark greyish–brown, rough
Distribution	West coast tropical evergreen and West coast semi–evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Very small, numerous to very numerous, mostly in radial multiples of 2–4
Parenchyma	Indistinct
Rays	Fine to very fine, closely spaced
Properties	
Colour	Yellowish–grey to pale brown, sapwood and heartwood not distinct
Hardness	Hard
Weight	Heavy, 770–790 kg/m^3, air–dry
Grain	Straight to curly; texture fine

Processing	
Drying	Difficult as it develops end-splits and surface cracks; green conversion and stacking under cover recommended
Working properties	Fairly easy to saw and work, finishes to a smooth surface
Natural durability and preservation	Non-durable, fairly durable under cover
Uses	Picture frames and carvings; packing cases and boxes.

86. HYDNOCARPUS PENTANDRA (Buch.-Ham.) Oken

[H. laurifolia (Dennst.) Sleumer]

(H. wightiana Bl.)'

Flacourtiaceae

Local names	marotty, nirutty
Tree	Medium to large, 15–30 m in height and up to 75 cm in diameter
	Bark pale brown, mottled with white, smooth, thin
Distribution	West coast tropical evergreen and West coast semi–evergreen forests
Wood	
Gross structure	Diffuse–porous
Growth rings	Indistinct or scarcely distinct
Vessels	Small to very small, numerous to very numerous, mostly in radial multiples of 2–4
Parenchyma	Indistinct
Rays	Fine to very fine, closely spaced
Properties	
	Yellowish–grey to pale brown, sapwood and heartwood not distinct
Hardness	Soft to moderately hard

Weight	Light to moderately heavy, 510-630 kg/m3, air-dry
Grain	Straight; texture fine
Processing	
Drying	Fairly easy but liable to warping
Working properties	Easy to saw and work, finishes to a smooth surface
Natural durability and preservation	Non- durable
Uses	Packing cases and boxes; match splints; temporary construction.

87. HYMENODICTYON EXCELSUM (Roxb.) Wall.

Rubiaceae

Trade name	kuthan
Local names	vella-kadambu, peruntholi
Tree	Medium, 15-20 m in height and about 60 cm in diameter Bark greyish-brown, soft, thick, exfoliating in small irregular scales
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large to medium, moderately numerous, rarely solitary, usually in radial multiples of 2-4 or in clusters; occasionally filled with deposits
Parenchyma	Apotracheal — tangential lines
Rays	Moderately broad, fairly close spaced
Properties	
Colour	White to light yellowish or brownish-grey, sapwood and heartwood not distinct, fairly lustrous

Hardness Soft

Weight Light, 510 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	393	64,300	5%	189
Air-dry	563	79,700	43	342

Processing

Drying Air and kiln-seasoning gives satisfactory results

Working properties Easy to saw and machine, turns well to a good finish

Natural durability and preservation Perishable. Treatable, complete penetration not always obtained

Uses Tea chests; packing cases and boxes; match boxes and splints; artificial limbs and rehabilitation aids; bobbins; cooperage; pencil slats; mathematical, engineering and drawing instruments; brushware.

88. KINGIODENDRON PINNATUM (Roxb. ex DC.) Harms

(Hardwickia pinnata Roxb. **eX DC.)**

Caesaipiniaceae

Trade name piney

Local names kulavu, chukkanna-payin, kiyavu

Tree Large, about 30 m in height and up to 100 cm in diameter

Bark dark brown, mottled with green, rough

Distribution West coast tropical evergreen and West Coast secondary evergreen *Dipterocarp* forests

Wood

Gross structure Diffuse-porous

Growth rings Fairly distinct

Vessels Medium to small, moderately few to few, solitary and in radial multiples of 2 or 3; filled with yellowish-blown deposits

Parenchyma Paratracheal — vasicentric, occasionally aliform and also in fine lines delimiting growth rings

Rays Fine to very fine, closely spaced, radial flecks distinct

Gum canals Present, scattered, almost cf the same size as the vessels from which not easily distinguishable under the hand lens

Properties

Colour Sapwood greyish-white, heartwood dark red to reddish-brow n, fairly lustrous

Hardness Moderately hard

Weight Moderately heavy, 610 kg/m^3 at 12%m.c.

Grain Straight to interlocked: texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	660.8	106,200	69	327.5
Air-dry	913.2	124,200	71	515.5

Processing

Drying Moderately refractory to seasoning; green conversion and immediate stacking under cover recommended

Working properties	Easy to saw, works to a fine finish and takes good polish
Natural durability and preservation	Very durable. Heartwood very refractory to treatment
Uses	Constructional purposes such as beams, rafters, ceiling and floor boards; Class II plywood; furniture and cabinets; block-boards; poles and posts; railway sleepers, lorry and bus bodies; brushware; turnery and carvings.

89. KNEMA ATTENUATA (Hook. f. & Thoms.) Warb.

(Myristica attenuata Wall. ex Hook. f. & Thorns.)

Myristicaceae

Local names	chorappayin, chennelli
Tree	Medium to large, 18-27 m in height and about 65 cm in diameter
	Bark greyish- biack, smooth, thin
Distribution	West coast tropical evergreen and West coast secondary evergreen *Dipterocarp* forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, occasionally solitary, mostly in radial multiples of 2 or 3, often in double rows; occasionally filled with tyloses and gummy deposits
Parenchyma	Paratracheal terminal bands appearing like growth rings
Rays	Fine to very fine, closely spaced
Properties	
Colour	Pale red to light reddish-brown, sapwood and heartwood not distinct, lustrous

Hardness Soft

Weight Light, 530 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	414	83,200	46	218
Air-dry	572	105,900	51	309

Processing

Drying Green conversion and open stacking recommended

Working properties Easy to saw and finishes to a shiny smooth surface

Natural durability and preservation Perishable

Uses Packing cases and boxes.

90. KYDIA CALYCINA Roxb.

Malvaceae

Trade name pula

Local names vella-chadachi, veembu

Tree Medium, 12–20 m in height with a clear bole of 5–8 m and about 40 cm in diameter Bark greyish, exfoliating in thin irregular flakes

Distribution West coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure

Diffuse–porous

Growth rings Distinct

Vessels Medium, few to moderately few, mostly solitary or in short radial multiples of 2, 3 or rarely more; occasionally filled with tyloses

Parenchyma Mostly apotracheal — distinct under lens as fine broken lines forming reticulum with rays; paratracheal — vasicentric, around the pores as a faint border

Rays Fine to moderately broad, former distinct only under lens, closely spaced, latter few and widely spaced, forming lustrous flecks on radial surface

Properties

Sapwood creamy white, heartwood greyish–brown with a purplish tinge, lustrous

Hardness Soft

Weight Light, 386 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
At 14.4% m.c.	483.4	72,700	43	237.2

Processing

Drying Green conversion and stacking under cover recommended

Working properties Easy to saw and plane to a smooth surface

Natural durability and preservation Non–durable

Uses Packing cases and boxes: Class plywood; match splints.

91. LAGERSTROEMIA MICROCARPA Wight

(L. lanceolata Wall. ex Clarke)

Lythraceae

Trade name	benteak
Local name	venthekku
Tree	Large, about 20-30 m in height and up to 110 cm in diameter Bark yellowish-grey, smooth, exfoliating in large papery flakes
Distribution	West coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests
Wood	
Gross structure	Semi-ring-porous to ring-porous
Growth rings	Distinct
Vessels	Large in early wood, medium to small in late wood, solitary or in radial multiples of 2 or 3; usually filled with abundant tyloses
Parenchyma	Paratracheal — predominantly aliform to aliform-confluent
Rays	Very fine, closely spaced
Properties	
Colour	Sapwood grey or pink, heartwood light reddish-brown to walnut brown
Hardness	Moderately hard
Weight	Moderately heavy, 640 kg/m^3 at 12%
Grain	Straight to somewhat interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	682	110,500	83	350
Air-dry	926	126,500	96	474

Processing

Drying — Air-seasoning difficult. Kiln-seasoning recommended

Working properties — Sawing and machining satisfactory, finishes to a smooth surface and takes good polish

Natural durability and preservation — Durable. Heartwood very refractory to treatment

Uses — Door and window frames; tea chests; furniture and cabinets; tool handles; poles and posts; railway sleepers; textile mill accessories; artificial limbs and rehabilitation aids; boat and shipbuilding; lorry and bus bodies; clubs, balancing bench, javelins, hurdles, vaulting stands and balancing bars; cooperage; cart and carriages; bentwood articles and toys.

92. LAGERSTROEMIA REGINAE Roxb.

(L. flos-reginae Retz.)

Lythraceae

Trade name — jarul

Local names — mani-ma ruthu, nir-venthekku

Tree — Medium, 10-20 m in height and up 90 cm in diameter; often buttressed

Bark grey to creamy yellow, smooth, peels off in irregular thin flakes

Distribution Mostly confined to river banks in West coast semi-evergreen, Moist teak bearing and *Myristica* swamp forests. Often planted as ornamental trees

Wood

Gross structure Diffuse-porous

Growth rings Scarcely distinct

Vessels Extremely large to Medium, moderately numerous, mostly solitary or in radial multiples of 2 or 3; usually filled with tyloses

Parenchyma Paratracheal — wavy, narrow, irregular bands connecting the vessels

Rays Very fine, closely spaced

Pith flecks Occasionally present

Properties Sapwood greyish-white to roseal white, heartwood light reddish-brown, rather lustrous

Hardness Moderately hard

Weight Moderately heavy, 640 kg/m^3 at 12% m.c.

Grain Straight or occasionally wavy; texture medium to coarse

Strength

Condition	Static Bending		Impact Rending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	crn	Max. crushing stress kg/cm^2
8.5% m.c	917.5	107,380	...	*507.5*

Processing

Drying Not difficult to season. Kiln-seasoning possible

Working properties Sawing and machining satisfactory, finishes to a smooth surface and takes good polish

Natural durability and preservation	Durable. Heartwood very refractory to treatment
Uses	Beams, door and window frames; boat and shipbuilding; furniture; tool handles; poles and fence posts; rice pounders.

93. LANNEA COROMANDELICA (Houtt.) Merr.

(Odina wodier Roxb.)

Anacardiaceae

Trade name	jhingam
Local names	kalash, uthi
Tree	Medium to large, 12–28 m in height and 40–80 cm in diameter Bark greyish–black, rough, exfoliating in small, thin, irregular flakes
Distribution	Moist teak bearing and Southern secondary moist mixed deciduous forests; occasionally in laterite thorn forest
Wood	
Gross structure	Diffuse–porous
Growth rings	Indistinct
Vessels	Medium to small, moderately few to moderately numerous, solitary or in radial multiples of 2 or 3; heavily plugged with
Parenchyma	Paratracheal — very scanty
Rays	Brownish; fine, seldom moderately broad, fairly close spaced
Gum canals	Horizontal
Properties	
Colour	Sapwood pale yellowish–grey, heartwood reddish–brown, rather lustrous
Hardness	Moderately hard

Weight Moderately heavy, 560 kg/m3 at 12% m.c.

Grain Straight to interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	426.3	56,300	58	196 0
Air-dry	663.3	71,600	56	324.2

Processing

Drying Difficult to season

Shrinkage , Green to oven-dry
Radial 3.0%
Tangential 5.4%

Working properties Sawing satisfactory, can be finished to a smooth surface and takes good polish

Natural durability and preservation Perishable, moderately durable under cover. Heartwood very refractory to treatment, sapwood treatable

Uses Class I general purpose plywood; blockboards; carvings and turnery; furniture; light packing cases; cooperage.

94. LITSEA CHINENSIS Lamk.

Lauraceae

Local name kalla-karuna

Tree Medium, 10-15 m in height and 30-40 cm in

Bark brown, smooth

Distribution West coast tropical evergreen and West coast semi-evergreen forests

Wood

Grossstructure	
	Diffuse-porous
Growth rings	Distinct
Vessels	Medium to small, moderateiy numerous to numerous, mostly in radial multipies of 2 or 3, rarely 6 and occasionalty solitary; often filled with tyloses and yellowish-brown gummy deposits
Parenchyma	Indistinct
Rays	Moderately broad to fine, fairly close spaced
Properties	
Colour	Yellowish-grey or olive–grey to olive-brown or greyish–brown
Hardness	Moderatelly hard
Weight	Moderately heavy, 690 kg/m^3 at 12% m.c.
Grain	Fairly straight to somewhat wavy; texture medium to coarse
Processing	
Drying	Seasons well, provided green conversion and slow seasoning adopted
Working properties	Sawing and machining difficult, takes fairly good polish
Natural durability and preservation	Moderately durable
Uses	Agricultural implements; locally for buil–ding construction; low quality furniture.

95. LOPHOPETALUM WIGHTIANUM Arn.

Celastraceae

Trade name banati

Local name venkotta

Tree Large to very large, 25-35 m in height and about 100 cm in diameter

Bark greyish-brown mottled with white and yellow, rough in old trees

Distribution West coast tropical evergreen, West coast semi-evergreen and *Myristica* swamp forests

Wood

Gross structure

Diffuse-porous

Growth rings Indistinct

Vessels Medium, moderately few to numerous, solitary or mostly in groups of 2 or 3

Parenchyma Apotracheal — tangential wavy lines

Rays Fine to very fine, fairly close spaced

Properties

Colour Yellowish-brown, sapwood and heartwood not distinct

Hardness Soft

Weight Light, 465 kg/m^3 at 12% m.c.

Grain Straight; texture somewhat coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	423.0	73,300	46	210.2
Air-dry	601.6	85,500	41	325.7

Processing

Drying — Refractory to seasoning

Shrinkage	Green to oven-dry
Radial	3.4%
Tangential	5.5%

Working properties — Not difficult to saw, machining gives a smooth surface and takes good polish

Natural durability and preservation — Non-durable

Uses — Ceiling boards and rafters in buildings; Class Ill general purpose plywood; furniture and cabinets; packing cases and boxes; match splints; artifical limbs and rehabilitation aids; pencil slats.

96. MADHUCA LONGIFOLIA (Koeing) MacBride

(Bassia longifolia Koeing)

Sapotaceae

Trade name — mohua

Local name — ilippa

Tree — Medium, 12-15 m in height and about 40 cm in diameter

Bark dark yellowish-grey, thick, with shallow vertical fissures

Distribution — West coast tropical evergreen and West coast semi-evergreen forests in North Kerala

Wood

Gross structure — Diffuse-porous

Growth rings — Distinct

Vessels — Mostly large to medium, rarely small, moderately numerous, occasionally solitary or in radial multiples of 2-4, often further grouped in oblique manner; filled with tyloses and reddish-brown gummy deposits

Parenchyma	Apotracheal –– fine tangential lines forming reticulum with rays
Rays	Fine to very fine, fairly close spaced
Properties	
Colour	Sapwood pale reddish-brown to brownish·white, heartwood dull reddish-brown
Hardness	Moderately hard
Weight	Heavy to very heavy, 975 kg/m^3 at 12% m.c.
Grain	Straight; texture coarse
Processing	
Drying	Green conversion followed by immersion in water for 4–6 weeks and stacking under cover recommended
Working properties	Not difficult to saw, but requires great care to bring to a smooth surface
Natural durability and preservation	Very durable, lasts exceprionally well under water. Heartwood very refractory to treatment
Uses	Beams in building construction; tool handles; agricultural implements; boat and shipbuilding.

97. MADHUCA NERIIFOLIA (Moon) H.J.Lam

(Bassia malabarica Bedd.)

Sapotaceae

name	atta-il
Tree	Small to medium, 10–15 m in height and 30–40 cm in diameter Bark dark brown, scaly
Distribution	West coast tropical evergreen forest, mostly along the river banks

Wood

Gross structure	
	Diffuse-porous
Growth rings	Distinct
Vessels	Large to medium, numerous, rarely solitary, mostly in radial or slightly oblique multipies of 6-8
Parenchyma	Apotracheal — fine tangential lines forming reticulum with rays
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood light brown and heartwood brownish-red with dark coloured patches
Hardness	Hard
Weight	Moderately heavy, 670 kg/m^3 at 12% m.c.
Grain	Straight to interlocked; texture medium to coarse
Natural durability and preservation	Moderately durable
Uses	Construction work; boatbuiiding; vats.

98. MALLOTUS PHILIPPENSIS (Lamk.) Muell. Arg.

Euphorbiaceae

Trade name	kamala-dye tree
Local names	kurangu-manjal, shenkolli
Tree	Small, about 90 m in height and 30 cm in diameter
	Bark grey or pale brown, usually with irregular fissures
Distribution	West coast tropical evergreen, West coast semi-evergreen and Moist teak bearing forests
Gross structure	
	Diffuse-porous

Growth rings Fairly distinct

Vessels Medium to small, moderately few to few, solitary, or in radial multiples of 2, 3 or 4, often in double rows

Parenchyma Predominantly apotracheal — short tangential lines; paratracheal — abaxial or adaxial

Rays Very fine, closely spaced

Properties

Colour Light brownish-grey or light greyish-red, sapwood and heartwood not distinct, fairly iustrous

Hardness Moderately hard

Weight Heavy, 770 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	542	75.100	107	241
Air-dry	822	89,700	97	415

Processing

Drying Seasons fairly well, liable to warping and shiinkage

Working properties Somewhat difficult to saw, works to a smooth surface and takes fairly good polish

Natural durability and preservation Perishable

Uses Small turnery articles; penholders; pulping.

99. MANGIFERA INDICA Linn.

Aaacardiaceae

Trade name	mango
Local name	mavu
Tree	Medium to large, 15–30 m in height and 50–100 cm in diameter Bark brown or dark grey, rough
Distribution	West coast tropical evergreen and West coast semi-evergreen forests; cultivated extensively
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large to medium, few to moderately numerous, solitary or in radial multiples of 2, 3 or more; often filled with tyloses
Parenchyma	Paratracheal — aliform to confluent, often delimiting growth rings
Rays	Fine to moderately broad, numerous, closely spaced
Pith flecks	Usually present
Properties	
Colour	Yellowish-white to greyish-brown, sapwood and heartwood not distinct or sometimes heartwood distinct and dark brown, somewhat lustrous
Hardness	Moderately hard
Weight	Moderately heavy, 690 kg/m^3 at 12%
Grain	Straight to somewhat interlocked; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm²	Modulus of Elasticity kg/cm²	cm
Green	612	91,200	89
Air-dry	904	111,800	66

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm²	Max. crushing stress kg/cm²	Modulus of Elasticity kg/cm²	Compressive stress at elastic limit kg/cm²
Green	199	294	94,300	54
Air-dry	277	448	108,400	96

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm²	Tangential kg/cm²	Radial kg/cm²	Tangential kg/cm²
Green	82	93	37	53
Air-dry	92	93	37	38

Processing

Drying

Not refractory; green conversion followed by stacking in dry ventilated area recommended. Kiln-seasoning improves the appearance of the timber with out degradation. Retains its shape remarkably well after seasoning

Shrinkage — Green to oven-dry

Radial	3.0%
Tangential	4.9%

Working properties

Easy to saw, machining satisfactory, takes good polish. Nail and screw holding capacity excellent. Peels well

Natural durability and preservation	Non-durable. Easily treatable
Uses	Ceiling boards, window frames; general purpose Class I plywood; furniture and cabinets; blockboards; match splints and boxes; boat and shipbuilding; bobbins; bentwood articles; shoe-lasts.

168. MELIA AZEDARACH Linn.

Meliaceae

Trade name	Persian lilac
Tree	Small to medium, 7-15 m in height and up to 50 cm in diameter Bark greyish-brown to dark grey with vertical fissures
Distribution	Native of West Asia, grown as avenue trees
wood	
Gross structure	Ring-porous
Growth rings	Distinct
Vessels	Large to very small, early wood vessels large, in 4-8 or more rows, late wood vessels very small, zig-zag or in oblique manner, occasionally in tangential bands across rays; often filled with reddish-brown deposits
Parenchyma	Paratracheal — vasicentric, forming sheaths around pores in irregular patches and also in tangential lines delimiting growth rings
Rays	Browinsh; moderately broad, rather widely spaced, ray flecks distinct on radial surface
Gum canals	Vertical, traumatic, often in tangential rows

Properties

Colour Sapwood yellowish-white, heartwood reddish-brown

Hardness Moderately hard

Weight Moderately heavy, 710kg/m^3 at 12% m.c.

Grain Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	598.7	81,300	130	176

Processing

Drying Seasons well without developing any defects

Shrinkage — Green to oven-dry: Radial 5.0%, Tangential 8.5%

Working properties Easy to saw, machining satisfactory, takes good polish after filling. Peels satisfactorily

Natural durability and preservation Perishable to non-durable

Uses Tennis and badminton rackets; toys; turnery; light furniture; plywood.

101. MELIA DUBiA Cav.

(M. composita Willd.)

Meliaceae

Trade name Malabar neem

Local names kattu-veppu,

Tree Large, up to 25 m in height and about 80 cm in diameter

Bark dark brown or blackish, peels off in rectangular strips

Distribution — Southern moist mixed deciduous and Moist teak bearing forests

'Wood

Gross structure — Semi-ring–porous to diffuse-porous

Growth rings — Distinct

Vessels — Large to medium, small in late wood, few, solitary or in radial pairs, transition from early to late wood gradual

Parenchyma — Paratracheal — scanty or vasicentric, rately forms small irregular or oblique patches around small vessel groups in the extreme late wood portions

Rays — Moderately broad, rather widely spaced, ray flecks distinct on radial surface

Gum canals — Vertical, traumatic

Properties

Colour — Sapwood grey or pinkish–white with yellow cast, heartwood light red

Hardness — Moderately hard

Weight — Light, 450 kg/m^3 at 12% m.c.

Grain — Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticily kg/cm^2	cm	Max. crushing stress
Green	399.84	51,759	212 94	371

Processing

Drying — Green conversion and open stacking under cover recommended

Working properties — Easy to saw, machining satisfactory, can be brought to a smooth surface

Natural durability and preservation — Moderately durable under cover

Uses — Plywood; light packing cases and boxes; match splints and boxes; cigar boxes.

102. MELIOSMA PINNATA (Roxb.) Walp. ssp. ARNOTTIANA (Wight) Beus.

[M. arnottiana (Wight) Walp.]

Meliosmaceae

Local name	kallavi
Tree	Medium, 12-18 m in height and about 40 cm in diameter
	Bark brownish-grey, smooth, lenticellate
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous to slightly ring-porous
Growth rings	Distinct
Vessels	Medium and small to very small, moderateiy few, solitary or in radial multiples of 2-4 or in clusters
Parenchyma	Paratracheal — scanty, vasicentric
Rays	Broad to moderately broad, very widely spaced; fine to very fine, fairly wide spaced
Properties	
Colour	Dark reddish-brown, sapwood and heartwood not distinct
Hardness	Very soft
Weight	Very light, 335 kg/m^3 at 12% m c.
Grain	Straight; texture coarse
Processing	
Drying	Liable to warp
Working properties	Easy to saw and work
Natural durability and preservation	Perishable
Uses	Fishing floats; packing cases. Can be tried for plywood.

103. MELIOSMA SIMPLICIFOLIA (Roxb.) Walp. ssp. SIMPLICIFOLIA

Meliosmaceae

Local name	kallavi
Tree	Medium, up to 20 m in height and about 40 cm in diameter
	Bark greyish-white
Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Distinct
Vessels	Small, numerous, solitary or in radial multiples of 2-4
Parenchyma	Paratracheal – scanty, vasicentric
Rays	Moderately broad, widely spaced, radial flecks distinct
Pith flecks	Occasionally present
Properties	
Colour	Reddish-brown, sapwood and heartwood not distinct
Hardness	Soft
Weight	Light, 495 kg/m^3 at 12%
Grain	Straight; texture fine
Processing	
Drying	Liable to warp
Working properties	Easy to saw and work, finishes to a smooth surface, takes good polish
Natural durability and preservation	Perishable
Uses	Light packing cases; locally for house construction; light furniture.

104. MESUA NAGASSARIUM (Burm. f.) Kosterm.

(M. ferrea Auct. non Linn.)

Guttiferae

Trade name	mesua
Local names	churuli, nangu, wayanavu
Tree	Medium to large, 18–30 m in height and about 80 cm in diameter Bark reddish-brown, peels off in thin flakes
Distribution	West coast tropical evergreen, Southern hill-top tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Inidistinct
Vessels	Medium, few to moderately few, mostly solitary, occasionally due to close proximity appear to be in chains, clusters, oblique radial lines or in irregular groups; partly filled with tyloses and reddish gummy deposits
Parenchyma	Apotracheal — narrow wavy reddish-brown concentric bands which often ena abruptiy
Rays	Fine to very fine, numerous, closely spaced
Properties	
Colour	Sapwood greyish-white or pinkish-grey, heartwood brick-red, occasionally with dark streaks on the longitudinal surface, fairly lustrous
Hardness	Very hard
Weight	Very heavy, 1,090 kg/m^3 at 12% m.c.
Grain	Straight to interlocked; texture medium to fine with a smooth feel

Strength

Condition	Static Bending		Impact Bending
	Moduius of Rupture kg/m^2	Modulus of Elasticity kg/m^2	cm
Green	1,214	172,900	137
Air-dry	1,735	207,900	168

Condition	Compression parallel to grain			Cornpression perpendicular to grain
	Compressivp stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	405	633	199,900	163
Air-dry	529	960	227,600	212

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	147	157	60	73
Air-dry	195	226	50	68

Processing

Drying

Difficult to season. Liable to surface cracking, warping and end-splitting; slow drying under cover, protected from hot wind and sun, recommended

Shrinkage — Green to oven-dry

Radial 7.1%

Tangential 9.4%

Working properties

Being extremely hard, difficult to saw even when green, can be worked with hand tools and machine, but is liable to tear up in rough streaks if worked on a quartered surface

Natural durability and preservation	Very durable. Heartwood very refractory to treatment
Uses	Railway sleepers; bridge and building construction; well construction; crushers; agricultural implements; tool handles; golf clubs; rehabilitation aids; country pipes and hookahs; cart and carriages; bows for gun stocks; boat and shipbuilding.

105. MICHELIA CHAMPACA Linn.

Magnoliaceae

Trade name	champ
Local name	chempagam
Tree	Large up to 30 m in height and 50–80 cm in diameter
	Bark grey, smooth
Distribution	Occasional in West coast tropical evergreen forest
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately numerous, solitary or in short radial multiples of 2 or 3; occasionally filled with tyloses
Parenchyma	Fine tangential lines delimiting growth rings
Hays	Fine to moderately broad, rather closely spaced
Properties	
Colour	Sapwood pale grey or white, heartwood light brown, lustrous
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 400–595 kg/m^3 at 12% m.c.

Grain Straight; texture medium to fine

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	563	83,900	66
Air-dry	634	95,100	61

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	210	283.0	93,800	44
Air-dy	281	415.1	103,300	64

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radlal kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	66.2	70.5	35.7	38.2
Air-dry	73.0	82.0	27.0	30.0

Processing

Drying Seasons well provided the logs are converted green into planks and scantlings and stacked under cover. Kiln-seasoning will discolour the wood

Shrinkage Green to oven-dry
Radial 3.2%
Tangential 5.2%

Working properties Easy to saw, works to a smooth finish and takes good polish

Natural durability and preservation Perishable to non-durable. Heartwood very refractory to treatment

Uses	Building construction; Class I general purpose plywood; decorative plywood furniture and cabinets; textile mill accessories; badminton rackets; mathematical, engineering arid drawing instruments; shoe-lasts; battery separators.

106, MILIUSA TOMENTOSA (Roxb.) Sinclair

***(Saccopetalum** tomentosum* Hook. f. & Thoms.)

Annonaceae

Trade name	hoom
Local name	kanakkaitha
Tree	Medium, 12–18 m in height and about 40 cm in diameter
	Bark dark greyish–brown to brown; rough, with shallow vertical fissures
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Idistinct
Vessels	Small to very small, solitary or in radial multiples of 2 or 3; often filled with yellowish deposits
Parenchyma	Apotracheal - visible under lens as fine lines
Rays	Broad to moderately broad, rather widely spaced
Properties	
Colour	Yellow to olive brown, sapwood an heartwood not distinct
Hardness	Moderately hard to hard
Weight	Moderately heavy to heavy, 655-835 kg/m^3 at 12%
Grain	Straight; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	740.4	110,600	*89*	*387 2*
Air-dry	*950.7*	126,800	89	516.2

Processing

Drying — Green conversion and open stacking under cover recommended

Shrinkage — Green to oven-dry
Radial 3.8%
Tangential 8.8%

Working properties — Easy to saw and work, takes good polish

Natural durability and preservation — Non-durable

Uses — Temporary construction; tool handles; packing cases and boxes; poles and fence posts.

107. MILIUSA VELUTINA (Dunal) Hook. f. Thorns.

Annonaceae

Local name — villunni

Tree — Small to medium, 8–15 m in height and 30-40 cm in diameter

Bark brownish-grey, longitudinally fissured, rough

Distribution — Sporadic in Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure — Diffuse-porous

Growth rings — Scarcely distinct, under lens appear as faint, pale yellow lines

Vessels — Small to very small, solitary or mostly in radial multiples of 2-4; often filled with yellowish deposits

Parenchyma — Apotracheal — as fine tangential lines forming reticulum with rays

Rays — Moderately broad to fine, broad rays rather widely spaced

Properties

Colour — Yellowish or greyish-brown, sapwood and heartwood not distinct, fairly lustrous

Hardness — Hard

Weight — Heavy, 755 kg/m^3 at 12% m.c.

Grain — Straight; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	583.8	79,200	69	281.6
Air-dry	767.2	93,200	56	476.6

Processing

Drying — Difficult to season as it develops end-splits; green conversion and open stacking under cover recommended

Shrinkage — Green to oven-dry
Radial 4.7%
Tangential 9.3%

Working properties — Easy to saw, machines well to a good finish

Natural durability and preservation — Perishable

Uses — Temporary construction; packing cases and boxes; low quality furniture.

108. MIMUSOPS ELENGI Linn.

Sapstaceae

Trade name	bulletwood
Local name	elengi
Tree	Medium to large, 15-25 m in height and about 65 cm in diameter; Bark dark grey, rough, with vertical fissures
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Very small, moderately few to moderately numerous, occasionally solitary, mostly in radial multiples of 2-10 in single or double rows; occasionally filled with gummy deposits
Parenchyma	Apotracheal — as fine broken tangential lines
Rays	Fine to very fine, fairly close spaced
Properties	
Colour	Sapwood pale reddish-brown, heartwood dark reddish-brown
Hardness	Very hard
Weight	Very heavy, 1.070 kg/m^3 at 12% m.c.
Grain	Fairly straight to irregular or shallowly interlocked; texture fine
Strength	

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	864	129,900	114	441
Air-dry	1.178	137,800	107	557

Processing	
Drying	Seasons well
Working properties	Easy to saw, works to a smooth finish and takes good polish
Natural durability and preservation	Very durable
Uses	Building and bridge construction; boat-building; furniture and cabinets; agricultural implements; musical instruments; tool handles; turnery and carvings.

109. MITRAGYNA PARVIFOLIA (Roxb.) Korth.

(Stephegyne parvifolia Roxb.)

Rubiaceae

Trade name	kaim
Local names	vimba, nir-kadambu, rose-kadambu
Tree	Medium to large, 12-25 m in height and up to 70 cm in diameter
	Bark light grey, smooth, exfoliating in small scales
	Moist teak bearing, Southern moist mixed deciduous and West coast semi-evergreen forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Small to very small, numerous, mostly solitary, occasionally in radial multiples of 2 or 3
Parenchyma	Indistinct
Rays	Fine to very fine, closely spaced
Properties	
Colour	Pale yellow to light greyish-brown, sapwood and heartwood not distinct

Hardness Moderately hard

Weight Moderately heavy, 640 kg/m^3 at 12% m.c.

Grain Straight to wavy; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel *to* grain
	Modulus of Rup'rure kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	630	78,200	102	315
Air-dry	787	94,500	53	456

Processing

Drying Green conversion and stacking under cover recommended. With great care kiln-seasoning fairly successful

Working properties Easy to saw and machine, works to a smooth surface

Natural durability and preservation Non-durable, fairly durabie under cover. Heartwood treatable hut complete penetration not always obtained

Uses Building construction; plywood; furniture and cabinets; tool handles; cooperage; cricket stumps and bails; mathematical, drawing and engineering instruments; shoe-lasts.

110. MORINDA COREIA Buch.-Ham.

(M. tinctoria Roxb.)

Rubiaceae

Local names manja-pavatta, manjanathi

Tree Small to medium, 7-12 m in height and about 30 in diameter

Bark brown or grey, corky, deeply cracked

Distribution	Southern dry mixed deciduous forest in Central Kerala
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Small, few to moderately few, occasionally solitary, mostly in radial multiples of 2–10
Parenchyma	Apotracheal — as fine discontinuous tangential lines
Rays	Moderately broad, fairly wide spaced; fine, closely spaced among the broad rays
properties	
Colour	Light red with yellow streaks, or golden yellow with a roseal cast or yellowish-brown, sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Light, 545 kg/m^3 at 12% m.c.
Processing	
Drying	Green conversion and stacking under cover, with ends protected, recommended
Working properties	Sawing not difficult, turns well to a fairly good finish with hand tools and machine
Natural durability and preservation	Reported to be moderately durable
Uses	Turnery and carvings; penholders; furniture; toys.

111. NOTHOPEGIA COLEBROOKEANA BI.

Anacardiaceae

Local name	macheru
Tree	Medium, about 15 m in height and 30 cm in diameter
	Bark pale greyish- brown, smooth or flaky, thin
Distribution	West coast tropical evergreen forest

Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Very small, moderately numerous, solitary or in radial multiples of 2 or 3
Parenchyma	Paratracheal — wavy tangential lines enclosing vessels, often vasicentric to aliform
Rays	Pale brown; fine to very fine, rather closely spaced
Properties	
Colour	White to pale pink, turninq light brown on exposure
Hardness	Hard to very hard
Weight	Very heavy, 875 kg/m^3, air-dry
Grain	Straight to Interlocked; texture fine
Processing	
Working properties	Not difficult to work, can be planed to a smooth shiny surface
Natural durability and preservation	Non-durable
Uses	Tool handles; turnery.

112. OCHROMA PYRAMIDALE (Cav. ex Lamk.) Urban

(O. *lagopus* Sw.)

Bombacaceae

Trade name	balsa
Local name	balsa
Tree	Medium, 20 m or more in height with a clear bole of 6–9 m and about 60 cm in diameter
Distribution	Native of Tropical America, raised in small scale plantations
Wood	
Gross structure	Diffuse-porous

Growth rings — Indistinct, occasionally delimited by fairly crowded vessels

Vessels — Large to medium, very few to few, sometimes with a tendency to crowd near growth rings

Parenchyma — Abundant, but not clearly distinguishable from fibres owing to the latter being extremely thin-walled

Rays — Broad to moderately broad, few, widely spaced

Properties

Colour — Sapwood white to oat-meal coloured with pinkish or greyish tinge, heartwood pale brown to reddish-brown

Hardness — Extremely soft

Weight — Very light, 120–290 kg/m^3 at 12% m.c.

Grain — Straight; texture ,medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	143	25,500	10	64
Air-dry	219	35,600	15	110

Processing

Drying — Kiln-seasoning recommended. Quick conversion and end-stacking the boards against a horizontal support suggested for air-seasoning

Working properties — Easy to saw and work; glues exceptionally well

Natural durability and preservation — Perishable. Permeable to treatment

Uses — Rafts, floats, lifebuoys and other life-saving equipment; in aircraft for corestock of sandwitch material; insulating material particularly for refrigeration trucks and cold storage rooms; toys, hat blocks and model plane kits

113. PALAQUIUM ELLIPTICUM (Dalz.) Engl.

(Dichopsis elliptica Benth.)

Sapotaceae

Trade name pali

Local name pali

Tree Large, about 30 m in height with a clear bole of 12 m and up to 110 cm in diarneter Bark dark brown mottled with white

Distribution West coast tropical evergreen and Southern hill-top tropical evergreen forests

Wood

Gross structure Diffuse-porous

Growth rings Indistincl

Vessels Large to medium and small, moderately numerous, solitary or mostly in radial multiples of 2-4 or occasionally in clusters; often filled with tyloses and reddish-brown gummy deposits

Parenchyma Apotracheal — as slightly wavy tangential lines forming reticulumwith rays

Rays Fine to very fine, fairly close spaced

Properties

Colour Sapwood pale red, heartwood light reddish-Drown

Hardness Moderately hard

Weight Moderately heavy, 690 kg/m^3 at 12% m.c.

Grain Straight to wavy; texture medium

Strength

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	697	8,600	71	339
Air-dry	1,080	141,500	86	573

Processing

Drying — Green conversion followed by stacking under cover recommended. Kiln-seasoning offers no difficulty

Shrinkage	Green to	13.9% m.c.
	Radial	4.7%
	Tangential	7.8%

Working properties — Not difficult to saw, works to a fine surface. Carl be easily peeled

Natural durability and preservation — Durable. Heartwood refractory to treatment

Uses — Construction-work; general purpose Class I plywood; tea chests; aircraft plywood; marine plywood; furniture; blockboards; tool handles; railway sleepers; bobbins.

114. PERSEA MACRANTHA (Nees) Mosterm.

(Machilus macrantha Nees)

Lauraceae

Trade name — machilus

Local names — kolamavu, ooravu

Tree — Large, 20–30 m in height and up to 100cm in diameter

Bark pale-brown with dark blotches, rough in old trees

Distribution — West coast tropical evergreen, West coast semi-evergreen, occasionally in Moist teak bearing and Southern subtropical hill forests

Wood

Gross structure

Diffuse-porous

Growth rings — Fairly distinct

Vessels — Medium to small. moderately numerous, mostly solitary or in radial multiples of 2.3 or 5, occasionally in double rows or clusters; filled with tyloses

Parenchyma Indistinct

Rays Fine, fairly close spaced

Pith flecks Occasionally present

Properties

Colour Light orange-brown to light reddish-brown, sapwood and heartwood not distinct, lustrous

Hardness Moderately hard

Weight Light to moderately heavy, 430–625 kg/m^3 at 12% m.c.

Grain Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression paraliel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	510	76,300	69	252
Air-dry	580	7,900	71	297

Processing

Drying Green conversion followed by immersion in water and stacking recommended

Working properties Easy to saw and work, planes to a dull smooth surface

Natural durability and preservation Non-durable

Uses Flooring and ceiling boards; Class I plywood for general purposes; packing cases and boxes; match splints.

115. PILIOSTIGMA MALABARICUM (Roxb.) Benth.

(Bauhinia malabarica Roxb.)

Caesalpiniaceae

Trade name	kanchan
Local name	arampuli
Tree	Small to medium, 8-15 m in height and about 30 cm in diameter
	Bark dark brown, thick, Fibrous, exfoliating in small, irregular flakes
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Moderately large to small, few to moderately numerous, mostly solitary or in radial multiples of 2, 3 or rarely more; occasionally filled with tyloses and yellowish-white deposits
Parenchyma	Paratracheal — broad or fairly irregular tangential bands and in patches around vessels
Rays	Fine to very fine, closely spaced
Properties	
Colour	Yellowish-grey to light reddish or greyish-brown, sapwood and heartwood not distinct
Hardness	Moderately hard to hard
Weight	Moderately heavy to heavy, 550-800 kg/m^3, air-dry
Grain	Straight to interlocked; texture medium to coarse
Processing	
Working properties	Not difficult to saw and work with tools, takes good polish. Peels easily
Natural durability and preservation	Non-durable
Uses	Agricultural implements; temporary construction.

116. POECILONEURON INDICUM Bedd.

Guttiferae

Trade name	ballagi
Local names	vayila, poothankolli
Tree	Large, up to 30 m in height and about 75 cm in diameter Bark grey, rough
Distribution	West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, moderately few to moderately numerous, mostly solitary but occasionally appear to be in pairs; often filled with tyloses
Parenchyma	Paratracheal — mostly aliform to aliform-confluent
Rays	Fine to very fine, fairly close spaced
Pith flecks	Occasionally present
Properties	
Colour	Sapwood light brown, heartwood dark reddish-brown
Hardness	Hard to very hard
Weight	Heavy to very heavy, 1,120 kg/m^3 at 12% m.c.
Grain	Straight to interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max crushing stress kg/cm^2
Green	1,119.7	162,700	117	588.7
Air-dry	1,609.1	217,500	130	907.8

Processing

Drying	Difficult to season, liable to surface cracks and end-splits, especially during kiln-seasoning Shrinkage Green to oven-dry Radial 8.5% Tangential 10.4%
Working properties	Not difficult to saw, works fairly well with hand tools and machine
Natural durability and preservation	Moderately durable. Heartwood very refractory to treatment
Uses	General construction-work; poles, cross-arms, ballies and fence posts; railway sleepers.

117. POLYALTHIA CERASOIDES (Roxb.) Hook. f. Thorns.

Annonaceae

Trade name	debdaru
Local name	cheru-nedunar
Tree	Small to medium, 8-15 m in height and about 30 cm in diameter Bark grey, rough, thin
Distribution	Sporadic in Southern moist mixed deciduous forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct, delimited by faint pale yellow lines
Vessels	Small to very small, moderately few to moderately numerous, solitary or in radial multiples of 2 or 3; sometimes filled with yellowish deposits

Parenchyma — Apotracheal — distinct under lens as fine tangential lines forming reticulum with rays

Rays — Moderately broad to fine, rather widely spaced

Properties

Colour — Yellowish–brown, sapwood and heart–wood not distinct

Hardness — Moderately hard

Weight — Moderately heavy, 640 kg/ms at 12% m.c.

Grain — Straight; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel *to* grain
	Modulus of Rupture kglcma	Modulus of Elasticity kg/cm2	cm	Max. crushing stress kg/cmz
Green	659	92,900	142	284
Air–dry	1,236	163,700	152	523

Processing

Drying — Green conversion and storage in water before seasoning recommended

Working properties — Not difficult to saw, planes to a fine smooth surface and takes satisfactory polish

Natural durability and preservation — Perishable

Uses — Temporary construction; turnery; bobbins; shoe–lasts; packing cases.

118. POLYALTHIA FRAGRANS (Dalz.) Bedd.

Annonaceae

Trade name debdaru

Local name nedunar

Tree Large, 20-30 m in height and about 60 cm in diameter

Bark greyish-brown, with shallow vertical fissures

Distribution West coast semi-evergreen and West coast secondary evergreen *Dipterocarp* forests

Wood

Gross structure Diffuse-porous

Growth rings Scarcely distinct

Vessels Very small, moderately few to moderately numerous, solitary or in radial multiples of 2, 3 or 6; occasionally filled with deposits

Parenchyma Apotracheal — visible under lens as fine tangential lines forming reticulum with rays

Rays Very fine, rather closely spaced

Properties

Colour Sapwood greyish-yellow, heartwood greyish-black

Hardness Moderately hard

Weight Light, 515 kg/m^3 at 12% m.c.

Grain Straight; texture fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	538.8	92,000	56	280.1
Air-dry	684.3	109,500	61	355.5

Processing

Drying — Somewhat difficult to season

Shrinkage — Green to oven-dry

Radial	3.4%
Tangential	7.3%

Working properties — Not difficult to saw and work

Natural durability and preservation — Perishable

Uses — Temporary construction; general purpose Class I plywood; blockboards; packing cases and boxes; match splints.

119. PONGAMIA PINNATA (Linn.) Pierre

(P. glabra Vent.)

Papilionaceae

Trade name — Indian beech

Local names — pongu, ungu

Tree — Medium, up to 18 m in height and about 50 cm in diameter

Bark greyish-brown

Distribution — West coast semi-evergreen forest. Often planted as avenue trees

Wood

Gross structure — Diffuse-porous

Growth rings — Indistinct

Vessels — Medium to small few to very few, solitary or in radial multiples of 2 or 3

Parenchyma — Paratracheal — wavy tangential bands alternate with the fibrous bands and end abruptly, occasionally vasicentric to aliform or aliform-confluent and as fine lines delimiting growth rings

Rays — Fine to very fine, closely spaced

Properties

Colour Yellowish-grey, sapwood and heartwood not distinct

Hardness Moderately hard

Weight Moderately heavy, 755 kg/m^3 at 12% m.c.

Grain Interlocked; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	594 0	91,500	112	268.9
Air-dry	981.2	122 800	122	559.2

Processing

Drying Somewhat difficult to season, liable to develop warps and splits

Shrinkage — Green to oven-dry

Radial 4.7%

Tangential 8.4%

Working properties Easy to saw and work

Natural durability and preservation Perishable

Uses Temporary construction; tool handles; cart and carriages.

120. PTEROCARPUS MARSUPIUM Roxb.

Papilionaceae

Trade name bijasal

Local name venga

Tree Medium to large, 15-30 m in height and up to 100 cm in diameter

Bark dark brown or grey with shallow cracks; exfoliating in thin flakes, on injury exudes a red gummy substance

Distribution — Southern moist mixed deciduous, Moist teak bearing, West coast semi-evergreen and Southern dry mixed deciduous forests

Wood

Gross structure — Diffuse-porous, often shows tendency towards semi-ring-porous

Growth rings — Scarcely distinct

Vessels — Large to medium, few to moderately few, solitary or in radial multiples of 2-4; often filled with gummy deposits

Parenchyma — Paratracheal — wavy or straight tangential bands, touching or partially enclosing the pores, often aliform to aliform-confluent

Rays — Very fine, numerous, closely spaced

Properties

Colour — Sapwood pale yellowish-white, heartwood golden brown or reddish-brown on exposure. Aqueous extract of wood is characteristic yellowish-blue and fluorescent

Hardness — Moderately hard to hard

Weight — Moderately heavy to heavy, 720-880 kg/m^3 at 12% m.c.

Grain — Interlocked; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	745	102,500	130
Air-dry	1,379	133,900	107

Condition	Compression parallel to grain			Compression perpendicular to grain.
	Compressive stress at elastic limit kg/cm²	Max. crushing stress kg/cm²	Modulus of Elasticity kg/cm²	Compressive stress at elastic limit kg/cm²
Green	279	365	108,000	71
Air-dy	330	683	121,600	158

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm²	Tangential kg/cm²	Radial kg/cm²	Tangential kg/cm²
Green	86	85	38	31
Air-dry	116	128	38	40

Processing

Drying

Non-refractory; green conversion and open stacking under cover recommended. Kiln-seasoning also suggested

Shrinkage	Green to oven-dry
Radial	4.3%
Tangential	6.1%

Working properties

Sawing not difficult, machining gives a smooth surface. Takes good and lasting polish after filling. Nail and screw holding capacity excellent

Natural durability and preservation

Very durable. Heartwood very refractory to treatment, however sapwood is treatable

Uses

Constructional purposes like beams, pillars, door and window frames; boatbuilding; bridge construction; tool handles; poles and posts; railway sleepers; jumping and vaulting stands; lorry bodies; spokes and felloes of cart wheels; cups and vessels for drinking water, as water extract of the wood is believed to be beneficial in diabetes.

121. PTEROSPERMUM DIVERSIFOLIUM Bl.

(P. glabrescens Wight *&* Arn.)

Sterculiaceae

Local name	pambaram
Tree	Medium, up to 18 m in height and 30-45 cm in diameter Bark greyish-brown, rather smooth
Distribution	West coast tropical evergreen forest in South and Central Kerala
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately few to moderately numerous, solitary or in radial multiples of 2, 3 or more, occasionally in clusters
Parenchyma	Apotracheal - diffuse, as fine broken tangential lines
Rays	Fine, closely spaced
Properties	
Colour	Sapwood whitish, heartwood pinkish-brown to light reddish-brown, somewhat lustrous
Hardness	Moderately hard
Weight	Light, 465 kg/m^3 at 12%
Grain	Straight to interlocked; texture medium
Processing	
Drying	Green conversion followed by open stacking under cover recommended
Working properties	Easy to saw when green, works well to a fairly smooth surface and takes good polish
Natural durability and preservation	Non-durable. Heartwood refractory to treatment
Uses	Temporary construction; low quality furniture; turnery; household appliances; agricultural implements.

122. PTEROSPERMUM RETICULATUM Wight & Arn.

Sterculiaceae

Local name	malayuram
Tree	Medium, about 20 m in height and 30–50 cm in diameter Bark pale brown, rough
Distribution	West coast semi-evergreen and West coast tropical evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately few to moderately numerous, solitary or in radial multiples of 2, 3 or more, occasionally in clusters
Parenchyma	Visible under lens as fine, tangential, broken lines
Rays	Fine, sometimes broad, closely spaced
Properties	
Colour	Sapwood white, heartwood greyish or light reddish-brown, somewhat lustrous
Hardness	Moderately hard
Weight	Moderately heavy, 690 kg/m^3 at 12% m.c.
Grain	Fairly straight to interlocked; texture medium
Processing	
Drying	Green conversion and open stacking under cover recommended
Working properties	Easy to saw when green, machines well, finishes to a fairly smooth surface and takes good polish
Natural durability and preservation	Non-durable. Heartwood refractory to treatment
Uses	Packing cases and boxes; agricultural implements; low quality furniture.

123. PTERYGOTA ALATA (Roxb.) R. Br.

(Sterculia alata Roxb.)

Sterculiaceae

Trade name	narikel
Local name	anathondi
Tree	Very large, up to 45 m in height with a clear bole of 15–20 m and 80-100 cm in diameter Bark greyish-brown, with horizontal wrinkles and shallow vertical fissures
Distribution	West coast tropical evergreen and West coast semi-evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium, very few to few or moderately numerous, often in radial multiples of 2 or 3, occasionally solitary or in large clusters
Parenchyma	Broad, wavy or in straight tangential bands
Rays	Broad to moderately broad and fine, the former widely spaced, forming radial flecks and the latter very few, visible only under lens
Gum canals	Occasional, in long tangential bands
Properties	
Colour	Greyish or pale yellowish-white to light greyish-brown, sapwood and heartwood not distinct, somewhat lustrous
Hardness	Moderately hard
Weight	Moderately heavy, 590 kg/m^3 at 12%
Grain	Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kglcma	Modulus of Elasticity kg/cms	cm	Max. crushing stress kg/cms
Green	**668.2**	**109,500**	**99**	**328.5**
Air-dry	**957.1**	**115,400**	**84**	**535.7**

Processing

Drying — Seasons well without much degradation: green conversion and open stacking under cover recommended

Shrinkage — Green to air-dry
Radial **2.9%**
Tangential **7.0%**

Working properties — Easy to saw, works well with hand tools and machine, finishes to a rough surface

Natural durability and preservation — Perishable

Uses — Class III general purpose plywood; packing cases and boxes; match splints and boxes. Can be used for pulping.

124. QUASSIA INDICA (Gaertn.) Nooteb.

(Samadera indica Gaertn.)

Simaroubaceae

Trade name — karingotta

Local name — karingotta

Tree — Small, about 10 m in height and 20–30 cm in diameter

Distribution — Sporadic in West coast tropical evergreen and West coast semi-evergreen forests

Wood

Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small, moderately few, solitary arid in radial multiples of 2 or 3
Parenchyma	Apotracheal — diffuse, tangential bands delimiting growth rings; paratracheal — vasicentric to aliform
Rays	Fine to very fine, closely spaced
Properties	
Colour	Light yellow to brownish-yellow, sapwood and heartwood not distinct
Hardness	Soft
Weight	Light, 390 kg/m^3, air-dry
Grain	Straight to slightly interlocked; texture fine
Processing	
Drying	Easy to season
Working properties	Easy to saw and machine, finishes to a smooth surface
Natural durability and preservation	Non-durable
Uses	Planks for ceiling; low quality furniture; toys and fancy articles; turnery; wooden footwear.

125. RADERMACHERA XYLOCARPA (Roxb.) K. Schum.

(Bignonia xylocarpa Roxb.)

Bigooniaceae

Local name	vedingkorana
Tree	Medium, about **15** m in height and up to 55 crn in diameter
	Bark light grey, rough

Distribution West coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure Diffuse-porous

Growth rings Scarcely distinct

Vessels Large to medium, numerous, mostly in radial multiples of 2-4 or 6, rarely in tangential clusters; often occluded with whitish or yellowish deposits

Parenchyma Abundant; paratracheal — vasicentric and terminal

Rays Moderately broad to fine, closely spaced

Properties

Colour Sapwood grey to light brownish-grey, heartwood greyish-brown *to* golden or orange-brown

Hardness Moderately hard

Weight Moderately heavy to heavy, 625-880 kg/m^3 at 12% m.c.

Grain Straight to irregularly interlocked; texture medium to coarse

Strength

Condition	Static Bending		impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	660.77	85,287	83.82	361.70
Air-dry	803.6 1	102,035	40.64	565.06

Processing

Easy to season

Shrinkage Green to oven-dry
Radial 3.8%
Tangential 5.4%

Working properties	Easy to saw and machine, works to a fins finish, takes good polish
Natural durability and preservation	Durable
Uses	Building construction; furniture; panelling; cart and carriages.

126. RHODODENDRON ARBOREUM Sm.

(R. nilagiricum Zenk.)

Ericaceae

Local name	kattu-puvarasu
Tree	small, 7-10 m in height and up to 30 cm in diameter Bark reddish-brown, rough, peels off in small flakes
Distribution	Confined to the Southern montane wet temperate forest in Munnar and Southern subtropical hill forest in Silent Valley
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Small to very small, moderately few to moderately numerous, mostly solitary, rarely paired tangentially or radially
Parenchyma	Indistinct
Rays	Moderately broad, widely spaced; fine to very fine, closely spaced among the broad rays
Properties	
Colour	Sapwood reddish-white to brownish-white, heartwood reddish-brown to brown
Hardness	Soft
Weight	Light to moderately heavy, 575 kg/m^3 at 12% m.c.

Grain	Straight to somewhat curly; texture very fine
Processing	
Drying	Green conversion followed by close stacking under cover recommended
Working properties	Easy to saw and work, turns well to a fine smooth surface
Natural durability and preservation	Non-durable
Uses	Tobacco pipes of low quality; turnery and carvings.

127. SALIX TETRASPERMA Roxb.

Salicaceae

Trade name	willow
Local name	vanji
Tree	Medium to large, 15-25 m in height and up to 80 cm in diameter Bark greyish-brown, with deep vertical fissures
Distribution	West coast semi-evergeen forest, mostly seen along the river banks
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Small, numerous, mostly solitary or in radial multiples of 2 or 3, rarely in tangential clusters
Parenchyma	Apotracheal as fine lines delimiting growth rings
Rays	Very fine, closely spaced
Properties	
Colour	Sapwood greyish-white, heartwood light reddish-brown, fairly lustrous

Hardness Soft

Weight Very light, 385 kg/m^3 at 12% m.c.

Grain Straight to somewhat interiocked; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compiession paralfei *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	**392**	**51,900**	**132**	**180**

Processing

Drying Easy to season; green conversion and open stacking under cover recommended

Working properties Easy to saw, can be brought to a smooth surface

Natural durability and preservation Non-durable to moderately durable

Uses Packing cases and boxes; artificial limbs and rehabilitation aids; pencil slats; penholders, bentwood articles; match splints and boxes; cricket stumps and bails. Suitable for cabinets and fancy works.

128. SANTALUM ALBUM Linn.

Santalaceae

Trade name sandalwood

Local name chandanam

Tree Small, 7-10 in height and 15-25 cm in diameter

Bark dark grey or brownish-black, rough, with short vertical cracks

Distribution Occasional in Southern dry mixed deciduous forest in Marayur. Also cultivated to a limited extent

Wood

Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Very small, numerous, mostly solitary, occasionally multiples of two in radial or tangential rows; often filled with orange-brown gummy deposits
Parenchyma	Indistinct
Rays	Fine to very fine, fairly close spaced
Properties	
Colour	Sapwood whitish or pale brown, heartwood light yellowish-brown to dark brown, lustrous
Odour	Heartwood scented with characteristic odour
Hardness	Hard
Weight	Heavy, 945 kg/m^3 at 12% m.c.
Grain	Straight to slightly wavy; texture fine
Processing	
Drying	Seasons well
Working properties	Easy to saw, turns well to a fine smooth surface and takes good polish. Easy to carve
Natural durability and preservation	Very durable
Uses	Turnery and carvings chess pieces; decorative panelling; fancy work and curio items. Heartwood mainly used for extraction of oil.

129. SAPINDUS LAURIFOLIA Vahl

*(S. **emarginatus** Vahl)*

Sapindaceae

Trade name	soapnut tree
Local names	pasakotta, uruangi
Tree	Medium, up to 20 m in height and about 50 cm in diameter Bark grey, smooth, peels off in thin scales
Distribution	West coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Medium to small, few to moderately numerous, solitary or in radial multiples of two or more; often filled with pinkish-brown or white deposits
Parenchyma	Paratracheal – aliform and in fine lines delimiting growth rings
Rays	Very fine, rather widely spaced
Properties	
Colour	Yellowish-white to brown, sapwood and and heartwood not distinct
Hardness	Hard
Weight	Heavy to very heavy, 897-1,025 kg/m^3 at 12% m.c.
Grain	Straight to wavy; texture medium
Processing	
Drying	Difficult to season, liable to surface cracks and end-splits
Natural durability and preservation	Non-durable
Uses	Carts and carriages; localiy for house construction; agricultural implements.

130. SARACA ASOCA (Roxb.) de Wilde

(S. ***indica*** **Auct.** non Linn.)

Caesalpiniaceae

Trade name	asok
Local name	asokam
Tree	Small, about 10 m in height and 20–30cm in diameter Bark brownish-black, smooth
Distribution	Sporadic in West coast tropical evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Medium to small, few to moderately few, solitary or in radial multiples of 2, 3 or rarely more
Parenchyma	Paratracheal — vasicentric to aliform, rarely confluent and as fine lines delimiting growth rings
Rays	Fine to very fine, closely spaced
Properties	
Colour	Pale yellowish-brown, sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Moderately heavy, 600 kg/m^3, air-dry
Grain	Straight; texture medium to coarse
Uses	Agricultural implements.

131. SCHLEICHERA OLEOSA (Lour.) Oken

(*S. trijuga* Willd.)

Sapindaceae

Trade name	kusum
Local name	poovani
Tree	Medium to large, 15–25 m in height and up to 100 cm in diameter Bark grey, exfoliating in small, irregular flakes
Distribution	West coast semi-evergreen, Moist teak bearing and Southern secondary moist mixed deciduous forests
wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct, undulating, delimited by somewhat dark and dense late wood fibres
Vessels	Medium to small, few to moderately numerous, somewhat unevenly distributed, mostly solitary and in radial multiples of 2 or 3; often filled with chalky arid reddish-brown gummy deposits
Parenchyma	Apotracheal — diffuse; paratracheal — very scanty, usually indistinct
Rays	Very fine, numerous, closely spaced
Properties	
Colour	Sapwood greyish-white, heartwood light reddish-brown
Hardness	Very hard
Weight	Very heavy, 1,090 kg/m^3 at 12%
Grain	Straight to somewhat interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	1,I 26.6	162,900	142	607.2
Air-dry	1,582.9	181,000	140	746.2

Processing

Drying — Very refractory; slow seasoning by close stacking under cover, protected from hot dry winds, recommended. Kiln-seasoning gives good results provided converted into planks soon after felling

Shrinkage — Green to oven-dry
Radial 5.5%
Tangential 10.8%

Working properties — Difficult to saw, with machine works to a fine surface and takes good polish

Natural durability and preservation — Durable

Uses — Treated timber can be used as beams, trusses and posts for construction purposes; tool handles; railway sleepers; agricultural implements; carts and carriages; pounders; tent accessories.

132. SEMECARPUS ANACARDIUM Linn.f.

Anacardiaceae

Local names — thenkotta, cherkuru

Tree — Medium, about 15 m in height and 30-40 cm in diameter

Bark brown, rough, exfoliating in irregular flakes

Distribution — Southern moist mixed deciduous forest

wood

Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium, very few to moderately few, solitary or in radial multiples of 2-5, rarely in clusters; often filled with tyloses
Parenchyma	Paratracheal — vasicentric to aliform
Rays	Moderately broad to fine
Properties	
Colour	Greyish-white or greyish-yellow to greyish-brown, sapwood and heartwood not distinct
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 495-590 kg/m^3, air-dry
Grain	Straight to slightly interlocked; texture coarse
Processing	
Working properties	Easy to saw and work
Natural durability and preservation	Non-durable
Uses	Low quality furniture; packing cases and boxes; match splints and boxes.

133. SHOREA ROXBURGHII G. Don

(S. ***talura*** Roxb.)

Dipterocarpaceae

Local name	taluram
Tree	Medium, up to 20 m in height and about 50 cm in diameter
	Bark light grey, narrowly fissured
Distribution	Sporadic in Southern dry mixed deciduous forest of North and Central Kerala

Wood

Gross structure

Diffuse-porous

Growth rings — Indistinct

Vessels — Medium to small, moderately few, mostly solitary; tyloses sparse

Parenchyma — Apotracheai — diffuse, short tangential bands; paratracheal — scanty to fairly abundant, embedding resin ducts

Bays — Fine to moderately broad, fairly close spaced, ray flecks often conspicuous on radial surface

Resin duets — Vertical, smaller than vessels, often solitary or in short or long tangential rows; filled with white deposits

Properties

Colour — Sapwood light yellow to yellowish-brown or grey, heartwood yellowish-brown to reddish-brown; fairly lustrous when freshly cut

Hardness — Hard

Weight — Moderately heavy to heavy, 770 kg/m^3 at 12% m.c.

Grain — Straight to interlocked; texture medium to coarse

Processing

Drying — Not difficult to season

Shrinkage	Green to oven-dry
Radial	4%
Tangential	*8%*

Working properties — Difficult to saw, works lo a hard, smooth surface; high silica content can blunt saw blades

Natural durability and preservation — Moderateiy durable. Heartwood very refractory to treatment

Uses — Building and bridge construction; low quality furniture; tool hadles; cart and carriages; boarbuilding.

134. SPONDIAS PINNATA (Linn. f.) Kurz

(S. mangifera Willd.)

Anacardiaceae

Trade names	amra, Indian hogplum
Local name	ambazham
Tree	Large, about 25 m in height and up to 70 cm in diameter Bark brown or grey, with wrinkles and vertical fissures
Dis	West coast semi-evergreen and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous to semi-ring-porous
Growth rings	Indistinct
Vessels	Large to medium, solitary or in radial multiples of 2, 3 or more, rarely in clusters; often filled with tyloses
Parenchyma	Paratracheal — scanty, vasicentric, visible only under lens
Rays	Moderately broad, widely spaced; fine, closely spaced
Gum canals	Horizontal, associated with broad rays
Properties	
Colour	Greyish-white to straw-coloured, sapwood and heartwood not distinct
Hardness	Soft
Weight	Very light to light, 390 kg/m^3, air-dry
Grain	Straight; texture coarse
Processing	
Drying	Easy to season; green conversion and open stacking under cover recommended
Working properties	Easy to saw and work, can be brought only to a moderate finish. Peels well
Natural durability and preservation	Perishable
Uses	General purpose Class III plywood after treatment; packing cases and bowes, match splints and boxes.

135. STERCULIA FOETIDA Linn.

Sterculiaceae

Trade name	pinari
Local name	potta-kavalam
Tree	Medium, about 18 m in height and 60 cm in diameter
Distribution	Occasional in Southern moist mixed deciduous forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large fo medium few, solitary or in radial multiples of 2 or 3; often filled with tyloses
Parenchyma	Apotracheal — diffuse fine lines delimiting growth rings
Rays	Broad to moderately broad, widely spaced; fine, closely spaced
Properties	
Colour	Sapwood greyish-white to pinkish, heartwood reddish-brown
Hardness	Soft to moderately hard
Weight	Light, 395 kg/m^3 at 12% m.c.
Grain	Straight; texture coarse
Processing	
Drying	Heartwood easy to season, sapwood susceptible to stains
Working properties	Easy to saw and work, finishes to a smooth surface
Natural durability and preservation	Perishable
Uses	Class III general purpose plywood; building; dugouts; packing cases.

136. STERCULIA GUTTATA Roxb.

Sterculiaceae

Local names	peenari kithondi
Tree	Medium, 15–20 m in height and about 60 cm in diameter
	Bark brownish or greyish, fairly smooth
Distribution	West Coast semi-evergreen, Moist teak bearing and Southern moist mixed deciduous forests
Wood	
Gross structure	
	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium, few to moderately few, solitary or in radial multiples of 2, 3 or often in clusters
Parenchyma	Apotracheal — in broken lines across the rays
Rays	Very broad to moderately broad, widely spaced; fine, closely spaced
Gum canals	Traumatic, in tangential bands
Properties	
Colour	Yellowish-white or grey to greyish-brown, lustrous
Hardness	Soft to very soft
Weight	Light to very light, 315 kg/m^3, air-dry
Grain	Straight; texture coarse
Processing	
Drying	Quick conversion followed by open stacking under cover recommended
Working properties	Easy to saw and work, but difficult to bring to a good finish
Natural durability and preservation	Perishable
Uses	Packing cases and boxes.

137. STERCULIA URENS Roxb

Sterculiaceae

Trade name	karar
Local name	thondi
Tree	Medium, 15–20 m in height with a clear bole of 7-10 m and about 50 cm in diameter
	Bark greenish-grey, smooth, exfoliating in large, thin flakes
Distribution	Moist teak bearing, Southern moist mixed deciduous and Southern dry mixed deciduous forests
Wood	
Cross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium, few, solitary or in radial multiples of 2 or 3; filled with tyloses
Parenchyma	Apotracheal — diffuse, broken tangential bands and fine lines delimiting growth rings
Rays	Broad to moderateiy broad, widely spaced; fine, closely spaced
Properties	
Colour	Sapwood greyish–white to pale pinkish, heartwood reddish–brown
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 545 kg/m^3 at 12% m.c
Grain	Straight; texture coarse
Processing	
Drying	Heartwood seasons well, sapwood susceptible to stains; green conversion recommended
Working properties	Easy to saw and work, heartwood finishes well and takes good polish
Natural durability and preservation	Perishable in exposed conditions, fairly durable under cover
Uses	Packing cases and boxes; picture and slate frames; low quality pencil slats; match splints and boxes.

138. STERCULIA VILLOSA Roxb.

Sterculiaceae

Trade name	udal
Local name	vakka
Tree	Small, about 10 m in height and 30 cm in diameter Bark grey, with corky warts, fibrous
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium, few to moderately few, soiltary or in radial multiples of 2 or 3, occasionally in clusters of 2-5; often filled with tyloses
Parenchyma	Apotracheal — as tangential lines
Rays	Very broad to moderately broad, widely spaced; fine, very few
Properties	
Colour	Pale yellowish or greyish to greyish-brown, sapwood and heartwood not distinct
Hardness	Very soft
Weight	Very light, 270 kg/m^3 at 12% m.c.
Grain	Straight; texture coarse
Processing	
Drying	Seasons well without much degradation; quick conversion followed by open stacking under cover recommended
Working properties	Easy to saw and work, difficult to bring to a good finish
Natural durability and preservation	Perishable
Uses	Class III general purpose plywood; packing cases and boxes; match splints and boxes.

139. STEREOSPERMUM CHELONOIDES (Linn. f.) DC.

[S. *suaveolens* (Roxb.) **DC.**]

Bignoniaceae

Trade name	padri
Local name	kariyam
Tree	Medium, about 20 m in height and 50 cm in diameter Bark grey, exfoliating in large irregular flakes
Distribution	Southern moist mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Large to medium and small, moderately few to few, mostly solitary, rarely in radial or oblique multiples of 2, 3 or occasionally in tangential clusters; often filled with tyloses and yellowish-white deposits
Parenchyma	Paratracheal — aliform-confluent, discontinuous wavy bands, often connecting the vessels
Rays	Moderately broad to fine, fairly close spaced
Properties	
Colour	Sapwood grey with faint yellowish cast, heartwood yellowish-brown, fairly lustrous
Hardness	Moderately hard
Weight	Moderately heavy to heavy,575-975 kg/m^3 at 12%
Grain	Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/crn^2
Green	666	88,600	147	314
Air-dry	876	106,680	130	513

Processing

Drying — Green conversion and air-seasoning recommended

Working properties — Not difficult to saw and work, can be brought to a smooth surface and takes good polish

Natural durability and preservation — Moderately durable

Uses — Construction-work; furniture and cabinets; tool handles; railway sleepers; lorry and bus bodies; cart and carriages; good quality charcoal. Suitable for turnery.

140. STEREOSPERMUM COLAIS (Buch.-Harm. ex Dillw.) Mabberley

*[S. **personatum** (Hassk.) Chatterjee]*

*[S. **chelonoides** Auct. non (Linn. f.) DC.]*

Bignoniaceae

Trade name — padri

Local name — padiri

Tree — Medium to large, 18-30 m in height and about 80 cm in diameter

Bark brown

Distribution — Southern moist mixed deciduous and Moist teak bearing forests

Wood

Gross structure

Diffuse-porous

Growth rings — Fairly distinct

Vessels — Very large to large and medium, moderately numerous, mostly solitary or in radial multiples of 2 or 3, often in clusters; occasionally filled with tyloses and gummy deposits

Parenchyma — Paratracheal — aliform-confluent, irregular bands often connecting the vessels

Rays — Moderately broad to fine, fairly close spaced

Properties

Colour — Light grey with a faint yellowish cast to brownish-grey, sapwood and heartwood not distinct

Hardness — Hard

Weight — Moderately heavy to heavy, 560-880 kg/m^3 at 12% m.c.

Grain — Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	820	110,800	121	416
Air-dry	1,009	124,700	126	544

Processing

Drying — Liable to surface cracking; green conversion and stacking under cover recommended

Working properties — Somewhat difficult to saw and work, can be brought to a good finish

Natural durability and preservation — Moderately durable. Treatable but complete penetration not always obtained

Uses	Tool handles; floor boards; packing cases; low quality furniture; temporary construction; suitable for railway sleepers after treatment.

141. STRYCHNOS NUX-VOMICA Linn.

Loganiaceae

Trade name	nux-vomica
Local name	kanjiram
Tree	Medium, 15-20 m in height and up to 70 cm in diameter
	Bark dark grey or yeliowish-grey, covered witn minute tubercles
Distribution	Southern moist mixed deciduous; Southern dry mixed deciduous and Moist teak bearing forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to very small, few. mostly solitary or in radial multiples of 2-6 or in oblique clusters
	Paratracheal — tangential lines connecting the vessels
Rays	Moderately broad to fine, fairly close spaced
Included phloem	Conspicuous, circular, oval or irregular areas between the rays, evenly distributed
Properties	
Colour	Creamy-white to yellowish grey or light brown, often with reddish-brawn lines marked by numerous strands of included phloem
Hardness	Hard

Weight	Heavy, 880 kg/m^3 at 12% m.c.
Grain	Straight or irregulariy interlocked; texture medium
Processing	
Drying	Difficult to season, liable to surface cracks
Working properties	Moderately hard to saw, difficult to work with hand tools and machine, does not give a good finish
Natural durability and preservation	Moderately durable to durable
Uses	Axe handles and hammer shafts; cart wheels; legs of cots.

142. SYZYGIUM CUMIMI (Linn.) Skeels

*(Eugenia **jambolana*** Lamk.)

Myrtaceae

Trade name	jaman
Local names	njaval, njara
Tree	Medium to very large, 15-35 m in height and *up* to 120 cm in diameter Bark light grey with dark patches
Distribution	West coast tropical evergreen and West coast semi-evergreen forests. Often planted as shade trees
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, numerous, solitary or in radial multiples of 2 or 3; often filled with tyloses and white deposits
Parenchyma	Paratracheal -- wavy or confluent bands
Rays	Fine, numerous, closely spaced

Properties

Colour Pale reddish-grey to brownish-grey, sapwood and heartwood not distinct, lustrous

Hardness Moderately hard

Weight Moderately heavy, 670 kg/m^3 at 12%m.c.

Grain Interlocked or curly; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	798	109,400	99	389
Air-dry	950	126,500	66	576

Processing

Drying Green conversion and stacking under cover recommended

Working properties Sawing not difficult, easy to work with hand tools and machine, can be brought to a smooth surface

Natural durability and preservation Durable. Heartwood very refractory to treatment

Uses Beams, rafters, posts, door and window frames in building construction; Class I general purpose plywood;
poles and fence posts; agricultural implements; boatbuilding.

143. SYZYGIUM GARDNERI Thw.

Myrtaceae

Trade name	jaman
Local name	karinjaval
Tree	Very large, about 35 m in height and 100 cm in diameter Bark greyish-white, smooth
Distribution	West coast tropical evergreen and Southern hill-top tropical evergreen forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large to medium' and small, numerous, mostly solitary or in radial multiples of 2 or 3; often filled with tyloses and white deposits
Parenchyma	Fine wavy tangential bands, often forming reticulum with rays
Rays	Fine, closely spaced; filled with reddish-brown deposits
Gum canals	Traumatic, horizontal canals occasional
Properties	
Colour	Reddish-brown, sapwood and heartwood not distinct
Hardness	Hard to very hard
Weight	Heavy to very heavy, 970 kg/m^3 at 12%
Grain	Interlocked; texture medium to fine
Processing	
Drying	Green conversion followed by stacking under cover recommended
Working properties	Difficult to saw the seasoned wood, machines fairly well, finishes to a smooth surface

Natural durability and preservation	Non-durable. Heartwood refractory to treatment
Uses	Country boats; fence posts; packing cases, temporary construction; low quality furniture.

144. TAMARINDUS INDICA Linn.

Caesalpiniaceae

Trade name	imli
Local name	puli
Tree	Large to very large, about 30 m in height and up to 150 cm in diameter
	Bark dark grey with longitudinal fissures and deep cracks
Distribution	Native of Africa. Cultivated
Wood	
Gross structure	
	Diffusa-porous
Growth rings	Fairly distinct
Vessels	Small to very small, moderately few to moderately numerous, solitary or in radial multiples of 2 4; occasionally filled with white deposits
Parenchyma	Paratracheal aliform and fine lines delimiting growth rings
Rays	Fine to very fine, closely spaced
Properties	
	Sapwood yellowish-white to greyish-brown, heartwood dark purplish-brown
Hardness	Hard to very hard
Weight	Heavy to very heavy, 915 kg/m^3 at 12%
Grain	Straight to interlocked and wavy; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/crn^2	cm	Max. crushing stress kg/cm^2
Green	571.7	56,300	122	279.6
Air-dry	1,040.4	96,500	81	494.5

Processing

Drying — Moderately refractory to air-seasoning

Shrinkage — Green to oven-dry

Radial 3.8%

Tangential 6.1%

Working properties — Very difficult to work

Natural durability and preservation — Non-durable in exposed conditions

Uses — Internal fittings in buildings; oil and sugar mill accessories; turnery and carvings; toys; chopping blocks; tent accessories; wooden mallets; naves of cart wheels; charcoal.

145. TECTONA GRANDIS Linn. f.

Verbenaceae

Trade name — teak

Local name — thekku

Tree — Large to very large, 25-45 m in height and up to 190 cm in dimater

Bark light brown or grey, with shallow longitudinal furrows

Distribution — Mostly in the Moist teak bearing forest. Raised extensively in plantations

Wood

Gross structure — Ring-porous

Growth rings	Distinct, delimited with early wood vessels
Vessels	Large in early wood, medium to small in late wood, mostly solitary and in short radial multiples; occasionally filled with tyloses and yellowish-white deposits
Parenchyma	Paratracheal — vasicentric and in broad bands delimiting growth rings
Rays	Moderately broad, fairly wide spaced
Properties	
	Sapwood pale yellowish or greyish, heartwood golden brown, occasionally with dark streaks
Hardness	Moderately hard
Weight	Moderately heavy, 650 kg/m^3 at 12% m.c.
Grain	Straight; texture fine and uneven
Odour	Characteristic odour
Strength	

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/m^2	Modulus of Elasticity kg/m^2	cm
Green	841	109,700	91
Air-dry	953	119,600	71

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	311	415	129,800	86
Air-dry	376	532	137,400	101

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm2	Tangential kg/cm^2
Green	90	100	63	79
Air-dry	97	108	58	66

Processing

Drying

Seasons very well, the best model wood for air-seasoning. Kiln-seasoning also gives very good results

Shrinkage	Green to over-dry
Radial	2.3%
Tangential	4.8%

Working properties

Somewhat brittle, works well with hand tools and machine

Natural durability and preservation

Very durable. Heartwood very refractory to treatment

Uses

A versatile wood. Building construction; Class I general purpose plywood; decorative plywood; furniture and cabinets; poles and cross arms; textile mill accessories; musical instruments; mathematical, engineering and drawing instruments; bus bodies; boat and shipbuilding.

146. TERMINALIA BELLIRICA (Gaertn.) Roxb.

Combretaceae

Trade name

bahera

Local name

thanni

Tree

Large, 20-30 m in height with a clear bole of 10-15 m and up to 130 cm in diameter; buttressed

Bark brownish-grey, with shallow longitudinal fissures

Distribution West coast semi-evergreen, West coast tropical evergreen, Moist teak bearing and Southern moist mixed deciduous forests

Wood

Gross structure Diffuse-porous

Growth rings Fairly distinct

Vessels Large to medium, few to moderately few, solitary or in radial multiples of 2 or 3, rarely more

Parenchyma Abundant; apotracheal and paratracheal, in wide broken, wavy or tangential bands, often aliform-confluent

Rays Fine to very fine, closely spaced

Gum canals Vertical, traumatic, occasional

Properties

Colour Creamy yellow or yellowish-brown, sapwood and heartwood not distinct

Hardness Moderately hard to hard

Weight Moderately heavy, 625 kg/m^3 at 12% m.c.

Grain Straight; texture coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	678.5	101,900	94	336.4
Air-dry	995.5	122,800	112	501.9

Processing

Drying Moderately refractory to seasoning; green conversion followed by open stacking under cover recommended. Kiln-seasoning offers no difficulty

Shrinkage Green to oven-dry

Radial 4 7%

Tangential 7.7%

Working properties	Easy to saw and work
Natural durability and preservation	Non-durable. Treatable but complete penetration not always obtained
Uses	Temporary construction-work; general purpose Class II plywood; blockboards; heavy packing cases and boxes.

147. TERMINALIA CHEBULA (Gaertn.) Retz.

Combretaceae

Trade name	myrobalan
Local name	kadukka
Tree	Medium, 12–20 m in height and up to 60 cm in diameter Bark dark brown, often with shallow vertical fissures
Distribution	Southern dry mixed deciduous forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately few to moderately numerous, solitary or in radial multiples of 2, 3 or more; occasionally filled with white deposits
Parenchyma	Paratracheal — vasicentric to aliform or aliform-confluent; often filled with white deposits
Rays	Fine to very fine closely spaced; filled with white deposits
Gum canals	Vertical, traumatic, often in tangential rows
Properties	
Colour	Sapwood grey or yellowish-grey, often with greenish tinge, heartwood dark brown to reddish-brown

Hardness Very hard

Weight Heavy to very heavy, 915 kg/m^3 at 12% m.c.

Grain Interlocked; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	**853.1**	**123,700**	**102**	**468.5**
Air-dry	**1,076.6**	**141,800**	**94**	**565.4**

Processing

Drying Refractory to seasoning; green conversion followed by close stacking and slow drying under cover recommended. Kiln-seasoning gives better results

Shrinkage Green to oven-dry
Radial 5.5%
Tangential 9.0%

Working properties Difficult to saw and work, takes good polish

Natural durability and preservation Perishable, moderately durable under cover. Heartwood only partially treatable

Uses Construction purposes as beams, scantlings and planks; tool handles; railway sleepers; mathematical, engineering, and drawing instruments.

148. TERMINALIA CRENULATA Heyne *ex* Roth

Combretaceae

Trade name	laurel *
Local names	thembavu, karumarurhu
Tree	Medium to large, 15-30 m in height with a clear bole of 8-15 m and up to 100 cm in diameter Bark greyish or black with longitudinal fissures and transverse cracks, exfoliating in irregular flakes
Distribution	West coast semi-evergreen, Moist teak bearing, Southern moist mixed deciduous and Southern dry mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Large, moderately numerous, solitary or in radial multiples of 2 or 3; often filled with tyloses
Parenchyma	Paratracheal — aliform to aliform-confluent and also in fine lines delimiting growth rings
Rays	Fine to very fine, closely spaced
Properties	
Colour	Sapwood pinkish-white to pinkish-grey or pale grey, heartwood varies considerably in colour, deep brown with dark streaks or walnut brown, dull to fairly lustrous
Hardness	Hard to very hard
Weight	Heavy to very heavy, 880 kg/m^3 at 12% m.c.
Grain	Straight to interlocked; texture coarse

* **The laurel tree found in Kerala is *Terminalia crenulata* [c.f. K. N. Bahadur and R. C. Gaur (1980). Indian J. For. 3 : 367-3691**

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	735	105,400	112
Air-dry	905	118,330	61

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	266	377	101,300	109
Air-dy	279	556	152,600	131

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/ cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	92	109	49	52
Air-dry	105	122	28	46

Processing

Drying

Very refractory to seasoning, liable to warping and end-splitting; green conversion soon after rainy season followed by stacking under cover with weight to prevent warping, recommended, With care kilnseasoning satisfactory

Shrinkage Green to oven-dry
Radial 4.7%
Tangential 7.7%

Working properties	Variable; straight grained wood easy to saw, can be worked to a smooth finish and takes good polish than the cross-grained wood. Peels satisfactorily Figured veneers with proper finish and matching, can be compared with walnut
Natural durability and preservation	Durable. Heartwood treatable but complete penetration not always obtained
Uses	Building and bridge construction purposes as beams, rafters, posts, door and window frames; Class I general purpose and decorative plywood; furniture and cabinets; blockboards; tool handles; piles, poles and fence posts; railway sleepers; sports goods; lorry and bus bodies; cart and carriages.

149. TERMINALIA PANICULATA Roth

Combretaceae

Trade name	kindal
Local names	pulla-maruthu, maruthi
Tree	Large, 20–30 m in height with a clear bole of about 10 m and up to 90 cm in diameter Bark brown to dark brown, moderately rough, peels off in thin flakes
Distribution	West coast semi-evergreen, Moist teak bearing Southern *moist* mixed deciduous and Southern dry mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Scarcely distinct
Vessels	Medium to small, moderately few to few, solitary or in radial multiples of 2, 3 or often more; occasionally filled with witish deposits and tyloses

Parenchyma — Paratracheal — vasicentric to aliform or aliform-confluent

Rays — Very fine, closely spaced

Properties

Colour — Sapwood greyish-white, often blotched with yellow, heartwood greyish-brown, rather lustrous

Hardness — Hard to very hard

Weight — Moderately heavy to heavy, 785 kg/m^3 at 12% m.c.

Grain — Straight to wavy; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	846.7	132,200	84	437.7
Air-dry	1,117.7	142,400	102	639.4

Processing

Drying — Very refractory to seasoning due to severe surface-cracks; green conversion and slow drying recommended

Shrinkage	Green to oven-dry
Radial	5.1%
Tangential	8.2%

Working properties — Easy to saw when green, fairly easy to plane, can be brought to a smooth surface and takes good polish. Peels well

Natural durability and preservation — Non-durable to moderately durable. Heartwood partially treatable

Uses — Construction purposes as beams, posts, rafters and planks; tea chests; commercial grade plywood; blockboards: agricultural implements; boatbu lding; railway sleepers; lorry bodies.

150. TETRAMELES NUDIFLORA R. Br. ex Benn.

Datiscaceae

Trade name	maina
Local name	cheeni
Tree	Very large, 30-45 m in height with a clear bole of 15 m and up to 180 cm in diameter; buttressed Bark greyish-white, lenticellate, smooth, thick, peels off in papery flakes
Distribution	West coast semi-evergreen, West coast tropical evergreen, Moist teak bearing and Southern moist mixed deciduous forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Very large to medium and small, moderately numerous to numerous
Parenchyma	Indistinct
Rays	Moderately broad to fine, closely spaced
Properties	
Colour	Yellowish-grey or light golden-brown, sapwood and heartwood not distinct, lustrous
Hardness	Soft
Weight	Very light, 350 kg/m^3 at 12% m.c.
Grain	Interlocked; texture coarse
Strength	

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	290	*48,800*	30	152
Air-dry	433	60,700	41	262

Processing	
Drying	Green conversion and stacking under cover recommended
Working properties	Easy to saw and work, can be brought to a smooth surface
Natural durability and preservation	Non-durable. Heartwood easily treatable
Uses	General purpose Class III plywood and veneers; blockboards; packing cases and boxes; match splints and boxes; boat and shipbuilding; cooperage.

151. THESPESIA POPULNEA (Linn.) Soland. ex Correa

Malvaceae

Trade name	bhendi
Local names	cheelanthi, poovarasu
Tree	Small to medium, 6-15 m in height and 20-40 cm in diameter Bark grey or greyish-brown, smooth or shallowly fissured
Distribution	In coastal areas and sometimes grown in villages
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Medium to small, few to moderately few, mostly solitary or in radial multiples of 2, 3 or more, occasionally in clusters; often plugged with dark red gum
Parenchyma	Apotracheai — visible only under lens, diffuse to diffuse-in-aggregate, forming irregular reticulum with rays
Rays	Fine, occasionally moderately broad and storied

Properties

Colour — Sapwood white with a pale yellowish or pinkish tinge, heartwood reddish-brown to chocolate brown or purplish-brown with dark streaks

Hardness — Moderately hard to hard

Weight — Moderateiy heavy to heavy, 770 kg/m^3 at 12% m.c.

Grain — Straight to somewhat interlocked; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	945.2	103,600	160	450.9
Air-dry	1,204.8	119,200	137	574 3

Processing

Drying — Seasons well

Shrinkage — Green to oven-dry

Radial	3.8%
Tangential	6.9%

Working properties — Sawing satisfactory, works well with hand tools and machine, gives a smooth finish and takes good polish

Natural durability and preservation — Fairly durable. Heartwood refractory to treatment

Uses — Furniture; tool handles; boat and ship-building; mathematical, engineering and drawing instruments; carts and carriages; wooden footwear.

152. TOONA CILIATA Roemer

*(Cedrela **toona*** Roxb. ex Rottler)

Meliaceae

Trade name	toon
Local names	madagiri-vembu, vembu, chuvanna-agil
Tree	Large, 20–30 m in height with a clear bole of 9–12 m and 60–90 cm in diameter Bark greyish-brown, thick, rough, exfoliating in irregular woody scales in old trees
Distribution	West coast tropical evergreen, Southern hill-top tropical evergreen, West coast semi-evergreen and occasionally in Moist teak bearivg forests
Wood	
Gross structure	Semi-ring-porous to ring-porous
Growth rings	Distinct
Vessels	Large in the early wood, transition from early wood to late wood gradual, small and moderately few in late wood, solitary or in radial multiples of 2 or 3; occasionally filled with dark brown gummy deposits
Parenchyma	Paratracheal — scanty. faintly delimiting growth rings
Bays	Moderately broad to fine, rather few, fairly wide spaced
Gum canals	Vertical, traumatic, occasional
Pith flecks	Often present
Properties	
Colour	Sapwood pinkish-brown, heartwood reddish-brown, rather lustrous
Hardness	Soft to moderately hard
Weight	Light to moderately heavy, 515 kg/m^3 at 12% m.c.
Grain	Straight; texture coarse and uneven

Strength

Condition	Static Bending		Impact Bending
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm
Green	436	63,980	58
Air-dry	562	78,530	43

Condition	Compression parallel to grain			Compression perpendicular to grain
	Compressive stress at elastic limit kg/cm^2	Max. crushing stress kg/cm^2	Modulus of Elasticity kg/cm^2	Compressive stress at elastic limit kg/cm^2
Green	162	215	61,800	41
Air-dry	184	321	56,950	48

Condition	Shear parallel to grain		Tension perpendicular to grain	
	Radial kg/cm^2	Tangential kg/cm^2	Radial kg/cm^2	Tangential kg/cm^2
Green	58	70	33	40
Air-dry	79	110	45	57

Processing

Drying — Refractory to seasoning, liable to warp: green conversion and careful stacking under cover recommended

Working properties — Easy to saw, machines fairly well, gives a smooth surface and takes good polish

Natural durability and preservation — Non-durable. Heartwood only partially treatable

Uses — Furniture and cabinets; general purpose Class I plywood; blockboards; cigar boxes; packing cases; textile mill accessories; pencil slats; tennis, badminton and squash racket frames; musical instruments.

153. TREWIA POLYCARPA Benth. *ex* Hook. f.

Euphorbiaceae

Trade name	gutel
Local names	pambarakumbil, thavala
Tree	Medium to large, 17–22 m in height and about 60 cm in diameter
	Bark grey, smooth, exfoliating in round, thin scales
Distribution	West coast semi-evergreen and Southern moist mixed deciduous forests, mostly seen along the banks of rivers and streams
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium. moderately few, solitary or in radial multiples of 2, 3 or 5, rarely in double rows or tangential clusters
Parenchyma	Paratracheal and apotracheal, the former sparse and the latter abundant
Rays	Fine to very fine, closeiy spaced
Properties	
Colour	White to pale brownish-grey, often discoloured due to fungal sap stain, sapwood and heartwood not distinct, lustrous when freshly cut
Hardness	Soft
Weight	Light to moderately heavy, 560 kg/m^3 at 12% m.c.
Grain	Straight; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	compression parallel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	392	68,500	66	192
Air-dry	562	70,100	53	369

Processing	
Drying	Seasons well
Working properties	Easy to saw and work; finishes to a smooth surface
Natural durability and preservation	Non-durable
Uses	Packing cases and boxes; match splints; boat and shipbuilding; badminton rackets.

154. VATERIA INDICA Linn.

***(V. malabarica* Bl.)**

Dipterocarpaceae

Trade names	vella-paine, Indian copal
Local names	vet fa-payin, payin
Tree	Large, **20-30** m in height with a clear bole of 8-15 m and up to 140 cm in diameter Bark grey, often blotched with green and white, thick
Distribution	West coast tropical evergreen, West coast semi-evergreen and West coast secondary evergreen *Dipterocarp* forests
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Large to medium, moderately numerous, mostly solitary and in short radial multiples, with a tendency towards oblique grouping; occasionally filled with tyloses
Parenchyma	Paratracheal — vasicentric, as a thin layer arround resin ducts
Rags	Moderately broad, few, fairly wide spaced, radial flecks conspicuous
Resin	Vertical, small, visible only under lens, appearing as scattered white dots; gummy infiltration abundant

Properties

Colour — Sapwood creamy white to greyish-white, heartwood grey to light yellowish or pinkish, turns brown on exposure

Hardness — Moderately hard

Weight — Moderately heavy, 575 kg/m^3 at 12% m.c,

Grain — Fairly straight to narrowly interlocked; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	573.1	109,500	51	300.2
Air-dry	770.8	129,800	71	457.5

Processing

Drying — Easy to season; quick surface drying by vertical stacking followed* by horizontal stacking under cover recommended, as liable lo staining and decay in green condition. Kiln-seasoning difficult

Shrinkage — Green to oven-dry
Radial 3.4%
Tangential 10.4%

Working properties — Easy to saw, finishes to a smooth surface. Peels well

Natural durability and preservation — Non-durable. Heartwood very refractory to treatment

Uses — Temporary construction; general purpose Class I plywood; marine plywood; tea chests; blockboards; packing cases and boxes.

155. VATERIA MACROCARPA Gupta

Dipferocarpaceae

Trade name	vellapine
Local name	vella-payin
Tree	Large, about 25 m in height and up to 120 cm in diameter Bark dark grey, smooth
Distribution	Confined to the West coast tropical evergreen forest of Muthikulam and Attappady
Wood	
Gross structure	Diffuse-porous
Growth rings	Indistinct
Vessels	Moderately large to small, few to many, in oblique groups; filled with tyloses
Parenchyma	Paratracheal — vasicentric and as thin layer surrounding resin ducts
Rays	Brownish; moderately broad, rather widely spaced
Resin ducts	Small, uniformly scattered, mostly solitary, rarely in tangential rows; white gummy deposits common
Properties	
Colour	Sapwood usually white or creamy-white, heartwood whitish-grey or light yellow, turning brownish or pinkish on exposure, somewhat lustrous when freshly cut
Hardness	Moderately hard
Weight	Moderately heavy, 605 kg/m^3, air-dry
Grain	Often interlocked; texture medium to coarse and fairly smooth
Processing	
Drying	Seasons fairly well
Working properties	Easy to work. Peels well
Natural durability and preservation	Non-durable
Uses	Packing cases and boxes; Class I plywood; tea chests.

156. VATICA CHINENSIS Linn.

(V. roxburghiana Bl.)

Dipterocarpaceae

Trade name vatica

Local name adakka-payin

Tree Small to medium, up to 20 m in height and about 50 cm in diameter

Bark pale grey, smooth

Distribution Sporadic in West coast semi-evergreen forest of North and Central Kerala

Wood

Gross structure Diffuse-porous

Growth rings Indistinct

Vessels Small, moderately numerous to numerous, often solitary; filled with tyloses

Parenchyma Paratracheal — scanty; apotracheal — diffuse, indistinct around the resin ducts

Rays Fine to very fine and comparatively broader, the former in between the latter

Resin ducts Very small, visible only under lens, smaller than pores, mostly solitary, occasionally 2 or 3, in tangential rows; often filled with white deposits

Pith flecks Occasional

Properties

Colour Sapwood pale yellow to yellowish-brown or grey, heartwood yellowish-brown to reddish-brown

Hardness Moderately hard to very hard

Weight Very heavy, 955 kg/m^3 at 12%

Grain Interlocked; texture fine and even

Processing

Drying Easy to season

Shrinkage — Green to oven-dry

Radial	0.8%
Tangential	3.3%

Working properties	Difficult to saw, machines satisfactorily, works to a good finish
Natural durability and preservation	Moderately durable
Uses	Building construction; plywood; low quality furniture.

157. VITEX ALTISSIMA Linn. f.

Verbenaceae

Trade Name	milla
Local names	myla, mylellu
Tree	Medium to large, 15-30 m in height and up to 100 cm in diameter
	Bark yellowish-brown, thin
Distribution	West coast semi-evergreen, Moist teak bearing and West coast tropical evergreen forests, occasionally in West coast secondary evergreen *Dipterocarp* forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Fairly distinct
Vessels	Medium to small, moderately few to moderately numerous, mostly solitary or in radial multiples of 2-4 or in clusters; occasionally filled with tyloses and deposits
Parenchyma	Paratracheal — as tangential lines delimiting growth rings
Rays	Fine to very fine, closely spaced
Properties	
	Light olive-grey to grey with a tinge of olive-brown, sapwood and heartwood not distinct
Hardness	Hard
Weight	Heavy, 815 kg/m^3 at 12%
Grain	Straight to interlocked or wavy; texture medium to coarse

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kgicm2	Modulus of Elasticity kgjcrnz	cm	Max. crushing stress kg/cma
Green	909	130,100	97	505
Air-dry	1,169	149,400	81	681

Processing

Drying — Liable to develop end-splits; green conversion recommended

Working properties — Somewhat difficult to saw, works to a medium smooth surface and takes good polish

Natural durability and preservation — Very durable

Uses — Building construction; tool handles; railway sleepers; furniture.

158. VITEX LEUCOXYLON Linn. f.

Verbenaceae

Local name — atta-nocchi

Tree — Small to medium, 7-12 m in height and about 30 cm in diameter

Bark grey, smooth

Distribution — West coast semi-evergreen and Southern moist mixed deciduous forests, mostly seen along the banks of streams

Wood

Gross structure — Diffuse-porous

Growth rings — Fairly distinct

Vessels	Small to very small, moderately few to moderately numerous, mostly solitary or in radial multiples of two or in tangential clusters
Parenchyma	Indistinct
Rays	Fine, closely spaced
Properties	
Colour	Light greyish-brown, sapwood and heartwood not distinct, slightly lustrous
Hardness	Moderately hard
Weight	Moderately heavy, 625 kg/m^3 at 12% m.c.
Grain	Straight; texture fine
Processing	
Drying	Difficult to season
Working properties	Moderately easy ,to saw and work, finishes to a smooth surface, machining satisfactory
Natural durability and preservation	Moderately durable
Uses	Constructional purposes; furniture; carts and carriages.

159. WALSURA TRIFOLIA (A. JUSS.) Harms

*(W. **piscida** Roxb.)*

Meliaceae

Local	perilla-pacha
Tree	Medium to large, 15–27 m in height and about 60 cm in diameter Bark greyish-brown, tessellated in rectangular pattern, thin
Distribution	West coast tropical evergreen forest in South and Central Kerala
Wood	
Gross structure	Diffuse-porous

Growth rings	Scarcely distinct
Vessels	Small to very small, moderately numerous, solitary or in radial multiples of 2, 3 or more; often filled with pale brown deposits
Parenchyma	Paratracheal — tangential bands alternate with wide fibre bands
Rays	Fine to very fine, closely spaced
Pith flecks	Often present
Properties	
Colour	Greyish or yellowish-brown to reddish-brown, sapwood and heartwood not distinct
Hardness	Very hard
Weight	Heavy to very heavy, 830 kg/m^3 at 12% m.c.
Grain	Slightly straight; texture medium to fine
Processing	
Drying	Not refractory to seasoning
Working properties	Difficult to saw and work, but gives a fine finish and takes good polish
Natural durability and preservation	Durable
Uses	General construction; furniture; carts and carriages; agricultural implements.

160. WRIGHTIA TINCTORIA (Roxb.) R. Br.

Apocynaceae

Trade name	dudhi
Local names	aiya-pala, dhantha-pala
Tree	Small, about 10 m in height and 30 cm in diameter
	Bark pale grey, smooth, thin
Distribution	Moist teak bearing, Southern moist mixed deciduous and Southern dry mixed duous forests

Wood

Gross structure	
	Diffuse-porous
Growth rings	Indistinct
Vessels	Small to very small, few to moderately few, solitary or in radial multiples of 2-5 or 6, rarely in short double rows; occasionally filled with orange-brown gummy deposits
Parenchyma	Indistinct
Rays	Very fine, closely spaced
Properties	
Colour	White to light lemon yellow, sapwood and heartwood not distinct
Hardness	Moderately hard
Weight	Moderately heavy, 575 kg/m^3 at 12% m.c.
Grain	Straight to somewhat wavy or curly; texture fine
Processing	
Drying	Easy to season
Working properties	Easy to saw and machine, can be brought to a fine finish
Natural durability and preservation	Non-durable
Uses	Chess pieces; mathematical, engineering and drawing instruments; turnery and carvings: toys.

161. XYLIA XYLOCARPA (Roxb.) Taub.

Mimosaceae

Trade name	irul
Local	irul, kadamaram
Tree	Medium to large, 15-25 m in height and up to 70 cm in diameter
	Bark reddish-grey, exfoliating in thick irregular flakes

Distribution — Moist teak bearing, Southern moist mixed deciduous and West coast semi-evergreen forests. Occasional in West coast secondary evergreen *Dipterocarp* forest

Wood

Gross structure — Diffuse-porous

Growth rings — Fairiy distinct

Vessels — Medium to small, moderately few to moderately numerous, solitary or in short radial multiples of 2, 3 or rarely more; filled with orange-brown or reddish-brown gummy deposits

Parenchyma — Apotracheal — diffus; eparatracheal - vasicentric, occasionally confluent and also as discontinuous lines delimiting growth rings

Rays — Fine, closely spaced

Properties

Colour — Sapwood pale brownish or pinkish-white, heartwood light to dark reddish-brown, often with dark streaks

Hardness — Hard to very hard

Weight — Heavy to very heavy, 850 kg/m^3 at 12% m.c

Grain — Straight lo interlocked; texture medium to fine

Strength

Condition	Static Bending		Impact Bending	Compre$sion paraliel *to* grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	812.5	116.400	76	436.5
Air-dry	1,097.8	142,100	74	714.0

Processing	
Drying	Green conversion during rainy season and stacking under cover recommended. Kiln-seasoning possible, provided a slow schedule is followed
Working properties	Difficult to saw due to blunting effect on the saw teeth, can be brought to a smooth surface and takes good polish
Natural durability and preservation	Very durable. Very refractory to treatment
Uses	Bridge and building construction; poles, cross arms, ballies and fence posts; railway sleepers; boat and shipbuilding; textile mill accessories; agricultural implements.

162. ZANTHOXYLUM RHETSA (Roxb.) DC.

(Fagara rhetsa Roxb.)

Rutaceae

Trade name	mullilam
Local name	mullilam
Tree	Medium to large, 15-22 m in height and 40-50 cm in diameter Bark cream coloured, thick, corky with conical thorns
Distribution	Moist teak bearing and Southern moist mixed deciduous forests. Occasionally in West coast semi-evergreen forest
Wood	
Gross structure	Diffuse-porous
Growth rings	Distinct
Vessels	Medium to small, moderately numerous to numerous, solitary or in radial multiples of 2-4 or more; frequently filled with yellowish deposits

Parenchyma — Paratracheal — banded at regular to irregular intervals and delimiting growth rings

Rays — Fine, fairly close spaced

Gum canals — Occasional, vertical

Properties

Colour — Yellowish-grey, sapwood and heartwood not distinct

Hardness — Moderately hard

Weight — Moderately heavy, 725 kg/m^3, kiln-dry

Grain — Straight to somewhat wavy; texture medium

Strength

Condition	Static Bending		Impact Bending	Compression parallel to grain
	Modulus of Rupture kg/cm^2	Modulus of Elasticity kg/cm^2	cm	Max. crushing stress kg/cm^2
Green	**775.6**	**130,200**	114	**369.3**
Air-dry	**1,296.0**	154,200	**137**	**636.0**

Processing

Drying — Seasons well

Working properties — Sawing and machining satisfactory, takes good polish. Nail holding capacity good

Natural durability and preservation — Moderately durable

Uses — General purpose Class I plywood; aircraft plywood; marine plywood; furniture and cabinets; blockboards; tool handles; fence posts and ballies; artificial limbs and rehabilitation aids; cricket stumps and bails; turnery; shuttles in textile mills.

APPENDIX I

Explanatory notes on quantitative terms used for description *of* species

I Tree height (metre)

a. Small	up to 10
b. Medium	10 to 20
c. Large	20 to 30
d. Very large	More than 30

I1 Gross structure

A. Vessels

1. Size

a. Very small and small	Pores not visible to the eye
b. Medium	Pores just visible to the eye but out-lines are not distinct
c. Large and very large	Pores distinctly visible to the eye

2. Distribution (Pores/mm^2)

a. Very few	up to 2
b. Few	2 to 5
c. Moderately few	5 to 10
d. Moderately numerous	10 to *20*
e. Numerous	20 to 40
f. Very numerous	More than 40

B. Rays

1. Size

a. Very fine and fine	Not visible or just visible to the eye
b. Moderately broad	Distinctly visible to the eye
c. Broad and very broad	Prominently visible to the eye

2. Distribution (Number of rays / mm in tangential longitudinal section)

a. Very widely spaced	Less than 5
b. Widely spaced	5 to
c. Closely spaced	10 or more

111 Physical properties

A. Hardness	
a. Very soft and soft	Readily indented by finger nail
b. Moderately hard	Not easily indented by finger nail but readily cut by sharp knife
c. Hard and very hard	Not indented by finger nail and difficult to cut by sharp knife
B. Weight/Density (kg/ms)	
a. Very light and light	Up to 550
b. Moderately heavy	550 to 750
c. Heavy and very heavy	More than 750
C. Texture	
a. Fine	Smooth to feel
b. Medium	Fairly smooth to feel
c. Coarse	Rough to feel
D. Durability (Life span in years as obtained in graveyard tests)	
a. Perishable	Less than 2
b. Non–durable	2 to 5
c. Moderately durable	5 to 7
d. Durable	7 to
e. Very durable	More than 10

APPENDIX II

Classification of wood according to end use

Use	indian Standard Specification	Serial number of the species
I CONSTRUCTION		
(a) Building	**IS** : 3629 - 1966 **IS** : 883 - 1970 **IS** : 1003 - 1977	1,2,3,4,5,7,10,11,12, 16, 17, 18, 19, 20, 24, 25, 27, 31, 32, 34, 35, 37. 40, 41,43, 44, 46, 47, 49, 51, 53, 54, 57, 59, 66, 69, 70, 71, 72, 74, 79, 80, 81, 82, 83, 88, 91', 92, 94, 95, 96, 99, 103, 104, 105, 108, 109, 113, 114, 116, 117, 120, 124, 125, 129, 131, 133, 139, 140, 142. 145, 146, 147, 148, 149, 156, 157, 158, 159,161
(b) Bridge		2, 11, 40, 53, 54, 80, 82, 104, 108, 120, 133, 148, 161
I1 PILES		2, 20, 145, 148, 161
I11 RAILWAY SLEEPERS		11, 12, 15, 18, 53, 54, 72, 81, 82, 83, 88, 91, 104, 113, 116, 120, 131, 139, 447, 148, 149, 157, 161
IV POLES, CROSS ARMS, BALLIES AND FENCE POSTS	**IS** : 3337 - 1965 **IS** : 3386 - 1965 **IS:** 876-1970 **IS** : 2203 - 1976	3, 6, 9, 15, 20, 25, 31, 35, 38, 53, 54, 62, 63, 64, 68, 72, 75, 80, 81, 82, 83, 88, 91,92,106, 116, 120, 142, 143, 145, 148, 149, 161, 162
V PLYWOODAND VENEERS		
(a) General purpose Class I		3, 10, '17, 20, 31, 32, 41, 47, 49, 50, 51, 53, 54, 55, 70, 74, 79, 93, 99, 105, 113, 114, 118, 142, 145, 148, 152, 154, 155, 162

Use	Indian Standard Specification	Serial number *of* the species
Class I1		19, 33, 34, 45, 88, 146, 155
Class 111		8, 13, 16, 26, 44, 68, 71, 90, 95, 123, 134, 135. 138, 150
(b) Tea chests		3, 10, 16, 17, 25, 31, 32, 50, 51, 68, 74, 79, 87, 91, 113, 149, 154, 155
(c) Flush door shutters	**IS** : 2202 - 1973	3, 9, 10, 11, 12, 20, 32, 33, 45, 47, 50, 71
(d) Blockboards	**IS** : 1659 - 1969	3, 8, 9, 10, 14, 18, 19, 20, 31, 33, 34, 42, 45, 49, 50, 71, 74, 79, 88, 93, 99, 113, 118, 142, 146, 148, 149, 150, 152, 154. 162
(e) Decorative plywood	**IS** : 1328 - 1970	9, 10, 11, 41, 47, 49, 57, 69, 71, 79, 105, 128. 145, 148
(f) Aircraft plywood	**IS** : 4859 - 1968	47, 49, 57, 112, 113, 145, 162
(g) Marine plywood	**IS:** 710-1976	19, 20, 41, 47, 49, 57, 113, 145, 154, 162
VI MATCHWOOD	**IS** : 1140 - 1970	
(a) Splints		8, 13, 16, 26, 29, 33, 39. 58, 59, 61, 65, 76, 77, 78, 86, 87, 90, 95, 99, 101, 114, 118, 123, 127, 132, 134, 137, 138, 150, 153
(b) Boxes		8, 26, 39, 65, 67. 76, 87, 99, 101, 123, 127, 132, 134, 137, 138, 150

	Uses	Indian Standard Specification	Serial number of the species
VII	PACKING CASES AND BOXES	IS : 6662 - 1972	3, 8, 9, 13, 14, 23, 2,5. 26, 28, 29, 31, 33, 39, 42, 44, 46, 58, 59, 61, 63, 64, 65, 67, 68, 71, 73, 76, 77, 78, 84, 85, 86, 87, 89, 90, 93,95, 99, 101, 102, 103, 106, 107, 114, 117, 118, 122, 123, 127, 132, 134, 135, 136, 137, 138, 140, 146, 150, 152,153, 154, 155
VIII	FURNITURE AND CABINETS	IS : 300 - 1963	4, 9, 10, 11, 14, 16, 17, 18, 19, 28, 21, 22, 23, 28, 30, 31, 32, 33, 40, 41, 43, 44, 45, 47, 49, 50, 51, 55, 56, 57, 66, 68, 69, 70, 72, 74, 76, 79, 88, 91, 92, 93, 95, 99, 100, 103, 105, 107, 108, 109, 110, 113, 125, 139, 145, 148, 151, 152, 157, 158, 159, 162
IX	TOOL HANDLES	IS : 620 - 1975	2, 3, 5, 6, 10, 11, 12, 15, 20, 22, 24, 27, 35, 36, 37, 43, 45, 47, 49, 50, 57, 66, 69, 70, 72, 74, 79, 81, 91, 92, 96, 104, 106, 108, 109, 111, 113, 119, 120, 131, 133, 139, 140, 141, 147, 148, 151, 157, 162
X	AGRICULTURAL IMPLEMENTS		1, 2, 5, 7, 15, 22, 24, 27, 36, 40, 62, 66, 72, 79, 94, 96, 104, 108, 115, 121, 122, 129, 130, 131, 142, 149, 159, 161

	Use	Indian Standard Specification	Serial number of the species
XI	BOAT AND SHIP-BUILDING		1, 2, 18, 20, 24, 26, 31, 32, 35, 49, 53, 54, 70, 72, 81, 91, 92, 96, 97, 99, 104, 108, 120, 133, 135, 142, 143, 145, 149, 150, 151, 153, 161
XI1	LORRY AND BUS BODIES	IS : 2179 - 1962	3, 10, 19, 20, 24, 70 72, 88, 91, 120, 139, 145: 148, 149
XI11	CARTS AND CARRIAGES		2, 10, 11, 12, 15, 20, 23, 24, 27, 36,, 46, 53, 54, 66, 70, 72, 81, 83, 91, 104, 119, 120, 125, 129, 131, 133, 139, 141, 144, 148, 151, 158, 159
XIV	PENCIL SLATS	IS : 3084 - 1975	8, 13, 16, 25, 26, 33, 59, 70, 77, 87, 35. 127' 137, 152
XV	BENTWOOD ARTICLES AND TOYS		8, 22, 24, 26, 28, 41, 47, 61, 74, 79, 91, 99, 100, 103, 112, 124, 127, 160
XVI	TURNERY, CARVINGS AND HANDICRAFTS		4, 5, 6, 9, 16, 19, 20, 21, 22, 24, 25, 36, 40, 41, 47, 52, 56, 62, 69, 85, 88, 93, 98, 100, 108, 111, 117, 121, 124, 126, 128, 139, 144, 160, 162
XVII	SHOE-LASTS		49, 70, 74, 99, 105, 109, 117
XVIII	TEXTILE MILL ACCESSORIES	IS :1048 - 1957 IS : 2579 - 1963 IS : 2623 - 1964 IS : 2624- 1964 IS 2625 - 1964	15, 20, 24, 41, 45, 47, 49, 52, 57, 70, 71, 74, 79, 87, 91, 99, 105, 113, 117, 145, 152, 161, 162

	Use	Indian Standard Specification	Serial number of the species
		IS : 3496 - 1966 IS : 4416 - 1967 IS : 5141 - '1969 IS : 1724 - 1971 IS : 3265 - 1971 IS : 2058 - 1973 IS : 9337 - 1979	
XIX	SPORTS GOODS	IS : 2460 - 1963 IS : 2461 - 1963 IS : 2462 - 1963 IS : 2463 - 1963 IS : 2719 - 1964 IS : 4143 - 1967 IS : 4613 - 1968 IS : 4614 - 1968 IS : 4980 - 1968 IS : 5172 - 1969 IS : 5214 - 1969 IS : 5739 - 1970 IS : 6621 - 1972 IS : 6978 - 1973 IS : 2578 - 1978 IS : 830 - 1979	2, 15, 20, 25, 47, 49, 57, 70, 72, 74, 91, 100, 104, 105, 109, 120, 127, 128, 148, 152, 153, 160, 162
XX	MUSICAL INSTRUMENTS		10, 12, 19, 47, 49, 70, 74, 75, 108, 145, 152
XXI	MATHEMAT1CAL, ENGINEERING AND DRAWING INSTRUMENTS		10, 11, 12, 19, 20, 21, 40, 47, 49, 52, 55, 57, 71, 74, *75,* 87, 105, 109, 145, 147, 151, 160
XXII	ARTIFICIAL LIMBS AND REHABILIT-ATION AIDS	IS : 5143 - 1969 IS : 5145 - 1969 IS 7924 - 1976	47, 57, 70, 71, 87, 91, 95, 104, 127, 162

Use	Indian Standard Specification	Serial number of the species
XXIII BATTERY SEPARATORS		74, 104
XXIV BRUSHWARE		19, 20, 34, 70, 72, 74. 87, 88
XXV COOPERAGE		20, 24, 26, 32, 57, 87, 91, 93, 109, 150
XXVI TENT ACCESSORIES		2, 7, 72, 131, 144

Glossary

Air-dry moisture content: the equilibrium moisture content of wood for conditions outdoors but under cover; see also **seasoning.**

Air-seasoning: see **seasoning.**

Aliform parenchyma: a type of paratracheal parenchyma that extends out from the flanks of a pore, forming an eyelet with it.

Annual growth ring: layer of wood laid down during a single growing season. In the temperate wood, annual growth rings are readily distinguished because of differences in the cells formed during early and late parts of the season. In some temperate and most of the tropical wood, annual growth rings are not easily distinguished.

Annual increment: see **annual growth ring.**

Annual ring: see **annual growth ring.**

Apotracheal-banded parenchyma: see **banded parenchyma.**

Apotracheal diffuse-in-aggregate parenchyma: apotracheal parenchyma cells that tend to be grouped in short tangential lines from ray to ray as seen in cross section; same as **diffuse-zonate parenchyma.**

Apotracheal-diffuse parenchyma: single apotracheal parenchyma strands or cells distributed irregularly among fibres or tracheids,

Apotracheal parenchyma: axial parenchyma independent of the pores or vessels, includes **marginal, diffuse, diffuse-in-aggregate** and **banded apotracheal parenchyma.** Formerly known as **metatracheal parenchyma.**

Axial parenchyma: parenchyma cells derived from fusiform cambial initials; also known as **longitudinal parenchyma.**

Axial strand parenchyma: cells of axial parenchyma arranged in a row along the grain.

Banded parenchyma: axial parenchyma forming concentric lines or bands as seen in cross section; termed **apotracheal-banded,** if independent of the pores, and **paratracheal-banded,** if definitely associated with the pores.

Bark: the tissues in the cylindrical axis of a tree outside of the cambium; composed of inner living bark and outer dead bark.

Bending stress: see **stress.**

Biseriate ray: ray consisting of two rows cells, as viewed in the tangential section.

Blockboard: a plywood board in which veneer layers used in the core are replaced by blocks of wood; the direction of grain of the blocks running at right angles to that of the adjacent veneer.

Bole: the main trunk of a tree capabla of yielding logs or large poles.

Built-up timber: an assembly made by joining layers of wood together with mechanical fastenings so that the grain of all laminations is essentially parallel; see **laminated wood.**

Buttress: a ridge of wood developed in the angle between a lateral root and the butt of a tree, which may sometimes extend up the stem to a considerable height.

Checks: ruptures along the grain that develop during seasoning either because of difference in radial and tangential shrinkage or because of uneven shrinkage of the tissues in adjacent portions of the wood.

Close-grained wood: wood with narrow, inconspicuous growth rings. The term is sometimes used to designate wood having small and closely spaced pores, but in this sense the term "fine textured" is more often used.

Coarse-grained wood: wood with wide conspicuous growth rings in which there is considerable difference between early wood and late wood. The term is sometimes used to designate wood with large pores, but in this sense the term "coarse textured" is more often used.

Compression stress: see **stress.**

Compression wood: see **reaction wood.**

Cooperage: containers consisting of two round heads and a body composed of staves held together with hoops, such as barrels and kegs.

Cross-grained wood: wood in which the fibres deviate from a line parallel to the sides of the piece. Cross grain may be either diagonal or spiral or a combination of the two.

Curly grain: grain that results from more or less abrupt and repeated right and left deviations from the vertical, in fibre alignment.

Density/Weight: mass per unit volume of wood. It is expressed as kilogram per cubic metre at a specified moisture content.

Diameter at breast height (d. b. h.): it is a conventional height at which the diameter/girth of a standing tree is measured. It is 1.30 m above the ground level. In buttressed trees, the measurement is taken just above the point of the emergence of the buttress.

Diffuse parenchyma: apotracheal parenchyma, the cells of which are scattered in the growth ring; see **apotracheal-diffuse parenchyma.**

Diffuse-in-aggregate parenchyma: see **apotracheal diffuse-in-aggregate-parenchyma .**

Diffuse-porous wood: see **porous wood.**

Diffuse-zonate parenchyma: see **apotracheal diffuse-in-aggregate parenchyma.**

Durability: a genera! term for permanence or resistance to deterioration. Frequently used to refer to the degree of resistance of a speciesof wood to attack

wood-destroying organisms like fungi, insects (beetles, termites) and marine borers under conditions that favour such attack,

Early wood: the portion of the annual growth ring that is formed during the early part of the growing season; see **late wood.**

Edge grain: figure in lumber which has been sawn *so* that the face of the board is in the radial plane of the log; commercial timber isconsidered edge-grained when the angle between surface and growth ring liss between 45° and 90° with the wide surface of the pieces (syn. **vertical grain, rift grain and quarter sawn).**

Fibre: an elongated cell with pointed ends and a thick or not infrequently a thin wall; includes (1) fibre tracheids with bordered pits and (2) libriform fibres with simple pits.

Fibreboard: a broad generic term inclusive of sheet materials of widely varying densities manufactured of refined or partially refined wood (or other vegetable) fibres. Bonding agents and other materials may be added to increase strength, resistance to moisture, fire, decay or to improve some other property.

Figure: the pattern produced in a wood surface by annual growth rings, rays, knots, deviations from regular grain such as interlocked and wavy grain, and irregular coloration.

Finish (Finishing of wood products): coatings of paint, varnish, lacquer, wax etc. applied to surfaces of wood products to protect and enhance their appear–ance or durability.

Flecks: see **ray.**

Grain: the direction, size, arrangement, appearance or quality of the fibres in wood.

Gum: a comprehensive term for non-volatile viscous plant exudates, which either dissolve or swell up in contact with water and are not soluble in alcohol.

Hardboard: a generic term for a panel manufactured primarily from interfelted ligno-cellulosic fibres (usually wood), consolidated under heal and pressure in a hot press to a density of 500 kg/m^3 or greater, and to which other materials may have been added during manufacture to improve certain properties.

Hardness: a property of wood that enables it to resist indentation.

Hardwood: Wood produced by angiosperms, same as **porouswood,** in contrast tothe conifers or **softwood.** The term has no reference to the actual hardness of the wood.

Heart check: wood separation formed in the radial plane; also called **heart shake** and **rift crack;** see **shake.**

Heart shake: separation of wood across the ring and generally following the rays; called **heart check** and **rift crack.**

Heartwood: dead inner core of a woody stem (or a log), generally distinguishable from the outer portion (sapwood) by its darker colour; see **sapwood.**

Impact bending: a strength test to ascertain resistance of wood to impact load. Expressed in cm, the maximum height of drop of a 22.68 **kg** hammer.

Initial parenchyma: see **marginal apotracheal parenchyma,**

Interlocked-grain: a condition produced in wood by the alternate orientation of fibers in successive layers of growth increments.

Kiln-seasoning: see **seasoning,**

Kino: an astringent exudation from wood.

Laminated wood: an assembly made by bonding layers of wood with an adhesive so that the grain of all laminations is essentially parallel; see **built-up timber**

Late wood: the portion of the annual growth ring that *is* formed after the early wood formation has ceased (during the summer); summer wood; see **early ivood.**

Longitudinal parenchyma: see **axial parenchyma**

Marginal apotracheal parenchyma: apotracheal parenchyma, the cells of which occurs singly or form a more or less continuous layer of variable width at the close of a season's growth, in which case it may also be called **terminal parenchyma,** or at the beginning of a season's growth, when it may also be termed **initial parenchyma.**

Metatracheal parenchyma: same as **apotracheal parenchyma**

Micron: a unit of length, one-millionth of a meter (μ), 10-cm; also expressed as micrometer (μm).

Modulus of elasticity (MOE) : the modulus of elasticity calculated from bending tests.

Modulus of rupture (MOR) : the maximum bending load to failure in kg/cm^2.

Moisture content (m.c.) : the amount of water contained in the wood, usually expressed as a percentage of weight of the oven-dry wood.

Multiseriate ray: ray consisting of sevaral to many rows of cells, as viewed in the tangential section,

Oven-dry wood: wood dried to a relatively constant weight in a ventilated oven at 101° to 105°C.

Paperboard: the distinction between paper and paperboard is not sharp, but broadly speaking, the thicker (over 0.031 cm)r heavier and more rigid grades of paper are called paperboard.

Paratracheal banded parenchyma see **banded parenchyma**

Paratracheal confluent parenchyma: coalescent aliform parenchyma forming irregular tangential or diagonal bands.

Paratracheal parenehyma: parenchyma associated with vessels or vascular tracheids.

Paratracheal scanty parenchyma: isolated parenchyma cells associated with vessels.

Paratracheal vasicentric parenchyma: paratracheal parenchyma forming a complete sheath around a vessel.

Parenchyma (soft tissue, storage tissue): tissue composed of cells that are isodiametric and have simple pits; functioning primarily in the metabolism and storage of food materials. These cells remain functional longer than the tracheids, fibres and vessel segments. Parenchymatous cells that are arranged in vertical strands, known more specifically as **axial parenchyma,** and those that are in horizontal series in the rays, as **ray parenchyma.**

Particleboard: panels manufactured from ligno-cellulosic materials — commonly wood — essentially in the form of particles (as distinct from fibres). The materials are bonded together with synthetic resin or other suitable binder, under heat and pressure, by a process wherein the interparticle bonds are created wholly by the added binder.

Peel: to convert a log into veneer by rotary cutting.

Pile: a long, heavy timber, round or square cut, that is driven deep into the ground to provide a secure foundation for structures built on soft, wet, or submerged sites.

Pith fleck: small areas of wound tissue darker or lighter than the surrounding tissue, produced in wood through injury to the cambium by larvae of the insects and subsequent occlusion of the resulting tunnels with parenchymatous cells.

Plywood: a composite panel made up of cross-banded layers of veneer bonded with an adhesive. Generally the grain of one or more plies is roughly at right angles to the other plies, and almost always an odd number of plies are used.

Pore: cross section of a vessel; a vessel as it appears on a transverse surface or in a transverse section of wood; see **vessels.**

Pore chain: several to many pores arranged in a radial line or series, the adjacent pores retaining their separate identities.

Pore cluster: nested pores or an irregular aggregation of pores.

Pore multiple: group of two or more pores contiguous radially and flattened along the lines of contact so as to appear as subdivisions of a single pore.

Porous wood: wood containing pores or vessels.

a) **Ring-porous wood:** porous wood in which pores are comparatively large at the beginning of each annual ring and they decrease in size more or less abruptly towards the outer portion of the ring, thus forming a distinct iriner zone of pores **(early wood)** and an outer zone with small pores **(late wood).**

b) **Diffuse-porous wood:** porous wood in which the pores exhibit littfe or no variation in size indicative of seasonal growth.

Preservative: any substance that, for a reasonable length of time, is effeotive in preventing the development and action of fungi, insects (beetles, termites) and marine borers that deteriorate wood.

Quarter sawn: the wide face of the board is the radial face of the log; same as **edge grain.**

Radial section: section cut along the grain parallel to the wood rays and usually at right angles to the growth rings: see **tangential section.**

Ray: ribbon-shaped strand of tissue extending in a radial direction across the grain, so oriented that the face of the ribbon is exposed as a fleck on the quarter surface; see **wood ray.**

Rag parenchyma: parenchyma composing the rays wholly or in part (syn. **radial parenchyma.)**

Reaction wood: wood with distinctive anatomical and physical characteristics, formed in parts of leaning or crooked stems and in branches. In dicotyledons, reaction wood is known as **tension wood** and in gymnosperms, as **compression wood.**

Resin: natural polymer secreted by plant tissues in special cavities or passages, collected by tapping. Insoluble in water, soluble in alcohol, ether or carbon disuiphide.

Resin duct: tubular, intercellular space sheathed by secreting cells (epithelium), that contain and transmit resinous materials.

Rift crack: see **heart check, heart shake.**

Rift grain: see **edge grain.**

Ring-porous wood: see **porous wood.**

Sapwood: the portion of the wond that in the living tree contains living cells and reserve materials.

Seasoning: removal of moisture from green wood either by (a) exposure to air under cover without arificial heat **(air-seasoning)** or (b) drying in a kiln with artificial heat **(kiln-seasoning);** see also **air-dry moisture content.**

Shake: rupture of cell **or** between cells resulting in the formation of an opening in the grain of the wood; the opening may develop at the common boundary of two rings or within a growth ring; see **heart check, heart shake.**

Shear stress: see **stress.**

Shrinkage: expressed as the percentage change in dimension of wood with respect to the swollen size as a basis.

Softwood: wood produced conifers, in contrast to the wood produced by angiosperms or **hardwood.** The term has no reference to the actual hardness of the wood,

Spiral-grained wood: wood in which the fibres are aligned in helical orientation around the axis of the bole; see **cross-grained wood.**

Static bending: bending under a constant or slowly applied load; flexure.

Straight-grained wood: wood in which the fibres run parallel to axis of the bole.

Stress: force per unit area; expressed as primary stresses, **compression,** with forces acting towards each other, **tension,** with forces acting against each other, or **shear,** with forces sliding on each other; a combination of primary forces produces **bending stress.**

Tangential section: section cut along the grain at right angles to the wood rays; see **radial section.**

Tension stress: see **stress.**

Tension wood: see **reaction wood.**

Terminal parenchyma: see **marginal apotracheal parenchyma.**

Texture of wood: impression resulting from the size and the proportional amounts of wood elements; in the hardwoods, the tangential diameter and number of vessels and rays; a term often used interchangeably with grain. Somerimes used *to* combine the concepts of density and degree of contrast between early wood and late wood. In this handbook texture refers to the finer structure of the wood (see **grain)** rather than the growth ring.

Tubercles: a wart-like excrescence or outgrowth

Tyloses: sac-like or cyst-like structures that sometimes develop in a vessel and rarely in a fibre because of tho proliferation of the protoplast of a parenchyma cell through a pit pair (sing. **tylosis).**

Vasicentric parenchyma: see **paratracheal vasicentric parenchyma.**

Veneer: thin sheet of wood sliced, sawed, or rotary--cut from a log.

Vertical grain: see **edge grain.**

Vessels: wood cells of comparatively large diameter that have open ends and are set one above the other to form continuous tubes. The openings *of* the vessels on the surface of a piece of wood are usually referred to as **pores.**

Warping: any distortion in a piece of wood from its true plane that may occur during seasoning.

Wavy-grained wood: wood in which the fibres collectively take the form of waves or undulations.

Wood: the principal strengthening and water-conducting tissue of trees, (syn, **xylem**

Wood ray: that portion of a ray included in the wood; see **ray**

Workability: the degree of ease and smoothness of cutting wood with hand tools or machine.

Xylem tissue: see **wood.**

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